# **Mech-Mind Robot Integrations**

**Mech-Mind** 

Jul 01, 2022

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This chapter introduces different ways of integrating your robot with Mech-Mind Software Suite.

The following section provides instructions for loading the full-control program onto different robots:

Full-Control Program

The following section provides information on the Standard Interface of Mech-Interface for different robots and PLCs:

 $Standard\ Interface$ 

# FULL-CONTROL PROGRAM

This chapter provides detailed information on realizing full-control of robots by Mech-Mind.

# 1.1 ABB

This section introduces the full-control program for ABB robots and the procedure of setting up the communication with a robot through the program.

# 1.1.1 ABB Setup Instructions

This section introduces the process of loading the robot full-control program onto an ABB robot.

The process consists of 4 steps:

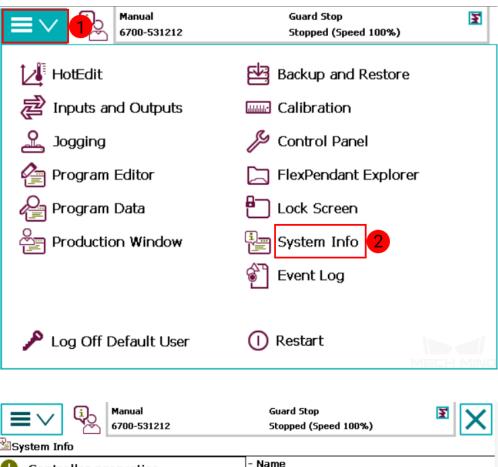
- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

#### **Check Controller and Software Compatibility**

- Controller: no requirement
- Controller system software version: RobotWare 6.02 or above
- Additional controller software options: 623-1 Multitasking and 8616-1 PCInterface
- Mech-Center: latest version recommended
- 1. Tap  $\blacksquare$  and then go to System Info $\rightarrow$  System properties to check the Robotware version.



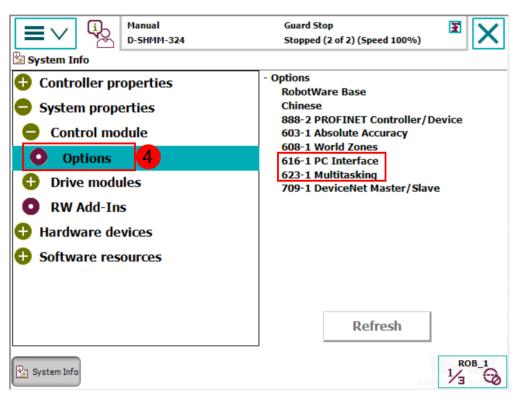


| System Info           |                                   |
|-----------------------|-----------------------------------|
| Controller properties | - Name<br>6700-531212             |
| System properties 3   | - Serial no<br><u>6700-531212</u> |
| Control module        | - RobotWare version<br>6.12.2013  |
| Drive modules         |                                   |
| RW Add-Ins            |                                   |
| Hardware devices      |                                   |
| Software resources    |                                   |
|                       |                                   |
|                       |                                   |
|                       |                                   |
|                       | Refresh                           |
| System Info           |                                   |

2. Go to System properties  $\rightarrow$  Control Module  $\rightarrow$  Options to check whether the necessary options are



#### installed.



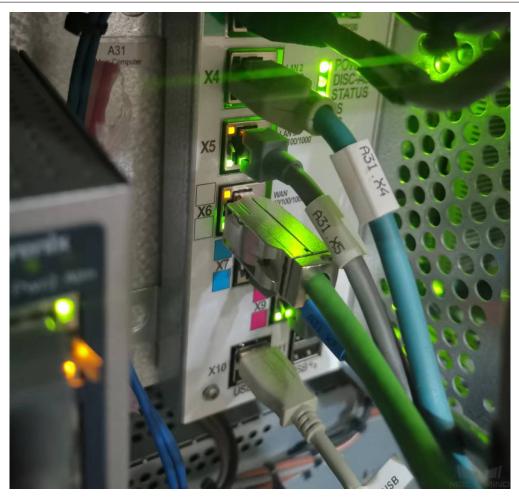
#### Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable of the IPC into the X6 (WAN) port of the robot controller, as shown below.







**Hint:** If you only need to load the full-control program via RobotStudio, you can use either LAN port or WAN port to connect the robot controller. However, in order to enable visual communication, the Ethernet cable can only be connected to the WAN port.

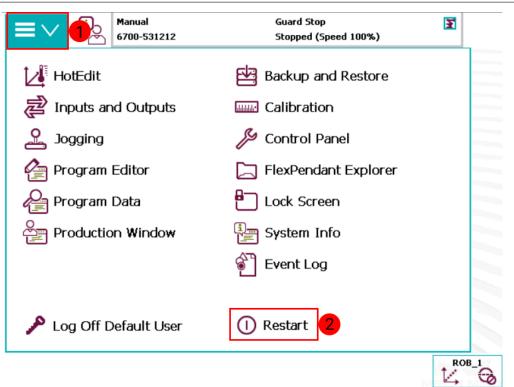
# **IP Configuration**

You can set the IP on the teach pendant or via RobotStudio.

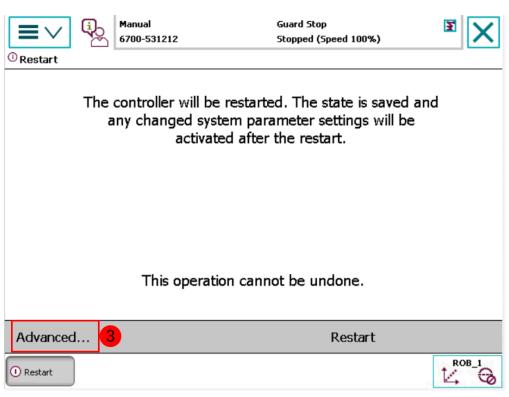
• Set the IP on the teach pendant







2. Select  $Advanced \cdots$ 

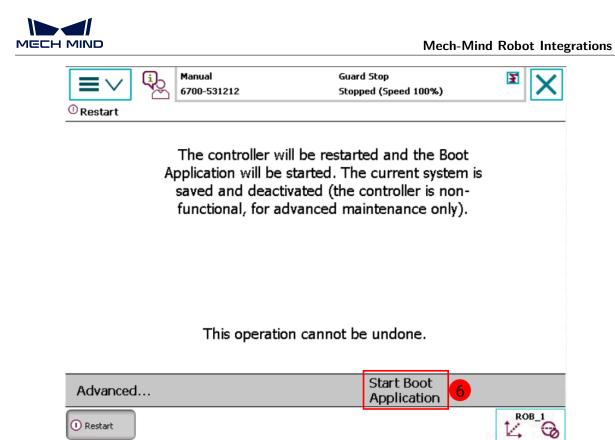




3. Select Start Boot Application and tap Next.

| © Restart | Manual<br>6700-531212 | Guard St<br>Stopped | op<br>(Speed 100%) |   | X     | X   |
|-----------|-----------------------|---------------------|--------------------|---|-------|-----|
|           | ID                    |                     |                    |   |       |     |
|           |                       |                     | Next               | 5 | Cance | el  |
| Restart   |                       |                     |                    | M | RO    | B_1 |

4. Select Start Boot Application to confirm.

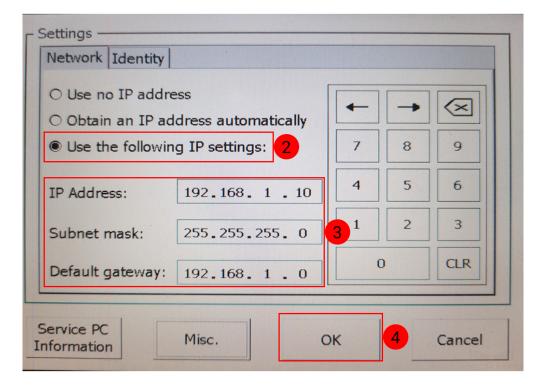


5. After restarting, you will see the interface as shown below. Tap Settings.

|                   | ABB Robotics<br>Boot Application | Default User          |
|-------------------|----------------------------------|-----------------------|
|                   | 6.12.02.00                       |                       |
|                   |                                  |                       |
|                   |                                  |                       |
|                   |                                  |                       |
| Install<br>System | Settings 1 Select<br>System      | Restart<br>Controller |



6. Select Use the following IP settings and configure the IP Address, Subnet Mask, and Default gateway. Tap *OK* after configuration.



7. Tap Select System.



|                   | ABB Robotic<br>Boot Applicati |                  | R<br>Default User     |
|-------------------|-------------------------------|------------------|-----------------------|
|                   | 6.12.02.00                    |                  |                       |
|                   |                               |                  |                       |
|                   |                               |                  |                       |
| Install<br>System | Settings                      | Select<br>System | Restart<br>Controller |

8. Select the system name in **Installed Systems** box and then tap Select. Tap OK after configuration.



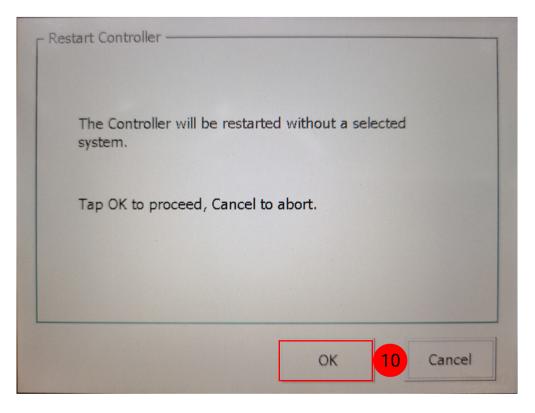
| 6700-531212 6       |          |
|---------------------|----------|
|                     |          |
|                     |          |
| Select 7            | Delete   |
| Selected System     | Deselect |
| <no system=""></no> |          |

9. Select Restart Controller.

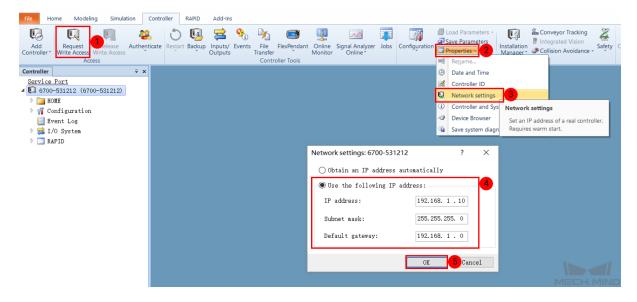
|                   | ABB Robotics<br>Boot Application | R<br>Default User       |
|-------------------|----------------------------------|-------------------------|
|                   | 6.12.02.00                       |                         |
|                   |                                  |                         |
|                   |                                  |                         |
| Install<br>System | Settings Select<br>System        | 9 Restart<br>Controller |



10. Tap OK to proceed.

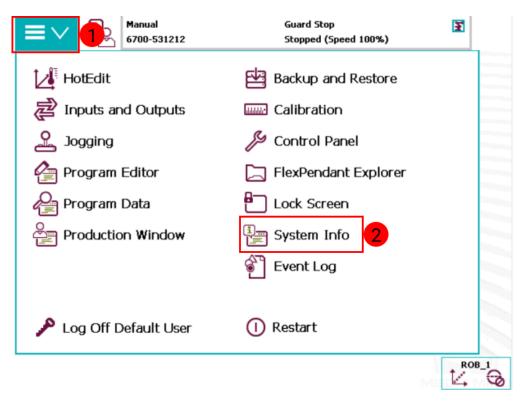


- Set the IP via RobotStudio
  - 1. Follow the steps as shown below to configure the robot IP, and restart the robot after configuration.





• Go to Sytem Info  $\rightarrow$  Network connections  $\rightarrow$  WAN to check if the IP configuration was successful after restarting.





| Manual<br>6700-531212  | Guard Stop<br>Stopped (Speed 100%)  |
|--|---|
| <ul> <li>Controller properties</li> <li>Network connections</li> <li>Service port</li> <li>WAN</li> </ul>              | - Configuration<br>Fix IP address<br>- IP address<br>192.168.1.10<br>- Subnet mask<br>255.255.255.0<br>- Default gateway<br>192.168.1.0 |
| <ul> <li>Installed systems</li> <li>System properties</li> <li>Hardware devices</li> <li>Software resources</li> </ul> | Refresh   |
| System Info  |   |

#### Load the Program Files

#### Prepare the Files

Please locate the folder 1. Copy the program files into an USB flash drive. where Mech-Center isinstalled and  ${\rm the}$ files  $\operatorname{are}$ stored  $\,$ inXXXX/Mech-Center/Mech\_RobServ/install\_packages/abb/server on ABB/config.

| > Mech-Mind > Mech-Center > Mech_RobServ > install_packages > abb > server on ABB > config |                   |          |      |  |
|--|-------------------|----------|------|--|
| Name   | Date modified     | Туре     | Size |  |
| D652.cfg   | 5/9/2022 12:06 AM | CFG File | 2 KB |  |
| DSQC1030.cfg   | 5/9/2022 12:06 AM | CFG File | 2 KB |  |
| EIO.cfg  | 5/9/2022 12:06 AM | CFG File | 2 KB |  |
| SYS.cfg  | 2/15/2022 8:51 PM | CFG File | 1 KB |  |
|  |                   |          |      |  |

2. The config file should be compatible with the I/O Unit in use. Please choose the right config file according to the table below:



| I/O Unit   | config file           |
|--|-----------------------|
| DSQC 652   | D652.cfg, SYS.cfg     |
| DSQC 1030  | DSQC1030.cfg, SYS.cfg |
| Other I/O Units or the program is only used for auto-calibration | EIO.cfg, SYS.cfg      |

#### Load the Files to the Robot

- 1. Open RobotStudio on the IPC and connect to the controller.
  - If the robot controller is connected via the LAN port, click on **One Click Connect** ....

| F | ile                | Home Modeling Simulation Controller   |  |  |  |  |
|---|--------------------|---|--|--|--|--|
| c | Add                |   |  |  |  |  |
|   | 6                  | One Click Connect<br>Connect to the service port of a controller.           |  |  |  |  |
|   | ļ                  | Add Controller<br>Add available controllers on the network.                 |  |  |  |  |
|   |                    | Add Controller from Device List   |  |  |  |  |
|   | ¢,                 | Start Virtual Controller<br>Start and connect to a virtual controller.      |  |  |  |  |
| R | Recent Controllers |   |  |  |  |  |
|   | ļ                  | 6700-531212 on '6700-531212'<br>Status: Available<br>Last IP: 192.168.125.1 |  |  |  |  |
|   |                    | MECH MING   |  |  |  |  |



• If the robot controller is connected via the WAN port or a switch, click on Add Controller and then select the controller and click on OK.

| File Home Modeling Simulation Controller RA                                 | APID Add-Ins  |                               |   |  |
|---|---|-------------------------------|---|--|
| Add<br>Controller*  | Outputs Transfer Monitor Onlin  | ashaar laka Configuration PSa | ve Parameters - Installation<br>Manager - Collision Avoid | on Safety Control Opera<br>ance Panel Wind |
| Connect to the service port of a controller.                                | Controller Tools  |                               | Configuration   | Virt                                       |
| Add Controller Add available controllers on the network.                    | Add Controller  |                               |   |  |
|   | Available controllers on the network:   |                               |   |  |
| Add Controller from Device List   | System Name         Controller Name           6700-531212         6700-531212 | TP_Address<br>192.108.125.1   | 6. 12. 2013   |  |
| Start Virtual Controller<br>Start and connect to a virtual controller.      | 6700-531212 6700-531212   | 192, 108, 123, 1              | 0.12.2013   |  |
| Recent Controllers  |   |                               |   |  |
| 6700-531212 on '6700-531212'<br>Status: Available<br>Last IP: 192.168.125.1 |   |                               |   |  |
|   |   |                               |   |  |
|   | Remote Controller   |                               | Filter  |  |
|   | Add      Refresh     Show Virtual Controllers     L-                          | ogin as Local Client [        | Low Bandwidth   | K 3 ancel                                  |

2. Import the config files as shown below. Click on *Confirm* in the pop-up windows.

| Image: Properties - Configuration         Sector         Configuration  | Create Open<br>Relation Relation<br>Transfer |
|--|--|
| Controller ÷ x Solution29-View1 x  | ÷  |
| Example 1     Open      ×  |  |
|  |  |
| Construction Con   |  |
| Profileration For Configuration For Configuratio For Configuration For Configuration For Configuration |  |
| b 25 1/0 System b 27 1/0 System b 27 APID Date modified Type Size  |  |
| ■ 3D Objects D652.ctg 5/9/2022 12:06 AM CFG File 2 KB  |  |
| Desktop DSQC1030.cfg 5/9/2022 12:06 AM CFG File 2 KB   |  |
| Documents ElO.cfg 5/9/2022 12:06 AM CFG File 2 KB  |  |
| Downloads 2/15/2022 8:51 PM CFG File 1 KB  |  |
| Select a nie to preview.   |  |
| ♪ Music  |  |
| E Pictures   |  |
| 📓 Videos   |  |
| _ USB (H.)   |  |
| _ USB (H)  |  |
| O Delete existing<br>parameters before<br>loading  | \  |
| O Load parameters if<br>no duplicates  | ÷ ×  |
| In ordinates   | ^  |
| and replace<br>duplicates  |  |
| File Name (N): "5D" "5VS" V Configuration Files (*.cfg)  |  |
| Open(0) Cancel   |  |
| UIRE_6700_205Kg_Z.20% (Station): 10010 - Notors UFF state 11/05/2022 11:21:28 Event Log  |  |
| UIRE_6700_205kg_2.80m (Station): 10011 - Motors ON state 11/05/2022 11:21:31 Event Log   | Controller status: 1/1                       |



 $\times$ 

RobotStudio

Load parameters from the selected file(s)?

If duplicate parameters are found they will be replaced.

|  | Confirm | Cancel   |
|--|---------|----------|
| RobotStudio  |         |          |
| Loading configuration data succe<br>The changes will not take effect u<br>restarted. |         | oller is |
| Do not show this dialog again  | n       | Confirm  |

3. Copy the whole **MM** folder and paste it to the **HOME** directory of the robot system, as shown below. Restart the controller to complete loading the program files.

| Add<br>Controller - Access<br>Access | The Transfer Controller Tools | Configuration   | eters             | ted Vision Safety Control   | Operator Task Frames   | Go Offline<br>Create Relation<br>Open Relation<br>Transfer |
|--------------------------------------|-------------------------------|---|-------------------|---|--|--|
| Controller                           | Name<br>board<br>confir       | th_RehServ\install_packages\abb\<br>Date modified Type<br>2021/6/4 9:46 文件夫<br>2021/6/4 9:46 文件夫<br>2021/6/4 9:46 文件夫 | Size              | Controller Explorer (1.3 GB<br>6700-523702 en '6700-523703<br>Hase<br>6700-823702, rif<br>BlueSverd ays | 2'/hd0w/6700-523702/HOME<br>Date modified Type<br>2021/7/23 1 文件夫<br>2021/7/23 1 RLF 文件<br>2021/7/23 1 RAFID modul.          |  |
|                                      | 22.4M2. txt<br>② 焼汞薄化飯. dorx  | 2021/5/10 1 文本文档<br>2021/5/10 1 DOCX 文档   | 394 B<br>520.1 KB | BlueSeerdi. sys<br>Baild ad<br>saild ad<br>System. zal<br>Uuser. sys                                    | 2021/7/23 1 和ATD sodal.<br>2021/7/13 1 电影野田 sodal.<br>2021/7/23 1 电影野猫<br>2021/7/23 1 和KTD sodal.<br>2021/7/23 1 和KTD sodal. | 643 B<br>1.3 KB<br>1.1 KB                                  |
|                                      |                               |   |                   |   |  |  |

4. Modify the safe zone threshold (in mm) in the **safe\_area.mod** program according to the actual on-site work space of the robot.

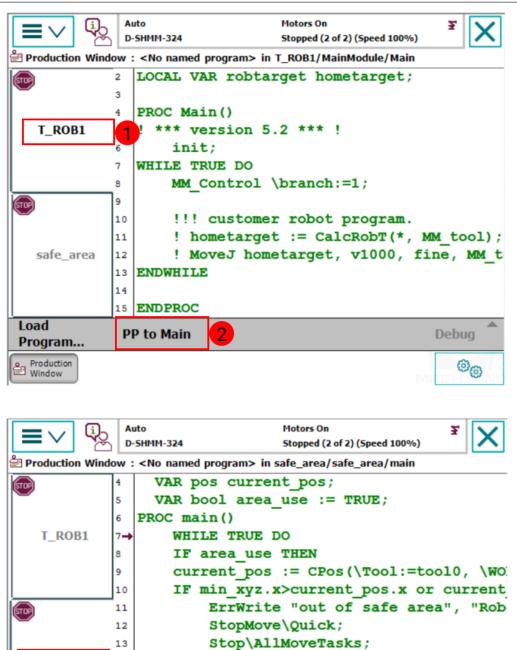


| 0 | iolution29:视图1 IRB_6700_205kg_2.80m (工作站) x |  |  |  |  |  |  |  |
|---|---|--|--|--|--|--|--|--|
| _ | safe_area/safe_area ×                       |  |  |  |  |  |  |  |
|   | 1   | MODULE safe_area   |  |  |  |  |  |  |
|   | 2   | <pre>CONST pos min_xyz:=[-3000,-3000,-3000];</pre>         |  |  |  |  |  |  |
|   | 3   | CONST pos max_xyz:=[3000,3000,3000];                       |  |  |  |  |  |  |
|   | 4   | VAR pos current_pos;                                       |  |  |  |  |  |  |
|   | 5   | VAR bool area_use := TRUE;                                 |  |  |  |  |  |  |
|   | 6   | □PROC main()   |  |  |  |  |  |  |
|   | 7   | WHILE TRUE DO  |  |  |  |  |  |  |
| ٥ | 8   | 🖃 IF area_use THEN   |  |  |  |  |  |  |
|   | 9   | <pre>current_pos := CPos(\Tool:=tool0, \WObj:=wobj0)</pre> |  |  |  |  |  |  |
|   | 10  | IF min_xyz.x>current_pos.x or current_pos.x>max            |  |  |  |  |  |  |
|   | 11  | ErrWrite "out of safe area", "Robot Stop" \                |  |  |  |  |  |  |
|   | 12  | <pre>StopMove\Quick;</pre>                                 |  |  |  |  |  |  |
|   | 13  | <pre>Stop\AllMoveTasks;</pre>                              |  |  |  |  |  |  |
|   | 14  | ENDIF  |  |  |  |  |  |  |
|   | 15  | ENDIF  |  |  |  |  |  |  |
|   | 16  | ENDWHILE   |  |  |  |  |  |  |
|   | 17  | ENDPROC  |  |  |  |  |  |  |
|   | 18  | ENDMODULE  |  |  |  |  |  |  |
|   |   |  |  |  |  |  |  |  |

### Run the program

1. Move the PP of tasks  $\mathbf{T\_ROB1}$  and  $\mathbf{safe\_area}$  to Main respectively.





2. After selecting PP to Main, if a window as shown below pops up, please tap Yes to confirm.

3

15

16

17 ENDPROC

**PP to Main** 

safe\_area

Load

Production Window ENDIF

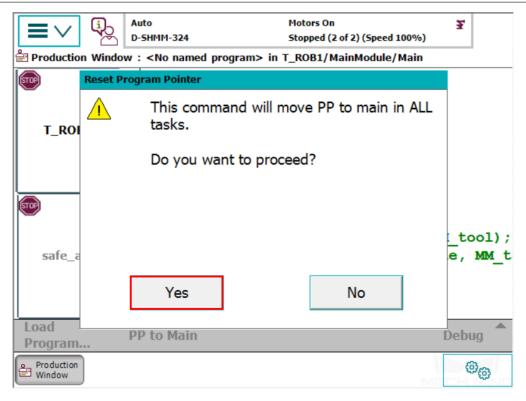
ENDIF ENDWHILE

4

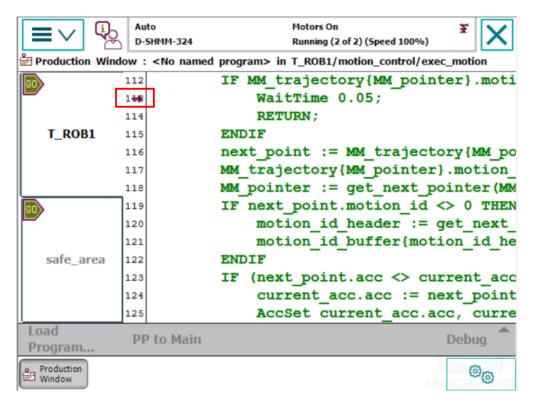
Debug

0<sub>0</sub>





3. Run the program manually or automatically. The program pointer is as shown below.





#### **Test Robot Connection**

Please refer to *Test Robot Connection* for detailed instructions.

# 1.1.2 ABB Program Description

#### **Program Module**

| Program Module | Description  |
|----------------|--|
| motion_server  | Background program used to receive data from Mech-Center               |
| status_server  | Background program used to send data of robot pose, signal, and status |
| motion_control | Foreground program used to guide the robot to move                     |
| pause_control  | Program used to pause  |
| MainModule     | Main program   |
| mm             | Program data used to define the full-control program                   |

#### Signal

Support 64 D/I and D/O signals in maximum. Support 16 D/I and D/O signals when loading the program files by default.

| D/O | go16 | go16_2 | go16_3 | go16_4 |
|-----|------|--------|--------|--------|
| D/I | gi16 | gi16_2 | gi16_3 | gi16_4 |

# 1.2 YASKAWA

This section introduces the full-control program for YASKAWA robots and the procedure of setting up the communication with a robot through the program.

## 1.2.1 YASKAWA Setup Instructions

This section introduces the process of loading the robot full-control program onto a YASKAWA robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program File
- Test Robot Connection

Please have a flash drive ready at hand.

**Note:** The flash drive must:



- Have a storage capacity smaller than 32 GB
- Be formatted to the FAT32 file system

#### Check Controller and Software Compatibility

- Controller: YRC1000 (excluding YRC1000 micro) and DX200
- Controller system software version:
  - YRC1000: no requirement
  - DX200: DN2.25.00A(US/CN)-00 or above
- Option function requirements: must have the MotoPlus and Ethernet functions enabled.

**Note:** The following instructions are based on YRC1000 controller. Details may differ for DX200 controller.

#### Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable into:

- An Ethernet port on the IPC
- LAN2 (CN106) port on YRC1000 controller; CN104 port on DX200 controller

#### Note:

- LAN1 port on YRC1000 and CN105 port on DX200 are for connecting the teach pendant only.
- If LAN2 port is occupied, please use LAN3 (CN107) instead.

#### **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Press down MAIN MENU when powering on the controller to enter the maintenance mode.
- 2. Select  $SYSTEM \rightarrow SECURITY \rightarrow MANAGEMENT MODE$ .



## **Mech-Mind Robot Integrations**

|               |                           | 8                |              |     | Į        |                                  | 1        |  |
|---------------|---------------------------|------------------|--------------|-----|----------|----------------------------------|----------|--|
| SYSTEM        | SETUP                     | TING MODE        | SYSTEM       |     | MODE     | OPERATIO                         |          |  |
| FILE 1        | VERSION                   |                  | FILE         |     | inop.    | EDITING<br>MANAGEME<br>SAFETY MU | IODE     |  |
| EX. MEMORY    | CONTROLLER<br>INFORMATION |                  | EX. MEMORY   |     |          |                                  | 3        |  |
| MotoPlus APL. | CPU RESET                 |                  | MotoPlus APL |     |          |                                  |          |  |
| DISPLAY SETUP | ALARM HISTORY             |                  | DISPLAY SETU | JP  |          |                                  |          |  |
| Aa            | QR CODE                   |                  | Aa           |     |          |                                  |          |  |
|               | SECURITY                  |                  |              |     |          |                                  |          |  |
| Main Menu     | Simple Menu 2             | Maintenance mode | Main Menu    | Sim | ple Menu | Maintena                         | nce mode |  |

3. Enter the password (the default password is sixteen 9 's), and then press on *Enter*.

|               |        |              |        | 1 |            |
|---------------|--------|--------------|--------|---|------------|
| SYSTEM        | SECURI | TY           |        |   |            |
|               | MOD    | ****         |        |   |            |
| FILE          |        | Current Pass | sword= |   |            |
|               | -      |              |        |   |            |
| EX. MEMORY    |        |              |        |   |            |
| MotoPlus APL. |        |              |        |   |            |
| <b>D</b>      |        |              |        |   |            |
| DISPLAY SETUR |        |              |        |   |            |
| Hex D         | ec Bin | 7            | 8      | 9 | Clear      |
| А             | D      | 4            | 5      | 6 | Back space |
| В             | E      | 1            | 2      | 3 | Cancel     |
| С             | F      | 0            | •      | 2 | Enter      |

4. Select  $SYSTEM \rightarrow SETUP \rightarrow OPTION FUNCTION \rightarrow LAN INTERFACE SETTING.$ 



**Mech-Mind Robot Integrations** 

|  | Ø         |   |   |                | <b>Ø</b> |  |  |  | <b>Ø</b>  |
|--|-----------|---|---|----------------|----------|--|--|--|---|
| ESTIMATION<br>FILE<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION |           | SYSTEM<br>FILE<br>FLE<br>EX. HENDRY<br>SOLOPIUS APL.<br>DISPLAY SETUP<br>CALL | SETUP<br>LANSIAGE<br>CONTROL GROU<br>APPLICATION<br>OPTION BANK<br>IO MOOLE<br>ONS MEMORY<br>DATE/TION BANK | I              |          | FILE<br>FILE<br>Ex. #EMONY<br>Botofice APL.<br>DISPLAY SETUP | CPTION FUNCTION<br>LAN INTERFAC<br>DIA INTERFAC<br>DIA INTERFAC<br>DIA INTERFAC<br>DIA INTERFAC<br>DIA INTERFACE<br>DIA INTER | E SETTING<br>TTON SETTING<br>(CPU Board)<br>TINS TIME<br>MIZATION<br>ITCHING<br>ICATION<br>UME IN JOB<br>SETUP<br>JOCATION<br>IC.<br>(C.<br>(SPO1) | ETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL |
| Nain Nenu Simple Henu Mainten  | ance mode | Wain Wenu   | Simple Nenu   | Naintenance mo | de       | Hain Henu  | Simple Menu  | Maintenance mode   | MECH MINI   |

5. In **IP ADDRESS SETTING(LAN2)**, select **MANUAL SETTING**, and then set the **IP ADDRESS** to one in the same subnet as the IPC, and the **SUBNET MASK** to **255.255.255.0**.

|           | 8  |  |
|-----------|--|--|
| SYSTEM    | LAN INTERFACE SETTING<br>HOST SETTING MANUAL SETTING<br>HOST NAME MY-HOST<br>DOMAIN SETTING MANUAL SETTING<br>DOMAIN NAME LOCAL.DOMAIN<br>IP ADDRESS SETTING(LAN2)<br>IP ADDRESS<br>SUBNET MASK<br>IP ADDRESS SETTING(LAN3)<br>IP ADDRESS SETTING(LAN3)<br>IP ADDRESS 172. 16. 0.<br>SUBNET MASK<br>255.255.255. 0<br>DEFAULT GATEWAY SETTING<br>DEFAULT GATEWAY<br>0. 0. 0. 0 | SYSTEN       LAN INTERFACE SETTING         HOST SETTING       MANUAL SETTING         HOST NAME       MY-HOST         DOMAIN SETTING       MANUAL SETTING         DOMAIN SETTING       MANUAL SETTING         DOMAIN SETTING       MANUAL SETTING         DOMAIN NAME       LOCAL.DOMAIN         IP ADDRESS       SETTING LAN2)         IP ADDRESS       SETTING LAN2)         IP ADDRESS       SETTING LAN3)         IP ADDRESS       SETTING LAN3)         IP ADDRESS       SETTING LAN3)         IP ADDRESS       172.16.         SUBNET MASK       255.255.255.         DISPLAY SETUP       DEFAULT GATEWAY SETTING         DEFAULT GATEWAY       0.0.0.0 |
| Main Menu | Simple Menu Maintenance mode   | Main Menu Simple Menu Maintenance mode   |

6. Press the  $\tt ENTER$  key, and then press on  $Y\!E\!S$  in the pop-up message.



| SYSTEM<br>FILE                          | LAN INTERFACE SETTING<br>HOST SETTING MANUAL SETTING<br>HOST NAME MY-HOST<br>DOMAIN SETTING MANUAL SETTING<br>DOMAIN NAME LOCAL.DOMAIN |
|---|--|
| EX. MEMORY<br>BD<br>MotoPlus APL.<br>BD | Modify?<br>YES NO  |
|   | DEFAULT GATEWAY SETTING NOT USED<br>DEFAULT GATEWAY 0. 0. 0. 0   |
| Main Menu                               | Simple Menu Maintenance mode   |

#### Load the Program File

#### Prepare the File

The program files are stored in the installation directory of Mech-Center. The default directory is C:/Mech-Mind/Mech-Center.

Navigate to *xxx/Mech-Center/mech\_interface/yaskawa*, and copy the full-control program to your flash drive:

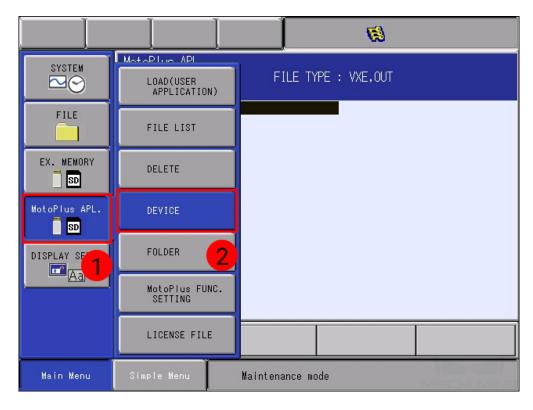
- If you are using a YRC1000 controller, copy **yrc1000.out**.
- If you are using a DX200 controller, copy **dx200.out**.

**Note:** Copy the file to the root directory of the flash drive. Do not put it in another folder or rename it.



#### Load the File to the Robot

- 1. Insert the flash drive into the USB port on the back of the teach pendant.
- 2. Under maintenance mode, select *MotoPlus APL*.  $\rightarrow$  *DEVICE*.

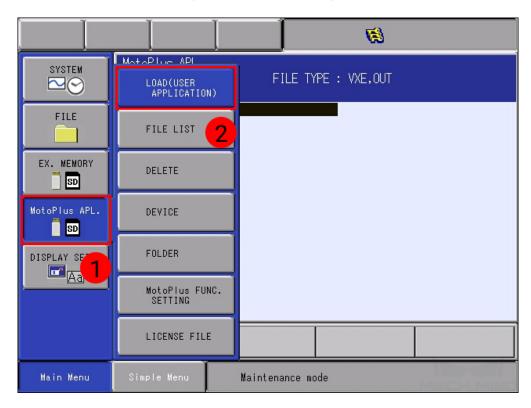


3. Select USB:Pendant for TARGET DEVICE.



|  |              |               | <i>(ii)</i>                         |  |
|--|--------------|---------------|-------------------------------------|--|
| SYSTEM   | DEVICE       |               |                                     |  |
| FILE<br>EX. MEMORY<br>SD<br>MotoPlus APL.<br>SD<br>DISPLAY SETUP<br>TA | TARGET DEVIC | E             | Pendant<br>:Pendant<br>I:Controller |  |
|  |              |               |                                     |  |
| Main Menu  | Simple Menu  | Maintenance m | ode                                 |  |

4. Select MotoPlus APL.  $\rightarrow$  LOAD(USER APPLICATION).





5. Select **YRC1000.OUT** (**DX200.OUT** for DX200 controller), and press **ENTER**. Select **YES** in the pop-up message to start loading the program.

|               |             | Ø [                 |               |  |               | <b>19</b>     |       |
|---------------|-------------|---------------------|---------------|--|---------------|---------------|-------|
| SYSTEM        | FOLDER : \  | FILE TYPE : VXE,OUT | SYSTEM        | MotoPlus APL.<br>USB:Pendant(L<br>FOLDER : \ | .0AD) FILE T  | YPE : VXE,OUT |       |
| FILE          | YRC1000.OUT | 1                   | FILE          | ★YRC1000.0UT                                 |               |               |       |
| EX. MEMORY    |             | •                   | EX. MEMORY    | *  | Load?         |               |       |
| MotoPlus APL. |             |                     | MotoPlus APL. | YES  | 3             | NO            |       |
| DISPLAY SETUP |             |                     | DISPLAY SETUP |  | 2             |               | ,<br> |
|               |             |                     |               |  |               |               |       |
|               |             |                     |               |  |               |               |       |
| Main Menu     | Simple Menu | nance mode          | Main Menu     | Simple Menu                                  | Maintenance m | ode           |       |

6. After loading completes, go to *MotoPlus APL*.  $\rightarrow$  *FILE LIST*, and you should see **YRC1000.OUT** (**DX200.OUT**) displayed.

|               |                           | <i>Ø</i>            |               |  |                   | <i>(</i>  |
|---------------|---------------------------|---------------------|---------------|--|-------------------|-----------|
| SYSTEM        | LOAD(USER<br>APPLICATION) | FILE TYPE : VXE,OUT | SYSTEM        | MotoPlus APL.<br>USB:Pendant(LOA<br>_FOLDER :\ | D) FILE TYPE : V. | XE,OUT    |
| FILE          | FILE LIST                 |                     | FILE          | ★YRC1000.OUT                                   |                   |           |
| EX. MEMORY    | DELETE 2                  |                     | EX. MEMORY    |  |                   |           |
| MotoPlus APL. | DEVICE                    |                     | MotoPlus APL. |  |                   |           |
|               | FOLDER                    |                     | DISPLAY SETUP |  |                   |           |
|               | MotoPlus FUNC.<br>SETTING |                     |               |  |                   |           |
|               | LICENSE FILE              |                     |               |  |                   |           |
| Main Menu     | Simple Henu               | Maintenance mode    | Main Menu     | Simple Menu                                    | Maintenance mode  | MECH MIND |

7. Restart the controller without pressing the MAIN MENU key; the program is now running automatically in the background. Turn the mode switch key to **PLAY**, and proceed to **Test Robot Connection**.





#### **Test Robot Connection**

Please refer to *Test Robot Connection* for detailed instructions on connecting to the robot in Mech-Center. As the robot will move at 100% velocity by default, it is recommended to adjust its velocity before running the corresponding Mech-Viz project.

| JOB              | DIT DISPLAY         | UTILITY | 12 🗳 🖌    | 1 🤫 🔟             |                   |
|------------------|---------------------|---------|-----------|-------------------|-------------------|
|                  | DOUT<br>MOVE<br>IND |         |           | S:0000<br>OOL: ** |                   |
|                  | BE SELECT JOB       |         |           |                   |                   |
| VARIABLE<br>B001 | 🚉 MASTER JOB        | 2       |           |                   |                   |
|                  | JOB CAPACITY        |         |           |                   |                   |
| ROBOT            | CYCLE               |         |           |                   |                   |
| SYSTEM INFO      | JOB EDIT(PLAY       |         |           |                   |                   |
|                  | DOUT PLAY EDIT JOE  | MODIFY  | OFF RATIO | <u>100</u> %      |                   |
| Main Menu        | Simple Menu         |         | ol file.  | Using robot       | without setting t |

1. Select  $JOB \rightarrow SELECT JOB$ .

2. Select any job in the  ${\bf JOB}$   ${\bf LIST},$  and then press the SELECT key.



3. Select  $UTILITY \rightarrow SPEED OVERRIDE$ .

| JOB            | EDIT                | DISPLAY                             | UTILITY              | 2 🖌 😣 🔟            |                 |
|----------------|---------------------|-------------------------------------|----------------------|--------------------|-----------------|
|                | PLAY<br>J:1<br>CONT | BACK<br>ROL GROUP:                  | SETUP SPECIAL<br>RUN | S:0000<br>TOOL: ** |                 |
|                | 000                 | D NOP<br>1 MOVJ VJ=!<br>2 MOVJ VJ=! |                      | 2                  |                 |
| VARIABLE       |                     | 3 END                               | PAM                  |                    |                 |
|                |                     |                                     |                      |                    |                 |
| ROBOT          |                     |                                     |                      |                    |                 |
| SYSTEM INFO    |                     | ED ADJUSTME                         | ENT MODIFY OFF       | RATIO <u>100</u> % |                 |
|                |                     |                                     |                      |                    |                 |
| ,<br>Main Menu | Simp                | le Menu                             | and Zg               | in the tool file.  | Using robot wit |

4. Press on **SPEED ADJUSTMENT** and then **OFF**, press the **SELECT** key to switch **MODIFY** to **ON**.



| JOB                         | EDIT | DISPLAY                                      | UTILITY        | 12 🖪 🖌            | 😣 🔯 🕞         | 包           |
|-----------------------------|------|--|----------------|-------------------|---------------|-------------|
|                             | PLAY | BACK<br>ROL GROUP:                           | R1             |                   | 1000<br>.: ** |             |
| GENERAL<br>VARIABLE<br>BOO1 |      | D NOP<br>1 MOVJ VJ=!<br>2 MOVJ VJ=!<br>3 END |                |                   |               |             |
|                             |      |  |                |                   |               |             |
|                             |      | ed adjustme                                  | 1<br>NT MODIFY | 2<br>DFF RATIO 10 | 0 %           |             |
|                             |      |  |                |                   |               |             |
| Main Menu<br>,              | Simp | )le Menu                                     | g g            | , and Zg in the H | tool file.    | Using robot |

5. Press on the number after RATIO, and press the SELECT key to change the speed ratio. Press on *Enter* to save the change.

| JOB                        | EDIT DISPLAY UTILITY                                 | 12 🗹 🖌 🍕 🔟 📑 🔃                         | JOB            | EDIT | DIS                       | PLAY UTIL  | тту 🚺 🗹     | M 🧐 🔯              |            |
|----------------------------|--|--|----------------|------|---------------------------|------------|-------------|--------------------|------------|
|                            | PLAYBACK<br>J:1<br>CONTROL GROUP: R1                 | S:0000<br>TOOL: **                     |                | J:   | .AYBACK<br>1<br>INTROL GF | ROUP: R1   |             | S:0000<br>TOOL: ** |            |
|                            | 0000 NOP<br>0001 MOVJ VJ=50.00<br>0002 MOVJ VJ=50.00 |  |                | ·    |                           |            |             |                    |            |
| VARIABLE<br>B001<br>IN/OUT | 0003 END   |  | VARIAB<br>B001 |      |                           |            |             |                    |            |
| ROBOT                      |  |  |                | ut   |                           |            |             |                    |            |
|                            |  | 4                                      |                |      | PEED ADJ                  | USTMENT MU | DIFY ON RAT |                    |            |
| SYSTEM INFO                | ĺ  |  | Hex            | Dec  | Bin                       | 7          | 8           | 9                  | Clear      |
|                            | SPEED ADJUSTMENT MODIFY                              | ON RATIO <mark>100</mark> %            | А              |      | D                         | 4          | 5           | 6                  | Back space |
|                            |  |  | В              |      | E                         | 1          | 2           | 3                  | Cancel     |
| Main Menu                  | Simple Menu 📄 : i                                    | n the tool file. Using robot without s | С              |      | F                         | 0          |             | -                  | Enter      |





## 1.2.2 YASKAWA Program Description

#### **Occupied IO**

| Occupied IO | Signal   |
|-------------|----------|
| DI (16)     | IN1–IN16 |
| DO (16)     | OT1–OT16 |

# 1.3 FANUC

This section introduces the full-control program for FANUC robots and the procedure of setting up the communication with a robot through the program.

# **1.3.1 FANUC Setup Instructions**

This section introduces the process of loading the robot full-control program onto a FANUC robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

#### Check Controller and Software Compatibility

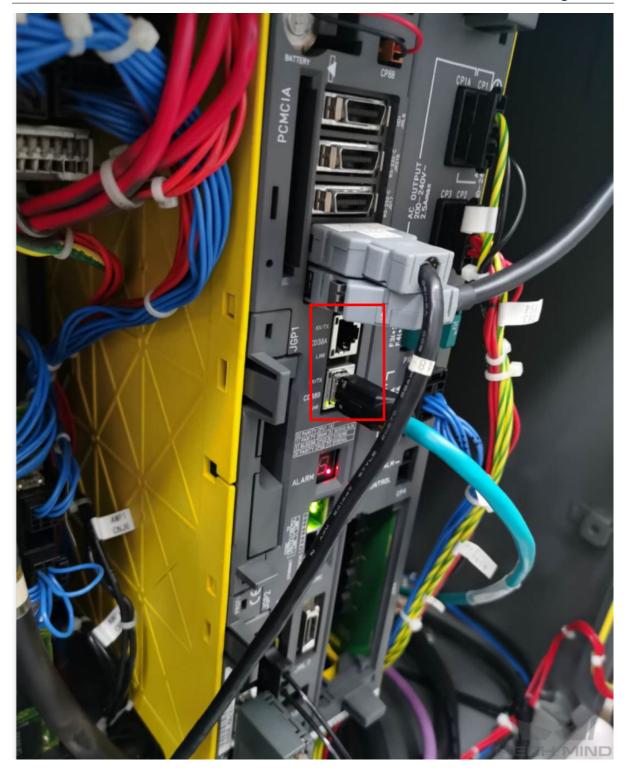
- Controller: no requirement
- Controller system software version: V7.5, V7.7, V8.\*, and V9.\*
- Additional controller software packages:
  - R651 or R632 (karel) used to enable karel function
  - R648 (User Socket Msg)
- Mech-Center: latest version recommended

#### Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable of the IPC into the Ethernet port of robot controller as shown in the figure. You can plug the cable into either CD38A port or CD38B port. CD38A corresponds to **Port#1** in the robot IP setting, while CD38B corresponds to **Port#2**.







#### **IP Configuration**

1. Press on  $MENU \rightarrow SETUP$ , select Host Comm in the context menu, and then press ENTER to open the SETUP Protocols window.

| BusyStepHoldFaultRunI/OProdTCyc | -              |  |  |  |  |  |  |
|---------------------------------|----------------|--|--|--|--|--|--|
| SETUP General                   |                | A 🖽  |  |  |  |  |  |
| MENU 1                          | SETUP 1        | 1/5  |  |  |  |  |  |
| 1 UTILITIES                     | 1 Prog Select  | SETUP 2<br>TUP 3   |  |  |  |  |  |
| 2 TEST CYCLE                    | 2 ZDT Client   | 2 iPendant Setup   |  |  |  |  |  |
| 3 MANUAL FCTNS                  | 3 General      | 3 BG Logic   |  |  |  |  |  |
| 4 ALARM                         | 4 Frames       | 4 Resume Offset  |  |  |  |  |  |
| 5 I/O                           | 5 Macro        | 5 Resume Tol.  |  |  |  |  |  |
| 6 SETUP                         | 6 Ref Position | 6 Stroke limit   |  |  |  |  |  |
| 7 FILE                          | 7 Port Init    | 7 Space fnct.  |  |  |  |  |  |
| 8                               | 8 Ovrd Select  | 8 Diag Interface   |  |  |  |  |  |
| 9 USER                          | 9 User Alarm   | 9 Host Comm  |  |  |  |  |  |
| 0 NEXT                          | 0 NEXT         | 0 NEXT   |  |  |  |  |  |
|                                 |                |  |  |  |  |  |  |
| Menu Favorites (press and ho    | ld to set)     |  |  |  |  |  |  |
| Ľ                               |                | >  |  |  |  |  |  |
| PREV SI                         |                |  |  |  |  |  |  |
|                                 |                | STEP $\begin{pmatrix} -X \\ (J1) \end{pmatrix} \begin{pmatrix} +X \\ (J1) \end{pmatrix}$<br>HOLD $\begin{pmatrix} -Y \\ (J2) \end{pmatrix} \begin{pmatrix} +Y \\ (J2) \end{pmatrix}$<br>ENTER $\begin{pmatrix} 4 \\ -Z \\ (J3) \end{pmatrix} \begin{pmatrix} +Z \\ (J3) \end{pmatrix}$ |  |  |  |  |  |

2. Select  $\mathbf{TCP}/\mathbf{IP}$  and press on *DETAIL* to open the **SETUP Host Comm** window.



| BusyStepHoldFaultRunI/OProdTCyc  | T2 JOINT 100    |
|--|-----------------|
| SETUP Protocols  | € 田             |
|  | 1/8             |
| 1 TCP/I<br>2 TELNE<br>3 SM<br>4 RIPE<br>5 PROXY<br>6 PING<br>7 HTTP<br>8 FTP |                 |
| [ TYPE ]   | DETAIL 2 SHOW ] |
| PREV SHII<br>PREV SHII   |                 |

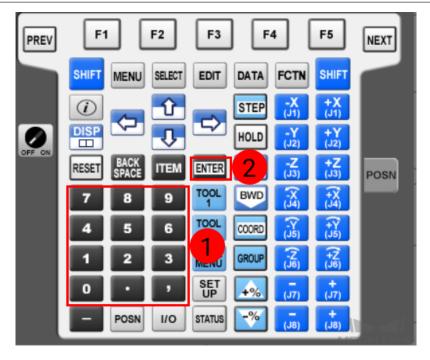
3. Enter the robot IP in the **IP address** line with the keyboard of the teach pendant. The robot IP should be in the same subnet as the IPC.



**Mech-Mind Robot Integrations** 

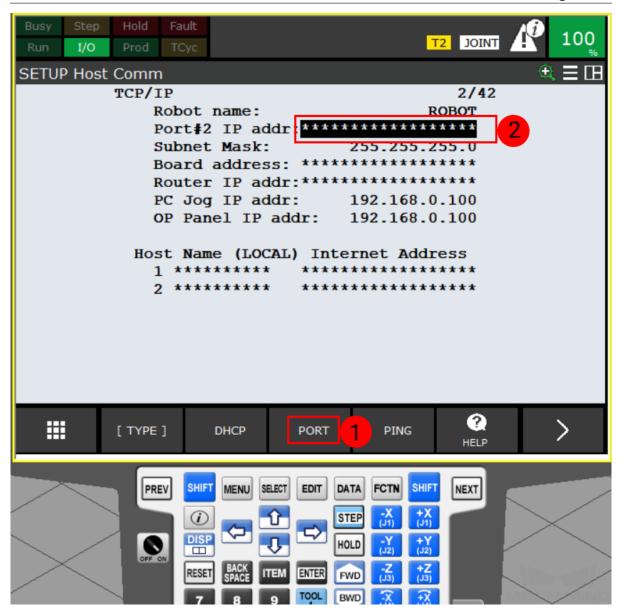
| BusyStepHoldFaultRunI/OProdTCyc   | Т  |                                     |
|---|--|-------------------------------------|
| SETUP Host Comm<br>TCP/IP<br>Robot<br>Port#<br>Subne<br>Board<br>Route<br>PC Joe<br>OP Par<br>Host Nam<br>1 *** | <pre>name: R( 1 IP addr: 192.168 t Mask: 255.255.23 address: ***********************************</pre> | 55.0<br>****<br>.100<br>.100<br>ess |
| [ TYPE ]  | DHCP PORT PING   | elp >                               |
| PREV SHI  |  | NEXT                                |





4. If the Ethernet cable is connected to port 2, please press *Port* to switch the port. Then you can enter the robot IP in the **IP address** line.





### Load the Program Files

### **Prepare the Files**

The program file is stored in the installation directory of Mech-Center. The default directory for Mech-Center 1.5.2 is C:/Mech-Mind/Mech-Center.

Navigate to *xxx/Mech-Center/Mech-RobServ/install\_packages/fanuc*, and copy all the contents of this folder to your flash drive:



**Note:** The folders and files must be saved in the root directory of the USB flash drive. Do not rename them.

### Load the Files to the Robot

1. After connecting the USB flash drive, press MENU and select  $FILE \rightarrow File$ , and then press ENTER to open the **FILE** window.

| Busy Step Hold Fault<br>Run I/O Prod TCyc | 100  |
|---|--|
| FILE                                      | ۵. 🕀   |
| MENU 1                                    | FILE 1 1/32  |
| 1 UTILITIES<br>2 TEST CYCLE               | 1 File 3.1 KAREL source)<br>2 File Memory .1 command files)  |
| 3 MANUAL FCTNS                            | 3 Auto Backup<br>I text files)   |
| 4 ALARM                                   | DT (all KAREL data files)<br>PC (all KAREL p-code)   |
| 6 SETUP                                   | TP (all TP programs)<br>MN (all MN programs)   |
| 7 FILE                                    | VR (all variable files)<br>SV (all system files)   |
| 8<br>9 USER                               | to generate directory  |
| 0 NEXT                                    |  |
| Menu Favorites (press and ho              | ld to set)   |
| <b>∟</b> ×                                | >  |
|   |  |
|   | $\begin{array}{c} \hline \\ \hline $ |
|   | 7 8 9 TOOL BWD 🔀 🔣   |

2. Press UTIL and select Set Device in the context menu.



| Busy Ste |            | TPIF-149 Must complete operation first          | 0  |
|----------|------------|---|----|
| FILE     |            |   | ΓH |
|          | UT1:\*.*   | 1/32  |    |
|          | 1 *        | <pre>* (all files)</pre>                        |    |
|          | 2 *        | KL (all KAREL source)                           |    |
|          | 3 *        | CF (all command files)                          |    |
|          | 4 *        | TX (all text files)                             |    |
|          | 5 *        | LS (all KAREL listings)                         |    |
|          | 6 *        | DT (all KAREL data files)                       |    |
|          | 7 *<br>8 * | PC (all KAREL p-code)                           |    |
|          | 8 *<br>9 * | TP (all TP programs)                            |    |
|          | 10 *       | MN (all MN programs)<br>VR (all variable files) |    |
|          | 10 *       | SV (all system 1 UTIL 1                         |    |
|          |            | to generate director 1 Set Device 2             |    |
|          | 11000 011  |   |    |
|          |            | 2 Format  |    |
|          |            | 3 Format FAT32                                  |    |
|          |            | 4 Make DIR                                      |    |
|          |            |   |    |
|          | [ TYPE ]   |   |    |
|          |            |   | 7  |
|          |            |   |    |
| /        | RE3        | ET SPACE ITEM ENTER FWD (33) (33)               |    |

3. Select the USB flash drive. If your flash drive is connected to the **controller**, please select **USB Disk (UD1:)**; if your USB flash drive is connected to the **teach pendant**, please select **USB on TP (UT1:)**.



|                    | ault TPIF-149 | Must complet | te operation first<br>T2 |          | Ŕ             | 100 <sub>%</sub> |
|--------------------|---------------|--------------|--------------------------|----------|---------------|------------------|
| FILE               |               |              |                          |          |               | <b>A</b> 🖽       |
| UT1:\*             | .*            |              |                          | 1/32     |               |                  |
|                    |               | (all fi      | les)                     |          |               |                  |
| 1                  |               |              | REL source               | -        |               |                  |
| 1 FROM Disk (FR:)  | n TP (UT1:)   | -            | mmand file               | s)       |               |                  |
| 2 Backup (FRA:)    |               | -            | xt files)<br>REL listin  | ()<br>() |               |                  |
|                    |               |              | REL data f               | -        |               |                  |
| 3 RAM Disk (RD:)   |               |              | REL p-code               | -        |               |                  |
| 4 Mem Card (MC:)   |               | -            | programs)                |          |               |                  |
| 5 Mem Device (MD:) |               | -            | programs)                |          |               |                  |
| 6 Console (CONS:)  |               | 1 -          | riable fil<br>stem files | -        |               |                  |
| 7 USB Disk (UD1:)  |               | erate di     |                          | ,        |               |                  |
| 8next page         | page          |              | lectory                  |          |               |                  |
|                    |               |              |                          |          |               |                  |
|                    | _             |              |                          |          | _             |                  |
| [ TYPE ]           | [ DIR ]       | LOAD         | [BACKUP]                 | [UTIL]   |               | >                |
| PREV               |               |              |                          | NEXT     |               |                  |
|                    |               |              |                          |          |               |                  |
|                    |               |              |                          |          | $\rightarrow$ | $\leq$           |
| OFF ON             |               | р 🖳 но       | LD -Y +Y<br>(J2) (J2)    |          |               |                  |
|                    | RESET BACK    | TEM ENTER FW |                          |          |               |                  |
|                    | 7 8           | 9 TOOL BV    |                          |          |               | /                |

4. Select the first line (all files) and press ENTER to enter the root directory of the USB flash drive.



| Busy Step         | Hold Fault      | TPIF-149 Must complete operation first  |
|-------------------|-----------------|---|
| Run I/O           | Prod TCyc       |   |
| FILE              |                 | ۹ 🕀                                     |
|                   | <u>UT1:\*.*</u> | 1/32                                    |
|                   | 1 *             | * (all files)                           |
|                   | 2 *             | KL (all KAREL source)                   |
|                   | 3 *             | CF (all command files)                  |
|                   | 4 *             | TX (all text files)                     |
|                   | 5 *             | LS (all KAREL listings)                 |
|                   | 6 *             | DT (all KAREL data files)               |
|                   | 7 *             | PC (all KAREL p-code)                   |
|                   | 8 *             | TP (all TP programs)                    |
|                   | 9 *             | MN (all MN programs)                    |
|                   | 10 *            | VR (all variable files)                 |
|                   | 11 *            | SV (all system files)                   |
|                   | Press DIR       | to generate directory                   |
|                   |                 |   |
|                   |                 |   |
|                   |                 |   |
|                   |                 |   |
|                   | [ TYPE ]        | [ DIR ] LOAD [BACKUP] [UTIL ]           |
|                   |                 |   |
|                   |                 |   |
|                   | PREV SHIF       | T MENU SELECT EDIT DATA FCTN SHIFT NEXT |
|                   |                 |   |
|                   |                 |   |
|                   |                 |   |
| $\sim$            | OFF ON          |   |
| $\langle \rangle$ | RESE            | T SPACE ITEM ENTER 2 53 75              |
|                   | 7               | 8 9 100 🐼 🐼 —                           |

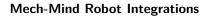
**Hint:** For the next step:

- If the USB flash drive is connected to the **robot controller**, please select **IN-STALL\_UD.cm**.
- If the USB flash drive is connected to the **robot teach pendant**, please select **IN-STALL\_UT.cm**.
- 1. Select the corresponding CM file and press  $\tt ENTER$  key on the teach pendant. Choose  $Y\!ES$  to start loading the programs.



| Busy Step<br>Run I/O | Hold Fault<br>Prod TCyc | TPIF-149 Must com | nplete operation first<br>T2 | JOINT  | 100    |
|----------------------|-------------------------|-------------------|------------------------------|--------|--------|
| FILE                 |                         |                   |                              |        | 🕀 🕀    |
|                      | UT1:\*.*                |                   |                              | 7/42   |        |
|                      | 1 FANUC                 | 2 7.7             | <dir></dir>                  |        |        |
|                      | 2 FANUC                 | 28.3              | <dir></dir>                  |        |        |
|                      | 3 FANUC                 | <b>.</b> 9.1      | <dir></dir>                  |        |        |
|                      | 4 FANUC                 | 29.3              | <dir></dir>                  |        |        |
|                      | 5 INST                  | ALL .             | CM                           | 1763   |        |
|                      | 6 TNST7                 | ALL UD            | CM                           | 2210   |        |
|                      | 7 INSTA                 | ALL_UT            | CM                           | 2204   |        |
|                      | 8 READ                  |                   | TXT                          | 417    |        |
|                      | _                       | SIMULATE          | <dir></dir>                  |        |        |
|                      | 10 VERSI                |                   |                              | 522394 |        |
|                      | 11 *                    |                   | files)                       |        |        |
|                      | Execute IN              | ISTALL_UT.CM      | ?                            |        |        |
|                      |                         |                   |                              |        |        |
|                      |                         |                   |                              |        |        |
|                      |                         |                   |                              |        |        |
|                      |                         |                   |                              |        |        |
|                      |                         |                   |                              |        |        |
|                      |                         |                   | YES 3                        | NO     |        |
| l                    |                         |                   |                              |        |        |
|                      |                         |                   |                              |        |        |
|                      | PREV                    | MENU SELECT EDIT  | DATA FCTN SHIFT              | NEXT   |        |
| <                    |                         |                   | STEP X +X                    |        |        |
|                      |                         |                   |                              |        | $\sim$ |
|                      |                         |                   |                              |        |        |
| $\sim$               | RESE                    | T BACK ITEM ENTER |                              | 1.0    |        |
|                      |                         |                   |                              |        |        |
|                      | 7                       | R G TOOL          | BWD X +X                     |        |        |

2. When the following screen is displayed, the loading and relavent configuration are completed. Press F4 to exit the program.





|                      |                       |           |             |           |            |       | _        |
|----------------------|-----------------------|-----------|-------------|-----------|------------|-------|----------|
| Busy Step<br>Run I/O | Hold Fault            | -         |             |           | T2         | JOINT | 100      |
| FILE                 |                       |           |             |           |            |       | 🕀 🕀      |
|                      | UT1:\*.*              |           |             |           | 7/         | 42    |          |
|                      | "Deleting             |           |             |           |            |       |          |
|                      | "MM_MOVES             |           |             |           |            |       |          |
|                      | "MM_RUN."<br>"PC Prog |           |             |           |            |       |          |
|                      | "                     |           |             |           |            |       |          |
|                      | "Start Lo             |           |             | grams"    |            |       |          |
|                      | • • • • • • • • •     | _         |             | -         |            |       |          |
|                      | "Programs             |           |             |           |            |       |          |
|                      | "HOST set             |           | inish"      |           |            |       |          |
|                      | "Finished             | 1"        |             |           |            |       |          |
|                      | Execution             | n is con  | mpleted     | success   | fullv      |       |          |
|                      |                       |           |             |           | 1          |       |          |
|                      |                       |           |             |           |            |       |          |
|                      |                       |           |             |           |            |       |          |
|                      |                       |           |             |           |            |       |          |
|                      | _                     |           | _           | _         | _          | _     |          |
|                      |                       |           |             | ок        |            |       |          |
| •••                  |                       |           |             |           |            |       |          |
|                      |                       |           |             |           |            |       |          |
|                      | PREV SI               | HIFT MENU | SELECT EDIT | DATA FCTN | SHIFT N    | EXT   |          |
|                      |                       |           |             |           | +X         |       |          |
|                      |                       |           |             |           | (J1)       |       |          |
|                      | OFF ON                |           |             | HOLD (J2) | (J2)       |       |          |
|                      |                       | SET BACK  | ITEM ENTER  | FWD (J3)  | +Z<br>(J3) |       |          |
|                      |                       |           |             |           |            | IVI.  | ELH MIND |

Attention: Please restart the robot after exiting the program.



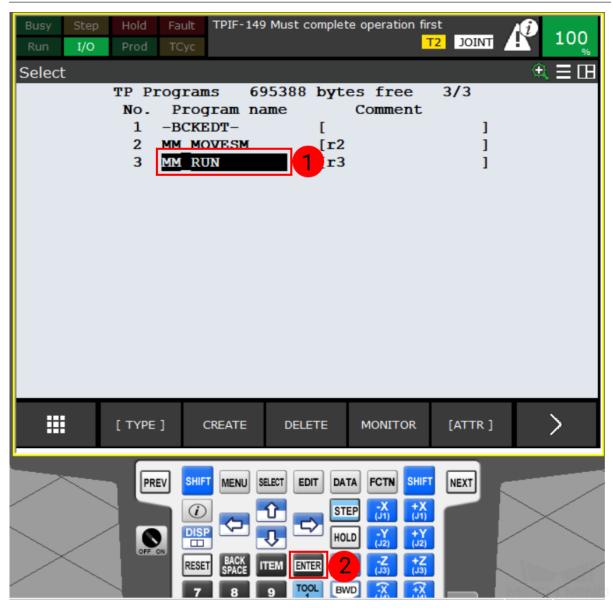
#### Run the Program

1. Press SELECT key on the teach pendant to open the program selection window, and then select  $TYPE \rightarrow TP \ Programs$ , as shown below.

| Busy Step Hold<br>Run I/O Prod | Fault     TPIF-149 Must complete operation first     100       TCyc     T2     JOINT |
|--------------------------------|--|
| Select                         | ± = ±  |
| All                            | 695388 bytes free 21/32  |
| No.                            | Program name Comment   |
| 17                             | IRVTYPE VR [ ]   |
| 18                             | MM_MOVEID PC [mm_moveid ]  |
|                                | MM_MOVESM [r2 ]  |
| 20                             | MM_RELAY PC [mm_relay ]  |
| TYPE 1                         | MM RUN [r3 ]   |
|                                | MM_STATE PC [mm_state ]  |
| 1 Recent                       | MM_STRUCT_H VR [ ]<br>MTPARAM VR [ ]   |
| 2 All                          | MTPARAMVR []REQMENUMR [Request PC Menu ]   |
| 3 Collections                  | SENDDATA MR [Send PC Data ]  |
| 4 TP Programs                  | 3  |
| 5 KAREL Progs                  |  |
| 6 Macro                        |  |
| 7 Cond                         |  |
| түре                           | CREATE DELETE MONITOR [ATTR]   |
|                                |  |

2. Select **MM\_RUN** and press **ENTER** to open the program. Then press the green button on the controller to auto-run the program.

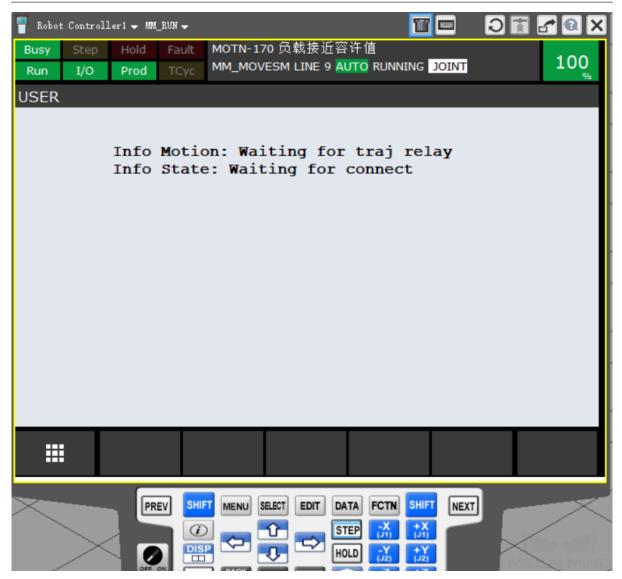




3. If the following screen is displayed, you can proceed to the next section.



**Mech-Mind Robot Integrations** 



### **Test Robot Connection**

Please refer to *Test Robot Connection* for detailed instructions.



# 1.3.2 FANUC Program Description

## **Program Module**

| Program Mod-  | Description  |
|---|--|
| ules  |  |
| mm_relay  | background program used to receive Robserver data                          |
| mm_state  | background program used to send data of robot pose, signal, and status     |
| mm_movesm   | foreground program used to guide the robot to move                         |
| mm_moveid background program used to write the data received by mm_relay to the regis |  |
| mm_run  | automatically run the foreground and background program after running this |
|   | module   |
| mm_struct_h   | defined struct data  |

# **Occupied Registers**

| Register     |     | Description                                 |
|--------------|-----|---|
| MOVE_SPD_REG | 180 | integer register: motion speed (in $\%$ )   |
| MOVE_CNT_REG | 181 | integer register: motion termination (in %) |
| MOVE_TYP_REG | 182 | indicate the move type J or L               |
| MOVL_RG_SPD  | 183 | move L speed                                |
| RI_C_BRANCH  | 184 | mm control branch                           |

| Position Register | Description                         |
|-------------------|-------------------------------------|
| MOVE_PREG 80      | position register for current point |

# **Occupied FLAGs**

| FLAG        |     | Description            |
|-------------|-----|------------------------|
| F_MSM_RDY   | 180 | ready signal flag      |
| F_MSM_DRDY  | 181 | data ready signal flag |
| F_TK_CTRL   | 182 | takes control flag     |
| RI_MM_LOCK  | 183 | trajectory lock flag   |
| R_STOP_MOVE | 190 | stop move flag         |
| F_STOP_CLR  | 191 | clear data flag        |



# 1.4 KUKA

This section introduces the full-control program for KUKA robots and the procedure of setting up the communication with a robot through the program.

# 1.4.1 KUKA Setup Instructions

This section introduces the process of loading the robot full-control program onto a KUKA robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

### **Check Controller and Software Compatibility**

Compatibility requirements are as follows:

- Controller model: KUKA KR C4
- Controller system software version: KSS 8.2 to 8.6
- Add-on software package: Ethernet KRL (V 2.2.8 or above)
- Mech-Center: latest version recommended

**Note:** All teach pendant actions in this chapter are performed on KSS 8.6. The specific steps and menu selections may differ slightly in older versions of system software.

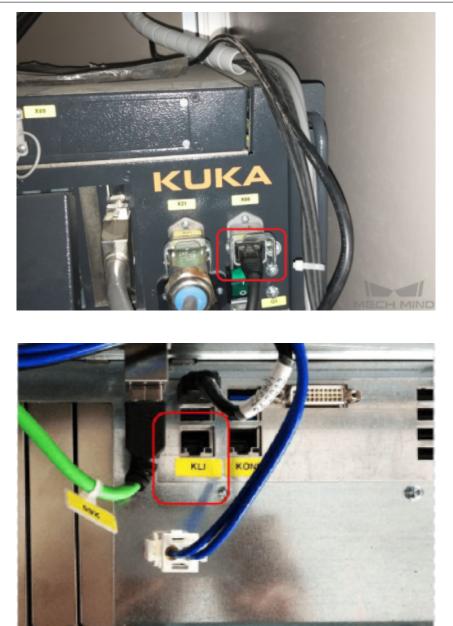
### Setup the Network Connection

### Hardware Connection

Plug the Ethernet cable into:

- An Ethernet port on the IPC
- The X66 port on KR C4 compact and KLI port on other KR C4 controllers





### **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Check the IP address of the IPC: please use the *ipconfig* command in Command Prompt or PowerShell to check the IP address.
- 2. Switch to expert mode:



- т**10** в0 100 ķ ₩ R Τ1 00 10 9:40:51 AM 5/11/2022 LOS 120 1 OK Confirm all 0 The logged-on user switched from Operator to Administrator. 2 1 0 < ហ × Configuratio File Inputs/outputs ► ► E Configuration ► T interpreter A1 Display Status keys 3 ► ► Diagnosis User group • A2 Start-up Miscellaneous ► 27 A3 Shutdown Safety configuration Help Brake test configuration ► A4 Machine configuration Collision detection A5 A6 Quick access Configuration > Miscellaneous > Language Display > Variable > Cyclical flags Configuration > Miscellaneous > Event planner Start-up > Calibrate > Tolerances
- 1. Press on  $\bigcirc$ , and then select *Configuration*  $\rightarrow$  *User group*.

2. Select **Expert**, enter the password (the default password is **kuka**), and press on *Log on*.



|          | 0S I R T1 ≥ 100 ★ ∞ <sup>⊤10</sup> ↔   | ω         |
|----------|--|-----------|
|          | 9:46:54 AM 5/11/2022 LOS 120      OK      OK      Confirm all  | ٢         |
| 3        | Log-on by selection  | 7         |
|          | Operator (default) is logged on.   |           |
| $\times$ | Select a user group:   |           |
|          | Operator (Default)   |           |
|          | User   | E         |
|          |  | A1        |
| $\odot$  | Expert   |           |
|          | Safety recovery technician   | • •       |
|          | Safety maintenance technician  | A2        |
|          |  |           |
|          | Administrator  | A3        |
|          | Password:  |           |
|          |  | A4        |
|          | 1 2 3 4 5 6 7 8 9 0  |           |
|          |  |           |
|          | $\mathbf{Q}^{\sim} \mathbf{W}^{-} \mathbf{E}^{-} \mathbf{R}^{\prime} \mathbf{T}^{+} \mathbf{Y}^{+} \mathbf{U}^{\left\{ \begin{array}{c} \mathbf{I} \end{array}\right\}} \mathbf{O}^{\left[ \begin{array}{c} \mathbf{P} \end{array}\right]}^{\prime}$ | A5        |
|          |  |           |
|          | A S D F G H J K L  | <b>A6</b> |
|          | ☆     Z     >     Copy<br>C     Paste<br>V     ,     .     ?       ↓     X     C     V     B     N     M     ↓   |           |
|          |  |           |
|          |  |           |
|          |  | Æ         |
|          | Default Password Log on  | 1         |
|          |  | ND        |

3. Press on  $\bigcirc$ , and then select *Start-up*  $\rightarrow$  *Network configuration*.



| 3          | 1  | S I R TI                     | 100<br>10 |             | ω         |  |  |
|------------|--|------------------------------|-----------|-------------|-----------|--|--|
|            | () 9:46:54 AM 5/11/2022 LOS                  |                              | ок        | Confirm all | 0         |  |  |
| <b>1</b> 3 | The logged-on user switched fro<br>Main menu | m Administrator to Operator. | -         |             | 7         |  |  |
|            | Main menu                                    | Start-up                     |           |             |           |  |  |
|            | File 🕨                                       | Start-up wizard              |           |             |           |  |  |
|            | Configuration                                | Supplementary load data      |           |             | کت<br>A1  |  |  |
| •          | Display 🕨                                    | Tool/base management         |           |             |           |  |  |
|            | Diagnosis 🕨                                  | Calibrate 🕨                  |           |             | A2        |  |  |
|            | Start-up                                     | 2 ト                          |           |             |           |  |  |
|            | Shutdown                                     | wn Software update           |           |             |           |  |  |
|            | Help 🕨                                       |                              |           |             |           |  |  |
|            |  | Robot data                   |           |             | <b>A4</b> |  |  |
|            |  | Network configuration        | 3         |             | A5        |  |  |
|            |  | Additional software          |           |             |           |  |  |
|            |  | Rights management            |           |             | <b>A6</b> |  |  |
|            | Quick access                                 |                              |           |             |           |  |  |
|            | Configuration > User group                   |                              |           | -           |           |  |  |
|            | Configuration > Miscellaneous                | > Language                   |           | -           |           |  |  |
|            | Display > Variable > Cyclical                | flags                        |           | -           | <b>K</b>  |  |  |
|            | Configuration > Miscellaneous                | > Event planner              |           | -           |           |  |  |

4. Input an **IP address** in the same subnet as that of the IPC, and then press on *Save*. In the next two pop-up windows, press on *Yes* and *OK*, respectively.



| 3        | S I F  | <b>Т</b> 1 | R   | ▶ 100<br>⋹ 10 | ¥       | Ń  | × 10<br>80 ≯ | > 00      |
|----------|--|------------|-----|---------------|---------|----|--------------|-----------|
|          | <ul> <li>10:41:27 AM 5/11/2022 LOS 120</li> <li>The logged-on user switched from Operator to E</li> <li>Network configuration</li> </ul> | xpert.     |     |               | OK      |    | Confirm      | all 🕹     |
|          | Windows interface (virtual5)   |            |     |               |         |    |              |           |
|          | Address type:  | Fixed IP   | add | lress         |         |    | 1            | E         |
| <b>@</b> | IP address:  | 192        |     | 168           | . :     | L  | . 147        | A1        |
|          | Subnet mask:   | 255        |     | 255           | . (     | )  | . 0          | A2        |
|          | Standard gateway:  | 0          |     | 0             | . (     | )  | . 0          | A3        |
|          | DNS Server:  | 0          |     | 0             | . (     | )  | . 0          |           |
|          |  |            |     |               |         | A  | dvanced      | A4        |
|          | The Windows interface is the network interface the controller. (If PROFINET is used without a be used.)                                  |            |     |               |         |    |              | A5        |
|          |  |            |     |               |         |    |              | <b>A6</b> |
|          |  |            |     |               |         |    |              |           |
|          | KLI  |            |     | Interr        | nal sul | 2  |              |           |
|          |  |            |     |               | Sav     | ve | Back         |           |



|                | Network configuration                         |   |                |            |      |
|----------------|---|---|----------------|------------|------|
|                | Yould you like                                | to save the change                        | s?             |            |      |
|                | Yes   | Cancel                                    |                |            |      |
| Network config | uration                                       |   |                | -999999    |      |
| Config         | guration has been modified. The<br>start with | e changes will be ap<br>n "Reload files"! | oplied after t | the next ( | cold |
|                | O   | ¢   |                |            |      |

5. Restart the robot to finish setting the IP address:





| 3 | S I R T1 ≥ 100 K ≠ 10 HH  | œ          |
|---|---|------------|
|   | (i) 10:47:26 AM 5/11/2022 LOS 120<br>The logged-on user switched from Expert to Operator. | ٥          |
|   | Main menu<br>Main menu  |            |
|   | File  | E          |
|   | Configuration   | <b>A1</b>  |
| 0 | Display ►   |            |
|   | Diagnosis   | <b>A2</b>  |
|   | Start-up  |            |
| ۲ | Shutdown 2  | <b>A3</b>  |
|   | Help  | <b>A4</b>  |
|   |   | <b>A5</b>  |
|   |   | <b>A6</b>  |
|   | Quick access Shutdown   |            |
|   | Start-up > Network configuration  |            |
|   | Configuration > User group  | <b>á</b> t |
|   | Configuration > Miscellaneous > Language  |            |

2. Press on Reboot control PC.



| 3 | $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | ω             |
|---|--|---------------|
|   | 8:43:39 AM 5/13/2022 LOS 120 The logged-on user switched from Operator to Expert.      OK Confirm all Shutdown | <b>©</b><br>7 |
|   | Default settings for shutdown     Start type   |               |
|   | ○ Cold start   | E             |
| ~ | Power-off wait time [s]  | A1            |
|   | Power-fail wait time [s]   | A2            |
|   | Settings for next shutdown  Force cold start  Power-off delay  time  | <b>A</b> 3    |
|   | Reload files Power-fail wait time  | A4            |
|   | Shutdown actions Shut down control PC Reboot control PC  | A5            |
|   | ⊘ Drive bus  | A6            |
|   |  |               |
|   |  | æ             |



### Load the Program Files

### Prepare the Files

The program files are stored in the installation directory of Mech-Center. The default directory for Mech-Center 1.5.2 is C:/Mech-Mind/Mech-Center.

Navigate to xxx/Mech-Center/Mech-RobServ/install\_packages/kuka/kuka\_new, and copy the following files to your flash drive.

- mm\_motion.xml
- mm\_status.xml
- mm\_server.dat
- mm\_server.sub
- motion\_control.src
- mainmodule.src
- mainmodule.dat

### Load the Files to the Robot

**Note:** Make sure you have switched to expert mode on the teach pendant. For instructions, see step 2 in **IP Configuration**.

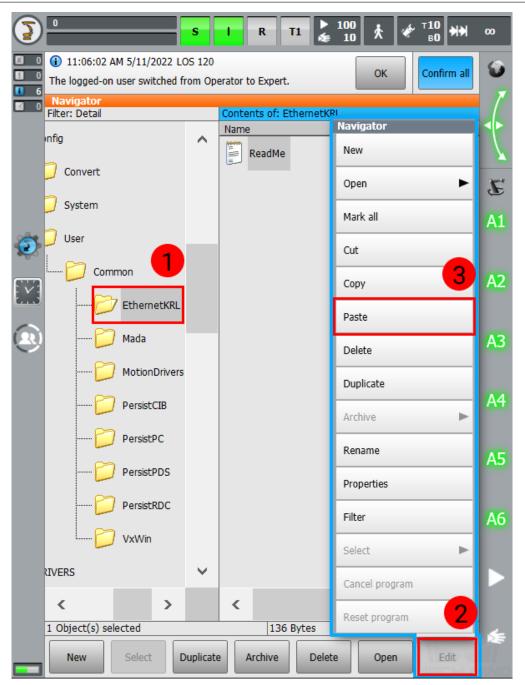
- 1. Plug the flash drive to the controller.
- 2. Select the flash drive, and locate the above files.
- 3. Select **mm\_motion.xml**, press on *Edit*, and then select **Copy**.



| 3           | 0 S   | I R T1 🍃   | 100 ★ ★ <sup>⊤10</sup> ₩               | 00       |
|-------------|---|--|--|----------|
| 0<br>0<br>6 | <ul> <li>11:06:02 AM 5/11/2022 LOS 120</li> <li>The logged-on user switched from Ope</li> </ul>                             | erator to Expert.  | OK Confirm all                         | 0        |
| 0           | Navigator<br>Filter: Detail<br>PCRC-2RL7HHTTRE (KRC:\)<br>KUKA_DISK (C:\)<br>KUKA_DATA (D:\)                                | Contents of: kuka_new Name mainmodule mainmodule mainmodule mainmodule mainmodule mainmodule | Navigator<br>New<br>Open<br>Mark all   | S A1     |
|             | <ul> <li>(E:\)</li> <li>MM_USB (F:\)</li> <li>MM_USB (F:\)</li> <li>MM_USB (F:\)</li> <li>System Volume Informat</li> </ul> | mm_server  | Cut 3<br>Copy<br>Paste                 | A2<br>A3 |
|             | (ARCHIVE:\)   | Motion_control   | Delete Duplicate Archive Rename        | A4<br>A5 |
|             |   |  | Properties Filter Select               | A6       |
|             | 2 Object(s) selected New Select Duplicate   | <     866 Bytes     Archive Delete   | Cancel program Reset program Open Edit | ¢.       |

4. Navigate to C:/KRC/ROBOTER/Config/User/Common/EthernetKRL, press on Edit, and then select Paste.





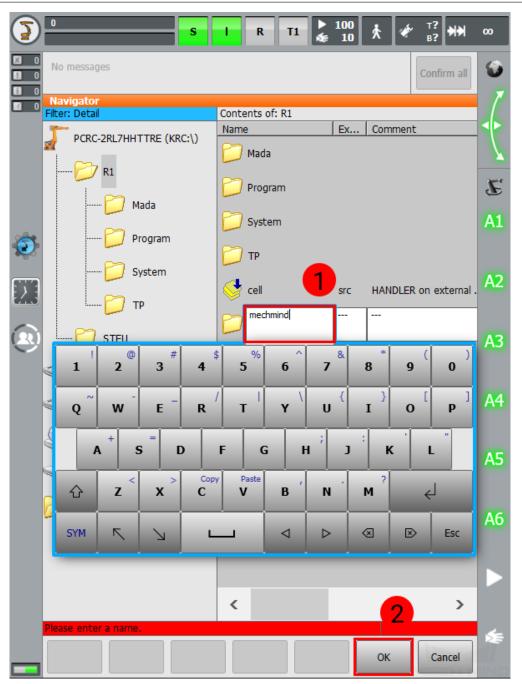
- 5. Navigate back to the flash drive, and repeat steps 3 and 4 for **mm\_status.xml**.
- 6. Navigate to KRC:/R1, and press on New.



| 3 | 0 S   | I R T1   | 100<br>10 | ★ * <sup>T?</sup><br>8? ** | 00                    |
|---|---|--|-----------|----------------------------|-----------------------|
|   | No messages   |  |           | Confirm all                | ٥                     |
|   | Navigator<br>Fiter: Detain<br>PCR 7HHTTRE (KRC:\)<br>R1<br>Mada<br>Program<br>Program   | Contents of: R1<br>Name<br>Mada<br>Program<br>System<br>TP |           | Comment                    | الج<br>من<br>من<br>من |
|   | <ul> <li>TP</li> <li>STEU</li> <li>KUKA_DISK (C:\)</li> <li>KUKA_DATA (D:\)</li> <li>(E:\)</li> <li>(E:\)</li> <li>(ARCHIVE:\)</li> </ul> |  |           |                            | A3<br>A4<br>A5<br>A6  |
|   | 5 Object  | Archive Delete   | 2         | ><br>Open Edit             | •                     |

7. Input **mechmind** for the folder name, and press on OK.

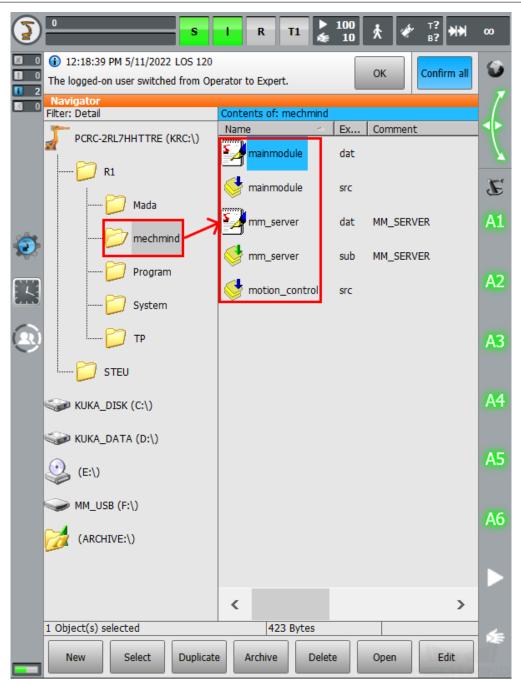




8. Navigate back to the flash drive, and copy and paste the other 5 files to KRL:/R1/mechmind.

Note: Long-press and drag to select multiple adjacent files.







### Set Autostart for Background Porgram

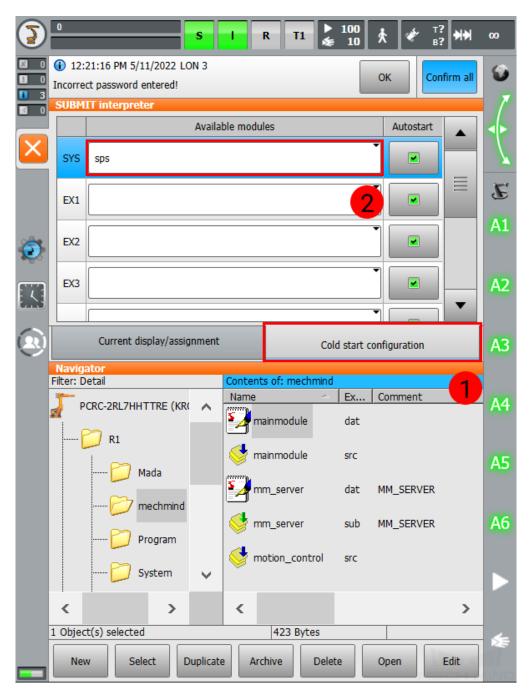
**Note:** Make sure you have switched to expert mode on the teach pendant. For instructions, see step 2 in **IP Configuration**.

1. Press on **S** and then *Display/Assign*.

| 3           | 0        |             |                | s        | -    | R        | T1         | ▶ 100<br>≨ 10 | *    | ÷ | T?<br>₿? ₩₩        | 00        |
|-------------|----------|-------------|----------------|----------|------|----------|------------|---------------|------|---|--------------------|-----------|
|             | All SU   | BMIT inte   | erpreters      |          |      |          |            |               |      |   |                    | 6         |
| 0<br>0<br>2 |          | State       |                | 1        | Sele | cted mod | ule        |               |      |   | Select/            | <b>U</b>  |
|             | SYS      | 9           | sps<br>SPS.SUB |          |      |          |            |               | (40) |   | Start              |           |
|             | EX1      |             |                |          |      |          |            |               |      |   | Stop               |           |
|             | EX2      |             |                |          |      |          |            |               |      |   | eselect            |           |
|             | EX3      |             |                |          |      |          |            |               |      |   |                    | E         |
| ~~~         | EX4      |             |                |          |      |          |            |               |      |   | Display/<br>Assign | <b>A1</b> |
| 2           | EX5      |             |                |          |      |          |            |               |      | _ | 2                  |           |
|             | EX6      |             |                |          |      |          |            |               |      | _ |                    | A2        |
|             | EX7      |             |                |          |      |          |            |               |      |   |                    |           |
|             |          |             | ТР             |          |      |          |            |               |      |   | -                  | A3        |
|             |          | 🔵 steu      |                |          |      |          |            |               |      |   |                    |           |
|             | 🥪 ки     | IKA_DISK    | (C:\)          |          |      |          |            |               |      |   |                    | <b>A4</b> |
|             | s n      | JKA_DATA    | (D.)           |          |      |          |            |               |      |   |                    |           |
|             |          |             | (0.)           |          |      |          |            |               |      |   |                    | A5        |
|             | (E       | =:\)        |                |          |      |          |            |               |      |   |                    |           |
|             | 🧼 MI     | M_USB (F:   | V              |          |      |          |            |               |      |   |                    | A6        |
|             | 裙 V      | ARCHIVE:\   | )              |          |      |          |            |               |      |   |                    | AO        |
|             |          |             |                |          |      |          |            |               |      |   |                    |           |
|             |          |             |                |          |      |          |            |               |      |   |                    | 14        |
|             | 1.01:    | (-) - 1 - 1 |                |          | <    | 100      | <b>D</b> + |               |      |   | >                  |           |
|             | 1 Object | (s) select  |                |          |      | 423      | Bytes      |               |      |   |                    | 1         |
|             | New      | S           | elect          | Duplicat | e A  | Archive  | De         | lete          | Open |   | Edit               |           |

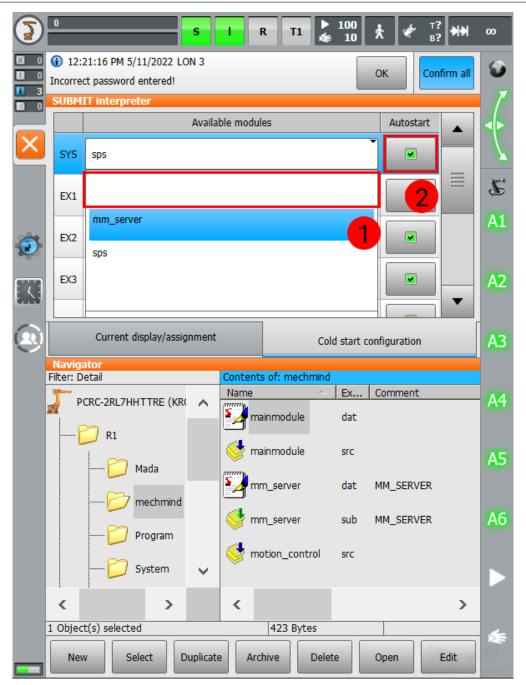


2. Press on Cold start configuration, and then press on the text box to the right of SYS.



3. Select the blank in the drop-down menu, and then press on the check-box in **Autostart** to uncheck it.





4. Similarly, select **mm\_server** from the drop-down menu for **EX1**, and make sure **Autostart** is checked.



| 3           | 0               | S   |  | а ті 🍹       | 100<br>10 K         |             | 00        |
|-------------|-----------------|---|--|--------------|---------------------|-------------|-----------|
| 0<br>0<br>3 | Incorr          | 2:21:16 PM 5/11/2022 LON 3<br>ect password entered! |  |              | O                   | Confirm all | 0         |
| 0           | SUBI            | 1IT interpreter                                     | ailable modul  | 05           |                     | Autostart . |           |
|             |                 | Ava   | allable modul  | 65           | <b>-</b>            |             |           |
|             | SYS             |   |  |              |                     |             |           |
|             | EX1             | mm_server   |  |              | ľ                   |             | E         |
| $\odot$     | EX2             |   |  |              | 1                   | 2           | A1        |
|             | EX3             |   |  |              | •                   |             | A2        |
|             |                 | Current display/assignme                            | ent  | Cold         | ▼ <br>I start confi | guration    | A3        |
|             | Navi<br>Filter: |   | Content  | of: mechmind |                     |             |           |
|             | 5               | PCRC-2RL7HHTTRE (KR                                 | Name   | ~            | Ex Co               | omment      | A4        |
|             | 2               | <b>~</b>  |  | inmodule     | dat                 |             |           |
|             |                 | C R1  | of the second se | inmodule     | src                 |             | A5        |
|             |                 | 🗁 mechmind  | nr 🔁 mr  | n_server     | dat M               | M_SERVER    |           |
|             |                 | Program   | 💛 mr   | n_server     | sub M               | M_SERVER    | <b>A6</b> |
|             |                 | System  | e de mo  | tion_control | SIC                 |             |           |
|             | <               | >   | <  |              |                     | >           |           |
|             | 1 Obje          | ect(s) selected                                     |  | 423 Bytes    |                     |             | <b>s</b>  |
|             | N               | ew Select Duplic                                    | ate Arc  | hive Delete  | e Oj                | oen Edit    | 25        |

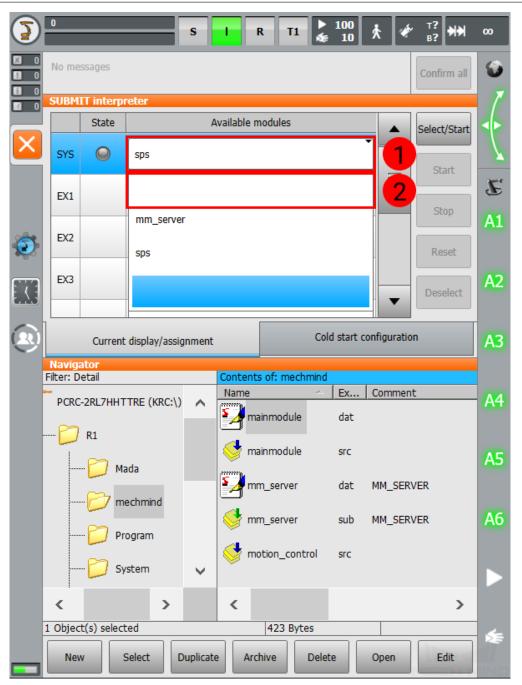
5. Press on **Current display/assignment**, press on the text box to the right of **SYS**, and then press *Deselect*.



| 3         | 0                  |                |               | s        | •        | R T1         | ►<br>€ | 100<br>10 | * *                | , <mark>⊺?</mark><br>₿? ₩₩ | œ         |
|-----------|--------------------|----------------|---------------|----------|----------|--------------|--------|-----------|--------------------|----------------------------|-----------|
|           | No me              | essages        |               |          |          |              |        |           |                    | Confirm all                | ٥         |
|           | SUBM               | IT interpr     | eter          |          |          |              |        |           |                    |                            | 1         |
|           |                    | State          |               | А        | vailable | modules      |        |           |                    | Select/Start               |           |
| ×         | SYS                | 0              | sps           |          |          |              |        |           |                    | Start                      | 7         |
|           | EX1                |                |               |          |          |              |        | 1         |                    | Stop                       | E         |
| <b>()</b> | EX2                |                |               |          |          |              |        |           |                    | Reset                      | A1        |
|           | EX3                |                |               |          |          |              |        |           |                    | Deselect                   | A2        |
|           |                    | Current        | display/assig | nment    |          |              | Colo   | d start o | ▼<br>configuration | on <b>2</b>                | A3        |
|           | Navig<br>Filter: D | ator<br>Iotail |               |          | Conter   | its of: mec  | hmind  |           |                    |                            |           |
|           | -                  |                |               |          | Name     | its of the c | ~      | Ex        | Commen             | nt                         |           |
|           | 🚽 P                | CRC-2RL7F      | HTTRE (KR     | ^        | P        | nainmodule   |        | dat       |                    |                            | A4        |
|           |                    |                | Mada          |          | 🔮 r      | nainmodule   |        | src       |                    |                            | A5        |
|           |                    |                | mechmind      |          | P        | nm_server    |        | dat       | MM_SER             | VER                        |           |
|           |                    | P              | Program       |          | 🔮 r      | nm_server    |        | sub       | MM_SER             | VER                        | <b>A6</b> |
|           |                    | -0             | System        | ~        | Se r     | notion_con   | trol   | src       |                    |                            |           |
|           | <                  | I              | >             |          | <        |              |        |           |                    | >                          |           |
|           | 1 Objec            | t(s) select    | ed            |          |          | 423 Byt      | tes    |           |                    |                            | 1         |
|           | Nev                | w S            | Select D      | uplicate | e A      | rchive       | Delet  | e         | Open               | Edit                       | Æ         |

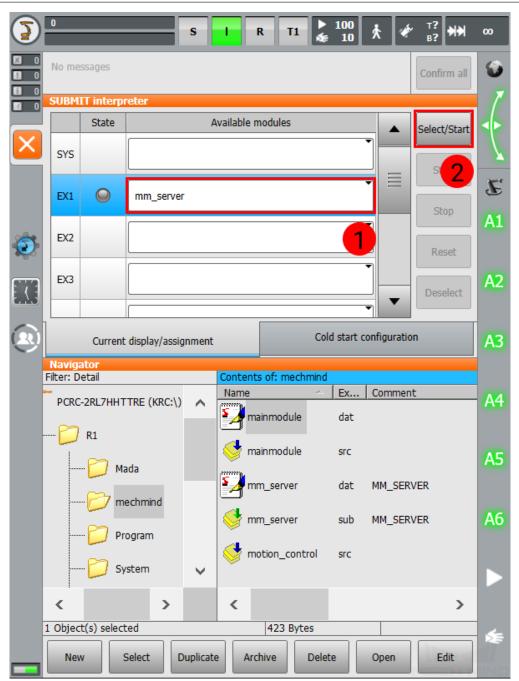
6. Press on the text box to the right of  $\mathbf{SYS}$  again, and select the blank in the drop-down menu.





7. Similarly, select **mm\_server** from the drop-down menu for **EX1**, and press on *Select/Start*.

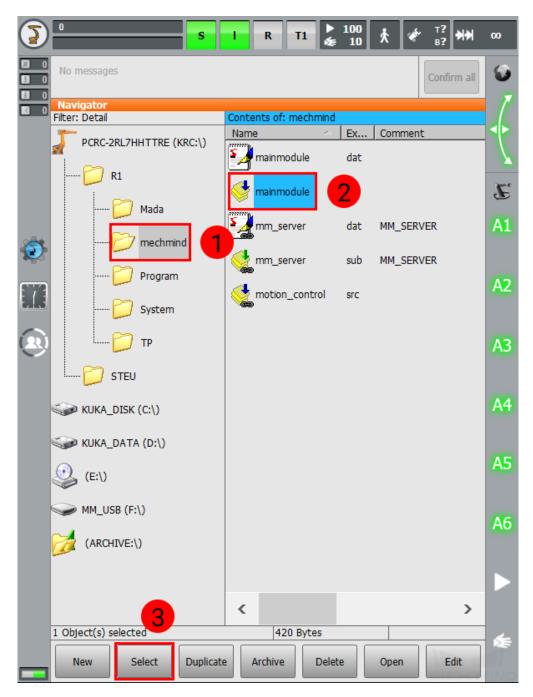






#### Select Foreground Program

1. Open the **mechmind** folder, select **mainmodule.src**, and then press on *Select*.



2. The following should appear on the screen.





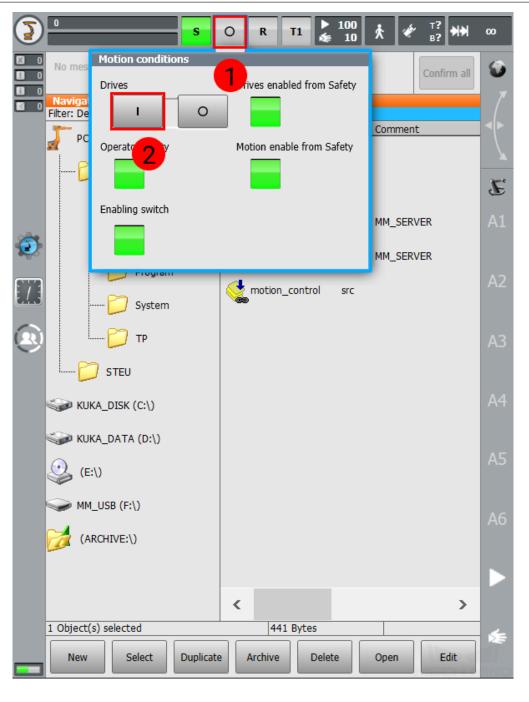


#### Run Program in AUT Mode

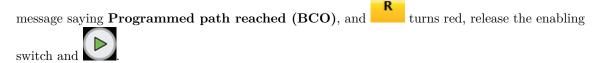
1. Turn the key switch to horizontal, select  ${\bf T1}$  on the screen, and then turn the switch back to vertical.







3. Press on the enabling switch (either one of three) on the back of the pendant and on the front at the same time to move the robot back to Home position. When the screen displays a



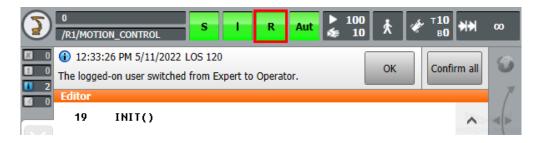


**Note:** Set an appropriate speed for the robot before moving it, and observe its motion carefully to avoid accidents.



4. Switch to **AUT** mode as described in step 10, and press on **W** to start running the full-control

program (**Line** should turn green).





#### **Test Robot Connection**

Please refer to *Test Robot Connection* for detailed instructions.

# 1.4.2 KUKA Program Description

## **Full-Control Programs**

| Program          | Description  |
|------------------|--|
| mm_server.sub    | Background program for receiving data from Mech-Center and sending robot pose, |
|                  | signal and status data   |
| mm_server.dat    | Data file for the background program   |
| mo-              | Foreground program for controlling and moving the robot                        |
| tion_control.src |  |
| mainmod-         | Foreground main module of the full-control program                             |
| ule.src          |  |
| mainmod-         | Data file for the main module  |
| ule.dat          |  |
| mm_status.xml    | Configuration file for communicating robot status                              |
| mm_motion.xm     | Configuration file for communicating robot motion                              |

#### **Internal Flags**

| Internal flag | Description   |
|---------------|---|
| \$FLAG[1]     | Flag indicating that mm_motion has successfully connected |
| \$FLAG[2]     | Flag indicating that mm_motion has received data          |
| \$FLAG[5]     | Flag indicating that mm_status has successfully connected |
| \$FLAG[6]     | Flag indicating that mm_status has received data          |

## IOs

| IO occupied | Signal             |
|-------------|--------------------|
| DI (16)     | \$IN[1]-\$IN[16]   |
| DO (16)     | \$OUT[1]-\$OUT[16] |
| DI (64)     | \$IN[1]-\$IN[64]   |
| DO (64)     | \$OUT[1]-\$OUT[64] |



# 1.5 Kawasaki

This section introduces the full-control program for Kawasaki robots and the procedure of setting up the communication with a robot through the program.

# 1.5.1 Kawasaki Setup Instructions

This section introduces the process of loading the robot full-control program onto a Kawasaki robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program File
- Test Robot Connection

Please have a flash drive ready at hand.

**Note:** A USB 2.0 flash drive is recommended. Otherwise, the robot controller may not recognize the flash drive.

#### Check Controller and Software Compatibility

- Controller: no requirement
- Controller system software version: no requirement
- Additional controller software options: not required
- Mech-Center: latest version recommended

#### Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable into:

- An Ethernet port on the IPC
- The Ethernet port inside the accessory panel on the front of the controller



#### **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Check the IP address of the IPC: please use the *ipconfig* command in Command Prompt or PowerShell to check the IP address.
- 2. On the teach pendant, press on Aux., and then select 8. System  $\rightarrow$  12. Network Setting.

| R01[C01] - Virtual Teach Pendant 0 -  | 🗆 🗙 🛃 R01[C01] - Virtual Teach Pendant 0 🛛 🚽 🗆 🗙  | 🛃 R01[C01] - Virtual Teach Pendant 0 - 🗆 🗡  |
|---|---|---|
| TELOGI Mittage source OFF   | Image: Second         | BEIGHT<br>L         Program<br>main<br>L         STEP<br>I heartost<br>L         PC<br>I heartost<br>2/watost         RUN WORD (CLL)<br>Aux.           (E1135) Motor power OFF.         1         June 2000         STEP CONT, WALSPEED<br>L         STEP CONT, WALSPEED  |
| INTERP SPD ACC TWR TOOL CLAMP J/E OUTPUT INPUT  | 12153 Aux.  | Aux. :System  |
| 2 TOU. tool1<br>3 WHILE TRUE DO<br>4 COLL mechanind(1)<br>5 ;200/E #PPOINT(0,0,0,0,0)           | I. Program Conversion     I. Program Conversion     TO     C. See/Lad     See/Lad | Heavy Available     Is. US Refoond     Industry Available     Industry Available     Is an intervent of the second of the s |
| RPS         Q         Q           OFF         Monitor1         Monitor2         Step<br>Forward | •   | 12. Metwork Setting   |
| Record I/0  | Selects System  | Selects Network Setting   |

- 3. Set IP Address to one in the same subnet as that of the IPC.
- 4. Set Subnet Mask to 255.255.255.0.

Note: If the IP address is set to either 192.168.0.1 or 192.168.1.1, please set **Subnet Mask** to **255.255.0.0** instead.

5. If you are using a network gateway, the gateway address should also be set. Please consult your IT support for help.



| R01[C01] - Virtual Teach Pendant 0  | - 🗆 🗙                            |
|---|----------------------------------|
| REPEAT       Program       [Comment]       STEP         main       1       1         [       ]       2*autost | RUN MOTOR CYCLE<br>Aux. REP. SPD |
| (E1133) MOUOR POWER OFF.  | REP. CONT.                       |
| Aux.:System:Network Setting<br>Port 1   | 1/ 2                             |
| IP Address0.0.0.0Host Name  |                                  |
| MAC Address eth0 00:09:0F:03:01:12<br>Network Address 0.0.0.0   |                                  |
| Undo Next Page Sets IP Address<br>Input range : [0 - 255]   |                                  |

6. Press the ENTER key to confirm, and then restart the controller.

## Load the Program File

#### Prepare the File

The program file is stored in the installation directory of Mech-Center. The default directory for Mech-Center 1.5.2 is C:/Mech-Mind/Mech-Center.

Navigate to *xxx/Mech-Center/Mech-RobServ/install\_packages/kawasaki*, and copy **mech-mind\_server.as** to your flash drive.



| Mech-Center > Mech_RobServ > install_packages > kawasaki |                    |  |  |  |
|--|--------------------|--|--|--|
| Name   | Date modified      |  |  |  |
| 📔 mechmind_axis7.as                                      | 5/10/2021 4:52 PM  |  |  |  |
| mechmind_server.as                                       | 10/22/2021 6:08 PM |  |  |  |
| README.txt   | 5/10/2021 4:52 PM  |  |  |  |
|  |                    |  |  |  |

**Note:** Copy the file to the root directory of the flash drive. Do not put it in another folder or rename it.

#### Load the File to the Robot

- 1. Insert the flash drive to the USB port inside the accessory panel on the controller.
- 2. Check the **Program** and **PC** areas to see if any programs are running. If so, backup and exit the programs according to the following instructions.



| 🛃 R01[C01] - Vii    | rtual Teach Penda | int O                   |                  |                            | <u> </u> |            |
|---------------------|-------------------|-------------------------|------------------|----------------------------|----------|------------|
| TEACH               | Program<br>[      | [Comment ]<br>main<br>] | STEP<br>1<br>[ ] | PC<br>1*autost<br>2*autost | RUN MO   | REP. SPD   |
| (E1135) Moto        | or power OFF      | •                       |                  | Lvž                        |          | MAN, SPEED |
| INTERP 8            | SPD ACC TM        | R TOOL CLAME            | ? J∕E OU         | TPUT                       | INPUT    | 12:59      |
| JOINT               | 9 1 0             | 1                       |                  | ][                         |          | ERROR      |
| 1 POINT<br>2 TOOL 1 |                   | NS(0,0,0,0,0,           | 0,0)             |                            |          | AUTO       |
|                     | TRUE DO           |                         |                  |                            |          | CHK once   |
| 4 CALL (            | mechmind(1)       |                         |                  |                            |          | Waiting    |
|                     | E #PPOINT(0,      | 0, 0, 0, 0, 0, 0)       |                  |                            |          | RPS OFF    |
| 6 END<br>[EOF]      |                   |                         |                  |                            |          | EXT. HOLD  |
|                     | I                 |                         |                  |                            |          |            |
|                     | RPS               | 3                       | Q                |                            |          |            |
|                     | OFF               | Monitor1                | Monitor2         |                            | J/E      |            |
|                     | 14                |                         |                  |                            | <b>N</b> |            |
| Record I/O          | Tool              |                         |                  |                            | Manual   |            |
| Monitor             | 1                 |                         |                  |                            | Output   | ECH MIND   |

If there is a program in the  ${\bf Program}$  area, please create backup first.

Follow the steps below to back up all files except for system logs to the flash drive.

1. Press on Aux., and select 2. Save/Load  $\rightarrow$  1. Save.

| R01[C01] - Virtual Teach Pendant 0 -                                      |   | 🛃 R01[C01] - Virtual Teach Pendant 0 — 🖂 📈   | 🛃 R01[C01] - Virtual Teach Pendant 0 - 🗆 🗡   |
|---|---|--|--|
| main         1         1*autost           [         ]         [         ] | OR CYCLE<br>REP. SPD<br>100%<br>AM, SPEED | TEVEN         Program         Comment         STEP         PC           1         1         1         1         1         1         Aux         BEF, SPD           2000000000000000000000000000000000000 | Imain         1         Paulost         REF. SED           [         ]         [         ]         [         ]           [         ]         [         ]         [         ]         ] |
| (BI136) Motor power urr.  | 2   | (BI136) NOTOT POWET UFF.   |  |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPOT INPUT                            | 12:53                                     | Aux.   | Aux.:Save/Load   |
| JOINT 9 1 0 1 [ ][ ]  | ERRUR                                     | 1. Program Conversion  | 1. Save  |
| 2 T00L tool1  | AUTO                                      | 2. Save/Load   | 2. Load  |
| 3 WHILE TRUE DO   | CHK once                                  | 3. Aux. Data Setting<br>4. Basic setting   | 3. File/Folder operate<br>10. Autosave Configuration   |
| 4 CALL mechnind(1)<br>5 ;JMOVE #PPOINT(0, 0, 0, 0, 0, 0)                  | Maiting                                   | 5. Advanced Setting  | 10. Horosave configuration   |
| 6 END   | KER OFF                                   | <ol><li>Input/Output Signal</li></ol>  |  |
| [BOF]   | EXT. HOLD                                 | 7. Log Function<br>8. System   |  |
|   |   | o, aysudii   |  |
| Stop.   |   |  |  |
| OFF Monitor1 Monitor2 Forward   |   |  |  |
|   |   |  |  |
|   |   |  |  |
| Record I/O  |   | Selects Save/Load  | Selects Save   |
| Monitor   |   |  |  |

2. Press on *Input File name* to input a **File Name** for the backup file, and then press on *SAVE*.



| 🕎 R01[C01] - Virtual Teach Pendant 0  |   | - 🗆 × ]  |
|---|---|--|
| Aux.:Save/Load:Save   |   | 1/8  |
| Please select the file to save.<br>Place of File <u>Linux\</u><br>File Name   |   |  |
| Save Data All Data<br>NAME (*)  | TYPE SIZE(KB)                               | UPDATE   |
| .portlist0<br>asm_conf.txt<br>cml_conf.txt<br>cm2_conf.txt<br>cm3_conf.txt<br>s default.as<br>id_conf.txt<br>s mechmind_server.as | 0.1<br>0.2<br>0.7<br>0.7<br>0.7<br>AS 146.2 | 21/08/09 12:16<br>21/08/09 12:16<br>21/08/09 12:16<br>21/08/09 12:16<br>21/08/09 12:16<br>21/08/09 12:16<br>21/08/09 12:16 |
| Deviz Linux Used Area   | 0 KB Empty Are                              | 0 KB   |
| Input<br>File name  | SaveData New SA<br>Folder                   | VE EXIT  |

Cancel robot control program and kill PC programs.

1. Press on the **Program** area, and select **Cancel register** in the drop down menu.



**Mech-Mind Robot Integrations** 

| R01[C01] - Virt  | ual Teach Penda        | nt 0                                      |          | C                          | _                |                                |
|--|------------------------|---|----------|----------------------------|------------------|--------------------------------|
| TEACH  | Program<br>[           | [Comment ]<br>main<br>]                   | 1<br>1   | PC<br>1*autost<br>2*autost | RUN M            | REP. SPD                       |
| (E1135) Moto   | NOW PROGR<br>CALL PROG | 100000 V                                  |          | Lvź                        | 2 VINT<br>INPUT  | MAN, SPEED                     |
| JOINT           JOINT           1         POINT           2         TOOL t           3         WHILE | EDIT                   | Directory<br>Copy<br>Delete<br>PG Comment | · Trout  |                            |                  | CHK once                       |
| 4 CALL a<br>5 ;JMOVE<br>6 END  |                        | Cancel reg<br>Rename<br>Display co        | gister   | 2                          |                  | Waiting<br>RPS OFF<br>EXT.HOLD |
| [EOF]  | [                      |   |          |                            |                  |                                |
|  | RPS                    | 9   | 9        |                            |                  |                                |
|  | OFF                    | Monitor1                                  | Monitor2 |                            | J/E              |                                |
| Record I/O<br>Monitor  | Tool<br>1              |   |          |                            | Manual<br>Output |                                |

2. Press on Aux., and select 8. System  $\rightarrow$  10. PC Program Run/Stop  $\rightarrow$  Selects Abort.



# **Mech-Mind Robot Integrations**

| 🛃 R01[C01] - Virtual Teach Pendant 0 –  | R01[C01] - Virtual Teach Pendant 0 - 🗆 🗙  |
|---|---|
| TEPCH         Program         Comment         STEP         PC           1*autost         1         1         2*autost         Aux.         REP. SP           1         1         1         2*autost         MAN. SPEEL         MAN. SPEEL   | Im         Imm  |
| (E1135) Motor power OFF.  | (E1135) Motor power OFF.  |
| INTERP SPD ACC         TWR TOOL CLAMP         J/E         OUTPUT         INPUT           JOINN 9 1 0 1         I         I         I         I         FRADR           1 POINT tooll = TRANS(0, 0, 0, 0, 0, 0)         III         IIII         IIIII         IIIII         IIIIII         IIIIII         IIIIIII         IIIIIII         IIIIIII         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII  | 1. Program Conversion<br>2. Save/Load<br>e 3. Aux. Data Setting<br>4. Basic setting<br>5. Advanced Setting<br>6. Input/Output Signal<br>7. Los Function<br>8. System  |
| Record I/O<br>Monitor   | Selects System  |
| Program       [Conment]       Program       Program       Image: Conment of the program </td <td>Image: Control of the second second</td> | Image: Control of the second |
| Aux.:System         1. Memory Available       18. USB Keyboard         2. Inhibit record       19. Operation Panelless Setting         3. Reset Check Sum Error       96. Operation function level         4. Software Version       97. Auxiliary function level         5. Initialize system       98. Change operation level         7. Check Specification       8. Environment Data         9. Time/Date       3         10. PO Program Run/Stop       3         12. Network Setting       15. FTP Server Setting  | Aux,:System:PC Program Run/Stop         1. Selects Start.       (PCENECITE)         2. Selects Abort.       (PCENEN)         3. Selects Stop       (PCENEN)         4. Select Continue (PCCONTINUE)       5. Kill PC Prg. (PCKILL)         6. Selects Status       (PCSTATUS)   |
| Selects PC Program Run/Stop   | Selects Abort (PCABORT)   |

3. Press the  $\tt ENTER$  key to abort PC program 1. Then, press 2 to change the program number, and then press  $\tt ENTER$  to abort PC program 2.



| R01[C01] - Virtual Teach Pendant 0  | – 🗆 X                            |
|---|----------------------------------|
| TEACH       Program       [Comment]       STEP       PC         [       ]       [       ]       ]       [       ]         [       ]       [       ]       ]       [       ]       ] | RUN MOTOR CYCLE<br>Aux. REP. SPD |
| Lv2   | MAN, SPEED                       |
| Aux.:System:PC Program Run/Stop:Selects Abort (PCABORT)   |                                  |
| PC Program No.  |                                  |
| Undo  |                                  |
| Input range : [1 - 5]   |                                  |

4. Press the R key to return, and select Kill PC Prog.



| 🗱 R01[C01] - Virtual Teach Pendant 0   | _    | · □ ×      |
|--|------|------------|
| TEACH       Program       [Comment]       STEP       PC         [       ]       [       ]       1 autost         [       ]       [       ]       2*autost         Error in receiving message       [       Lv2 | Aux. | MAN, SPEED |
| Aux, :System:PC Program Run/Stop   |      |            |
| 1. Selects Start (PCEXECUTE)<br>2. Selects Abort (PCABORT)<br>3. Selects Stop (PCEND)<br>4. Select Continue(PCCONTINIE)<br>5. Kill PC Prg. (PCKILL)<br>6. Selects Status (PCSTATUS)                            |      |            |
| Selects Kill PC Prg. (PCKILL)  |      |            |

5. Press the ENTER key to kill PC program 1. Then, press 2 to change the program number, and then press ENTER to kill PC program 2.



| R01[C01] - Virtual Teach Pendant 0   |           |
|--|-----------|
| TEACH       Program       [Comment]       STEP       PC       RU         1       autost       1       autost       A | REP. SPD  |
| PC program aborted.No = 1002   | AN, SPEED |
| Aux.:System:PC Program Run/Stop:Kill PC Prg. (PCKILL)  |           |
| PC Program No.   |           |
| Undo<br>Input range : [1 - 5]  |           |

- 6. Press the R key to return. Check the **PC** area to see if any programs are still listed. If so, repeat steps 2 and 4 until there are no programs listed in the **PC** area.
- 3. Make sure that the robot is in teach mode, and make sure that the **Program** and **PC** areas have nothing listed.



| R01[C01] - Virtual Teach Pendant 0 |                    |                  |            |
|------------------------------------|--------------------|------------------|------------|
| TEACH                              | ment ] STEP        | PC RUN MOT       | REP. SPD   |
| Cleared error state.               |                    |                  | IAN, SPEED |
|                                    | L CLAMP J/E OUTPUT | INPUT            | 12:52      |
| JOINT 9 1 0 1                      |                    |                  | ERROR      |
| [EOF]                              |                    |                  | AUTO       |
|                                    |                    |                  | CHK once   |
|                                    |                    |                  | Waiting    |
|                                    |                    |                  | RPS OFF    |
|                                    |                    |                  | EXT. HOLD  |
| RPS                                | a a [              |                  | -          |
| OFF Mor                            | nitor1 Monitor2    | J/E              |            |
|                                    |                    | Manual           |            |
| Record I/0 Tool<br>Monitor 1       |                    | Manual<br>Output |            |

**Note:** To switch the robot to teach mode, turn the Teach/Repeat switch on the controller to **TEACH**, and the teach lock switch on the teach pendant to **ON**.

4. Press on Aux., and select 2. Save/Load  $\rightarrow$  2. Load.

| R01[C01] - Virtual Teach Pendant 0 -  |   | 🛃 R01[C01] - Virtual Teach Pendant 0 — 🗆 📈  | 🛃 R01[C01] - Virtual Teach Pendant 0 - 🗆 🗙   |
|---|---|---|--|
|   | TOR CYCLE<br>REP, SPD<br>100%<br>MAN, SPEED         | TEVEN         Program         Comment         STEP         PC         RUN         POTOR         CYCLE           dbp                                   |  |
| (BI135) MOTOF POWER UFF.  | 2   | (BI135) NOTOT POWER UPF.  | PC program aported, No = 1002  |
| INTERP SPD ACC TMR TOOL CLAMP J/B OUTPUT INPUT  | 12:53   | Aux,  | Aux.:Save/Load   |
| OLIGT         9         1         0         1 <th1< th="">         1         <th1< th=""> <th1< th=""></th1<></th1<></th1<> | AUTO<br>CHK once<br>Maiting<br>RPS OFF<br>EXT. HOLD | 1. browgen Grouperion<br>G. Nur, Neth Setting<br>5. Advanced Setting<br>5. Advanced Setting<br>6. Input/Output Signal<br>7. Log Function<br>8. System | L. Save<br>La Loss<br>La Loss<br>La Ville Folder Operato<br>10. Autosawe Configuration |
| RPS CFF Nonitor1 Monitor2 Porward   |   |   |  |
| Record I/0<br>Monitor   |   | Selects Save/Load   | Selects Load   |

5. Press on mechmind\_server.as in the file list twice to select it, and then press on LOAD.



| 🛃 R01[C01] - Virtual Teach Pendant 0   |                    |                          | - 0  | ı ×                              |
|--|--------------------|--------------------------|--|----------------------------------|
| Aux.:Save/Load:Load  |                    |                          |  | 8/8                              |
| Please select the load file,<br>Place of File <u>Linux\</u><br>File Name <u>mechmind_server.as</u><br>Load Type ▼ All Data □ Speci<br>NAME (*) | ified Data<br>TYPE | SIZE (KB)                | UPDA   |                                  |
| . portlist0<br>asm_conf.txt<br>cm1_conf.txt<br>cm2_conf.txt<br>cm3_conf.txt  | <br><br>           | 0.1<br>0.2<br>0.7<br>0.7 | 21/08/09<br>21/08/09<br>21/08/09<br>21/08/09<br>21/08/09 | 12:16<br>12:16<br>12:16<br>12:16 |
| default, as     id conf. txt     if mechmind_server, as  | AS<br><br>AS       | 146.2                    | 21/08/09   | 12:16<br>12:16                   |
| Device Linux Used Area   |                    | Capty Are                |  | 0 KB                             |
| File Type  |                    | LO                       | AD   | EXIT                             |

6. When loading completes, make sure no errors occurred during loading, and press on the  ${\tt R}$  key to exit.



| R01[C01] - Virtual Teach Pendant 0 |    | × |
|------------------------------------|----|---|
| Aux, :Save/Load:Load               | 8/ | 8 |
| Loading (. \mechmind_server.as)    |    |   |
| Program init()                     |    |   |
| Program init_data()                |    |   |
| Program autostart2.pc              |    | 1 |
| Program autostart.pc               |    | ī |
| Program motion_parser()            |    |   |
| Program main()                     |    |   |
| Program mechmind(, branch)         |    |   |
| Program get_next_m_ptr()           |    |   |
| Program get_next_a_ptr()           |    |   |
| Real                               |    |   |
| File load completed. (0 errors)    |    |   |
|                                    |    |   |
|                                    |    |   |
|                                    |    |   |
|                                    |    |   |
|                                    |    |   |
|                                    |    |   |
|                                    |    | 5 |
|                                    |    |   |
|                                    |    |   |
|                                    |    |   |
|                                    |    |   |

#### **Further Configurations**

1. Press on Aux., and select 5. Advanced Settings  $\rightarrow$  2. System Switch.

| R01[C01] - Virtual Teach Pendant 0 -   |  | 📸 R01[C01] - Virtual Teach Pendant 0 — 🗆  | 🛛 🛃 R01[C01] - Virtual Teach Pendant 0 🛛 🚽 🖂 🖂   |
|--|--|---|--|
|  | OR CYCLE<br>REP. SPD<br>100%                       | TEXEN         Program         Connent         STEP         PC         Aux         NEXP. SP           the  |  |
| (KII35) Motor power UFF.   | 2. H   | Lieared error state,  | Cleared error state.   |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT   | 12:53  | Aux.  | Aux.: Advanced Setting   |
| ODBT         9         1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<> | AUTO<br>CHK once<br>Maiting<br>RPS OFF<br>EXT.HOLD | 1. Program Conversion<br>2. Saw. Data Setting<br>3. Mar. Data Setting<br>3. Mar. Data Setting<br>3. Mar. Conversion Stranger<br>4. Institution Stranger<br>3. System<br>5. System | 1. Zeroins<br>2. Bog. Houlation Brior Range at Bobler<br>4. Bog. Nulle Hirto Range at Bobler<br>5. Base Coordinates<br>7. Writion Limits<br>8. Slow Pepart |
| GFF Monitor1 Monitor2 Step   |  |   | 9. Interface Panel.<br>12. Deviation Limit for Continuing<br>17. Tool Change<br>18. MOUTHS AREA X7Z LIMTIS   |
| Record I/O<br>Monitor  |  | Selects Advanced setting  | Selects System Switch  |

2. Press on *Next Page*, find **AUTOSTART.PC** and **AUTOSTART2.PC**, check the **On** boxes of these two programs, and press the ENTER key to save the changes.



| 🛃 R01[C01] - Vir | tual Teach Pendant 0         |                     | - 🗆 X  |
|------------------|------------------------------|---------------------|--|
| TEACH            | Program [Comment]            | TEP PC              | RUN MOTOR CYCLE<br>Aux. REP. SPD<br>100%<br>MAN. SPEED |
| Cleared erro     |                              | Lv                  |  |
| Aux. : Advanc    | ed Setting:System Switch 👘   |                     | 2/6  |
| Class            | Switch Name                  |                     |  |
|                  | MESSAGES                     | 🔽 On                | 🗆 Off  |
|                  | SCREEN                       | 🔽 On                | □ Off  |
|                  | AUTOSTART, PC                | 🗹 On 🖉              | □ Off  |
|                  | AUTOSTART2, PC               | $\neg \square 0n 2$ | 🗌 Off  |
|                  | AUTOSTART3, PC               | 🗌 On                | ☑ Off  |
|                  | AUTOSTART4. PC               | 🗖 On                | ▼ Off  |
|                  | AUTOSTART5, PC               | 🗖 On                | ▼ Off  |
|                  | ERRSTART, PC                 | 🗖 On                | ▼ Off  |
|                  | AUTOSTART, LSQ               | 🗖 On                | ▼ 0ff  |
|                  | DISPIO 01                    | 🗖 On                | ▼ 0ff  |
|                  | HOLD, STEP                   | 🗆 On                | ▼ Off  |
|                  | WS_COMPOFF                   | 🗆 On                | ▼ 0ff  |
| Undo             | Prev Page Next Page          |                     |  |
|                  | rec, of PC at cont, power on | ON:Effect, OFF      | :Ineffect  |
|                  | •                            |                     | MECH MIND  |

3. Press on the **Program** area, select **Directory**.



| 🛃 R01[C01] - Virt     | tual Teach Penda        | ant O   |               |    |                         |   |
|-----------------------|-------------------------|---|---------------|----|-------------------------|---|
| TEACH                 | Program<br>[            | [Comment ]<br>]   | STEP<br>1     | PC | Aux.                    | OTOR CYCLE<br>REP. SPD  |
| Cleared erro          | NOW PROGR<br>CALL PROG  | 100000 V  |               |    | Lv2                     | MAN, SPEED  |
| JOINT<br>[EOF]        | EDIT                    | Directory<br>Copy<br>Delete<br>PG Comment<br>Cancel reg<br>Rename<br>Display co | gister        | 2  |                         | I ERROR<br>AUTO<br>CHK once<br>Waiting<br>RPS OFF<br>EXT.HOLD |
| Record I/O<br>Monitor | OFF<br>OFF<br>Tool<br>1 | X<br>Monitor1   | X<br>Monitor2 |    | J/E<br>Manual<br>Output |   |

4. Select **main**, and press the ENTER key to save the change.



| R01[C01] - Virtual Teach  | Pendant 0  |         | - 🗆 X |  |
|---|--|---------|-------|--|
| Directory<br>PROGRAM NAME STEP<br>autostart.pc<br>autostart2.pc<br>get_next_a_ptr<br>get_next_m_ptr<br>init<br>init data<br>main<br>mechmind<br>motion_parser<br>test | NUM<br>35 (<br>78 (<br>5 (<br>12 (<br>11 (<br>6 (<br>46 (<br>87 (<br>2 ( | COMMENT |       |  |
| Input   |  |         |       |  |

5. Switch the robot to repeat mode, press on the white button below *Aux.*, and change the drop-down options to **STEP CONT** and **REPEAT CONT**.



| R01[C01] - Virtual Teach Pendant 0   |                          |                      |
|--|--------------------------|----------------------|
| REPEAT     Program     [Comment]     STEP       1     main     1       1     []     1  | RUN MC                   | REP. SPD             |
|  | STEP CONT.<br>REP. CONT. | MAN, SPEED           |
| JOINT         9         1         0         1         [         ][           1         POINT tool1 = TRANS(0, 0, 0, 0, 0, 0) | STEP<br>CONT             | AUTO                 |
| 4 CALL mechmind(1)<br>5 ;JMOVE #PPOINT(0,0,0,0,0)<br>6 END<br>[EOF]  | REPEAT<br>CONT           | RPS OFF<br>EXT. HOLD |
| RPS     A     A       OFF     Monitor1     Monitor2  | Step<br>Forward          | 3                    |
| Record I/O<br>Monitor  | M                        |                      |

**Note:** To switch the robot to repeat mode, turn the Teach/Repeat switch on the controller to **REPEAT**, and the teach lock switch on the teach pendant to **OFF**.

6. Restart the controller. Now the teach pendant should show the following interface, with two PC programs running (indicated by the asterisks after the program numbers) and **1** displayed in the **STEP** area.



| R01[C01] - Virtual Teach Pendant 0   |                          |                       |
|--|--------------------------|-----------------------|
| REPEATProgram[Comment]STEP1main111[]2*autost   | RUN MO                   | TOR CYCLE<br>REP. SPD |
| Lv2<br>INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT  | STEP CONT.<br>REP. CONT. | MAN, SPEED            |
| JOINT 9         1         0         1         []           1         POINT tool1 = TRANS(0,0,0,0,0)  | STEP<br>CONT             | AUTO                  |
| 4 CALL mechmind(1)<br>5 ;JMOVE #PPOINT(0,0,0,0,0)<br>6 END<br>[EOF]  | REPEAT<br>CONT           | RPS OFF<br>EXT. HOLD  |
| RPS     Image: Constant of the second s | Step<br>Forward          | 3                     |
| Record I/O<br>Monitor  | M                        |                       |

Note: If the STEP isn' t 1, please press on the STEP area and change it to 1.

## **Test Robot Connection**

- 1. Please refer to *Test Robot Connection* for detailed instructions on connecting to the robot in Mech-Center.
- 2. Press on MOTOR while holding down the  ${\tt A}$  key to power the motor.
- 3. Press on  $\mathit{CYCLE}$  while holding down the A key to run the program.
- 4. If RUN does not turn green, press the RUN/HOLD key while holding down the A key.



| 🛃 R01[C01] - Virtual Teach Pendant 0 — 🗆 📈   |   |  |  |  |  |  |
|--|---|--|--|--|--|--|
| mechmind     38     1*autost       [     ]     [     2*autost  | TOR CYCLE<br>REP. SPD<br>100%<br>MAN. SPEED         |  |  |  |  |  |
| (P1000) Cannot execute program because motor power is<br>OFF. Lv2 REP. CONT.   |   |  |  |  |  |  |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT<br>JOINT 9 1 0 1 [ ][   | 12:57<br>ERROR                                      |  |  |  |  |  |
| <pre>35 CALL get_next_m_ptr<br/>36 GOTO head<br/>37 ELSE<br/>38 TWAIT 0.02<br/>39 first_count = first_count+1<br/>40 IF first_count&gt;50 THEN<br/>41 is_first = TRUE</pre>  | AUTO<br>CHK once<br>Waiting<br>RPS OFF<br>Call main |  |  |  |  |  |
| RPS       Image: Second I/O Monitor       Image: Second I/O Monitor <th i="" image:="" monitor<="" o="" second="" t<="" td=""><td></td></th> | <td></td>   |  |  |  |  |  |

The robot is successfully connected if MOTOR, CYCLE, and RUN are lit green, and no error messages appear in Mech-Center or on the teach pendant.

# 1.5.2 Kawasaki Program Description

## **Full-Control Programs**

| Program        | Description   |  |
|----------------|---|--|
| init           | Set IP and signals                                    |  |
| init_data      | Initialize variables                                  |  |
| autostart.pc   | PC program 1 for receiving commands                   |  |
| autostart2.pc  | PC program 2 for sending robot pose and status        |  |
| motion_parser  | Subprogram called by PC program for decoding commands |  |
| main           | Foreground main program                               |  |
| mechmind       | The full-control program                              |  |
| get_next_m_ptr | Index control (motion)                                |  |
| get_next_a_ptr | Index control (storage)                               |  |



#### **Internal Signals**

| Name         | Signal | Description         |
|--------------|--------|---------------------|
| stop_sig     | 2011   | Stop motion         |
| viz_conl_sig | 2012   | Full-control signal |

# **1.6 NACHI**

This section introduces the process of loading the robot full-control program onto an NACHI robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

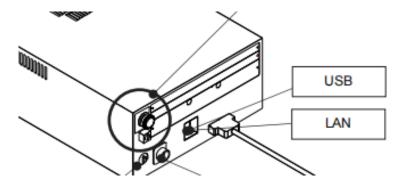
# 1.6.1 Check Controller and Software Compatibility

- There is no specific requirements on the version of robot controller.
- It is recommended to use Mech-Center of the lastest version.

## 1.6.2 Setup the Network Connection

#### Hardware Connection

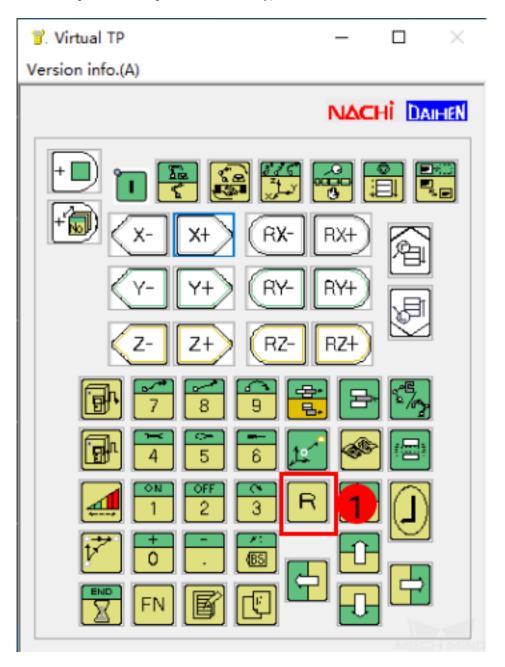
Plug the Ethernet cable into the LAN port of the robot controller to connect it with the IPC.





# Change the Protecting Level

1. Open the teach pendant and press the key, as shown below.



2. Enter **314** in the box as shown below, and then press (Enter key) on the teach pendant.



|           | Teach        | Program       | Step                       | 5/11/2022      | 17:11    | -12            | 7                       |
|-----------|--------------|---------------|----------------------------|----------------|----------|----------------|-------------------------|
|           | reach        | NOT SEL       | 0 STEPS<br>Ø               |                |          | W1:<br>WZ12-01 | Leach/Play<br>Condition |
| 屬         | Dead<br>Zone |               |                            |                | Joint    | Manual Spe     | ed<br>H                 |
| Tool      | 🗶 Shorta     | cut R code I  | Entry                      |                |          | UNIT           | 1                       |
| 71        | Shortcut     | t function li | st                         |                |          |                |                         |
|           | R314         | Change        | e the protec               | ting level     |          |                | ^ <b>I</b> Ø            |
|           | R316         | TP LO         | - · ·                      | , .            |          |                | Cancel                  |
| Monitor2  | R317         | -             |                            | ord(TP LOCK)   |          |                | I-Wait                  |
|           | R335         | Step C        |                            |                |          |                |                         |
|           | R348         | _             |                            | ring language  |          |                |                         |
|           | R354<br>R355 |               | rence Disab                |                |          |                |                         |
| File      | R356         |               | detect. sam<br>detect. sam |                |          |                |                         |
|           | R372         |               | scope meas                 | •              |          |                |                         |
|           | R400         |               | Overlap An                 |                |          |                | ×                       |
| Constant  | R401         |               |                            | operation Med  | hanism   |                | ACC                     |
| setting   | i 🖸 in       | nut the sho   | rtout code (               | Or locate curs | or and p | ress           |                         |
| jĵ        | "Enter".     |               |                            |                |          |                |                         |
| Senare    | 314          |               |                            |                |          |                |                         |
| Utilities |              |               |                            |                |          |                | Smooth                  |





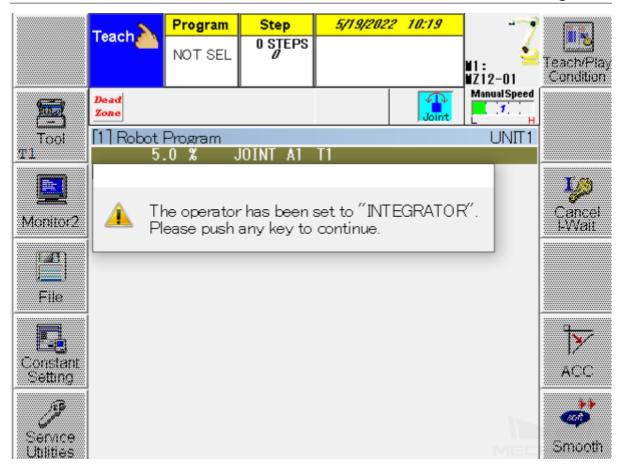
3. Enter the default password **12345** in the box, and then press 🔀 key on the teach pendant to change into **SPECIALIST** level.



|                     | Turk            | Program                                    | Step         | 5/11/202 | 2 17:12 |                |                         |
|---------------------|-----------------|--|--------------|----------|---------|----------------|-------------------------|
|                     | Teach           | NOT SEL                                    | 0 STEPS<br>Ø |          |         | ₩1:<br>₩212-01 | Teach/Play<br>Condition |
|                     | Dead<br>Zone    |  |              |          | Joint   | Manual Speed   |                         |
| Tool<br>T1          | [1] Robot<br>5  |  | OINT A1      | T1       |         | UNIT1          |                         |
| E                   | [EOF]           |  |              |          |         |                | Cancel                  |
| Monitor2            |                 |  |              |          |         |                | I-Wait                  |
|                     |                 |  |              |          |         |                |                         |
| File                | [2] User T      | ask Monito                                 | r            |          |         |                |                         |
|                     | <u> R</u> Passw | ord setting                                |              |          |         |                |                         |
| Constant<br>Setting | 👩 Ple           | e operator i<br>ase enter t<br>e soft-keyb | he passwo    | rd.      |         |                | ACC                     |
| Senace              | edi             | t″.<br>⇒⇔⇔≪l                               |              |          |         | 4              |                         |
| Utilities           |                 | .1   |              |          |         |                | Smooth                  |

4. A pop-up window as shown below suggests that you have successfully changed the protecting level and all functions can be used from now on.





# **IP** Configuration

1. Go to Constant Setting  $\rightarrow$  8 Communication  $\rightarrow$  2 Ethernet  $\rightarrow$  1 TCP/IP to configure **TCP/IP Settings**.



Mech-Mind Robot Integrations

|                      | Teach             | Program           | Step     | 5/11/202 | 2 17:01 |                |                         |
|----------------------|-------------------|-------------------|----------|----------|---------|----------------|-------------------------|
|                      | reach             | NOT SEL           | 0 STEPS  |          |         | M1:<br>M212-01 | Teach/Play<br>Condition |
|                      | Dead<br>Zone      |                   |          |          | Joint   | Manual Speed   |                         |
| Tool<br>T1           | [1] Robot  <br>5. | Program<br>.0 % J | IOINT A1 | T1       |         | UNIT1          |                         |
|                      | [EOF]             |                   |          |          |         |                | V2                      |
| Monitor2             |                   |                   |          |          |         |                | Cancel<br>I-Wait        |
| File                 |                   |                   |          |          |         |                |                         |
| Constant<br>Setting  | 1                 |                   |          |          |         |                | ACC                     |
| Service<br>Utilities |                   |                   |          |          |         | MED            | Smooth                  |



|    | Constant Setting   | UNIT1                             |  |  |  |  |
|----|--|-----------------------------------|--|--|--|--|
| 1  | Control Constants  | 33 Fail Safe                      |  |  |  |  |
| 2  | Screen Constants   | 38 User Help                      |  |  |  |  |
| З  | Machine Constants  | 44 Direct Teach                   |  |  |  |  |
| 4  | Accuracy and Smoothness  | 45 External Tracking              |  |  |  |  |
| 5  | Operation Constants  | 46 Circle interpolation condition |  |  |  |  |
| 6  | Signals  |                                   |  |  |  |  |
| 7  | f-Keys   |                                   |  |  |  |  |
| 8  | Communication  | 2                                 |  |  |  |  |
| 9  | Territory Definition   |                                   |  |  |  |  |
| 12 | Format and Configuration   |                                   |  |  |  |  |
| 22 | I/F Panel on Touch Screen  |                                   |  |  |  |  |
| 24 | Logging Data   |                                   |  |  |  |  |
| 25 | Function Grouping  |                                   |  |  |  |  |
| 26 | Mechanism Change   |                                   |  |  |  |  |
| 29 | Multi drive reference position   |                                   |  |  |  |  |
| 31 | Vision sensor  |                                   |  |  |  |  |
| ?  |  | ed constants such as              |  |  |  |  |
|    | r jEthernet.   |                                   |  |  |  |  |
| 31 | 31 Vision sensor<br>Used to set Communication related constants such as<br>Ethernet. |                                   |  |  |  |  |

2. Enter the robot IP address in the  ${\bf IP}$   ${\bf Address}$  box.

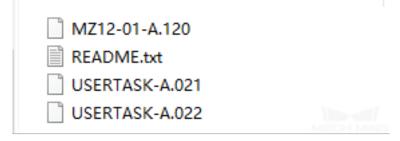
**Hint:** The robot IP should be in the same subnet as the IPC. If you need to set the static IP, please contact the network administrator.

# 1.6.3 Load the Program Files

## Prepare the Files

Copy the full-control program files of NACHI robot with an USB flash drive. The files are stored in: XXXX/Mech-Center/Mech\_RobServ/install\_packages/nachi





Attention: Please rename the MZ12-01-A.120 file according to the actual robot model name. For example, when loading the file to the SRA166-1 robot, rename the file as SRA166-1-A.120, and then copy and paste it into your flash drive.

#### Load the File to the Robot

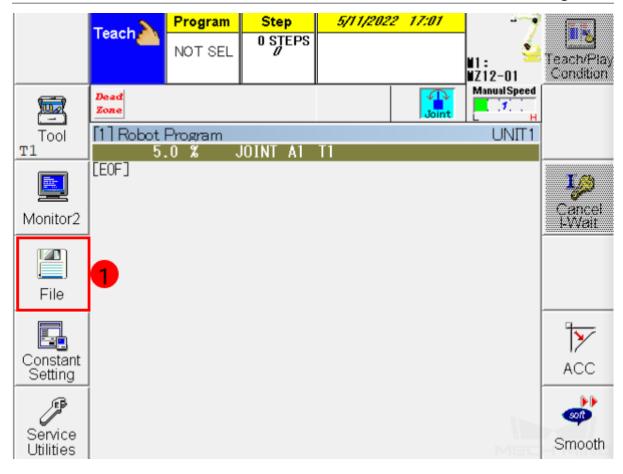
1. Plug the USB flash drive into the USB port on the back of the teach pendant, as shown below.



2. Select  $\mathit{File} \rightarrow \mathit{File}\ \mathit{copy}$  on the touch panel.



**Mech-Mind Robot Integrations** 





| S° File Manager                                    |
|--|
| 1 File Copy  |
| 2 Directory  |
| 3 File Delete                                      |
| 4 File Protect                                     |
| 5 Verify   |
| 6 Format IC card/Floppy disk                       |
| 8 File transfer(Ethernet FTP)                      |
| 10 File Backup                                     |
| 11 File Restore                                    |
| 12 Automatic Backup                                |
| 14 File copy restriction                           |
|  |
|  |
|  |
|  |
|  |
| Used to copy files between various memory devices. |
|  |

3. Device (src) is the folder of the USB flash drive. Select the folder where the program files are stored under Device (src) and the **PROGRAM** folder under Device (dest) and then press on *Select All File* 



| 💲 File Copy   |   |     |                             | UNIT1  |                       |
|---|---|-----|-----------------------------|--|-----------------------|
| Device(src)   | Method  |     |                             |  | Ā                     |
| Hard Disk   | File ~  |     |                             |  | Name                  |
| ● _ mmind ^<br>● _ MMwork<br><mark>nachi</mark><br>System Vol | Name<br>MZ12-01-A.120<br>USERTASK-A<br>USERTASK-A |     | Size<br>401<br>1431<br>1339 | Modified<br>05/10/21 16:52<br>09/29/21 17:02<br>09/29/21 17:02 | L23<br>Ascending      |
| < >   |   |     |                             |  |                       |
| 116.119.704 K bvtes<br>Device(dest)                           | free  |     |                             |  | Make<br>Folder        |
| Memory  |   |     |                             |  |                       |
| Memory A<br>PLCEngine<br>WORK                                 | Name<br>MZ12-01-A.120<br>MZ12-01.120              | Att | Size<br>401<br>531          | Modified<br>05/10/21 16:52<br>05/11/22 18:00                   | Select<br>All<br>File |
|   | USERTASK-A  |     | 1431                        | 09/29/21 17:02   | <b>3</b>              |
| < >   | 4USERTASK-A                                       |     | 1339                        | 09/29/21 17:02   |                       |
| 29.209.500 K bvtes fr   | ree   |     |                             |  | Quit                  |
|   |   |     |                             |  |                       |
| 🕐 Select a folder.  |   |     |                             |  |                       |
|   |   |     |                             |  | Execute               |

4. Press on *Execute* to import files.



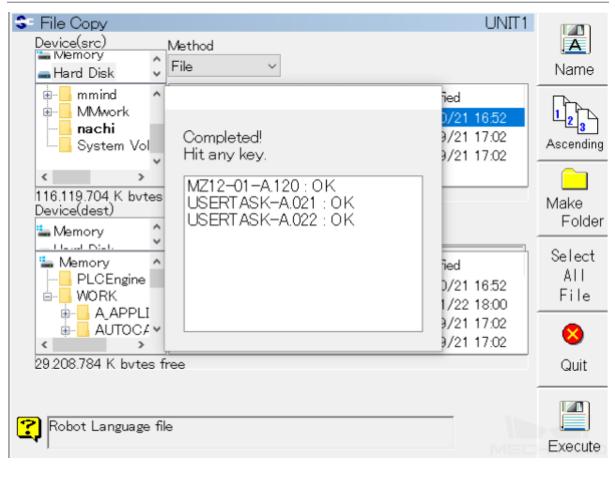
| S= File Copy<br>Device(src)<br>Hemory              | Method<br>File ~   |  | UNIT1  | A<br>Name             |
|--|--|--|--|-----------------------|
| mmind     MMwork     Molected     System Vol       | Name<br>MZ12-01-A.120<br>USERTASK-A<br>USERTASK-A                | Att Size<br>401<br>1431<br>1339        | 05/10/21 16:52<br>09/29/21 17:02                   | Ascending             |
| 116.119.704 K bvtes<br>Device(dest)<br>Memory      | free   |  |  | Make<br>Folder        |
| Memory<br>PLCEngine<br>WORK<br>A_APPLI<br>AUTOCA ~ | Name<br>MZ12-01-A.120<br>MZ12-01.120<br>USERTASK-A<br>USERTASK-A | Att Size<br>401<br>531<br>1431<br>1339 | 05/10/21 16:52<br>05/11/22 18:00<br>09/29/21 17:02 | Select<br>All<br>File |
| 29.209.500 K bvtes f                               | ree  |  |  | Quit 4<br>Execute     |

5. If the following messages appear on the screen, the program files have been loaded successfully.



| S <sup>-</sup> File Copy<br>Device(src)<br>Memory<br>Hard Disk                              | < >              | Method<br>File ~   |              |             |                                      | UNIT1                | A<br>Name                |
|---|------------------|--|--------------|-------------|--------------------------------------|----------------------|--------------------------|
| ● mmind<br>● MMwork<br>- nachi<br>- System  | ^                | Name<br>MZ12-01-A.120<br>AUCEDTACK-A   | Att          | Size<br>401 | Modified<br>05/10/21 1<br>00/00/01 1 |                      | L23<br>Ascending         |
| <ul> <li>I16.119.704 K</li> <li>Device(dest)</li> <li>Memory</li> <li>Used Dist.</li> </ul> | Me<br>Soi<br>De: | Vill copy the followi<br>thod : File<br>urce folder : Hard [<br>stination folder : Ma<br>mber of files : 3 | _<br>Disk¥na | chi         | PROGRAM                              |                      | Make<br>Folder<br>Select |
| Memory<br>PLCEng<br>  |                  | YES  |              | IO          |                                      | 52<br>00<br>02<br>02 | All<br>File              |
| 29.208.976 К ь  |                  |  |              |             |                                      |                      | Quit                     |
| Robot Langua  | ge til           | e  |              |             |                                      | MEC                  | Execute                  |





| Attention: | Please reboot the robot after exiting the program. |  |
|------------|--|--|
|------------|--|--|

### Convert the Program File

1. Go back to the main interface, press on Service Utilities  $\rightarrow ASCII$  File Edit to edit the ASCII files.



Mech-Mind Robot Integrations

|                      | Teach             | Program           | Step     | 5/11/202 | 2 17:01 | 1              |                         |
|----------------------|-------------------|-------------------|----------|----------|---------|----------------|-------------------------|
|                      | reach             | NOT SEL           | 0 STEPS  |          |         | M1:<br>M212-01 | Teach/Play<br>Condition |
|                      | Dead<br>Zone      |                   |          |          | Joint   | Manual Speed   |                         |
| Tool<br>T1           | [1] Robot  <br>5. | Program<br>.0 % J | IOINT A1 | T1       |         | UNIT1          |                         |
|                      | [EOF]             |                   |          |          |         |                | <b>I</b> Ø              |
| Monitor2             |                   |                   |          |          |         |                | Cancel<br>I-Wait        |
|                      |                   |                   |          |          |         |                |                         |
| File                 |                   |                   |          |          |         |                |                         |
| Constant             |                   |                   |          |          |         |                | Ĩ <b>∑</b><br>ACC       |
| Setting              |                   |                   |          |          |         |                |                         |
| Service<br>Utilities | 1                 |                   |          |          |         | MED            | smooth                  |



### **Mech-Mind Robot Integrations**

| S= Service                       | UNIT1                             |
|----------------------------------|-----------------------------------|
| 1 Teach/Playback Condition       | 25 Robot Diagnosis                |
| 2 Select Monitor Window Layout   | 26 Torque sampling for Interferen |
| 3 Monitor 1                      | 30 Auto.moment of inertia Setting |
| 4 Monitor 2                      | 34 Circle locus correction        |
| 5 Monitor 3                      | 36 User Application entry         |
| 6 Monitor 4                      | 37 Operation history disp.        |
| 7 File Manager                   | 39 Collision detection            |
| 8 Text Out                       |                                   |
| 9 Program Conversion             |                                   |
| 10 User Coord. Definition        |                                   |
| 12 UserTask                      |                                   |
| 13 System Version                |                                   |
| 14 PLC Program Edit              |                                   |
| 15 ASCII File Edit               | 2                                 |
| 18 Troubleshooting               |                                   |
| 19 Automatic COG Setting         |                                   |
| Select Monitor Window Layout, Ve | ertical, horizontal, Piling       |

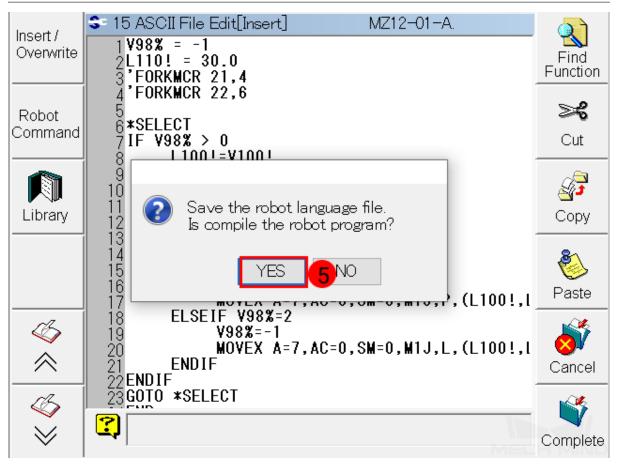
2. Select the file and press on *Execute*. Please perform the same operation on all three files in turn, and you can only start executing after the previous execution is completed.



| S® ASCII File Edit<br>Device<br>Memory<br>@CDROM<br>System                                       | File Name<br>MZ12-01-A.12                  | :0  |             |  |   | Name   |
|--|--|-----|-------------|--|---|--|
| Memory<br>A_APPLICAT<br>AUTOCAL<br>LOG<br>PLC<br>PROGRAM<br>Undo<br>UNIT<br>UserApp<br>UserError | Name<br>MZ12-01-A<br>USERTASK<br>USERTASK- | Att | 425<br>1431 | Modified<br>22/04/29 16:46<br>21/09/29 17:02<br>21/09/29 17:02 | 3 | Ascending<br>SL  |
| < >>   |  |     |             |  |   | y<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L<br>L |

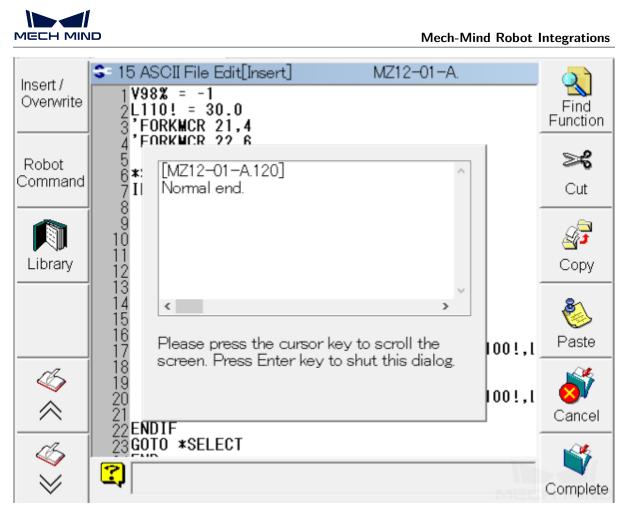
3. After pressing on *Execute*, a window as below will pop up, and then select Yes.





4. After converting the program file to the robot language, a message as shown below will appear.





#### **Designate the Program**

1. Return to the main interface, go to Monitor2-> User Task-> User Task Monitor.



Mech-Mind Robot Integrations

|                      | Teach             | Program           | Step     | 5/11/202 | 2 17:01 |                |                         |
|----------------------|-------------------|-------------------|----------|----------|---------|----------------|-------------------------|
|                      | reach             | NOT SEL           | 0 STEPS  |          |         | ¥1:<br>¥212-01 | Teach/Play<br>Condition |
|                      | Dead<br>Zone      |                   |          |          | Joint   | Manual Speed   |                         |
| Tool<br>T1           | [1] Robot F<br>5. | Program<br>.0 % J | IOINT A1 | T1       |         | UNIT1          |                         |
|                      |                   |                   |          |          |         |                | V2                      |
| Monitor2             |                   |                   |          |          |         |                | Cancel<br>I-Wait        |
|                      |                   |                   |          |          |         |                |                         |
| File                 |                   |                   |          |          |         |                |                         |
| Constant             |                   |                   |          |          |         |                | 7                       |
| Setting              |                   |                   |          |          |         |                | ACC                     |
| E                    |                   |                   |          |          |         |                | <b>e</b>                |
| Service<br>Utilities |                   |                   |          |          |         | MEC            | Smooth                  |



| S= Monitor 2                  |                                |   |
|-------------------------------|--------------------------------|---|
| 0 Monitor OFF                 | 24 Servo Analog Output         |   |
| 1 Robot Program               | 25 Servo                       |   |
| 2 Axis Position               | 26 Motion                      |   |
| 3 Controller Status           | 27 Stopwatch                   |   |
| 4 Failure Logging             | 28 Operation Time              |   |
| 5 Fixed Inputs                | 31 Stop Logging                |   |
| 6 Fixed Outputs               | 37 User Task 🔁 🛛 🐇             | , |
| 7 User Inputs                 | 38 Fieldbus monitor 🔗          |   |
| 8 User Outputs                | 44 Failure Monitor             |   |
| 11 Analog I/O                 | 46 Playback Logging 🧳          |   |
| 12 Program Queue              | 48 WI/F Status 🛛 📈             |   |
| 17 Any valiable monitor       | 50 Servo ON/OFF                |   |
| 18 Integer Variables          | 55 Gravity Revise Bend Monitor |   |
| 19 Real Variables             | 57 Serial Communication        |   |
| 20 Strings Variables          | 60 Disturbance Torque Monitor  |   |
| 21 Local Variables            | 61 Program editor logging      |   |
| Used to turn the monitor scre | een off.                       |   |



| S= User Task                                |
|---|
| 1 User Task Monitor 3                       |
| 2 Local Integer Variables                   |
| 3 Local Real Variables                      |
| 4 Local Strings Variables                   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
| Used to display the condition of user task. |

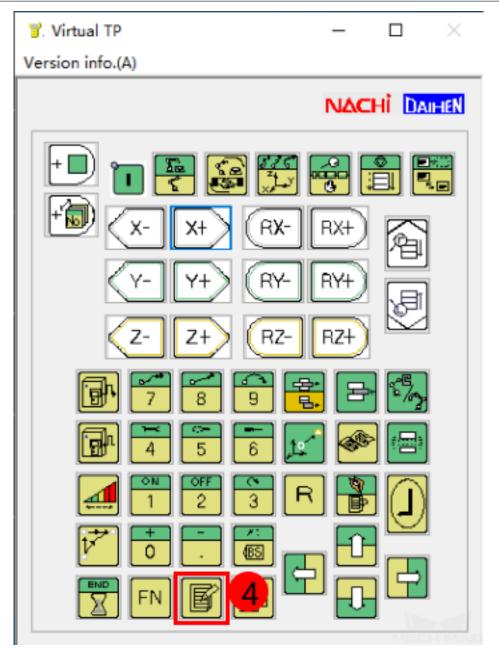
2. Now you can see the **User Task Monitor** as shown below. Press the pendant, and then the **User Task Monitor** () line will turn orange, suggesting that it is editable now. Enter 21 in the first line in the Program column, and enter 22 in the second line. Then, press





|           | Teach           | Program    | Step    | 5/11/2022    | 17:08  | 7              |                         |
|-----------|-----------------|------------|---------|--------------|--------|----------------|-------------------------|
|           |                 | NOT SEL    | 0 STEPS |              |        | M1:<br>MZ12-01 | Teach/Play<br>Condition |
|           | Dead<br>Zone    |            |         |              | Joint  | Manual Speed   |                         |
| Tool      | [1] Robot<br>5. |            | OINT A1 | T1           |        | UNIT1          |                         |
|           | [EOF]           |            |         |              |        |                | <b>1</b> /2             |
| Monitor2  |                 |            |         |              |        |                | Cancel<br>I-Wait        |
|           |                 |            |         |              |        |                |                         |
| File      | [2] User T      | ask Monito | r       |              |        |                |                         |
|           | Prog.           | Priority   | Com     | ment         | Status | Error          | ₩                       |
| Constant  | 1 0             | 4          |         |              | Stop   |                | 1/                      |
| Setting   | 2 0             | 3          |         |              | Stop   |                | ACC                     |
| ,₽₽       | 30              | 3          |         |              | Stop   |                |                         |
| Service   | 4 0             | 3          |         |              | Stop   |                | soft)                   |
| Utilities | Load leve       | 1 3%       | Priori  | ty:1(Low)-6( | High)  | ME             | Smooth                  |

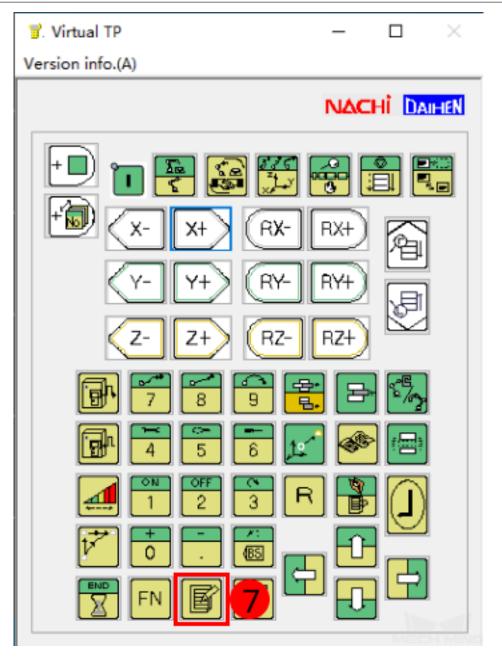






|            | Tanah        | Program    | Step    | 5/11/2022   | 17:08   |                |                         |
|------------|--------------|------------|---------|-------------|---------|----------------|-------------------------|
|            | Teach        | NOT SEL    | 0 STEPS |             |         | ₩1:<br>₩Z12-01 | Teach/Play<br>Condition |
|            | Dead<br>Zone |            |         |             | Joint   | Manual Speed   |                         |
| Tool<br>T1 | [1] Robot I  |            | OINT A1 | T1          |         | UNIT1          |                         |
|            | [EOF]        | .0 10 0    |         |             |         |                | <b>1</b> 20             |
| Monitor2   |              |            |         |             |         |                | Cancel<br>I-Wait        |
|            |              |            |         |             |         |                |                         |
| File       | [2] User Ti  | ask Monito | r       |             |         |                | 5                       |
|            | Prog.        | Priority   | Com     | ment        | Status  | Error          | -<br>1                  |
| Constant   | 1 0          | 6 4        |         |             | Stop    |                | 1/                      |
| Setting    | 2 0          | ्          |         |             | Stop    |                | ACC                     |
| (F)        | 30           | 3          |         |             | Stop    |                |                         |
| Service    | 4 0          | 3          |         |             | Stop    |                | soft                    |
| Utilities  | Load level   | 3%         | Priori  | ty:1(Low)-6 | i(High) | MEC            | Smooth                  |





Hint: If the robot cannot move in a smooth way, please change the priority level of the program 21 from 4 to 5.

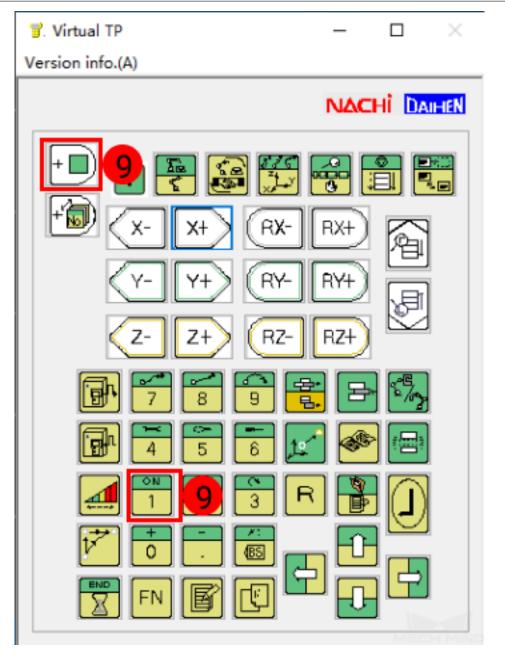


3. Select the **Status** column, and press **1** and 1 keys at the same time.



|            | T            | Program    | Step    | 5/11/2022    | 17:08  |                |                         |
|------------|--------------|------------|---------|--------------|--------|----------------|-------------------------|
|            | Teach        | NOT SEL    | 0 STEPS |              |        | ₩1:<br>₩212-01 | Teach/Play<br>Condition |
|            | Dead<br>Zone |            |         |              | Joint  | Manual Speed   |                         |
| Tool<br>T1 | [1] Robot    |            | OINT A1 | T1           |        | UNIT1          |                         |
|            | [EOF]        | .046 J     | OINT A1 |              |        |                | 10                      |
| Monitor2   |              |            |         |              |        |                | Cancel<br>I-Wait        |
|            |              |            |         |              |        |                |                         |
| File       | [2] User T   | ask Monito | r       |              |        |                |                         |
|            | Prog.        | Priority   | Com     | ment         | Status | Error          | 1                       |
| Constant   | 1 0          | 4          |         |              | Stop   |                | ACC                     |
| Setting    | 2 0          | 3          |         |              | Stop   | 8—             | ACC                     |
| (F)        | 3 0          | 3          |         |              | Stop   |                | soft                    |
| Service    | 4 0          | 3          | D       |              | Stop   |                |                         |
| Utilities  | Load level   | 3%         | Prior   | ity:1(Low)-6 | (High) | MEC            | Smooth                  |





4. Go to *Program→ Designated Program*, enter **120** in the box, and then press designated program will appear in the Program panel and **User Task Monitor**.



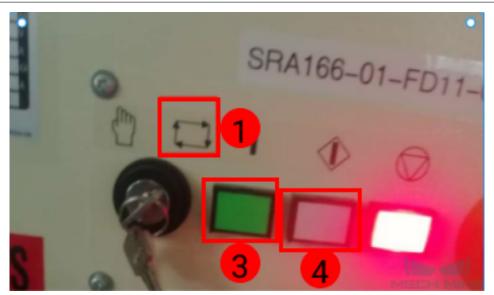
|                        | Teach                                      | <b>Program</b><br>NOT SEL     | Step<br>10 STEPS | 5/11/2022   | <u>9 17:08</u>          |              | Teach/Play<br>Condition |
|------------------------|--|-------------------------------|------------------|-------------|-------------------------|--------------|-------------------------|
| Tool<br>T1<br>Monitor2 | Dead<br>Zone<br>[1] Robot I<br>5.<br>[E0F] | Current p<br>Designate        | ed program       | 0           | Joint                   | Manual Speed | Cancel<br>I-Wali        |
| File                   | [2] User Ta                                | ask Monito                    | r                |             |                         |              |                         |
| Constant<br>Setting    | Prog.<br>1<br>2                            | Priority<br>4<br>3            | Com              | ment        | Status<br>Stop<br>Stop  | Error        | ACC                     |
| Service<br>Utilities   | 3 0<br>4 0<br>Load level                   | 3  <br>3  <br><mark>0%</mark> | Priori           | ty:1(Low)-6 | Stop<br>Stop<br>S(High) | MEC          | Smooth                  |

#### Start the robot

1. Turn the key on the controller and orientate it to the location  $% \mathcal{A}^{(n)}$  .







2. Turn the selector switch as shown below. Press the green button and white button in turn to start the robot.



**Hint:** After running the full-control program successfully, you can open Mech-Center to connect the robot.



### 1.6.4 Test Robot Connection

Please refer to *Test Robot Connection* for detailed instructions.

# **1.7 AE Peitian Setup Instructions**

This section introduces the process of loading the robot full-control program onto an AE Peitian robot.

The process consists of 5 steps:

- Log In
- Check IP and Controller Compatibility
- IP Configuration
- Load the Program File
- Test Robot Connection

Please have a flash drive ready at hand.

### 1.7.1 Log In

Every time you open the teach pendant, you will need to log in with an account. The initial passwords are as shown below.

| Account | Password   |
|---------|------------|
| Teacher | PEACE      |
| OEM     | GRACE      |
| Admin   | OMNIPOTENT |



|               | 🕑 System Settings 🔻  |   |       |   |   |   |   |   |    |   |   |            |
|---------------|--|---|-------|---|---|---|---|---|----|---|---|------------|
| V+            |  |   | 1     | 2 | 3 | 4 | 5 | 6 | 7  | 8 | 9 | 0          |
|               |  |   | q     | w | e | r | t | у | u  | i | 0 | р          |
| V-            | Log in   |   | a     | s | d | f | g | h | j  | k | Ι | ←          |
|               | 🔎 Admin  | - | Shift | z | x | c | v | b | n  | m |   | 4          |
| F1            | <b>P</b>   | Х | +     | - | * | / | = | ( | )  |   |   | ►          |
| F2            | Log in   |   | {     | } | [ | ] | , | · | Ń  | : | ; | "          |
|               |  |   | <     | > | ? | ! | @ | # | \$ | % | ^ | &          |
|               |  |   | ~     | Ι | ١ |   | _ |   |    | , | - | Eng.<br>→中 |
| 2nd<br>(ctrl) | HMI Version: 2.6.4.211117_rc<br>MachineID: 11:11:11:11:11:11 |   |       |   |   |   |   |   |    |   |   |            |

# 1.7.2 Check IP and Controller Compatibility

1. Go to System  $\rightarrow$  System and Update  $\rightarrow$  System Information.





2. Now you can check the IP information in the window as shown below.

| ×  | 1  | Ο                              | ( <u>M</u> )  | R1  |                 | oregro   | unc   |        | ¥ORI                         | .D                                 | <b>.</b>                      | FI                           | LANGE   | 2                       |      | 15     | :55:1         |
|----|--|--------------------------------|---|---|-----------------|----------|-------|--------|------------------------------|------------------------------------|-------------------------------|------------------------------|---|-------------------------|------|--------|---------------|
|    |  | CONT                           |   | 3%  | i 0             | ve<br>st | rsior | n file | does                         | not e                              | xi 🎽                          | 4                            | Run   | Monitor                 | File | System | Expan         |
| Co | oordin   | nate s                         | yste  | m meas  | ureme           | nt       |       |        |                              |                                    |                               |                              |   | ⇔                       | בום  |        | Х             |
|    | ARCS<br>ARCS<br>ARCS<br>ARCS<br>HG R<br>HG R<br>HG R | Rema<br>abso<br>emain<br>emain | in t<br>in a<br>in a<br>lute<br>tim<br>acco<br>abso | ccumul<br>bsolut<br>date<br>es<br>umulat<br>olute | e tim<br>ed tim |          |       |        | 0<br>0<br>197<br>0<br>0<br>0 | Hou<br>Hou<br>). 01.<br>Hou<br>Hou | r 00M<br>01<br>r 00M<br>r 00M | inut<br>inut<br>inut<br>inut | e 00se<br>e 00se<br>e 00se<br>e 00se<br>:e 00se | econd<br>econd<br>econd |      |        |               |
|    | s  | tore                           | info  | rmatio  | n —             |          |       |        |                              |                                    |                               |                              |   |                         |      |        | $\frac{1}{2}$ |
|    | 0ccu   | pied                           | space   | f syst<br>e of s<br>syste                         | ystem           |          |       |        | 0 B                          |                                    | 0.00 (<br>2.11 (              |                              |   |                         |      |        |               |
|    | — I<br>HMI<br>ARCS                                   | P inf                          | orma  | tion  |                 |          |       |        | 127                          | 0.0.                               | 1                             |                              |   |                         |      |        |               |

## 1.7.3 IP Configuration

The IP address of an AE Peitian robot has been specified during programming, and you only need to select the IP adddress when loading the program files.

### 1.7.4 Load the Program File

- 1. Go to the folder where Mech-Center is installed, and locate the full-control program file task\_main. arl. The path of the file is: XXXX/Mech-Center/Mech\_RobServ/install\_packages/ae.
- 2. Use an USB flash drive to copy the program file task\_main.arl and paste it into the /script folder of the robot system.
- 3. Go to  $File \rightarrow File Management$ , select USB(sim) in the list and open the folder.



| :       | 🛎 🕕 💭 🛞 R1 Foo            | reground 💭 WORLD 🧖 FLANGE 🙈 🎹 15:58:03                   |
|---------|---------------------------|--|
|         | Cont 3% <b>i</b> 0        | 15:46:32 Software platform of Run Monitor File Of Expand |
| V+      | File Management 2         |  |
|         | New New Open Load refresh |  |
| V-      | Current Path /            | J1   |
|         | Name 🗸 Size               | Date Modified Description                                |
|         | usersubprog               | 2021-11-26 12:01:23 J <sup>2</sup>                       |
|         | USB(sim)                  | 2022-05-12 14:48:23                                      |
| F1      | _ subprog                 | 2021-11-26 12:01:23 J3                                   |
|         | script                    | 2022-05-12 15:23:56                                      |
| F2      | screenshot                | 2021-11-26 12:01:23 J4                                   |
|         | log                       | 2022-05-12 14:31:02                                      |
| F3      | hmi_log                   | 2021-11-26 12:01:23                                      |
|         | _ config                  | 2022-05-12 15:55:20                                      |
| 2nd     | 📙 backup                  | 2021-11-26 12:01:23                                      |
| ((ctrl) | File Management           |  |

4. Select the file  $task_main.arl$ , and select Copy, and then select Up to go to the parent directory.



|               | 😂 🕦 🖸 🛞 R1 Foreground 🔯 WORLD 🛃 FLANGE  | Â       |      | 15:    | 58:13                |
|---------------|---|---------|------|--------|----------------------|
|               | CONT 3% i 0 15:46:32 Software platform of Run   | Monitor | File | System | Expand               |
| V+            | File Management   | ⇔       | בום  |        | ×                    |
|               | Image: Second |         |      |        |                      |
| <u> </u>      | Current Path /USB(sim)  |         |      |        | $\Box$ <sup>J1</sup> |
|               | Name $\bigtriangledown$ Size Date Modified Description  |         |      |        |                      |
|               | task_main.ar1 4 KB 2021-05-10 16:52:35 4  |         |      |        | J2                   |
| F1            |   |         |      |        | 13                   |
| F2            |   |         |      |        | J4                   |
| F3            |   |         |      |        | J2                   |
| 2nd<br>(ctrl) | File Management   |         |      |        | 16                   |

5. After opening the folder /script, select *Paste* to move the file task\_main.arl into it.



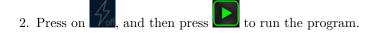
|               | 😆 🕦 🖸 🛞 R1 Foreground 🔯 WORLD 🛃 FLANGE  | 2       | **** | 15:58:29        |
|---------------|---|---------|------|-----------------|
|               | CONT     3%     0 version file does not exi st     Image: st       Image: st     st     Fun   | Monitor | File | System Expand   |
| V+            | File Management   | ⇔       | בום  |                 |
|               | Image: Second |         |      |                 |
| <u> </u>      | Current Path /script 7  |         |      | ] <sup>J1</sup> |
|               | Name $\bigtriangledown$ Size Date Modified Description  |         |      |                 |
|               | task_main.ar1 4 KB 2022-05-12 15:23:56  |         |      | J2              |
| F1            |   |         |      | 13              |
| F2            |   |         |      | J4              |
| F3            |   |         |      | ]5              |
| 2nd<br>(ctrl) | File Management   |         |      | Je              |

# 1.7.5 Run the Program

1. Double click on task\_main.arl to open the program file and then select Load.



|               | 🗢 🕐 🖸 🛞 R1 Foreground 💽 WORLD 🏠 FLANGE 🔗 🎹 15:58:39  |
|---------------|--|
|               | 3 CONT     3%     0     version file does not exi       1     1  |
| (V+           | File Management $\leftrightarrow$ $\Box$ $\times$ Program Editor $\leftrightarrow$ $\Box$ $\times$ $4$   |
| V-            | Image: New Folder       Im |
|               | Current Path /script<br>Name $\bigtriangledown$ Size Date Modified 1 // AE robot IP  |
| F1            | Name       V Size       Date Modified         1       2022-05-12       15::         2       const string server_ip =         "192.168.100.60"         3       const string server_gate =         "192.168.100.255"         4       const string server_mask =  |
| F2            | "255. 255. 255. 255. 0"         5         6         const int statusPort = 5308         7         const int motionPort = 5309  |
| F3            | 8     9     socket status_socket       10     socket motion_socket       11  |
| 2nd<br>(ctrl) | 12     const byte CMD_MOVEJ = 1       13     const byte CMD_MOVEJ = 2       File Management     Program Editor   |



# 1.7.6 Test Robot Connection

Please refer to *Test Robot Connection* for detailed instructions.

# **1.8 HYUNDAI Setup Instructions**

This section introduces the process of loading the robot full-control program onto a Hyundai robot.

The process consists of 5 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Further Configuration
- Connect to the Robot



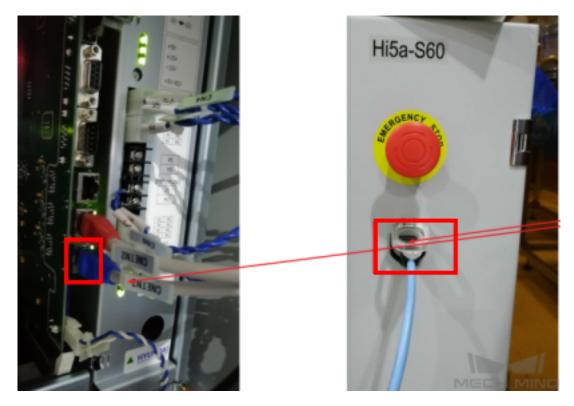
### 1.8.1 Check Controller and Software Compatibility

• There is no requirement on the version of robot controller.

### **1.8.2 Setup the Network Connection**

#### Hardware Connection

Plug the Ethernet cable of the IPC into the CNETN3 port inside the controller or the Ethernet port on the outside, as shown below.

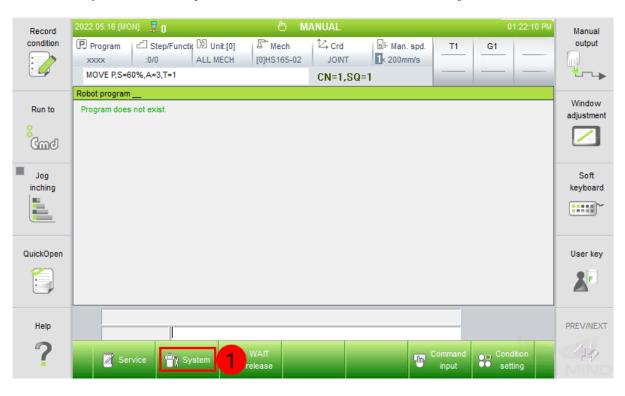


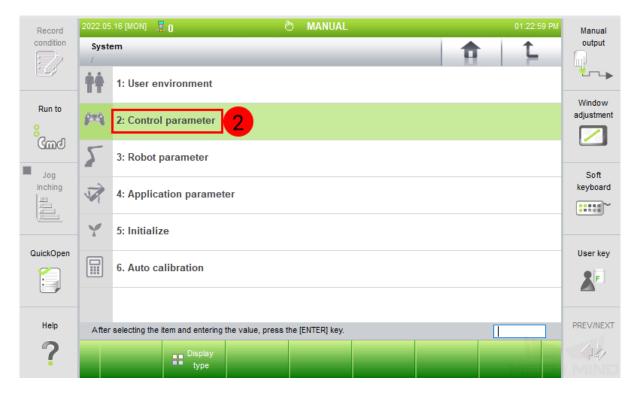
**Hint:** There are three port inside the controller, namely CNETN1, CNETN2, and CNETN3, which correspond to the EN0 address, TP address and EN2 User Ethernet address on the teach pendant respectively.



#### **IP Configuration**

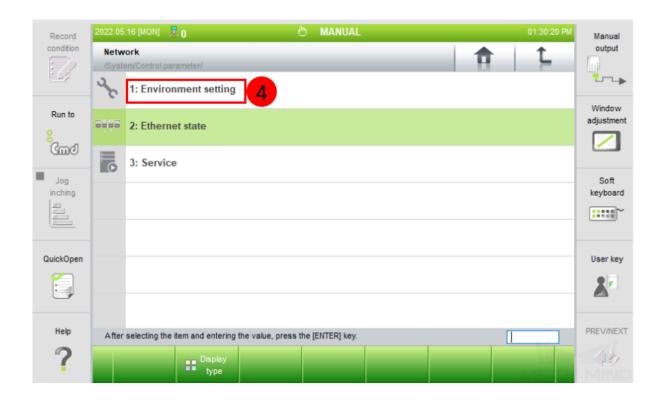
1. Go to System  $\rightarrow$  Control parameter  $\rightarrow$  Network  $\rightarrow$  Environment setting.







| Record         | 2022.05.16 [MON] 📮 👔 👘 MANUAL   | 01:30:04 PM Manual   |
|----------------|---|----------------------|
| condition      | Control parameter<br>/System/   | 1 1 output           |
|                | 8: Program reservation execution  | ě-,                  |
| Run to         | 9: Network 3  | Window<br>adjustment |
| Gmd            | 10: Register license key of option function                             |                      |
| Jog<br>inching | 11: Automatic backup and restoration                                    | Soft<br>keyboard     |
| QuickOpen      |   | User key             |
| Help           | After selecting the item and entering the value, press the [ENTER] key. | PREV/NEXT            |
| ?              | Display<br>type Previous  | 14                   |



2. Select *EN2(Public)*, and set the right **IP Address**. Please also make sure that the **Sebnet Mask** is set to **255.255.255.0**.



| Record condition | 2022.05.12 [ТНИ] 💂 0 🖑 MANUAL 05:06:28 РМ<br>Environment setting                 | Manual<br>output     |
|------------------|--|----------------------|
| Run to           | EN0 (Cooper. control) EN1 (T/P-main) EN2 (Public) 5 (Public)                     | Window<br>adjustment |
| 6m2              | IP Address = 0.0.0.0   | Soft                 |
| inching          | Subnet Mask         =         0         0         0         7                    | keyboard             |
| QuickOpen        | Gateway = 0 . 0 . 0 . 0  | User key             |
|                  | - Warning  | <b>X</b> F           |
| Help             | After selecting the item and entering the value, press the [ENTER] key.[0 - 255] | PREV/NEXT            |
| ?                | Prev Tab 💦 Next Tab 💽 Complete   |                      |

#### Hint:

- The robot IP should be in the same subnet as the IPC.
- The subnet mask of the IPC is the same as that of the robot, which is **255.255.255.0**.
- Restart the robot after modifying the IP address.

### 1.8.3 Load the Program Files

1. Connect the USB flash drive to the teach pendant.

Note: To control a HYUNDAI robot, our full-control program **0101.JOB** and **0102.JOB** need to be initialized by changing the **Program File Format Version** information on the first line.

**Hint:** If you already have other available program on the robot, please directly copy and paste the program into the flash drive and skip to step 5.

2. Select Command input.



| Record    | 2022.06.09 [THU] 📮 🛛                                    | 04:42:01 P   | Manual        |            |
|-----------|---|--|---------------|------------|
| condition | Program C Step/Functic D Unit:[0]<br>0006 :0/0 ALL MECH | Image: |               | output     |
| - 🌽       | MOVE P,S=60%,A=3,T=1                                    | CN=1,SQ=1  |               |            |
|           | Robot program   |  |               | Window     |
| Run to    | Program does not exist.                                 |  |               | adjustment |
| Gmd       |   |  |               |            |
| Jog       |   |  |               | Soft       |
| inching   |   |  |               | keyboard   |
|           |   |  |               | ·····      |
| QuickOpen |   |  |               | User key   |
|           |   |  |               | <b>X</b> F |
|           |   |  |               |            |
| Help      |   |  |               | PREV/NEXT  |
| ?         |   | VAIT Jease   | Command Input |            |

3. Choose either of the command to input, as shown below.

| Record         | 2022.06     | 5.09 [THU]            | - 0          |          | e         | MANUA |                   |           |       | 04:37      | :12 PM | Manual               |
|----------------|-------------|-----------------------|--------------|----------|-----------|-------|-------------------|-----------|-------|------------|--------|----------------------|
| condition      |             |                       | Step/Functio |          |           |       |                   | Man. spd. | T1    | G1         |        | output               |
|                | 0005<br>MOV | 5 :0.<br>/E P,S=60%,A |              | ALL MECH | H [0]HS10 |       | NT [5⊧2<br>I,SQ=1 | 00mm/s    |       |            | _      |                      |
| :              |             | program               |              |          |           | CI    | 1,50-1            |           |       |            |        | F                    |
| Run to         |             | am does not e         | xist.        |          |           |       |                   |           |       |            |        | Window<br>adjustment |
| emd 8          |             |                       |              |          |           |       |                   |           |       |            |        |                      |
| Jog<br>inching |             |                       |              |          |           |       |                   |           |       |            |        | Soft<br>keyboard     |
| QuickOpen      |             |                       |              |          |           |       |                   |           |       |            |        | User key             |
| Help           |             | Select F butto        | n menu.      |          |           |       |                   |           | _     |            |        | PREV/NEXT            |
| ?              |             | Motion,VO             | Flow co      | ntrol    | Others    | Spot  | Arc               | Han       | dling | Assignment | 2      | <b>*</b>             |



| Record    | 2022.0                                      | 6.09 [ТНО] 🔄   | -0             |                        | <u>ل</u> ا            | MANUAL          |                          |      | 04:57:10 PM |            |  |  |
|-----------|---|----------------|----------------|------------------------|-----------------------|-----------------|--------------------------|------|-------------|------------|--|--|
| condition | Pro<br>000                                  |                | Step/Functic [ | 辺 Unit:[0]<br>ALL MECH | P Mech<br>[0]HS165-02 | Î⊈ Crd<br>JOINT | s∓ Man. sp<br>1< 200mm/s |      |             | output     |  |  |
|           | MOVE P,S=60%,A=3,T=1 CN=1,SQ=1              |                |                |                        |                       |                 |                          |      |             |            |  |  |
|           | Robot program Robot:HS165-02, Baxes, 1steps |                |                |                        |                       |                 |                          |      |             |            |  |  |
| Run to    | S1  | MOVE P,P1,S=   |                |                        |                       |                 |                          |      |             | adjustment |  |  |
| emd.      |   |                |                |                        |                       |                 |                          |      |             |            |  |  |
| Jog       |   |                |                |                        |                       |                 |                          |      |             | Soft       |  |  |
| inching   |   |                |                |                        |                       |                 |                          |      |             | keyboard   |  |  |
|           |   |                |                |                        |                       |                 |                          |      |             |            |  |  |
| QuickOpen |   |                |                |                        |                       |                 |                          |      |             | User key   |  |  |
|           |   |                |                |                        |                       |                 |                          |      |             | A.         |  |  |
| Help      |   | Select the con | nmand.         |                        |                       |                 |                          |      |             | PREV/NEXT  |  |  |
|           |   |                |                |                        |                       |                 |                          |      |             | PREVINEAT  |  |  |
| ?         |   | MOVE           | PRINT          | INP                    | UT Sig                | nal output      | WAIT                     | SMOV | CONTPATH    | <b>+</b>   |  |  |

4. Now you can see the robot version information on the top. Then save the program.

- 5. Select the newly created program file (or a previous program file), and select *Copy*. Then switch to the USB folder and select *Paste*.
- 6. Connect the flash drive to the IPC. Open the program, and then copy the first line.
- 7. Copy and paste the full-control program files **0101.JOB** and **0102.JOBO** into the flash drive. Open the two full-control program and paste the copied code to replace the first line in the program, and then save the changes.

Program File Format Version : 1.6 MechType: 370(HS220-01) TotalAxis: 6 AuxAxis: 0 DIM lildx AS Integer DIM liVel[200] AS Integer DIM limotionType[200] AS Integer FOR lildx=1 TO 200

**Hint:** The full-control program files are stored in XXX/Mech-Center/Mech\_RobServ/install\_packages/hyundai/Hi5a-S.

liVel[lildx]=0



8. Connect the flash drive to the teach pendant. Go to  $System \rightarrow File \ manager \rightarrow USB$ , select **0101.JOB** and **0102.JOB**, and then select *Copy*. Then switch to **T/P**, select *Paste* to load the files to the robot.

## **1.8.4 Further Configuration**

1. Change the IP address of the IPC to **192.168.0.150**.

**Hint:** This IP address is a default one which is specified in **0101.JOB** and **0102.JOB**. If you need to change the IP address, please modify the IP address in the program accordingly, and the new IP address should be in the same subnet as that of the robot controller.

- 1. Set the management IP address of the router to **192.168.0.1**.
- 2. Go to System  $\rightarrow$  User Environment.





| Record<br>condition | 2022.05.16 [MON] ↓ 01:22:59 PM<br>System / |                          |                    |                    |                 |  |  |  | Manual<br>output     |  |  |
|---------------------|--|--------------------------|--------------------|--------------------|-----------------|--|--|--|----------------------|--|--|
|                     | ŤŤ   | 1: User en               | wironment          | 2                  |                 |  |  |  | *~~ <b>&gt;</b>      |  |  |
| Run to              | 2: Control parameter                       |                          |                    |                    |                 |  |  |  | Window<br>adjustment |  |  |
| Gind                | 3: Robot parameter                         |                          |                    |                    |                 |  |  |  |                      |  |  |
| Jog<br>inching      |  | 4: Application parameter |                    |                    |                 |  |  |  |                      |  |  |
|                     | Y  | 5: Initialize            |                    |                    |                 |  |  |  |                      |  |  |
| QuickOpen           |  | 6. Auto ca               | libration          |                    |                 |  |  |  | User key             |  |  |
| Help                | After                                      | selecting the i          | tem and entering t | he value, press th | ne [ENTER] key. |  |  |  | PREV/NEXT            |  |  |
| ?                   |  |                          | Display<br>type    |                    |                 |  |  |  | 14                   |  |  |

- 3. Select User Key and enter the general password 314 to request permission.
- 4. Change the  $\mathbf{P}^*$  Coordinate to Axis.

| Record    | Conside 27 (Tue) * a              |   |    | O MAN    | UAL             | _    | 01:18:22 PM | Manual              |  |
|-----------|-----------------------------------|---|----|----------|-----------------|------|-------------|---------------------|--|
| condition | User environment                  |   |    |          |                 |      |             | tuquo               |  |
| E4        | 1: Pose record type               | τ.  | œ  | Base     | C Robot C Axis  | cu   | C Un        | 5.0                 |  |
| Run to    | 2: Confirm delete command         |   | C  | Disable  | @ Enable        |      |             | Window<br>adjustmen |  |
|           | 3: WAIT(DI/WI) release            | *   | G  | Disable  | C Enable        |      |             |                     |  |
|           | 4: Program strobe signal use      |   | (6 | Disable  | C Enable        |      |             | -                   |  |
| · 203     | 5: Ext. update of playback prog.  |   | G  | Disable  | C Enable        |      |             | Soft                |  |
| Inching   | 6: Collision sensor               |   |    |          |                 |      |             |                     |  |
| 1         | (1) Sensor                        | -   | (4 | Em, stop | C Stop          |      |             |                     |  |
|           | (2) Signal logic                  | ×   | C  | Positive | Regative        | R    |             | User key            |  |
| QuickOper |                                   |   |    |          | $\frown$        |      | C 115       |                     |  |
|           | 7: P+ Coordinate                  | -   |    | Base     | C Robot C Axis  | )(3) | CUn         | -                   |  |
| -         | 8: P+ Selection                   |   | 6  | Command  | C Current value |      |             |                     |  |
| Help      | Selected the coordinate system to | Selected the coordinate system to use for P+, |    |          |                 |      |             |                     |  |
| 2         |                                   |   |    | I Pr     | evicius 🐹 Next  |      |             |                     |  |



### **1.8.5 Connect to the Robot**

- 1. Open Mech-Center and click on Deployment Settings.
- 2. Go to **Robot Server**, and make sure **Use robot server** is checked.
- 3. Check if the robot model displayed after **Robot type in Mech-Viz project** matches the one in use.
- 4. Set the Robot IP address, and click on **Save**.

| Deployment Settings | ×                                 |
|---------------------|-----------------------------------|
|                     |                                   |
|                     | ✓ Use robot server                |
|                     | Robot server path                 |
|                     | Robot type in Mech-Viz project: 2 |
| Robot Server        | Robot IP                          |
|                     | RobotServer Program Folder        |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     |                                   |
|                     | 4                                 |
|                     | Save Cancel                       |
|                     | oure                              |



- 5. Click on *Connect Robot* in the Toolbar.
- 6. Switch the robot into AUTO mode.
- 7. Open **0101.JOB**, select  $Program \rightarrow Step/Function$ , and enter **0** in the pop-up **Step selection** window. The way to reset the **0102.JOB** is the same.
- 8. Execute the program **0101.JOB**.
- 9. The robot is successfully connected if:
  - A message saying Robot: server connected to the robot shows up in the Log panel, and



with the robot model shows up in the **Service Status** panel.

#### Reconnect the robot

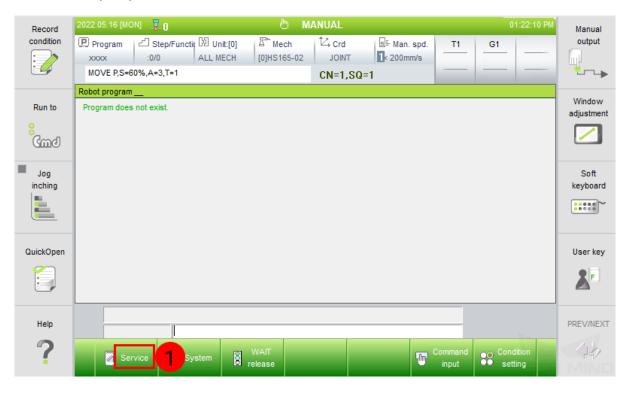
1. Under teach mode, press R.. [NO], enter 314 and then press ENTER [YES] to request permission.

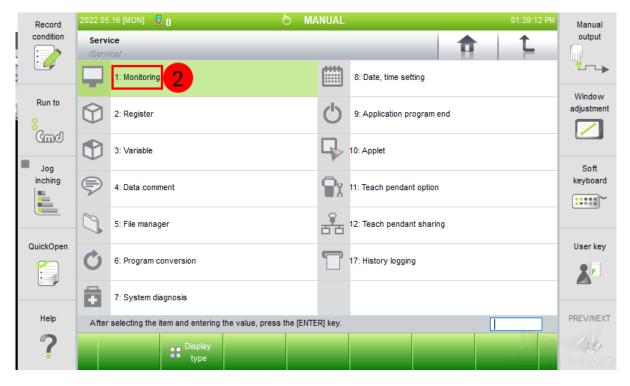


| 2022.05.16 [MON | 1 📮 0          |               | 6 м             | ANUAL      |   |         |            | 38:36 PN |
|-----------------|----------------|---------------|-----------------|------------|---|---------|------------|----------|
| Program (       | 스 Step/Functio |               | E Mech          | Î⊈ Crd     | _ Man. spd.   | T1      | G1         |          |
| XXXXX           | :0/0           | ALL MECH      | [0]HS165-02     | JOINT      | 1< 200mm/s  |         |            |          |
| MOVE P,S=609    | %,A=3,T=1      |               |                 | CN=1,SQ:   | =1  |         |            |          |
| Robot program _ | _              |               |                 |            |   |         |            |          |
| Program does n  | ot exist.      |               |                 |            |   |         |            |          |
|                 | Program se     | election      |                 |            |   |         |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 |                |               |                 |            |   | _       |            |          |
|                 | Enter prog     | ram number (1 | ~ 9999):        | 314        |   |         | 2          |          |
|                 |                | -             |                 |            |   |         |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 | ·              | List show/    | hide: [Program] |            |   |         |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 | •              |               |                 |            |   |         |            |          |
| 📝 Servi         | ce 🖓 Sy        | stem 🕱        | WAIT<br>release |            | - In the second s | Command | O Conditio |          |
|                 |                |               | release         |            |   | input   | •• setting | 9        |
| <u> </u>        |                |               |                 |            |   |         |            |          |
| i X             |                | ST            | BWD STEP        | SPEED H    | <b>!</b>  | SC [    | _e×        |          |
|                 |                | CTRL          | FWD             | LOW        |   |         |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 |                | (- X+<br>(S+) | RX-<br>(R2-)    | X+<br>R2+) |   |         |            |          |
|                 |                | 5-) (S+)      | (R2-) (         | R2+)       |   |         |            |          |
|                 |                | (- Y+         | RY- R           | Y+         |   |         |            |          |
|                 |                | t-) (H+)      | (B-) (          | B+)        |   |         |            |          |
|                 |                | 7             | P7.             |            |   |         |            |          |
|                 |                | Z-<br>(V+)    | RZ-<br>(R1-)    | Z+<br>R1+) |   |         |            |          |
|                 |                |               |                 | 7          | 8   | 9       |            |          |
|                 |                |               |                 |            |   |         |            |          |
|                 |                |               | HISTORY POS.    | 4          | 5   | 6       |            |          |
|                 |                |               | RE              |            |   |         |            |          |
|                 |                |               | PR              | og         |   |         |            |          |
|                 |                |               |                 |            | 2   | 3       |            |          |
|                 |                |               | TOOL UN         |            |   | 1       |            |          |
|                 |                |               |                 | сн О       |   | _       |            |          |



2. Each time when reconnect the robot, the background tasks should be stopped and the pstep in the foreground program should be reset to 0. Select Service  $\rightarrow$  Monitoring  $\rightarrow$  Multi-tasking\_state  $\rightarrow$  ENTER [YES] to enter the multi-tasking interface.



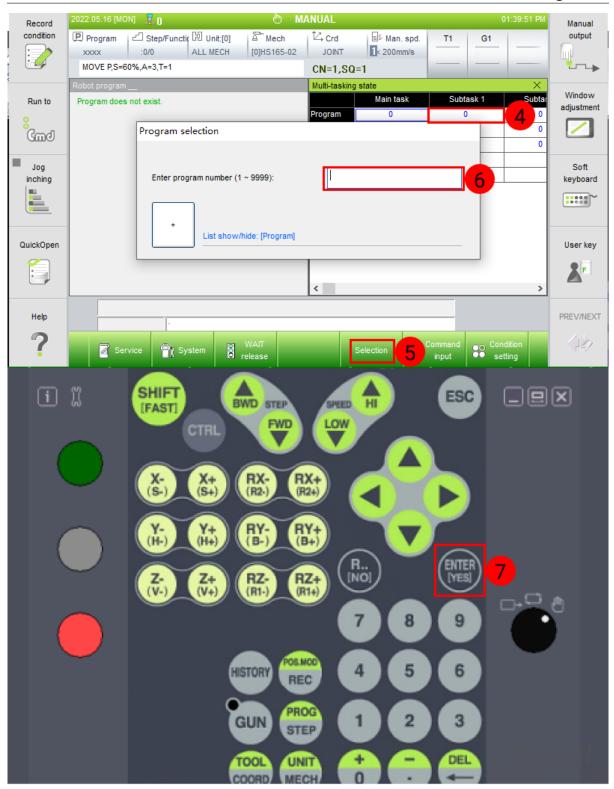




| Record         | 2022.05       | i.16 [MON] 🛛 📘  | 0                  | ę                   | 5 M/     | ANUAL      |                     |                  | 01:39:34 PM | Manual               |
|----------------|---------------|-----------------|--------------------|---------------------|----------|------------|---------------------|------------------|-------------|----------------------|
| condition      | Moni<br>/Serv | itoring<br>ice/ |                    |                     |          |            |                     | <b>A</b>         | 1           | output               |
|                |               | 1: Data of ea   | ch axis            |                     |          | Ø          | 12: Job program H   | HotEdit          |             | *~. <b>&gt;</b>      |
| Run to         | Ē             | 2: Input/Outp   | ut signal          |                     |          | $\bigcirc$ | 14: Operating info  | ormation         |             | Window<br>adjustment |
| Gmd            | Т.            | 3: Fieldbus s   | ignal              |                     |          |            | 15: Embedded fie    | ldbus node state |             |                      |
| Jog<br>inching | C             | 4: Spot weld    | ing data           |                     |          | I-s        | 18: Multi-tasking s | state 3          |             | Soft<br>keyboard     |
|                |               | 7: PLC relay    | data               |                     |          | ¦нц        | 20: Edit Ladder     |                  |             |                      |
| QuickOpen      | $\bigcirc$    | 8: Analog dat   | a                  |                     |          | Ţ          | 21: PRM informati   | on               |             | User key             |
|                |               | 11: Various da  | ta                 |                     |          | Ф.         | 22: Roller Hemmin   | g Data           |             |                      |
| Help           | After         | selecting the i | tem and entering t | the value, press th | he (ENTE | ER] key.   |                     |                  |             | PREV/NEXT            |
| ?              |               |                 | Display<br>type    |                     |          |            |                     |                  |             | 4                    |

3. Select Program (Suntask) and then select *Selection*. Enter **3** in the **Program selection** window and then press ENTER [YES] to complete configuration.







# **1.9 UR Setup Instructions**

This section introduces the process of setting up full control of an UR robot.

The UR robots can be controlled at script level. At the script level, the **URScript** is the programming language that controls the robot. Therefore, the IPC controls an UR robot by sending scripts to it.

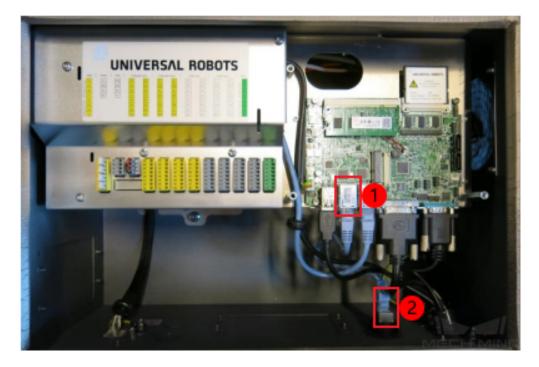
#### Attention:

- Once received a script, the robot will execute it. If the script has not finished executing, and the robot received another script which contains motion commands, the robot will stop immediately and execute the current script. If a script function defined by "sec" (not "def") is sent via the port 30002, and the function does not contain motion commands, the robot will not stop immediately.
- For e-Series robots such as UR5e, Mech-Viz can only guide the robot to move when they are set to remote control, or else Mech-Viz can only synchronize the robot instead of moving it.

### **1.9.1 Setup the Network Connection**

#### Hardware Connection

Start the robot and plug the Ethernet cable into the port of the robot controller, as shown below.



is the network port inside the controller, and is the default network port.



 ${\bf Tip:}~$  In order to make the network connection faster and more stable, it is recommended to use port ~.

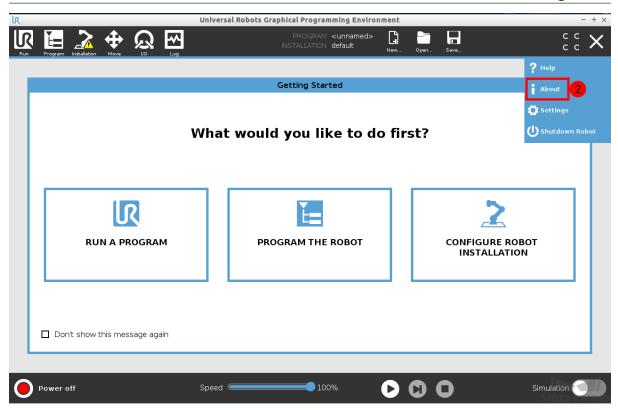
### 1.9.2 Check IP and Controller Compatibility

1. Press on the icon in the upper-right corner of the teach pendant.

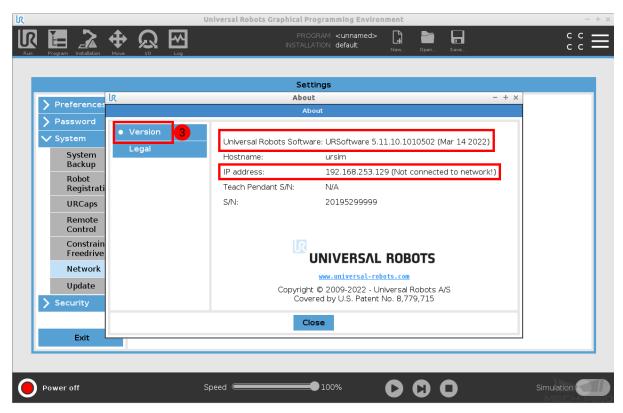
| k                                    | Universal Robots Gr | aphical Programming Enviror                                       | nment  |           |              | - + ×    |
|--------------------------------------|---------------------|---|--------|-----------|--------------|----------|
| Run Program Installation Move NO Log |                     | PROGRAM <b><unnamed></unnamed></b><br>INSTALLATION <b>default</b> | New    | Open Save |              | сс<br>сс |
|                                      |                     |   |        |           |              | 1        |
|                                      |                     | Getting Started   |        |           |              |          |
|                                      |                     |   |        |           |              |          |
|                                      |                     |   | ~      |           |              |          |
|                                      | What would          | d you like to d   | o firs | st?       |              |          |
|                                      |                     |   |        |           |              |          |
|                                      |                     |   |        |           |              |          |
| (177)                                |                     |   |        |           |              |          |
| R                                    |                     | E=  |        |           | 2            |          |
| RUN A PROGRAM                        | DB                  | OGRAM THE ROBOT   |        | CON       | FIGURE ROBOT |          |
| RUNA PROGRAM                         | PR                  |   |        |           | ISTALLATION  |          |
|                                      |                     |   |        |           |              |          |
|                                      |                     |   |        |           |              |          |
|                                      |                     |   |        |           |              |          |
| Don't show this message again        |                     |   |        |           |              |          |
|                                      |                     |   |        |           |              |          |
|                                      |                     |   |        |           |              |          |
| Power off                            | Speed               | 100%  |        |           | Simulati     |          |
|                                      |                     |   |        |           | ME           |          |

2. Select About.





3. Press on Version.





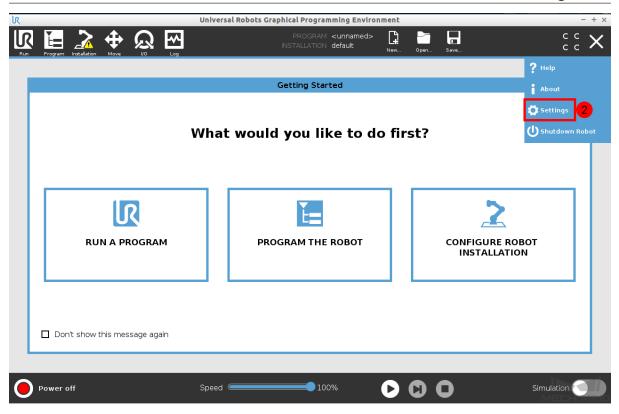
## **1.9.3 IP Configuration**

1. Press on the icon in the upper-right corner of the teach pendant.

| R                       |             |                         | Universal Robots | Graphical Programming Enviror                        | nment  |           |                              | - + ×   |
|-------------------------|-------------|-------------------------|------------------|--|--------|-----------|------------------------------|---------|
| Run                     | Program Ins |                         |                  | PROGRAM <unnamed><br/>INSTALLATION default</unnamed> | New    | Open Save |                              | c<br>c  |
|                         |             |                         |                  | Getting Started                                      |        |           |                              |         |
|                         |             |                         |                  | Getting Started                                      |        |           |                              |         |
|                         |             |                         | What wou         | ld you like to de                                    | o fir  | -+7       |                              |         |
|                         |             |                         | what wou         | iu you iike to u                                     | 0 1113 | 561       |                              |         |
|                         |             |                         |                  |  |        |           |                              |         |
|                         |             |                         |                  |  |        |           | 5                            | 1       |
|                         |             |                         |                  |  |        |           | <u> </u>                     |         |
|                         |             | RUN A PROGRAM           | PI               | ROGRAM THE ROBOT                                     |        |           | IFIGURE ROBOT<br>NSTALLATION |         |
|                         |             |                         |                  |  |        |           |                              | 1       |
|                         |             |                         |                  |  |        |           |                              |         |
|                         | 🔲 Don't s   | show this message again |                  |  |        |           |                              |         |
| 1                       |             |                         |                  |  |        |           |                              |         |
| $\overline{\mathbf{O}}$ | Power off   |                         | Speed            | 100%   | 0      |           | Simulation                   |         |
|                         |             |                         |                  |  |        |           | MILL                         | FINITUL |

2. Select Settings.





3. Select System  $\rightarrow$  Network.

| ᠒ 🖪 🕻 ቆ                      |   | Graphical Programming Environ PROGRAM <unnamed></unnamed> | nment        |                 | - +<br>c c _ |
|------------------------------|---|---|--------------|-----------------|--------------|
| Run Program Installation Mov |   | INSTALLATION default                                      | New Open     | Save            | сс —         |
|                              |   |   |              |                 |              |
|                              |   | Settings  |              |                 |              |
| > Preferences > Password     | Network   |   |              |                 |              |
| System 3                     | Select your network method <ul> <li>DHCP</li> </ul>       |   |              |                 |              |
| System<br>Backup<br>Robot    | O Static Address<br>O Disabled network                    |   |              |                 |              |
| Registration<br>URCaps       | X Not connected to network!<br>Network detailed settings: |   |              |                 |              |
| Remote<br>Control            | IP address:   |   |              | 192.168.253.129 |              |
| Constrained                  | Subnet mask:  |   |              | 255.255.255.0   |              |
| Freedrive<br>Network         | Default gateway:  |   |              | 192.168.253.2   |              |
| Update                       | Preferred DNS se  |   |              | 192.168.253.2   |              |
| > Security                   | Alternative DNS s   | erver:  |              | 0.0.0.0         |              |
|                              |   |   |              | Apply           |              |
| Exit                         |   |   |              |                 |              |
|                              |   |   |              |                 |              |
| Power off                    | Speed   | 100%  | $\mathbf{O}$ | 0               | Simulation   |



Enter the correnct IP address, which should be in the same subnet as the IPC. After configuration, press on Apply.

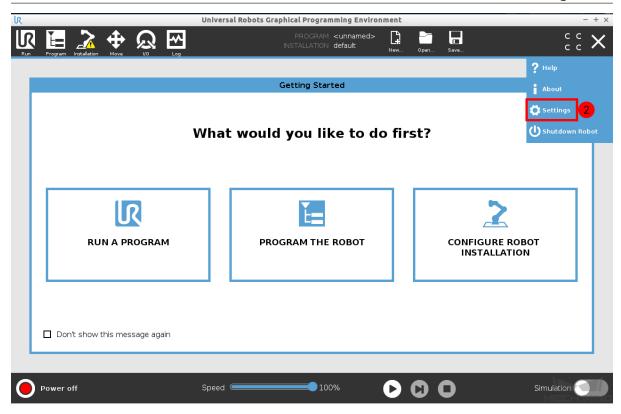
### 1.9.4 Start Remote Control

1. Press on the icon in the upper-right corner of the teach pendant.

| ĸ   |         |              |           |                           |                 | Univer | rsal Robots | Graphical Pr | ogramming E  | Invironment |      |      |            |            | - + × |
|-----|---------|--------------|-----------|---------------------------|-----------------|--------|-------------|--------------|--|-------------|------|------|------------|------------|-------|
| Run | Program | Installation | Hove Hove | $\mathbf{R}_{\mathbf{r}}$ | <b>≁</b><br>Log |        |             |              | GRAM <b><unnar< b=""><br/>ATION default</unnar<></b> |             | Open | Save |            | с (<br>с ( |       |
|     |         |              |           |                           |                 |        |             | Getting      | Started  |             |      |      |            |            |       |
|     |         |              |           |                           |                 |        |             |              |  |             |      |      |            |            |       |
|     |         |              |           |                           |                 | Wha    | t wou       | ld you       | ı like to  | o do fii    | rst? |      |            |            |       |
|     |         |              |           |                           |                 |        |             |              |  |             |      |      |            |            |       |
|     |         |              |           | 2                         |                 |        |             | Ĭ            |  |             |      |      | >          |            |       |
|     |         | RU           |           | ROGRA                     | м               |        | Р           | ROGRAM       | —<br>ТНЕ ROBO  | от          |      |      | GURE ROBOT |            |       |
|     |         |              |           |                           |                 |        |             |              |  |             |      | IN   | STALLATION |            |       |
|     |         |              |           |                           |                 |        |             |              |  |             |      |      |            |            |       |
|     | 🗖 Dor   | n't show t   | his me    | ssage ag                  | ain             |        |             |              |  |             |      |      |            |            |       |
|     |         |              |           |                           |                 |        |             |              |  |             |      |      |            |            |       |
| 0   | Power   | off          |           |                           |                 | Speed  |             |              | 0100%  | D           |      | 0    | Si         | imulation  |       |

2. Select Settings.

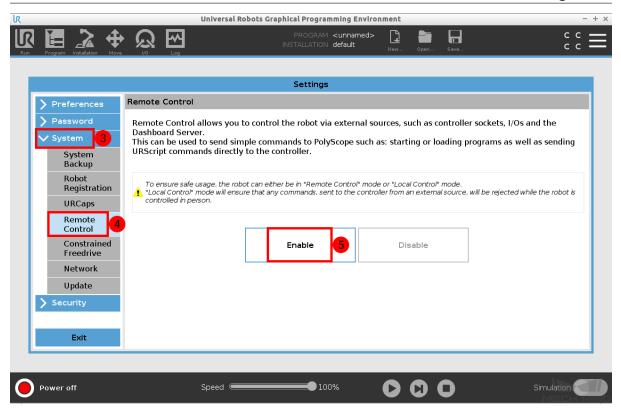




3. Select System  $\rightarrow$  Remote Control.



#### **Mech-Mind Robot Integrations**



4. Press on *Enable* to enable the remote control.

### 1.9.5 Test Robot Connection

Please refer to *Test Robot Connection* for detailed instructions.

## 1.10 ROKAE Xmate 7 Collaborative Robot Setup Instructions

This section introduces the process of setting up full control of a ROKAE Xmate 7 collaborative robot. The process consists of 4 steps:

- Upgrade Software
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

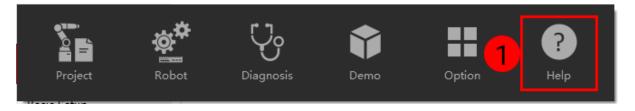


### 1.10.1 Upgrade Software

- 1. Start the robot and open the ROKAE Xmate7 control system software.
- 2. Click on  $Robot \rightarrow Search \ Available \ Robots \rightarrow Connect$  to connect the robot as shown below.

| $\equiv$   | Project: mechm | ind_xmate7   |  | (j) s  | ystem ready. | 🗶 tool0  | 占 wobj0  | ø   | 0::  |
|--|----------------|--|--|--------|--------------|--|--|---|--|
| Project<br>Basic Setup<br>Appearance<br>File Manag | e              | Bound IP: 0.0.0.0<br>Seach Available Ro<br>Robot Service | Connection<br>192.168.0.160<br>Disconnected<br>Disconnected<br>Onnection | option | P<br>Help    | control to b<br>bound IP, this<br>Controller Sc<br>Each robot st<br>after every ha<br>Upgrade Sen<br>The upgrade<br>contoller pro<br>Automatic Ro<br>Turn on the fin<br>disconnected<br>Otherwise, it<br>function is tur<br>used for the<br>reconnection | letect any prepare<br>pound IP, you can<br>s operation will tal<br><b>ervice</b><br>tarts an independent<br>ardware prepared | click here to<br>ke effect after<br>ent controlle<br>l.<br>aning, so that<br>raded at any<br>network is<br>ally reconnect<br>vity reconnect<br>ction time, a<br>n(reconnect | n valid<br>or change<br>er restart.<br>er service<br>t the<br>y time.<br>t.<br>the<br>e will be<br>ind the |
|  | «              |  |  |        |              |  |  |   |  |

- 3. If an alert window pops up, showing that the current control system is not compatible with the robot model, please upgrade the system according to the instruction.
- 4. After upgrading the control system, you will need to upgrade the controller software manually.
  - 1. Please download the ROKAE upgrade package first and then copy and paste it into a USB flash drive.
  - 2. Select *Help*.



3. Go to Software Upgrade  $\rightarrow$  Open to select the upgrade package in the USB flash drive, and then click on Upload.



| Project: mechm    | ind_xmate7  | i System ready. |      | 🗶 tool0  | 🕹 wobj0                                | 0            | 0::      |
|-------------------|---|-----------------|------|--|--|--------------|----------|
| ← Help            | Software Upgrade  |                 |      |  |  |              |          |
| About Rokae       | Controller Upgrade  |                 |      | Controller Up                                      | grade                                  |              |          |
| Robot Instruction | Select package  |                 | Open |  | controller needs<br>id compatibility p |              | e HMI    |
| Software Upgrade  | <ul> <li>Interactive Data</li> <li>Robot Configuration</li> <li>Controller Log</li> <li>Project Data</li> <li>Demo</li> <li>Servo</li> <li>Uploed</li> <li>Controller Backup</li> <li>Backup Options</li> <li>Interactive Data</li> <li>Robot Configuration</li> <li>Controller Log</li> <li>Project Data</li> <li>Select folder</li> </ul> |                 | Open | Controller Ba<br>The controller<br>to local folder | packs all the nee                      | ded files an | d upload |
| «                 | Export  |                 |      |  |  |              |          |

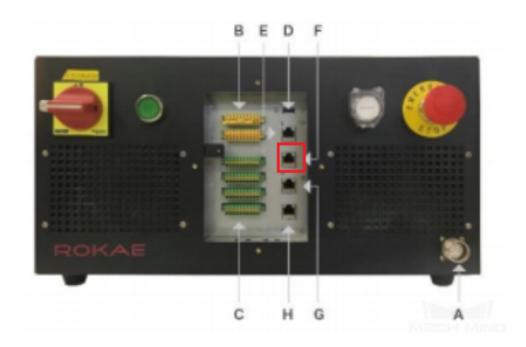
**Note:** The ROKAE controller of 3.6 version is compatible with Mech-Center 1.5.0 or higher. If you are using a controller whose version is lower than 3.6, please use the Mech-Center of a previous version.

### 1.10.2 Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable of the IPC into the F port as shown below.





#### **IP Configuration**

The default robot IP address is 192.168.0.160, please set the IP address of the IPC to 192.168.0.222. After configuration, you can check the connection by entering the command **ping 192.168.0.160** in the Command Prompt window.

### 1.10.3 Load the Program Files

#### **Prepare the Files**

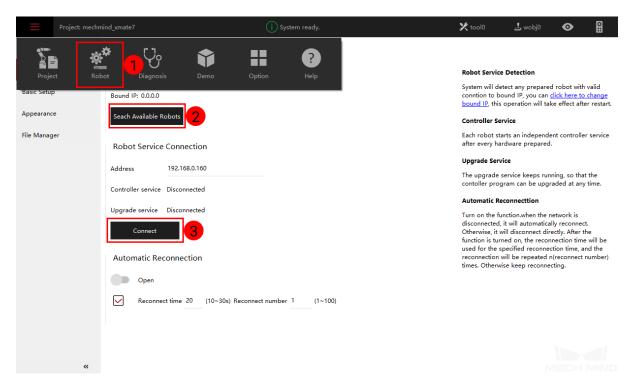
Go to the folder where Mech-Center is installed and copy the **mechmind\_xmate7.zip** on the path  $XXX \setminus Mech-Center \setminus Mech\_RobServ \setminus install\_packages \setminus rokae$ , and paste it into the flash drive.

| getDIServer           | 2022/5/10 19:47 |
|-----------------------|-----------------|
| 📒 singleTask5         | 2022/5/10 19:47 |
| splineCurve           | 2022/5/10 19:47 |
| 🚞 mechmind_xmate7.zip | 2022/2/16 10:51 |
|                       |                 |



#### **Connect the Robot**

1. Click on  $Robot \rightarrow Search \ Available \ Robots \rightarrow Connect$  to connect the robot again.



#### Switch the Level

Go to *Basic Settings*  $\rightarrow$  *User Group* and select **Admin** as the user level, enter the default password 123456, and then click on *Login* to finish setting.



| Project: mechr       | nind_xmate7 | i System ready. | 🗶 tool0                   | 占 wobj0           | •   | 0:: |
|----------------------|-------------|-----------------|---------------------------|-------------------|-----|-----|
| ← Robot              | User Group  |                 |                           |                   |     |     |
| > Basic Settings     | User Level  |                 | User Group Rig            | hts               |     |     |
| User Group           | Admin 🖌 🙎   |                 | Operator                  |                   |     |     |
| Controller Setting   |             |                 | Run program<br>Bug report |                   |     |     |
| Calibration          | Password    |                 | bug report                |                   |     |     |
|                      |             |                 | Admin                     |                   |     |     |
| Base Calibration     | Login 4     |                 | Edit program              |                   |     |     |
| Dynamic Idenfication |             |                 | Change robot se           | ettings           |     |     |
| Body Params          |             |                 |                           |                   |     |     |
| Kinematic Params     |             |                 | God                       |                   |     |     |
| Force Control        |             |                 | All permissions t         | to control the ro | bot |     |
| Quick Turn           |             |                 |                           |                   |     |     |
|                      |             |                 |                           |                   |     |     |
| ✓ Safety             |             |                 |                           |                   |     |     |
| Soft Limit           |             |                 |                           |                   |     |     |
| Virtual Wall         |             |                 |                           |                   |     |     |
| Collision Detection  |             |                 |                           |                   |     |     |
| **                   |             |                 |                           |                   |     |     |

#### Load the Files to the Robot

Please follow the steps below to load the full-control program to the robot.

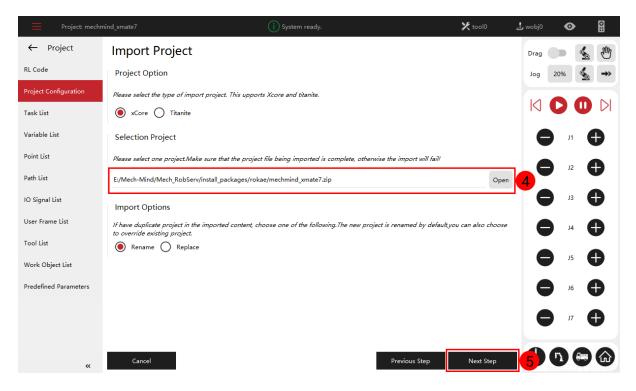
1. Go to  $Project \rightarrow Project$  Configuration.





| ← ProjectProject ConfigurationRL CodeActivated ProjectProject ConfigurationPoint Lit  | Project: mechn        | nind_xmate7                             | i System ready. | 🗶 tool0                            | 🕹 wobj0 | •   | 0<br>III   |
|---|-----------------------|---|-----------------|------------------------------------|---------|-----|------------|
| Activated Project Project   Project Configuration 2   2 208      2 208 </td <td>← Project</td> <td>Project Configuration</td> <td></td> <td></td> <td>Drag</td> <td></td> <td>🌜 🖑</td>  | ← Project             | Project Configuration                   |                 |                                    | Drag    |     | 🌜 🖑        |
| Project Configuration Immind_xmate7     Task List Pull form Controller   Variable List Default Project   Point List Default Project   Path List Select Robot   Io Signal List LOCALHOST   Vork Object List No Project   Work Object List No Project   Predefined Parameters Reload   Select Robot Initially Use   More Project Initially Use <tr< td=""><td>RL Code</td><td>Activated Project</td><td>Project</td><td>t</td><td>Jog</td><td>20%</td><td><u>∢</u> →</td></tr<>  | RL Code               | Activated Project                       | Project         | t                                  | Jog     | 20% | <u>∢</u> → |
| Variable List       Default Project       Default Project       Default Project       Default Project         Point List       Default Project       Spichronization       Image: Composition of the project data is pulled from controller immediatly after connection established. Your local project will be pushed to controller immediatly after connection established. Your local project will be pushed to controller server when important value changed, such as tool, work juser frame List       Default Project       Image: Composition of the project. The project data is pulled from controller immediatly after connection established. Your local project will be pushed to controller server when important value changed, such as tool, work juser frame data on. Desides, the RL code is transmitted by running operation triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. If you want to keep your code safe at any time, please press.       Ja       Image: Composition triggerd. Image: Composition triggerd. Image: Composit withe triggerd.       Ja   |                       | 2.hmind_xmate7                          | necessa         | ary information needed by working  |         | 0   |            |
| Default Project Umbrind the select Project   Point List Select Robot   IO Signal List Select Robot   User Frame List LOCALHOST   Tool List Select Project   Work Object List No Project   Predefined Parameters Reload   Set Default Set Default   Predefined Parameters Reload   Set Default Set Default   | Task List             | Pull form Controller Push to Controller |                 |                                    |         |     |            |
| Point List       No Project       The project data is pulled from controller immediatly after connection established. Your local project will be pushed to controller server when important value changed, such as tool, wold, user frame usits       IO Signal List       IO CALHOST       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII  | Variable List         | Default Project                         |                 |                                    | G       | л   | Ð          |
| Path List       immedially after connection<br>established/Your local project will be<br>pushed to controller server when<br>important value changed, such as tool,<br>wold; user frame List       Select Robot       Immedially user frame and so on. Besides, the<br>RL code is transmitted by running<br>operation triggerd. If you want to keep<br>your code safe at any time, please press<br>the buttons in this page manually.       Immedially User   | Point List            | No Project                              |                 |                                    |         | 12  |            |
| IO Signal List       important value changed, such as tool, wobj user frame and so on. Besides, the RL code is transmitted by running operation triggerd. If you want to keep your code safe at any time, please press the buttons in this page manually.       J 3       J         Tool List       Select Project       Initially Use       J 4       J         Work Object List       No Project       Initially Use       J 5       J         Predefined Parameters       Reload       Set Default       Default       Default Project       J 6       J         After selecting the project, click the Set default button to set the selected project       After selecting the project, click the Set default button to set the selected project       J 7       J   | Path List             |   | immedi          | liatly after connection            |         | 12  | U          |
| User Frame List       LOCALHOST       RL code is transmitted by running operation triggerd. If you want to keep your code safe at any time, please press the buttons in this page manually.       Image: transmitted by running operation triggerd. If you want to keep your code safe at any time, please press the buttons in this page manually.         Work Object List       No Project       Image: transmitted by running operation triggerd. If you want to keep your code safe at any time, please press the buttons in this page manually.       Image: transmitted by running operation triggerd. If you want to keep | IO Signal List        | Select Robot                            | importa         | ant value changed, such as tool,   | G       | J3  | Ð          |
| Tool List       Select Project       initially Use       initially Use       initially Use         Work Object List       No Project       Imitially Use       Imitialis       Im   | User Frame List       | LOCALHOST                               | RL code         | e is transmitted by running        |         |     |            |
| Work Object List       No Project       O       Wenusing for the first time, please click the *+* button below to create a new project wizard.       J6         Predefined Parameters       Reload       Set Default       Default Project       After selecting the project, click the Set default button to set the selected project       J7       D   | Tool List             | Select Project                          | your co         | ode safe at any time, please press |         | J4  | •          |
| Predefined Parameters       Reload       Set Default       the "+" button below to create a new project wizard.       J6       I         Default Project         After selecting the project, click the Set default button to set the selected project  | Work Object List      | No Project                              |                 | •                                  | E       | J5  | Ð          |
| After selecting the project, click the Set default button to set the selected project   | Predefined Parameters | Reload Set Default                      | the "+"         | button below to create a new       | C       | J6  | Ð          |
| default button to set the selected project  |                       |   | Defaul          | t Project                          |         |     |            |
|   |                       |   | default         | button to set the selected project |         | J7  | Ð          |
| ± <mark>3</mark> + ∠ ∎ <b>() ()</b> 🕾 6   | «                     | ± 3                                     |                 | + 2 0                              |         | 5   |            |

2. Open the program file to be imported, and then click on Next Step.





3. An "Import Success" message will appear in the lower right corner.

| Project: mechm        | ind_xmate7                              | i System ready. | 🗶 tool0  | 🕹 wobj0 | •   | 0::            |
|-----------------------|---|-----------------|--|---------|-----|----------------|
| ← Project             | Project Configuration                   |                 |  | Drag    |     | 1              |
| RL Code               | Activated Project                       |                 | Project  | Jog     | 20% | <b>-&gt;</b> > |
| Project Configuration | mechmind_xmate7                         |                 | A project is responsible for storing all the<br>necessary information needed by working<br>robots.                       |         |     |                |
| Task List             | Pull form Controller Push to Controller |                 | Each project can schedule multiple tasks,<br>and each robot is allowed to create   |         |     |                |
| Variable List         | Default Project                         |                 | and each robot is allowed to create<br>multiple projects.  | 0       | J1  | Ð              |
| Point List            |   |                 | Synchronization  |         |     |                |
| Path List             | No Project                              |                 | The project data is pulled from controller<br>immediatly after connection<br>established.Your local project will be      |         | J2  | Ð              |
| IO Signal List        | Select Robot                            |                 | pushed to controller server when<br>important value changed, such as tool,   |         | J3  | Ð              |
| User Frame List       | LOCALHOST                               | 4               | wobj, user frame and so on. Besides, the<br>RL code is transmitted by running<br>operation triggerd. If you want to keep |         |     |                |
| Tool List             | Select Project                          |                 | your code safe at any time, please press<br>the buttons in this page manually.   |         | J4  | U              |
| Work Object List      | mechmind_xmate7                         | 0               | Initially Use  | 9       | J5  | Ð              |
| Predefined Parameters | Reload Set Default                      |                 | When using for the first time, please click<br>the "+" button below to create a new<br>project wizard.                   | •       | J6  | Ð              |
|                       |   | (i) mechmind_   | xmate7 import success! X   |         | 17  | •              |
|                       |   |                 |  |         | 37  |                |
| "                     | t t                                     |                 |  | 0       |     |                |
| w                     |   |                 |  |         |     |                |

4. Select the program to be loaded.

| Project: mechr        | nind_xmate7                             | i System ready. | 🗶 tool0  | y wobj0 | Ø    | 011        |
|-----------------------|---|-----------------|--|---------|------|------------|
| ← Project             | Project Configuration                   |                 |  | Drag    |      | s. U       |
| RL Code               | Activated Project                       |                 | Project  | Jog     | 20%  | <u>≰</u> → |
| Project Configuration | mechmind_xmate7                         |                 | A project is responsible for storing all the<br>necessary information needed by working<br>robots.                       |         |      |            |
| Task List             | Pull form Controller Push to Controller |                 | Each project can schedule multiple tasks,  | K       | 0    |            |
| Variable List         | Default Project                         |                 | and each robot is allowed to create<br>multiple projects.  | G       | л    | Ð          |
| Point List            |   |                 | Synchronization  |         |      |            |
| Path List             | No Project                              |                 | The project data is pulled from controller<br>immediatly after connection<br>established.Your local project will be      | E       | J2   | Ð          |
| IO Signal List        | Select Robot                            |                 | pushed to controller server when<br>important value changed, such as tool,   |         | EL E | Ð          |
| User Frame List       | LOCALHOST                               |                 | wobj, user frame and so on. Besides, the<br>RL code is transmitted by running<br>operation triggerd. If you want to keep |         | J4   | •          |
| Tool List             | Select Project                          |                 | your code safe at any time, please press<br>the buttons in this page manually.   |         |      |            |
| Work Object List      | mechmind_xmate7 _                       |                 | Initially Use  | E       | J5   | Ð          |
| Predefined Parameters | No Project ult                          |                 | When using for the first time, please click<br>the "+" button below to create a new<br>project wizard.                   | C       | J6   | Ð          |
|                       | mechmind_xmate10                        |                 | Default Project  |         |      | •          |
|                       | mechmind_xmate7                         |                 | After selecting the project click the Set  |         | J7   | Ð          |
|                       | mechmind_xmate8                         |                 | default button to set the selected project<br>as default project.  |         | -    | -          |
|                       | mechmind_xmate9                         |                 | + 4 1  |         | 5    |            |
| «                     |   |                 |  |         |      |            |



#### 5. Click on *Reload*.

| Project: mechm        | nind_xmate7                             | i System ready.              | 🗶 tool0  | 🕹 wobj0 | Ø   | 0::      |
|-----------------------|---|------------------------------|--|---------|-----|----------|
| ← Project             | Project Configuration                   |                              |  | Drag    |     | . H      |
| RL Code               | Activated Project                       | Project                      |  | Jog     | 20% | <b>→</b> |
| Project Configuration | mechmind_xmate7                         |                              | esponsible for storing all the<br>formation needed by working  |         | 0   | Ы        |
| Task List             | Pull form Controller Push to Controller |                              | can schedule multiple tasks,<br>pot is allowed to create   |         |     |          |
| Variable List         | Default Project                         | multiple proj                |  |         | JI  | •        |
| Point List            |   | Synchroniza                  | tion   |         |     |          |
| Path List             | No Project                              | immediatly a                 | data is pulled from controller<br>fter connection  | G       | J2  | Ð        |
| IO Signal List        | Select Robot                            | pushed to co<br>important va | Your local project will be<br>ontroller server when<br>lue changed, such as tool,<br>ame and so on. Besides, the | G       | J3  | Ð        |
| User Frame List       | LOCALHOST                               | RL code is tra               | ansmitted by running<br>ggerd. If you want to keep   |         |     |          |
| Tool List             | Select Project                          | your code sa                 | ife at any time, please press<br>n this page manually.   |         | J4  |          |
| Work Object List      | mechmind_xmate7                         | Initially Use                |  | G       | J5  | <b>9</b> |
| Predefined Parameters | Reload 7 Set Default                    |                              | for the first time, please click<br>on below to create a new<br>d.   | C       | J6  | Ð        |
|                       |   | Default Proj                 | ect  |         |     |          |
|                       |   |                              | g the project,click the Set<br>in to set the selected project<br>oject.  | 5       | J7  | U        |
| «                     | t.                                      |                              | + ∠ 🗉  |         |     |          |

#### **Socket Configuration**

1. Click on *Robot*.



2. Go to  $Communication \rightarrow Socket$  and then follow the steps as shown in the figure below to configure the socket.



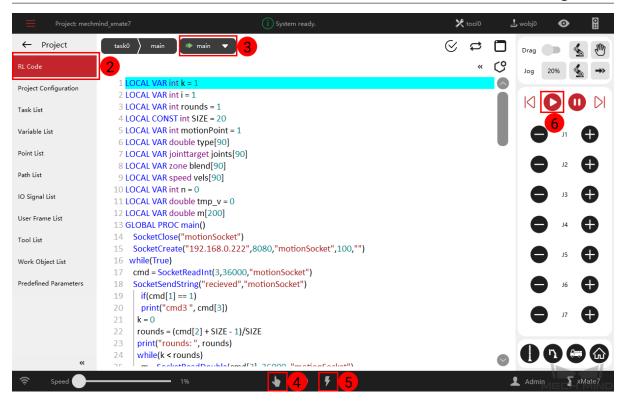
| Project: mech              | mind_xmate7          | i System ready. | 🗶 tool0 🕹 wobj0 📀 😫  |
|----------------------------|----------------------|-----------------|--|
| ← Robot                    | Socket               |                 | 📀 Last updated: 2022/05/18 18:12:55  |
| $\vee$ Safety              | Enable               |                 | Socket   |
| Soft Limit<br>Virtual Wall | Open 4               |                 | The upper system (PLC, MES, etc) can send control<br>command to the robot or obtain various states of<br>the robot through this interface. |
| virtuai vvali              | Socket Configuration |                 | You can define your own terminator.  |
| Collision Detection        | Socket Conliguration | 1               | Control Command  |
| Safe Area                  | Type Client          | 4               | Motor on: "motor_on"   |
|                            | IP 192.168.0.222     |                 | Motor off: "motor_off"   |
| Safety Monitor             |                      | <b>5</b> -      | PPToMain: "pp_to_main"   |
| Collaboration              | Port 8081            |                 | PPToLine: "pp_to_line"   |
|                            | Suffix               |                 | Start program: "start"   |
| Communication              |                      |                 | Stop program: "stop"   |
| System IO                  |                      |                 | Clear alarm: "clear_alarm"   |
|                            |                      |                 | Switch auto: "switch_mode:auto"  |
| Socket                     | 3                    |                 | Switch manual: "switch_mode:manual"  |
| Modbus                     |                      |                 | Monitor Command  |
|                            |                      |                 | Motor state: "motor_on_state"  |
| Modbus Register            |                      |                 | Program state: "robot_running_state"   |
| End Tool                   |                      |                 | Estop state: "estop_state"   |
|                            |                      |                 | Operating mode: "operating_mode"   |
| RCI Settings               |                      |                 | Home state: "home_state"   |
| «                          |                      |                 | Fault state: "fault_state"   |
|                            |                      |                 |  |

### 1.10.4 Test Robot Connection

- 1. Click on *Connect Robot* in Mech-Center.
- 2. Run the full-control program, as shown below.







3. If a message saying **Robot: server connected to the robot** shows up in the **Log** panel, the robot is successfully connected.

# 1.11 AUBO Setup Instructions

This section introduces the process of setting up full control of an AUBO robot.

The process consists of 5 steps:

- Check Controller Compatibility
- Setup the Network Connection
- SDK Compatibility
- Troubleshooting
- Test Robot Connection



### 1.11.1 Check Controller Compatibility

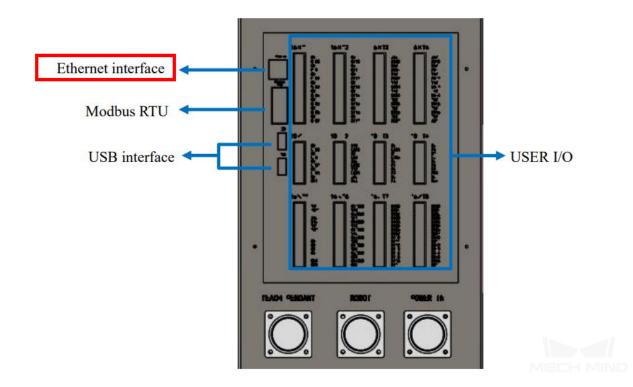
The version of the controller should be above 4.5.44.

Go to About  $\rightarrow$  Version  $\rightarrow$  Server Version to check the version of the controller.

### 1.11.2 Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable into the Ethernet interface of the controller to connect the IPC and the robot controller.



#### **IP** Configuration

Press on Settings  $\rightarrow$  System  $\rightarrow$  Network to configure the Interfaces, Netmask, IP Address, and Gateway, and then select Save. Please note that the robot IP should be in the same subnet as the IPC.



| Каиво     | Admin   | 8 O            |
|-----------|---|----------------|
|           | Robot Teaching Programming Settings 1 ensions System Info About |                |
| IO State  | Network   |                |
| Robot     | Network Config  |                |
|           | Interfaces v Netmask  | 4              |
| System    | 2 IP Address Gateway  |                |
| Language  | Cancel Save 5 Reset   |                |
| DateTime  | Network debugging   |                |
| Network   | 3<br>192.168.100.1 ping ifconfig Server Status Clear            | Debugging info |
| Password  |   | Debugging into |
| System    |   |                |
| Update    |   |                |
|           |   |                |
|           |   |                |
|           |   |                |
|           |   |                |
|           |   |                |
|           |   |                |
|           |   |                |
| Zero Pose | Init Pose 0.00 2022-05-07 10:22:59 Speed:                       | 50%            |

### 1.11.3 SDK Compatibility

- 1. Please download the AUBO Python-Dlls first.
- 2. Copy all the DLL files in the python-Dlls folder.
- 3. Locate the folder where python is installed on the IPC and paste all the DLL files into the **DLLs** folder (The default path is *C:/Program Files/Python36/DLLs*). The DLL files are as shown below.
  - libconfig.dll
     libgcc\_s\_seh-1.dll
     libpy3auboi5.pyd
     libstdc++-6.dll
     libwinpthread-1.dll
     MSVCR100.DLL
     serviceinterface1.dll



4. You do not need to load the files to the robot.

### 1.11.4 Test Robot Connection

Please refer to *Test Robot Connection* for detailed instructions.

### 1.11.5 Troubleshooting

After copying and pasting the files, if the robot cannot be connected successfully, and the error is **DLL** load failed: %1 is not a valid Win32 application, please check whether the C++ runtime library on your computer is complete. The complete C++ runtime library is as shown below.

```
    Microsoft Visual C++ 2005 Redistributable
    Microsoft Visual C++ 2005 Redistributable (x64)
    Microsoft Visual C++ 2008 Redistributable - x64 9.0.30729.6161
    Microsoft Visual C++ 2010 Redistributable - x86 9.0.30729.6161
    Microsoft Visual C++ 2010 x64 Redistributable - 10.0.40219
    Microsoft Visual C++ 2010 x86 Redistributable - 10.0.40219
    Microsoft Visual C++ 2012 Redistributable (x64) - 11.0.61030
    Microsoft Visual C++ 2012 Redistributable (x86) - 11.0.61030
    Microsoft Visual C++ 2013 Redistributable (x64) - 12.0.30501
    Microsoft Visual C++ 2013 Redistributable (x86) - 14.22.27821
    Microsoft Visual C++ 2015-2019 Redistributable (x86) - 14.22.27821
```

If the library is not complete, please download the vc runtime library repair DirectX Repair V3.9 to fix the error.

## 1.12 JAKA Setup Instructions

This section introduces the process of setting up full control of a JAKA robot.

The process consists of 3 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Test Robot Connection

JAKA robots are controlled through the mobile or PC application JAKA Zu APP, instead of a teach pendant.



Before proceeding, please make sure you have downloaded and installed JAKA Zu APP on the device you wish to use for controlling the robot.

Please download the application here, under Technical Information  $\rightarrow APP$  Software.

### 1.12.1 Check Controller and Software Compatibility

• Controller version: 1.5.12\_28\_x86

**Note:** The controller version must be 1.5.12\_28\_x86. If your controller is of a lower version, please upgrade it; if higher, please downgrade.

- JAKA Zu APP version: V 1.5 (for both Android and Windows)
- Mech-Center: latest version recommended

### 1.12.2 Setup the Network Connection

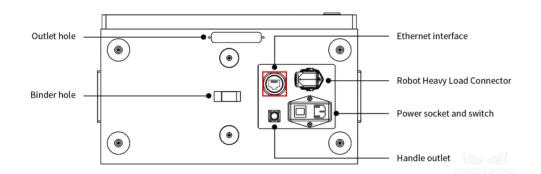
#### Hardware Connection

The hardware setup differs depending on what device you have installed JAKA Zu APP on.

• If you installed JAKA Zu APP on the IPC:

Plug the Ethernet cable into:

- An Ethernet port on the IPC
- The Ethernet port inside the accessory panel on the front of the controller



- If you installed JAKA Zu APP on a mobile device:
  - 1. Prepare a router with wireless function.
  - 2. Connect both the IPC and the controller to the router with Ethernet cables.
  - 3. Connect the mobile device to the router's wireless network.

**Note:** If you are using multiple cameras, make sure the router has enough LAN ports for the IPC and cameras.



#### **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Check the IP address of the IPC: please use the *ipconfig* command in Command Prompt or PowerShell to check the IP address.
- 2. Open JAKA Zu APP, click on in the upper right, and then click on

| JAKA                   |                          |  |  | ttings Log | () () () () () () () () () () () () () ( |
|------------------------|--------------------------|--|--|------------|--|
|                        | Connect robot            |  |  | $\times$   |  |
|                        | Current connection: None |  |  |            |  |
|                        | Robot ID                 | Robot name Robot IP<br>Robot 192.168.126.1 | Control version Status<br>281.6.7_07_X86 Disconnecte |            |  |
| JAKA ZU <sup>®</sup> 3 | <u></u>                  |  |  | 2          | Zu <sup>o</sup> 18                       |
|                        |                          |  | Offline  | connection |  |
| C:/                    | R                        | JAKA                                       | 686  |            |  |
| Programming control    | Manual operation         | Home                                       | I/O Pane   | 1          | Monitoring Information                   |

3. Enter the password for **administrator** (the default password is *jakazuadmin*), and click on *Connect robot*.

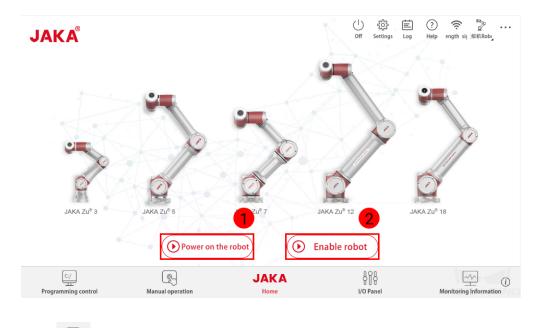
| JAKA                              |                  |   | Off | र्देट्रे 📰<br>Settings Log | (?) 🛜 🗔<br>Help ength sig Disconne |
|-----------------------------------|------------------|---|-----|----------------------------|------------------------------------|
|                                   | Connect robot    |   |     | $\times$                   | -9                                 |
| JAKA ZU <sup>o</sup> 3            | <                | Username<br>administrator<br>Password<br>please input password @<br>Connect robot |     |                            | Zu <sup>e</sup> 18                 |
| C:/<br>TTT<br>Programming control | Manual operation | JAKA  | 9   | Panel                      | Monitoring Information             |



4. If successfully connected, the **Status** of the robot should change to **Connected**. Close the **Connect robot** window.

| JAKA                       |                           | لُ) الج<br>Off Setti  |                        |
|----------------------------|---------------------------|---|------------------------|
|                            | Connect robot             |   | ×                      |
| 1                          | Current connection: Robot | Officiant   |                        |
|                            | Robot ID Robot name       | Robot IP         Control version         Status           192.168.126.1281.6.7_07_X86         Connected | œ                      |
| JAKA ZU <sup>o</sup> 3     |                           |   | Zuº 18                 |
| C:/<br>Programming control | Manual operation          | JAKA  | Monitoring Information |

5. Click on Power on the robot and then Enable robot to power on the robot.



6. Click on \_\_\_\_\_ in the lower right to check the controller version. The controller version must be 1.5.12\_28\_x86. If not, please upgrade or downgrade the controller to this version.



| JAKA                             |   |   | Off      | र्ट्ट्रे<br>Settings | E ? 奈 ? …<br>Log Help rength s 重級初Rol |
|----------------------------------|---|---|----------|----------------------|---------------------------------------|
|                                  | About   |   |          | $\times$             |                                       |
| JAKA ZU <sup>®</sup> 3           | Language settings:<br>Sound Volume<br>Soft keyboard:<br>App version:<br>Servo version:<br>Controller version:<br>Robot number:<br>Official website: | (中文) Eng     (回)     (ভ)     (ভ | lish 日本語 |                      | AKA ZU <sup>e</sup> 18                |
| C:/<br>TT<br>Programming control | Manual operation  | JAKA  |          | Panel                | Monitoring Information                |

7. Close the **About** window, and click on in the upper right. In System setting  $\rightarrow$  Network Setting, select **Use the following IP address**, and set the **IP address** to one in the same subnet as the IPC, and **Subnet mask** to **255.255.255.0**.

| <               |                 |   |                        |                    | Log           | frignal URobot 1   | ••••      |
|-----------------|-----------------|---|------------------------|--------------------|---------------|--------------------|-----------|
| 🞯 System sett   | ting 10pe       | ration Setting  | Safety setting         | 🔓 Program          | Setting       | Hardware and Commu | inication |
| Initial setting | Network Setting | Ac 2 rogram Manag   | ement Upgrade firmware | Upgrade Controller | System Backup | User manage        | ment      |
|                 |                 | <ul> <li>Get IP add</li> <li>Use the fol<br/>address</li> <li>IP address:</li> <li>Subnet mask:</li> <li>Default gatev</li> </ul> |                        |                    |               |                    |           |
|                 |                 |   | Determine              |                    |               |                    |           |



### 1.12.3 Test Robot Connection

Please refer to *Test Robot Connection* for detailed instructions.

# **1.13 ELITE Setup Instructions**

This section introduces the process of setting up full control of an ELITE robot.

### 1.13.1 Check Controller and Software Compatibility

• Controller software version: 2.19.2 or lower

Note: See step 2 in IP Configuration for instructions on checking the software version.

### 1.13.2 Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable into:

- An Ethernet port on the IPC
- The Ethernet port inside the controller



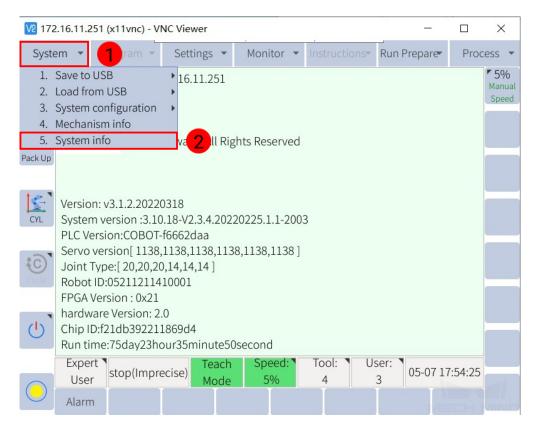




#### **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Check the IP address of the IPC: please use the *ipconfig* command in Command Prompt or PowerShell to check the IP address.
- 2. Press on System  $\rightarrow$  5. System info to check the current IP address and software version.





| 172.16    | 172.16.11.251 (x11vnc) - VNC Viewer – 🗆 🗡 |            |                      |              |                     |     |   |                           |                              | ×              |                              |
|-----------|---|------------|----------------------|--------------|---------------------|-----|---|---------------------------|------------------------------|----------------|------------------------------|
| System    | ▼ Pr                                      | ogram 🔻    | Settings 🝷           | Mon          | itor 🔻              | Ins | tructions                                       | Run F                     | Prepare                      | Proc           | ess 🔻                        |
| A Pack Up |   | Set networ | ſk                   |              |                     |     | IP:   | 172.16                    | 5.11.251                     |                | <b>5%</b><br>Manual<br>Speed |
| Expand    |   | Address:   | 172.16.11.251        |              |                     |     |   |                           | 014 forw<br>Reserved         |                |                              |
| CYL       |   | Netmask    | K: (!55.255.255.0    | $\mathbf{D}$ |                     |     | Version: v<br>System v<br>PLC Versi             | ersior<br>on:CC           | 1 :3.10.18-<br>DBOT-f666     | V2.3.<br>52da: |                              |
| Cycle     |   | Gateway    | r: (172.16.11.254    |              |                     |     | Servo ver<br>Joint Typ<br>Robot ID:<br>FPGA Ver | e:[ 20<br>05211<br>sion : | ,20,20,14<br>2114100<br>0x21 | ,14,14         |                              |
| U.        |   |            |                      |              |                     |     | hardware<br>Chip ID:f2<br>Run time              | 21db3                     | 92211869                     |                |                              |
|           | User                                      | stop(Impre | ecise) Teach<br>Mode |              | eed: <b>`</b><br>5% |     |   | ser: 1<br>3               | 05-07 17                     | :53:26         |                              |
| A         | Alarm                                     |            |                      |              |                     |     |   |                           |                              |                |                              |

- 3. If the IP address isn't in the same subnet as the IPC, change it with the following steps:
  - 1. Turn the key to **TEACH**, and check the current user mode in the lower left. If it's not Admin mode, press and select **Admin**. Then, enter the **Password** and press **OK**.





2. Select System  $\rightarrow$  3. System configuration  $\rightarrow$  Network configuration.



| V2 172.16.11.251 (x11vnc) - VNC                       | Viewer  | _             |                              |
|---|---|---------------|------------------------------|
| System 💌 🚺 ram 👻 🗄                                    | Settings  Monitor  Instructions   | Run Prepare   | Process 💌                    |
| 1. Save to USB2. Load from USB3. System configuration | 16.11.251   |               | <b>5%</b><br>Manual<br>Speed |
| 4. Mechanism info                                     | I. Robot configuration       2 Network configuration                                      |               |                              |
| 5. System info  | 3. Language configuration   |               |                              |
| PLC Version:COBOT-f66                                 | -V2.3.4.20220225.1.1-2003<br>62daa<br>38,1138,1138,1138,1138 ]<br>1,14,14 ]<br>001<br>9d4 |               |                              |
| Expert User stop(Imprecis                             |   | ser: 05-07 17 | :55:04                       |

3. Set the IP address to one in the same subnet as the IPC. Press Save to save the change.



| V2 172.16.11.251 (x11vnc) - VNC Viewer |       |                 |                 |         |         |              |                        |         |        |                              |
|--|-------|-----------------|-----------------|---------|---------|--------------|------------------------|---------|--------|------------------------------|
| Syste                                  | m 👻   | Program 👻       | Settings 👻      | Monitor | 👻 Inst  | tructions    | Run Pre                | epare   | Pro    | cess 🔻                       |
| A Pack Up                              |       | Set networ      | k               |         |         | IP           | :172.16.1              | 1.251   |        | <b>5%</b><br>Manual<br>Speed |
| Expand                                 |       | Address:        | 172.16.11.251   | )       |         | All          | ght © 201<br>Rights Re |         |        |                              |
|  |       |                 |                 |         | Origina | l value:172. | 16.11.251              |         |        |                              |
| <u></u>                                |       |                 |                 | 7       | 8       | 9            | -                      | Backs   | pace   |                              |
| CYL                                    |       | Netmask         | : 255.255.255.0 | 4       | 5       | 6            | Left                   | Rig     | ht     |                              |
| Cycle                                  |       | Gateway         | 172.16.11.254   | 1       | 2       | 3            |                        |         |        |                              |
|  |       | outeway         |                 |         | 0       | ·            | Cancel                 | Dor     | ne     |                              |
| $\cup$                                 |       |                 |                 |         |         | Run tim      | e:75day2               | 3hour3  | 5mir   |                              |
|  | Exper | t Tetera (Incom | Teach           | Speed   | To      |              | ser.                   |         |        |                              |
|  | User  | stop(Impre      | Mode            | 5%      | 4       | 1            | 3                      | 5-07 18 | :21:05 |                              |
| $\bigcirc$                             | Save  |                 |                 |         |         |              |                        |         | Quit   |                              |

## 1.13.3 Test Robot Connection

- 1. Turn the key to **REMOTE**, press the **Servo** key in the lower right of the teach pendant, and make sure the **SERVO** indicator in the upper left lights up.
- 2. Connect to the robot in Mech-Center. Please refer to *Test Robot Connection* for detailed instructions.

# 1.14 Test Robot Connection

**Note:** To successfully connect to the robot in Mech-Center, the corresponding Mech-Viz project must be open, and **Autoload Current Project** must be checked for the project.

- 1. Open Mech-Center and click on Deployment Settings.
- 2. Go to Robot Server, and make sure Use robot server is checked.
- 3. Check if the robot model displayed after **Robot type in Mech-Viz project** matches the one in use.
- 4. Set the Robot IP address, and click on **Save**.



| Deployment Settings | ×   |
|---------------------|---|
|                     |   |
|                     | Use robot server                                |
|                     | Robot server path                               |
|                     | Robot type in Mech-Viz project: KAWASAKI_RS020N |
| Robot Server        | Robot IP  |
|                     | RobotServer Program Folder                      |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     |   |
|                     | 4   |
|                     | Save Cancel                                     |

- 5. Click on *Connect Robot* in the Toolbar.
- 6. The robot is successfully connected if:
  - A message saying Robot: server connected to the robot shows up in the Log panel, and



with the robot model shows up in the **Service Status** panel.



Mech-Mind Robot Integrations



| Mech-Center        | - 🗆 X                                |
|--------------------|--------------------------------------|
|                    |                                      |
| 🔯 Vision Eve 🕨 🔝 魁 | ŭ 🚺                                  |
| Service Status     |                                      |
|                    |                                      |
|                    |                                      |
|                    | Robot: server connected to the robot |
|                    |                                      |
|                    |                                      |
|                    |                                      |
|                    |                                      |
|                    |                                      |
|                    |                                      |
|                    |                                      |
|                    | MECH MIND                            |

# CHAPTER TWO

## STANDARD INTERFACE

This chapter provides detailed information on setting up communication with Mech-Mind Software Suite through Mech-Interface's Standard Interface.

# 2.1 ABB

This section introduces the Standard Interface for ABB robots.

## 2.1.1 ABB Setup Instructions

This section introduces the process of loading the standard interface program onto an ABB robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

#### **Check Controller and Software Compatibility**

Compatibility requirements are as follows:

- Robot: a 4-axis or 6-axis ABB robot
- RobotWare Option: 616-1 PC Interface



**Hint:** You can tap  $\square$  in the upper left corner on the teach pendant and then go to *System* Info  $\rightarrow$  System properties to check if the necessary option has been installed.

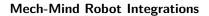


| System Info  | Motors On<br>Stopped (Speed 100%)  |
|--|--|
| <ul> <li>Controller properties</li> <li>System properties</li> <li>Control module</li> <li>Options</li> <li>Drive modules</li> <li>RW Add-Ins</li> <li>Hardware devices</li> <li>Software resources</li> </ul> | - Options<br>RobotWare Base<br>Chinese<br>709-1 DeviceNet Master/Slave<br>888-2 PROFINET Controller/Device<br>608-1 World Zones<br>613-1 Collision Detection<br>616-1 PC Interface |
|  | Refresh ROB_1  |
| System Info  | 1/3 0  |

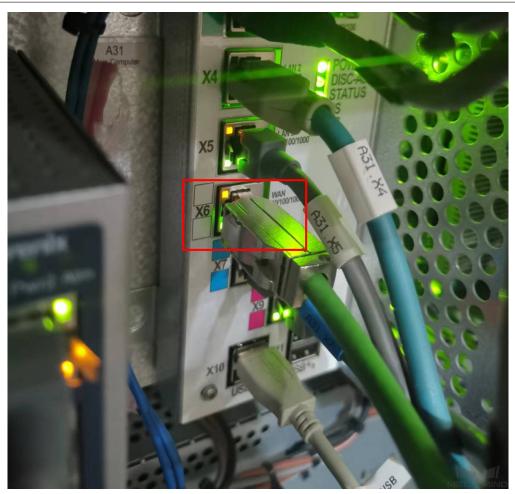
### Setup the Network Connection

### Hardware Connection

Plug the Ethernet cable of the IPC into the X6 (WAN) port of the robot controller, as shown below.







**Hint:** If you only need to load the program files via RobotStudio, you can use either LAN port or WAN port to connect the robot controller. However, in order to enable visual communication, the Ethernet cable can only be connected to the WAN port.

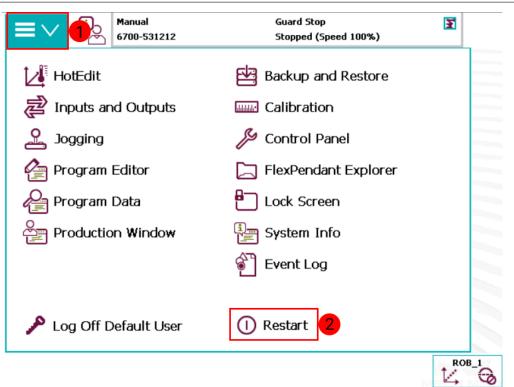
## **IP Configuration**

You can set the IP on the teach pendant or via RobotStudio.

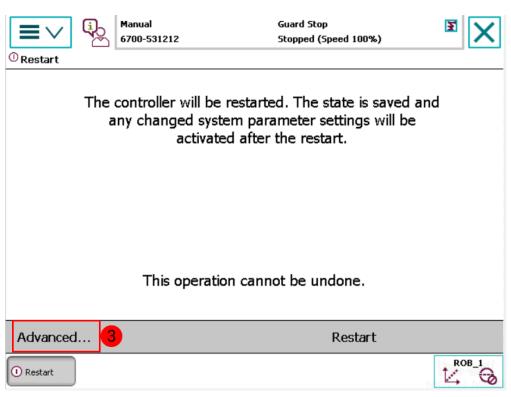
• Set the IP on the teach pendant

1. Tap and select *Restart*.





2. Select  $Advanced \cdots$ 

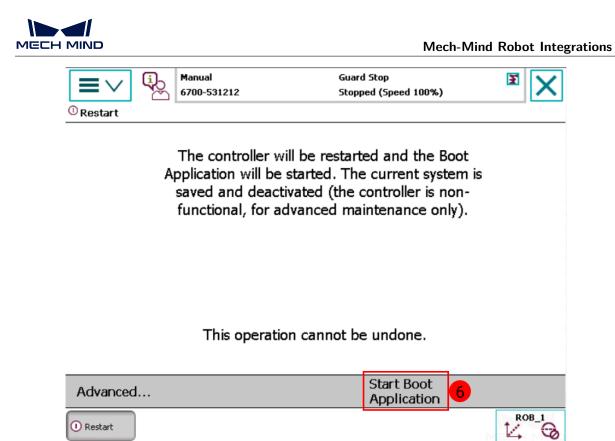




3. Select Start Boot Application and tap Next.

| © Restart | Manual<br>6700-531212 | Guard St<br>Stopped | op<br>(Speed 100%) | x X      |
|-----------|-----------------------|---------------------|--------------------|----------|
| _         | ID                    |                     |                    |          |
|           |                       |                     | Next               | 5 Cancel |
| Restart   |                       |                     |                    |          |

4. Select Start Boot Application to confirm.

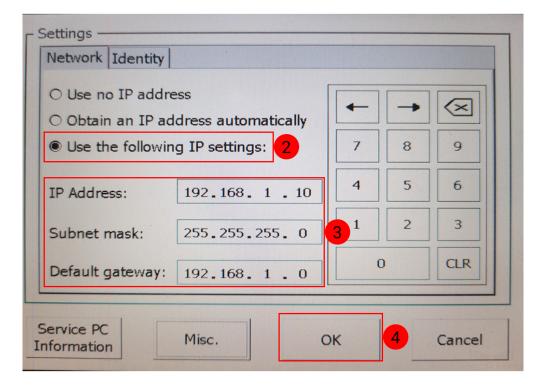


5. After restarting, you will see the interface as shown below. Tap Settings.

|                   | ABB Robotics<br>Boot Application | Default User          |
|-------------------|----------------------------------|-----------------------|
|                   | 6.12.02.00                       |                       |
|                   |                                  |                       |
|                   |                                  |                       |
|                   |                                  |                       |
| Install<br>System | Settings 1 Select<br>System      | Restart<br>Controller |



6. Select Use the following IP settings and configure the IP Address, Subnet Mask, and Default gateway. Tap *OK* after configuration.



7. Tap Select System.



|                   | ABB Robotic<br>Boot Applicati |                  | R<br>Default User     |
|-------------------|-------------------------------|------------------|-----------------------|
|                   | 6.12.02.00                    |                  |                       |
|                   |                               |                  |                       |
|                   |                               |                  |                       |
| Install<br>System | Settings                      | Select<br>System | Restart<br>Controller |

8. Select the system name in **Installed Systems** box and then tap Select. Tap OK after configuration.



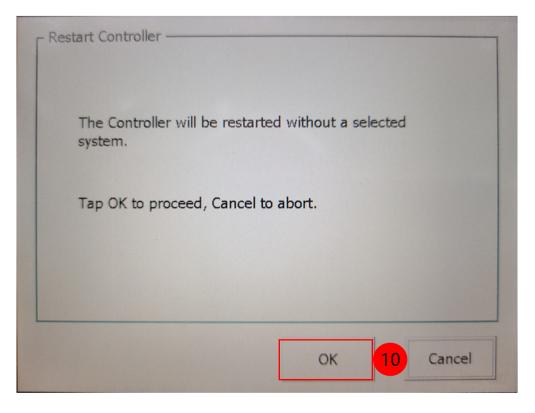
| 6700-531212 6       |          |
|---------------------|----------|
|                     |          |
|                     |          |
| Select 7            | Delete   |
| Selected System     | Deselect |
| <no system=""></no> |          |

9. Select Restart Controller.

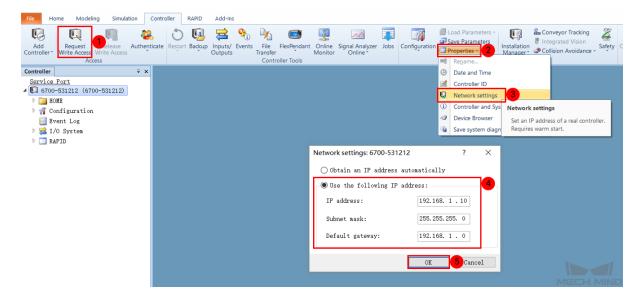
|                   | ABB Robotics<br>Boot Application | R<br>Default User       |
|-------------------|----------------------------------|-------------------------|
|                   | 6.12.02.00                       |                         |
|                   |                                  |                         |
|                   |                                  |                         |
| Install<br>System | Settings Select<br>System        | 9 Restart<br>Controller |



10. Tap OK to proceed.

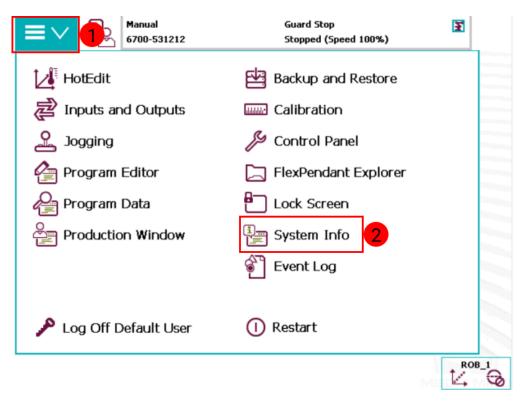


- Set the IP via RobotStudio
  - 1. Follow the steps as shown in the figure below to configure the robot IP, and restart the robot after configuration.





• Go to Sytem Info  $\rightarrow$  Network connections  $\rightarrow$  WAN to check if the IP configuration was successful after restarting.



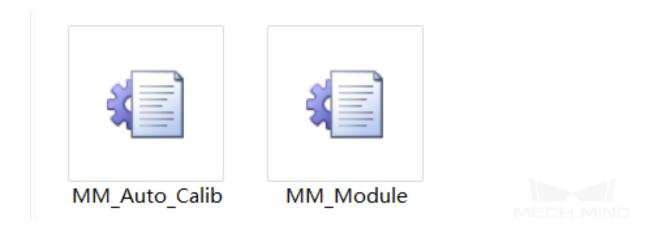


| Bystem Info  | Guard Stop<br>Stopped (Speed 100%)  |
|--|---|
| <ul> <li>Controller properties</li> <li>Network connections</li> <li>Service port</li> <li>WAN</li> </ul>              | - Configuration<br>Fix IP address<br>- IP address<br>192.168.1.10<br>- Subnet mask<br>255.255.255.0<br>- Default gateway<br>192.168.1.0 |
| <ul> <li>Installed systems</li> <li>System properties</li> <li>Hardware devices</li> <li>Software resources</li> </ul> | Refresh   |
| System Info  |   |

### Load the Program Files

### Prepare the Files

# > Mech-Mind > Mech-Center > mech\_interface > abb



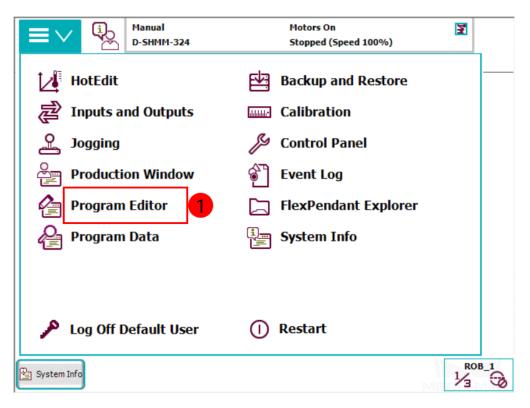


Hint: MM\_Module.mod and MM\_Auto\_Calib.mod are program module files.

### Load the Files to the Robot

You can load the program modules (i.e., MM\_Module.mod and MM\_Auto\_Calib.mod) with the teach pendant or via RobotStudio.

- Load the modules with the teach pendant
  - 1. Insert the flash drive into the USB port of the teach pendant.
  - 2. Go to Program Editor  $\rightarrow$  Tasks and Programs.





|     | <b>■</b> ∨ 🖗  | ed 100%)             | 3         | X         |          |           |               |       |
|-----|---|----------------------|-----------|-----------|----------|-----------|---------------|-------|
| ₽ < | <no named="" progr<="" td=""><td><u>am&gt; in</u> T_F</td><td>ROB1/Modu</td><td>ule1/main</td><td></td><td></td><td></td><td></td></no> | <u>am&gt; in</u> T_F | ROB1/Modu | ule1/main |          |           |               |       |
|     | Tasks and Prog  | rams 🙎               |           | Modules   | •        |           | Routines      | •     |
| 23  | PROC  | C mair               | ı ()      | $\wedge$  | PP to M  | ain       | PP to Curso   | ·     |
| 24  |   | !Add                 | your      | éodè      | PP to Re | outine    | Cursor to PP  | ,     |
| 25  | ENDI  | PROC                 |           |           | Cursor t | o MP      | Go to positio | n     |
| 26  | ENDMODUI  | LE                   |           |           | Call Rou | tine      | Cancel Call   | Rout. |
|     |   |                      |           |           | View Va  | lue       | Check Progr   | am    |
|     |   |                      |           |           | View Sy  | stem Data | Search Rout   | ine   |
|     |   |                      |           |           |          |           |               |       |
|     |   |                      |           |           |          |           |               |       |
|     |   |                      |           |           |          |           |               |       |
| A   |   | Edit                 |           | Debug     | Mod      | lify      | Hide          |       |
| In  | struction   | Luit                 |           | Debug     | Pos      | ition     | Declarat      | ions  |
| 9   | T_ROB1<br>Module1   |                      |           |           |          |           |               | B_1   |

3. Select **T\_ROB1** and tap *Show Modules*.

|                    | Manual<br>D-SHMM-324 |                   | Motors On<br>Stopped (Speed 100 | %)     | X           |
|--------------------|----------------------|-------------------|---------------------------------|--------|-------------|
| Tasks and Programs |                      |                   |                                 |        |             |
| Task Name          |                      | Program Name      |                                 | Туре   | 1 to 1 of 1 |
| T_ROB1             |                      | <no name=""></no> |                                 | Normal | 3           |
|                    |                      |                   |                                 |        |             |
|                    |                      |                   |                                 |        |             |
|                    |                      |                   |                                 |        |             |
|                    |                      |                   |                                 |        |             |
|                    |                      |                   |                                 |        |             |
|                    |                      |                   |                                 |        |             |
|                    |                      |                   |                                 |        |             |
| File               |                      |                   | Show<br>Modules                 | 4      | Open        |
| T_ROB1<br>Module1  |                      |                   |                                 | ME     |             |



4. Select  $File \rightarrow Load Module$ .

| Land Land Land Land Land Land Land Land |                | Motors Off<br>Stopped (Speed 100%) |                |  |  |  |  |
|---|----------------|------------------------------------|----------------|--|--|--|--|
| Modules                                 |                |                                    |                |  |  |  |  |
| Name 🛆                                  | Туре           | Changed                            | 1 to 5 of 5    |  |  |  |  |
| BASE                                    | System module  |                                    |                |  |  |  |  |
| MM_Auto_Calib                           | Program module |                                    |                |  |  |  |  |
| MM_Module                               | Program module |                                    |                |  |  |  |  |
| New Module                              | Program module |                                    |                |  |  |  |  |
| Load Module 6                           | System module  |                                    |                |  |  |  |  |
| Save Module As                          |                |                                    |                |  |  |  |  |
| Change Declaration                      |                |                                    |                |  |  |  |  |
| Delete Module                           |                |                                    |                |  |  |  |  |
| File 5 Refres                           | h              | Show Module                        | Back           |  |  |  |  |
| T_ROB1 Production<br>Module1 Window     |                | Μ                                  | 0 <sub>0</sub> |  |  |  |  |

5. Select the module in the USB flash drive one at a time and tap OK to load the module.



| Open H:/abb                         | Motors (<br>Stopped | Off<br>(Speed 100%) | ¥           |
|-------------------------------------|---------------------|---------------------|-------------|
|                                     | Module              | Files (*.mod        | ) 🔽         |
| Name A                              | Туре                |                     | 1 to 2 of 2 |
| MM_Auto_Calib.mod                   | .mod file           |                     |             |
| MM_Module.mod                       | .mod file           | . 7                 |             |
|                                     |                     | _                   |             |
| File name: MM_Module.mod            |                     |                     |             |
| <b>1</b>                            | 습                   | ок                  | 8 Cancel    |
| T_ROB1 Production<br>Module1 Window |                     |                     | 00          |

Hint: It is recommended to load the MM\_Module.mod module before the MM\_Auto\_Calib.mod module, or else an error may occur. The instructions on loading the two modules are the same.

6. Select  $\mathit{Yes}$  in the pop-up window to confirm adding a new module.



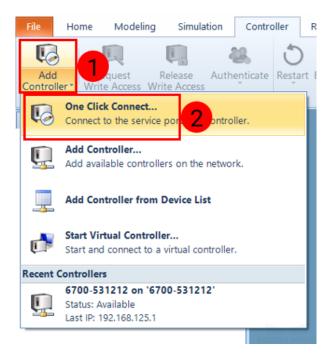
|                   | ÷<br>C       | Auto<br>D-SHMM-324 | Motors Off<br>Stopped (Speed 100%) | ž   |             |
|-------------------|--------------|--------------------|------------------------------------|-----|-------------|
| Modules           | Modules      | 5                  |                                    |     |             |
| Name 🛆            | ?            | Bv adding a new m  | odule you will lose the            |     | 1 to 5 of 5 |
| BASE              | Ċ            | program pointer.   |                                    |     |             |
| MM_Auto           |              | Do you want to con | tinue?                             |     |             |
| MM_Modu           |              |                    |                                    |     |             |
| Module1           |              |                    |                                    |     |             |
| user              |              |                    |                                    |     |             |
|                   |              |                    |                                    |     |             |
|                   |              | Yes 9              | No                                 |     |             |
| File              |              | Refresh            | Show Module                        | Bac | k           |
| T_ROB1<br>Module1 | Prod<br>Wind | uction             |                                    | 6   | 90<br>9     |

7. After loading successfully, you can see the two modules in  ${\bf T\_ROB1}.$ 

| Auto<br>D-SHMM-324                  | Motor<br>Stopp | ¥X          |                |
|-------------------------------------|----------------|-------------|----------------|
| Name /                              | Туре           | Changed     | 1 to 5 of 5    |
| BASE                                | System module  |             |                |
| MM_Auto_Calib                       | Program module |             |                |
| MM_Module                           | Program module |             |                |
| Module1                             | Program module | -           |                |
| user                                | System module  |             |                |
|                                     |                |             |                |
|                                     |                |             |                |
|                                     |                |             |                |
| File Refresh                        |                | Show Module | Back           |
| T_ROB1 Production<br>Module1 Window |                | Л           | 0 <sub>0</sub> |



- Load the modules via RobotStudio
  - 1. Insert the flash drive into the USB port of the computer.
  - 2. Open RobotStudio and connect the robot.
    - If the robot controller is connected via the LAN port, click on One Click Connect.



 If the robot controller is connected via the WAN port or a switch, click on Add Controller and then select the controller and click on OK.

| File             | Home Modeling  | Simulation             | Controller | RAPID     | Add-In:                         |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
|------------------|--|------------------------|------------|-----------|---------------------------------|-----------|------------------|------------------------------------|-----------------------------|----------|----------------|--|-------------------------------|--------|---------|---------------------|------|
| Add<br>Controlle | er Write Access Write  | elease Authorie Access | enticate   | rt Backup | Inputs/<br>Outputs              | Tra       |                  | nt Online<br>Monitor               | Signal Analyzer<br>Online * | Jobs     | Configuration  | <ul> <li>Load Paramete</li> <li>Save Paramete</li> <li>Properties *</li> </ul> | rs<br>Installation<br>Manager |        | on Sofo | ty Control<br>Panel | Wind |
| Į.               | One Click Connect<br>Connect to the service                        | port of a contro       | ller.      |           |                                 |           | Controller Tools |                                    |                             |          |                |  | Configuration                 |        |         |                     | Virt |
| Q                | Add Controller<br>Add available controlle                          |                        | ·k.        |           | ld Contr                        |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
| _                | Add Controller from E  | evice List             |            | s         | ailable<br>ystem Na<br>700-5312 | ne        |                  | twork:<br>Controller<br>6700-53121 |                             |          | Address        |  | RobotWare W                   | ersion |         |                     |      |
| ¢.               | Start Virtual Controlle<br>Start and connect to a                  |                        |            |           | 700-531                         | :12       |                  | 6700-5312                          | .4                          | 192      | 2. 108. 125. 1 |  | 6.12.2013                     |        |         |                     |      |
| Recent C         | Controllers  |                        |            |           |                                 |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
| <u>,</u>         | 6700-531212 on '670<br>Status: Available<br>Last IP: 192.168.125.1 | 0-531212'              |            |           |                                 |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
|                  |  |                        |            |           |                                 |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
|                  |  |                        |            |           |                                 |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
|                  |  |                        |            |           |                                 |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
|                  |  |                        |            |           |                                 |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
|                  |  |                        |            |           |                                 |           |                  |                                    |                             |          |                |  |                               |        |         |                     |      |
|                  |  |                        |            | R         | emote C                         | ontroller | ∆dd              |                                    |                             |          |                |  | Filter                        | ~      |         |                     | ו    |
|                  |  |                        |            |           | Refresh                         | 🗌 Sh      | now Virtual Co   | ntrollers                          | 🗌 Login a                   | us Local | l Client       | Low Bar  | dwidth                        | 0      | ĸ       | 4 ncel              |      |



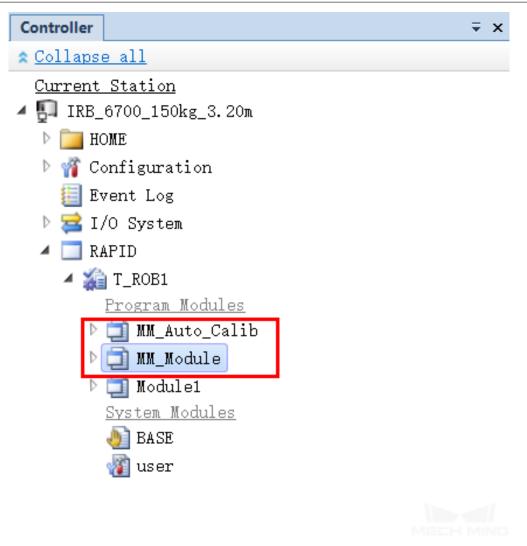
3. Click on *Controller* and right click on **T\_ROB1**. Select **Load Module** in the context menu, and then open the two modules, as shown below.

| Controlle   | er   | ∓ × Solut | ion                           |
|---|--|-----------|-------------------------------|
| a Collar  | <u>pse all</u>   |           |                               |
| Curre   | nt Station   |           |                               |
|   | <br>B_6700_150kg_3.20m   |           |                               |
| -   | HOME   |           |                               |
|   | Configuration  |           |                               |
|   | Event Log  |           |                               |
|   | I/O System   |           |                               |
| -   | RAPTD  |           |                               |
| 4   |  |           |                               |
|   | $ \overset{\text{Pr}}{\stackrel{\text{r}}{=}} \overset{\text{r}}{\stackrel{\text{s}}{=}} \text{Synchronize to Station} $ |           |                               |
|   | ▷ 🗧 🔁 🛛 Load Program   |           |                               |
|   | 🕨 🗖 🔀 🛛 Save Program As  |           |                               |
|   | Sv 🛒 🛋 Rename Program  |           |                               |
|   |  |           |                               |
|   | Mew Module   |           |                               |
|   | Load Module  |           |                               |
|   | Go To Program F Load Module  |           |                               |
|   | Go To Motion Pc Loads a RAPID modu   | ıle.      |                               |
|   | Follow Program Pointer   |           | •                             |
|   | Paste Ctrl+V   |           |                               |
|   | Adjust Robtargets  |           | 1                             |
|   |  |           |                               |
|   |  |           |                               |
|   |  |           |                               |
| 3 Open  |  |           | ×                             |
| $\leftarrow$ $\rightarrow$ $\checkmark$ $\uparrow$ $\blacksquare$ > This PC > USB (H:) > al | bb   | v Ū       | Search abb 🔎                  |
| *   |  |           | <b>≈</b> • □ 0                |
| 🧢 This PC   |  |           |                               |
| 3D Objects  |  |           |                               |
| Desktop   | <b>N</b>   |           |                               |
| Documents MM_Auto_Calib   | MM_Module  |           |                               |
| Downloads   | -  |           |                               |
| Music   |  |           |                               |
| E Pictures  |  |           |                               |
| 📑 Videos  |  |           |                               |
| USB (H:)  |  |           |                               |
| 🧅 USB (H:)  |  |           |                               |
| File Name (N): "MM_Auto_Ca  | alib" "MM_Module"  | ~         | RAPID Modules (*.mod;*.sys) ~ |
|   |  |           | Open (O) Cancel               |
|   |  |           |                               |

4. If MM\_Module.mod and MM\_Auto\_Calib.mod appear in T\_ROB1, the modules are loaded successfully.





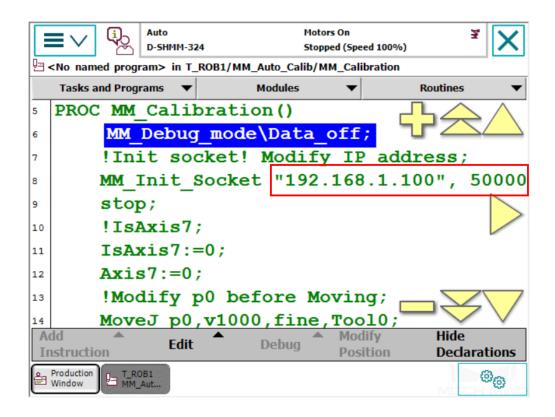


### **Further Configurations**

Locate and open **MM\_Calibration** routine in **MM\_Auto\_Calib** module. Change the IP address in the program to the IP address of the IPC.



| ■ V I_ROB1                   |                | Motors On<br>Stopped (Speed 100%) |                 |  |  |  |  |
|------------------------------|----------------|-----------------------------------|-----------------|--|--|--|--|
| Modules                      |                |                                   |                 |  |  |  |  |
| Name 🛆                       | Туре           | Chang                             | ged 1 to 5 of 5 |  |  |  |  |
| BASE                         | System module  | _                                 |                 |  |  |  |  |
| MM_Auto_Calib                | Program module | 1                                 |                 |  |  |  |  |
| MM_Module                    | Program module | 1                                 |                 |  |  |  |  |
| Module1                      | Program module |                                   |                 |  |  |  |  |
| user                         | System module  |                                   |                 |  |  |  |  |
|                              |                |                                   |                 |  |  |  |  |
|                              |                |                                   |                 |  |  |  |  |
|                              |                |                                   |                 |  |  |  |  |
|                              |                |                                   |                 |  |  |  |  |
| File 🕈 F                     | lefresh 🛛      | Show Module                       | 2 Back          |  |  |  |  |
| Production<br>Window Module1 |                |                                   | 0 <sub>0</sub>  |  |  |  |  |





### **Test Robot Connection**

### **Configuration in Mech-Center**

- 1. Open Mech-Center and click on *Deployment Settings*.
- 2. Select Mech-Interface
- 3. Check Use Mech-Interface.
- 4. Select Standard Interface.
- 5. Select  $\mathbf{TCP}$  Server,  $\mathbf{HEX}$  and  $\mathbf{Little}$  endian in Interface Option.
- $6.\,$  Select the robot model and click on Save to save the configurations.

| File Tool User View Help        |   |
|---------------------------------|---|
| Deployment Settings             | EVe<br>ech-Eye Viewer Run Stop Interface Connect Robot Administrator  |
|                                 |   |
| Appearance & Behavi             | V Use Mech-Interface 3  |
| Mech-Viz<br>Mech-Vision         | Interface Program Folder Interface Service Type   |
| Mech-Eye Viewer<br>Robot Server | • Standard Interface 4 • Adapter  |
| Mech-Interface 2                | Interface Optic     TCP Server     HEX *     Little en *     5       Listed robot     ABB     ABB_IRB6700_150_3; *     rzyx     6 |
|                                 | Custom robot RobotVendor1 RobotType1 rzyx<br>Host Address O . O . O . O : 50000 7   |
|                                 |   |
|                                 |   |
|                                 |   |
|                                 | Save 8 ancel  |

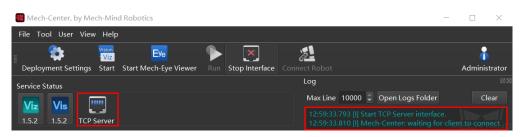
Note: The default port number is 50000. If it is modified, please modify the corre-



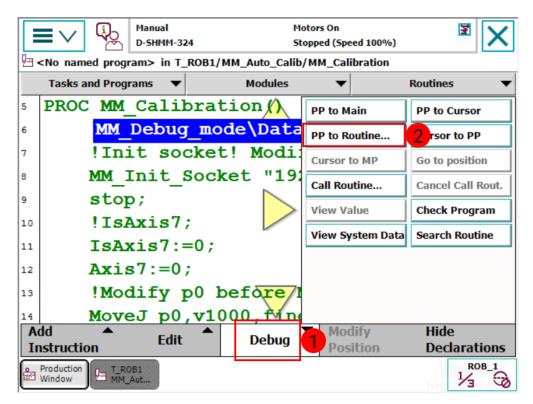
sponding code in the robot program when initializing communication.

### Test the Connection

1. Start TCP Server interface in Mech-Center.



2. Tap  $Debug \rightarrow PP$  to Routine.



3. Select **MM\_Calibration** and then tap *OK*.



| Move PP to Routin    | Manual<br>D-SHMM-324<br>e |             | Motors On<br>Stopped (Spe | ed 100%) | )           | 2   | X           |
|----------------------|---------------------------|-------------|---------------------------|----------|-------------|-----|-------------|
| Selected routine     | _                         | Calibration |                           |          |             |     |             |
| Name A               | in the list.              | Туре        |                           | Modul    | A           |     | 1 to 3 of 3 |
| Init_Data            |                           | Procedure   |                           |          | -<br>1odule |     |             |
| main                 |                           | Procedure   |                           | Modu     | le1         |     |             |
| MM_Calibration       |                           | Procedure   |                           | MM_/     | \uto_Ca     | lib | 3           |
|                      |                           |             |                           |          |             |     |             |
|                      |                           |             |                           |          |             |     |             |
|                      |                           |             |                           |          | _           |     |             |
|                      |                           |             |                           | ОК       | 4           | Can | cel         |
| Production<br>Window | Aut                       |             |                           |          | м           | 1/3 | OB_1        |

4. Press the  $\bigcirc$  button on the teach pendant to execute the program until the PP moves to line 9.

|    |   | С.<br>С  | Manual<br>D-SHMM-32 | 24             |               | tors On<br>opped (Spe | ed 100%) |                 |          | ×   |             |   |
|----|---|----------|---------------------|----------------|---------------|-----------------------|----------|-----------------|----------|-----|-------------|---|
| Ŀ. | <no nam<="" th=""><th>ed prog</th><th>ram&gt; in T_</th><th>ROB1/M</th><th>M_Auto_Calib/</th><th>MM_Cali</th><th>bration</th><th></th><th></th><th></th><th></th><th></th></no> | ed prog  | ram> in T_          | ROB1/M         | M_Auto_Calib/ | MM_Cali               | bration  |                 |          |     |             |   |
|    | Tasks a   | nd Prog  | rams 🔻              |                | Modules       | •                     | Routine  | s 🕻             |          |     |             | 2 |
| 5  | PROC  | MM       | Cali                | orati          | ion()         |                       |          | $ \land \land $ |          | a   |             |   |
| 6- |   | MM       | Debug               | mod            | le\Data       | off                   | ; '\-' Z |                 |          |     |             |   |
| 7  |   | In:      | it so               | cket           | Modif         | Y IF                  | address  | ;               | <b>1</b> |     | Enable      |   |
| 8  |   | MM :     | Init_               | Socke          | et "127       | .0.0                  | .1", 500 | 00, 6           | 0        | 16  |             |   |
| 9  |   | sto      | p; _                |                |               |                       |          |                 | V        | ╘╽╟ | 105         |   |
| 10 |   | !Is/     | Axis7               | ;              |               |                       |          |                 |          |     |             |   |
| 11 |   | IsA      | kis7:               | =0;            |               |                       |          |                 |          |     |             | L |
| 12 |   | Axi      | s7:=0               | ;              |               |                       |          |                 |          |     | Hold To Run |   |
| 13 |   | ! Moo    | dify j              | p0 be          | efore M       | lovin                 | g;       | $\leq$          |          |     |             |   |
| 14 |   | Move     | eJ p0               | , <b>v1</b> 0( | 00,fine       | , Too                 |          |                 |          |     |             |   |
|    | dd<br>nstructio   | <b>•</b> | Edit                | <b></b>        | Debug         | Mod<br>Doc            |          | e<br>darations  |          |     |             |   |
|    | T_ROB1<br>MM_Aut  | )        |                     |                |               | PUS                   | idon Dec |                 |          |     |             | Ø |

5. If the messages as shown below appear respectively on the teach pendant and in the **Log** panel of Mech-Center, then the robot can be connected successfully.



|                      | Manual<br>D-SHMM-324 | Motors On<br>Stopped (Speed : | 100%) |
|----------------------|----------------------|-------------------------------|-------|
| All Tasks            | nit connecti         | on successfully               |       |
|                      |                      | on successfully               |       |
|                      |                      |                               |       |
|                      |                      |                               |       |
|                      |                      |                               |       |
|                      |                      |                               |       |
|                      |                      |                               |       |
|                      |                      |                               |       |
|                      | Don't Show           | Don't Show                    |       |
| Clear                | Logs                 | Task Name                     |       |
| Production<br>Window | ROB1<br>M_Aut        |                               |       |

12:59:33.793 [I] Start TCP Server interface. 12:59:33.810 [I] Mech-Center: waiting for client to connect 13:02:36.777 [I] Mech-Center: client connected 13:02:36.777 [I] Client address is 13:02:38.271 [W] Mech-Center: client disconnected 13:02:38.272 [I] Mech-Center: waiting for client to connect

## 2.1.2 ABB Calibration Program

This section introduces the process of calibrating the camera extrinsic parameters using the calibration program.

The process consists of 4 steps:

- Select the Calibration Program
- Teach the Calibration Start Point
- Run the Calibration Program
- Start Calibration in Mech-Vision



Before proceeding, please make sure that:

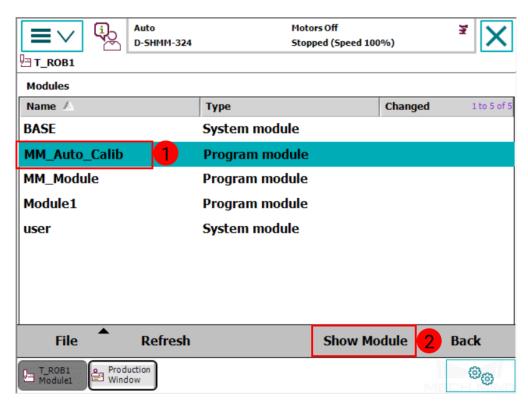
- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You are familiar with the contents in calibration\_guide.

The calibration process introduced in this section is applicable to scenarios where standard interface is used to communicate and the extrinsic parameters need to be calibrated multiple times.

### **Calibration Process**

### Select the Calibration Program

Select and open the program module **MM\_Auto\_Calib** in **T\_ROB1**. Please make sure that the IP address in the program is the same as that of the IPC, and the port number is set correctly.





|                  | Manual<br>D-SHMM-324<br>D_Calib |               | d Stop<br>ped (Speed 100%) | X           |
|------------------|---------------------------------|---------------|----------------------------|-------------|
| Routines         |                                 | A             | ctive filter:              |             |
| Name 🛆           |                                 | Module        | Туре                       | 1 to 1 of 1 |
| MM_Calibration(  | 0 3                             | MM_Auto_Calib | Proced                     | lure        |
|                  |                                 |               |                            |             |
|                  |                                 |               |                            |             |
|                  |                                 |               |                            |             |
|                  |                                 |               |                            |             |
|                  |                                 |               |                            |             |
|                  |                                 |               |                            |             |
|                  |                                 |               |                            |             |
|                  |                                 |               |                            |             |
| File             | Y                               |               | Show Routine               | 4 Back      |
| T_ROB1<br>MM_Aut |                                 |               |                            |             |

|    | Auto Motors On<br>D-SHMM-324 Stopped (Speed 100%)                    |
|----|--|
| 별· | <no named="" program=""> in T_ROB1/MM_Auto_Calib/MM_Calibration</no> |
|    | Tasks and Programs 🔻 Modules 🔻 Routines 🔻                            |
| 5  | PROC MM_Calibration()  |
| 6  | <pre>MM_Debug_mode\Data_off;</pre>                                   |
| 7  | !Init socket! M <u>odify IP address;</u>                             |
| 8  | MM_Init_Socket "192.168.1.100", 50000                                |
| 9  | stop;  |
| 10 | !IsAxis7;  |
| 11 | <pre>IsAxis7:=0;</pre>   |
| 12 | Axis7:=0;  |
| 13 | !Modify p0 before Moving;  |
| 14 | MoveJ p0,v1000,fine,Tool0;   |
|    |  |
|    | Production U T_ROB1 000  |

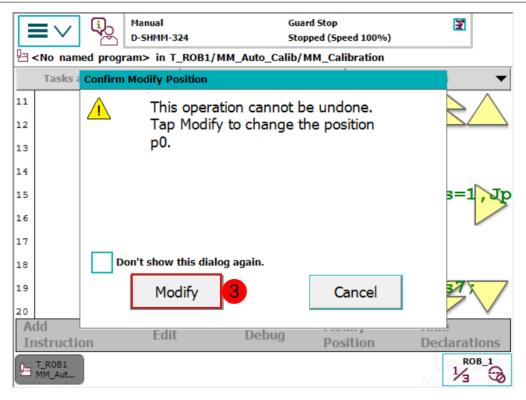


### Teach the Calibration Start Point

Move the robot to the start point for the calibration, and then modify this position as P0. Press on *Modify* in the pop-up window to confirm.

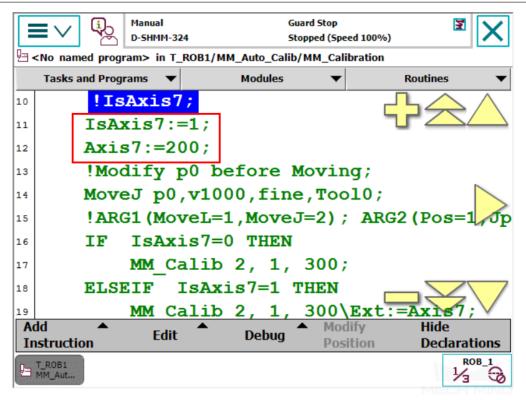
|      |                         | С.       | Manual<br>D-SHMM-324 |                   |      | ed (Speed 10       |        | X                | X            |
|------|-------------------------|----------|----------------------|-------------------|------|--------------------|--------|------------------|--------------|
| 년크 • | Hard Strain Calibration |          |                      |                   |      |                    |        |                  |              |
|      | Tasks a                 | and Prog | rams 🔻               | Module            | es   | •                  | Routi  | nes              | •            |
| 11   |                         | IsA      | cis7:=               | 0;                |      |                    |        | >                | $\land$      |
| 12   |                         | Axis     | s7:=0;               |                   |      |                    |        | $\Delta$         |              |
| 13   |                         | !Moo     | lify p               | 0 before          | e Mo | ving;              |        |                  |              |
| 14   |                         | Mov      | eJ p0                | , <b>v1</b> 000,f | ine  | ,Tool(             |        |                  |              |
| 15   |                         | ! AR(    | 31 (Mov              | eL=1,Mov          | veJ= | 2); A              | RG2 (P | os=1             | ,Jp          |
| 16   |                         | IF       | IsAxi                | s7=0 THI          | EN   |                    |        |                  | /            |
| 17   |                         |          | MM_Ca                | lib 2, 1          | L, 3 | ; 00               |        |                  |              |
| 18   |                         | ELSE     | IF I                 | sAxis7=1          | L TH | EN                 |        |                  |              |
| 19   |                         |          | MM_Ca                | lib 2, 1          | L, 3 | 00\Ex              | t:=Ax  | is7              | /            |
| 20   |                         | END      | EF                   |                   |      |                    |        |                  | $\checkmark$ |
|      | dd<br>1structio         | ▲<br>on  | Edit                 | ▲ Debu            | ıg 🗖 | Modify<br>Position |        | ide<br>eclaratio | ons          |
|      | T_ROB1<br>MM_Aut        |          |                      |                   |      |                    |        | ROB              | L<br>()      |





If the 6-axis robot is installed on a guide rail that is controlled by the robot, please set IsAxis7: =1, and configure the value of Axis7 according to actual situation, as shown below. If there is no guide rail on site or the guide rail is controlled by a PLC, please skip this step.





### Run the Calibration Program

Press on  $Debug \rightarrow PP$  to Routine.



|    | Nanual<br>D-SHMM-324                  | lotors On<br>itopped (Speed 100%) | X                 |                      |
|----|---------------------------------------|-----------------------------------|-------------------|----------------------|
|    | Tasks and Programs 🔻                  | ▼                                 | Routines 🔻        |                      |
| 5  | PROC MM_Calib                         | ration ()                         | PP to Main        | PP to Cursor         |
| 6  | MM_Debug_                             | _mode\Data                        | PP to Routine     | 2 rsor to PP         |
| 7  | !Init soc                             | ket! Modi                         | Cursor to MP      | Go to position       |
| 8  | MM_Init_S                             | ocket "19                         | Call Routine      | Cancel Call Rout.    |
| 9  | stop;                                 |                                   | View Value        | Check Program        |
| 10 | !IsAxis7;                             |                                   | View System Data  |                      |
| 11 | IsAxis7:=                             | 0;                                | view System Data  | Search Kouune        |
| 12 | Axis7:=0;                             |                                   |                   |                      |
| 13 | !Modify p                             | 0 before                          |                   |                      |
| 14 | MoveJ p0,                             | v1000, fin                        | 6                 |                      |
|    | dd <b>A</b> Edit                      | Debug                             | A Modify Position | Hide<br>Declarations |
| ê  | Production<br>Window T_ROB1<br>MM_Aut |                                   |                   |                      |

1. Select **MM\_Calibration**, and then press on OK.

| Manual<br>D-SHMM-324<br>Move PP to Routine<br>Selected routine: MM_<br>Select a routine from the list. | Motors C<br>Stopped<br>Calibration | On 😰 🔀                   |
|--|------------------------------------|--------------------------|
| Name /   | Туре                               | Module 1 to 3 of 3       |
| Init_Data  | Procedure                          | MM_Module                |
| main   | Procedure                          | Module1                  |
| MM_Calibration   | Procedure                          | MM_Auto_Calib            |
|  |                                    | OK <mark>4</mark> Cancel |
| Production<br>Window   |                                    |                          |



2. Press the  $\bigcirc$  key on the teach pendant to run the program until the PP moves to line 17.

|          | No named program> in T_ |           | Motors On<br>Running (Sp<br>Calib/MM_Ca |          | X                    |
|----------|-------------------------|-----------|---|----------|----------------------|
|          | Tasks and Programs 🛛 🔻  | Modu      | les 🔻                                   | Rou      | utines 🔻             |
| 13       | !Modify p0              | before N  | loving;                                 |          |                      |
| ¥        | MoveJ <mark>p0</mark> , | v1000,fin | ne,Tool(                                | );       |                      |
| 15       | ! ARG1 (Move            | L=1,Moved | J=2); AF                                | G2 (Pos= | 1,Jps=2);            |
| 16       | IF IsAxis               | 7=0 THEN  |   |          |                      |
| 17       | MM_Cal                  | ib 2, 1,  | 300;                                    |          |                      |
| 18       | ELSEIF Is               | Axis7=1 1 | HEN                                     |          |                      |
| 19       | MM_Cal                  | ib 2, 1,  | 300\Ext                                 | :=Axis7  | ;                    |
| 20       | ENDIF                   |           |   |          |                      |
| 21       | MoveJ p0,v              | 1000,fine | , Tool0;                                |          |                      |
| 22       | ENDPROC                 |           |   |          |                      |
| 23       | ENDMODULE               |           |   |          |                      |
| Ac<br>In | Id <b>A</b> Edit        | Deb       | 110                                     | any      | Hide<br>Declarations |
| 9        | T_ROB1<br>MM_Aut        |           |   |          |                      |

Proceed to the next section when the the following are displayed:

• On the teach pendant:



|                  | Manual<br>D-SHMM-324           | Motors On<br>Running (Speed 100%) | 3 |
|------------------|--------------------------------|-----------------------------------|---|
| T ROB1->MM:      | Init connecti<br>D Calibration | on successfully<br>Start!         |   |
|                  |                                |                                   |   |
|                  |                                |                                   |   |
|                  |                                |                                   |   |
|                  | Don't Show                     | Don't Show                        |   |
| Clear            | Logs                           | Task Name                         |   |
| T_ROB1<br>MM_Aut |                                |                                   |   |

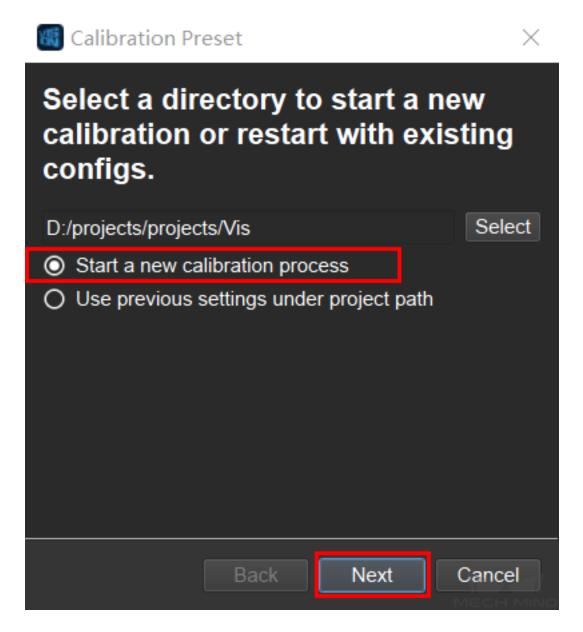
• In Mech-Center **Log** panel:

| Log   |
|---|
|   |
|   |
| Entering the calibration process, please start the calibration in Mech-Vision |
|   |



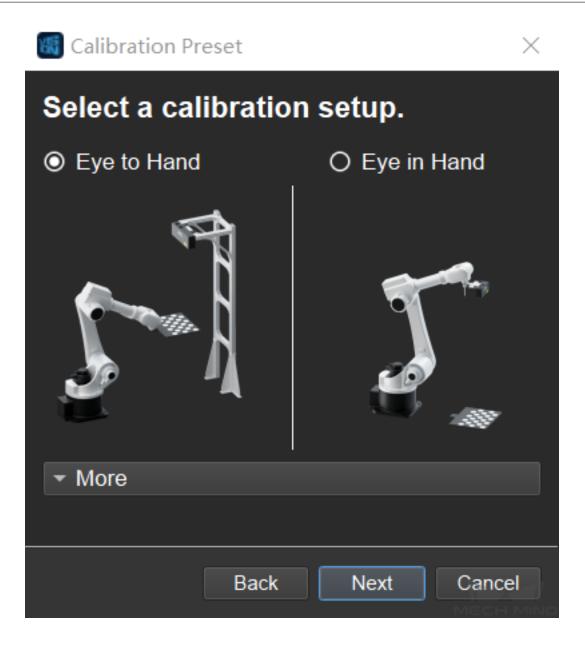
#### Start Calibration in Mech-Vision

- 1. In Mech-Vision, click on Camera Calibration (Standard) in the Toolbar, or select Camera  $\rightarrow$  Camera Calibration  $\rightarrow$  Standard from the Menu Bar.
- 2. Follow the instructions in Mech-Vision to complete the following configuration:
  - 1. Select **Start a new calibration process**;



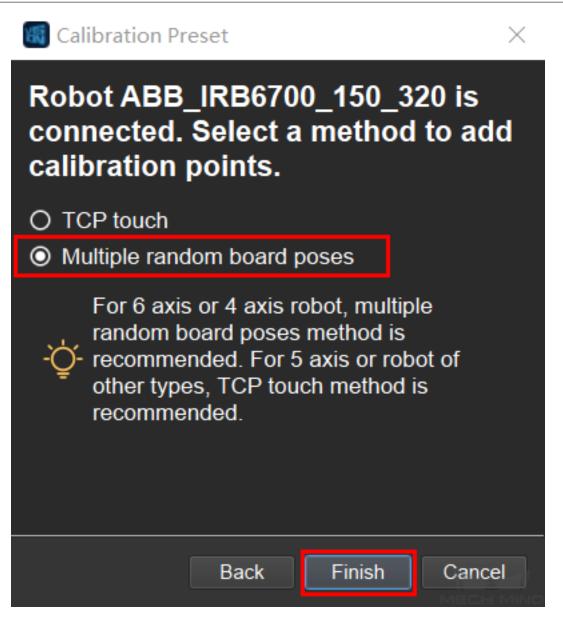
2. Select the camera mounting method;





3. Select Multiple random board poses for adding calibration points.





**Note:** If after selecting the camera mounting method, the window says **No robot is connected**, the connection between the robot and Mech-Center is not properly established. Please re-run the robot program.

3. Follow the instructions in Mech-Vision to finish the calibration.

Note: In 5 Add Marker-Images and Poses after you click on *Move Robot along Trajectory* and Add Board Images, if the robot does not reach the next calibration point within 60 seconds, Mech-Vision will report a timeout error and stop the calibration process. In such case, please select and run MM\_Auto\_Calib on the teach pendant again, and restart the calibration process in



Mech-Vision.

# 2.1.3 ABB Example Program

This section introduces the example program provided with Mech-Center and the operations required to perform an actual pick-and-place task.

Please download the pick-and-place sample first.

Check the section corresponding to your own application setup:

- Obtain Vision Results from Mech-Vision
- Obtain Planned Path from Mech-Viz

Before running the program, please make sure that:

- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You have completed the extrinsic parameter calibration with *the calibration program* or by manually adding calibration points.
- Mech-Vision and Mech-Viz projects are created and set to autoload.
- The **Project list** in *Mech-Center*  $\rightarrow$  *Deployment Settings*  $\rightarrow$  *Mech-Vision* is synced by clicking on

LL, and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings | ×  |
|---------------------|--|
|                     | ✓ Use Mech-Vision<br>Exec path …<br>Project path |
| Mech-Vision         | Project path                                     |
|                     |  |

- The TCP has been correctly specified.
- The robot speed is set to a low value, so that the operator can notice any unexpected behavior before accidents occur.



## **Obtain Vision Results from Mech-Vision**

PROC Vision\_Sample\_1() 47 48 FUNCTION: Eye to Hand simple pick and place with Mech-Vision 49! mechmind, 2022-5-1 50 51AccSet 100, 100; 52VelSet 100, 5000; 53 MoveAbsJ Home\NoEOffs,v3000,fine,Gripp1TCP;!move robot home position 54MoveL camera\_capture,v500,fine,Gripp1TCP; 55PoseNum:=0; 56 !Set ip address of IPC 57 MM\_Init\_Socket "127.0.0.1",50000,60; 58 WaitTime 0.1: 59 !Set vision recipe 60 MM\_Switch\_Model 1,1; 61 !Run vision project 62 MM\_Start\_Vis 1,1,2; 63 WaitTime 1; 64 MM\_Get\_VisData 1,LastData,PoseNum,Status; 65 IF Status<>1100 THEN 66 Stop; 67 68 ENDIF 69 MM\_Get\_Pose 1,pickpoint,label,speed1; MoveL RelTool(pickpoint,0,0,-100),v1000,fine,Gripp1TCP; 70 MoveL pickpoint,v300,fine,Gripp1TCP; 71Stop; 72 !Add object grasping logic here. 73 MoveL Offs(pickpoint,0,0,100), v1000, fine, Gripp1TCP; 74 MoveL waypoint1,v1000,z50,Gripp1TCP; 75MoveL RelTool(drop,0,0,-100),v1000,fine,Gripp1TCP; 76 MoveL drop,v300,fine,Gripp1TCP; 77 78 Stop: !Add object releasing logic here. 79 MoveL Offs(drop,0,0,100), v1000, fine, Gripp1TCP; 80 81 MoveAbsJ Home\NoEOffs,v3000,fine,Gripp1TCP; 82 **RETURN** : ENDPROC 83

## **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with **MM\_Init\_Socket**.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_Switch\_Model.
- 5. Run the Mech-Vision project with **MM\_Start\_Vis**.
- 6. Wait for 1 second. Under Eye-In-Hand, this **WaitTime** instruction is required to make sure the robot stays still until image acquisition is completed. Under Eye-To-Hand, this **WaitTime** instruction can be replaced with **MoveL** or **MoveJ**.



- 7. Obtain the vision results from Mech-Vision.
- 8. Check if the returned status code indicates any error. If an error code is returned, the program is stopped.
- 9. Move the robot to the picking pose and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

# Define the TCP

The TOOL is defined as **Gripp1TCP**. Change the value of **Gripp1TCP** to the actual TCP values.

## Define HOME position

Set the Home position in **Home**.

## Teach the Image Capturing Pose

Record the image capturing pose in **camera\_capture**.

# Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

You can add one or more waypoints to **waypoint**.

## Teach the Placing Pose

Record the placing pose in **drop**.

## Define Z-Offset from Picking/Placing Pose

Z-offset distances relative to the tool frame from the picking/placing pose are used to ensure collision doesn' t occur when the robot is approching or departing the picking/placing pose.

Adjust the following commands according to your actual needs.

- MoveJ RelTool(pickpoint,0,0,-100): the Z-offset when approching the picking pose is set to 100. Robot will move to 100 mm above the picking pose.
- MoveL Offs(pickpoint,0,0,100): the Z-offset when departing the picking pose is set to 100. Robot will move to 100 mm above the picking pose.



- MoveL RelTool(drop,0,0,-100): the Z-offset when approching placing pose is set to 100. Robot will move to 100 mm above the placing pose.
- MoveL Offs(drop,0,0,100): the Z-offset when departing the placing pose is set to 100. Robot will move to 100 mm above the placing pose.

# Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking or placing the object.

#### **Obtain Planned Path from Mech-Viz**

```
PROC vision_sample_2()
85
      86
      ! FUNCTION: Eye to Hand simple pick and place with Mech-Viz
87
      ! mechmind, 2022-5-1
88
      89
      AccSet 100, 100;
90
      VelSet 100, 5000;
91
      MoveAbsJ Home\NoEOffs,v3000,fine,Gripp1TCP;!move robot home position
92
93
      MoveL camera_capture,v500,fine,Gripp1TCP;
      PoseNum:=0;
94
      !Set ip address of IPC
95
      MM_Init_Socket "127.0.0.1",50000,60;
96
      WaitTime 0.1;
97
      !Set vision recipe
98
      MM_Switch_Model 1,1;
99
      !Run Viz project
100
      MM_Start_Viz 1;
101
102
      WaitTime 0.1;
103
      !set branch exitport
104
      MM_Set_Branch 1,1;
      !get planned path
105
      MM_Get_VizData 2, LastData, PoseNum, VisPosNum, MM_Status;
106
      IF MM_Status<>2100 THEN
107
          Stop;
108
      ENDIF
109
      FOR i FROM 1 TO PoseNum DO
110
111
          count:=i:
          MM_Get_Pose count,P{count},label1{count},speed{count};
112
      ENDFOR
113
114
      !follow the planned path to pick
      FOR j FROM 1 TO PoseNum DO
115
116
          count:=j;
          MoveL p{count},v1000,fine,Gripp1TCP;
117
          IF count=VisPosNum THEN
118
              Stop;
119
              !add object grasping logic here
120
          ENDIF
121
      ENDFOR
122
      !go to drop location
123
      MoveL RelTool(drop,0,0,-100),v1000,z50,Gripp1TCP;
124
      MoveL drop,v500,fine,Gripp1TCP;!drop point
125
```

(continues on next page)



(continued from previous page)

```
126
127
128
129
130
131
```

stop; !add object releasing logic here MoveL Offs(drop,0,0,100), v1000, fine, Gripp1TCP; MoveAbsJ Home\NoEOffs,v3000,fine,Gripp1TCP; RETURN ; ENDPROC

# **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with **MM\_Init\_Socket**.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_Switch\_Model.
- 5. Run the Mech-Viz project with **MM\_Start\_Viz**.
- 6. Obtain the planned path from Mech-Viz.
- 7. Check if the returned status code indicates any error. If an error code is returned, the program is stopped.
- 8. Store obtained target points in the planned path to  $\mathbf{P}\{\}$  with a **FOR** loop.
- 9. Move the robot along the planned path with a  ${\bf FOR}$  loop and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

## Define the TCP

The TOOL is defined as **Gripp1TCP**. Change the value of **Gripp1TCP** to the actual TCP values.

# Define HOME position

Set the Home position in **Home**.



## Teach the Image Capturing Pose

Record the image capturing pose in **camera\_capture**.

## Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

You can add one or more waypoints to **waypoint**.

## Teach the Placing Pose

Record the placing pose in **drop**.

## Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking or placing the object.

#### Define Z-Offset from Picking/Placing Pose

Z-offset distances relative to the tool frame from the picking/placing pose are used to ensure collision doesn' t occur when the robot is approching or departing the picking/placing pose.

Adjust the following commands according to your actual needs.

- MoveL RelTool(drop,0,0,-100): the Z-offset when approching placing pose is set to 100. Robot will move to 100 mm above the placing pose.
- MoveL Offs(drop,0,0,100): the Z-offset when departing the placing pose is set to 100. Robot will move to 100 mm above the placing pose.

# 2.1.4 ABB Standard Interface Commands

The ABB Standard Interface provides the following procedures:

- Initialize Communication
- Start Mech-Vision Project
- Get Vision Result
- Start Mech-Viz Project
- Get Planned Path
- Obtain Pose
- Obtain Joint Positions
- Switch Mech-Vision Recipe
- Select Mech-Viz Branch





- Set Move Index
- Get Software Status
- Input Object Dimensions to Mech-Vision
- Get DO Signal List
- Set DO Signal List
- Input TCP to Mech-Viz
- Calibration

When programming the ABB robot, please pay attention to the following:

- Multiple parameters should be separated by commas.
- All parameters should be defined as local variables in the program file.
- Parameters can be defined as Input or Output parameters.
- Arguments in the program: the input arguments can be constants, global variables or local variables, and the output arguments can be global variables or local variables.

This Standard Interface is over the TCP/IP protocol.

## **Initialize Communication**

```
MM_Init_Socket "IP_Address",Server_Port,Time_Out;
```

This procedure is used to set the host IP address, port number, and wait time for TCP/IP communication.

## Parameters

• Input Parameters

| Name        | Description   |
|-------------|---|
| IP_Address  | the IP address of the host                              |
| Server_Port | TCP/IP port number; the default port number is 50000    |
| Time_Out    | Wait time in seconds before stopping connection attempt |

## Example

| MM_Init_Socket | "192.168.1.2 | 20",50000,60; |
|----------------|--------------|---------------|
|----------------|--------------|---------------|

When running the example, the host IP address should be set to 192.168.1.20, the port number should be set to 50000, and the wait time is 60 seconds.



#### Start Mech-Vision Project

```
MM_Start_Vis Job,Pos_Num_Need,SendPos_Type;
```

This procedure is applications that use Mech-Vision but not Mech-Viz. It runs the corresponding Mech-Vision project to acquire and process data.

# Parameters

• Input Parameters

| Name      | Description  |
|-----------|--|
| Job       | Mech-Vision Project ID, from 1 to 99   |
|           | Please go to Deployment Settings $\rightarrow$ Mech-Vision to check and adjust the number. |
| Pos_Num   | Needber of poses for Mech-Vision to send, from 0 to 20, where 0 means "send all"           |
|           |  |
| SendPos_' | <b>T</b> Spet the image capturing pose for the robot to send, from 0 to $2$                |
|           | 0: Do not send image capturing pose (for Eye To Hand) 1: Send image capturing              |
|           | pose as joint positions 2: Send image capturing pose as robot flange pose                  |

## Example

| MM_Start_Vis | 1,1,1; |
|--------------|--------|
|--------------|--------|

This example triggers Mech-Vision No. 1 project to run; the Mech-Vision No. 1 project is expected to send back 1 pose; and the robot will send image capturing pose as joint to Mech-Center.

## **Get Vision Result**

MM\_Get\_VisData Job,Last\_Data,Pos\_Num,MM\_Status;

This procedure is for applications that use Mech-Vision but not Mech-Viz. It obtains the vision result from the corresponding Mech-Vision project.

## Parameters

• Input Parameter

| Γ | Name | Description  |
|---|------|--|
| Γ | Job  | Mech-Vision Project ID, from 1 to 99   |
|   |      | Please go to Deployment Settings $\rightarrow$ Mech-Vision to check and adjust the number. |

• Output Parameters



| Name      | Description   |  |
|-----------|---|--|
| Last_Data | Last_Data Variable, indicating whether all vision result has been sent, 0 or 1    |  |
|           | 0: NOT all vision result has been sent (more on the way) 1: All vision result has |  |
|           | been sent   |  |
| Pos_Num   | Variable for storing the number of received poses                                 |  |
| MM Status | Variable for storing status code, refer to the standard interface status codes    |  |

## Example

|     | мм  | Cat  | ViaData  | 1,LastData,PoseNum,MMStatus; |  |
|-----|-----|------|----------|------------------------------|--|
| - I | rm_ | uer. | _visbata | I,LaStData,FOSENum,Emptatus, |  |

This example obtains the vision result from Mech-Vision project No.1. Whether all vision result has been sent is stored in **LastData**, the number of poses received is stored in **PoseNum**, and the status code is stored in **MMStatus**.

## Start Mech-Viz Project

MM\_Start\_Viz SendPos\_Type;

This procedure is for applications that use both Mech-Vision and Mech-Viz. It runs the corresponding Mech-Viz project (which triggers the corresponding Mech-Vision project to run), and sets the initial joint positions of the simulated robot in Mech-Viz.

#### Parameter

• Input Parameter

| Name    | Description   |
|---------|---|
| SendPos | Type initial joint positions for the simulated robot in Mech-Viz, 0 or 1                        |
|         | 0: Set the initial joint positions of the simulated robot to $[0,0,0,0,0,0]$ 1: Set the initial |
|         | joint positions of the simulated robot to the current joint positions of the real robot         |

Note: When the scene contains object models that obstruct the robot to move from [0,0,0,0,0,0] to the first target point, this parameter must be set to 1.

## Example

| MM | Start_ | Viz | 1; |
|----|--------|-----|----|
|----|--------|-----|----|

This example runs the corresponding Mech-Viz project, and sets the initial joint positions of the simulated robot to the current joint positions of the real robot.



#### **Get Planned Path**

MM\_Get\_VizData GetPos\_Type,Last\_Data,Pos\_Num,VisPos\_Num,MM\_Status;

This procedure obtains the planned path from Mech-Viz.

#### Parameters

• Input Parameter

| Name        | Description   |
|-------------|---|
| GetPos_Type | Whether Mech-Viz should send target points as joint positions or TCPs, 1 or |
|             | 2   |
|             | 1: Mech-Viz sends joint positions 2: Mech-Viz sends TCPs                    |

#### • Output Parameters

| Name   | Description   |
|--------|---|
| Last_I | Datariable, indicating whether all target points have been sent, 0 or 1               |
|        | 0: NOT all target points have been sent (more on the way) 1: All target points have   |
|        | been sent   |
| Pos_N  | ultrariable for storing the number of received target points                          |
| VisPos | Nariable for storing the position of the first visual_move target point in the path   |
|        | Example path: move-1, move-2, visual_move-3, move-3, visual_move-2 In this path,      |
|        | the position of the first visual_move target point is 3. If the path does not contain |
|        | visual_move target point, the return value is 0.                                      |
| MM_S   | tatasiable for storing status code, refer to the standard_interface_status_codes      |

#### Example

MM\_Get\_VizData 2,Last,Pose\_Num,Vis\_Index,StatusCode;

This example obtains the planned path from Mech-Viz in the form of TCPs. Whether all target points have been sent is stored in **Last**, the number of target points received is stored in **Pose\_Num**, the position of the visual\_move target point is stored in **Vis\_Index**, and the status code is stored in **StatusCode**.

#### Obtain Pose

MM\_Get\_Pose Index,P90,Label,Pose\_Speed;

This procedure stores a pose returned by Mech-Vision or a target point (as TCP) returned by Mech-Viz in the specified variable.



#### **Parameters**

• Input Parameter

|       | Description                                |
|-------|--|
| Index | Specify the index of the pose to be stored |

• Output Parameters

| Name       | Description  |
|------------|--|
| P90        | Variable for storing the specified pose                            |
| Label      | Variable for storing the label corresponding to the specified pose |
| Pose_Speed | Variable for storing the speed corresponding to the specified pose |

## Example

MM\_Get\_Pose 1,P90,Label,PoseSpeed1;

This example stores the first received pose to **P90**, the corresponding label to **Label**, and the corresponding speed to **PoseSpeed1**.

#### **Obtain Joint Positions**

| мм    | Cot Ing | Index Jointtorret Johol Dogo Speed                |   |
|-------|---------|---|---|
| PhPI_ | Gec_Jbs | <pre>Index, Jointtarget, Label, Pose_Speed;</pre> | , |

This procedure stores a set of joint positions returned by Mech-Viz in the specified variable.

**Note:** As Mech-Vision does not output joint position data, this procedure can only be used with Mech-Viz.

#### Parameters

• Input Parameter

|       | Description  |
|-------|--|
| Index | Specify the index of the set of joint positions to be stored |

• Output Parameters

| Name        | Description  |
|-------------|--|
| Jointtarget | Variable for storing the specified set of joint positions                            |
| Label       | Variable for storing the label corresponding to the specified set of joint positions |
| Pose_Speed  | Variable for storing the speed corresponding to the specified set of joint positions |



## Example

MM\_Get\_Jps 1,jpose1,Label1,PoseSpeed1;

This example stores the first set of received joint positions to **jpose1**, the corresponding label to **Label1**, and the corresponding speed to **PoseSpeed1**.

## Switch Mech-Vision Recipe

MM\_Switch\_Model Job,Model\_Number;

This procedure specifies which parameter recipe of the Mech-Vision project to use. For more information on parameter recipe, please see parameter\_recipe\_configuration.

#### Note:

• This procedure must be called BEFORE **MM\_Start\_Vis**.

#### Parameters

• Input Parameters:

| Name         | Description   |
|--------------|---|
| Job          | Mech-Vision Project ID, from 1 to 99  |
|              | Can check and adjust in $Mech$ - $Center \rightarrow Deployment Settings \rightarrow Mech$ - $Vision$ |
| Model_Number | The number of a parameter recipe in the Mech-Vision project, from 1 to 99                             |

#### Example

MM\_Switch\_Model 1,1;

This example switches the parameter recipe used to No. 1 in Mech-Vision project No. 1.

## Select Mech-Viz Branch

MM\_Set\_Branch Branch\_Num,Exit\_Num;

This procedure is used to select along which branch the Mech-Viz project should proceed. Such branching is achieved by adding branch\_by\_service\_message Task(s) to the project. This procedure specifies which out port such Task(s) should take.

#### Note:

- MM\_Start\_Viz must be called BEFORE this procedure.
- When the next Task to be executed in Mech-Viz is a **branch\_by\_service\_message** Task, Mech-Viz will wait for this procedure to send the out port number it should take.



• The name of all **branch\_by\_service\_message** Tasks in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

## Parameters

• Input Parameters

| Name       | Description   |
|------------|---|
| Branch_Num | Name of the <b>branch_by_service_message</b> Task, from 1 to 99 |
| Exit_Num   | The number of the out port to take, from 1 to 99                |

## Example

MM\_Set\_Branch 1,3;

This example tells Mech-Viz to take out port **3** for the **branch\_by\_service\_message** Task named **1**.

#### Set Move Index

MM\_Set\_Index Skill\_Num,Index\_Num;

This procedure sets the value for the Current Index parameter of Mech-Viz Tasks. Tasks that have this parameter include move\_list, move\_grid, custom\_pallet\_pattern, and smart\_pallet\_pattern.

#### Note:

- MM\_Start\_Viz must be called BEFORE this procedure.
- The name of all Tasks with index parameters in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

# Parameters

• Input Parameters

| Name      | Description   |
|-----------|---|
| Skill_Num | Name of the Task, from 1 to 99                                  |
| Index_Num | Value for the Current Index parameter when the Task is executed |



#### Example

MM\_Set\_Index (2,10);

This example sets the Current Index value to 9 for the Task named **2**. When the Task is executed, the Current Index value will be added 1 and become 10.

## Get Software Status

This procedure is currently capable of checking whether Mech-Vision is ready to run projects. In the future, this procedure can be used for obtaining the execution status of Mech-Vision, Mech-Viz and Mech-Center.

## Parameter

• Output Parameter

| Name      | Descriptio                  | n   |         |     |        |       |       |    |     |       |
|-----------|-----------------------------|-----|---------|-----|--------|-------|-------|----|-----|-------|
| MM_Status | Variable                    | for | storing | the | status | code, | refer | to | the | stan- |
|           | dard_interface_status_codes |     |         |     |        |       |       |    |     |       |

## Example

#### MM\_Get\_Status StatusCode;

This example obtains the status code and stores it in **StatusCode**.

## Input Object Dimensions to Mech-Vision

```
MM_Set_BoxSize Job,Lenght,Width,Height;
```

This procedure inputs object dimensions to the Mech-Vision project.

## Note:

• This procedure must be called BEFORE **MM\_Start\_Vis**.



## **Parameters**

• Input Parameters

| Name   | Description   |
|--------|---|
| Job    | Mech-Vision Project ID, from 1 to 99  |
|        | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| Lenght | Length of object in mm  |
| Width  | Width of object in mm   |
| Height | Height of object in mm  |

# Example

MM\_Set\_BoxSize(1,500,300,200)

This example sets the object dimensions in the read\_object\_dimensions Step in the Mech-Vision project No. 1 to 500\*300\*200 mm.

# Get DO Signal List

#### MM\_Get\_DoList Status;

This procedure obtains the planned DO Signal list for controlling multiple sections of a sectioned vacuum gripper.

## Note:

- MM\_Get\_VizData must be called BEFORE this procedure.
- Please deploy the Mech-Viz project based on the template project in *Mech-Center/tool/viz\_project/suction\_zone*, and set the suction cup configuration file in the Mech-Viz project.
- Set the current robot model as the **Received Name** in Mech-Viz.

## Parameter

• Output Parameter

| Name   | Description  |
|--------|--|
| Status | Variable for storing the status code, refer to the standard_interface_status_codes |



#### Example

| MM_ | Get | DoList | Status; |
|-----|-----|--------|---------|
|-----|-----|--------|---------|

This procedure stores the status code of Mech-Viz in **Status**.

# Set DO Signal List

MM\_Set\_DoList Serial,G016;

This procedure sets the DoList sent by Mech-Viz to go signals. It supports 4 groups of 16-bit go signals in maximum. If you need to set multiple groups of go signal, please run this procedure for several times.

Note: MM\_Get\_DoList must be called BEFORE this procedure.

#### Parameters

• Input Parameters

| Name   | Description                          |
|--------|--------------------------------------|
| Serial | Variable for storing the status code |
| GO16   | Group output for setting DO signals  |

#### Example

| MM_Set_DoList 1,GO16; |  |
|-----------------------|--|
| MM_Set_DoList 2,GO32; |  |
|                       |  |

The first example sets the 0-15 values in the DoList calculated by Mech-Viz to corresponding **GO16** signals, and the second example sets the 16-32 values in DoList to corresponding **GO32** signals.

## Input TCP to Mech-Viz

MM\_Set\_Pos Pos;

This procedure inputs TCP data to the outer\_move Task.

#### Note:

- This procedure must be called BEFORE **MM\_Start\_Viz**.
- Please deploy the Mech-Viz project based on the template project in *Mech-Centertoolviz\_projectouter\_move*, and put the **outer\_move** Task at a proper position in the workflow.



#### Parameter

• Input Parameter

| Name | Description  |
|------|--|
| Pos  | Variable for storing the TCP data to be sent to Mech-Viz |

## Example

MM\_Set\_Pos P10;

This example sends the TCP data stored in **P10** to the **outer\_move** task in the Mech-Viz project.

#### Calibration

MM\_Calib Move\_Type,Pos\_Jps,Wait\_time,\\num Ext;

This procedure is used for hand-eye calibration (camera extrinsic parameter calibration). It automates the calibration process in conjunction with the **Camera Calibration** function in Mech-Vision. For detailed instructions, see *ABB Calibration Program*.

#### Parameters

• Input Parameters

| Name      | Description                                    |
|-----------|--|
| Move_Type | Motion type, 1 or 2                            |
|           | 1: MoveL 2: MoveJ                              |
| Pos_Jps   | Pose as flange pose or joint positions, 1 or 2 |
|           | 1: flange pose 2: Joint positions              |
| Wait_Time | Wait time between poses in seconds             |
| Ext       | Data of the external 7th axis in mm (Optional) |

## Examples

• Example 1

MM\_Calib 2,1,300;

This example moves the robot in MoveJ type, receives pose data in the form of flange pose, and sets the wait time between two poses to 300 seconds. In addition, this robot does not have an external axis installed.

• Example 1

MM\_Calib 2,1,300,\\EXT:=Axis7;



This example moves the robot in MoveJ type, receives pose data in the form of flange pose, and sets the wait time between two poses to 300 seconds. Moreover, the 7th axis value of this robot is Axis7.

# 2.1.5 ABB Error Messages

The following errors may occur while running the Standard Interface program on the robot.

```
"MM:Robot Error", " Socket Timeout, Check connetion"
```

The robot program didn't receive data within the specified wait time when calling the instruction **SocketRecive**.

# Troubleshooting

- Check if the sequence of calling **SocketSend** and **SocketReceive** is correct.
- Check if the Standard Interface is started in Mech-Center.
- Check if the arguments of  ${\bf SocketReceive}$  are set correctly.

# "MM:Robot Error", " Socket Closed, Check connection"

The robot couldn't establish communication with Mech-Center.

# Troubleshooting

- Check if the hardware are properly connected.
- Check if the Standard Interface is started in Mech-Center.
- Check the IP addresses of the robot and the IPC, and if the port number is configured correctly.
- Check if the firewall is turned off on the IPC.
- Contact Mech-Mind Technical Support for further assistance.

# "MM:Robot Error"," Wrong Arguments"

When calling a Mech-Mind Standard Interface procedure, arguments provided are not correct.

# Troubleshooting

Please refer to ABB Standard Interface Commands and input the correct arguments accordingly.



# "MM:Robot Error", "CMD No. Error"

The command code returned to the robot does not match the one sent to Mech-Center.

## Troubleshooting

The sequence of command sending and receiving is problematic. Please contact Mech-Mind Technical Support for further assistance.

"MM:IPC Error", "Check IPC status"

Returned status code is an error code. Please check Mech-Center' s log.

## Troubleshooting

- Please refer to the standard\_interface\_status\_codes for the specific error.
- Please contact Mech-Mind Technical Support for further assistance.

# 2.2 YASKAWA

This section introduces the Standard Interface for YASKAWA robots.

# 2.2.1 YASKAWA Setup Instructions

This section introduces the process of loading the Standard Interface program onto a YASKAWA robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

**Note:** A USB 2.0 flash drive is recommended. Otherwise, the robot controller may not recognize the flash drive.



#### Check Controller and Software Compatibility

- Robot: 6-axis YASKAWA robot
- Controller: YRC1000 (excluding YRC1000 micro) and DX200
- Option function requirements: must have the MotoPlus and Ethernet functions enabled.

**Note:** The following instructions are based on YRC1000 controller. Details may differ for DX200 controller.

#### Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable into:

- An Ethernet port on the IPC
- LAN2 (CN106) port on YRC1000 controller; CN104 port on DX200 controller

#### Note:

- LAN1 port on YRC1000 and CN105 port on DX200 are for connecting the teach pendant only.
- If LAN2 port is occupied, please use LAN3 (CN107) instead.

## **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Press down MAIN MENU when powering on the controller to enter the maintenance mode.
- 2. Select  $SYSTEM \rightarrow SECURITY \rightarrow MANAGEMENT MODE$ .



# **Mech-Mind Robot Integrations**

|               |                           | 8                |              |     | Į        |                                  | 1        |  |
|---------------|---------------------------|------------------|--------------|-----|----------|----------------------------------|----------|--|
| SYSTEM        | SETUP                     | TING MODE        | SYSTEM       |     | MODE     | OPERATIO                         |          |  |
| FILE 1        | VERSION                   |                  | FILE         |     | inop.    | EDITING<br>MANAGEME<br>SAFETY MU | IODE     |  |
| EX. MEMORY    | CONTROLLER<br>INFORMATION |                  | EX. MEMORY   |     |          |                                  | 3        |  |
| MotoPlus APL. | CPU RESET                 |                  | MotoPlus APL |     |          |                                  |          |  |
| DISPLAY SETUP | ALARM HISTORY             |                  | DISPLAY SETU | JP  |          |                                  |          |  |
| Aa            | QR CODE                   |                  | Aa           |     |          |                                  |          |  |
|               | SECURITY                  |                  |              |     |          |                                  |          |  |
| Main Menu     | Simple Menu 2             | Maintenance mode | Main Menu    | Sim | ple Menu | Maintena                         | nce mode |  |

3. Enter the password (the default password is sixteen 9 's), and then press on *Enter*.

|               |             | Ī                 |       | <b>69</b> |            |  |
|---------------|-------------|-------------------|-------|-----------|------------|--|
| SYSTEM        | SECURIT     | (                 |       |           |            |  |
|               | MODE        | ****              | ***** |           |            |  |
| FILE          |             | Current Password= |       |           |            |  |
| EX. MEMORY    |             |                   |       |           |            |  |
| MotoPlus APL. |             |                   |       |           |            |  |
| DISPLAY SETUR | • <b>  </b> |                   |       |           |            |  |
| Hex D         | ec Bin      | 7                 | 8     | 9         | Clear      |  |
| А             | D           | 4                 | 5     | 6         | Back space |  |
| В             | E           | 1                 | 2     | 3         | Cancel     |  |
| С             | F           | 0                 | •     | 2         | Enter      |  |

4. Select  $SYSTEM \rightarrow SETUP \rightarrow OPTION FUNCTION \rightarrow LAN INTERFACE SETTING.$ 



**Mech-Mind Robot Integrations** 

|  | Ø         |   |  |                | <b>Ø</b> |  |  |  | <b>Ø</b>  |
|--|-----------|---|--|----------------|----------|--|--|--|---|
| ESTIMATION<br>FILE<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION<br>ESTIMATION |           | SYSTEM<br>FILE<br>FLE<br>EX. HENDRY<br>SOLOPIUS APL.<br>DISPLAY SETUP<br>CALL | SETUP<br>LANGUAGE<br>CONTROL GROU<br>APPLICATION<br>OPTION BANK<br>IO MOOLE<br>ONS MEMORY<br>DATE/TION BUNKT | I              |          | FILE<br>FILE<br>Ex. #EMONY<br>Botofice APL.<br>DISPLAY SETUP | CPTION FUNCTION<br>LAN INTERFAC<br>DIA INTERFAC<br>DIA INTERFAC<br>DIA INTERFAC<br>DIA INTERFAC<br>DIA INTERFACE<br>DIA INTER | E SETTING<br>TTON SETTING<br>(CPU Board)<br>TINS TIME<br>MIZATION<br>ITCHING<br>ICATION<br>UME IN JOB<br>SETUP<br>JOCATION<br>IC.<br>(C.<br>(SPO1) | ETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL<br>EETAIL |
| Nain Nenu Simple Henu Mainten  | ance mode | Wain Wenu   | Simple Nenu  | Naintenance mo | de       | Hain Henu  | Simple Menu  | Maintenance mode   | MECH MINI   |

5. In **IP ADDRESS SETTING(LAN2)**, select **MANUAL SETTING**, and then set the **IP ADDRESS** to one in the same subnet as the IPC, and the **SUBNET MASK** to **255.255.255.0**.

|           | 8  |  |
|-----------|--|--|
| SYSTEM    | LAN INTERFACE SETTING<br>HOST SETTING MANUAL SETTING<br>HOST NAME MY-HOST<br>DOMAIN SETTING MANUAL SETTING<br>DOMAIN NAME LOCAL.DOMAIN<br>IP ADDRESS SETTING(LAN2)<br>IP ADDRESS<br>SUBNET MASK<br>IP ADDRESS SETTING(LAN3)<br>IP ADDRESS SETTING(LAN3)<br>IP ADDRESS 172. 16. 0.<br>SUBNET MASK<br>255.255.255. 0<br>DEFAULT GATEWAY SETTING<br>DEFAULT GATEWAY<br>0. 0. 0. 0 | SYSTEM       LAN INTERFACE SETTING         HOST SETTING       MANUAL SETTING         HOST NAME       MY-HOST         DOMAIN SETTING       MANUAL SETTING         DOMAIN SETTING       MANUAL SETTING         DOMAIN SETTING       MANUAL SETTING         DOMAIN NAME       LOCAL.DOMAIN         IP ADDRESS       SETTING LAN2)         IP ADDRESS       SETTING LAN2)         IP ADDRESS       SETTING LAN3)         IP ADDRESS       SETTING LAN3)         IP ADDRESS       SETTING LAN3)         IP ADDRESS       172.16.         SUBNET MASK       255.255.255.         DISPLAY SETUP       DEFAULT GATEWAY SETTING         DEFAULT GATEWAY       0.0.0.0 |
| Main Menu | Simple Menu Maintenance mode   | Main Menu Simple Menu Maintenance mode   |

6. Press the  $\tt ENTER$  key, and then press on  $Y\!E\!S$  in the pop-up message.



| SYSTEM<br>FILE                          | LAN INTERFACE SETTING<br>HOST SETTING MANUAL SETTING<br>HOST NAME MY-HOST<br>DOMAIN SETTING MANUAL SETTING<br>DOMAIN NAME LOCAL.DOMAIN |
|---|--|
| EX. MEMORY<br>BD<br>MotoPlus APL.<br>BD | Wodify?<br>YES NO  |
|   | DEFAULT GATEWAY SETTING NOT USED<br>DEFAULT GATEWAY 0. 0. 0. 0   |
| Main Menu                               | Simple Menu Maintenance mode   |

## Load the Program Files

## **Prepare the Files**

The program files are stored in the installation directory of Mech-Center. The default directory is C:/Mech-Mind/Mech-Center.

Navigate to  $xxx/Mech-Center/mech\_interface/yaskawa$ , and copy the following files to your flash drive.

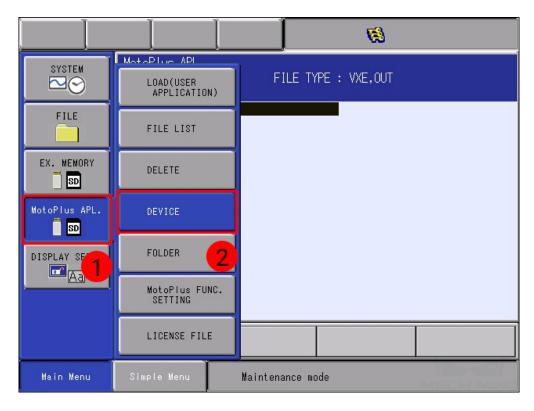
- $\mathbf{JBI}$  folder
- yrc1000.out if you are using a YRC1000 controller
- dx200.out if you are using a DX200 controller

**Note:** Copy the file to the root directory of the flash drive. Do not put it in another folder or rename it.



#### Load the MotoPlus Application File to the Robot

- 1. Insert the flash drive into the USB port on the back of the teach pendant.
- 2. Under maintenance mode, select *MotoPlus APL*.  $\rightarrow$  *DEVICE*.

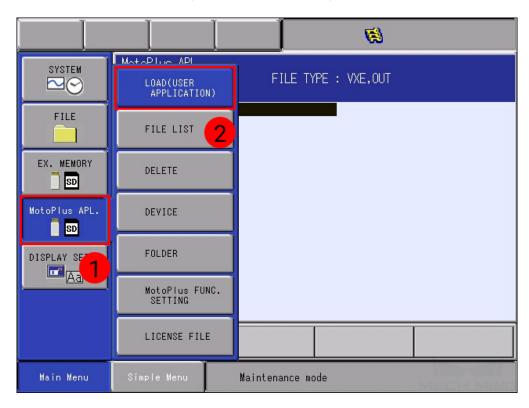


3. Select USB:Pendant for TARGET DEVICE.



|   |              |                | <i>(ii)</i>                        |  |
|---|--------------|----------------|------------------------------------|--|
| SYSTEM  | DEVICE       |                |                                    |  |
| FILE<br>EX. MEMORY<br>SD<br>MotoPlus APL.<br>SD<br>DISPLAY SETUP<br>Maa | TARGET DEVIC | E SD:<br>USB   | Pendant<br>Pendant<br>I:Controller |  |
|   |              |                |                                    |  |
| Main Menu   | Simple Menu  | Maintenance mo | ode                                |  |

4. Select MotoPlus APL.  $\rightarrow$  LOAD(USER APPLICATION).





5. Select **YRC1000.OUT** (**DX200.OUT** for DX200 controller), and press **ENTER**. Select **YES** in the pop-up message to start loading the program.

|               |             | Ø [                 |               |  |               | <b>19</b>     |       |
|---------------|-------------|---------------------|---------------|--|---------------|---------------|-------|
| SYSTEM        | FOLDER : \  | FILE TYPE : VXE,OUT | SYSTEM        | MotoPlus APL.<br>USB:Pendant(L<br>FOLDER : \ | .0AD) FILE T  | YPE : VXE,OUT |       |
| FILE          | YRC1000.OUT | 1                   | FILE          | ★YRC1000.0UT                                 |               |               |       |
| EX. MEMORY    |             | •                   | EX. MEMORY    | *  | Load?         |               |       |
| MotoPlus APL. |             |                     | MotoPlus APL. | YES  | 3             | NO            |       |
| DISPLAY SETUP |             |                     | DISPLAY SETUP |  | 2             |               | ,<br> |
|               |             |                     |               |  |               |               |       |
|               |             |                     |               |  |               |               |       |
| Main Menu     | Simple Menu | nance mode          | Main Menu     | Simple Menu                                  | Maintenance m | ode           |       |

6. After loading completes, go to *MotoPlus APL*.  $\rightarrow$  *FILE LIST*, and you should see **YRC1000.OUT** (**DX200.OUT**) displayed.

|               |                           | <i>Ø</i>            |               |   |                  | Ø         |
|---------------|---------------------------|---------------------|---------------|---|------------------|-----------|
| SYSTEM        | LOAD(USER<br>APPLICATION) | FILE TYPE : VXE,OUT | SYSTEM        | MotoPlus APL.<br>USB:Pendant(LOAD<br>_FOLDER :\ | )) FILE TYPE     | : VXE,OUT |
| FILE          | FILE LIST                 |                     | FILE          | ★YRC1000.OUT                                    |                  |           |
| EX. MEMORY    | DELETE 2                  |                     | EX. MEMORY    |   |                  |           |
| MotoPlus APL. | DEVICE                    |                     | MotoPlus APL. |   |                  |           |
|               | FOLDER                    |                     | DISPLAY SETUP |   |                  |           |
|               | MotoPlus FUNC.<br>SETTING |                     |               |   |                  |           |
|               | LICENSE FILE              |                     |               |   |                  |           |
| Main Menu     | Simple Menu               | Maintenance mode    | Main Menu     | Simple Menu                                     | Maintenance mode | MECH MIND |

# Load the Job Files to the Robot

1. Restart the controller without pressing the MAIN MENU key, and select SYSTEM INFO  $\rightarrow$  SECURITY  $\rightarrow$  MANAGEMENT MODE.



# **Mech-Mind Robot Integrations**

| JOB                 | DIT DISPLAY U             | TILITY 🚺 🔀 🛃       | 1 🗞 🙋 🖵 🙌                    | DATA             | EDIT | DISPLAY    | UTILITY                | 12 🗹 🖬 🕶 🗃 📮 🙌                            |
|---------------------|---------------------------|--------------------|------------------------------|------------------|------|------------|------------------------|---|
| JOB<br>DOUT<br>MOVE |                           | EU LOGDATA         | 0001<br>L: 00                |                  |      | ECURITY    |                        |   |
|                     | Se MONITORING TIME        | Ser Definition     | 8.1.20;50000;2″)             |                  |      |            | MANAGEMEN<br>SAFETY MU | NT MODE                                   |
| VARIABLE            | CONTROLLER<br>INFORMATION | 🖓 CPU RESET        | ″)                           | VARIABLE<br>B001 |      |            |                        | 3   |
|                     | et alarm History          | OR CODE            |                              |                  |      |            |                        |   |
| ROBOT               | ALM CONT.<br>CUSTOMIZE    | NETWORK UTILITY    |                              |                  |      |            |                        |   |
| SYSTEM INFO         | J/O MSG HISTORY           | 🚤 USER PASSWORD    |                              | SYSTEM INFO      |      |            |                        |   |
|                     | RETWORK SERVICE           | - SECURITY         |                              |                  |      |            |                        |   |
| Main Menu           | Simple Menu               | ult in premature 2 | ure of the robot. Set W, Xg, | Main Menu        | S    | imple Menu | without                | setting tool info, may result in prematur |

2. Enter the password (the default password is sixteen 9 's), and then press on *Enter*.

| DATA     | EDIT  | DISPLAY | UTILI       | TY 🛛 🕄 🖻 | M ⊷ 🔞 | 📮 <del>(h</del> |  |  |  |
|----------|-------|---------|-------------|----------|-------|-----------------|--|--|--|
| JOB      | SECU  | RITY    |             |          |       |                 |  |  |  |
| DOUT     | _ M   | IODE    | *********** |          |       |                 |  |  |  |
|          |       | Curre   | nt Pass     | sword=   |       |                 |  |  |  |
| VARIABLE | 1     |         |             |          |       |                 |  |  |  |
| B001     |       |         |             |          |       |                 |  |  |  |
|          |       |         |             |          |       |                 |  |  |  |
| ROBOT    |       |         |             |          |       |                 |  |  |  |
| Hex D    | ec Bi | in      | 7           | 8        | 9     | Clear           |  |  |  |
| nex D    | ес в  |         | /           | 0        | 9     | Clear           |  |  |  |
| A        | D     |         | 4           | 5        | 6     | Back space      |  |  |  |
| В        | E     |         | 1           | 2        | 3     | Cancel          |  |  |  |
| С        | F     |         | 0           |          | 2     | Enter           |  |  |  |

3. Press on the right arrow button, and select  $SETUP \rightarrow TEACHING COND$ .



| DATA          | EDIT DISPLAY |           | ] 12 🗷 🖌              | 1 📢 🔟 🖳 🙌                |        |
|---------------|--------------|-----------|-----------------------|--------------------------|--------|
| EX. MEMORY    | SECURITY     | ond. [3   | NCTION COND.          | *** USER ID              |        |
| PARAMETER     | OPERATE CO   | ND.       | ISPLAY COLOR<br>COND. | SET SPEED                |        |
| SETUP         | 2 PERATE EN  | ABLE 🕒 L  | OGDATA COND.          | KEY ALLOCATION           |        |
| SAFETY FUNC.  | FUNCTION E   | NABLE 🔁 D | ATE/TIME              | SIMULTANEOUS<br>KEY HELP |        |
| PM            | JOG COND.    | s end     | ET WORD               | € JOG KEY ALLOC.         |        |
| MotoPlus APL. | PLAYBACK C   |           | ESERVE JOB<br>NAME    | 🔊 AUTO BACKUP SET        |        |
|               | ]            |           |                       | <u> </u>                 |        |
| Main Menu     | Simple Menu  | in p      | remature failure      | e of the robot. Set ₩,   | Xg, Yg |

4. Set LANGUAGE LEVEL to EXPANDED.

| DATA E   | DIT DISPLAY  | UTILITY   | 12 🗳 🖌   | 🔞 🔟 🖳 🙌   |      |
|--|--|---|--|---|------|
| EX. MEMORY<br>PARAMETER<br>SETUP<br>SAFETY FUNC.<br>PM<br>MotoPlus APL.<br>SD<br>MotoPlus APL. | TEACHING COND<br>LANGUAGE LEVE<br>INSTRUCTION I<br>MOVE INSTRUCT<br>BUZZER WHEN P<br>STEP ONLY CHA<br>RECT/CYLINDRI<br>TOOL NO. SWIT<br>TOOL NO. INTL<br>CHECK AT P-VA<br>POS.TEACH ONL<br>JOB UNDELETE<br>TEST RUN CONT<br>MANUAL SPEED<br>USER ALARM CA<br>PROMP BEF OVE | L<br>NPUT LEARNING<br>ION SET POSIT<br>OSITION TEACH<br>NGING<br>CAL<br>CH<br>K FOR STEP EN<br>R TOOL NO. CH<br>Y JOG CONTROL<br>FUNCTION<br>ROL<br>SELECT(TEST R<br>PACITY | i<br>TON<br>HING<br>ITRY<br>HANGE<br>. GROUP<br>RUN) | SUBSET<br>STANDARD<br>EXPANDED<br>CONSIDER<br>PROHIBIT<br>RECT<br>PROHIBIT<br>INVALID<br>PROHIBIT<br>INVALID<br>HIGH ACCURACY<br>INVALID<br>STANDARD<br>INVALID |      |
| Main Menu  | Simple Menu  | bot. Set  | W, Xg, Yg, a   | nd Zg in the tool fil   | MIND |



5. Select *EX. MEMORY*  $\rightarrow$  *DEVICE*, and then select **USB:Pendant** for **DEVICE**.

| DATA  | DIT DISPLAY   | UTILITY 1 🔀   | 1 👒 🔟 📑 🙌   | DATA  | EDIT | DISPLAY  | UTILITY  | 12 🗳 🕷 🕲 📮 🔭                                    |
|---|---|---|---|---|------|--|----------|---|
| EX. HENORY<br>SS<br>PARAMETER<br>SETUP<br>SAFETY FUNC.<br>PM<br>MotoPlus APL.<br>SD | DAD<br>SAVE<br>VERIFY<br>CONTINUE<br>DEVICE<br>FOLDER | SETTING<br>EARNING<br>T POSITION<br>W TEACHING<br>STEP ENTRY<br>. NO. CHANGE<br>CONTROL GROUP<br>22<br>(TEST RUN)<br>F POS VARIABLE | EXPANDED<br>VALID<br>LINE<br>CONSIDER<br>PROHIBIT<br>RECT<br>PROHIBIT<br>PERMIT<br>INVALID<br>NVALID<br>STANDARD<br>INVALID | EX. MEMORY<br>PARAMETER<br>SETUP<br>SAFETY FUNC<br>PM<br>MotoPlus APL |      | EVICE / SETU<br>DEVICE<br>FILE SAVE (<br>JOB LOAD OV | VERWRITE | SD: Pendant<br>USBBRendant<br>USB1: Cont roller |
|   |   |   |   |   |      |  |          |   |
| Main Menu   | Simple Menu   | W, Xg, Yg, and Zg in  | the tool file. Using  | ob Main Menu  | SI   | imple Menu   | re fail  | ure of the robot. Set W, Xg, Yg, and Zg in      |

6. Select *EX. MEMORY*  $\rightarrow$  *FOLDER*, and then select **JBI** from the list.

Note: Make sure you are IN the JBI folder (JBI is displayed after TARGET FOLDER).

| DATA          | DIT DISPLAY UTILITY | 12 🗷 📶 🧐 🖾 🕀 👘                          | DATA          | EDIT DISPLA                 | Y UTILITY | 12 🗹 🖌 🕫 🐻 📮 🙌                         |
|---------------|---------------------|---|---------------|-----------------------------|-----------|--|
| EX. MEMORY    | 1 OAD               | USB:Pendant                             | EX. MEMORY    | FOLDER LIST<br>TARGET FOLDE | R JBI     | ⊐ 3                                    |
| SETUP         | save TE             | INVALID<br>INVALID                      | SETUP         | FOLDER NUM.                 |           | _                                      |
| SAFETY FUNC.  | VERIFY              |   | SAFETY FUNC.  |                             |           |  |
| PM            | DELETE              |   | PM            |                             |           |  |
| MotoPlus APL. | 4월 DEVICE           |   | MotoPlus APL. | Í                           |           |  |
| DISPLAY SETUP | 🖗 FOLDER 🛛 🙎        |   | DISPLAY SETUP |                             |           |  |
|               |                     |   |               |                             |           |  |
| Main Menu     | Simple Menu         | le. Using robot without setting tool in | Main Menu     | Simple Menu                 |           | Xg, Yg, and Zg in the tool file. Using |

7. Select EX.  $MEMORY \rightarrow LOAD$ .



| DATA       | EDIT | DISPLAY   | UTILITY    | 12 🖻 ۲       | 1 😣 🔟        | 📮 🖰          |   |
|------------|------|-----------|------------|--------------|--------------|--------------|---|
| EX. MEMO   | RY   | LOAD      |            |              |              |              |   |
| SETUP      | 1    | SAVE      | 2          |              |              |              |   |
| SAFETY FUI | NC.  | VERIFY    |            |              |              |              |   |
| PM         |      | DELETE    |            |              |              |              |   |
| MotoPlus A | .PL. | DEVICE    |            |              |              |              |   |
| DISPLAY SE | TUP  | ⊘ FOLDER  |            |              |              |              |   |
|            |      |           |            |              |              |              |   |
| Main Men   | u Si | mple Menu | <b>i</b> e | t W, Xg, Yg, | and Zg in th | e tool file. | ι |

8. Select  $EDIT \rightarrow SELECT ALL$ , and then press ENTER. Select **YES** in the pop-up message to start loading the programs.

| DATA       | EDIT                              | <b>1</b> AY  | UTILITY   | 12 🖻 🖬 🕻          | 🕯 🐻 🖳 🙌           | Ţ         | DATA       | EDIT            | DISPLAY                               | UTILITY               | 12 🖻 🖌       | 😣 🙋 🖳          | •             |
|------------|-----------------------------------|--|-----------|-------------------|-------------------|-----------|------------|-----------------|---------------------------------------|-----------------------|--------------|----------------|---------------|
| EX. MEMO   | SELECT ALL                        |  | DEVICE(LO | AD)               | SINGLE NO.        | 18        | EX. MEMO   | DEV             | ERNAL MEMOF<br>ICE USB:Per<br>DER JBI | Y DEVICE(LO/<br>idant | ND)          | SINGLE         | IO. <u>18</u> |
| SAFETY FU  | SELECT MARK<br>(*)<br>CANCEL SELE |  |           |                   |                   |           | SETUP      | ★M              | M_AUTO_CALI<br>M_CALIB<br>M_GET_DOLIS | ST                    |              |                |               |
| PM         | MM_<br>MM_                        | GET_POSE<br>GET_STATUS<br>GET_VISDAT<br>GET_VIZDAT   | A         |                   |                   |           |            |                 |                                       | Load                  |              |                |               |
| MotoPlus A | PL. MM_<br>MM_                    | INIT_SOCKE<br>SET_BOXSIZ<br>SET_BRANCH<br>SET_DOLIST | Έ<br>Ι    |                   |                   |           | MotoPlus A | <b>*</b> M      | M_SET_BRANG                           | <b>—</b> і 😈          | NO           |                |               |
|            |                                   | SET_INDEX  |           |                   |                   |           |            | <sup>™</sup> ★M | M_SET_INDE>                           | (                     |              |                |               |
| Main Men   |                                   | le Menu  | f:        | ailure of the rob | ot. Set W, Xg, Yg | ş, and Zg | Main Men   | u Sii           | ple Menu                              | et                    | W, Xg, Yg, a | nd Zg in the t | ool file. L   |

9. After loading completes, go to  $JOB \rightarrow SELECT JOB$ , and you should see all the job files displayed.



# **Mech-Mind Robot Integrations**

| DATA                | DIT DISPLAY UT | TILITY 🚺 🗈 🖬     | 😣 🔟 🖳 🙌 🛛 🖻              | JOB         | DIT DISPLAY                                    | UTILITY  | 12 🗷 📶 👒 🔟 🗔 👘                              |
|---------------------|----------------|------------------|--------------------------|-------------|--|----------|---|
| JOB<br>DOUT<br>MORE | JOB            | PLAY EDIT JOB    | SINGLE NO. 18            |             | JOB LIST                                       |          |   |
|                     | SELECT JOB     |                  |                          |             | MM_AUTO_CALIN<br>MM_CALIB<br>MM_GET_DOLIS      |          |   |
| VARIABLE<br>B001    |                |                  |                          | VARIABLE    | MM_GET_JPS<br>MM_GET_POSE                      |          |   |
|                     | AASTER JOB     |                  |                          |             | MM_GET_STATU:<br>MM_GET_VISDA<br>MM_GET_VIZDA  | TA<br>TA |   |
| ROBOT               | JOB CAPACITY   |                  |                          | ROBOT       | MM_INIT_SOCK<br>MM_SET_BOXSI:<br>DATE/TIME :20 |          | 2.42  |
| SYSTEM INFO         | CYCLE          |                  |                          | SYSTEM INFO | GROUP SET :R1<br>COMMENT :                     |          | 40  |
|                     | JOB EDIT(PLAY) |                  |                          |             |  |          |   |
| Main Menu           | Simple Menu    | ₩, Xg, Yg, and Z | g in the tool file. Usir | Main Menu   | Simple Menu                                    | a)       | v result in premature failure of the robot. |

# **Test Robot Connection**

# Configure Mech-Interface in Mech-Center

- 1. Open Mech-Center and click on *Deployment Settings*.
- 2. Go to Mech-Interface, check Use Mech-Interface and select Standard Interface.

| Deployment Settings |   | ×           |
|---------------------|---|-------------|
|                     |   |             |
| Inte                | Use Robo-Interface 2<br>erface Service Type<br>Standard Interface 3 • Adapter |             |
|                     |   |             |
|                     |   | Save Cancel |



- 3. Set the following fields:
  - Interface Option: Set to TCP Server and ASCII.
  - Listed robot: Select the robot model you are using.
  - Host Address: The default port number is **50000**. If you need to change the port number, make sure to change it later on in the robot program as well.
- 4. Click on Save.

| Deployment Settings |   |            |                          |   | ×      |
|---------------------|---|------------|--------------------------|---|--------|
| Deployment Settings | <ul> <li>Use Mech-Interface</li> <li>Interface Service Type</li> <li>Standard Interface</li> <li>Interface Options</li> <li>Listed robot</li> <li>Custom robot</li> <li>Host Address</li> </ul> | TCP Server | Adapter<br>YASKAWA_GP180 | <ul> <li>ASCII ▼</li> <li>sxyz</li> </ul> |        |
|                     |   |            |                          | 2<br>Save                                 | Cancel |

5. Click on *Start Interface* in the Toolbar.



# Modify and Run Robot Program

1. Select  $JOB \rightarrow SELECT JOB$ .

| DATA             | DIT DISPLAY U  | лісту 🚺 🗈 🖌      | 😒 🔟 📑 👘 🗈                 |
|------------------|----------------|------------------|---------------------------|
|                  | JOB            | PLAY EDIT JOB    | SINGLE NO. 18             |
|                  | SELECT JOB     |                  |                           |
| VARIABLE<br>B001 |                |                  |                           |
|                  | AASTER JOB     |                  |                           |
| ROBOT            | JOB CAPACITY   |                  |                           |
| SYSTEM INFO      | TR CYCLE       |                  |                           |
|                  | JOB EDIT(PLAY) |                  |                           |
| ,<br>Main Menu   | Simple Menu    | W, Xg, Yg, and Z | Zg in the tool file. Usir |

2. Select  $MM\_AUTO\_CALIB$  in the **JOB LIST**, and then press the SELECT key.



| JOB E                                      | DIT DISPLAY UTILITY 🚺 🏠 🖾 场 🧐 🖳 🙌   |
|--|---|
| JOB<br>DOUT<br>GENERAL<br>VARIABLE<br>BOO1 | JOB LIST<br>1<br>MM_AUTO_CALIB<br>MM_CALIB<br>MM_GET_DOLIST<br>MM_GET_POSE<br>MM_GET_POSE |
|  | MM_GET_STATUS<br>MM_GET_VISDATA<br>MM_GET_VIZDATA<br>MM_INIT_SOCKET<br>MM_SET_BOXSIZE     |
| SYSTEM INFO                                | DATE/TIME :2022/06/07 14:34<br>GROUP SET :R1<br>COMMENT :                                 |
|  |   |
| Main Menu                                  | Simple Menu ting tool info. may result in premature failure of                            |

- 3. Change the IP address and port number in line 0001 to the actual ones of the IPC:
  - 1. Move the cursor to the instruction side of line 0001, and press SELECT. a text box will show on the bottom.



| JOB            | EDIT | DISPLAY  | UTILITY    | 12 🗹 🖬 😣 🐻 🕻               | 🤰 🕀               |
|----------------|------|--|------------|----------------------------|-------------------|
|                | J:M  | CONTENT<br>M_AUTO_CALIE<br>TROL GROUP:             |            | S:0000<br>TOOL: **         |                   |
|                | 00   | 00 NOP<br>01 <mark>CALL JOB</mark><br>02 MOVJ PO99 |            | CKET (~192.168.1.20;500    | 00;2″)            |
| VARIABLE       | 00   | 03 TIMER T=<br>04 CALL JOB<br>05 END               |            | <i>"</i> 1;1;1;6;0;99″)    |                   |
|                |      |  |            |                            |                   |
|                |      |  |            |                            |                   |
| SYSTEM INF     |      | LL JOB:MM_I  | NIT_SOCKET | (~192.168.1.20;50000;2     | ")                |
|                |      |  |            |                            |                   |
| ,<br>Main Menu | Sin  | ple Menu   |            | e robot. Set W, Xg, Yg, an | nd Zg in the tool |

2. In the text box, move the cursor to the IP address and port number, and press ENTER.

| JOB           | IT 🛛 DISPLAY 🖉 UTILITY 🗍 🏠 🔀 📶 😒 🐻 🖳 🕀   |
|---------------|--|
|               | JOB CONTENT<br>J:MM_AUTO_CALIB S:0000<br>CONTROL GROUP: R1 TOOL: **                                      |
|               | 0000 NOP<br>0001 <mark>CALL JOB:MM_INIT_SOCKET (~192.168.1.20;50000;2~)</mark><br>0002 MOVJ P099 VJ=5.00 |
| VARIABLE B001 | 0003 TIMER T=1.00<br>0004 CALL JOB:MM_CALIB (~1;1;1;6;0;99~)<br>0005 END                                 |
|               |  |
| ROBOT         |  |
| SYSTEM INFO   | CALL JOB:MM_INIT_SOCKET (~192.168.1.20;50000;2~)   |
|               |  |
| Main Menu     | Simple Menu result in premature failure of the robot. Se   |



3. Change the IP address and port number, and then press on *Enter*.

| DATA     | EDI   | T      | DISPLAY       | Тлл    | LITY | 12 🗳    | i 📶 🕻 | 8     | <b> </b> | ð 🖸            |
|----------|-------|--------|---------------|--------|------|---------|-------|-------|----------|----------------|
| [Resu    | t] [] | 92.168 | .1.20;        | 50000; | 2    |         |       |       | Regi     | ster           |
|          | 1     |        |               |        |      |         |       |       |          |                |
|          |       |        |               |        |      |         |       |       |          |                |
| KEYBOAR  | D SY  | MBOL   | REGIST<br>WOR |        |      |         |       |       |          |                |
| 1        | 2     | 3      | 4             | 5      | 6    | 7       | 8     | 9     | 0        | Back<br>Space  |
| Q        | w     | Е      | R             | т      | Y    | U       | I     | 0     | Ρ        | Cancel         |
| A        | s     | D      | F             | G      | н    | J       | к     | L     |          | ipsLock<br>OFF |
| Z        | ×     | (      | : v           | E      | 3 1  | J N     | 1 S   | pace  | E        | Enter          |
| Main Men | u I   | Simple | Menu          |        | ı t  | he tool | file. | Using | robot    | without set!   |

4. Insert a **PAUSE** command after line 0001: make sure the cursor is on line 0001, and press INFORM LIST. Select  $CONTROL \rightarrow PAUSE$  in the pop-up menu, and press INSERT and then ENTER.



| JOB         | EDIT DISPLAY                                     | UTILITY | 12 🗳        | <mark>₩ %</mark> { | 🖲 🖵 🕀       |             |
|-------------|--|---------|-------------|--------------------|-------------|-------------|
| JOB         | JOB CONTENT<br>J:MM_AUTO_CALIB                   |         |             | 0.0000             |             | IN/OUT      |
|             | CONTROL GROUP: R                                 | JUMP    | ABORT       | SETUALM            | ELSE        | CONTROL     |
|             | 00000 NOP<br>0001 CALL JOB:M<br>0002 MOVJ P099 V | CALL    | CWAIT       | SWITCH             | LATESTJOB   | DEVIC       |
| VARIABLE    | 0003 TIMER T=1.0                                 | TIMER   | PRINT       | CASE               | SETTM       | MOTION      |
| B001        | 0004 CALL JOB:MN<br>0005 END                     | LABEL   | CLS         | DEFAULT            |             | ARITH       |
|             |  | COMMENT | MSG         | WHILE              |             | SHIFT       |
| ROBOT       | 1  | RET     | INPUT       | FOR                |             | OTHER       |
|             |  | NOP     | ADVINIT     | IFTHEN             |             | SAME        |
| SYSTEM INFO | PAUSE  | PAUSE   | ADVSTOP     | ELSEIF             |             | PRIOR       |
|             |  | 2       |             |                    |             |             |
| Main Menu   | Simple Menu                                      | n.      | g robot wit | hout setti:        | ng tool inf | o. may resi |

- 5. Turn the mode switch to TEACH mode, press the SERVO ON READY key, and then hold down the enable switch on the back while moving the cursor back to line 0000.
- 6. Press the INTERLOCK key and TEST START key at the same time; the job will start running and should be paused after line 0001.
- 7. The robot can be successfully connected if Mech-Center's **Log** panel displays the following messages:
  - Mech-Center: client connected
  - A message showing the **client address**
  - Mech-Center: client disconnected
  - Mech-Center: waiting for client to connect





**Note:** Delete **PAUSE** after testing the connection to avoid pausing the robot by mistake during calibration.

# 2.2.2 YASKAWA Calibration Program

This section introduces the process of calibrating the camera extrinsic parameters using the calibration program.

The process consists of 4 steps:

- Select the Calibration Program
- Teach the Calibration Start Point
- Run the Calibration Program
- Start Calibration in Mech-Vision

Before proceeding, please make sure that:

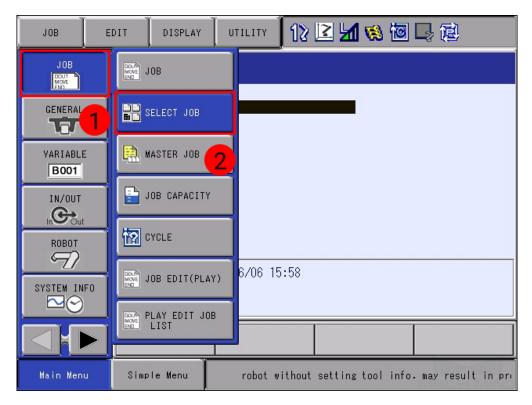
- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You are familiar with the contents in calibration\_guide.

**Note:** This section is intended for scenarios where the communication between the robot and Mech-Center is established through Standard Interface, and calibration has to be performed frequently.



## Select the Calibration Program

1. Select  $JOB \rightarrow SELECT JOB$ .



2. Select MM\_AUTO\_CALIB in the JOB LIST, and then press the SELECT key.



| JOB   | EDIT                                  | DISPLAY   | UTILITY                  | 12 🗷 📶         | 🔞 🔟 📑 (        |              |
|---|---------------------------------------|---|--------------------------|----------------|----------------|--------------|
| JOB<br>GENERAL<br>VARIABLE<br>BOO1<br>IN/OUT<br>IN/OUT<br>ROBOT | 1<br>MM<br>MM<br>MM<br>MM<br>MM<br>MM | _<br>LIST<br>_AUTO_CALII<br>_CALIB<br>_GET_DOLIS'<br>_GET_POSE<br>_GET_VISDA'<br>_GET_VISDA'<br>_GET_VIZDA'<br>_INIT_SOCKI<br>_SET_BOXSIJ | T<br>S<br>TA<br>TA<br>ET |                |                |              |
| SYSTEM INFO   | GRO                                   | E/TIME :20<br>JPSET :R1<br>MENT :   | 122/06/06 15             | 5:58           |                |              |
|   | ·                                     |   |                          |                |                |              |
| Main Menu   | Simp                                  | ole Menu  | ı premat                 | ure failure of | the robot. Set | W, Xg, Yg, a |

## Teach the Calibration Start Point

- 1. Move the robot to the start point for the calibration.
- 2. Move the cursor to the instruction side of line 2, and press the  $\tt DIRECT$  OPEN key.



| JOB              | EDIT | DISPLAY                              | UTILITY             | 12 🛙     | 2 📶 형             |           | } <del>(</del> †) |     |
|------------------|------|--------------------------------------|---------------------|----------|-------------------|-----------|-------------------|-----|
|                  | J:MM | CONTENT<br>_AUTO_CALIE<br>ROL GROUP: |                     |          | S:0001<br>TOOL: ( |           |                   |     |
|                  | 000  | 2 MOVJ P098                          |                     | CKET ("  | 192.168.1.        | .20;5000  | 0;2″)             |     |
| VARIABLE<br>B001 | 000  | 3 TIMER T=<br>4 CALL JOB:<br>5 END   | I.00<br>MM_CALIB (1 | ″1;1;1;  | 6;0;99″)          |           |                   |     |
|                  | ļ    |                                      |                     |          |                   |           |                   |     |
| SYSTEM INFO      | ļ    |                                      |                     |          |                   |           |                   |     |
|                  | MOV  | /J P099 VJ=                          | 5.00                |          |                   |           |                   |     |
|                  |      |                                      |                     |          |                   |           |                   |     |
| Main Menu        | Simp | )le Menu                             | Zg in               | the tool | file.             | Using rol | bot without s     | eti |

3. Change the value of P099 to the current pose of the robot: press SERVO ON READY key, and then press MODIFY and then ENTER while holding down the enable switch on the back. Make sure the value for **TOOL** is **00**.

| DATA  | DIT DISPLAY                   |               | 🖻 🌌 😵 🔟                    | 🕞 <del>(†</del> ) 🕨 |
|---|-------------------------------|---------------|----------------------------|---------------------|
| JOB<br>GENERAL<br>VARIABLE<br>BOO1<br>IN/OUT<br>IN/OUT<br>ROBOT<br>SYSTEM INFO<br>SYSTEM INFO | Y -3<br>Z 3<br>R× -17<br>Ry - |               | S< 180<br>R< 180<br>T< 180 |                     |
|   |                               |               | PAGE                       |                     |
| Main Menu   | Simple Menu                   | ne tool file. | Using robot wi             | thout setting tool  |



4. Press DIRECT OPEN again to return to the job.

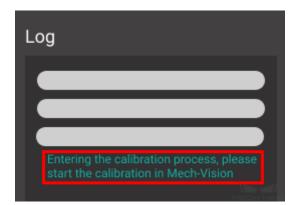
## **Run the Calibration Program**

- 1. Move the cursor back to line 0000, and turn the mode switch to PLAY mode, and press the SERVO ON READY key.
- 2. To move the robot at low speed, go to  $UTILITY \rightarrow SETUP$  SPECIAL RUN, and change **SPEED** LIMIT to VALID.

| JOB                 | DIT DISPLAY  | UTILITY              | 2 📶 🐝 🔟 🖵 🔃                           | DATA        | EDIT   | DISPLAY                                     | UTILITY | 12 🖻 📶 😣                                 | 10 12 12  |
|---------------------|--|----------------------|---------------------------------------|-------------|--------|---|---------|--|-----------|
| JOB<br>MOVE<br>END  | PLAYBACK<br>J:MM_AUTO_CALIE<br>CONTROL GROUP:                  | SETUP SPECIAL<br>RUN | 23:0000<br>TOOL: **                   |             | LOW    | IAL PLAY<br>SPEED STAR<br>D LIMIT           | Γ       | INVALII<br>VALID                         | 3         |
| GENERAL<br>VARIABLE | 00000 NOP<br>0001 CALL JOB:<br>0002 MOVJ P098<br>0003 TIMER T= |                      | (″192.168.1.20;50000;2″)              |             | MACH   | RUN SPEED<br>IINE LOCK<br>K-RUN<br>PROHIBIT |         | INVALII<br>INVALII<br>INVALII<br>INVALII |           |
| IN/OUT              |  | MM_CALIB ( T;T;      | 1;6;0;99″)                            | IN/OUT      | , MEAV | FRUHIBIT                                    |         | IINVALII                                 | 2         |
|                     |  |                      |                                       |             |        |   |         |  |           |
| SYSTEM INFO         |  |                      |                                       | SYSTEM INFO |        |   |         |  |           |
|                     |  |                      |                                       |             |        |   | COMPLET | E  |           |
| Main Menu           | Simple Menu  | setting tool         | info, may result in premature failure | Main Menu   | Sim    | ple Menu                                    | E SF    | EED LIMIT mode                           | MECH MIND |

3. Press the START button. The program starts to run when the button lights up.

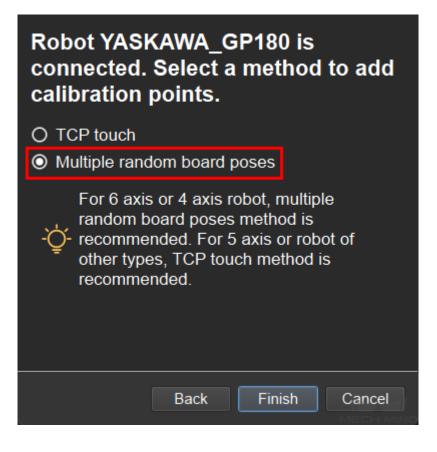
4. Proceed to the next section when the following message is displayed in Mech-Center's Log panel: Entering the calibration process, please start the calibration in Mech-Vision





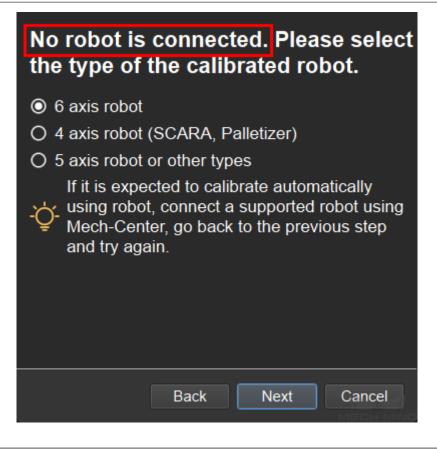
#### Start Calibration in Mech-Vision

- 1. In Mech-Vision, click on Camera Calibration (Standard) in the Toolbar, or select Camera  $\rightarrow$  Camera Calibration  $\rightarrow$  Standard from the Menu Bar.
- 2. Follow the instructions in Mech-Vision to complete the following configuration:
  - 1. Select **Start a new calibration process**;
  - 2. Select the camera mounting method;
  - 3. Select Multiple random board poses for adding calibration points.



**Note:** If after selecting the camera mounting method, the window says **No robot is connected**, the connection between the robot and Mech-Center is not properly established. Please re-run the robot program.





3. Follow the instructions in Mech-Vision to finish the calibration.

**Note:** In **5** Add Marker-Images and Poses after you click on *Move Robot along Trajectory and Add Board Images*, if the robot does not reach the next calibration point within 60 seconds, Mech-Vision will report a timeout error and stop the calibration process. In such case, please select **calibration** in the program directory and run this program again, and restart the calibration process in Mech-Vision.

# 2.2.3 YASKAWA Example Program

This section introduces the example program provided with Mech-Center and the operations required to perform an actual pick-and-place task.

The example program **mm\_sample.JBI** can be found in *Mech-Center/mech\_interface/yaskawa*. It contains two parts: the first part obtains vision results from Mech-Vision; the second part obtains planned path from Mech-Viz.

Check the section corresponding to your own application setup:

- Obtain Vision Results from Mech-Vision
- Obtain Planned Path from Mech-Viz

Before running the program, please make sure that:



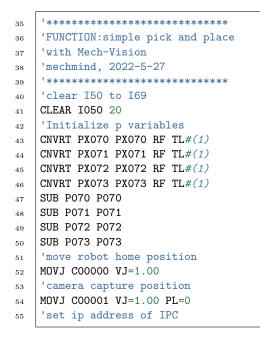
- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You have completed the extrinsic parameter calibration with the calibration program or by manually adding calibration points.
- Mech-Vision and Mech-Viz projects are created and set to autoload.
- The **Project list** in Mech-Center  $\rightarrow$  Deployment Settings  $\rightarrow$  Mech-Vision is synced by clicking on 1Ļ

and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings |  |              | $\times$ |
|---------------------|--|--------------|----------|
| Mech-Vision         | ✓ Use Mech-Vision<br>Exec path<br>Project path |              |          |
|                     | ID<br>1  | Project list |          |
|                     |  |              |          |

- The TCP has been correctly specified.
- The robot speed is set to a low value, so that the operator can notice any unexpected behavior before accidents occur.

#### **Obtain Vision Results from Mech-Vision**



(continues on next page)



(continued from previous page)

```
CALL JOB:MM_INIT_SOCKET ARGF"192.168.170.22;50000;1"
56
    TIMER T=0.20
57
    'set vision recipe
58
    'MM_SET_MODEL("1,1")
59
    'Run vision project
60
    CALL JOB:MM_START_VIS ARGF"1;2;2"
61
    TIMER T=1.00
62
    'get result from Vis
63
    CALL JOB:MM_GET_VISDATA ARGF"1;50;51;52"
64
    TIMER T=0.20
65
    PAUSE IF 1052<>1100
66
    'set the first pos to P071;
67
    'set lables to I61;
68
     'set speed to I62;
69
    CALL JOB:MM_GET_POSE ARGF"1;71;61;62"
70
    PAUSE IF I061<>1
^{71}
72
    'set -200mm to Z
    SETE P070 (3) -200000
73
   MULMAT P072 P071 P070
74
    'set -300mm to Z
75
   SETE P070 (3) -300000
76
   MULMAT P073 P071 P070
77
    'way point
78
   MOVJ C00002 VJ=1.00
79
   MOVL P072 V=80.0 PL=0
80
    MOVL P071 V=80.0 PL=0
81
    'enable girpper
82
    DOUT OT#(1) ON
83
    MOVL P073 V=80.0 PL=0
84
85
    MOVJ CO0003 VJ=1.00
86
    'drop point
    MOVJ CO0004 VJ=1.00 PL=0
87
    'release gripper
88
    DOUT OT#(1) OFF
89
    'way point
90
    MOVJ CO0005 VJ=1.00
^{91}
    'move robot home position
^{92}
    MOVJ C00006 VJ=1.00
93
```

#### **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with MM\_INIT\_SOCKET.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_SET\_MODEL.
- 5. Run the Mech-Vision project with **MM\_START\_VIS**.
- 6. Wait for 1 second. Under Eye-In-Hand, this **TIMER** instruction is required to make sure the robot stays still until image acquisition is completed. Under Eye-To-Hand, this **TIMER** instruction can be replaced with **MOVJ** or **MOVL**.



- 7. Obtain the vision results from Mech-Vision.
- 8. Check if the returned status code indicates any error. If an error code is returned, the program is paused.
- 9. Move the robot to the picking pose and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

#### Define the TCP

Change TL#(1) to the tool number to which the actual TCP is saved.

Note: Do not use TOOL 0 as it is used for calibration in MM\_AUTO\_CALIB.

#### Teach the Image Capturing Pose

Record the image capturing pose in **C00001** in line 54.

#### Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

Record the waypoints to C00002 in line 79 and C00005 in line 91. You can add more waypoints if needed.

#### Teach the Placing Pose

Record the placing pose in C00004 in line 87.

#### Define Z-Offset from Picking/Placing Pose

Z-offset distances relative to the tool frame from the picking/placing pose are used to ensure collision doesn' t occur when the robot is approching or departing the picking/placing pose.

The **MULMAT** function is used to calculate and store the pose representing the offset from the picking pose in a new variable.

Adjust the following commands according to your actual needs.

• SETE P070 (3) -200000 in line 73: the Z-offset when approching the picking pose is set to 200 mm. Robot will move to P072, which is 200 mm above the picking pose.



• SETE P070 (3) -300000 in line 75: the Z-offset when departing the picking pose is set to 300 mm. Robot will move to P073, which is 300 mm above the picking pose.

## Add Object Grasping and Releasing Logics

Modify **DOUT OT#(1) ON** in line 83 to the actual logic for controlling the tool action when picking the object.

Modify **DOUT OT#(1) OFF** in line 89 to the actual logic for controlling the tool action when placing the object.

## Define HOME position

Teach HOME position to **C00000** in line 52.

#### **Obtain Planned Path from Mech-Viz**

```
94
    'FUNCTION:simple pick and place
95
     'with Mech-Viz
96
    'mechmind, 2022-5-27
97
     ******
98
    'clear I50 to I69
99
    CLEAR 1050 20
100
    'Initialize p variables
101
    CNVRT PX071 PX071 RF TL#(1)
102
    CNVRT PX072 PX072 RF TL#(1)
103
    CNVRT PX073 PX073 RF TL#(1)
104
    SUB P071 P071
105
    SUB P072 P072
106
    SUB P073 P073
107
108
    'move robot home position
    MOVJ C00007 VJ=1.00
109
110
    'camera capture position
    MOVJ C00008 VJ=1.00 PL=0
111
     'set ip address of IPC
112
    CALL JOB:MM_INIT_SOCKET ARGF"192.168.170.22;50000;1"
113
    TIMER T=0.20
114
     'set vision recipe
115
    CALL JOB:MM_SET_MODEL ARGF"1;1"
116
117
    TIMER T=0.20
    'Run Viz project
118
    CALL JOB:MM_START_VIZ ARGF"1"
119
    TIMER T=0.20
120
    CALL JOB:MM_SET_BRANCH ARGF"1;1"
121
    'get result from Viz
122
    TIMER T=1.00
123
    CALL JOB:MM_GET_VIZDATA ARGF"2;50;51;52;53"
124
    TIMER T=0.20
125
    PAUSE IF 1053<>2100
126
127
    'set the first pos to P071;
128
    'set lables to I61;
```

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(continued from previous page)

| 129 | 'set speed to I62;                    |
|-----|---------------------------------------|
| 130 | CALL JOB:MM_GET_POSE ARGF"1;71;61;62" |
| 131 | PAUSE IF I061<>1                      |
| 132 | 'set the second pos to P072;          |
| 133 | 'set lables to I63;                   |
| 134 | 'set speed to I64;                    |
| 135 | CALL JOB:MM_GET_POSE ARGF"2;72;63;64" |
| 136 | PAUSE IF I063<>1                      |
| 137 | 'set the third pos to P073;           |
| 138 | 'set lables to I65;                   |
| 139 | 'set speed to I66;                    |
| 140 | CALL JOB:MM_GET_POSE ARGF"3;73;65;66" |
| 141 | PAUSE IF I065<>1                      |
| 142 | 'way point                            |
| 143 | MDVJ C00009 VJ=1.00                   |
| 144 | MOVL P071 V=80.0 PL=0                 |
| 145 | MOVL P072 V=80.0 PL=0                 |
| 146 | 'enable girpper                       |
| 147 | DOUT OT#(1) ON                        |
| 148 | MOVL P073 V=80.0 PL=0                 |
| 149 | 'way point                            |
| 150 | MOVJ C00010 VJ=1.00                   |
| 151 | 'drop point                           |
| 152 | MOVJ C00011 VJ=1.00 PL=0              |
| 153 | 'release gripper                      |
| 154 | DOUT OT#(1) OFF                       |
| 155 | 'move robot home position             |
| 156 | MDVJ C00012 VJ=1.00                   |
|     |                                       |

## **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with MM\_INIT\_SOCKET.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_SET\_MODEL.
- 5. Run the Mech-Viz project with **MM\_START\_VIZ**.
- 6. Obtain the planned path from Mech-Viz.
- 7. Check if the returned status code indicates any error. If an error code is returned, the program is halted.
- 8. Store obtained target points in the planned path to P071, P072, and P073.
- 9. Move the robot along the planned path and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.



## Define the TCP

Change TL#(1) to the tool number to which the actual TCP is saved.

Note: Do not use TOOL 0 as it is used for calibration in MM\_AUTO\_CALIB.

## Teach the Image Capturing Pose

Record the image capturing pose in **C00001** in line 111.

## Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses. Record the waypoint to **C00009** in line 143. You can add more waypoints if needed.

## Teach the Placing Pose

Record the placing pose in C00011 in line 152.

#### Add Object Grasping and Releasing Logics

Modify **DOUT OT#(1) ON** in line 147 to the actual logic for controlling the tool action when picking the object.

Modify **DOUT OT#(1) OFF** in line 154 to the actual logic for controlling the tool action when placing the object.

#### Define HOME position

Teach HOME position to C00007 in line 109.

# 2.2.4 YASKAWA Standard Interface Commands

The YASKAWA Standard Interface provides the following jobs:

- Initialize Communication
- Start Mech-Vision Project
- Get Vision Result
- Start Mech-Viz Project
- Get Planned Path
- Obtain Pose



- Obtain Joint Positions
- Switch Mech-Vision Recipe
- Select Mech-Viz Branch
- Set Move Index
- Get Software Status
- Input Object Dimensions to Mech-Vision
- Get DO Signal List
- Input TCP to Mech-Viz
- Calibration

When writing your own program, pay attention to the following:

- Multiple parameters should be separated by semi-colons.
- When calling jobs: input argument is a string by default; output argument is a string by default, each element in the string corresponding to a global variable in the background.

This Standard Interface is over the TCP/IP protocol.

#### **Initialize Communication**

```
MM_INIT_SOCKET ("IP_Address;Server_Port;Time_Out")
```

This job sets the IP address and port number of the IPC and wait time before the program stops trying to establish the communication.

## Arguments

• Input arguments

| Name        | Description   |
|-------------|---|
|             | IP address of the IPC                                   |
| Server_Port | Port number of the IPC, the default is 50000            |
| Time_Out    | Wait time in minutes before stopping connection attempt |

#### Example

```
CALL JOB:MM_INIT_SOCKET ("192.168.1.1;50000;5")
```

This example sets the IP address and port number of the IPC to 192.168.1.1:50000 and wait time to 5 minutes.



#### Start Mech-Vision Project

MM\_START\_VIS ("Job;Pos\_Num\_Need;SendPos\_Type")

This job is for applications that use Mech-Vision but not Mech-Viz. It runs the corresponding Mech-Vision project to acquire and process data.

## Arguments

• Input arguments

| Name     | Description   |  |
|----------|---|--|
| Job      | Mech-Vision Project ID, from 1 to 99  |  |
|          | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |  |
| Pos_Num  | Pos_Num_Needber of poses for Mech-Vision to send, from 0 to 20, where 0 means "send all"        |  |
|          |   |  |
| SendPos_ | <b>T</b> Spet the image capturing pose for the robot to send, from 0 to $2$                     |  |
|          | 0: Do not send image capturing pose (for Eye To Hand) 1: Send image capturing                   |  |
|          | pose as joint positions 2: Send image capturing pose as robot flange pose                       |  |

#### Example

CALL JOB:MM\_START\_VIS ("1;1;1")

This example runs Mech-Vision project No. 1, and asks the project to send over 1 pose, and the robot sends its joint positions when this job is called as the image capturing pose to Mech-Center.

#### **Get Vision Result**

MM\_GET\_VISDATA ("Job;Last\_Data;Pose\_Num;MM\_Status")

This job is for applications that use Mech-Vision but not Mech-Viz. It obtains the vision result from the corresponding Mech-Vision project.

## Arguments

• Input argument

| Name | Description   |
|------|---|
| Job  | Mech-Vision Project ID, from 1 to 99  |
|      | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |

• Output arguments



| Name  | Description   |  |  |
|---|---|--|--|
| Last_Da   | Last_DataI variable, indicating whether all vision result has been sent, 0 or 1   |  |  |
|   | 0: NOT all vision result has been sent (more on the way) 1: All vision result has |  |  |
|   | been sent If 0, call this JOB again until all are sent                            |  |  |
| Pose_NumI variable for storing the number of received poses                             |   |  |  |
| MM Statusvariable for storing status code, refer to the standard interface status codes |   |  |  |

## Example

CALL JOB:MM\_GET\_VISDATA ("1;50;51;52")

This example obtains the vision result from Mech-Vision project No. 1. Whether all vision result has been sent is stored in **I50**, the number of poses received is stored in **I51**, and the status code is stored in **I52**.

#### Start Mech-Viz Project

MM\_START\_VIZ ("SendPos\_Type")

This job is for applications that use both Mech-Vision and Mech-Viz. It runs the corresponding Mech-Viz project (which triggers the corresponding Mech-Vision project to run), and sets the initial joint positions of the simulated robot in Mech-Viz.

#### Argument

• Input argument

| Name    | Description  |  |
|---------|--|--|
| SendPos | Typeinitial joint positions for the simulated robot in Mech-Viz, 0 or 1                        |  |
|         | 0: Set the initial joint positions of the simulated robot to $[0,0,0,0,0,0]$ 1: Set the initia |  |
|         | joint positions of the simulated robot to the current joint positions of the real robot        |  |

Note: When the scene contains object models that obstruct the robot to move from [0,0,0,0,0,0] to the first target point, this parameter must be set to 1.

## Example

```
CALL JOB:MM_START_VIZ ("1")
```

This example runs the corresponding Mech-Viz project, and sets the initial joint positions of the simulated robot to the current joint positions of the real robot.



#### Get Planned Path

MM\_GET\_VIZDATA ("GetPos\_Type;Last\_Data;Pos\_Num;VisPos\_Num;MM\_Status")

This job obtains the planned path from Mech-Viz.

#### Arguments

• Input argument

| Name        | Description   |  |
|-------------|---|--|
| GetPos_Type | Whether Mech-Viz should send target points as joint positions or TCPs, 1 or |  |
|             | 2   |  |
|             | 1: Mech-Viz sends joint positions 2: Mech-Viz sends TCPs                    |  |

#### • Output arguments

| Name  | Description   |  |  |
|---|---|--|--|
| Last_Da   | Last_Datariable, indicating whether all target points have been sent, 0 or 1          |  |  |
|   | 0: NOT all target points have been sent (more on the way) 1: All target points have   |  |  |
|   | been sent If 0, call this JOB again until all are sent                                |  |  |
| Pos_Nu  | Pos_NuInvariable for storing the number of received target points                     |  |  |
| VisPos  | Nurriable for storing the position of the first visual_move target point in the path  |  |  |
|   | Example path: move-1, move-2, visual_move-3, move-3, visual_move-2 In this path,      |  |  |
|   | the position of the first visual_move target point is 3. If the path does not contain |  |  |
|   | visual_move target point, the return value is 0.                                      |  |  |
| MM_Statusriable for storing status code, refer to the standard_interface_status_codes |   |  |  |

#### Example

CALL JOB:MM\_GET\_VIZDATA ("2;50;51;52;53")

This example obtains the planned path from Mech-Viz in the form of TCPs. Whether all target points have been sent is stored in **I50**, the number of target points received is stored in **I51**, the position of the visual\_move target point is stored in **I52**, and the status code is stored in **I53**.

#### **Obtain Pose**

MM\_GET\_POSE ("Index;PosTarget;Label;Pose\_Speed")

This job stores a pose returned by Mech-Vision or a target point (as TCP) returned by Mech-Viz in the specified variable.



## Arguments

• Input argument

| Name  | Description                                |
|-------|--|
| Index | Specify the index of the pose to be stored |

• Output arguments

| Name       | Description  |  |
|------------|--|--|
| PosTarget  | P variable for storing the specified pose                                      |  |
| Label      | I variable for storing the label corresponding to the specified pose           |  |
| Pose_Speed | Pose_Speed I variable for storing the speed corresponding to the specified pos |  |

## Example

CALL JOB:MM\_GET\_POSE ("1;60;61;62")

This example stores the first received pose to P60, the corresponding label to I61, and the corresponding speed to I62.

## **Obtain Joint Positions**

MM\_GET\_JPS ("Index; JointTarget; Label; Pose\_Speed")

This job stores a set of joint positions returned by Mech-Viz in the specified variable.

Note: As Mech-Vision does not output joint position data, this job can only be used with Mech-Viz.

## Arguments

• Input argument

| Name  | Description  |
|-------|--|
| Index | Specify the index of the set of joint positions to be stored |

• Output arguments

| Name        | Description  |  |
|-------------|--|--|
| JointTarget | P variable for storing the specified set of joint positions                            |  |
| Label       | I variable for storing the label corresponding to the specified set of joint positions |  |
| Pose_Speed  | I variable for storing the speed corresponding to the specified set of joint positions |  |



#### Example

```
CALL JOB:MM_GET_JPS ("1;60;61;62")
```

This example stores the first set of received joint positions to **P60**, the corresponding label to **I61**, and the corresponding speed to **I62**.

#### Switch Mech-Vision Recipe

```
MM_SET_MODEL ("Job;Model_Number")
```

This job specifies which parameter recipe of the Mech-Vision project to use. For more information on parameter recipe, please see parameter\_recipe\_configuration.

## Note:

- This job must be called BEFORE **MM\_START\_VIS**.
- The corresponding Mech-Vision project must have parameter recipes already configured and saved.

#### Arguments

• Input arguments

| Name                                     | Description   |  |
|--|---|--|
| Job Mech-Vision Project ID, from 1 to 99 |   |  |
|  | Can check and adjust in $Mech-Center \rightarrow Deployment \ Settings \rightarrow Mech-Vision$ |  |
| Model_Number                             | ber The number of a parameter recipe in the Mech-Vision project, from 1 to 99                   |  |

#### Example

| CALL JOB:MM_SET_MODEL | ("1;1") |
|-----------------------|---------|
|-----------------------|---------|

This example switches the parameter recipe used to No. 1 in Mech-Vision project No. 1.

#### Select Mech-Viz Branch

MM\_SET\_BRANCH ("Branch\_Num;Exit\_Num")

This job is used to select along which branch the Mech-Viz project should proceed. Such branching is achieved by adding branch\_by\_service\_message Task(s) to the project. This job specifies which out port such Task(s) should take.

#### Note:

• MM\_START\_VIZ must be called BEFORE this job.



- When the next Task to be executed in Mech-Viz is a **branch\_by\_service\_message** Task, Mech-Viz will wait for this job to send the out port number it should take.
- The name of all **branch\_by\_service\_message** Tasks in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

## Arguments

• Input arguments

| Name       | Description   |  |  |
|------------|---|--|--|
| Branch_Num | Name of the <b>branch_by_service_message</b> Task, from 1 to 99 |  |  |
| Exit_Num   | The number of the out port to take, from 1 to 99                |  |  |

## Example

```
CALL MM_SET_BRANCH ("1;3")
```

This example tells Mech-Viz to take out port 3 for the **branch\_by\_service\_message** Task named **1**.

#### Set Move Index

MM\_SET\_INDEX ("Skill\_Num;Index\_Num")

This job sets the value for the Current Index parameter of Mech-Viz Tasks. Tasks that have this parameter include move\_list, move\_grid, custom\_pallet\_pattern, and smart\_pallet\_pattern.

#### Note:

- **mm\_start\_viz** must be called BEFORE this job.
- The name of all Tasks with index parameters in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

#### Arguments

• Input arguments

| Name      | Description   |
|-----------|---|
| Skill_Num | Name of the Task, from 1 to 99                                  |
| Index_Num | Value for the Current Index parameter when the Task is executed |



#### Example

CALL JOB:MM\_SET\_INDEX ("2;10")

This example sets the Current Index value to 9 for the Task named **2**. When the Task is executed, the Current Index value will be added 1 and become 10.

#### Get Software Status

```
MM_GET_STATUS ("Status")
```

This job is currently capable of checking whether Mech-Vision is ready to run projects. In the future, this job can be used for obtaining the execution status of Mech-Vision, Mech-Viz and Mech-Center.

#### Argument

• Output argument

| Name   | Description  |
|--------|--|
| Status | I variable for storing the status code, refer to the standard_interface_status_codes |

## Example

| CALL | JOB:MM_ | GET | STATUS | ("70") |
|------|---------|-----|--------|--------|
|------|---------|-----|--------|--------|

This example obtains the status code and stores it in **I70**.

## Input Object Dimensions to Mech-Vision

```
MM_SET_BOXSIZE("Job;Length;Width;Height")
```

This job inputs object dimensions to the Mech-Vision project.

#### Note:

• This job must be called BEFORE **MM\_START\_VIS**.



## Arguments

• Input arguments

| Name   | Description   |
|--------|---|
| Job    | Mech-Vision Project ID, from 1 to 99  |
|        | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| Length | Length of object in mm  |
| Width  | Width of object in mm   |
| Height | Height of object in mm  |

## Example

CALL JOB:MM\_SET\_BOXSIZE ("1;500;300;200")

This example sets the object dimensions in the read\_object\_dimensions Step in the Mech-Vision project No. 1 to  $500^*300^*200$  mm.

## Get DO Signal List

#### MM\_GET\_DOLIST

This job obtains the planned DO Signal list for controlling multiple sections of a sectioned vacuum gripper.

## Note:

- MM\_GET\_VIZDATA must be called BEFORE this job.
- Please deploy the Mech-Viz project based on the template project in *Mech-Center/tool/viz\_project/suction\_zone*, and set the suction cup configuration file in the Mech-Viz project.

#### Arguments

No parameters.

#### Example

CALL JOB:MM\_GET\_DOLIST

This example obtains the DO signal list planned by Mech-Viz and writes the values in OT1 - OT16.



#### Input TCP to Mech-Viz

#### MM\_SET\_POSE ("Pos")

This job inputs TCP data to the outer\_move Task.

#### Note:

- This job must be called BEFORE **MM\_START\_VIZ**.
- Please deploy the Mech-Viz project based on the template project in *Mech-Centertoolviz\_projectouter\_move*, and put the **outer\_move** Task at a proper position in the workflow.

#### Argument

• Input argument

| Name | Description  |
|------|--|
| Pos  | P variable for storing the TCP data to be sent to Mech-Viz |

#### Example

|--|

This example sends the TCP data stored in P10 to the **outer\_move** task in the Mech-Viz project.

#### Calibration

MM\_CALIB ("Move\_Type;Pos\_Jps;Wait\_Time;Rnum;Ext;Pos")

This job is used for hand-eye calibration (camera extrinsic parameter calibration). It automates the calibration process in conjunction with the **Camera Calibration** function in Mech-Vision. For detailed instructions, see *KUKA Calibration Program*.

#### Arguments

• Input arguments



| Name      | Description  |  |
|-----------|--|--|
| Move_Type | Motion type, 1 or 2  |  |
|           | 1: MOVL 2: MOVJ  |  |
| Pos_Jps   | Pose as flange pose or joint positions, 1 or 2             |  |
|           | 1: flange pose 2: Joint positions                          |  |
| Wait_Time | Wait time before stopping communication attempt in minutes |  |
| Rnum      | Number of robot axes                                       |  |
| Ext       | Data of the external 7th axis in mm, optional              |  |
| Pos       | Start point for the calibration, P99 by default            |  |

## Example

```
CALL JOB:MM_CALIB ("2;1;5;6;0;99")
```

This example moves the robot with MOVJ, receives pose data in the form of flange pose, and sets the wait time to 5 minutes. This robot has 6 axes and does not have an external axis installed. The start point for the calibration is stored in **P99**.

# 2.2.5 YASKAWA Error Messages

The following errors may occur while running the Standard Interface program on the robot.

#### MM:Robot\_Internal\_Error

Error occurred while the MotoPlus application attempts to call the MotoPlus API.

#### Example

When the MotoPlus application attempts to obtain the current pose of the robot, ret = -1.

```
ret = mpGetCartPos(&cgsData, &cartPosData);
if (ret != 0)
return INTERNAL_ERROR;
```

#### Troubleshooting

Please refer to *Programmer's Manual for New Language Environment MotoPlus* and check the application.



#### MM:Robot\_Socket\_Closed

Error occurred when the MotoPlus application called the mpSocket and mpConnect functions, and the robot is disconnected from Mech-Center.

## Troubleshooting

- Check if the hardware are properly connected.
- Check if the Standard Interface is started in Mech-Center.
- Check the IP addresses of the robot and the IPC, and if the port number is configured correctly.
- Check if the firewall is turned off on the IPC.
- Contact Mech-Mind Technical Support for further assistance.

## MM:Robot\_Argument\_Error

When calling a Mech-Mind Standard Interface job, arguments provided are not sufficient.

#### Example

When calling **MM\_START\_VIS**, 3 arguments should be provided. If only 1 argument is provided, this error is reported.

• Correct:

CALL JOB:MM\_START\_VIS ("1;1;2")

• Incorrect:

```
CALL JOB:MM_START_VIS ("1")
```

#### Troubleshooting

Please refer to YASKAWA Standard Interface Commands and input the correct arguments accordingly.

#### MM:Robot\_CMD\_Error

- The command code sent by the job does not exist;
- The command code received by the MotoPlus Application does not match the one sent.



## Troubleshooting

- Please refer to the Standard Interface Development Manual and make sure the command code sent by the job is correct.
- The sequence of command sending and receiving is problematic. Please contact Mech-Mind Technical Support for further assistance.

## MM:IPC\_Return\_Error

Returned status code is an error code. Please check Mech-Center' s log.

## Troubleshooting

- Please refer to the standard\_interface\_status\_codes for the specific error.
- Please contact Mech-Mind Technical Support for further assistance.

# 2.3 FANUC

This section introduces the Standard Interface for FANUC robots.

# 2.3.1 FANUC Setup Instructions

This section introduces the process of loading the standard interface program onto a FANUC robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

## Check Controller and Software Compatibility

Compatibility requirements are as follows:

- Robot: a 6-axis or 7-axis FANUC robot
- Additional controller software packages:
  - R651 or R632 (karel)
  - R648 (User Socket Msg)
- Controller system software version: V7.5, V7.7, V8.\*, and V9.\*

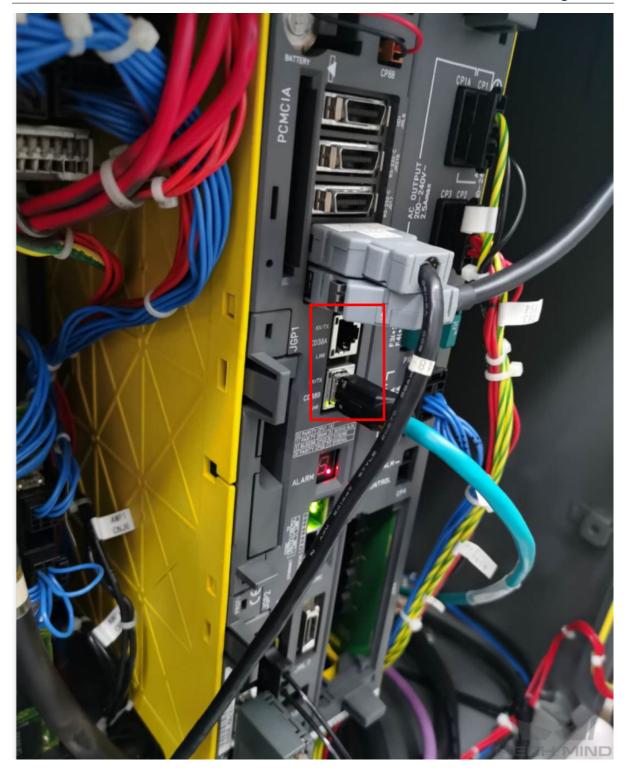


## Setup the Network Connection

#### Hardware Connection

Plug the Ethernet cable of the IPC into the Ethernet port of robot controller as shown in the figure. You can plug the cable into either CD38A port or CD38B port. CD38A corresponds to **Port#1** in the robot IP setting, while CD38B corresponds to **Port#2**.







## **IP Configuration**

1. Press  $MENU \rightarrow SETUP$ , and then select Host Comm in the context menu, and then press ENTER to open the SETUP Protocols window.

| Busy         Step         Hold         Fault           Run         I/O         Prod         TCyc | -              |   |
|--|----------------|---|
| SETUP General  |                | ۹ 🕀   |
| MENU 1   | SETUP 1        |   |
| 1 UTILITIES  | 1 Prog Select  | SETUP 2<br>TUP 3  |
| 2 TEST CYCLE   | 2 ZDT Client   | 2 iPendant Setup  |
| 3 MANUAL FCTNS   | 3 General      | 3 BG Logic  |
| 4 ALARM  | 4 Frames       | 4 Resume Offset   |
| 5 I/O  | 5 Macro        | 5 Resume Tol.   |
| 6 SETUP  | 6 Ref Position | 6 Stroke limit  |
| 7 FILE   | 7 Port Init    | 7 Space fnct.   |
| 8  | 8 Ovrd Select  | 8 Diag Interface  |
| 9 USER   | 9 User Alarm   | 9 Host Comm   |
| 0 NEXT   | 0 NEXT         | 0 NEXT  |
|  |                |   |
| Menu Favorites (press and ho   | ld to set)     |   |
| Ľ  |                | >   |
|  |                |   |
|  |                | STEP $(J_1)$ $(J_1)$<br>HOLD $(J_2)$ $(J_2)$<br>ENTER 4 $(J_3)$ $(J_3)$ $(J_3)$<br>EWD $\overline{X}$ $+\overline{X}$ |

2. Select **TCP/IP** and press *DETAIL* to open the **SETUP Host Comm** window.



| BusyStepHoldFaultRunI/OProdTCyc |   |
|---------------------------------|---|
| SETUP Protocols                 | 1/8<br>Pescription<br>P/IP Detailed Setup<br>Telnet Protocol<br>Socket Messaging Device<br>ROS Ethernet Packets<br>Proxy Server<br>Ping Protocol<br>HTTP Authentication<br>File Transfer Protocol |
| [ TYPE ]                        | DETAIL 2 SHOW ]   |
| PREV SHIFT ME                   | INU SELECT EDIT DATA FCTN SHIFT NEXT<br>$1 \longrightarrow 10^{-1}$ STEP $(J_1)$ $(J_1)$<br>HOLD $(J_2)$ $(J_2)$<br>CK ITEM ENTER FWD $(J_3)$ $(J_3)$<br>3 9 TOOL BWD $(X)$ $(X)$                 |

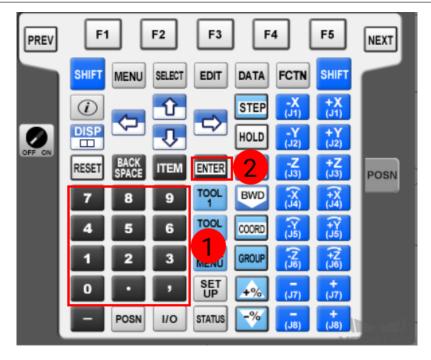
3. Enter the robot IP in the **IP address** line with the keyboard of the teach pendant. The robot IP should be in the same subnet as the IPC.



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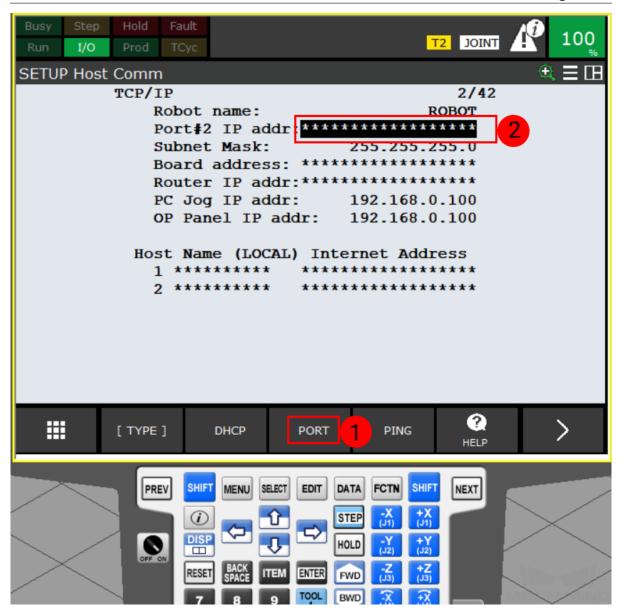
| BusyStepHoldFaultRunI/OProdTCyc   | <b>T2</b>  |   |
|---|--|---|
| SETUP Host Comm<br>TCP/IP<br>Robot name:<br>Port#1 IP a<br>Subnet Mask<br>Board addre<br>Router IP a<br>PC Jog IP a<br>OP Panel IP<br>Host Name (LO<br>1 ******** | ROF<br>ddr: 192.168.1  | % Ξ ⊡<br>2/42<br>30T<br>1<br>2.0<br>***<br>***<br>100<br>100<br>100 |
| [TYPE] DHCP   | PORT PING  | HELP  |
| PREV SHIFT MENU   | SELECT EDIT DATA FCTN SHIFT<br>C C C C C C C C C C C C C C C C C C C | NEXT  |





4. If the Ethernet cable is connected to port 2, please press *Port* to switch the port. Then you can enter the robot IP in the **IP address** line.





#### Load the Program Files

#### **Prepare the Files**

The program files are stored in the installation directory of Mech-Center. The default directory for Mech-Center 1.5.2 is C:/Mech-Mind/Mech-Center.

Navigate to *xxx/Mech-Center/Mech-interface/fanuc*, and copy all the contents of this folder to your flash drive.



**Note:** The folders and files must be saved in the root directory of the USB flash drive. Do not rename them.

# Load the Files to the Robot

1. After connecting the USB flash drive, press MENU and select  $FILE \rightarrow File$ , and then press ENTER to open the **FILE** window.

| Busy Step Hold Fault<br>Run I/O Prod TCyc | 100   |
|---|---|
| FILE                                      | ۹ 🖽   |
| MENU 1                                    | FILE 1 1/32                                     |
| 1 UTILITIES                               | 1 File 3.1 files)                               |
| 2 TEST CYCLE                              | 2 File Memory .1 command files)                 |
| 3 MANUAL FCTNS                            | 3 Auto Backup                                   |
| 4 ALARM                                   | DT (all KAREL data files)                       |
| 5 I/O 🕨                                   | PC (all KAREL p-code)                           |
| 6 SETUP                                   | TP (all TP programs)                            |
| 7 FILE                                    | MN (all MN programs)<br>VR (all variable files) |
| 8   | SV (all system files)                           |
| 9 USER                                    | to generate directory                           |
| 0 NEXT                                    |   |
|   |   |
| Menu Favorites (press and ho              | ld to set)                                      |
|   |   |
|   | >   |
|   |   |
|   |   |
|   |   |
|   |   |
| OFF ON                                    |   |
| RE  | SET BACK ITEM ENTER 4 JJ (J3)                   |
|   | 7 8 9 TOOL BWD 🔀 🔂                              |

2. Press UTIL and select **Set Device** in the context menu.



| Busy Ste |            | TPIF-149 Must complete operation first          | 0  |
|----------|------------|---|----|
| FILE     |            |   | ΓH |
|          | UT1:\*.*   | 1/32  |    |
|          | 1 *        | <pre>* (all files)</pre>                        |    |
|          | 2 *        | KL (all KAREL source)                           |    |
|          | 3 *        | CF (all command files)                          |    |
|          | 4 *        | TX (all text files)                             |    |
|          | 5 *        | LS (all KAREL listings)                         |    |
|          | 6 *        | DT (all KAREL data files)                       |    |
|          | 7 *<br>8 * | PC (all KAREL p-code)                           |    |
|          | 8 *<br>9 * | TP (all TP programs)                            |    |
|          | 10 *       | MN (all MN programs)<br>VR (all variable files) |    |
|          | 10 *       | SV (all system 1 UTIL 1                         |    |
|          |            | to generate director 1 Set Device 2             |    |
|          | 11000 011  |   |    |
|          |            | 2 Format  |    |
|          |            | 3 Format FAT32                                  |    |
|          |            | 4 Make DIR                                      |    |
|          |            |   |    |
|          | [ TYPE ]   |   |    |
|          |            |   | 7  |
|          |            |   |    |
| /        | RE3        | ET SPACE ITEM ENTER FWD (33) (33)               |    |

3. Select the USB flash drive. If your flash drive is connected to the **controller**, please select **USB Disk (UD1:)**; if your USB flash drive is connected to the **teach pendant**, please select **USB on TP (UT1:)**.



|                    | TPIF-149 Must complete operation first   | 100  |
|--------------------|--|------|
| FILE               |  | ÷. 🖽 |
| UT1:\*.            | .* 1/32  |      |
|                    | (all files)  |      |
| 1                  | (all KAREL source)   |      |
| 1 FROM Disk (FR:)  | TP (UT1:) (all command files)  |      |
| 2 Backup (FRA:)    | (all text files)<br>(all KAREL listings)   |      |
|                    | (all KAREL data files)   |      |
| 3 RAM Disk (RD:)   | (all KAREL p-code)   |      |
| 4 Mem Card (MC:)   | (all TP programs)  |      |
| 5 Mem Device (MD:) | (all MN programs)  |      |
| 6 Console (CONS:)  | (all variable files)   |      |
| 7 USB Disk (UD1:)  | (all system files)<br>erate directory  |      |
| 8next page         | page   |      |
|                    |  |      |
| [ TYPE ]           | [ DIR ] LOAD [BACKUP] [UTIL ]  | >    |
| PREV               | SHIFT MENU SELECT EDIT DATA FCTN SHIFT NEXT  |      |
|                    | DISP     Image: Constraint of the second secon |      |

4. Select the first line (all files) and press ENTER to enter the root directory of the USB flash drive.



| Busy Step         | Hold Fault | TPIF-149 Must complete operation first |
|-------------------|------------|--|
| Run I/O           | Prod TCyc  | %                                      |
| FILE              |            | ۹. 🖽                                   |
|                   | UT1:\*_*   | 1/32                                   |
|                   | 1 *        | * (all files)                          |
|                   | 2 *        | KL (all KAREL source)                  |
|                   | 3 *        | CF (all command files)                 |
|                   | 4 *        | TX (all text files)                    |
|                   | 5 *        | LS (all KAREL listings)                |
|                   | 6 *        | DT (all KAREL data files)              |
|                   | 7 *        | PC (all KAREL p-code)                  |
|                   | 8 *        | TP (all TP programs)                   |
|                   | 9 *        | MN (all MN programs)                   |
|                   | 10 *       | VR (all variable files)                |
|                   | 11 *       | SV (all system files)                  |
|                   | Press DIR  | to generate directory                  |
|                   |            |  |
|                   |            |  |
|                   |            |  |
|                   |            |  |
|                   |            |  |
|                   | [ TYPE ]   | [ DIR ] LOAD [BACKUP] [UTIL ]          |
|                   |            |  |
| ,                 |            |  |
|                   | PREV SHIP  | MENU SELECT EDIT DATA FCTN SHIFT NEXT  |
| >                 |            |  |
|                   |            |  |
| <                 |            |  |
| $\sim$            |            |  |
| $\langle \rangle$ | RESE       | T SPACE ITEM ENTER 2 73 743            |
|                   | 7          |  |

**Hint:** For the next step:

- If the USB flash drive is connected to the **robot controller**, please select **IN-STALL\_UD.cm**.
- If the USB flash drive is connected to the **robot teach pendant**, please select **IN-STALL\_UT.cm**.
- 5. Select the corresponding CM file and press  $\tt ENTER$  key on the teach pendant. Choose  $Y\!ES$  to start loading the programs.

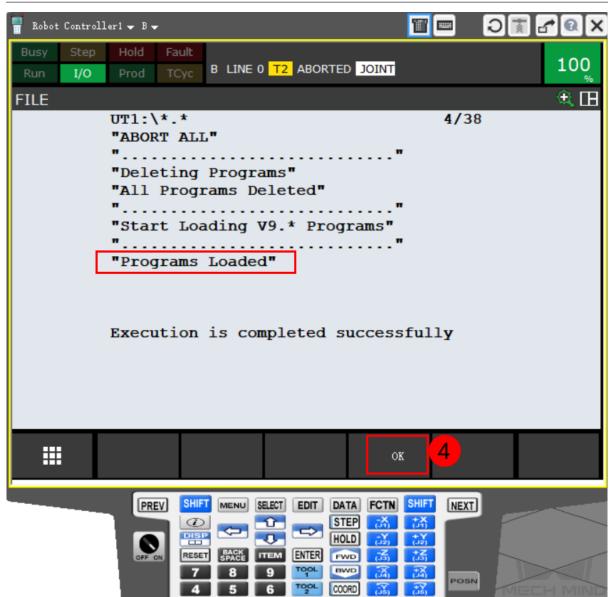


Mech-Mind Robot Integrations

| 📲 Robot Controlleri 🛩 B 🕇 |                               |                              | ⊃ <b>≣</b> - ¶@ × |
|---------------------------|-------------------------------|------------------------------|-------------------|
| BusyStepHoldRunI/OProd    | Fault<br>TCyc B LINE 0 T2 ABO | RTED JOINT                   | 100%              |
| FILE                      |                               |                              | 🕀 🕀               |
| UT1:                      | \ <b>*</b> .*                 | 4/                           | '38               |
|                           | FANUC_V8                      | <dir></dir>                  |                   |
|                           | FANUC_V9                      | <dir></dir>                  |                   |
|                           | INSTALL UD                    | CM                           | 3208              |
|                           | INSTALL_UT                    | CM                           | 3208              |
|                           | SRC                           | <dir></dir>                  |                   |
|                           | UÅ̲å;ØÖE¹ñÓÃUD                | TXT                          | 0                 |
| 7                         | -                             | files)                       |                   |
| 8 9                       | -                             | KAREL source) command files) |                   |
| 10                        | -                             | text files)                  |                   |
| 10                        | •                             | KAREL listings               | 3                 |
|                           | ite INSTALL UT.CM             | -                            | <i>"</i>          |
|                           |                               | -                            |                   |
|                           |                               |                              |                   |
|                           |                               |                              |                   |
|                           |                               |                              |                   |
|                           |                               |                              |                   |
|                           |                               |                              |                   |
|                           |                               | yes 3                        | NO                |
|                           |                               |                              |                   |
| PRI                       |                               | DATA FCTN SHIFT N            | EXT               |
|                           |                               |                              |                   |
|                           |                               |                              |                   |
| OFF                       | N RESET SPACE ITEM ENTER      |                              |                   |
|                           | 7 8 9 TOOL                    |                              | OSN               |
|                           | 4 5 6 TOOL                    | COORD 武 🔝 🗏                  | MECH MIND         |

6. When the message "Programs Loaded" is displayed, the program files have been loaded successfully. Press OK to exit the program.

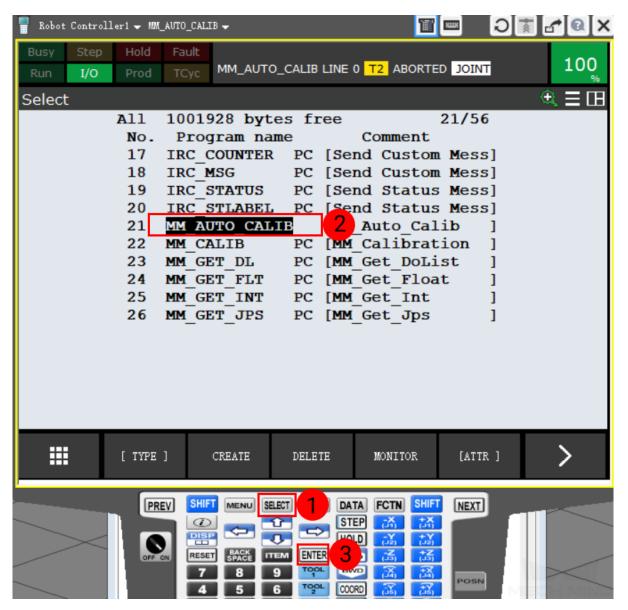






#### **Further Configurations**

1. After loading the program files, press SELECT key on the teach pendant to enter the program selection interface. Select MM\_AUTO\_CALIB and then press ENTER to open the program.



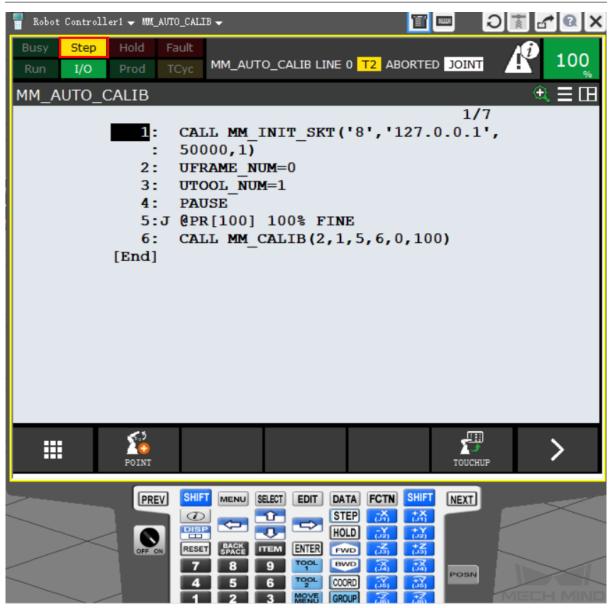
- 2. Configure the arguments of MM\_INIT\_SKT. There are 4 arguments in total. Please configure them according to your actual situation. Then, press STEP key to switch into Step mode.
  - Argument 1: client port number (string 1-8)
  - Argument 2: IP address of the IPC
  - Argument 3: server port number of the IPC
  - Argument 4: timeout (min)





3. Now the *Step* icon on the teach pendant turns yellow as shown below.





4. Press and hold either one of the deadman switches on the back of the teach pendant.





5. Press the SHIFT and FWD keys at the same time to run line 1.





6. After running line 1 of the program, press MENU and then select USER.



| 🚪 Robot Controller1 🗸 MM_AUTO_C# | IIB 🗕   |   |                | ⊺Q X  |
|----------------------------------|---|---|----------------|-------|
| BusyStepHoldFaultRunI/OProdTCyc  |   | NE 0 T2 ABORTE  |                | 100   |
| MM_AUTO_CALIB                    |   |   |                | € ⊟ ⊞ |
| MENU 1                           | UTILITIES 1   |   | 1/7<br>0.0.1', |       |
| 1 UTILITIES                      | 1 Home  |   | 0.0.1,         |       |
| 2 TEST CYCLE                     | 2 Hints   | gle entry shift   |                |       |
| 3 MANUAL FCTNS                   | 3 iRCalibration   | oup Exchg   |                |       |
| 4 ALARM                          | 4 Robot Condition   | ]   |                |       |
| 5 I/O 🕨                          | 5 Prog Adjust   |   | 0)             |       |
| 6 SETUP                          | 6 Program Shift   |   |                |       |
| 7 FILE                           | 7 Mirror Image Shif   |   |                |       |
| 8                                | 8 Tool Offset   |   |                |       |
| 9 USER 2                         | 9 Frame Offset  |   |                |       |
| 0 NEXT                           | 0 NEXT  | NEXT  |                |       |
|                                  | <u> </u>  |   |                |       |
| Menu Favorites (press and ho     | ld to set)  |   |                | _     |
| <b>∠</b>                         |   |   |                | >     |
|                                  | Image: Number of the sector | DATA FCTN SHIFT<br>STEP A A<br>HOLD A A<br>FVVD A A<br>EVVD | POSN           |       |

7. If the message "MM:Restart Robot" appear on the screen, the program can be executed successfully on the robot. Please restart the robot later.



**Mech-Mind Robot Integrations** 

| 📲 Robot | Controll | ler1 🗸 MM_ | auto_cali | B 🖵     |        |           |           |                          |                          |      | Ð     | <u>ئا</u> آ | *]@]X |
|---------|----------|------------|-----------|---------|--------|-----------|-----------|--------------------------|--------------------------|------|-------|-------------|-------|
| Busy    | Step     | Hold       | Fault     |         |        |           | <b>TD</b> |                          | 1011                     |      |       |             | 100   |
| Run     | I/O      | Prod       | ТСус      | INIT_SK |        | 229       | 12 P/     | AUSED                    | JOIN                     |      |       |             | %     |
| USER    |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         | Γ        | MM:Re      | start     | Robo    | t      |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           | _       |        |           |           |                          |                          |      |       |             |       |
|         |          |            |           |         |        |           |           |                          |                          |      |       |             |       |
| L       |          |            | _         |         | -      |           |           | _                        | _                        | _    |       |             |       |
| >       |          | PRE        |           |         | SELECT | EDIT      | DATA      |                          | SHIFT                    | NEXT |       | _           | ~     |
|         |          |            |           |         | 1<br>I |           | STEP      | -X<br>(J1)<br>-Y<br>(J2) | +X<br>(J1)<br>+Y<br>(J2) |      |       |             |       |
|         | >        |            | N RESET   |         |        | ENTER     | FWD       | (J2)<br>-Z<br>(J3)       | (J2)<br>+Z<br>(J3)       |      |       |             |       |
|         |          |            | 7         | 8       | 9      | TOOL<br>1 | BWD       | (.).(A)                  | (Å.)                     | POSN |       |             | ~     |
|         |          |            | 4         | 5       | 6      | TOOL 2    | COORD     | (JS)                     | (J5)                     |      | De De | EEH         |       |

# **Test Robot Connection**

# **Configuration in Mech-Center**

- 1. Open Mech-Center and click on *Deployment Settings*.
- 2. Select Mech-Interface
- 3. Check Use Mech-Interface.
- 4. Select Standard Interface.
- 5. Select **TCP Server**, **HEX** and **Big endian** in Interface Options.
- 6. Select the robot model and click on Save to save the configurations.



| File Tool User View Help        |   |                 |
|---------------------------------|---|-----------------|
| Deployment Settings             | Ye Stop Interface Connect Robot Ad                | ministrator     |
| Appearance & Behavi             | ✓ Use Mech-Interface<br>Interface Program Fold    | ×               |
| Mech-Viz                        | Interface Service Type                            |                 |
| Mech-Vision                     |   |                 |
| Mech-Eye Viewer<br>Robot Server | Standard Interface 4 October 2010                 |                 |
| Mech-Interface 2                |   |                 |
|                                 | Interface Optic ? TCP Server                      | 5               |
|                                 | Listed robot FANUC      FANUC_M710IC_45M      sxy | <sup>yz</sup> 6 |
|                                 | Custom robot RobotVendor1 RobotType1 rzyx         |                 |
|                                 | Host Address 0.0.0.0: 50000 7                     |                 |
|                                 | > Advanced Settings                               |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 |   |                 |
|                                 | Save  | ncel            |
|                                 | Save 8  | MIND            |

**Note:** The default port number is 50000. If it is modified, please modify the corresponding code in the robot program when initializing communication.



### Test the Connection

1. Start TCP Server interface in Mech-Center.

| <b>11</b> M | iech-Cei  | nter, by | / Mech | -Mind Robotics                    |                             |        |                 |                     |
|-------------|-----------|----------|--------|-----------------------------------|-----------------------------|--------|-----------------|---------------------|
| File        | Tool      | User     | View   | Help                              |                             |        |                 |                     |
| De          | eployme   | ent Sett | ings   | Vision<br>Viz<br>Start Viz/Vision | Eye<br>Start Mech-Eye Viewe | er Run | Start Interface | کی<br>Connect Robot |
| Serv        | vice Stat | tus      |        |                                   |                             |        |                 |                     |
| Proj        | ect Stat  | us       |        |                                   |                             |        |                 |                     |
| Pro         | oject Na  | me       | Status | Exec Time                         |                             |        |                 |                     |
|             |           |          |        |                                   |                             |        |                 |                     |

2. Run the first command of the program **MM\_AUTO\_CALIB** again according to the instructions mentioned before. If the message as shown below appear in the **Log** panel of Mech-Center, then the robot can be connected successfully.

|           |             |   | U             |
|-----------|-------------|---|---------------|
|           |             |   | Administrator |
| Log       |             |   | đX            |
| Max Line  | 10000 🤤     | Open Logs Folder                                | Clear         |
|           |             | t TCP Server interface<br>h-Center: waiting for |               |
| connect   |             |   |               |
|           |             | h-Center: client conne<br>nt address is         | ected         |
| 10:11:50. | 895 [W] Me  | ech-Center: client disc                         | onnected      |
|           | 895 [l] Mec | h-Center: waiting for                           | client to     |
| connect   |             |   |               |
|           |             |   |               |
|           |             |   | MECH MIND     |



# 2.3.2 FANUC Calibration Program

This section introduces the process of calibrating the camera extrinsic parameters using the calibration instruction.

The process consists of 4 steps:

- Select the Calibration Program
- Teach the Calibration Start Point
- Run the Calibration Program
- Start Calibration in Mech-Vision

Before proceeding, please make sure that:

- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You are familiar with the contents in calibration\_guide.

The calibration process introduced in this section is applicable to scenarios where standard interface is used to communicate and the extrinsic parameters need to be calibrated multiple times.

#### **Calibration Process**

## Select the Calibration Program

Press the SELECT on the teach pendant, and then select MM\_AUTO\_CALIB and press ENTER to open the program.



Mech-Mind Robot Integrations

| 📲 Robot Controller1 🗕 MM_AUTO_CALLB 🚽 🛛 🚺 🔤 🛛 🚺 🛃  | r[@[X            |
|--|------------------|
| Busy     Step     Hold     Fault       Run     I/O     Prod     TCyc     MM_AUTO_CALIB LINE 0     T2     ABORTED JOINT | 100<br>%         |
| Select   | $\equiv \square$ |
| All 1001928 bytes free 21/56   |                  |
| No. Program name Comment   |                  |
| 17 IRC_COUNTER PC [Send Custom Mess]   |                  |
| 18 IRC_MSG PC [Send Custom Mess]   |                  |
| 19 IRC_STATUS PC [Send Status Mess]  |                  |
| 20 IRC STLABEL PC [Send Status Mess]   |                  |
| 21 <u>MM_AUTO_CALIB</u> 2 MM_Auto_Calib ]  |                  |
| 22 MM_CALIB PC [MM_Calibration ]<br>23 MM GET DL PC [MM Get DoList ]   |                  |
| 23 MM_GET_DL PC [MM_Get_DoList ]<br>24 MM GET FLT PC [MM Get Float ]   |                  |
| 25 MM GET INT PC [MM Get Int ]   |                  |
| 26 MM GET JPS PC [MM Get Jps ]   |                  |
|  |                  |
|  |                  |
|  |                  |
|  |                  |
|  |                  |
|  |                  |
| [ TYPE ] CREATE DELETE MONITOR [ATTR ]   | $\mathbf{x}$     |
| [ TYPE ] CREATE DELETE MONITOR [ATTR ]   | /                |
|  |                  |
| PREV SHIFT MENU SELECT DATA FCTN SHIFT NEXT  | ~                |
|  |                  |
|  |                  |
|  |                  |
|  |                  |



## Teach the Calibration Start Point

1. After opening the program, press the STEP key on the teach pendant to switch into Step mode. Then the *Step* icon on the screen will turn yellow.



2. Move the cursor to the 5th line. Press and hold either of the deadman switches on the back of the teach pendant, and then press the SHIFT and FWD keys at the same time to run the command on the 5th line, as shown below.



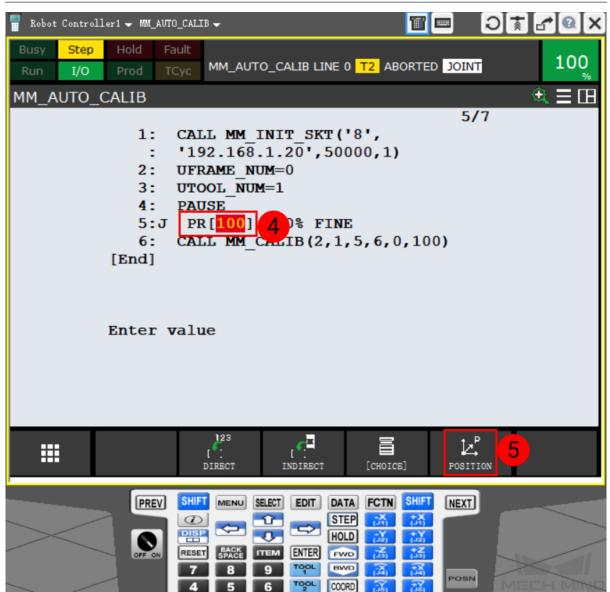






3. Select [100], and go to Position  $\rightarrow$  REPRE  $\rightarrow$  Cartesian.







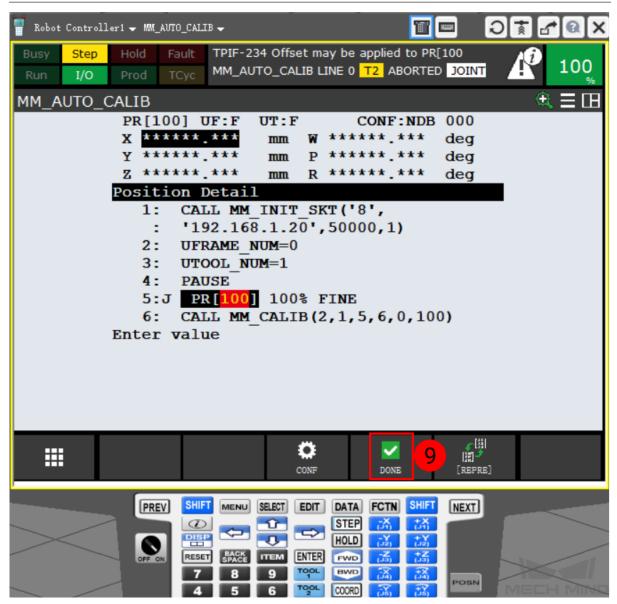
| 📲 Robot Controlleri 🗸 MM_AUTO_CALIB 🗸 🛛 👔 📼 🛛 🗊 🗗 💽 🗙  |
|--|
| Busy         Step         Hold         Fault         TPIF-234 Offset may be applied to PR[100         100           Run         I/O         Prod         TCyc         MM_AUTO_CALIB LINE 0         T2         ABORTED         JOINT         100    |
| MM_AUTO_CALIB 🏨 🗮 🖽  |
| PR[100] UF:F UT:F<br>J1 ************************************   |
| REPRE 1<br>1 Cartesian<br>2 Joint  |
|  |
| PREV SHIFT MENU SELECT EDIT DATA FCTN SHIFT NEXT<br>PREV SHIFT MENU SELECT EDIT DATA FCTN SHIFT NEXT<br>STEP (A) (A)<br>PISP PREV PRESET SHOE TEM ENTER PRO (A) (A)<br>RESET SHOE TEM ENTER PRO (A) (A)<br>POSN<br>4 5 6 TOOL CORD (A) (A)<br>POSN |

4. Press on *Continue* in the pop-up window and then press on *DONE*.



| 🚪 Robot Controlle    | er1 🗸 IM_AUTO_CALIB 🚽 🛛 🚺 🖅 🕢 🔀 🔀 🔀   |
|----------------------|---|
| Busy Step<br>Run I/O | Hold       Fault       TPIF-234 Offset may be applied to PR[100         Prod       TCyc       MM_AUTO_CALIB LINE 0       T2_ABORTED_JOINT       100<br>%  |
| MM_AUTO_C            | CALIB 🏨 🗮 🖽   |
|                      | PR[100] UF:F UT:F   |
|                      | Position Data will be modified with<br>the active User and Tool Frames. These<br>frames may not be the same frames that<br>were used to record the Position<br>Register.  |
|                      | Active User Frame : 0   |
|                      | F Active Tool Frame : 1   |
|                      | CANCEL CONTINUE   |
|                      |   |
|                      | DONE [REPRE]  |
|                      | PREV       SHIFT       MENU       SELECT       EDIT       DATA       FCTN       SHIFT       NEXT         Image: Strategy of the strategy of t |



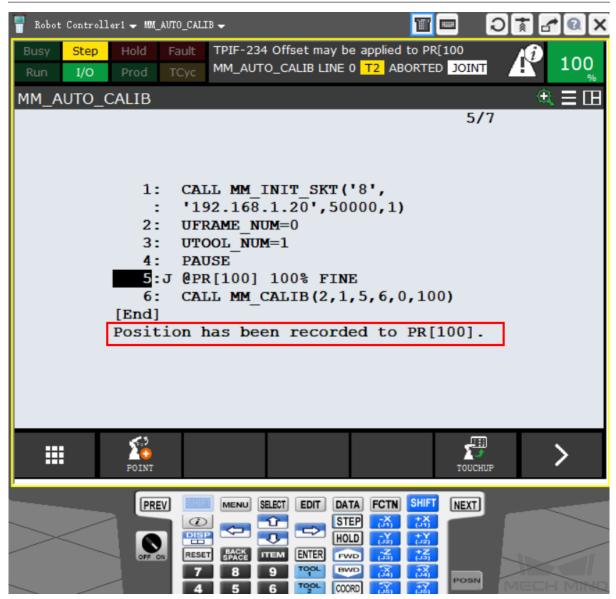


5. Select the number at the beginning of the 5th line, as shown below. Then press the SHIFT key and TOUCHUP on the screen together. A message "Position has been recorded to PR[100]" will appear.









6. Press STEP key on the teach pendant to exit the Step mode, then the *Step* icon on the screen will turn grey.

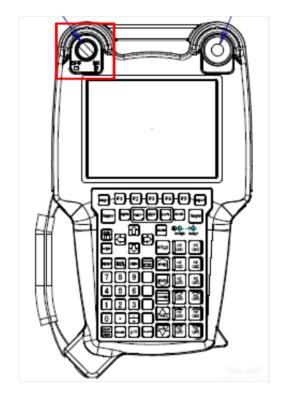


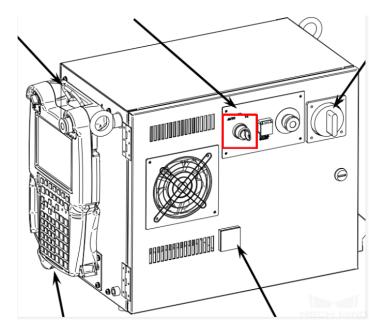




# Run the Calibration Program

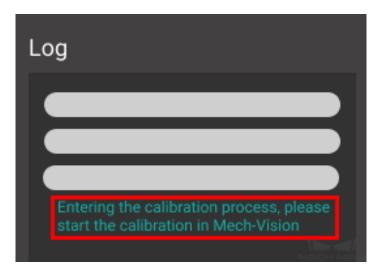
1. Swith to AUTO mode: turn the switch on the teach pendant to **OFF** and then turn the switch key on the controller to **AUTO**, as shown below.







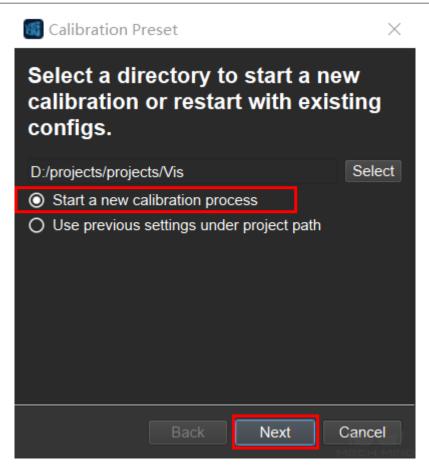
2. Press the green button on the controller to auto-run the calibration program. If the following message appear in Mech-Center **Log** panel, you can start calibration in Mech-Vision.



#### Start Calibration in Mech-Vision

- 1. In Mech-Vision, go to Camera  $\rightarrow$  Camera Calibration  $\rightarrow$  Standard.
- 2. Follow the instructions in Mech-Vision to complete the following configuration:
  - 1. Select **Start a new calibration process**;





- 2. Select the camera mounting method;
- 3. Select Multiple random board poses for adding calibration points.



| 🐻 Calibration P                        | reset                                      |  | $\times$ |
|--|--|--|----------|
| Robot FAN<br>connected.<br>calibration | Select a                                   |  |          |
| O TCP touch                            |  |  |          |
| O Multiple rand                        | dom board                                  | poses  |          |
| random t<br>-☆- recomme                | ooard poses<br>ended. For s<br>es, TCP tou | robot, multipl<br>s method is<br>5 axis or robo<br>uch method is | ot of    |
|  | Back                                       | Finish   | Cancel   |

**Note:** If after selecting the camera mounting method, the window says **No robot is connected**, the connection between the robot and Mech-Center is not properly established. Please re-run the robot program.

3. Follow the instructions in Mech-Vision to finish the calibration.

**Note:** In **5** Add Marker-Images and Poses after you click on *Move Robot along Trajectory* and Add Board Images, if the robot does not reach the next calibration point within 60 seconds, Mech-Vision will report a timeout error and stop the calibration process. In such case, please select and run **MM\_AUTO\_CALIB** on the teach pendant again, and restart the calibration process in Mech-Vision.



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# 2.3.3 FANUC Example Program

This section introduces the example program provided with Mech-Center and the operations required to perform an actual pick-and-place task.

The example program **mm\_sample** can be found in XXXX/Mech-Center/mech-interface/fanuc.

Check the section corresponding to your own application setup:

- Obtain Vision Results from Mech-Vision
- Obtain Planned Path from Mech-Viz

Before running the program, please make sure that:

- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You have completed the extrinsic parameter calibration with *the calibration program* or by manually adding calibration points.
- Mech-Vision and Mech-Viz projects are created and set to autoload.
- The **Project list** in *Mech-Center*  $\rightarrow$  *Deployment Settings*  $\rightarrow$  *Mech-Vision* is synced by clicking on

, and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings |                   |              | $\times$ |
|---------------------|-------------------|--------------|----------|
|                     |                   |              |          |
|                     | ✓ Use Mech-Vision |              |          |
|                     | Exec path         |              |          |
| Mech-Vision         | Project path 🚺    |              |          |
|                     | ID                | Project list |          |
|                     | 1                 |              |          |
|                     | 2                 |              |          |
|                     |                   |              |          |
|                     |                   |              |          |

- The TCP has been correctly specified.
- The robot speed is set to a low value, so that the operator can notice any unexpected behavior before accidents occur.

#### **Obtain Vision Results from Mech-Vision**

```
1: !FUNCTION:Eye to Hand simple pick ;
2: !MechMind,2022-05-30 ;
3: ;
4: !SET Tool ;
5: UTOOL_NUM=1 ;
6: !Move to HOME Position ;
7:J P[1] 100% FINE ;
8: !Move to Camera capture Position ;
```

(continues on next page)



(continued from previous page)

```
9:L P[2] 3000mm/sec FINE
10: !Set IP address and Port ;
11: CALL MM_INIT_SKT('8','192.168.1.20',50000,1);
12: WAIT
            .10(sec) ;
13: !Set Vision Recipe ;
14: //CALL MM_SET_MOD(1,1) ;
15: !Run Vision Project ;
16: CALL MM_START_VIS(1,1,2) ;
17: WAIT 1.00(sec);
18: CALL MM_GET_VIS(1,50,51,52) ;
19: IF (R[52]<>1100) THEN ;
20: PAUSE ;
21: ENDIF ;
22: CALL MM_GET_POS(1,60,70,80);
23:L PR[60] 800mm/sec CNT100 Offset,PR[1]
                                             ;
24:L PR[60] 800mm/sec FINE
25: !Add object grasping logic here ;
26:
      ;
27:L PR[60] 800mm/sec CNT100 Offset,PR[1]
                                             ;
28: !Add transition point ;
29:L P[3] 800mm/sec FINE
30: !Move to DROP Position ;
31:L P[4] 800mm/sec CNT100 Offset, PR[2]
                                          ;
32:L P[4] 200mm/sec FINE
                           ;
33: !Add object releasing logic here ;
34:
35:L P[4] 800mm/sec CNT100 Offset, PR[2]
                                          ;
36: !Move to HOME Position ;
37:J P[1] 100% FINE
                      ;
```

#### **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with MM\_INIT\_SKT. For detailed information, please refer to *FANUC Standard Interface Commands*.
- If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_SET\_MOD. For detailed information, please refer to FANUC Standard Interface Commands.
- 5. Run the Mech-Vision project with **MM\_START\_VIS**.
- 6. Wait for 1 second. Under Eye-In-Hand, this **WAIT** instruction is required to make sure the robot stays still until image acquisition is completed. Under Eye-To-Hand, this **WAIT** instruction is not needed if there is a motion procedure between **MM\_START\_VIS** and **MM\_GET\_VIS**
- 7. Obtain the vision results from Mech-Vision.
- 8. Check if the returned status code indicates any error. If an error code is returned, the program is paused.
- 9. Move the robot to the picking pose and perform picking.



- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

# Define HOME position

Please set the HOME position in register  $\mathbf{P}[\mathbf{1}]$ .

# Define the TCP

The TCP in this example is defined as **UTOOL\_NUM=1**. Please change the value **1** according to the actual TCP values.

# Teach the Image Capturing Pose

Please record the image capturing pose in register  $\mathbf{P}[2]$ .

#### Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

The waypoints in this example is saved in  $\mathbf{P}[3]$ . You can add one or more waypoints.

#### Teach the Placing Pose

Please record the placing pose in register  $\mathbf{P}[4]$ .

# Define Z-Offset from Picking/Placing Pose

Z-offset distances relative to the tool frame from the picking/placing pose are used to ensure collision doesn't occur when the robot is approching or departing the picking/placing pose.

Adjust the following commands according to your actual needs.

- L PR[60] 800mm/sec CNT100 Offset, PR[1]: the Z-offset when approching the picking pose is saved in PR[1].
- L PR[60] 800mm/sec CNT100 Offset, PR[1]: the Z-offset when departing the picking pose is saved in register PR[1].
- L P[4] 800mm/sec CNT100 Offset, PR[2]: the Z-offset when approching placing pose is saved in register PR[2].
- L P[4] 800mm/sec CNT100 Offset, PR[2]: the Z-offset when departing the placing pose is saved in register PR[2].



## Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking or placing the object.

**Obtain Planned Path from Mech-Viz** 

```
1: !FUNCTION:Eye to Hand simple pick ;
2: !and place with Mech-Viz ;
3: !MechMind,2022-05-30 ;
4: ;
5: !SET Tool ;
6: UTOOL_NUM=1 ;
7: !Move to HOME Position ;
8:J P[1] 100% FINE
                     ;
9: !Move to Camera capture Position ;
10:L P[2] 3000mm/sec FINE
11: !Set IP address and Port ;
12: CALL MM_INIT_SKT('8','192.168.1.20',50000,1) ;
13: WAIT .10(sec);
14: !Set Vision Recipe ;
15: //CALL MM_SET_MOD(1,1) ;
16: !Run Viz Project ;
17: CALL MM_START_VIZ(1) ;
18: WAIT
           .10(sec) ;
19: !set branch exitport ;
20: //CALL MM_SET_BCH(1,1) ;
21: !get planned path ;
22: CALL MM_GET_VIZ(2,50,51,52,53);
23: IF (R[53]<>2100) THEN ;
24: PAUSE ;
25: ENDIF ;
26: CALL MM_GET_POS(1,60,70,80) ;
27: CALL MM_GET_POS(2,61,71,81);
28: CALL MM_GET_POS(3,62,72,82) ;
29: !follow the planned path to pick ;
30:L PR[60] R[70]mm/sec FINE
                               ;
31:L PR[61] R[71]mm/sec FINE
32: !Add object grasping logic here ;
33:
     :
34:L PR[62] R[72]mm/sec FINE
                                ;
35: !Add transition point ;
36:L P[3] 800mm/sec FINE
                           ;
37: !Move to DROP Position ;
38:L P[4] 800mm/sec CNT100 Offset,PR[2]
                                           ;
39:L P[4] 200mm/sec FINE
                         ;
40: !Add object releasing logic here ;
41:
42:L P[4] 800mm/sec CNT100 Offset, PR[2]
                                           ;
43: !Move to HOME Position ;
44:J P[1] 100% FINE
                      ;
```



#### **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with MM\_INIT\_SKT. For detailed information, please refer to FANUC Standard Interface Commands.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_SET\_MOD.
- 5. Run the Mech-Viz project with **MM\_START\_VIZ**.
- 6. Obtain the planned path from Mech-Viz.
- 7. Check if the returned status code indicates any error. If an error code is returned, the program is paused.
- 8. Store obtained target points in the planned path to **PR[60]**, **PR[61]**, and **PR[62]**. For detailed information, please refer to *FANUC Standard Interface Commands*.
- 9. Move the robot along the planned path and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

#### **Define HOME position**

Please set the HOME position in register  $\mathbf{P}[\mathbf{1}]$ .

# Define the TCP

The TCP in this example is defined as **UTOOL\_NUM=1**. Please change the value **1** according to the actual TCP values.

# Teach the Image Capturing Pose

Please record the image capturing pose in register  $\mathbf{P}[2]$ .



# Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

The waypoints in this example is saved in  $\mathbf{P[3]}$ . You can add one or more waypoints.

# Teach the Placing Pose

Please record the placing pose in register  $\mathbf{P[4]}$ .

# Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking or placing the object.

# 2.3.4 FANUC Standard Interface Commands

The FANUC Standard Interface provides the following procedures:

- Initialize Communication
- Start Mech-Vision Project
- Get Vision Result
- Start Mech-Viz Project
- Get Planned Path
- Obtain Pose
- Obtain Joint Positions
- Switch Mech-Vision Recipe
- Select Mech-Viz Branch
- Set Move Index
- Get Software Status
- Input Object Dimensions to Mech-Vision
- Get DO Signal List/ Set DO Signal List
- Input TCP to Mech-Viz
- Calibration

When programming the FANUC robot, please pay attention to the following:

- Multiple parameters should be separated by commas.
- All parameters should be defined as local variables in the program file.
- Parameters can be defined as Input or Output parameters.

This Standard Interface is over the TCP/IP protocol.



#### Initialize Communication

MM\_INIT\_SKT (C\_Tag, Ip\_Addr, Svr\_Port, Time\_Out)

This procedure is used to set the host IP address, port number, and wait time for  $\mathrm{TCP}/\mathrm{IP}$  communication.

# Parameters

• Input Parameters

| Name     | Description  |
|----------|--|
| C_Tag    | Client port number, i.e. the port number string of the robot |
| Ip_Addr  | The IP address of the IPC                                    |
| Svr_Port | Server port number; the default port number is 50000         |
| Time_Out | Wait time in minutes before stopping connection attempt      |

# Example

|--|

When running the example, the specified client port number is 1, the host IP address should be set to 192.168.1.20, the port number should be set to 50000, and the wait time is 5 minutes.

# Start Mech-Vision Project

| MM | START | VIS | (Job,Pos | Num | Need, | SendPos | Type) |
|----|-------|-----|----------|-----|-------|---------|-------|
|    |       |     |          |     |       |         |       |

This procedure is for applications that use Mech-Vision but not Mech-Viz.. It runs the corresponding Mech-Vision project to acquire and process data.

#### **Parameters**

• Input Parameters

| Name     | Description  |
|----------|--|
| Job      | Mech-Vision Project ID, from 1 to 99   |
|          | Please go to Deployment Settings $\rightarrow$ Mech-Vision to check and adjust the number. |
| Pos_Num  | Nexedber of poses for Mech-Vision to send, from 0 to 20, where 0 means "send all"          |
|          |  |
| SendPos_ | <b>Type</b> the image capturing pose for the robot to send, from 0 to $2$                  |
|          | 0: Do not send image capturing pose (for Eye To Hand) 1: Send image capturing              |
|          | pose as joint positions 2: Send image capturing pose as robot flange pose                  |



# Example

CALL MM\_START\_VIS (1,1,1)

This example triggers Mech-Vision No. 1 project to run; the Mech-Vision No. 1 project is expected to send back 1 pose; and the robot will send image capturing pose as joint to Mech-Center.

# Get Vision Result

MM\_GET\_VIS (Job,Reg\_Lst\_Data,Reg\_Pos\_Num,Reg\_Status)

This procedure is for applications that use Mech-Vision but not Mech-Viz. It obtains the vision result from the corresponding Mech-Vision project.

#### Parameters

• Input Parameter

| [ | Name | Description  | 1 |
|---|------|--|---|
|   | Job  | Mech-Vision Project ID, from 1 to 99   | 1 |
|   |      | Please go to <i>Deployment Settings</i> $\rightarrow$ <i>Mech-Vision</i> to check and adjust the number. |   |

• Output Parameters

| Name         | Description   |
|--------------|---|
| Reg_Lst_Data | Data Register, indicating whether all vision result has been sent, 0 or 1     |
|              | 0: NOT all vision result has been sent (more on the way) 1: All vision result |
|              | has been sent   |
| Reg_Pos_Nun  | Data Register for storing the number of received poses, from 1 to 20          |
| MM_Status    | Data Register for storing status code, refer to the stan-                     |
|              | dard_interface_status_codes   |

# Example

CALL MM\_GET\_VIS (1,50,51,52)

This example obtains the vision result from Mech-Vision project No.1. Whether all vision result has been sent is stored in register  $\mathbf{R[50]}$ , the number of poses received is stored in register  $\mathbf{R[51]}$ , and the status code is stored in register  $\mathbf{R[52]}$ .



## Start Mech-Viz Project

MM\_START\_VIZ (SendPos\_Type)

This procedure is for applications that use both Mech-Vision and Mech-Viz. It runs the corresponding Mech-Viz project (which triggers the corresponding Mech-Vision project to run), and sets the initial joint positions of the simulated robot in Mech-Viz.

# Parameter

• Input Parameter

| Name    | Description   |
|---------|---|
| SendPos | Type initial joint positions for the simulated robot in Mech-Viz, 0 or 1                        |
|         | 0: Set the initial joint positions of the simulated robot to $[0,0,0,0,0,0]$ 1: Set the initial |
|         | joint positions of the simulated robot to the current joint positions of the real robot         |

Note: When the scene contains object models that obstruct the robot to move from [0,0,0,0,0,0] to the first target point, this parameter must be set to 1.

#### Example

| CALL | MM | START | VIZ | (1) |
|------|----|-------|-----|-----|
|------|----|-------|-----|-----|

This example runs the corresponding Mech-Viz project, and sets the initial joint positions of the simulated robot to the current joint positions of the real robot.

#### **Get Planned Path**

MM\_GET\_VIZ (Jps\_Pos,Reg\_Lst\_Data,Reg\_Pos\_Num,Reg\_VPos\_Num,Reg\_Status)

This procedure obtains the planned path from Mech-Viz.

#### Parameters

• Input Parameter

| Name    | Description   |
|---------|---|
| Jps_Pos | Whether Mech-Viz should send target points as joint positions or TCPs, 1 or 2 |
|         | 1: Mech-Viz sends joint positions 2: Mech-Viz sends TCPs                      |

• Output Parameters



| Name    | Description   |
|---------|---|
| Reg_Lst | <b>Data</b> Register, indicating whether all target points have been sent, 0 or 1         |
|         | 0: NOT all target points have been sent (more on the way) 1: All target points have       |
|         | been sent   |
| Reg_Po  | s DatamRegister for storing the number of received target points which range from 1-20    |
| Reg_VF  | oDaNauRegister for storing the position of the first visual_move target point in the path |
|         | Example path: move-1, move-2, visual_move-3, move-3, visual_move-2 In this path,          |
|         | the position of the first visual_move target point is 3. If the path does not contain     |
|         | visual_move target point, the return value is 0.  |
| Reg_Sta | tData Register for storing status code, refer to the standard_interface_status_codes      |

# Example

CALL MM\_GET\_VIZ (2,50,51,52,53)

This example obtains the planned path from Mech-Viz in the form of TCPs. Whether all target points have been sent is stored in register  $\mathbf{R[50]}$ , the number of target points received is stored in register  $\mathbf{R[51]}$ , the position of the visual\_move target point is stored in register  $\mathbf{R[52]}$ , and the status code is stored in register  $\mathbf{R[53]}$ .

# **Obtain Pose**

|--|

This procedure stores a pose returned by Mech-Vision or a target point (as TCP) returned by Mech-Viz in the specified Position Register.

# Parameters

• Input Parameter

NameDescriptionSerialSpecify the index of the pose to be stored

• Output Parameters

| Name       | Description   |
|------------|---|
| Pr_Num     | Position Register for storing the specified pose                        |
| Label      | Data Register for storing the label corresponding to the specified pose |
| Pose_Speed | Data Register for storing the speed corresponding to the specified pose |



# Example

CALL MM\_GET\_POS (1,60,61,62)

This example stores the first received pose to register PR[60], the corresponding label to register R[61], and the corresponding speed to register R[62].

# **Obtain Joint Positions**

MM\_GET\_JPS (Serial, Pr\_Num, Reg\_Label, Reg\_Speed)

This procedure stores a set of joint positions returned by Mech-Viz in the specified Position Registers.

**Note:** As Mech-Vision does not output joint position data, this subprogram can only be used with Mech-Viz.

# Parameters

• Input Parameter

|        | Description  |
|--------|--|
| Serial | Specify the index of the set of joint positions to be stored |

• Output Parameters

| Name      | Description  |
|-----------|--|
| Pr_Num    | Position Register for storing the specified set of joint positions                             |
| Reg_Label | Data Register for storing the label corresponding to the specified set of joint po-<br>sitions |
| Reg_Speed | Data Register for storing the speed corresponding to the specified set of joint positions      |

# Example

CALL MM\_GET\_JPS (1,60,61,62)

This example stores the first set of received joint positions to PR[60], the corresponding label to register R[61], and the corresponding speed to register R[62].



# Switch Mech-Vision Recipe

#### MM\_SET\_MOD (Job,Model\_Num)

This procedure specifies which parameter recipe of the Mech-Vision project to use. For more information on parameter recipe, please see parameter\_recipe\_configuration.

#### Note:

• This procedure must be called BEFORE **MM\_START\_VIZ**.

#### Parameters

• Input Parameters:

| Name      | Description   |
|-----------|---|
| Job       | Mech-Vision Project ID, from 1 to 99  |
|           | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| Model_Num | The number of a parameter recipe in the Mech-Vision project, from 1 to 99                       |

#### Example

| CALL MM_SET_MOD (2,2) |  |
|-----------------------|--|
|-----------------------|--|

This example switches the parameter recipe used to No. 2 in Mech-Vision project No. 2.

# Select Mech-Viz Branch

```
MM_SET_BCH (Branch_Num,Export_Num)
```

This procedure is used to select along which branch the Mech-Viz project should proceed. Such branching is achieved by adding branch\_by\_service\_message Task(s) to the project. This subprogram specifies which out port such Task(s) should take.

#### Note:

- **MM\_START\_VIZ** must be called BEFORE this procedure.
- When the next Task to be executed in Mech-Viz is a **branch\_by\_service\_message** Task, Mech-Viz will wait for this procedure to send the out port number it should take.
- The name of all **branch\_by\_service\_message** Tasks in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.



# Parameters

• Input Parameters

| Name       | Description   |
|------------|---|
| Branch_Num | Name of the <b>branch_by_service_message</b> Task, from 1 to 99 |
| Export_Num | The number of the out port to take, from 1 to 99                |

# Example

| CALL MM_SET_BCH (1,3) |  |
|-----------------------|--|
|-----------------------|--|

This example tells Mech-Viz to take out port **3** for the **branch\_by\_service\_message** Task named **1**.

# Set Move Index

MM\_SET\_IDX (Skill\_Num,Index\_Num)

This procedure sets the value for the Current Index parameter of Mech-Viz Tasks. Tasks that have this parameter include move\_list, move\_grid, custom\_pallet\_pattern, and smart\_pallet\_pattern.

# Note:

- MM\_START\_VIZ must be called BEFORE this procedure.
- The name of all Tasks with index parameters in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

# Parameters

• Input Parameters

| Name      | Description   |
|-----------|---|
| Skill_Num | Name of the Task, from 1 to 99                                  |
| Index_Num | Value for the Current Index parameter when the Task is executed |

# Example

| . MM_SET_IDX (2,10) |
|---------------------|
|---------------------|

This example sets the Current Index value to 9 for the Task named **2**. When the Task is executed, the Current Index value will be added 1 and become 10.



## **Get Software Status**

MM\_GET\_STAT (MM\_Status:OUT)

This procedure is currently capable of checking whether Mech-Vision is ready to run projects. In the future, this procedure can be used for obtaining the execution status of Mech-Vision, Mech-Viz and Mech-Center.

# Parameter

• Output Parameter

| Name      | Description    |         |         |     |        |       |       |    |     |       |
|-----------|----------------|---------|---------|-----|--------|-------|-------|----|-----|-------|
| MM_Status | Data Registe   | r for   | storing | the | status | code, | refer | to | the | stan- |
|           | dard_interface | _status | _codes  |     |        |       |       |    |     |       |

## Example

CALL MM\_GET\_STAT (70)

This example obtains the status code and stores it in register  $\mathbf{R}[\mathbf{70}]$ .

#### Input Object Dimensions to Mech-Vision

MM\_SET\_BS (Job:IN,Lenght,Width,Height)

This procedure inputs object dimensions to the Mech-Vision project.

#### Note:

• This procedure must be called BEFORE MM\_START\_VIS.

# Parameters

• Input Parameters

| Name   | Description   |
|--------|---|
| Job    | Mech-Vision Project ID, from 1 to 99  |
|        | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| Lenght | Length of object in mm  |
| Width  | Width of object in mm   |
| Height | Height of object in mm  |



## Example

CALL MM\_SET\_BS (1,11.0,12.0,13.0)

This example sets the object dimensions in the read\_object\_dimensions Step in the Mech-Vision project No. 1 to 11\*12\*13 mm.

## Get DO Signal List/ Set DO Signal List

• Get DO Signal List

MM\_GET\_DL

• Set DO Signal Lis

MM\_SET\_DL

These two procedures obtain the planned DO Signal list for controlling multiple sections of a sectioned vacuum gripper and set the DOs accordingly.

#### Note:

- MM\_GET\_VIZ must be called BEFORE this procedure.
- Please deploy the Mech-Viz project based on the template project in *Mech-Center/tool/viz\_project/suction\_zone*, and set the suction cup configuration file in the Mech-Viz project.

#### Parameters

No parameters.

#### Example

| CALL MM_GET_DL |  |
|----------------|--|
|                |  |

CALL MM\_SET\_DL

These two examples obtain the DO signal list planned by Mech-Viz, store it in  $Do\_Port[i]$ , and input the values to the corresponding digital outputs.



#### Input TCP to Mech-Viz

# MM\_SET\_POS (X,Y,Z,W,P,R)

This procedure inputs TCP data to the outer\_move Task.

#### Note:

- This procedure must be called BEFORE **MM\_START\_VIZ**.
- Please deploy the Mech-Viz project based on the template project in *Mech-Centertoolviz\_projectouter\_move*, and put the **outer\_move** Task at a proper position in the workflow.

#### Parameter

• Input parameter

| Name | Description                         |
|------|-------------------------------------|
| Х    | Variable 1 of the pose (mm)         |
| Y    | Variable 2 of the pose (mm)         |
| Ζ    | Variable 3 of the pose (mm)         |
| W    | Variable 4 of the pose (arc degree) |
| Р    | Variable 5 of the pose (arc degree) |
| R    | Variable 6 of the pose (arc degree) |

#### Example

CALL MM\_SET\_POS (100.1,200.2,300.3,90.0,180.0,0.0)

This example sends the pose of TCP (100.1,200.2,300.3,90.0,180.0,0.0) to the outer\_move task in the Mech-Viz project.

#### Calibration

MM\_CALIB (Move\_Type,PosJps,WaitTime,AxisNum,AxisVal,Reg\_CalibPos)

This procedure is used for hand-eye calibration (camera extrinsic parameter calibration). It automates the calibration process in conjunction with the **Camera Calibration** function in Mech-Vision. For detailed instructions, see *FANUC Calibration Program*.



# Parameters

• Input Parameters

| Name         | Description  |  |  |
|--------------|--|--|--|
| Move_Type    | Motion type, 1 or 2  |  |  |
|              | 1: Linear motion 2: Joint moton  |  |  |
| PosJps       | sJps Pose as flange pose or joint positions, 1 or 2                              |  |  |
|              | 1: flange pose 2: Joint positions  |  |  |
| WaitTime     | Wait time between poses in minutes   |  |  |
| AxisNum      | The axis number of the robot   |  |  |
| AxisVal      | Data of the external 7th axis in mm (Optional; input 0 when there is no external |  |  |
|              | axis)  |  |  |
| Reg_CalibPos | The Position Register used in MM_AUTO_CALIB; PR[100] by default                  |  |  |

# Example

CALL MM\_CALIB (2,1,5,6,0,100)

This example moves a 6-axis robot in Joint motion type, receives pose data in the form of flange pose, and sets the wait time between two poses to 5 minutes. Moreover, the robot does not have an external 7th axis. The register  $\mathbf{PR}[100]$  is used to store the received pose data.

# 2.3.5 FANUC Error Messages

The following errors may occur while running the Standard Interface program on the robot.

# MM:Robot\_Internal\_Error

Error occurred while the robot program attempts to call the system function.

# Troubleshooting

Please refer to KAREL Reference Manual and check the program.

# MM:Robot\_Socket\_Closed

Error occurred when the robot program called the  $\mathbf{MSG}\_\mathbf{CONNECT}$  procedure to establish communication with Mech-Center.



# Troubleshooting

- Check if the hardware are properly connected.
- Check if the Standard Interface is started in Mech-Center.
- Check the IP addresses of the robot and the IPC, and if the port number is configured correctly.
- Check if the firewall is turned off on the IPC.
- Contact Mech-Mind Technical Support for further assistance.

# MM:Robot\_Argument\_Error

When calling a Mech-Mind Standard Interface procedure, arguments provided are not correct.

# Troubleshooting

Please refer to FANUC Standard Interface Commands and input the correct arguments accordingly.

# MM:Robot\_CMD\_Error

The command code returned to the robot does not match the one sent to Mech-Center.

# Troubleshooting

The sequence of command sending and receiving is problematic. Please contact Mech-Mind Technical Support for further assistance.

# MM:IPC\_Return\_Error

Returned status code is an error code. Please check Mech-Center' s log.

# Troubleshooting

- Please refer to the standard\_interface\_status\_codes for the specific error.
- Please contact Mech-Mind Technical Support for further assistance.

# 2.4 KUKA

This section introduces the Standard Interface for KUKA robots.



# 2.4.1 KUKA Setup Instructions

This section introduces the process of loading the Standard Interface program onto a KUKA robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

# Check Controller and Software Compatibility

Compatibility requirements are as follows:

- Robot: 6-axis KUKA robot
- Controller model: KUKA KR C4
- Controller system software version: KSS 8.2 to 8.6
- Add-on software package: Ethernet KRL (V 2.2.8 or above)

**Note:** All teach pendant actions in this chapter are performed on KSS 8.6. The specific steps and menu selections may differ slightly in older versions of system software.

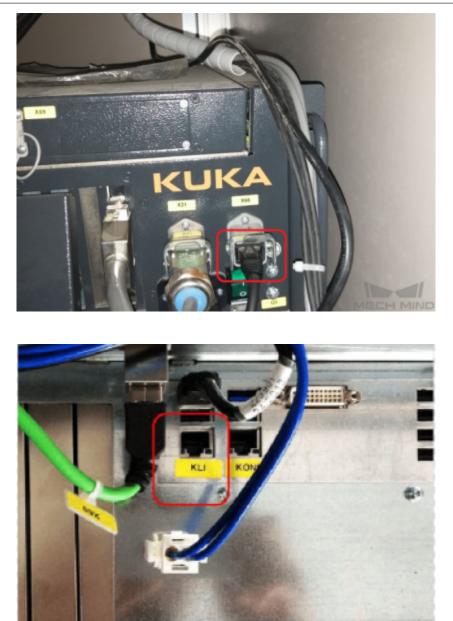
# Setup the Network Connection

# Hardware Connection

Plug the Ethernet cable into:

- An Ethernet port on the IPC
- The X66 port on KR C4 compact and KLI port on other KR C4 controllers





# **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Check the IP address of the IPC: please use the *ipconfig* command in Command Prompt or PowerShell to check the IP address.
- 2. Switch to expert mode:



- т**10** в0 100 ķ ₩ R Τ1 00 10 9:40:51 AM 5/11/2022 LOS 120 OK Confirm all 0 The logged-on user switched from Operator to Administrator. 0 < ហ × Configuratio File Inputs/outputs ► ► E Configuration ► T interpreter A1 Display Status keys 3 ► ► Diagnosis User group • A2 Start-up Miscellaneous ► 27 A3 Shutdown Safety configuration Help Brake test configuration ► A4 Machine configuration Collision detection A5 A6 Quick access Configuration > Miscellaneous > Language Display > Variable > Cyclical flags Configuration > Miscellaneous > Event planner Start-up > Calibrate > Tolerances
- 1. Press on  $\bigcirc$ , and then select Configuration  $\rightarrow$  User group.

2. Select **Expert**, enter the password (the default password is **kuka**), and press on *Log on*.



| 3     | 0S_I_R_T1 ≥ 100 ★ ★ 100 ↔   | x  |
|-------|---|----|
|       | 9:46:54 AM 5/11/2022 LOS 120  The logged-on user switched from Administrator to Operator.  OK  Confirm all  | 0  |
|       | Log-on by selection   | 1  |
|       | Operator (default) is logged on.  |    |
| X     | Select a user group:  |    |
|       | Operator (Default)  |    |
|       | User  | E  |
|       |   | A1 |
| 5     | Expert  |    |
| ~     | Safety recovery technician  |    |
|       |   | A2 |
| لتستا | Safety maintenance technician   |    |
|       | Administrator   | A3 |
|       | Password: 2 1   |    |
|       | rassword.   |    |
|       |   | A4 |
|       | !     @     #     \$     %     ^     &     *     (     )       1     2     3     4     5     6     7     8     9     0  |    |
|       | ~ /   \ { } [ ]   | A5 |
|       | $\mathbf{Q}^{\prime\prime} \mathbf{W}^{\prime} \mathbf{E}^{\prime} \mathbf{R}^{\prime\prime} \mathbf{T}^{\prime\prime} \mathbf{Y}^{\prime\prime} \mathbf{U}^{\prime\prime} \mathbf{I}^{\prime\prime} \mathbf{O}^{\prime} \mathbf{P}^{\prime\prime}$ |    |
|       |   |    |
|       | ASDFGHJKL   | A6 |
|       | Copy Paste , ?<br>C Z X C V B N M ∠   |    |
|       | ☆     Z     X     C     V     B     N     M     ←   |    |
|       | SYM K V LI A D A D Free   |    |
|       |   |    |
|       |   | Æ  |
|       | Default Password Log on   |    |
|       |   | ND |

3. Press on  $\bigcirc$ , and then select *Start-up*  $\rightarrow$  *Network configuration*.



| 3        | 1   | S I R TI                | 100<br>10 K |             | ω          |
|----------|---|-------------------------|-------------|-------------|------------|
|          | (i) 9:46:54 AM 5/11/2022 LOS                                |                         | ок          | Confirm all |            |
| 0<br>13  | The logged-on user switched from Administrator to Operator. |                         |             |             |            |
| <b>1</b> | Main menu   |                         |             |             |            |
|          |   |                         |             |             |            |
|          | Main menu   | Start-up                |             |             | <b>X</b>   |
|          | File  | Start-up wizard         |             |             | E          |
|          | Configuration   | Supplementary load data |             |             | A1         |
| $\odot$  | Display 🕨   | Tool/base management    |             |             |            |
| ETA      | Diagnosis 🕨   | Calibrate               |             |             | A2         |
|          | Start-up  | 2 ►                     |             |             |            |
|          | Shutdown  | Software update         |             |             | <b>A3</b>  |
|          | Help 🕨  | Service                 |             |             |            |
|          |   | Robot data              |             |             | <b>A</b> 4 |
|          |   | Network configuration   | 3           |             | A5         |
|          |   | Additional software     |             |             | ~          |
|          |   | Rights management       |             |             | <b>A6</b>  |
|          | Quick access  |                         |             |             |            |
|          | Configuration > User group                                  |                         |             | -*          |            |
|          | Configuration > Miscellaneous                               | > Language              |             | -           |            |
|          | Display > Variable > Cyclical                               | flags                   |             | -           | <b>S</b>   |
|          | Configuration > Miscellaneous                               | > Event planner         |             | +           |            |

4. Input an **IP address** in the same subnet as that of the IPC, and then press on *Save*. Press on *Yes* and *OK*, respectively, in the next two pop-up windows.



| 3           |   | t T1                    | R            | ▶ 100<br><b>⊜</b> 10 | ¥                    | Ý               | т10<br>в0 ₩₩         | œ         |
|-------------|---|-------------------------|--------------|----------------------|----------------------|-----------------|----------------------|-----------|
| 0<br>0<br>1 | <ul> <li>10:41:27 AM 5/11/2022 LOS 120</li> <li>The logged-on user switched from Operator to E</li> </ul> | xpert.                  |              |                      | ОК                   |                 | Confirm all          | <b>9</b>  |
|             | Network configuration Windows interface (virtual5)  |                         |              |                      |                      |                 |                      |           |
|             | Address type:   | Fixed IF                | o add        | ress                 |                      |                 | 1                    | E         |
| •           | IP address:   | 192                     |              | 168                  | . 1                  |                 | 147                  | A1        |
|             | Subnet mask:  | 255                     |              | 255                  | . 0                  |                 | 0                    | A2        |
|             | Standard gateway:   | 0                       |              | 0                    | . 0                  |                 | 0                    | A3        |
|             | DNS Server:   | 0                       |              | 0                    | . 0                  |                 | 0                    | A4        |
|             |   |                         |              |                      |                      | Ad              | vanced               |           |
|             | The Windows interface is the network interface the controller. (If PROFINET is used without a be used.)   | ce via whi<br>an advanc | ch W<br>ed c | /orkVis<br>onfigur   | ual comr<br>ation, a | nunic<br>static | ates with<br>IP must | A5        |
|             |   |                         |              |                      |                      |                 |                      | <b>A6</b> |
|             |   |                         |              |                      |                      |                 |                      |           |
|             | KLI   |                         |              | Inter                | nal sul              | 2               |                      | se.       |
|             |   |                         |              |                      | Save                 | 9               | Back                 |           |



|                | Network configuratio               | n 688888   |                            |
|----------------|------------------------------------|--|----------------------------|
|                | Would you                          | u like to save the change                          | es?                        |
|                | Yes                                | Cancel   |                            |
| Network config | uration                            |  |                            |
| Config         | guration has been modified<br>star | I. The changes will be a<br>t with "Reload files"! | pplied after the next cold |
|                | [                                  | ок   |                            |

5. Restart the robot to finish setting the IP address:





| 3 |   | ω         |
|---|---|-----------|
|   | (i) 10:47:26 AM 5/11/2022 LOS 120<br>The logged-on user switched from Expert to Operator. | 0         |
|   | Main menu<br>Main menu  |           |
|   | File  | E         |
|   | Configuration   | <b>A1</b> |
| 0 | Display ►   |           |
| M | Diagnosis   | <b>A2</b> |
|   | Start-up  |           |
| ۲ | Shutdown 2  | A3        |
|   | Help  | <b>A4</b> |
|   |   |           |
|   |   | A5        |
|   | Quick access  | <b>A6</b> |
|   | Shutdown -  |           |
|   | Start-up > Network configuration  |           |
|   | Configuration > User group  | ۶         |
|   | Configuration > Miscellaneous > Language  |           |

2. Press on Reboot control PC.



| 3           | $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | 00             |
|-------------|--|----------------|
| 0<br>0<br>6 | 8:43:39 AM 5/13/2022 LOS 120 The logged-on user switched from Operator to Expert.      OK Confirm all Shutdown | <b>9</b>       |
|             | Default settings for shutdown     Start type   |                |
| <b>()</b>   | Cold start     Image: Hibernate       Power-off wait time [s]     Image: Hibernate                             | <b>S</b><br>A1 |
|             | Power-fail wait time [s]   |                |
| ۲           | Settings for next shutdown  Force cold start  Power-off delay  Reload files  Power-fail wait  time             |                |
|             | Shut down actions Shut down control PC Reboot control PC   | A4<br>A5       |
|             | ⊘ Drive bus  | A6             |
|             |  |                |
|             |  | *              |



# Load the Program Files

# **Prepare the Files**

The program files are stored in the installation directory of Mech-Center. The default directory is C:/Mech-Mind/Mech-Center.

Navigate to xxx/Mech-Center/mech\_interface/kuka, and copy the following files to your flash drive.

- mm\_module.src
- mm\_module.dat
- XML\_Kuka\_MMIND.xml

Load the Files to the Robot

**Note:** Make sure you have switched to expert mode on the teach pendant. For instructions, see step 2 in **IP Configuration**.

- 1. Plug the flash drive to the controller.
- 2. Select the flash drive, and locate the above files.
- 3. Long-press and select **mm\_module.src** and **mm\_module.dat**, press on *Edit*, and then select **Copy**.



| 3 | R!                          | I R T1 🏅                   | 100 ★ ★ <sup>T?</sup> ★ | œ  |
|---|-----------------------------|----------------------------|-------------------------|----|
|   | Expert.                     | ety recovery technician to | OK Confirm all          | ٢  |
| 0 | Navigator<br>Filter: Detail | Contents of:               |                         |    |
|   | PCRC-2RL7HHTTRE (KRC:\)     | Name                       | Navigator<br>New        |    |
|   | 🧼 KUKA_DISK (C:\)           | 🛃 –                        | Open 🕨                  | E  |
|   | KUKA_DATA (D:\)             | XML_Kuka_MMIN              | Mark all                | A1 |
| 0 | (E:\)                       |                            | <sub>Cut</sub>          |    |
|   | MM_USB (F:\)                |                            | Сору                    | A2 |
|   | D Adapter                   |                            | Paste                   |    |
| 3 | 💋 kuka                      |                            | Delete                  | A3 |
|   | System Volume Informat      |                            | Duplicate               |    |
|   | test_simulate               |                            | Archive ►               | A4 |
|   | (ARCHIVE:\)                 |                            | Rename                  | A5 |
|   |                             |                            | Properties              |    |
|   |                             |                            | Filter                  | A6 |
|   |                             |                            | Select 🕨                |    |
|   |                             |                            | Cancel program          |    |
|   | 2 Object(s) selected        | < 35957 Bytes              | Reset program           | 2  |
|   | New Select Duplicate        | Archive Delet              | e Open Edit             | N. |

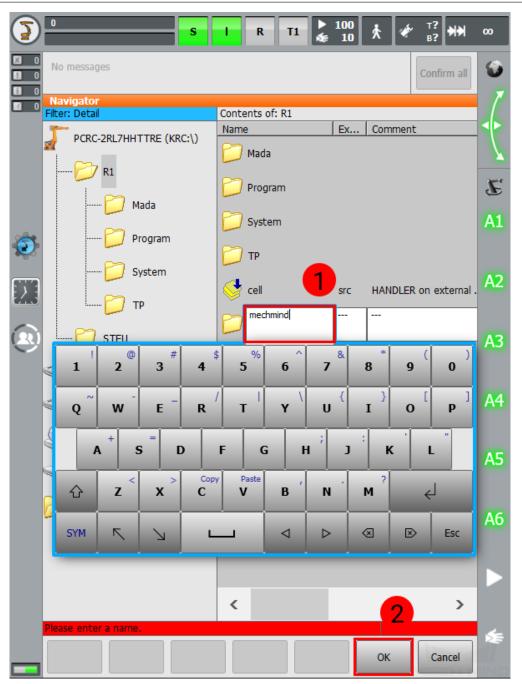
4. Navigate to KRC:/R1, and press on New.



| 3        | o s  | I R T                   | ▶ 100<br>≰ 10 | ★ ★ <sup>T?</sup><br>B? ₩ | œ          |
|----------|--|-------------------------|---------------|---------------------------|------------|
|          | No messages  |                         |               | Confirm all               | ٥          |
| 0<br>0   | Navigator<br>Fiter: Detain<br>PC, 27HHTTRE (KRC:\) | Contents of: R1<br>Name | Ex            | Comment                   | •          |
|          |  | Drogram                 |               |                           | æ<br>7     |
| <b>5</b> | 💋 Mada<br>📁 Program                                | 📁 System                |               |                           | <b>A1</b>  |
|          | 📁 System   | Cell                    | src           | HANDLER on external       | A2         |
|          | STEU   |                         |               |                           | A3         |
|          | WUKA_DATA (D:\)                                    |                         |               |                           | <b>A</b> 4 |
|          | (E:\) (MM_USB (F:\)                                |                         |               |                           | A5         |
|          | (ARCHIVE:\)  |                         |               |                           | <b>A6</b>  |
|          |  |                         |               |                           |            |
|          | 5 Objector   | <                       |               | >                         | <b>\$</b>  |
|          | New Select Duplicate                               | e Archive               | Delete        | Open Edit                 |            |

5. Input **mechmind** for the folder name, and press on OK.





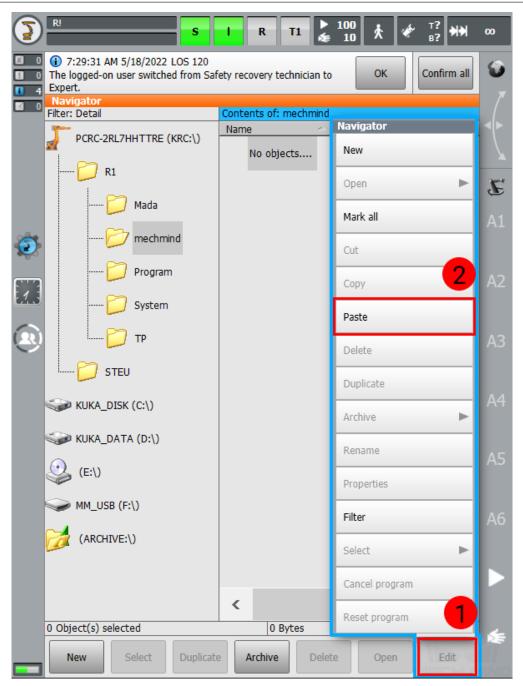
6. Select the **mechmind** folder, and press on **Open**.



| 3 | R!   |  | • |
|---|--|--|---|
|   | <ul> <li>7:29:31 AM 5/18/2022 LOS 120<br/>The logged-on user switched from Saf<br/>Expert.</li> <li>Navigator<br/>Filter: Detail</li> <li>PCRC-2RL7HHTTRE (KRC:\)</li> <li>R1</li> <li>Mada</li> <li>mechmind</li> <li>Program</li> <li>System</li> <li>System</li> <li>TP</li> <li>STEU</li> <li>KUKA_DISK (C:\)</li> <li>KUKA_DATA (D:\)</li> <li>(E:\)</li> <li>MM_USB (F:\)</li> </ul> | afety recovery technician to OK Confirm all   Contents of: R1   Name   Mada   Mada   Mada   Program   System   TP   Cell   src   HANDLER on external |   |
|   | (ARCHIVE:\)  |  |   |
|   | 1 Object(s) selected   | < 2 >  |   |
|   | New Select Duplicate   |  | • |

7. Press on  $\mathit{Edit},$  and then select  $\mathbf{Paste}.$ 





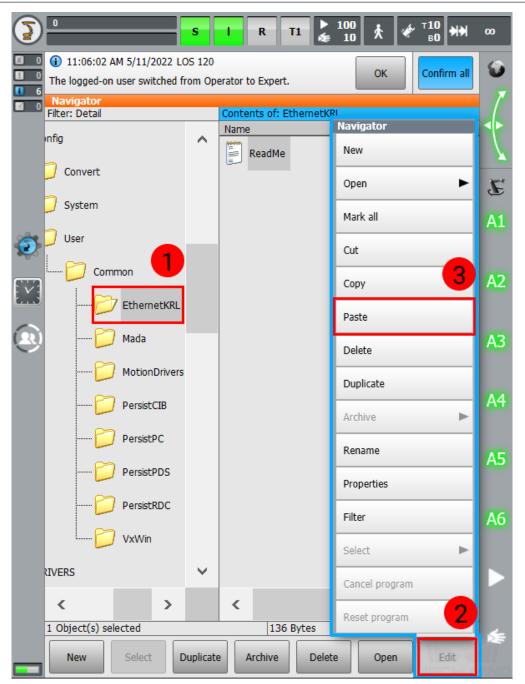
8. Navigate back to the flash drive, and copy XML\_Kuka\_MMIND.xml.



| 3                | R!                          | I R T1 🍃                   | 100<br>10 ★ ★ <sup>T?</sup><br>8? | œ        |
|------------------|-----------------------------|----------------------------|-----------------------------------|----------|
| 0<br>0<br>1<br>4 | Expert.                     | ety recovery technician to | OK Confirm all                    | <b>9</b> |
| 0                | Navigator<br>Filter: Detail | Contents of: kuka          |                                   |          |
|                  |                             | Name 🗠                     | Navigator                         |          |
|                  | PCRC-2RL7HHTTRE (KRC:\)     | mm_module                  | New                               |          |
|                  | WIKA_DISK (C:\)             | mm_modul                   | Open 🕨                            | E        |
|                  | 🧼 KUKA_DATA (D:\)           | XML_Kuka_MMIN              | Mark all                          | A1       |
| 5                | (E:\)                       |                            | Cut 3                             | ~1       |
| Ne S             |                             |                            | Cut                               |          |
| 673              | MM_USB (F:\)                |                            | Сору                              | A2       |
| لالكما           | 💋 Adapter                   |                            | Paste                             |          |
|                  | 📂 kuka                      |                            |                                   | A3       |
|                  |                             |                            | Delete                            |          |
|                  | System Volume Informat      |                            | Duplicate                         |          |
|                  | 📁 test_simulate             |                            | Archive 🕨                         | A4       |
|                  | (ARCHIVE:\)                 |                            | Rename                            | A5       |
|                  |                             |                            | Properties                        | 1.5      |
|                  |                             |                            | Filter                            | A6       |
|                  |                             |                            | Select ►                          |          |
|                  |                             |                            | Cancel program                    |          |
|                  | < >                         | <                          | Reset program                     |          |
|                  | 1 Object(s) selected        | 438 Bytes                  |                                   | 5=       |
|                  | New Select Duplicate        | e Archive Delete           | e Open Edit                       |          |

9. Navigate to C:/KRC/ROBOTER/Config/User/Common/EthernetKRL, press on Edit, and then select Paste.

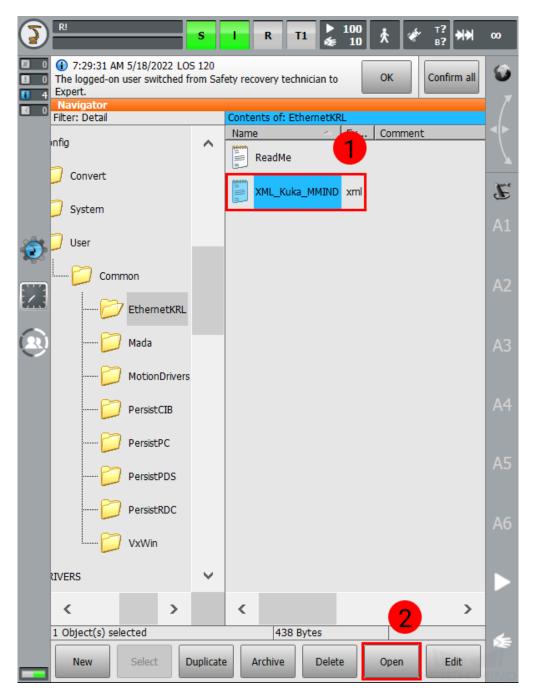






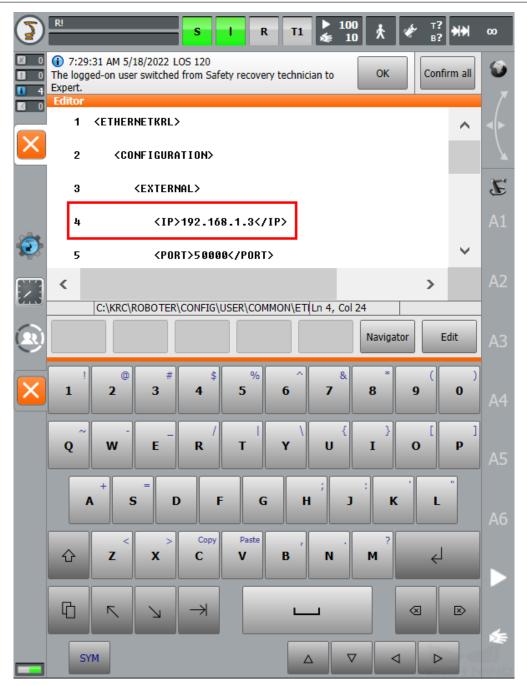
# Modify IP Address in XML file

1. Select XML\_Kuka\_MMIND.xml, and press on *Open*.



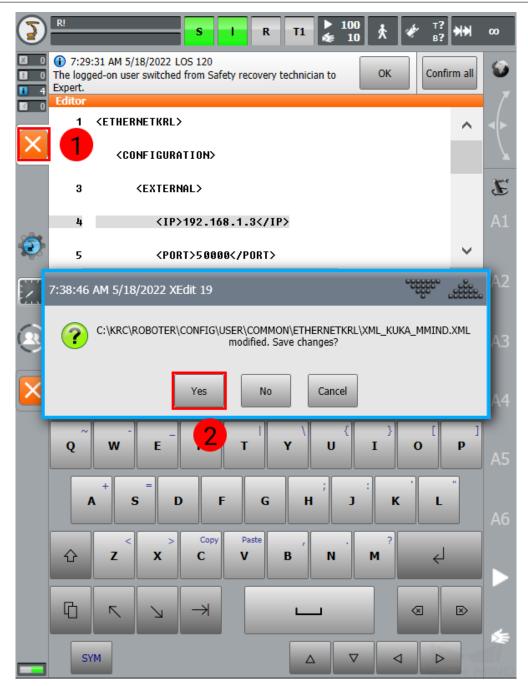
2. Press on line 4 where it says <**IP**>**192.168.1.1**<**IP**>, and press to change the IP address to the IPC' s actual IP address.





- 3. Check line 5 to see if the port number is correct. If not, change it to the IPC's actual port number.
- 4. Press on  $\bigcirc$  and then *Yes* to save the changes.







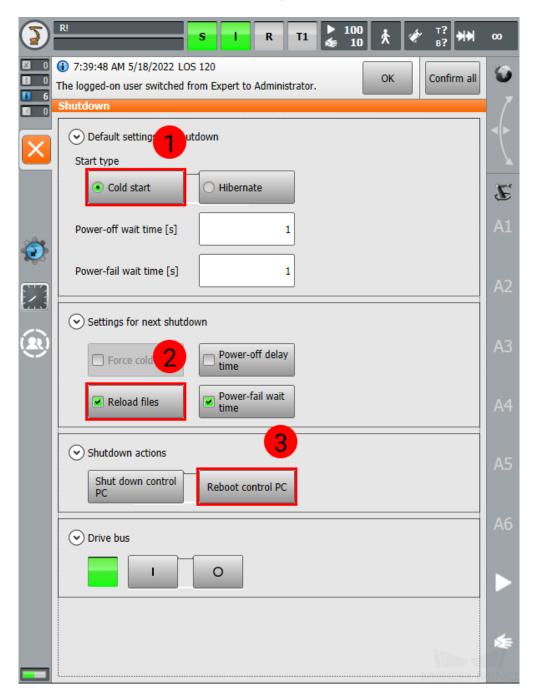
# Restart the Robot

- 1. Switch to administrator mode following the instructions of step 2 in **IP Configuration**. The default password is **kuka**.
- 2. Press on **()**, and select **Shutdown**.

| 3 |  | 00 |
|---|--|----|
|   | No messages Confirm all                  | ٢  |
|   | Main menu<br>Main menu                   |    |
|   | File                                     | E  |
|   | Configuration ►                          | A1 |
| ۲ | Display ►                                |    |
|   | Diagnosis                                | A2 |
|   | Start-up                                 |    |
| ۲ | Shutdown 2                               | A3 |
|   | Help ►                                   |    |
|   |  | A4 |
|   |  | A5 |
|   |  | ~5 |
|   |  | A6 |
|   | Quick access                             |    |
|   | Configuration > Miscellaneous > Language |    |
|   | Configuration > User group               |    |
|   | Shutdown 🛁                               | Æ  |
|   | Start-up > Network configuration         |    |



3. Select Cold start and Reload files, and then press on Reboot control PC.



4. Press on Yes in the pop-up window to restart the robot.



| 3 | R! S I R T1 ≥ 100 ★ ₹? ₩  | 00         |
|---|---|------------|
|   | Image: Triangle of the logged-on user switched from Expert to Administrator.       OK       Confirm all | ٥          |
| 0 | Shutdown  |            |
| × | Default settings for shutdown     Start type  |            |
|   | Cold start     Hibernate  | E          |
| Ð | Power-off wait time [s]   | A1         |
|   | Power-fail wait time [s] 1  |            |
|   | Reboot control PC   | 42 I       |
| ۲ | Do you really want to reboot the control PC? Note: A cold start will be carried out.                    | 43         |
|   | Yes No  | 44         |
|   | Shutdown actions Shut down control PC Reboot control PC   | A5         |
|   | ⊘ Drive bus   | <b>A</b> 6 |
|   |   |            |
|   | MECH  | ٠          |



# **Test Robot Connection**

### **Configure Mech-Interface in Mech-Center**

- 1. Open Mech-Center and click on Deployment Settings.
- 2. Go to Mech-Interface, check Use Mech-Interface and select Standard Interface.

| eployment Settings  | ~ |
|---|---|
|   |   |
| Mech-Interface 1<br>Use Mech-Interface 2<br>Interface Service Type<br>Standard Interface 3<br>Adapter |   |
| Save Cancel   |   |
|   |   |

3. Set the following fields:

- Interface Option: Set to TCP Server, HEX, and Little endian.
- Listed robot: Select the robot model you are using.
- Host Address: The default port number is 50000. If you need to change the port number, make sure to change it accordingly in the XML\_Kuka\_MMIND.xml on the teach pendant as well.
- 4. Click on Save.



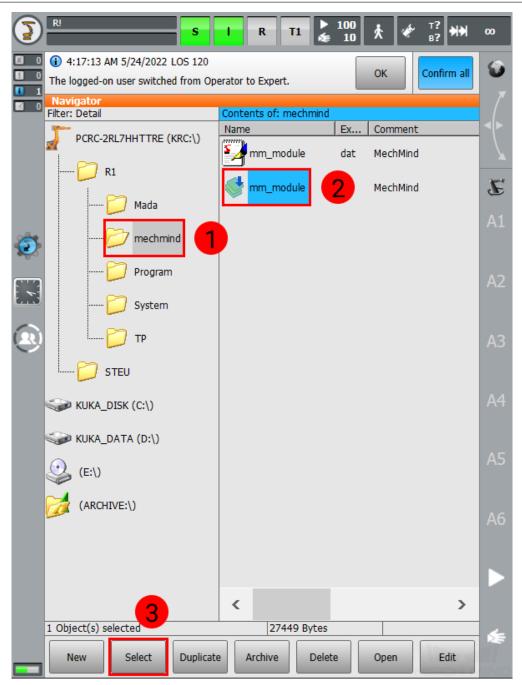
| Deployment Settings |  | $\times$ |
|---------------------|--|----------|
|                     | ✓ Use Mech-Interface   |          |
|                     | Interface Service Type<br>• Standard Interface • Adapter   |          |
| Mech-Interface      | Interface Options TCP Server    HEX  Little end   Listed robot KUKA   KUKA_KR10_R1100_2   rzyx Custom robot Host Address | 1        |
|                     | 2<br>Save  | Cancel   |
|                     |  |          |

5. Click on *Start Interface* in the Toolbar.

# Run the Robot Program

1. On the teach pendant, open the **mechmind** folder, select  $mm\_module.src$ , and then press on *Select*.





2. The following should appear on the screen.



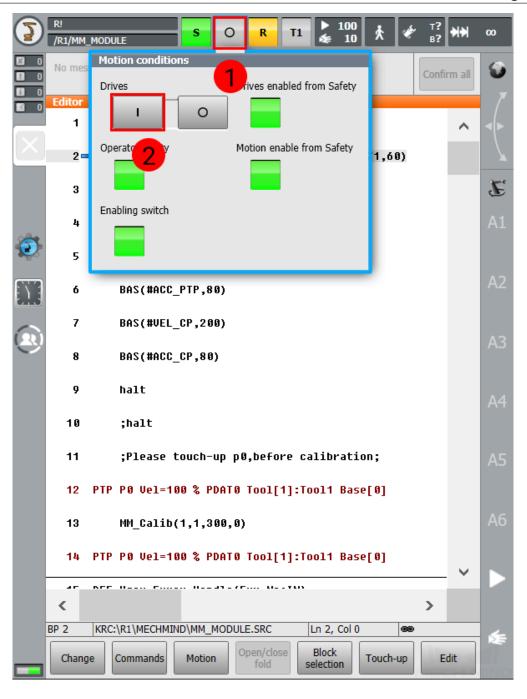
| 3          | R!<br>/R1/MM_MOD                                      | ULE S I R T1 & 100 K & T?                                   | ♦₩     | 00 |
|------------|---|---|--------|----|
| <b>1</b> 0 | <ol> <li>4:18:25 A</li> <li>Start key requ</li> </ol> | M 5/24/2022 KSS01356  | rm all | ٥  |
| 2          | Editor  |   |        | 7  |
|            | 2 🔿   | MM_Init_Socket("XML_Kuka_MMIND",873,871,60)                 |        |    |
| $\times$   | 3   | MM_Debug_Mode(1)  |        | 7  |
|            | 4   | BAS(#TOOL,1)  |        | E  |
| <u></u>    | 5   | BAS(#VEL_PTP,80)  |        | A1 |
| ÷.         | 6   | BAS(#ACC_PTP,80)  |        |    |
|            | 7   | BAS(#VEL_CP,200)  |        | A2 |
|            | 8   | BAS(#ACC_CP,80)   |        | A3 |
|            | 9   | halt  |        |    |
|            | 10  | ;halt   |        | A4 |
|            | 11  | ;Please touch-up p0,before calibration;                     |        |    |
|            | 12 PTF  | P 0 Vel=100 % PDAT0 Tool[1]:Tool1 Base[0]                   |        | A5 |
|            | 13  | MM_Calib(1,1,300,0)   |        |    |
|            | 14 PTP  | P 0 Vel=100 % PDAT0 Tool[1]:Tool1 Base[0]                   |        | A6 |
|            | 15 DEF  | <pre>User_Error_Handle(Err_No:IN)</pre>                     | ~      |    |
|            |   | TUT F U.  |        |    |
|            | <   | >   |        |    |
|            | BP 2 KRC  | C:\R1\MECHMIND\MM_MODULE.SRC Ln 2, Col 0                    |        | Æ  |
|            | Change  | CommandsMotionOpen/close<br>foldBlock<br>selectionTouch-upE | dit    |    |

3. Turn the key switch to horizontal, select T1 on the screen, and then turn the switch back to vertical.

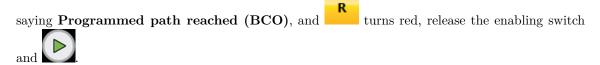


| 4. Check the icon to the right of :                                       |
|---|
| • If it looks like then skip this step.                                   |
| • If it looks like , then press on it and select in the drop-down window. |





5. Press on the enabling switch (either one of three) on the back of the pendant and will on the front at the same time to move the robot back to P0 position. When the screen displays a message





**Note:** Set an appropriate speed for the robot before moving it, and observe its motion carefully to avoid accidents.



6. Switch to AUTO mode as described in step 3, and press on to start running the full-control

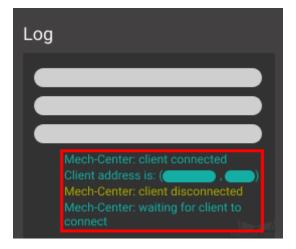
program (**Line** should turn green).

| R!<br>/R1/MM_MO | DULE |         | 5 | R | T1 | ▶ 10<br>≰ 1 | о<br>х о | Ý | <sup>⊤1</sup><br>80 ₩ | 00 |  |
|-----------------|------|---------|---|---|----|-------------|----------|---|-----------------------|----|--|
| No messag       | es   |         |   |   |    |             |          |   | Confirm all           | 0  |  |
| Editor          |      |         |   |   |    |             |          |   |                       | 7  |  |
| 64              | INT  | Timeout |   |   |    |             |          |   | ^                     |    |  |

- 7. The robot can be successfully connected if Mech-Center's **Log** panel displays the following messages:
  - Mech-Center: client connected



- A message showing the **client address**
- Mech-Center: client disconnected
- Mech-Center: waiting for client to connect



# 2.4.2 KUKA Calibration Program

This section introduces the process of calibrating the camera extrinsic parameters using the calibration subprogram.

The process consists of 4 steps:

- Select the Calibration Program
- Teach the Calibration Start Point
- Run the Calibration Program
- Start Calibration in Mech-Vision

Before proceeding, please make sure that:

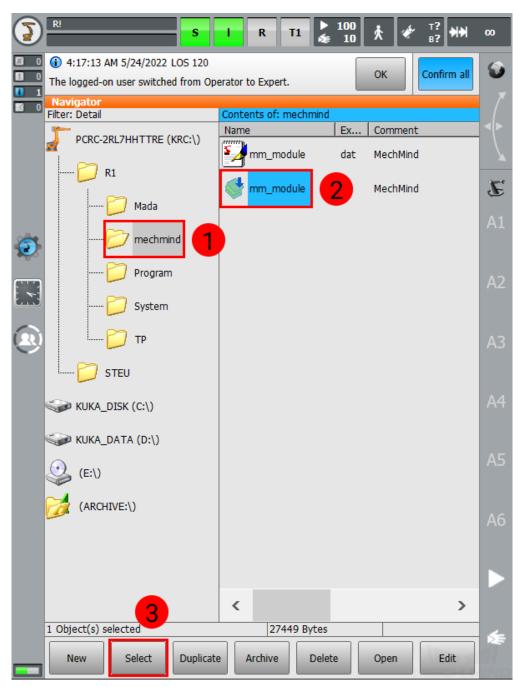
- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You are familiar with the contents in calibration\_guide.

**Note:** This section is intended for scenarios where the communication between the robot and Mech-Center is established through Standard Interface, and calibration has to be performed frequently.



# Select the Calibration Program

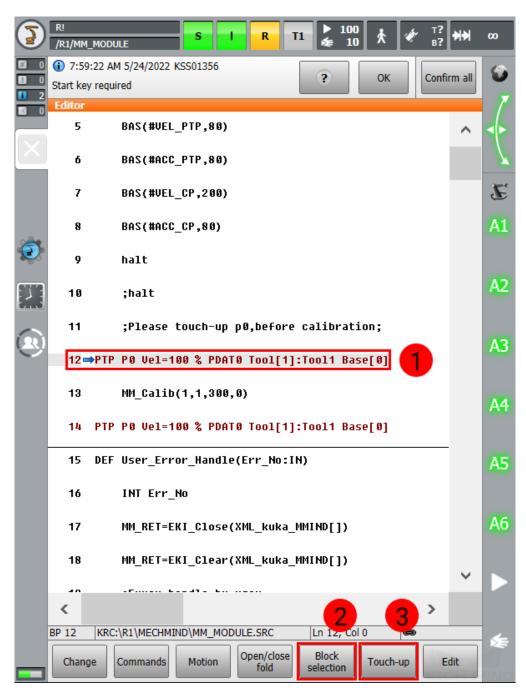
On the teach pendant, navigate to *KRC:/R1/mechmind*, select **mm\_module.src**, and then press on *Select*.





# Teach the Calibration Start Point

- 1. Move the robot to the start point for the calibration.
- 2. On the teach pendant, move the cursor to Line 12, and press on *Block selection* and then *Touch-up*.



3. Press on Yes in the pop-up window to finish teaching the initial point for calibration.



| 3  | R!<br>/R1/MN | 1_MODULE | :          | S                                       | R                 | T1              | ▶ 100<br>⋹ 10 | *        | é        | т?<br>в? | ₩₩    | 00        |
|--|--------------|----------|------------|---|-------------------|-----------------|---------------|----------|----------|----------|-------|-----------|
|  |              | essages  |            |   |                   |                 |               |          | С        | onfir    | m all | 0         |
| 0  | Editor       |          |            |   |                   |                 |               |          |          |          |       |           |
|  | 5            | B        | AS(#VEL    | _PTP,80)                                |                   |                 |               |          |          |          | ^     |           |
|  | 6            | B        | AS(#ACC    | _PTP,80)                                |                   |                 |               |          |          |          |       | 7         |
|  | 7            | B        | AS(#VEL    | _CP,200)                                |                   |                 |               |          |          |          |       | E         |
| 6  | 8            | 8        | AS(#ACC    | _CP,80)                                 |                   |                 |               |          |          |          |       | A1        |
| The second secon | 9            | h        | alt        |   |                   |                 |               |          |          |          |       |           |
|  | 1            | TechHar  | odler      |   |                   |                 |               | -25555   | °        |          | ١     | <b>A2</b> |
|  | 1            | ?        | Point "X   | 20" already e                           | exists - overv    | write? (Too     | ol[1], Bas    | e[0], #I | BASE)    |          | L     | A3        |
|  | 1            | ртр р    | 0 Vel=1    | Y<br>00 % PDA                           | es                | No              | .1 Base       | 101      |          |          | J     | <b>A4</b> |
|  |              |          |            | • | · · · · · · · · · |                 |               |          |          |          |       |           |
|  | 15           | DEF U    | lser_Err   | or_Handl                                | e(Err_No          | :IN)            |               |          |          |          |       | <b>A5</b> |
|  | 16           | I        | NT Err_    | No                                      |                   |                 |               |          |          |          |       |           |
|  | 17           | M        | IM_RET=E   | KI_Close                                | (XML_kuk          | a_MMIND         | (])           |          |          |          |       | <b>A6</b> |
|  | 18           | Μ        | IM_RET=E   | KI_Clear                                | (XML_kuk          | a_MMIND         | (])           |          |          |          | ~     |           |
|  | 40           | -        | гь ь       |   |                   |                 |               |          |          |          |       |           |
|  | <     BP 12  | KRC-\P   |            | ND\MM_MOI                               |                   | In              | 12, Col 0     |          |          | >        |       |           |
|  | 0112         |          | a (PECHINI |   |                   |                 | 12, 0010      |          | <u> </u> |          |       | Æ         |
|  | Chan         | ige Co   | mmands     | Motion                                  | Open/clos<br>fold | se Blo<br>seleo | ock<br>ction  | Touch-u  | qu       | Ed       | lit   |           |

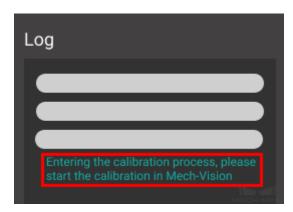


# Run the Calibration Program

- R 1. Press on select *Reset program*, and then press to run the calibration program. R! 100 т1 \*\* 00 R 10 /R1/MM\_MODULE Program No messages 1 Confirm all Cancel program dito 5 BAS(#VEL\_PT ^ Reset program BAS(#ACC\_PT 6 E 7 BAS(#VEL\_CP,200) Α1 8 BAS(#ACC\_CP,80) 9 halt A2 10 ;halt 11 ;Please touch-up p0,before calibration; Q, A3 12 → PTP P0 Vel=100 % PDAT0 Tool[1]:Tool1 Base[0] 13 MM\_Calib(1,1,300,0) Α4 14 PTP P0 Vel=100 % PDAT0 Tool[1]:Tool1 Base[0] DEF User\_Error\_Handle(Err\_No:IN) 15 A5 16 INT Err\_No A6 17 MM\_RET=EKI\_Close(XML\_kuka\_MMIND[]) MM\_RET=EKI\_Clear(XML\_kuka\_MMIND[]) 18 V < > KRC:\R1\MECHMIND\MM\_MODULE.SRC BP 12 Ln 12, Col 0 . >3 Open/close Block Change Commands Motion Touch-up Edit fold selection
- 2. Proceed to the next section when the following are displayed:
  - On the teach pendant: a message saying Calibration Start!



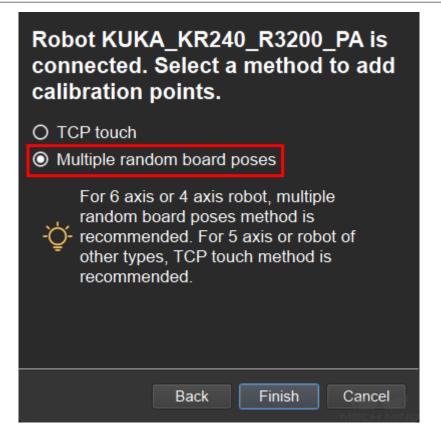
• In Mech-Center Log panel: Entering the calibration process, please start the calibration in Mech-Vision



# Start Calibration in Mech-Vision

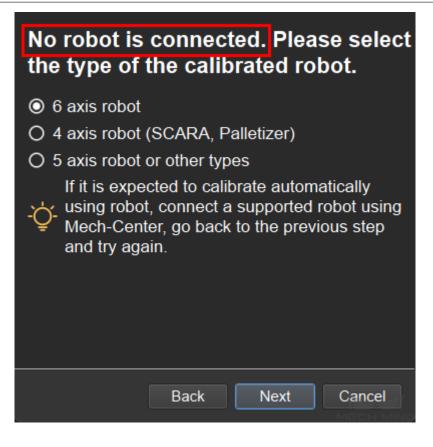
- 1. In Mech-Vision, click on Camera Calibration (Standard) in the Toolbar, or select Camera  $\rightarrow$  Camera Calibration  $\rightarrow$  Standard from the Menu Bar.
- 2. Follow the instructions in Mech-Vision to complete the following configuration:
  - 1. Select **Start a new calibration process**;
  - 2. Select the camera mounting method;
  - 3. Select Multiple random board poses for adding calibration points.





**Note:** If after selecting the camera mounting method, the window says **No robot is connected**, the connection between the robot and Mech-Center is not properly established. Please re-run the robot program.





3. Follow the instructions in Mech-Vision to finish the calibration.

**Note:** In **5** Add Marker-Images and Poses after you click on *Move Robot along Trajectory and Add Board Images*, if the robot does not reach the next calibration point within 60 seconds, Mech-Vision will report a timeout error and stop the calibration process. In such case, please select and run **mm\_module.src** on the teach pendant again, and restart the calibration process in Mech-Vision.

# 2.4.3 KUKA Example Program

This section introduces the example program provided with Mech-Center and the operations required to perform an actual pick-and-place task.

The following example program files can be found in Mech-Center/mech\_interface/kuka:

- MM\_SAMPLE01.dat
- MM\_SAMPLE01.src
- MM\_SAMPLE02.dat
- MM\_SAMPLE02.src





 ${\bf SAMPLE01} \mbox{ obtains vision results from Mech-Vision; } {\bf SAMPLE02} \mbox{ obtains planned path from Mech-Viz.}$ 

Check the section corresponding to your own application setup:

- Obtain Vision Results from Mech-Vision
- Obtain Planned Path from Mech-Viz

Before running the program, please make sure that:

- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You have completed the extrinsic parameter calibration with *the calibration program* or by manually adding calibration points.
- Mech-Vision and Mech-Viz projects are created and set to autoload.
- The **Project list** in *Mech-Center*  $\rightarrow$  *Deployment Settings*  $\rightarrow$  *Mech-Vision* is synced by clicking on

III, and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings |   | $\times$ |
|---------------------|---|----------|
| Mech-Vision         | ✓ Use Mech-Vision<br>Exec path<br>Project path 11 |          |
|                     |   |          |
|                     |   |          |

- The TCP has been correctly specified.
- The robot speed is set to a low value, so that the operator can notice any unexpected behavior before accidents occur.

#### **Obtain Vision Results from Mech-Vision**

```
&ACCESS RVO
1
    &REL 5
^{2}
    DEF MM_SAMPLE01 ( )
3
      ;FUNCTION:Eye to Hand simple pick and place with Mech-Vision
^{4}
      ;mechmind, 2022-5-31
\mathbf{5}
      INT Job
6
      INT Pos_Num
7
      INT Last_Data
8
      INT MM_Status
9
      E6POS MM_pick
10
11
      E6POS MM_waypoint
12
      E6POS MM_camera_capture
```

(continues on next page)



(continued from previous page)

| 13 | E6POS MM_drop  |
|----|--|
| 14 | INT MM_Label   |
| 15 | INT MM_Speed   |
| 16 | ;FOLD PTP HOME Vel=100 % DEFAULT;%{PE}%R 8.3.44,%MKUKATPBASIS,%CMOVE,%VPTP,%P 1:PTP, 2:HOME, |
|    | →3:, 5:100, 7:DEFAULT  |
| 17 | \$BWDSTART=FALSE   |
| 18 | PDAT_ACT=PDEFAULT  |
| 19 | FDAT_ACT=FHOME   |
| 20 | BAS(#PTP_PARAMS,100)   |
| 21 | \$H_POS=XHOME  |
| 22 | PTP XHOME  |
| 23 | ; ENDFOLD  |
| 24 |  |
| 25 | BAS(#TOOL,1)   |
| 26 | LIN MM_camera_capture  |
| 27 | ;Set ip address of IPC   |
| 28 | MM_Init_Socket("XML_Kuka_MMIND",873,871,60)  |
| 29 | wait sec 0.1   |
| 30 | ;Set vision recipe   |
| 31 | MM_Switch_Model(1,1)   |
| 32 | ;Run vision project  |
| 33 | MM_Start_Vis(1,1,2)  |
| 34 | wait sec 1   |
| 35 | MM_Get_VisData(1,Pos_Num,MM_Status)  |
| 36 | IF MM_Status<> 1100 THEN   |
| 37 | halt   |
| 38 | ENDIF  |
| 39 | MM_Get_Pose(1,MM_pick,MM_Label,MM_Speed )  |
| 40 | MM_pick.z=MM_pick.z+100  |
| 41 | LIN MM_pick  |
| 42 | MM_pick.z=MM_pick.z-100  |
| 43 | LIN MM_pick  |
| 44 | ;Add object grasping logic here.   |
| 45 | LIN_REL {z -100}#TOOL  |
| 46 | LIN MM_waypoint  |
| 47 | MM_drop.z=MM_drop.z+100  |
| 48 | LIN MM_drop  |
| 49 | MM_drop.z=MM_drop.z-100  |
| 50 | LIN MM_drop  |
| 51 | ;Add object releasing logic here.  |
| 52 | LIN_REL {z -100}#TOOL  |
| 53 | ;FOLD PTP HOME Vel=100 % DEFAULT;%{PE}%R 8.3.44,%MKUKATPBASIS,%CMOVE,%VPTP,%P 1:PTP,         |
|    | $\Rightarrow$ 2:HOME, 3:, 5:100, 7:DEFAULT   |
| 54 | \$BWDSTART=FALSE   |
| 55 | PDAT_ACT=PDEFAULT  |
| 56 | FDAT_ACT=FHOME   |
| 57 | BAS(#PTP_PARAMS,100)   |
| 58 | \$H_POS=XHOME  |
| 59 | PTP XHOME  |
| 60 | ; ENDFOLD  |
| 61 | END  |



### **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with **MM\_Init\_Socket**.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_Switch\_Model.
- 5. Run the Mech-Vision project with **MM\_Start\_Vis**.
- 6. Wait for 1 second. Under Eye-In-Hand, this **WAIT SEC** instruction is required to make sure the robot stays still until image acquisition is completed. Under Eye-To-Hand, this **WAIT SEC** instruction can be replaced with motion commands.
- 7. Obtain the vision results from Mech-Vision.
- 8. Check if the returned status code indicates any error. If an error code is returned, the program is halted.
- 9. Move the robot to the picking pose and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

### Define the TCP

Change **BAS**(**#TOOL**,1) in line 25 to the tool coordinate system to which the actual TCP is saved.

# Teach the Image Capturing Pose

Record the image capturing pose in MM\_camera\_capture in line 26.

# Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses. You can add one or more waypoints to **MM\_waypoint** in line 46.



# Teach the Placing Pose

Record the placing pose in **MM\_drop** in line 48.

# Define Z-Offset from Picking/Placing Pose

Z-offset distances relative to the tool frame from the picking/placing pose are used to ensure collision doesn't occur when the robot is approching or departing the picking/placing pose.

Adjust the following commands according to your actual needs.

- MM\_pick.z=MM\_pick.z+100 in line 40: the Z-offset when approching the picking pose is set to 100. Robot will move to 100 mm above the picking pose.
- LIN\_REL {z -100}#TOOL in line 45: the Z-offset when departing the picking pose is set to 100. Robot will move to 100 mm above the picking pose.
- MM\_drop.z=MM\_drop.z+100 in line 47: the Z-offset when approching placing pose is set to 100. Robot will move to 100 mm above the placing pose.
- LIN\_REL {z -100}#TOOL in line 52: the Z-offset when departing the placing pose is set to 100. Robot will move to 100 mm above the placing pose.

### Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking the object to line 44.

Add logic for controlling the tool action when placing the object to line 51.

#### Define HOME position

Teach the HOME position before running the program.

# **Obtain Planned Path from Mech-Viz**

```
&ACCESS RVO
1
    &REL 2
2
    DEF MM_SAMPLE02 ( )
3
    INT Job
^{4}
      INT Pos_Num
\mathbf{5}
      INT VisPos_Num
6
      INT Last_Data
7
      INT MM_Status
8
      DECL E6POS MM_movepoint[20]
9
      E6POS MM_waypoint
10
      E6POS MM_camera_capture
11
      E6POS MM_drop
12
      DECL INT MM_Label[20]
13
      INT MM_Speed[20]
14
      INT count
15
      ;FOLD PTP HOME Vel=100 % DEFAULT;%{PE}%R 8.3.44,%MKUKATPBASIS,%CMOVE,%VPTP,%P 1:PTP, 2:HOME,_
16
      3:, 5:100, 7:DEFAULT
```

(continues on next page)



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|         | (continued from previous p   |
|---------|--|
| 17      | \$BWDSTART=FALSE   |
| 18      | PDAT_ACT=PDEFAULT  |
| 19      | FDAT_ACT=FHOME   |
| 20      | BAS(#PTP_PARAMS,100)   |
| 21      | \$H_POS=XHOME  |
| 22      | PTP XHOME  |
| 23      | ; ENDFOLD  |
| $^{24}$ |  |
| 25      | BAS(#TOOL,1)   |
| 26      | LIN MM_camera_capture  |
| 27      | ;Set ip address of IPC   |
| 28      | MM_Init_Socket("XML_Kuka_MMIND",873,871,60)  |
| 29      | wait sec 0.1   |
| 30      | ;Set vision recipe   |
| 31      | ;MM_Switch_Model(1,1)  |
| 32      | ;Run Viz project   |
| 33      | MM_Start_Viz(1)  |
| 34      | wait sec 0.1   |
| 35      | ;set branch exitport   |
| 36      | ;MM_Set_Branch(1,1)  |
| 37      | ;get planned path  |
| 38      | MM_Get_VizData(2,Last_Data,Pos_Num,VisPos_Num,MM_Status)                             |
| 39      | IF MM_Status<> 2100 THEN   |
| 40      | halt   |
| 41      | ENDIF  |
| 42      | FOR count=1 TO Pos_Num   |
| 43      | MM_Get_Pose(count,MM_movepoint[count],MM_Label[count],MM_Speed[count])               |
| 44      | ENDFOR   |
| 45      | ;follow the planned path to pick   |
| 46      | FOR count=1 TO Pos_Num   |
| 47      | LIN MM_movepoint[count]  |
| 48      | IF count==VisPos_Num THEN  |
| 49      | ;add object grasping logic here  |
| 50      | ENDIF  |
| 51      | ENDFOR   |
| 52      | ;go to drop location   |
| 53      | LIN MM_waypoint  |
| 54      | MM_drop.z=MM_drop.z+100  |
| 55      | LIN MM_drop  |
| 56      | MM_drop.z=MM_drop.z-100  |
| 57      | LIN MM_drop  |
| 58      | ;Add object releasing logic here.  |
| 59      | LIN_REL {z -100}#TOOL  |
| 60      | ;FOLD PTP HOME Vel=100 % DEFAULT;%{PE}%R 8.3.44,%MKUKATPBASIS,%CMOVE,%VPTP,%P 1:PTP, |
|         | →2:HOME, 3:, 5:100, 7:DEFAULT  |
| 61      | \$BWDSTART=FALSE   |
| 62      | PDAT_ACT=PDEFAULT  |
| 63      | FDAT_ACT=FHOME   |
| 64      | BAS(#PTP_PARAMS, 100)  |
| 65      | \$H_POS=XHOME  |
| 66      | PTP XHOME  |
| 67      | ; ENDFOLD  |
| 68      | END  |
|         |  |



### **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with **MM\_Init\_Socket**.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with MM\_Switch\_Model.
- 5. Run the Mech-Viz project with **MM\_Start\_Viz**.
- 6. Obtain the planned path from Mech-Viz.
- 7. Check if the returned status code indicates any error. If an error code is returned, the program is halted.
- 8. Store obtained target points in the planned path to MM\_movepoint[] with a FOR loop.
- 9. Move the robot along the planned path with a FOR loop and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

# Define the TCP

Change **BAS**(**#TOOL**,1) in line 25 to the tool coordinate system to which the actual TCP is saved.

#### Teach the Image Capturing Pose

Record the image capturing pose in MM\_camera\_capture in line 26.

# Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

You can add one or more waypoints to MM\_waypoint in line 53.

# Teach the Placing Pose

Record the placing pose in **MM\_drop** in line 55.



# Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking the object to line 49. Add logic for controlling the tool action when placing the object to line 58.

# Define HOME position

Teach the HOME position before running the program.

# 2.4.4 KUKA Standard Interface Commands

The KUKA Standard Interface provides the following subprograms:

- Initialize Communication
- Start Mech-Vision Project
- Get Vision Result
- Start Mech-Viz Project
- Get Planned Path
- Obtain Pose
- Obtain Joint Positions
- Switch Mech-Vision Recipe
- Select Mech-Viz Branch
- Set Move Index
- Get Software Status
- Input Object Dimensions to Mech-Vision
- Get DO Signal List
- Input TCP to Mech-Viz
- Calibration

When writing your own program, pay attention to the following:

- Multiple parameters should be separated by commas.
- All parameters should be defined as runtime variables in the program file.
- Parameters can be defined as IN or OUT parameters.

This Standard Interface is over the TCP/IP protocol.



#### Initialize Communication

MM\_Init\_Socket(XML\_Name[]:IN,Alive\_Flag:IN,Recv\_Flag:IN,Time\_Out:IN)

This subprogram sets the name of the XML file used for setting up the TCP/IP communication, flag for successful communication, flag for successful data reception, and wait time before the program stops trying to establish the communication.

# Parameters

• IN parameters

| Name  | Description   |  |  |  |  |
|---|---|--|--|--|--|
| XML_Name[]                                    | Name of the XML file, case-sensitive                                      |  |  |  |  |
| Alive_Flag                                    | ALIVE flag number in the XML file   |  |  |  |  |
|   | When the flag is set to ON, the communication is successfully established |  |  |  |  |
| Recv_Flag RECEIVE flag number in the XML file |   |  |  |  |  |
|   | When the flag is set to ON, the robot has successfully received data      |  |  |  |  |
| Time_Out                                      | Wait time in seconds before stopping connection attempt                   |  |  |  |  |

### Example

MM\_Init\_Socket("XML\_Kuka\_MMIND",873,871,60)

This example sets the XML file for setting up communication as XML\_Kuka\_MMMIND, the flag for successful communication as 873, the flag for successful data reception as 871, and wait time as 60 seconds.

# Start Mech-Vision Project

MM\_Start\_Vis(Job:IN,Pos\_Num\_Need:IN,SendPos\_Type:IN)

This subprogram is for applications that use Mech-Vision but not Mech-Viz. It runs the corresponding Mech-Vision project to acquire and process data.

#### Parameters

• IN parameters

| Name     | Description   |  |  |  |  |  |  |
|----------|---|--|--|--|--|--|--|
| Job      | Mech-Vision Project ID, from 1 to 99  |  |  |  |  |  |  |
|          | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |  |  |  |  |  |  |
| Pos_Num  | Pos_Num_Needber of poses for Mech-Vision to send, from 0 to 20, where 0 means "obtain           |  |  |  |  |  |  |
|          | all".   |  |  |  |  |  |  |
| SendPos_ | $_{\rm TSpet}$ the image capturing pose for the robot to send, from 0 to 2                      |  |  |  |  |  |  |
|          | 0: Do not send image capturing pose (for Eye To Hand) 1: Send image capturing                   |  |  |  |  |  |  |
|          | pose as joint positions 2: Send image capturing pose as robot flange pose                       |  |  |  |  |  |  |



# Example

MM\_Start\_Vis(1,1,1)

This example runs Mech-Vision project No. 1, and asks the project to send over 1 pose, and the robot sends its joint positions when this subprogram is called as the image capturing pose to Mech-Center.

# Get Vision Result

MM\_Get\_VisData(Job:IN,Last\_Data:OUT,Pos\_Num:OUT,MM\_Status:OUT)

This subprogram is for applications that use Mech-Vision but not Mech-Viz. It obtains the vision result from the corresponding Mech-Vision project.

# Parameters

• IN parameter

| Name | Description   |
|------|---|
| Job  | Mech-Vision Project ID, from 1 to 99  |
|      | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |

• OUT parameters

| Name      | Description   |
|-----------|---|
| Last_Data | Variable, indicating whether all vision result has been sent, 0 or 1              |
|           | 0: NOT all vision result has been sent (more on the way) 1: All vision result has |
|           | been sent   |
| Pos_Num   | Variable for storing the number of received poses                                 |
| MM_Status | Variable for storing status code, refer to the standard_interface_status_codes    |

# Example

MM\_Get\_VisData(1,Last,Pose\_Num,Status)

This example obtains the vision result from Mech-Vision project No. 1. Whether all vision result has been sent is stored in **Last**, the number of poses received is stored in **Pose\_Num**, and the status code is stored in **Status**.



### Start Mech-Viz Project

#### MM\_Start\_Viz(SendPos\_Type:IN)

This subprogram is for applications that use both Mech-Vision and Mech-Viz. It runs the corresponding Mech-Viz project (which triggers the corresponding Mech-Vision project to run), and sets the initial joint positions of the simulated robot in Mech-Viz.

# Parameter

• IN parameter

| Name    | Description   |
|---------|---|
| SendPos | Type initial joint positions for the simulated robot in Mech-Viz, 0 or 1                        |
|         | 0: Set the initial joint positions of the simulated robot to $[0,0,0,0,0,0]$ 1: Set the initial |
|         | joint positions of the simulated robot to the current joint positions of the real robot         |

Note: When the scene contains object models that obstruct the robot to move from [0,0,0,0,0,0] to the first target point, this parameter must be set to 1.

### Example

MM\_Start\_Viz(1)

This example runs the corresponding Mech-Viz project, and sets the initial joint positions of the simulated robot to the current joint positions of the real robot.

# **Get Planned Path**

MM\_Get\_VizData(Jps\_Pos:IN,Last\_Data:OUT,Pos\_Num:OUT,VisPos\_Num:OUT,MM\_Status:OUT)

This subprogram obtains the planned path from Mech-Viz.

#### Parameters

• IN parameter

| Name    | Description   |
|---------|---|
| Jps_Pos | Whether Mech-Viz should send target points as joint positions or TCPs, 1 or 2 |
|         | 1: Mech-Viz sends joint positions 2: Mech-Viz sends TCPs                      |

• OUT parameters



| Name   | Description   |  |
|--------|---|--|
| Last_I | Last_Datariable, indicating whether all target points have been sent, 0 or 1          |  |
|        | 0: NOT all target points have been sent (more on the way) 1: All target points have   |  |
|        | been sent   |  |
| Pos_N  | u Mariable for storing the number of received target points                           |  |
| VisPos | Wariable for storing the position of the first visualmove target point in the path    |  |
|        | Example path: move-1, move-2, visual_move-3, move-3, visual_move-2 In this path,      |  |
|        | the position of the first visual_move target point is 3. If the path does not contain |  |
|        | visual_move target point, the return value is 0.                                      |  |
| MM_S   | tatasiable for storing status code, refer to the standard_interface_status_codes      |  |

# Example

MM\_Get\_VizData(2,Last,Pose\_Num,VisPose\_Num,Status)

This example obtains the planned path from Mech-Viz in the form of TCPs. Whether all target points have been sent is stored in **Last**, the number of target points received is stored in **Pose\_Num**, the position of the visual\_move target point is stored in **VisPose\_Num**, and the status code is stored in **Status**.

# **Obtain Pose**

MM\_Get\_Pose(Serial:IN,MM\_P:OUT,MM\_Label:OUT,MM\_Speed:OUT)

This subprogram stores a pose returned by Mech-Vision or a target point (as TCP) returned by Mech-Viz in the specified variable.

# Parameters

• IN parameter

NameDescriptionSerialSpecify the index of the pose to be stored

• OUT parameters

| Name     | Description  |
|----------|--|
| MM_P     | Variable for storing the specified pose                            |
| MM_Label | Variable for storing the label corresponding to the specified pose |
| MM_Speed | Variable for storing the speed corresponding to the specified pose |



# Example

MM\_Get\_Pose(1,XP1,Label,Pose\_Speed)

This example stores the first received pose to **XP1**, the corresponding label to **Label**, and the corresponding speed to **Pose\_Speed**.

# **Obtain Joint Positions**

MM\_Get\_Jps(Serial:IN,MM\_J:OUT,MM\_Label:OUT,MM\_Speed:OUT)

This subprogram stores a set of joint positions returned by Mech-Viz in the specified variable.

**Note:** As Mech-Vision does not output joint position data, this subprogram can only be used with Mech-Viz.

# Parameters

• IN parameter

|        | Description  |
|--------|--|
| Serial | Specify the index of the set of joint positions to be stored |

• OUT parameters

| Name     | Description  |
|----------|--|
| MM_J     | Variable for storing the specified set of joint positions                            |
| MM_Label | Variable for storing the label corresponding to the specified set of joint positions |
| MM_Speed | Variable for storing the speed corresponding to the specified set of joint positions |

# Example

MM\_Get\_Jps(1, JP1, Label, Pose\_Speed)

This example stores the first set of received joint positions to **JP1**, the corresponding label to **Label**, and the corresponding speed to **Pose\_Speed**.



# Switch Mech-Vision Recipe

#### MM\_Switch\_Model(Job:IN,Model\_Number:IN)

This subprogram specifies which parameter recipe of the Mech-Vision project to use. For more information on parameter recipe, please see parameter\_recipe\_configuration.

### Note:

- This subprogram must be called BEFORE **MM\_Start\_Vis**.
- The corresponding Mech-Vision project must have parameter recipes already configured and saved.

# Parameters

• IN parameters

| Name         | Description   |
|--------------|---|
| Job          | Mech-Vision Project ID, from 1 to 99  |
|              | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| Model_Number | The number of a parameter recipe in the Mech-Vision project, from 1 to 99                       |

# Example

| MM_Switch_Model(2,2) |
|----------------------|
|----------------------|

This example switches the parameter recipe used to No. 2 in Mech-Vision project No. 2.

# Select Mech-Viz Branch

```
MM_Set_Branch(Branch_Num:IN,Export_Num:IN)
```

This subprogram is used to select along which branch the Mech-Viz project should proceed. Such branching is achieved by adding branch\_by\_service\_message Task(s) to the project. This subprogram specifies which out port such Task(s) should take.

# Note:

- MM\_Start\_Viz must be called BEFORE this subprogram.
- When the next Task to be executed in Mech-Viz is a **branch\_by\_service\_message** Task, Mech-Viz will wait for this subprogram to send the out port number it should take.
- The name of all **branch\_by\_service\_message** Tasks in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.



# Parameters

• IN parameters

| Name       | Description   |
|------------|---|
| Branch_Num | Name of the <b>branch_by_service_message</b> Task, from 1 to 99 |
| Export_Num | The number of the out port to take, from 1 to 99                |

# Example

| M_Set_Branch(1,3) |
|-------------------|
|-------------------|

This example tells Mech-Viz to take out port 3 for the **branch\_by\_service\_message** Task named **1**.

# Set Move Index

MM\_Set\_Index(Skill\_Num:IN,Index\_Num:IN)

This subprogram sets the value for the Current Index parameter of Mech-Viz Tasks. Tasks that have this parameter include move\_list, move\_grid, custom\_pallet\_pattern, and smart\_pallet\_pattern.

# Note:

- **MM\_Start\_Viz** must be called BEFORE this subprogram.
- The name of all Tasks with index parameters in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

# Parameters

• IN parameters

| Name      | Description   |
|-----------|---|
| Skill_Num | Name of the Task, from 1 to 99                                  |
| Index_Num | Value for the Current Index parameter when the Task is executed |

# Example

This example sets the Current Index value to 9 for the Task named **2**. When the Task is executed, the Current Index value will be added 1 and become 10.



### **Get Software Status**

MM\_Get\_Status(MM\_Status:OUT)

This subprogram is currently capable of checking whether Mech-Vision is ready to run projects. In the future, this subprogram can be used for obtaining the execution status of Mech-Vision, Mech-Viz and Mech-Center.

# Parameter

• OUT parameter

| Name      | Descriptio                  | n   |         |     |        |       |       |    |     |       |
|-----------|-----------------------------|-----|---------|-----|--------|-------|-------|----|-----|-------|
| MM_Status | Variable                    | for | storing | the | status | code, | refer | to | the | stan- |
|           | dard_interface_status_codes |     |         |     |        |       |       |    |     |       |

### Example

MM\_Get\_Status(Status)

This example obtains the status code and stores it in **Status**.

### Input Object Dimensions to Mech-Vision

MM\_Set\_BoxSize(Job:IN,Lenght:IN,Width:IN,Height:IN)

This subprogram inputs object dimensions to the Mech-Vision project.

#### Note:

• This subprogram must be called BEFORE **MM\_Start\_Vis**.

### Parameters

• IN parameters

| Name   | Description   |
|--------|---|
| Job    | Mech-Vision Project ID, from 1 to 99  |
|        | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| Lenght | Length of object in mm  |
| Width  | Width of object in mm   |
| Height | Height of object in mm  |



# Example

MM\_Set\_BoxSize(1,500,300,200)

This example sets the object dimensions in the read\_object\_dimensions Step in the Mech-Vision project No. 1 to  $500^*300^*200$  mm.

# Get DO Signal List

| MM_Get_DoList() |  |
|-----------------|--|
| MM_Set_DoList() |  |

These two subprograms obtain the planned DO Signal list for controlling multiple sections of a sectioned vacuum gripper and set the DOs accordingly.

### Note:

- $MM\_Get\_VizData$  must be called BEFORE this subprogram.
- Please deploy the Mech-Viz project based on the template project in *Mech-Center/tool/viz\_project/suction\_zone*, and set the suction cup configuration file in the Mech-Viz project.

### Parameters

No parameters.

# Example

| MM_Get_DoList() |  |
|-----------------|--|
| MM_Set_DoList() |  |

These two examples obtain the DO signal list planned by Mech-Viz, store it in **Do\_Port**[i], and input the values to the corresponding digital outputs.

# Input TCP to Mech-Viz

MM\_Set\_Pos(Out\_Pos:IN)

This subprogram inputs TCP data to the outer\_move Task.

#### Note:

- This subprogram must be called BEFORE MM\_Start\_Viz.
- Please deploy the Mech-Viz project based on the template project in *Mech-Centertoolviz\_projectouter\_move*, and put the **outer\_move** Task at a proper position in the workflow.



# Parameter

• IN parameter

| Name    | Description  |
|---------|--|
| Out_Pos | Variable for storing the TCP data to be sent to Mech-Viz |

# Example

| MM_Set_Pos(XP50) |
|------------------|
|------------------|

This example sends the TCP data stored in **XP50** to the **outer\_move** task in the Mech-Viz project.

# Calibration

MM\_CALIB(Move\_Type:IN,PosJps:IN,WaitTime:IN,E1:IN)

This subprogram is used for hand-eye calibration (camera extrinsic parameter calibration). It automates the calibration process in conjunction with the **Camera Calibration** function in Mech-Vision. For detailed instructions, see KUKA Calibration Program.

# Parameters

• IN parameters

| Name      | Description                                    |  |
|-----------|--|--|
| Move_Type | Motion type, 1 or 2                            |  |
|           | 1: LIN 2: PTP                                  |  |
| PosJps    | Pose as flange pose or joint positions, 1 or 2 |  |
|           | 1: flange pose 2: Joint positions              |  |
| WaitTime  | Wait time between poses in seconds             |  |
| E1        | Data of the external 7th axis in mm            |  |

# Example

MM\_CALIB(2,1,300,0)

This example moves the robot in PTP type, receives pose data in the form of flange pose, and sets the wait time between two poses to 300 seconds. This robot does not have an external axis installed.



# 2.4.5 KUKA Error Messages

The following errors may occur while running the Standard Interface program on the robot.

# ROBOT\_SOCKET\_TIMEOUT

 $MM\_Flag\_Recv$  is called to check data reception. This error is reported if no data are received within the specified wait time.

# Troubleshooting

- Check if the order of calling **EKI\_Send** and **MM\_Flag\_Recv** is correct.
- Check if the Standard Interface is started in Mech-Center.
- Check if the wait time input through the **MM\_Init\_Socket** command is too short.

# ROBOT\_SOCKET\_CLOSED

 $MM_Flag_Alive$  detected that communication could not be established within the specified wait time.

# Troubleshooting

- Check if the hardware are properly connected.
- Check if the Standard Interface is started in Mech-Center.
- Check the IP addresses of the robot and the IPC, and if the port number is configured correctly.
- Check if the firewall is turned off on the IPC.
- Contact Mech-Mind Technical Support for further assistance.

# **ROBOT ARGUMENT ERROR**

When calling a Mech-Mind Standard Interface subprogram, arguments provided are not correct.

# Troubleshooting

Please refer to KUKA Standard Interface Commands and input the correct arguments accordingly.



# ROBOT\_CMD\_ERROR

The command code received does not match the one sent.

# Troubleshooting

The sequence of command sending and receiving is problematic. Please contact Mech-Mind Technical Support for further assistance.

# Error Codes

Returned status code is an error code. Please check Mech-Center' s log.

# Troubleshooting

- Please refer to the standard\_interface\_status\_codes for the specific error.
- Please contact Mech-Mind Technical Support for further assistance.

# 2.5 Kawasaki

This section introduces the Standard Interface for Kawasaki robots.

# 2.5.1 Kawasaki Setup Instructions

This section introduces the process of loading the Standard Interface program onto a Kawasaki robot.

The process consists of 4 steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

**Note:** A USB 2.0 flash drive is recommended. Otherwise, the robot controller may not recognize the flash drive.



### **Check Controller and Software Compatibility**

- Controller: E and F series
- Controller system software version: no requirement
- Additional controller software options: not required
- Mech-Center: latest version recommended

#### Setup the Network Connection

#### Hardware Connection

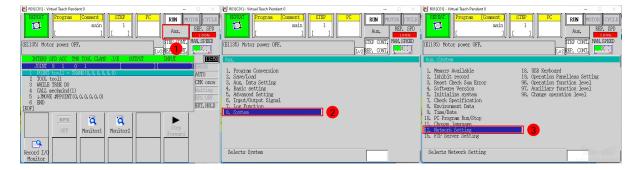
Plug the Ethernet cable into:

- An Ethernet port on the IPC
- The Ethernet port inside the accessory panel on the front of the controller

# **IP Configuration**

To allow communication between the IPC and the robot controller, both must have an IP address in the same subnet. This means that the first three numbers of the IP addresses should be the same. For example, 192.168.100.1 and 192.168.100.2 are in the same subnet.

- 1. Check the IP address of the IPC: please use the *ipconfig* command in Command Prompt or PowerShell to check the IP address.
- 2. On the teach pendant, press on Aux., and then select 8. System  $\rightarrow$  12. Network Setting.



- 3. Set IP Address to one in the same subnet as that of the IPC.
- 4. Set Subnet Mask to 255.255.255.0.

Note: If the IP address is set to either 192.168.0.1 or 192.168.1.1, please set **Subnet Mask** to **255.255.0.0** instead.

5. If you are using a network gateway, the gateway address should also be set. Please consult your IT support for help.



|  | RUN       MOTOR       CYCLE         Aux.       REP. SPD         STEP CONT.       MAN. SPEED         REP. CONT.       2 |
|--|--|
| Aux.:System:Network Setting         Port 1         IP Address       0.0.0.0.0         Host Name       0.0.0.0         Subnet Mask       0.0.0.0         Gateway       0.0.0.0         Primary DNS Server       0.0.0.0         Domain Name       0.0.0.0 | 1/2  |
| MAC Address eth0 00:09:0F:03:01:12<br>Network Address 0.0.00<br>Undo Next Page Sets IP Address<br>Input range : [0 - 255]  |  |

6. Press the ENTER key to confirm, and then restart the controller.

# Load the Program Files

## **Prepare the Files**

The program files are stored in the installation directory of Mech-Center. The default directory is C:/Mech-Mind/Mech-Center.

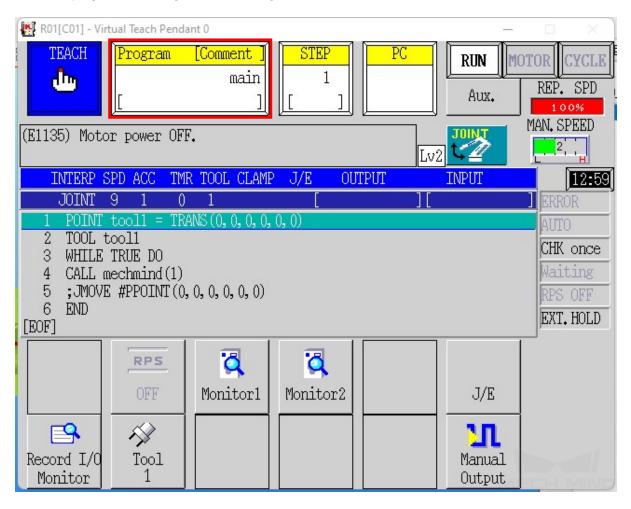
Navigate to xxx/Mech- $Center/mech\_interface/kawasaki$ , and copy **mm\\_module.as** to your flash drive.

**Note:** Copy the file to the root directory of the flash drive. Do not put it in another folder or rename it.



#### Load the Files to the Robot

- 1. Insert the flash drive to the USB port inside the accessory panel on the controller.
- 2. Check the **Program** area to see if any robot control program is running. If so, backup and exit the program according to the following instructions.



If there is a program in the **Program** area, please create backup first.

Follow the steps below to back up all files except for system logs to the flash drive.

1. Press on Aux., and select 2. Save/Load  $\rightarrow$  1. Save.



# Mech-Mind Robot Integrations

| 🛃 R01[C01] - Virtual Teach Pendant 0 🛛 — 🗆 🗡   | 😸 R01[C01] - Virtual Teach Pendant 0 - 🗆 🗡                            | 🛃 R01[C01] - Virtual Teach Pendant 0 - 🗆 🗡   |
|--|---|--|
| TEACH<br>(h)         Program [Connent]         STEP<br>1         PC         RUN         HOTOR         CVCLA           (h)         (h)< | Imain         1         Aux.         REP. SPD           []         [] | TEXA:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Texa:<br>Te |
| (E1135) Motor power OFF.   | (E1135) Motor power OFF.  | (E1135) Motor power OFF.   |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT   | Aux.  | Aux. :Save/Load  |
| JOINT 9 1 0 1 [ ][ ] ERROR   | 1. Program Conversion   | 1. Save  |
| 1 POINT tool1 = TRANS (0, 0, 0, 0, 0) AUTO<br>2 TOOL tool1   | 2, Save/Load  | 2. Load  |
| 3 WHILE TRUE DO  | 3. Aux. Data Setting  | <ol> <li>File/Folder operate</li> <li>Autosave Configuration</li> </ol>  |
| 4 CALL mechnind(1) Maiting   | <ol> <li>Basic setting</li> <li>Advanced Setting</li> </ol>           | 10. Hutosave Configuration   |
| 5 ;JNOVE #PPOINT(0, 0, 0, 0, 0)<br>6 END   | 6. Input/Output Signal  |  |
| (ROF)  | 7. Log Function   |  |
|  | 8. System   |  |
| RPS 🛱 🦉 🕨  |   |  |
| OFF Monitor1 Monitor2 Step<br>Forward  |   |  |
|  |   |  |
|  |   |  |
| Record I/0   | Selects Save/Load   | Selects Save   |
| Monitor  |   | ME CHIMINE   |

2. Press on *Input File name* to input a **File Name** for the backup file, and then press on *SAVE*.

| 🛃 R01[C01] - Virtual Teach Pendant 0  |                        | – – ×  |
|---|------------------------|--|
| Aux.:Save/Load:Save   |                        | 1/ 8   |
| Please select the file to save.<br>Place of File <u>Linux\</u><br>File Name   |                        |  |
| Save Data All Data<br>NAME (*)  | TYPE SI                | IZE (KB) UPDATE  |
| .portlist0<br>asm_conf.txt<br>cm1_conf.txt<br>cm2_conf.txt<br>cm3_conf.txt<br>s default.as<br>id_conf.txt<br>s mechmind_server.as | <br><br>               | IZE (KB)         UPDATE           0.1         21/08/09         12:16           0.2         21/08/09         12:16           0.7         21/08/09         12:16           0.7         21/08/09         12:16           0.7         21/08/09         12:16           0.7         21/08/09         12:16           0.7         21/08/09         12:16           0.3         21/08/09         12:16           7.6         21/10/22         19:08 |
| Deviz Linux Used Area   | 0 KB Empty             | y Are 0 KB   |
| Input<br>File name  | SaveData New<br>Folder | SAVE EXIT  |

Cancel robot control program.

1. Press on the **Program** area, and select **Cancel register** in the drop down menu.



**Mech-Mind Robot Integrations** 

| 🛃 R01[C01] - Vir   | tual Teach Penda       | ant O                                     |                | C 2 | _                |                                |
|--|------------------------|---|----------------|-----|------------------|--------------------------------|
| TEACH  | Program<br>[           | [Comment ]<br>main<br>]                   | STEP<br>1<br>1 | PC  | RUN M            | REP. SPD                       |
| (E1135) Moto<br>INTERP (   | NOW PROGR<br>CALL PROG | Sec. 20                                   |                | Lv  | 2<br>Z<br>INPUT  | MAN, SPEED                     |
| JOINT           JOINT           1         POINT           2         TOOL t           3         WHILE | EDIT                   | Directory<br>Copy<br>Delete<br>PG Comment | - Toput        | ][  |                  | AUTO<br>CHK once               |
| 4 CALL o<br>5 ;JMOVE<br>6 END  |                        | Cancel reg<br>Rename<br>Display co        | gister         | 2   |                  | Waiting<br>RPS OFF<br>EXT.HOLD |
| [EOF]  | 1                      | 1   | 1              |     | 1                |                                |
|  | RPS                    | 3   | <b>Q</b>       |     |                  |                                |
|  | OFF                    | Monitor1                                  | Monitor2       |     | J/E              |                                |
| <b></b>  | 1                      |   |                | 3   | U                |                                |
| Record I/O<br>Monitor  | Tool<br>1              |   |                |     | Manual<br>Output |                                |

3. Make sure that the robot is in teach mode, and make sure that the **Program** area has nothing listed.



| R01[C01] - Virtual Teach Pendant 0 |                     | - 🗆 X  |
|------------------------------------|---------------------|--|
| TEACH                              | ment ]<br>] [ ] PC  | RUN     MOTOR     CYCLE       Aux.     REP. SPD       100% |
| Cleared error state.               |                     |  |
|                                    | DL CLAMP J/E OUTPUT | INPUT 12:52  |
| JOINT 9 1 0 1<br>[EOF]             |                     | ERROR  |
| [FOL]                              |                     | AUTO   |
|                                    |                     | CHK once   |
|                                    |                     | Waiting  |
|                                    |                     | RPS_OFF<br>EXT. HOLD                                       |
|                                    |                     |  |
| RPS                                | <b>Q Q</b>          |  |
| OFF Mor                            | nitor1 Monitor2     | J/E  |
| Record I/O Tool                    |                     | Manual   |
| Monitor 1                          |                     | Output   |

**Note:** To switch the robot to teach mode, turn the Teach/Repeat switch on the controller to **TEACH**, and the teach lock switch on the teach pendant to **ON**.

4. Press on Aux., and select 2. Save/Load  $\rightarrow$  2. Load.

| R01[C01] - Virtual Teach Pendant 0 -   |  | 🛃 R01[C01] - Virtual Teach Pendant 0 — 🗆 📈   | 🛃 R01[C01] - Virtual Teach Pendant 0 - 🗆 🗙                                |
|--|--|--|---|
|  | OR CYCLE<br>REP. SPD<br>100%<br>MM, SPEED                    | TEVEN         Program         Comment         STEP         PC         RUN         POTOR         CYCLE           dbp  |   |
| (KII35) MOTOR POWER UPP.   | 2  | (B1135) NOTOT POWET UPF.   | p. program aborted, No = 1002   |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT   | 12753  | Aux,   | Aux.:Save/Load  |
| OLIGT         9         1         0         1         1           1         FORM tools   | ERROR<br>AUTO<br>CHK once<br>Maiting<br>RPS ORF<br>EXT. HOLD | 1. Prozen Groversion<br>24. Gazardovic Setting<br>5. Abardovic Sting<br>5. Advanced Setting<br>6. Advanced Setting<br>6. April 1998 Signal<br>7. Log Function<br>8. System | 1. Save<br>La docă<br>A TLIE/Molder operato<br>10. Autosave Configuration |
| RPS         Image: Constraint of the second sec |  |  |   |
| Record I/0<br>Monitor  |  | Selects Save/Load  | Selects Load  |

5. Press on **mm\_module.as** in the file list twice to select it, and then press on *LOAD*.



| R01[C01] - Virtual Teach Pen | dant 0    |                |          | - 🗆 X          |
|------------------------------|-----------|----------------|----------|----------------|
| Aux.:Save/Load:Load          |           |                |          | 1/8            |
| Please select the lo         | and file  |                |          |                |
| Place of File Linu           |           |                |          |                |
|                              |           |                |          |                |
|                              | odule, as |                | 15-      |                |
|                              | 11 Data   | Specified Data |          |                |
|                              | AME (*)   | TYPE           | SIZE(KB) |                |
| .portlist0                   |           |                | 0.1      | 21/08/20 16:26 |
| asm_conf.txt                 |           |                | 0.2      | 21/08/20 16:26 |
| cm1_conf.txt                 |           |                | 0.7      | 21/08/20 16:26 |
| cm2 conf.txt                 |           |                | 0.7      | 21/08/20 16:26 |
| cm3_conf.txt                 |           |                |          |                |
| As default.as                |           | AS             |          | 21/08/20 16:26 |
| id conf. txt                 | _         |                |          | 21/08/20 16:26 |
| A mm_module.as               |           | AS             |          | 21/09/09 16:37 |
| wa umuTunodorre* aa          |           | CD             | 10,0     | 21/05/05 10.07 |
|                              |           |                |          |                |
| Device Linux                 | Used Area | 0 KB           | Empty Ar | 0 KB           |
| Device Fillor                | USCU ALCA | 0 ID           |          |                |
|                              |           |                |          |                |
|                              |           |                |          |                |
| Input                        |           |                | LO       | AD EXIT        |
| File name                    |           |                | LO       | ND DATI        |
|                              |           |                |          |                |
|                              |           |                |          | MIELE MIND     |

6. When loading completes, make sure no errors occurred during loading, and press on the  ${\tt R}$  key to exit.



| R01[C01]   | ] - Virtual Teach Pendant 0 — 🗆 🗙      |
|--|--|
| Aux. :Sav  | ve/Load:Load 1/ 8                      |
| Program  | vis_recv();TCP/IP 俊ÊÕÊý象               |
| Program  |  |
| Program  |  |
| Program  |  |
| Program  | mm_start_viz(.sendpos_type);Æô強VIZ     |
| Program  |  |
| Program  |  |
| Program  |  |
| Program  |  |
|  | m mm_get_dolist();資È…OÁĐ燕              |
| Program  |  |
| And and a second s | vision_sample_1():mechmindÊó状之ŇùÀý壳段Dò |
| File loa   | d completed. (0 errors)                |
|  |  |
|  |  |
|  |  |
|  |  |
|  | MIELEUMINU                             |

# **Test Robot Connection**

## Configure Mech-Interface in Mech-Center

- 1. Open Mech-Center and click on Deployment Settings.
- 2. Go to Mech-Interface, check Use Mech-Interface and select Standard Interface.



| Deployment Settings |                                | ×           |
|---------------------|--------------------------------|-------------|
|                     |                                |             |
|                     | ✓ Use Mech-Interface 2         |             |
|                     | Interface Service Type         |             |
|                     | Standard Interface     Adapter |             |
| Mech-Interface      |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                |             |
|                     |                                | Save Cancel |

- 3. Set the following fields:
  - Interface Option: Set to TCP Server and ASCII.
  - Listed robot: Select the robot model you are using.

**Note:** If the robot you are using is not listed, select **Custom robot** instead. Make sure to set Euler angle order to **rzyz**.

- Host Address: The default port number is 50000. If you need to change the port number, make sure it falls between 8192 and 65535.
- 4. Click on Save.



| Deployment Settings |   | $\times$ |
|---------------------|---|----------|
|                     |   |          |
|                     | ✓ Use Mech-Interface                                    |          |
|                     | Interface Service Type    Standard Interface    Adapter |          |
| Mech-Interface      | Interface Options TCP Server • ASCII •                  |          |
|                     | Listed robot KAWASAKI      KAWASAKI_RS020N      rzyz    | 1        |
|                     | Custom robot  |          |
|                     | Host Address  |          |
|                     |   |          |
|                     |   |          |
|                     |   |          |
|                     |   |          |
|                     |   |          |
|                     |   |          |
|                     |   |          |
|                     | 2   |          |
|                     | Save  | Cancel   |

5. Click on *Start Interface* in the Toolbar.

## Modify and Run Robot Program

1. On the teach pendant, press on the **Program** area, select **Directory**.



**Mech-Mind Robot Integrations** 

| R01[C01] - Vir | tual Teach Penda       | ant O                    |           |     | _      |                  |
|----------------|------------------------|--------------------------|-----------|-----|--------|------------------|
| TEACH          | Program<br>[           | [Comment ]<br>]          | STEP<br>1 | PC  | RUN M  | REP. SPD         |
| INTERP S       | NOW PROGR<br>CALL PROG |                          |           | Ŀ   | V2 V2  | MAN, SPEED       |
| JOINT<br>[EOF] | EDIT                   | Directory<br>Copy        |           | - 2 |        | ERROR            |
|                |                        | Delete                   | T         |     |        | AUTO<br>CHK once |
|                |                        | PG Comment<br>Cancel reg |           |     |        | Waiting          |
|                |                        | Rename<br>Display co     | ontents   |     |        | RPS OFF          |
|                |                        | pupping or               |           |     |        | EXT. HOLD        |
|                | RPS                    | ä                        | ā         |     |        |                  |
|                | OFF                    | Monitor1                 | Monitor2  |     | J/E    |                  |
| Record I/0     | Tool                   |                          |           |     | Manual |                  |
| Monitor        | 1                      |                          |           |     | Output |                  |

2. Select vision\_sample \_1 in the list, and then press the ENTER key to confirm.



| R01[C01] - Virtual Teach Pendant 0 | – 🗆 X              |
|------------------------------------|--------------------|
| Directory                          |                    |
| PROGRAM NAME STEP NUM              | COMMENT            |
| mm_set_branch 17 (                 | ÉÖ branch )        |
| mm_set_index 17 (                  | ÉÖ index )         |
| mm_set_pos 18 (                    | Í 何勧 Î×Ê 象 )       |
| mm_start_vis 41 (                  | 乾窟vision垢殻)        |
| mm_start_viz 38 (                  | Æ 強VIZ )           |
| mm_stop_viz 17 (                   | 1 Ö viz )          |
| mm_switch_model 17 (               | Ç 算visionĂ 圭 )     |
| motion_parser 87 (                 | )                  |
| test 2 (                           | )                  |
| vis_close 17 (                     | TCP/IP(僅蝕A 俊 )     |
| vis_disconnect 18 (                | Ç 茅sockets )       |
| vis_open 13 (                      | TCP/IP秀A Á 俊 )     |
| vis_recv 44 (                      | TCP/IP 俊ÊÊ象)       |
| vis send 29 (                      | TCP/IP窟ÉÊ象)        |
| vision_sample_1 24 (               | mechmindê 状疝 À 殻 ) |
|                                    |                    |
|                                    |                    |
|                                    |                    |
|                                    |                    |
|                                    |                    |
| Input   Prev Page                  |                    |
|                                    |                    |
|                                    |                    |

- 3. Modify the IP address and port number in the program:
  - Press the J/E key, select **Program Edit** in the pop-up menu, and then press the ENTER key to confirm.



| R01[C01] - Virtual Teach Pend | ant O                                 |                              | de la |        |   |
|-------------------------------|---------------------------------------|------------------------------|-------|--------|---|
| TEACH                         | [Comment ]<br>n_sample_1<br>注 状立Ñ À ] | STEP           1           [ |       | RUN MO | TOR CYCLE<br>REP. SPD<br>100%<br>CHK, SPEED |
|                               |                                       |                              | Lv    |        |   |
| Teach                         | ,AME                                  | P J/E OU                     | ITPUT | INPUT  | 32 <b>.</b> 7H                              |
| AS Language Teach             |                                       |                              | ][    |        | ERROR                                       |
| Pose Teach                    |                                       | ************                 | ****  | ****   | AUTO  |
| Program Edit                  | A r                                   | ·}ùÀý壳钮ò                     |       |        | CHK once                                    |
| 4 ;**********                 | ****                                  | ***                          | ***   | ***    | Waiting                                     |
| 5 ACCURACY 10 ALWA            | YS                                    |                              |       |        | RPS OFF                                     |
| 6 SPEED 50 ALWAYS<br>7 HOME   |                                       |                              |       |        | EXT. HOLD                                   |
|                               |                                       |                              |       | 1      |   |
| RPS                           | Q                                     | Q                            |       |        |   |
| OFF                           | Monitor1                              | Monitor2                     |       | J/E    |   |
|                               |                                       |                              |       | 0/1    |   |
|                               |                                       |                              |       | 10     |   |
| Record I/O Tool               |                                       |                              |       | Manual |   |
| Monitor 1                     |                                       |                              |       | Output |   |

- Select  $vision\_sample\_1$  in the list, and then press the <code>ENTER</code> key to confirm.



| R01[C01] - Virtual        | Teach Pendant 0 | – – ×                         |
|---------------------------|-----------------|-------------------------------|
| Program Edit -            | select program, | Program Name : vision_sample_ |
| PROGRAM NAME              | STEP NUM        | COMMENT                       |
| vision_sample_            | 1 24 (          | mechmindê 状泣N à 殻D )          |
| autostart, pc             | 35 (            | )                             |
| autostart2.pc             |                 | )                             |
| calibrate                 | 33 (            | 炎協ö設E:笥)                      |
| get_next_a_ptr            |                 | )                             |
| get_next_m_ptr            |                 | )                             |
| init                      | 12 (            |                               |
| init_data                 | 11 (            |                               |
| main                      | 6 (             |                               |
| mechmind                  | 46 (<br>46 (    | (水力)                          |
| mm_calib<br>mm_get_dolist | 22 (            | 炎協)<br>資E DOA 燕)              |
| mm_get_jps                | 7 (             |                               |
| mm_get_pose               | 7               |                               |
| mm_get_status             | 16 (            | ý<br>資注 È 周× Ì )              |
| mm_get_visdata            |                 | 資产 visionê 象)                 |
| mm_get_vizdata            |                 | 資於Wiz卦指A抄)                    |
| mm_init_skt               | 22 (            | TCP/IP I I 兜 晒)               |
|                           | 、               |                               |
|                           |                 |                               |
| Input                     | Next Pag        | e                             |
|                           |                 |                               |
|                           |                 |                               |

• Use the arrow keys on the teach pendant to move the cursor to Line 10, and then press the ENTER key to confirm.



| R01[C01] - Virtual Teach Pendant 0 —  | o x                                |
|---|------------------------------------|
| TEACH       Program       [Comment]       STEP       PC       RUN       MO         小山       vision_sample_1       1 | TOR CYCLE<br>REP. SPD<br>100%      |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT         1;************************************   | Range<br>Edit<br>Specify<br>range, |
| 8 BREAK<br>9 pos num = 0<br>10 CALL mm_init_skt(127, 0, 0, 1, 50000, 60)  |                                    |
| 12 ;ó ó 垢殻C 算 Å 圭C 算<br>13 ;call mm_switch_model(1,1)<br>14 ;乾窟vision垢殻:垢殻園催1 資È 1倖Î × × 炎 Ê Ó 2 隈À Î ×<br>15 CALL mm_start_vis(1,1,2)<br>16 TWAIT 1  | Cancel                             |
| Program= vision_sample_1 Step = 10  |                                    |

- Use the arrow keys and number keys to change:
  - **127,0,0,1** to the IPC' s actual IP address
  - 50000 to the port number set in Mech-Center



| R01[C01] - Vi      | irtual Teach Penda                                      | ant O                               |                          |                      | <u></u>        | D X                   |
|--------------------|---|-------------------------------------|--------------------------|----------------------|----------------|-----------------------|
| TEACH              | Program<br>vision<br>[mechmindf                         | [Comment]<br>n_sample_1<br>: 状応 À ] | STEP<br>1<br>[ ]         | PC                   | RUN            | TOR CYCLE<br>REP. SPD |
| 1 ;****<br>2 -* FI | SPD ACC TI<br>*************<br>NCTTON-mech<br>ION INPUT | *****                               | ****                     | )UTPUT<br>********** | INPUT<br>***** | Delete                |
| CALL               | mm_init_skt   | (127, 0, <b>0</b> , 1,              | 50000 <mark>,</mark> 60) |                      |                | Copy<br>range         |
| MOTION<br>INS      | MOTION<br>AUX   | POS. /<br>VAR.                      | IN/OUT                   | PROGRAM<br>CONTROL   | USER DEF.      | Сору                  |
| SYSTEM<br>SWITCH   |   |                                     |                          |                      |                | Cancel                |
| CHARACTER          |   |                                     |                          |                      | (comma)        | Complete              |

- Press  $\tt ENTER$  to save the changes, and then press R to exit.
- In the pop-up windows, press Yes and Close, respectively.



| Confirm  |  |
|--|--|
| Write edited contents, OK?                                   |  |
| Yes No   |  |
| Confirm  |  |
| Write edited contents, OK?<br>Writing<br>Writing completion. |  |
| Close  |  |

4. Switch the robot to repeat mode, press on **RPT. SPD** to adjust the repeat speed to **10%**. Press on the white button below *Aux.*, and change the drop-down options to **STEP CONT** and **REPEAT ONCE**.



| 🛃 R01[C01] - V                           | irtual Teach Penda   | int 0                                |                  |           | _               |   |
|--|--|--------------------------------------|------------------|-----------|-----------------|---|
| REPEAT                                   | Program<br>vision<br>[mechmindf                                    | [Comment]<br>n_sample_1<br>  状立N A ] | STEP<br>1<br>[ ] | PC<br>Lv2 | Aux.            | TOR CYCLE<br>REP. SPD<br>1 0%<br>CHK. SPEED         |
|  | SPD ACC TM   | R TOOL CLAME                         | PJ/E OU          | TPUT      | INPUT           | 32 <b>.</b> 8H                                      |
| JOINT                                    | 9 1 0  | 1                                    |                  | ][        |                 | ERROR   |
| 2 ;* FU<br>3 ;* me<br>4 ;****<br>5 ACCUR | NCTION:mech<br>chmind, 2023<br>*********************************** | nind Êó状×ト<br>1/4/21<br>**********   | ·} ùÀý壳段Đò       |           |                 | AUTO<br>CHK once<br>Waiting<br>RPS OFF<br>EXT. HOLD |
| Record I/0<br>Monitor                    | OFF  | Konitor1                             | Konitor2         |           | Step<br>Forward |   |

**Note:** To switch the robot to repeat mode, turn the Teach/Repeat switch on the controller to **REPEAT**, and the teach lock switch on the teach pendant to **OFF**.

5. If the program is run from STEP 1, the robot will return to HOME position first according to the command in Line 7. To avoid this when testing the robot' s connection with Mech-Center, press on the **STEP** area, press the number key 9, and then press ENTER to confirm.



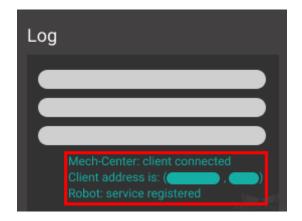
| R01[C01] - Virtual Teach Pendar                        | nt O   |   | _               |                                      |
|--|--|---|-----------------|--------------------------------------|
|  | <mark>[Comment]</mark><br>_sample_1<br>状范NÀ] | STEP<br>1<br>[ ]  | RUN MOT         | CR CYCLE<br>REP. SPD                 |
| INTERP SPD ACC TMR                                     | NOW STEP<br>CALL STEP                        | 9 2   | CONT.<br>ONCE   | CHK, SPEED                           |
| JOINT 9 1 0<br>1 ;************************************ | EDIT   | Bottom<br>Copy<br>Delete<br>Input comment<br>Search Comment |                 | ERROR<br>AUTO<br>CHK once<br>Waiting |
| 5 ACCURACY 10 ALWAY<br>6 SPEED 50 ALWAYS<br>7 HOME     | 1  |   |                 | RPS OFF<br>EXT. HOLD                 |
| OFF  | X<br>Monitor1                                | Monitor2  | Step<br>Forward |                                      |
| Record I/0<br>Monitor                                  |  |   | M               |                                      |

- 6. Press on MOTOR while holding down the A key to power the motor.
- 7. Press on  $\mathit{CYCLE}$  while holding down the  $\mathtt{A}$  key to run the program.
- 8. If RUN does not turn green, press the RUN/HOLD key while holding down the A key.



| R01[C01] - Virtual Teach Pendant 0 —   |                |
|--|----------------|
| REPEAT     Program     [Comment]     STEP     PC     RUN     MOTOR       1     11     11     11     11     11     11 |                |
| Limechmindê 状迹 À ] [[] ] Ling Aux.   | EP. SPD<br>10% |
|  | SPEED          |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT   | 20:05          |
|  | RROR           |
|  | UTO            |
| 9 pos_num = 0<br>10 CALL mm_init_skt(127,0,0,1,50000,60)   | HK once        |
| 10 GALL MMSKC(127, 0, 0, 1, 30000, 00)   | aiting         |
|  | PS OFF         |
| 13 ;call mm_switch_model(1,1)  |                |
| 14 ;乾窟vision垢殻:垢殻園催1 資於 倖1思Ё×∞炎 È荒Ã2 隈A捨思Ё   |                |
|  |                |
| OFF Monitor1 Monitor2 Step<br>Forward  |                |
|  |                |
| Record I/O   |                |
| Monitor  |                |

- 9. The robot is successfully connected if Mech-Center's Log panel displays the following messages:
  - Mech-Center: client connected
  - A message showing the **client address**
  - Robot: server registered





# 2.5.2 Kawasaki Calibration Program

This section introduces the process of calibrating the camera extrinsic parameters using the calibration program.

The process consists of 4 steps:

- Select the Calibration Program
- Teach the Calibration Start Point
- Run the Calibration Program
- Start Calibration in Mech-Vision

Before proceeding, please make sure that:

- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You are familiar with the contents in calibration\_guide.

**Note:** This section is intended for scenarios where the communication between the robot and Mech-Center is established through Standard Interface, and calibration has to be performed frequently.

## Select the Calibration Program

1. Switch the robot to teach mode, press on the **Program** area, and select **Directory**.



| 🛃 R01[C01] - V        | /irtual Teach Pe         | endant 0  |               |    | -                       |  |
|-----------------------|--------------------------|---|---------------|----|-------------------------|--|
| TEACH                 | Program<br>[             | [Comment ]<br>]   | STEP<br>1     | PC | RUN M                   | CYCLE<br>REP. SPD  |
| Cleared erro          | NOW PROGR<br>CALL PROG   |   |               | Lv | 2 TOINT<br>INPUT        | MAN, SPEED   |
| JOINT<br>[EOF]        | EDIT                     | Directory<br>Copy<br>Delete<br>PG Comment<br>Cancel reg<br>Rename<br>Display co | gister        | 2  |                         | ERROR<br>AUTO<br>CHK once<br>Maiting<br>RPS OFF<br>EXT. HOLD |
| Record I/0<br>Monitor | OFF<br>OFF<br>Tool<br>01 | X<br>Monitor1   | X<br>Monitor2 |    | J/E<br>Manual<br>Output |  |

**Note:** To switch the robot to teach mode, turn the Teach/Repeat switch on the controller to **TEACH**, and the teach lock switch on the teach pendant to **ON**.

2. Select **calibrate** from the list, and press  $\tt ENTER$  to confirm.



| R01[C01] - Virtual            | Teach Pendant 0 | ×                      |
|-------------------------------|-----------------|------------------------|
| Directory                     |                 |                        |
| PROGRAM NAME ST               | EP NUM          | COMMENT                |
| calibrate                     | 33 (            | 炎協ö 殻 È 笥 )            |
| mm_calib                      | 46 (            | 炎協 )                   |
| mm_get_dolist                 | 22 (            | 資E DOA 燕 )             |
| mm_get_jps                    | 7 (             | )                      |
| mm_get_pose                   | 7 (             | )                      |
| mm_get_status                 | 16 (            | · 資产 E 周× I )          |
| mm_get_visdata                | 32 (            | 資产 vision 全象 )         |
| mm_get_vizdata                | 46 (            | 資产viz計論抄)              |
| mm_init_skt                   | 22 (            | TCP/IP I f 兜 晒 )       |
| mm_set_boxsize                | 17 (            | Í何勧定芏×樫雁)<br>ÉÖbranch) |
| mm_set_branch<br>mm_set_index | 17 (<br>17 (    | ÉÖindex)               |
| mm_set_pos                    | 18 (            | 1 何勧 Î×Ê象)             |
| mm_start_vis                  | 41 (            | 乾窟vision垢殼)            |
| mm_start_viz                  | 38 (            | 毛 強VIZ )               |
| mm_stop_viz                   | 17 (            | ÍÖviz)                 |
| mm_switch_model               | 17 (            | Ç 算visionA 圭 )         |
| vis_close                     | 17 (            | TCP/IP僅蝕A 俊)           |
|                               |                 |                        |
|                               |                 |                        |
| Input                         | Next Page       |                        |
|                               |                 |                        |
|                               |                 | MEEH MIND              |

## Teach the Calibration Start Point

- 1. Move the robot to the start point for the calibration.
- 2. Press on the  $\mathbf{STEP}$  area, enter  $\mathbf{11}$  with the number key, and then press  $\mathbf{ENTER}$  to confirm.



| 🛃 R01[C01] - Virtual Teach Po                                  | endant 0                                       |                            |     | _                |                      |
|--|--|----------------------------|-----|------------------|----------------------|
| TEACH<br><b>小</b> [炎協ö 殻                                       | <mark>[Comment]</mark><br>calibrate<br>) È 笥 ] | STEP<br>1<br>[ ]           |     | RUN MC           | REP. SPD             |
| Cleared error state.   | NOW STEP<br>CALL STEP                          |                            | 1 2 | Г<br>Л           | CHK. SPEED           |
| JOINT 9 1 0<br>1 ;************************************         |  | Bottom<br>Copy<br>Delete   |     |                  | ] ERROR<br>AUTO      |
| 3 ;* mechmind, 202<br>4 ;*************                         | 1<br>*   | Input comme<br>Search Comm |     | ***              | CHK once<br>Waiting  |
| 5 ACCURACY 1 ALWAY<br>6 SPEED 50 MM/S AL<br>7 POINT lasttool = | WAYS   | 压ÄTCPÉè協                   | 5   |                  | RPS OFF<br>EXT. HOLD |
| RPS  | 3  | 3                          |     |                  |                      |
| OFF  | Monitor1                                       | Monitor2                   |     | J/E              |                      |
| 🕒 🔗  |  |                            |     | ា                |                      |
| Record I/O Tool<br>Monitor O1                                  | ndex num);這任in                                 | de                         |     | Manual<br>Output |                      |

3. Press down the A key and POS MOD key at the same time, and press on Yes to modify the position in STEP 11.



| 🛃 R01[C01] - Virtual Teach Pendant 0 —  |  |
|---|--|
| TEACH       Program       [Comment]       STEP       PC       RUN       M         calibrate       [炎協ö 殼Đ È 笥 ]       [1]       11       Aux. | OTOR CYCLE<br>REP. SPD<br>100%<br>MAN. SPEED |
| Cleared error state.  |  |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT  | 19:27  |
| JOINT 9 1 0 1 [ ][  | ERROR  |
| 8 BREAK Confirmation message  | AUTO   |
| 9 TOOL NULL<br>10 calib_ret = Modify posi step11?   | CHK once                                     |
| 11 JMOVE vis_ca   | Waiting                                      |
| 12 BREAK Yes No   | RPS OFF                                      |
| 13 CALL vis_ope   | EXT. HOLD                                    |
| 14 TWAIT 0.1  |  |
|   |  |
| OFF Monitor1 Monitor2 J/E   |  |
|   |  |
| I 🕒   🎶    II II II II.   |  |
| Record I/O Tool Manual  |  |
| Monitor 01 Output   | ECH MIND                                     |

## Run the Calibration Program

1. Switch the robot to repeat mode, press on **RPT. SPD** to adjust the repeat speed to **10%**. Press on the white button below *Aux.*, and change the drop-down options to **STEP CONT** and **REPEAT ONCE**.



| R01[C01] - Virtual Teach Pendant 0  | - 🗆 🗙        |
|---|--------------|
| REPEAT     Program     [Comment]     STEP     PC     RU       calibrate     11     11     A | UX. REP. SPD |
| Step 11 position data rewritten.  | ONCE         |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPU   | <u>19:27</u> |
| JOINT 9 1 0 1 [ ][  | ERROR        |
| 8 BREAK   | AUTO         |
| 9 TOOL NULL<br>10 calib_ret = 0   | CHK once     |
| 11 JMOVE vis_calib_start;炎協兜的大  | Waiting      |
| 12 BREAK  | RPS OFF      |
| 13 CALL vis_open  | EXT. HOLD    |
| 14 TWAIT 0.1  |              |
|   | ward         |

**Note:** To switch the robot to repeat mode, turn the Teach/Repeat switch on the controller to **REPEAT**, and the teach lock switch on the teach pendant to **OFF**.

2. Press on the  $\mathbf{STEP}$  area, enter 1 with the number key, and then press  $\mathbf{ENTER}$  to confirm.



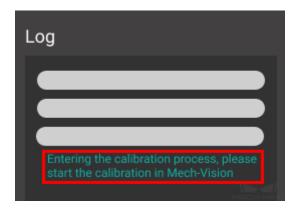
| R01[C01] - Virtual Teach Pendant 0 -  |           |
|---|-----------|
| REPEAT         Program         [Comment]         STEP         PC         RUN         MOTO           Image: Comment in the second s |           |
| ▲ [炎協ö 殻Đ È 笥 ]] [] ▲ux.  | 1 0%      |
| Step 11 position data rewritten.  | IK, SPEED |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT  | 1.2H      |
|   | ERROR     |
| 1 ;********   | AUTO      |
| 2 ;* FUNCTION:mechmind 炎協Ö÷殻ĐòÈë笥<br>3 ;* mechmind, 2021/4/21   | CHK once  |
| 4 ;************************************   | Waiting   |
| 5 ACCURACY 1 ALWAYS<br>6 SPEED 50 MM/S ALWAYS   | RPS OFF   |
| 7 POINT lasttool = TOOL;隠贋o 庄ATCPÉè協  | EXT. HOLD |
| RPS 👸 🦉 🕨   |           |
| OFF Monitor1 Monitor2 Step<br>Forward   |           |
|   |           |
| Record I/0  |           |
| Monitor   | H MIND    |

- 3. Press on MOTOR while holding down the A key to power the motor.
- 4. Press on CYCLE while holding down the A key to run the program.
- 5. If RUN does not turn green, press the RUN/HOLD key while holding down the A key.



| 🛃 R01[C01] - Virtual Teach Pendant 0 — 🗆 🛛  |
|---|
| REPEAT         Program         [Comment]         Coinc.         PC         RUN         MOTOR         CYCLE           calibrate         11         11         11         11         REP. SPD |
|   |
| Step II position data rewritten.  |
| INTERP SPD ACC TMR TOOL CLAMP J/E OUTPUT INPUT 1.2H   |
| JOINT 9 1 0 1 [ ][ ] ERROR  |
| 8 BREAK   |
| 9 TOOL NULL<br>10 calib_ret = 0 CHK once  |
| 10 Callb_ret = 0<br>11 JMOVE vis_calib_start;炎協兜的完备   |
| 12 BREAK  |
| 12 CALL uig open  |
| 14 TWAIT 0.1  |
|   |
| OFF Monitor1 Monitor2 Step<br>Forward   |
|   |
| Record I/O<br>Monitor   |

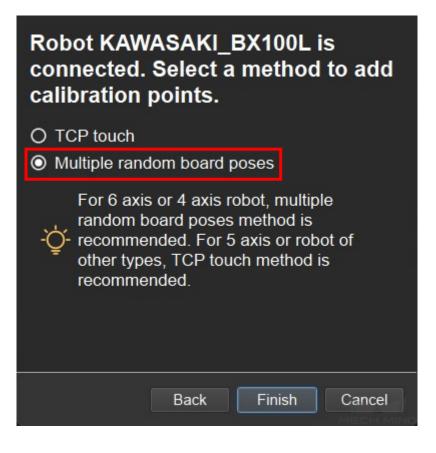
6. Proceed to the next section when the following message is displayed in Mech-Center's Log panel: Entering the calibration process, please start the calibration in Mech-Vision





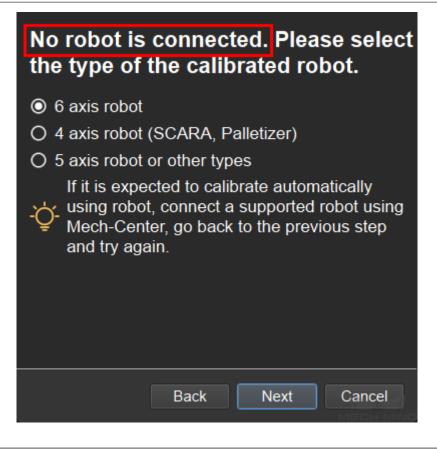
#### Start Calibration in Mech-Vision

- 1. In Mech-Vision, click on Camera Calibration (Standard) in the Toolbar, or select Camera  $\rightarrow$  Camera Calibration  $\rightarrow$  Standard from the Menu Bar.
- 2. Follow the instructions in Mech-Vision to complete the following configuration:
  - 1. Select **Start a new calibration process**;
  - 2. Select the camera mounting method;
  - 3. Select Multiple random board poses for adding calibration points.



**Note:** If after selecting the camera mounting method, the window says **No robot is connected**, the connection between the robot and Mech-Center is not properly established. Please re-run the robot program.





3. Follow the instructions in Mech-Vision to finish the calibration.

**Note:** In **5** Add Marker-Images and Poses after you click on *Move Robot along Trajectory and Add Board Images*, if the robot does not reach the next calibration point within 60 seconds, Mech-Vision will report a timeout error and stop the calibration process. In such case, please select **calibration** in the program directory and run this program again, and restart the calibration process in Mech-Vision.

# 2.5.3 Kawasaki Example Program

This section introduces the example program provided with Mech-Center and the operations required to perform an actual pick-and-place task.

The example program **mm\_sample.as** can be found in *Mech-Center/mech\_interface/kawasaki*. It contains two parts: **vision\_sample\_1** obtains vision results from Mech-Vision; **vision\_sample\_2** obtains planned path from Mech-Viz.

Check the section corresponding to your own application setup:

- Obtain Vision Results from Mech-Vision
- Obtain Planned Path from Mech-Viz

Before running the program, please make sure that:



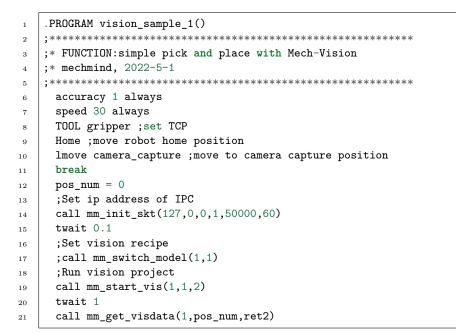
- You have *loaded the Standard Interface program* onto the robot and can establish communcation with Mech-Center.
- You have completed the extrinsic parameter calibration with the calibration program or by manually adding calibration points.
- Mech-Vision and Mech-Viz projects are created and set to autoload.
- The **Project list** in Mech-Center  $\rightarrow$  Deployment Settings  $\rightarrow$  Mech-Vision is synced by clicking on 11

and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings |   | $\times$ |
|---------------------|---|----------|
| Mech-Vision         | <ul> <li>✓ Use Mech-Vision</li> <li>Exec path …</li> <li>Project path 11</li> </ul> |          |
|                     | ID Project list 1 2   |          |

- The TCP has been correctly specified.
- The robot speed is set to a low value, so that the operator can notice any unexpected behavior before accidents occur.

#### **Obtain Vision Results from Mech-Vision**



(continues on next page)



(continued from previous page)

```
if ret2 <> 1100
22
           halt
23
       end
^{24}
       call mm_get_pose(1,&pick[1],label[1],speed[1])
^{25}
       LAPPRO pick[1],100
^{26}
      LMOVE pick[1]
27
       break
28
       ;Add object grasping logic here.
29
       ldepart 100
30
      lmove waypoint[1]
31
      lappro drop[1],100
32
       lmove drop[1]
33
       ;Add object releasing logic here.
34
       ldepart 100
35
      HOME
36
     END
37
```

## **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with **mm\_init\_skit**.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with mm\_switch\_model.
- 5. Run the Mech-Vision project with **mm\_start\_vis**.
- 6. Wait for 1 second. Under Eye-In-Hand, this **TWAIT** instruction is required to make sure the robot stays still until image acquisition is completed. Under Eye-To-Hand, this **TWAIT** instruction can be replaced with **LMOVE** or **JMOVE**.
- 7. Obtain the vision results from Mech-Vision.
- 8. Check if the returned status code indicates any error. If an error code is returned, the program is halted.
- 9. Move the robot to the picking pose and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.



## Define the TCP

Change the value of **gripper** in line 8 to the actual TCP values.

## Teach the Image Capturing Pose

Record the image capturing pose in **camera\_capture** in line 10.

## Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

You can add one or more waypoints to **waypoint**[] in line 31.

## Teach the Placing Pose

Record the placing pose in drop[1] in line 33.

## Define Z-Offset from Picking/Placing Pose

Z-offset distances relative to the tool frame from the picking/placing pose are used to ensure collision doesn' t occur when the robot is approching or departing the picking/placing pose.

Adjust the following commands according to your actual needs.

- LAPPRO pick[1],100 in line 26: the Z-offset when approching the picking pose is set to 100. Robot will move to 100 mm above the picking pose.
- **ldepart 100** in line 30: the Z-offset when departing the picking pose is set to **100**. Robot will move to 100 mm above the picking pose.
- **lappro drop[1],100** in line 32: the Z-offset when approching placing pose is set to **100**. Robot will move to 100 mm above the placing pose.
- **ldepart 100** in line 35: the Z-offset when departing the placing pose is set to **100**. Robot will move to 100 mm above the placing pose.

## Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking the object to line 29.

Add logic for controlling the tool action when placing the object to line 34.



#### **Define HOME position**

The HOME position need to be set on the teach pendant in Aux.  $\rightarrow 4$ . Basic setting  $\rightarrow 2$ . Home Position beforehand.

## **Obtain Planned Path from Mech-Viz**

```
.PROGRAM vision_sample_2()
1
    2
    ;* FUNCTION:simple pick and place with Mech-Viz
3
    ;* mechmind, 2022-5-1
4
    \mathbf{5}
     accuracy 1 always
6
7
      speed 30 always
     TOOL gripper ;set TCP
8
     Home ; move robot home position
9
10
     LMOVE camera_capture ;move to camera_capture position
11
      break
     pos_num = 0
12
      ;Set ip address of IPC
13
      call mm_init_skt(127,0,0,1,50000,60)
14
15
      twait 0.1
      ;Set vision recipe
16
17
      ;call mm_switch_model(1,1)
18
      ;Run Viz project
      call mm_start_viz(1)
19
^{20}
      twait 0.1
^{21}
      ;set branch exitport
      ;call mm_set_branch(1,1)
^{22}
      ;get planned path
23
      call mm_get_vizdata(2,pos_num,vispos_num,ret1)
^{24}
      if ret1 <> 2100
^{25}
^{26}
         halt
27
      end
28
      for count=1 to pos_num
        call mm_get_pose(count,&movepoint[count],label[count],speed[count])
29
30
      end
      ;follow the planned path to pick
31
      for count =1 to pos_num
32
       speed speed[count]
33
       LMOVE movepoint[count]
34
        if count == vispos_num then
35
            ;add object grasping logic here
36
37
        end
      end
38
      ;go to drop location
39
      ldepart 100
40
      lmove waypoint[1]
41
      lappro drop[1],100
^{42}
      lmove drop[1] ;drop point
43
      ;add object releasing logic here
44
      ldepart 100
45
     HOME
46
    . END
47
```





#### **Program Logic**

- 1. Move the robot to HOME position.
- 2. Move the robot to the image capturing pose.
- 3. Initialize communication with **mm\_init\_skit**.
- 4. If parameter recipes are used in the Mech-Vision project, the recipe to be used is set with **mm\_switch\_model**.
- 5. Run the Mech-Viz project with **mm\_start\_viz**.
- 6. Obtain the planned path from Mech-Viz.
- 7. Check if the returned status code indicates any error. If an error code is returned, the program is halted.
- 8. Store obtained target points in the planned path to &movepoint[] with a FOR loop.
- 9. Move the robot along the planned path with a **FOR** loop and perform picking.
- 10. Move the robot to a waypoint between the picking pose and placing pose.
- 11. Move the robot to the set placing pose and perform placing.
- 12. Return the robot to HOME position.

The following parts should be modified according to your actual needs.

## Define the TCP

Change the value of **gripper** in line 8 to the actual TCP values.

## Teach the Image Capturing Pose

Record the image capturing pose in camera\_capture in line 10.

## Teach the Waypoint(s)

Waypoints are intermediate poses between the picking pose and placing pose. They are used to ensure that the robot doesn't collide with the surrounding when moving between the picking and placing poses.

You can add one or more waypoints to **waypoint**[] in line 41.

## Teach the Placing Pose

Record the placing pose in **drop**[1] in line 43.



## Add Object Grasping and Releasing Logics

Add logic for controlling the tool action when picking the object to line 29.

Add logic for controlling the tool action when placing the object to line 34.

## Define HOME position

The HOME position need to be set on the teach pendant in Aux.  $\rightarrow 4$ . Basic setting  $\rightarrow 2$ . Home Position beforehand.

# 2.5.4 Kawasaki Standard Interface Commands

The Kawasaki Standard Interface provides the following subroutines:

- Initialize Communication
- Start Mech-Vision Project
- Get Vision Result
- Start Mech-Viz Project
- Get Planned Path
- Obtain Pose
- Obtain Joint Positions
- Switch Mech-Vision Recipe
- Select Mech-Viz Branch
- Set Move Index
- Get Software Status
- Input Object Dimensions to Mech-Vision
- Get DO Signal List
- Input TCP to Mech-Viz
- $\bullet \quad Calibration$

When writing your own program, pay attention to the following:

- Multiple parameters should be separated by commas.
- All parameters should be defined as local variables.
- Parameters can be defined as input or output parameters.
- Input arguments can be constants, global variables or local variables; output arguments can be global variables or local variables.

This Standard Interface is over the TCP/IP protocol.



#### Initialize Communication

mm\_init\_skt(.ip1,.ip2,.ip3,.ip4,.port,.time\_out)

This subroutine sets the IP address and port number of the IPC and wait time before the program stops trying to establish the communication.

## Parameters

• Input parameters

| Name      | Description   |
|-----------|---|
| .ip1ip4   | IP address of the IPC                                   |
| .port     | Port number of the IPC, the default is 50000            |
| .time_out | Wait time in seconds before stopping connection attempt |

#### Example

CALL mm\_init\_skt(192,168,1,1,50000,60)

This example sets the IP address and port number of the IPC to 192.168.1.1:50000 and wait time to 60 seconds.

#### Start Mech-Vision Project

```
mm_start_vis(.job,.pos_num_need,.sendpos_type)
```

This subroutine is for applications that use Mech-Vision but not Mech-Viz. It runs the corresponding Mech-Vision project to acquire and process data.

## Parameters

• Input parameters

| Name   | Description   |
|--|---|
| .job   | Mech-Vision Project ID, from 1 to 99  |
|  | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| .pos_num   | Next ber of poses for Mech-Vision to send, from 0 to 20, where 0 means "send all".              |
| .sendpos_typet the image capturing pose for the robot to send, from 0 to 2 |   |
|  | 0: Do not send image capturing pose (for Eye To Hand) 1: Send image capturing                   |
|  | pose as joint positions 2: Send image capturing pose as robot flange pose                       |



#### Example

CALL mm\_start\_vis(1,1,1)

This example runs Mech-Vision project No. 1, and asks the project to send over 1 pose, and the robot sends its joint positions when this subroutine is called as the image capturing pose to Mech-Center.

#### **Get Vision Result**

```
mm_get_visdata(.job,.pos_num,.ret)
```

This subroutine is for applications that use Mech-Vision but not Mech-Viz. It obtains the vision result from the corresponding Mech-Vision project.

#### Parameters

• Input parameter

| Name | Description   |
|------|---|
| .job | Mech-Vision Project ID, from 1 to 99  |
|      | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |

• Output parameters

| Name     | Description  |  |
|----------|--|--|
| .pos_num | Variable for storing the number of received poses                              |  |
| .ret     | Variable for storing status code, refer to the standard_interface_status_codes |  |

#### Example

CALL mm\_get\_visdata(1,posnum,statuscode)

This example obtains the vision result from Mech-Vision project No. 1. The number of poses received is stored in **posnum**, and the status code is stored in **statuscode**.

#### Start Mech-Viz Project

```
mm_start_viz(.sendpos_type)
```

This subroutine is for applications that use both Mech-Vision and Mech-Viz. It runs the corresponding Mech-Viz project (which triggers the corresponding Mech-Vision project to run), and sets the initial joint positions of the simulated robot in Mech-Viz.



### Parameter

• Input parameter

| Name     | Description   |  |
|----------|---|--|
| .sendpos | Type initial joint positions for the simulated robot in Mech-Viz, 0 or 1                        |  |
|          | 0: Set the initial joint positions of the simulated robot to $[0,0,0,0,0,0]$ 1: Set the initial |  |
|          | joint positions of the simulated robot to the current joint positions of the real robot         |  |

Note: When the scene contains object models that obstruct the robot to move from [0,0,0,0,0,0] to the first target point, this parameter must be set to 1.

### Example

CALL mm\_start\_viz(1)

This example runs the corresponding Mech-Viz project, and sets the initial joint positions of the simulated robot to the current joint positions of the real robot.

### Get Planned Path

mm\_get\_vizdata(.getpos\_type,.pos\_num,.vispos\_num,.ret)

This subroutine obtains the planned path from Mech-Viz.

### Parameters

• Input parameter

| Name         | Description   |  |
|--------------|---|--|
| .getpos_type | Whether Mech-Viz should send target points as joint positions or TCPs, 1 or 2 |  |
|              | 1: Mech-Viz sends joint positions 2: Mech-Viz sends TCPs                      |  |

• Output parameters

| Name    | Description   |  |
|---------|---|--|
| .pos_r  | ukariable for storing the number of received target points                            |  |
| .vispos | Mamiable for storing the position of the first visualmove target point in the path    |  |
|         | Example path: move-1, move-2, visual_move-3, move-3, visual_move-2 In this path,      |  |
|         | the position of the first visual_move target point is 3. If the path does not contain |  |
|         | visual_move target point, the return value is 0.                                      |  |
| .ret    | Variable for storing status code, refer to the standard_interface_status_codes        |  |



#### Example

CALL mm\_get\_vizdata(2,posnum,vis\_index,statuscode)

This example obtains the planned path from Mech-Viz in the form of TCPs. The number of target points received is stored in **posnum**, the position of the visual\_move target point is stored in **vis\_index**, and the status code is stored in **statuscode**.

#### **Obtain Pose**

mm\_get\_pose(.index,.&targetpos,.label,.speed)

This subroutine stores a pose returned by Mech-Vision or a target point (as TCP) returned by Mech-Viz in the specified variable.

#### Parameters

• Input parameter

| Name   | Description                                |
|--------|--|
| .index | Specify the index of the pose to be stored |

• Output parameters

| Name        | Description  |  |
|-------------|--|--|
| .&targetpos | Variable for storing the specified pose  |  |
|             | Must add "&" before the variable name to indicate the variable as transformation |  |
|             | values   |  |
| .label      | Variable for storing the label corresponding to the specified pose               |  |
| .speed      | Variable for storing the speed corresponding to the specified pose               |  |

#### Example

CALL mm\_get\_pose(1,.&pt[1],pt\_label[1],pt\_speed[1])

This example stores the first received pose to pt[1], the corresponding label to  $pt\_label[1]$ , and the corresponding speed to  $pt\_speed[1]$ .



#### **Obtain Joint Positions**

mm\_get\_jps(.index,.#targetpos,.label,.speed)

This subroutine stores a set of joint positions returned by Mech-Viz in the specified variable.

**Note:** As Mech-Vision does not output joint position data, this subroutine can only be used with Mech-Viz.

#### Parameters

• Input parameter

|        | Description  |
|--------|--|
| .index | Specify the index of the set of joint positions to be stored |

• Output parameters

| Name        | Description  |  |
|-------------|--|--|
| .#targetpos | Variable for storing the specified set of joint positions                            |  |
|             | Must add "#" before the variable name to indicate the variable as joint displace-    |  |
|             | ment values  |  |
| .label      | Variable for storing the label corresponding to the specified set of joint positions |  |
| .speed      | Variable for storing the speed corresponding to the specified set of joint positions |  |

#### Example

CALL mm\_get\_jps(1,.#pt[1],pt\_label[1],pt\_speed[1])

This example stores the first set of received joint positions to pt[1], the corresponding label to  $pt\_label[1]$ , and the corresponding speed to  $pt\_speed[1]$ .

#### Switch Mech-Vision Recipe

mm\_switch\_model(.job,.model\_number)

This subroutine specifies which parameter recipe of the Mech-Vision project to use. For more information on parameter recipe, please see parameter\_recipe\_configuration.

#### Note:

- This subroutine must be called BEFORE **mm\_start\_vis**.
- The corresponding Mech-Vision project must have parameter recipes already configured and saved.



#### Parameters

• Input parameters

| Name          | Description   |  |
|---------------|---|--|
| .job          | Mech-Vision Project ID, from 1 to 99  |  |
|               | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |  |
| .model_number | The number of a parameter recipe in the Mech-Vision project, from 1 to 99                       |  |

#### Example

| CALL mm_switch_model(2,2) |  |
|---------------------------|--|
|---------------------------|--|

This example switches the parameter recipe used to No. 2 in Mech-Vision project No. 2.

### Select Mech-Viz Branch

mm\_set\_branch(.branch\_num,.exit\_num)

This subroutine is used to select along which branch the Mech-Viz project should proceed. Such branching is achieved by adding branch\_by\_service\_message Task(s) to the project. This subroutine specifies which out port such Task(s) should take.

#### Note:

- **mm\_start\_viz** must be called BEFORE this subroutine.
- When the next Task to be executed in Mech-Viz is a **branch\_by\_service\_message** Task, Mech-Viz will wait for this subroutine to send the out port number it should take.
- The name of all **branch\_by\_service\_message** Tasks in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

### Parameters

• Input parameters

| Name        | Description   |
|-------------|---|
| .branch_num | Name of the <b>branch_by_service_message</b> Task, from 1 to 99 |
| .exit_num   | The number of the out port to take, from 1 to 99                |



#### Example

CALL mm\_set\_branch(1,3)

This example tells Mech-Viz to take out port 3 for the **branch\_by\_service\_message** Task named **1**.

#### Set Move Index

mm\_set\_index(.skill\_num,.index\_num)

This subroutine sets the value for the Current Index parameter of Mech-Viz Tasks. Tasks that have this parameter include move\_list, move\_grid, custom\_pallet\_pattern, and smart\_pallet\_pattern.

#### Note:

- **mm\_start\_viz** must be called BEFORE this subroutine.
- The name of all Tasks with index parameters in the Mech-Viz project must be changed to numbers between 1 and 99, and the names should be unique among all tasks in the project.

#### Parameters

• Input parameters

| Name       | Description   |
|------------|---|
| .skill_num | Name of the Task, from 1 to 99                                  |
| .index_num | Value for the Current Index parameter when the Task is executed |

#### Example

```
CALL mm_set_index(2,10)
```

This example sets the Current Index value to 9 for the Task named **2**. When the Task is executed, the Current Index value will be added 1 and become 10.

#### Get Software Status

mm\_get\_status(.ret)

This subroutine is currently capable of checking whether Mech-Vision is ready to run projects. In the future, this subroutine can be used for obtaining the execution status of Mech-Vision, Mech-Viz and Mech-Center.



#### Parameter

• Output parameter

 Name
 Description

 .ret
 Variable for storing the status code, refer to the standard\_interface\_status\_codes

#### Example

CALL mm\_get\_status(statuscode)

This example obtains the status code and stores it in **statuscode**.

#### Input Object Dimensions to Mech-Vision

mm\_set\_boxsize(.job,.length,.width,.height)

This subroutine inputs object dimensions to the Mech-Vision project.

#### Note:

- This subroutine must be called BEFORE  $mm\_start\_vis$ .

#### Parameters

• Input parameters

| Name    | Description   |
|---------|---|
| .job    | Mech-Vision Project ID, from 1 to 99  |
|         | Can check and adjust in Mech-Center $\rightarrow$ Deployment Settings $\rightarrow$ Mech-Vision |
| .length | Length of object in mm  |
| .width  | Width of object in mm   |
| .height | Height of object in mm  |

#### Example

|--|

This example sets the object dimensions in the read\_object\_dimensions Step in the Mech-Vision project No. 1 to  $500^*300^*200$  mm.



#### Get DO Signal List

#### mm\_get\_dolist()

This subroutine obtains the planned DO Signal list for controlling multiple sections of a sectioned vacuum gripper.

#### Note:

- **mm\_get\_vizdata** must be called BEFORE this subroutine.
- Please deploy the Mech-Viz project based on the template project in *Mech-Center/tool/viz\_project/suction\_zone*, and set the suction cup configuration file in the Mech-Viz project.

#### Parameters

No parameters.

#### Example

CALL mm\_get\_dolist

This example obtains the DO signal list planned by Mech-Viz and stores it in **setdo**[] array. The first array element is **setdo**[0] and the last is **setdo**[io\_index-1].

#### Input TCP to Mech-Viz

mm\_set\_pos(.&pos)

This subroutine inputs TCP data to the outer\_move Task.

#### Note:

- This subroutine must be called BEFORE **mm\_start\_viz**.
- Please deploy the Mech-Viz project based on the template project in *Mech-Centertoolviz\_projectouter\_move*, and put the **outer\_move** Task at a proper position in the workflow.



#### Parameter

• Input parameter

| Name  | Description  |
|-------|--|
| .&pos | Variable for storing the TCP data to be sent to Mech-Viz                         |
|       | Must add "&" before the variable name to indicate the variable as transformation |
|       | values   |

#### Example

| call mm_set_pos(&pos) |
|-----------------------|
|-----------------------|

This example sends the TCP data stored in **&pos** to the **outer\_move** task in the Mech-Viz project.

### Calibration

calibrate()

This subroutine is used for hand-eye calibration (camera extrinsic parameter calibration). It automates the calibration process in conjunction with the **Camera Calibration** function in Mech-Vision. For detailed instructions, see *Kawasaki Calibration Program*.

### 2.5.5 Kawasaki Error Messages

The following errors may occur while running the Standard Interface program on the robot.

**Note:** If robot reports an error message and the program is halted, please cancel the program and select it from the directory again after problem is resolved.

#### Error: Invalid TCP socket, Error: vis\_socket invalid ID

When the program calls the  $\mathbf{TCP}\_\mathbf{SEND}$  or  $\mathbf{TCP}\_\mathbf{CLOSE}$  functions, the value of  $\mathbf{vis}\_\mathbf{socket}$  is incorrect.

### Troubleshooting

- Check the program to see if **TCP\_CONNECT** is called before **TCP\_SEND** or **TCP\_CLOSE**. **TCP\_CONNECT** must be called first to assign value to **vis\_socket**.
- Check if the variable **vis\_socket** is used in other user programs.



### Error: TCP\_CLOSE fault

Calling the  $\mathbf{TCP\_CLOSE}$  function failed.

### Troubleshooting

- Check if the hardware are properly connected.
- Check if the Standard Interface is started in Mech-Center.
- Contact Mech-Mind Technical Support for further assistance.

### Error: TCP connect fault

Calling the **TCP\_CONNECT** function failed.

### Troubleshooting

- Check if the hardware are properly connected.
- Check if the Standard Interface is started in Mech-Center.
- Check the IP addresses of the robot and the IPC, and if the port number is configured correctly.
- Check if the firewall is turned off on the IPC.
- Contact Mech-Mind Technical Support for further assistance.

### Error: TCP\_SEND null string

The string sent when calling the **TCP\_SEND** function is empty.

#### Troubleshooting

Check if the variable **\$vis\_data[1]** is used in other user programs.

### Error: TCP\_SEND fault

Communication failed when calling the **TCP\_SEND** function.

### Troubleshooting

- Check the parameters of **TCP\_SEND**.
- Contact Mech-Mind Technical Support for further assistance.



#### Error: TCP\_SEND retry counter exceed limit

Communication failed when calling the **TCP\_SEND** function, and retry times exceeded set limit.

### Troubleshooting

- Check the parameters of **TCP\_SEND**.
- Contact Mech-Mind Technical Support for further assistance.

### Error: TCP\_RECV fault

Communication failed when calling the  $\mathbf{TCP}$ \_**RECV** function.

#### Troubleshooting

- Check the parameters of **TCP\_RECV**.
- Check if the Standard Interface is started in Mech-Center.
- Contact Mech-Mind Technical Support for further assistance.

#### Error: TCP\_RECV retry counter exceed limit

Communication failed when calling the **TCP\_RECV** function, and retry times exceeded set limit.

#### Troubleshooting

- Check the parameters of **TCP\_RECV**.
- Check if the Standard Interface is started in Mech-Center.
- Contact Mech-Mind Technical Support for further assistance.

#### Error: CMD error

The command code received does not match the one sent.

#### Troubleshooting

The sequence of command sending and receiving is problematic. Please contact Mech-Mind Technical Support for further assistance.



#### Error: IPC error

Returned status code is an error code. Please check Mech-Center' s log.

### Troubleshooting

- Please refer to the standard\_interface\_status\_codes for the specific error.
- Please contact Mech-Mind Technical Support for further assistance.

# 2.6 EtherNet/IP - KEYENCE PLC

This section provides information on setting up communication between a KEYENCE PLC and Mech-Mind Software Suite via EtherNet/IP.

### 2.6.1 Overview

- Hardware and Software Requirements
- Configure IPC and Initiate Communication
- Install EDS file and Configure Communication
- Import Example Program and Download to PLC
- Test with Mech-Vision/Mech-Viz Project

### 2.6.2 Hardware and Software Requirements

#### Hardware

- KEYENCE PLC:
  - KV-8000 series
  - KV-8000A
  - KV-7500
  - KV-5500
  - Other models with a KV-EP21V or KV-NC1EP EtherNet/IP Unit
- USB Type A Male to Type B Male cable
- AC 220 V to DC 24 V power adapter
- HMS IXXAT INpact EIP Slave PCIe interface card installed on the IPC in Mech-Mind Vision System
- Switch
- Ethernet cables



Attention: A KV-8000 model is used in the example below.

#### Software

- KEYENCE PLC programming software KV STUDIO V11.41
- Mech-Mind Software Suite: Mech-Center 1.5.1 or above, Mech-Vision 1.5.0 or above, and Mech-Viz 1.5.0 or above
- VCI V4 (driver software for HMS IXXAT INpact 40 interface card)
- HMS IPconfig software
- Mech-Mind EDS file:
  - File name: **005A002B003A0100.EDS**
  - Location: Mech-Mind/Mech-Center/mech\_interface/EthernetIP
- Example programs:
  - CameraSignalsMove.mod
  - CameraTest.mod
  - ObtainPose.kfb

The files are stored in Mech-Mind/Mech-Center/mech\_interface/documents/CN/基恩士 EtherNet IP 编程指南. Please copy and paste all files to the computer with KV STUDIO installed.

**Note:** Connect the Mech-Mind Vision System IPC, computer with KV STUDIO installed, and PLC to the same router.

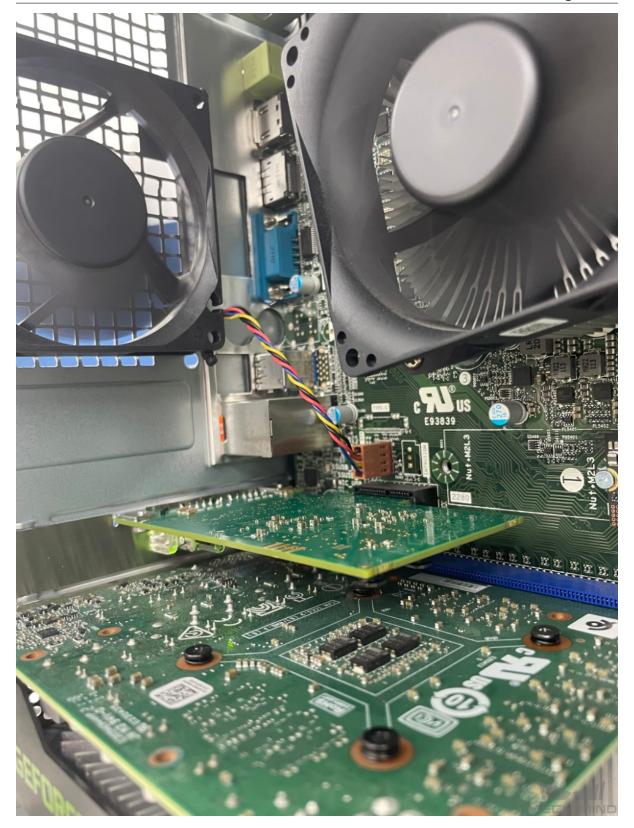
# 2.6.3 Configure IPC and Initiate Communication

#### Check PCI-e Card and Driver Software

1. Please make sure that the INpact EIP Slave PCIe interface card has been pressed into the PCI-e slot of the IPC, as shown below.

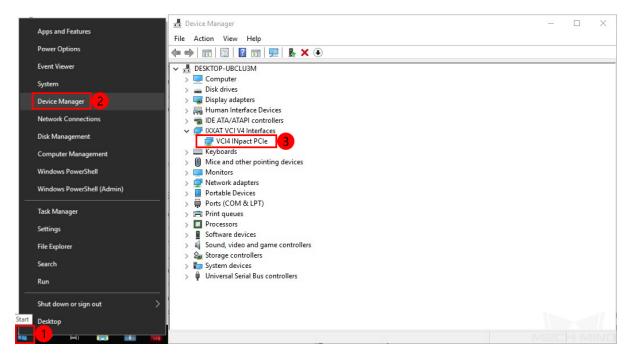


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2. Start the IPC, go to  $Start \rightarrow Device Manager$  and check if the driver software VCI4 INpact PCIe has been installed.



### Configure Mech-Interface in Mech-Center

1. Open Mech-Center, and click on *Deployment Settings*.

| File | Tool   | User    | View  | Help          | -                     |     |                 |               |
|------|--------|---------|-------|---------------|-----------------------|-----|-----------------|---------------|
|      | 9      | •       |       | Vision<br>Viz | Еуе                   |     |                 | 2             |
|      | oloyme | nt Sett | tings | Start         | Start Mech-Eye Viewer | Run | Start Interface | Connect Robot |

2. Go to **Mech-Interface**, check **Use Mech-Interface** and select *Standard Interface*  $\rightarrow$  *ETHERNET IP*. Click on *Save* to complete configurations.



| Beployment Settings   |  | × |
|---|--|---|
| Appearance & Behavior<br>Mech-Viz<br>Mech-Vision<br>Mech-Eye Viewer<br>Robot Server<br>Mech-Interface | V Use Mech-Interface 2<br>Interface Program Folder<br>Interface Service Type<br>Standard Interface 3 Adapter<br>Interface Options ETHERNET IP 4<br>Listed robot ABB ABB_IRB1200_5_09 rzyx<br>Custom robot RobotVendor RobotType1 rzyx<br>Advanced Settings |   |
|   | Save 5 Cancel  |   |

3. Click on *Start Interface* in the Toolbar. Then an ETHERNET IP icon will display in the service status bar.



| Mech-Center, by Mech-Mind Robotics               |                       |               | _                                 |       | ×         |
|--|-----------------------|---------------|-----------------------------------|-------|-----------|
| File Tool User View Help                         |                       |               |                                   |       |           |
| Deployment Settings Start Start Mech             | Ye Run Stop Interface | Connect Robot |                                   | Admir | nistrator |
| Service Status                                   |                       |               | Log                               |       |           |
| Vis Viz 💿  | EtherNet              |               | Max Line 10000 📮 Open Logs Folder | c     | lear      |
|  |                       |               |                                   |       |           |
| 1.5.2 1.5.2 Virtual Camera ETI<br>Project Status | HERNET IP             |               |                                   |       |           |
| Project Name Status                              | Exec Time D           | etails        |                                   |       |           |
|  |                       |               |                                   |       |           |
| Metalwork IDLE                                   |                       |               |                                   |       |           |
| 🇯 check_collision change IDLE                    |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |
|  |                       |               |                                   |       |           |

### Configure IP address of the PCI-e Card

1. Download and install **HMS IP config software** on the IPC first. Use an Ethernet cable to connect the network ports of the IPC and the INpact EIP Slave PCIe.

**Attention:** After configurating the IP and initiating communication successfully, the Ethernet cable used here can be removed.

2. Open HMS IPconfig, click on and select Ixxat INpact EtherNet/IP(TM). Then uncheck Retrieve IP settings dynamically from a DHCP server and enter the IP address and subnet mask, as shown below. After configuration, click on *Apply*.



| HMS IPconfig  | - 🗆 X   |
|---|---|
| Scanned Devices:  | Device Configuration Apply 6  |
| Itxat INpact EtherNet/IP(TM)         2           192.168.1.10         00-30-11-37-47-69 | <ul> <li>DHCP Configuration</li> <li>Retrieve IP settings dynamically from a DHCP server</li> <li>IP Configuration</li> <li>IP address</li> <li>192.168.1.10</li> <li>Subnet mask</li> <li>255.255.255.0</li> </ul>   |
|   | Default Gateway 0.0.00  DNS Configuration Primary DNS 0.0.00 Secondary DNS 0.0.00 Host Name   |
|   | Password Password Change password New Password Mem Passw |

Attention: The IP address should be the same as which is configured in the PLC.

# 2.6.4 Install EDS file and Configure Communication

### **Create PLC Project**

1. Open KV STUDIO, click on Refer to select a location to store the project, and click on OK to save settings.



| KV ST   | UDIO    |                      |                       |                |              |           |
|---------|---------|----------------------|-----------------------|----------------|--------------|-----------|
| File(F) | View(V) | Monitor/Simulator(N) | Operation recorder/Re | eplay(R) Tool( | T) Window(W) | Help(H)   |
|         |         | 🖻 🛍 🗟 🖶 🖪 🔾 🕝        | USB                   | - 1            | 🖻 💕 📲 🔂      | 成國縣團      |
| 14      | No Es   |                      |                       |                |              | > ② 』 导 ( |
|         |         |                      |                       |                |              |           |
|         |         |                      |                       |                |              |           |
|         |         |                      |                       |                |              |           |
|         |         | New project          |                       |                | $\times$     |           |
|         |         | Project name(N)      | _                     | PLC mode       | el(K)        |           |
|         |         | MM_Camera_KV         | 3                     | KV-8000        | 2 ~          |           |
|         |         | Position(P)          |                       |                |              |           |
|         |         | C:\Users\CTOS\Do     | cuments\EIP           |                | Refer(S)     | 4         |
|         |         | Comment(C)           |                       |                |              |           |
|         |         |                      |                       |                | ~            |           |
|         |         |                      |                       |                |              |           |
|         |         |                      |                       |                | ×            |           |
|         |         | Detail(D)            |                       | ОК             | 5 Cancel     |           |
|         |         |                      |                       |                |              |           |
|         |         |                      |                       |                |              |           |
|         |         |                      |                       |                |              |           |
|         |         |                      |                       |                | ME           | CH MIND   |

2. If the message "Automatically set the operation recorder setting?" pops up, select Yes.



3. If the message "Setup unit setting info now?" pops up, select No.



| Confirm unit setting information  |                                      |  |
|---|--------------------------------------|--|
| Setup unit setting info now?  |                                      |  |
| * [Yes]Start Unit Editor.<br>* [No]Close this dialog.<br>* [Read unit setting]Read unit setting information<br>Yes(Y) No(N) | on from PLC.<br>Read unit setting(U) |  |

4. Go to Unit configuration  $\rightarrow KV 8000$ , double click on EtherNet/IP R30000 DM10000.



| KV STUDIO -[Monitor: KV-8000] - [MM_Camera_KV *]       |
|--|
| File(F) Edit(E) View(V) Program(M) ST/Script(S) Conver |
| i 🗅 📂 🗟 🗟 🗠 🛍 🗟 🖶 🔂 🕜 i 👥 USB                          |
| - 🗶 🏣 📰 🌌 🐼 🎬 🖷 🏅 🗞 🗞 🖳 🔵 💌 🕨                          |
| Project 🛛 🕹 🗸  |
| Unit configuration                                     |
| 🖬 占 [0] KV-8000  |
| E EtherNet/IP R30000 DM10000                           |
| organization [1] Ixxat INpact EtherNet/IP(TM)          |
| 🛃 Unit configuration switching                         |
| 📇 Device comment                                       |
| 🖵 Variable   |
| 👘 Structure  |
| 😑 🚮 Operation recorder setting                         |
| ID0  |
| CPU system setting                                     |
| 🚊 🚰 Program: MM_Camera_KV                              |
| Every-scan execution                                   |
| 🖽 🧱 Main   |
| Initialize module                                      |
| Standby module   |
| Fixed-period module                                    |
| Inter-unit sync module                                 |
| Function Block   |
| Macro  |
| Subroutine macro                                       |
| Self-hold macro<br>Device default                      |
|  |
| File register setting<br>0:Memory card                 |
| 1:CPU memory   |
| User document  |
|  |
|  |

5. An **EtherNet/IP settings** window will appear as shown below. Select *Manual* in the pop-up window.



| EtherNet/IP settings<br>File(F) Edit(E) Settings(S) View(V) Conv<br>(1) (1) (1) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2                                      |                  | D) Communication(N) Too | I(T) He  | elp(H)  |                        | -                               | - 🗆   | ×            |
|---|------------------|-------------------------|----------|---|------------------------|---------------------------------|---|--------------|
| KV-8000[0] : 192.168.0.10   |                  |                         | Unit lis | tt <b>/IP unit</b><br>t(1) Unit se<br>.   <b>₽</b> E ₽=   2015                                | 30 1                   | Search (                        | unit( <u>3)</u>   | д            |
| EtherNet/IP settings           The EtherNet/IP setting has not beer           * "Manual"Set the configuration fr           * "Auto Configuration"Search the | om the equipment | list.                   |          | Unit nam<br>eyence Cor<br>KV-5500<br>KV-7500<br>KV-8000 Sc<br>KV-EP02<br>KV-N16EF<br>KV-N16FY | e<br>poration<br>eries | 1.1<br>1.1<br>1.1<br>1.1<br>1.1 | EDS fil<br>KV-5500<br>KV-7500<br>KV-8000<br>EtherNe<br>16-poin<br>16-poin |              |
| Manual(M)<br>Output   | Auto Configura   | tion(A)                 |          |   |                        |                                 |   | Ą            |
| à 💼   # 🎜   😢 🎭   🏨   |                  |                         |          |   |                        |                                 |   |              |
| N Node name I   | P address        | Connection              |          | RPI[IN]<br>(ms)   | RPI[OUT]<br>(ms)       | Time                            | out   | Refr<br>cior |
|   |                  |                         |          |   |                        |                                 |   |              |
| H + + H Message Verify Setup list   |                  |                         |          |   |                        |                                 |   | >            |
|   |                  | Editor                  |          |   | OK                     | Cancel                          | Apply   |              |

6. Select KV-8000, click on *Unit setting* and then set the IP address of the PLC.



| 🛃 EtherNet/IP settings  | – – ×   |   |
|---|---|---|
| File(F) Edit(E) Settings(S) View(V) Convert(C) EDS file(D) Communication(N) Too | ol(T) Help(H)                                     |   |
| 📲 🔃 🐘 🕹 👘 🐘 📓 🌮 🚳 🟟 👰 🗹 խ 😭 🥝   |   |   |
| KV-8000[0] : 192.168.1.21   | EtherNet/IP unit                                  | ņ |
|   | Unit list(1) Unit setting(2) 2 arch unit(3)       |   |
|   |   |   |
|   | Scanner settings                                  | ~ |
|   | IP address 192.168.1.21                           |   |
|   | Unit comments                                     |   |
|   | Product name KV-8000                              |   |
|   | Vendor name Keyence Corporation                   |   |
|   | Revision 1.1                                      |   |
|   | Tag setting <setting></setting>                   |   |
|   | Sensor application                                |   |
|   | Setup backup sens <setting></setting>             |   |
|   | Setup batch trans <setting></setting>             |   |
|   |   |   |
|   |   | ~ |
|   | IP address  |   |
|   | To set up IP address.                             |   |
|   |   |   |
| Output  |   | ņ |
| 🗈 💼   🗰 🎜   🕺 🗛   🏪   |   |   |
| N Node name IP address Connection   | RPI[IN] RPI[OUT]<br>(ms) (ms) Time out Re:<br>pri |   |
|   |   |   |
| II I I Message Verify Setup list  | >   | 8 |
| Edito   | OK Cancel Apply                                   | 1 |

### Install EDS File and Configure Network

1. Click on *EDS file* in the **EtherNet/IP settings** window, and select **Reg**. An **Open** window will pop up.

| EtherNet/IP settings                             |                             |         |         |  |
|--|-----------------------------|---------|---------|--|
| File(F) Edit(E) Settings(S) View(V) Convert(C) E | DS file(D) Communication(N) | Tool(T) | Help(H) |  |
| 📲 🔃 🐩 🖓   🔏 🗈 💼   🛼   🗃 🌮   🗞 🙉 @                | Reg(I)                      |         |         |  |
| KV-8000[0] : 192.168.1.21                        | Delete(D)                   |         |         |  |
| KV-8000[0] : 192.168.1.21                        | Search(S)                   |         |         |  |
|  | Edit comments(E)            |         |         |  |

2. Locate and select the EDS file and click on Open.



| 🛃 Open               |                |                     | 1.0 | 50                                 | ×                |
|----------------------|----------------|---------------------|-----|------------------------------------|------------------|
| Look in:             | Ethernet IP    |                     | ~   | G 🗊 🖻 🗔 -                          |                  |
| Recent Items         | Name           | ^<br>3A0100.EDS     | 1   | Date modified<br>4/2/2022 11:41 AM | Type<br>EDS File |
| Desktop              |                |                     |     |                                    |                  |
| Documents<br>This PC |                |                     |     |                                    |                  |
| い<br>WPS云文档          | <              |                     |     |                                    | >                |
| III JAAIA            | File name:     | 005A002B003A0       | 100 |                                    | Open             |
|                      | Files of type: | EDS file(*.eds; *.e |     | ~                                  | Cancel           |

Attention: The EDS file is stored in the folder where Mech-Center is installed. The default path is Mech-Mind/Mech-Center/mech\_interface/ETHERNETIP. If KV STUDIO is not installed on the same IPC where Mech-Center is installed, you can copy and paste the ETHERNETIP folder to the PC with KV STUDIO installed.

3. If the message "The icon specified for EDS file could not be found." pops up, select Select icon files and then click on *OK*.

| EtherNet/IP settings   | ×      |
|--|--------|
| The icon specified for EDS file could not be found.<br>005A002B003A0100.EDS<br>Select icon file(S) |        |
| O Use default icon(D) OK 2   | Cancel |



4. After selecting the icon files, click on  ${\it Open}.$ 

| 🛃 Open                                 |                |                   |           | ×      |
|--|----------------|-------------------|-----------|--------|
| Look in:                               | EthemetIP      | ~                 | G 🤌 📂 🛄 - |        |
| Recent Items Desktop Documents This PC | mechmindlog    | 90                |           |        |
|  | File name:     | mechmindlogo      | ~2[       | Open   |
|  | Files of type: | Icon file (*.ico) | ~         | Cancel |

5. If the EDS file is registered successfully, **Ixxat INpact EtherNet/IP(TM)** will appear in the Unit list. Double click it to connect to the EtherNet/IP network.



| 🛃 Ethe   | erNet/IP se | ettings            |           |      |        |       |                |        |              |                   |                     | _           |        | 3    | ×          |
|----------|-------------|--------------------|-----------|------|--------|-------|----------------|--------|--------------|-------------------|---------------------|-------------|--------|------|------------|
|          |             |                    |           |      |        |       | nmunication(N) | Too    | I(T) Help    | H)                |                     |             |        |      |            |
| 📲 🕦      |             | <mark>⊁ ₽</mark> ₪ |           | 8 6  | 段 🔍 😿  | la li | 0              |        |              |                   |                     |             |        |      |            |
|          | KV-8000 (   | 0] : 192.1         | 68.1.21   |      |        |       |                |        | EtherNet/I   | <sup>p</sup> unit |                     |             |        |      | <b>џ</b>   |
| Î        |             |                    |           |      |        |       |                |        | Unit list(1) | Unit              | setting( <u>2</u> ) | Search unit | 3)     |      |            |
|          |             |                    |           |      |        |       |                |        |              |                   |                     |             |        |      |            |
|          |             |                    |           |      |        |       |                |        |              | Ur                | nit name            |             |        | Rev. | ^          |
|          |             |                    |           |      |        |       |                |        | I I          | n-Sight           | 2000 Ser            | ies         |        | 11.1 |            |
|          |             |                    |           |      |        |       |                |        |              | -                 | 5700 Ser            |             |        | 11.1 |            |
|          |             |                    |           |      |        |       |                |        |              |                   | 7900-750            |             |        | 11.1 |            |
|          |             |                    |           |      |        |       |                |        |              | -                 | 8000 Ser            |             |        | 11.1 |            |
|          |             |                    |           |      |        |       |                |        |              | -                 | 9000 Ser            |             |        | 11.1 |            |
|          |             |                    |           |      |        |       |                |        |              |                   | rial Netw           |             |        | _    |            |
|          |             |                    |           |      |        |       |                |        | EDS I:       | xxat INp          | bact Ethe           | rNet/IP(T   | M)     | 1.50 | L.         |
|          |             |                    |           |      |        |       |                |        | <            |                   |                     |             |        | >    |            |
|          |             |                    |           |      |        |       |                |        | Ixxat        | INpact 1          | therNet/            | IP(TM)[1.   | 501    |      |            |
|          |             |                    |           |      |        |       |                |        |              | -                 | herNet/IP(          |             |        |      |            |
|          |             |                    |           |      |        |       |                |        |              |                   |                     |             |        |      |            |
|          |             |                    |           |      |        |       |                |        |              |                   |                     |             |        |      |            |
|          |             |                    |           |      |        |       |                |        |              |                   |                     |             |        |      |            |
| Output   |             |                    |           |      |        |       |                |        |              |                   |                     |             |        |      | <b>Ļ</b>   |
| <b>b</b> | M 🎜         | 🛃 💀   🔛            |           |      |        |       |                |        |              |                   |                     |             |        |      |            |
| N        |             | Node nam           | e         | IP a | ddress |       | Connecti       | on     |              | RPI[IN]<br>(ms)   | RPI[OUT<br>(ms)     | Time out    | 5      |      | efr<br>ior |
|          |             |                    |           |      |        |       |                |        |              |                   |                     |             |        |      |            |
|          | H Mes       | sage / Verify      | Setup lis | st/  |        |       | <              |        |              |                   |                     |             | $\geq$ | >    |            |
|          |             |                    |           |      |        |       | _              | Editor |              |                   | OK                  | Cancel      | Ap     | ply  |            |

6. Set the IP address in the **Initial adapter settings** window, set the IP address of the IPC as same as which is set in HMS IP config, and then click on OK.

| Node address(A) |           | 1     |   |   |       |     |  |
|-----------------|-----------|-------|---|---|-------|-----|--|
| IP address(I)   | 192       | . 168 | 1 | • | 10    | ]1  |  |
| Con             | nection n | ame   |   |   |       | I/O |  |
| Exclusive owner |           |       |   |   | 🔂 IN/ | OUT |  |

7. Select Ixxat INpact EtherNet/IP(TM), click on Unit setting(2) and then click on .. next to Connection settings.



| Image: Settings       -         File(F)       Edit(E)       Settings(S)       View(V)       Convert(C)       EDS file(D)       Communication(N)       Tool(T)       Help(H)         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Settings       Image: Settings       Image: Settings       Image: Settings         Image: Settings       Image: Sett |              |
|---|--------------|
| KV-8000[0] : 192.168.1.21         I: Ixxat INpact EtherNet/IP(TM) : 192.168.1.10         Exclusive owner         I: Ixxat INpact EtherNet/IP(TM) : 192.168.1.10         Node address         I: IP address         IP address         IP oddress         INVed or name         IXxat INpact Ether.         Vendor name         Intervention   | -            |
| Unit list(1) Unit setting(2) 2 carch unit(3)<br>I: Ixxat INpact EtherNet/IP(TM) : 192.168.1.10<br>Exclusive owner<br>Unit list(1) Unit setting(2) 2 carch unit(3)<br>I adapter settings<br>Node address 1<br>IP address 152.168.1.10<br>Node name Ixxat INpact Ethe<br>Product name Ixxat INpact Ethe<br>Vendor name HMS Industrial Ne<br>Revision 1.50<br>Connection settings <setting><br/>Transmission adap <setting><br/>Reserved adapter No<br/>Cyclic(I/O) messa Unit error<br/>Sensor application</setting></setting>  |              |
| 1: Ixxat INpact EtherNet/IP(TM) : 192.168.1.10         ■ Exclusive owner         1         ■ Exclusive owner         1         IF IF         ■ Adapter settings         Node address       1         IF address       192.168.1.10         Node name       Ixxat INpact Ethe         Product name       Ixxat INpact Ethe         Vendor name       HMS Industrial Ne         Revision       1.50         Connection settings <setting>         Transmission adap       Setting&gt;         Reserved adapter       No         Cyclic(I/O) messa       Unit error         ■ Sensor application</setting>   |              |
| 1: Ixxat INpact EtherNet/IP(TM) : 192.168.1.10         Exclusive owner         IP address         1P address  |              |
| Node address 1<br>IP address 192.168.1.10<br>Node name Ixxat INpact Ethe<br>Product name Ixxat INpact Ethe<br>Vendor name HMS Industrial Ne<br>Revision 1.50<br>Connection settings <setting><br/>Transmission adap <setting><br/>Reserved adapter No<br/>Cyclic(I/O) messa Unit error<br/>Sensor application</setting></setting>   |              |
| IP address       192.168.1.10         Node name       Ixxat INpact Ethe         Product name       Ixxat INpact Ethe         Vendor name       HMS Industrial Ne         Revision       1.50         Connection settings <setting>         Transmission adap       <setting>         Reserved adapter       No         Cyclic(I/O) messa       Unit error         E Sensor application</setting></setting>  |              |
| Node name Ixxat INpact Ethe<br>Product name Ixxat INpact Ethe<br>Vendor name HMS Industrial Ne<br>Revision 1.50<br>Connection settings <setting><br/>Transmission adap <setting><br/>Reserved adapter No<br/>Cyclic(I/O) messa Unit error<br/>E Sensor application</setting></setting>  | -            |
| Product name Ixxat INpact Ethe<br>Vendor name HMS Industrial Ne<br>Revision 1.50<br>Connection settings <setting><br/>Transmission adap <setting><br/>Reserved adapter No<br/>Cyclic(I/O) messa Unit error<br/>Sensor application</setting></setting>   |              |
| Vendor name HMS Industrial Ne<br>Revision 1.50<br>Connection settings <setting><br/>Transmission adap <setting><br/>Reserved adapter No<br/>Cyclic(I/O) messa Unit error<br/>E Sensor application</setting></setting>   |              |
| Revision 1.50<br>Connection settings <setting><br/>Transmission adap <setting><br/>Reserved adapter No<br/>Cyclic(I/O) messa Unit error<br/>Sensor application</setting></setting>  |              |
| Connection settings <setting>       3         Transmission adap       <setting>       3         Reserved adapter       No          Cyclic(I/O) messa       Unit error          Sensor application</setting></setting>   |              |
| Transmission adap <setting><br/>Reserved adapter No<br/>Cyclic(I/O) messa Unit error<br/>E Sensor application</setting>   | -            |
| Reserved adapter No<br>Cyclic(I/O) messa Unit error<br>Sensor application   | •••          |
| Cyclic(I/O) messa Unit error  |              |
| Sensor application  |              |
|   |              |
| Connection settings<br>To set up adapter connection.  |              |
| Output  | ą            |
|   |              |
| N Node name IP address Connection Time out  | Refr<br>rior |
| 1 🔤 Ixxat INpact EtherN 192.168 🎶 Exclusive owner [IN_100 10.0 10.0 RPI*16 Norm   | 1            |
|   |              |
| K ← → → Message Verify Setup list <   |              |
| Editor OK Cancel Apply  | >            |

8. Now you can see a **Connection settings** window. Click on *Assign device* and then assign the **IN** and **OUT** manually, as shown below. Go back to the **EtherNet/IP settings** window after assigning.



| Connection settings - 1:bxat           | Npact EtherNet/IP(TM) ? ×                       | Device assignment settings   |                      |                            |  |               | ×            |
|--|---|--|----------------------|----------------------------|--|---------------|--------------|
| Connection list(L)                     |   | IN (input from adapter) OUT (outp  | ut to adapter) 5     |                            |  |               |              |
| No. Connect<br>1 Exclusive owner [IN_1 |   |  | ice(B)               | IN_100 [46<br>Offset       | Word]<br>Assignment  | Name          | ^            |
| Add(A) Delete(E                        |   | Manual assign(M) 3 ord     Device assign area(D)     Leading Size (     # 1 DM15100  | rord) Offset<br>46 0 | 0<br>1<br>2<br>3<br>4<br>5 | DM15100<br>DM15101<br>DM15102<br>DM15103<br>DM15104<br>DM15105 |               |              |
| Connection name(C)                     | Exclusive owner ~                               |  |                      | 6<br>7                     | DM15106<br>DM15107   |               |              |
| Time out(T)                            | RPI*16 v (IN:160.0ms / OUT:160.0ms)             |  |                      | 8<br>9                     | DM15108<br>DM15109   |               |              |
| Refresh priority(F)                    | Normal ~<br>Setup parameter(P) Assign device(D) | Set(S) Delete(E)   |                      | 10                         | DM15110  | Reg to assign | ✓<br>area(R) |
| IN (input from adapter)                |   |  |                      |                            |  |               |              |
| Connection type                        | Point-to-point ~                                |  |                      |                            |  | OK            | Cancel       |
| Connection point                       | IN_100 ~  | Device assignment settings   |                      |                            |  |               | ×            |
| Data size                              | 46 Word   | IN (input from adapter) OUT (outp  | out to adapter)      |                            |  |               |              |
| Send trigger                           | Cyclic ~  | Assignment settings  | vice(B)              | OUT_150 [                  |  |               |              |
| RPI (communication cycle)              | 10.0 ms (1.0 to 3200.0ms)                       | Auto assign(A) Bit device(B)     Offset Assignment Name     Offset Assignment Name     Offset Assignment Name     Offset Assignment Name |                      |                            |  |               | ^            |
| Production inhibit time                | ms  | Device assign area(D)  |                      | 1                          | DM16101<br>DM16102   |               |              |
| OUT (output to adapter)                |   | Leading Size (v<br>#1 DM16100 7  | word) Offset<br>56 0 | 3                          | DM16103  |               |              |
| Connection type                        | Point-to-point ~                                |  |                      | 4                          | DM16104<br>DM16105   |               |              |
| Connection point                       | OUT_150 ~                                       |  |                      | 6                          | DM16106  |               |              |
| Data size                              | 56 Word   |  |                      | 7 8                        | DM16107<br>DM16108   |               |              |
| RPI (communication cycle)              | 10.0 ms (1.0 to 3200.0ms)                       |  |                      | 9                          | DM16109<br>DM16110   |               | ~            |
|  | Keep consistent with IN                         | Set(S) Delete(E)   |                      |                            |  | Reg to assign | area(R)      |
|  | OK Cancel                                       |  |                      |                            |  | ОК            | Cancel       |

Note: The Input and Output in the figure are applicable to this example only.

9. Now the information of the server appear in the EtherNet/IP settings window. Click on OK.



| EtherNet/IP settings                  | - 145 - Million States |               | 80.0     |             |                          |                  | _              |           |
|---------------------------------------|------------------------|---------------|----------|-------------|--------------------------|------------------|----------------|-----------|
| File(F) Edit(E) Settings(S) View(V) ( |                        |               | (N) Tool | l(T) Help   | (H)                      |                  |                |           |
| KV-8000[0] : 192.168.1.21             |                        |               |          | EtherNet/   | P unit                   |                  |                |           |
|                                       |                        |               |          | Unit list(1 | ) Unit s                 | etting(2)        | Search unit(3) |           |
|                                       |                        |               |          | ₽E ₽=       | 1                        |                  |                |           |
|                                       |                        |               |          |             | ter settin               |                  |                |           |
| 1: Ixxat INpact EtherNe               | t/IP(TM) : 192.        | 168.1.10      |          |             | address                  | igs<br>1         |                |           |
| IN 100 [Edit]                         | OUT 150 [Edit]         |               |          |             | dress                    |                  | 92.168.1.10    |           |
| DM 15100-15145                        |                        |               |          |             | name                     |                  | xxat INpact    | Ethe      |
|                                       |                        |               |          | Prod        | act name                 |                  | xxat INpact    |           |
|                                       |                        |               |          | Vend        | or name                  | H                | MS Industria   | l Ne      |
|                                       |                        |               |          | Revis       | sion                     | 1                | .50            |           |
|                                       |                        |               |          | Conne       | ection set               | tings <          | Setting>       |           |
|                                       |                        |               |          | Tran        | smission a               | dap <            | Setting>       |           |
|                                       |                        |               |          | Rese        | rved adapt               | er N             | 0              |           |
|                                       |                        |               |          | -           | ic(I/O) me               |                  | nit error      |           |
|                                       |                        |               |          | - Sense     | or applica               | tion             |                |           |
|                                       |                        |               |          |             | ion settin<br>up adapte: | -                | ion.           |           |
| utput                                 |                        |               |          |             |                          |                  |                |           |
| a 💼   🗰 🍠   🕏 🛼   🏪                   |                        |               |          |             |                          |                  |                |           |
| N Node name                           | IP address             | Connec        | tion     |             | RPI[IN]<br>(ms)          | RPI[OUT]<br>(ms) | Time out       | Re<br>pri |
| I Ixxat INpact EtherN                 | 192.168                | Exclusive own | er [IN   | 100         | 10.0                     | 10.0             | RPI*16         | Normal    |
|                                       |                        |               |          |             |                          |                  |                |           |
| ♦ ► ► Message Verify Setup list       |                        |               |          |             |                          |                  |                | >         |
|                                       |                        |               | Editor   |             |                          | OK               | Cancel         | Apply     |

10. Click on *OK* in the **Unit Editor** window.



| 🛗 Unit Edit                | tor - Edit mode |                  |     |           |  | 8 <u>–</u>                   |          | ×        |
|----------------------------|-----------------|------------------|-----|-----------|--|------------------------------|----------|----------|
|                            | dit(E) Convert  |                  |     |           | Help(H)  |                              |          |          |
|                            |                 | 0                |     | ^         | Unit   |                              |          | Д        |
| Width:57mm                 |                 | KV-8000          |     |           | Select unit( <u>1</u> ) Se   | tup unit(2)                  |          |          |
| Height:90mm<br>Depth:115mm |                 |                  |     |           |  | 👷 🗞 🜃                        | [0] K    | v-8000   |
| Curr. Cons.                | :400mA          |                  |     |           | E Function   |                              |          | ^        |
| Weight:340g                |                 |                  |     |           | Socket functi  | on Not use                   | ed (*)   | •        |
|                            |                 | R30000<br>-33915 |     |           | 🖯 Base   |                              |          |          |
|                            |                 | -33915           |     |           | Leading DM No  | . DM1000                     | D        |          |
|                            |                 |                  |     |           | Number of DMs  | 230                          |          | ~        |
| <                          |                 |                  |     | ,         | Socket function<br>When socket fun<br>following funct<br>used. "Socket0"<br>socket". | ction is use<br>ions, settin | gs may 1 |          |
|                            |                 |                  |     | -         |  |                              |          |          |
| Message                    |                 |                  |     |           |  |                              |          | <b>д</b> |
|                            | Process         | Row              | No. | Code      | Message  |                              |          |          |
|                            |                 |                  |     | 0         |  |                              |          |          |
| нары                       | Message         |                  |     | <         |  |                              |          | >        |
|                            |                 |                  |     | Editor Li | ne:1, Col:1 OK   | Cancel                       | Appl     | V Z      |

### Download Hardware Configuration to PLC

1. Go back to the main interface of KV STUDIO, click on button in the menu bar.

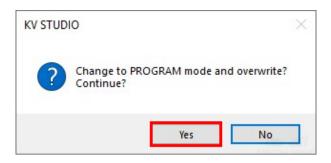
| KV STUDIO -[Editor: KV-8000] - [MM_Camera_KV *]   |    |        |       |                 |                              |                                 |
|---|----|--------|-------|-----------------|------------------------------|---------------------------------|
| File(F) Edit(E) View(V) Program(M) ST/Script(S)   |    |        |       |                 | Operation recorder/Replay(R) |                                 |
| 🗄 🗅 🙌 🗟 📾 🚵 🐜 🖶 🗟 🕢 🗄 🔛 USB   |    | -      | i 🗈 🗗 | 🚽 🕹 🖸 🚮         | 🐝 🏛 😂 📼 🔛 i 🟥                | 175 F4 SF4 F7 SF7 F8 SF8 F9 SF9 |
| ! 🕼 🌐 📰 🌌 🗃 🎬 🖷 🖏 Խ 🛼 🔘 🌒   |    |        | кну   | / >> O 🖑        | 🖳 🕐 💷 🗄 Editor               | - Comments Comr                 |
| Project   | ųΧ | Main 🗙 |       | Transfer to PLC |                              |                                 |
| <ul> <li>Unit configuration</li> <li>[0] KV-8000</li> <li>EtherNet/IF R30000 DM10000</li> <li>Unit configuration switching</li> <li>Device comment</li> <li>Variable</li> <li>Structure</li> <li>Operation recorder setting</li> <li>ID0</li> </ul> |    | 00001  |       | 1               | 2                            | 3                               |

2. Keep the default settings, and click on *Execute* in the **Transfer program** window.



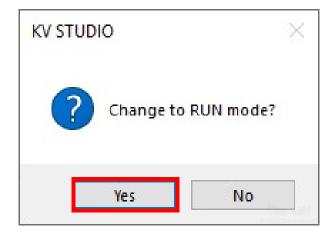
| Tr    | ansfer program [Communication destir   | nation: KV-8000, route: USB] | × |
|-------|--|------------------------------|---|
| Trans | fer items(I)   |                              |   |
|       | Item   |                              |   |
|       | Unit setting info  |                              |   |
| 1     | Global device comments   |                              |   |
| 1     | Global variable  |                              |   |
| 1     | Structure  |                              |   |
| 1     | CPU system setting   |                              |   |
| 1     | Program  |                              |   |
| 1     | Operation recorder setting   |                              |   |
| 1     | Device default info  |                              |   |
| 1     | Logging/trace setting info   |                              |   |
| 1     | Ethernet/serial function setting info  |                              |   |
| 1     | File Register setting  | Unit setting info            |   |
| 1     | User document  |                              |   |
| 1     | Positioning unit parameter   |                              |   |
| 1     | Camera setting   |                              |   |
| 1     | Data utilization setting   |                              |   |
| ) Tra | Select all(S) Cancel all(D)<br>ear program/variable in PLC(Q)<br>ansfer in PROGRAM mode(P) |                              |   |
| OTra  | ansfer in RUN mode(R)  |                              |   |
|       | Execute(E) Cancel(C)   |                              |   |

3. Select *Yes* in the pop-up window showing the message "Change to PROGRAM mode and overwrite?".



4. Select Yes in the pop-up window showing the message "Change to RUN mode?".





### **Check Communication**

1. If the PLC is connected successfully, the status of **Ixxat INpact EtherNet/IP(TM)** will be displayed as online in **Monitor** mode.

| 🗰 KV STUDIO -[Monitor: KV-8000] - [MM_Camera_KV *]   |                           |                    |                       |                 |
|--|---------------------------|--------------------|-----------------------|-----------------|
| File(F) Edit(E) View(V) Program(M) ST/Script(S) Conver   | t(A) Monitor/Simulator(N) | Debug(D) Operation | recorder/Replay(R) To | ol(T) Window(W) |
| : 🗅 🔒 🖶 😫 🗠 🍇 🖶 💫 🥐 : 👥 USB  | - 10 -                    | 🖬 🗈 🔬 🖬 🖗 📾 🖗      |                       | SF4 F7 SF7 F8   |
|  |                           |                    | Monitor               | - Com           |
| Project 🛛 🕹 🗸  | Main 🗙                    |                    |                       |                 |
| <pre>Image: Construction Image: Construction I</pre> | 00004                     | 1                  | 2                     | 3               |
| CPU system setting<br>Program: MM_Camera_KV<br>Main<br>Initialize module<br>Standby module<br>Fixed-period module<br>Inter-unit sync module<br>Function Block<br>Macro   | 00005                     |                    |                       |                 |
| <pre>Bublottle matro Bublottle matro Bublottle</pre> | 00006                     |                    | )<br>Met              |                 |

2. The PLC is successfully connected to Mech-Center if the following message is displayed in Mech-Center Log panel:



#### Connect to ETHERNET IP controller successfully

| Mech-Center, by Mech-Mi  | nd Robotics                            |           |                |                    |          |         |  | -  |       | ×         |
|--------------------------|--|-----------|----------------|--------------------|----------|---------|--|----|-------|-----------|
| File Tool User View H    | elp                                    |           |                |                    |          |         |  |    |       |           |
|                          | <mark>/iz</mark> EX<br>art Start Mech- |           | Stop Interface | Z<br>Connect Robot |          |         |  |    |       | nistrator |
| Service Status           |  |           |                |                    | og       |         |  |    |       |           |
| Vis Viz                  |  | EtherNet  |                |                    | Max Line | 10000 🤤 | Open Logs Folde                        | er |       | Clear     |
|                          | ual Camera ETH                         |           |                |                    |          |         | t ETHERNET IP inte<br>nect to ETHERNET |    | oller |           |
| Project Status           |  |           |                |                    |          |         |  |    |       |           |
| Project Name             | Status                                 | Exec Time | De             | tails              |          |         |  |    |       |           |
| Metalwork                | IDLE                                   |           |                |                    |          |         |  |    |       |           |
| Metalwork                | IDEE                                   |           |                |                    |          |         |  |    |       |           |
| 🚾 check_collision change | IDLE                                   |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |
|                          |  |           |                |                    |          |         |  |    |       |           |

Note: If you don't see this log message, please check if:

- The hardware are properly connected;
- If Mech-Interface has been started by clicking on *Start Interface* in the Toolbar;
- If the hardware configuration has been downloaded to the PLC.

# 2.6.5 Import Example Program and Download to PLC

**Note:** Before you add the example program to a project already in use, it is recommended to import it to a new project and test it first. In the following steps, the project created earlier is used to import and test the example program.



### **Import Example Program Files**

1. In the main interface of KV STUDIO, go to  $File \rightarrow Import \rightarrow Import program$ .

| File( | (F) <b>1</b> E) View(V) Program(I   | M) ST/Script(S)  | Convert(A) | Monitor/                | Simulator(N)                              | Debug(D) | Operation recorder/Replay(R) | Tool(T) Wi      |
|-------|---|------------------|------------|-------------------------|---|----------|------------------------------|-----------------|
| •     | New project(N)<br>Open project(O)<br>Close project(C)                             | Ctrl+N<br>Ctrl+O |            |                         |   |          | 編 Ⅲ 4, 100 Ⅲ 15 %            | 5 F4 SF4 F7<br> |
|       | Save project(S)<br>Save project as(A)   | Ctrl+S           | × Ma       |                         |   |          |                              |                 |
|       | Save compact project(J)<br>Verify project(B)<br>Project property(F)               |                  | ,          |                         |   | 1        | 2                            |                 |
| 1     | Register sensor settings file(E) Import(I)  |                  |            | 00003                   | ım(M)                                     | 3        |                              |                 |
|       | Memory card(M)<br>Save device comments in CSV/T.<br>Read device comments in CSV/T |                  | h          | mport log inf           | eent / variable<br>io(L)<br>e defaults(D) |          |                              |                 |
|       | Mnemonics list(R)<br>Output CSV/TXT file(U)<br>HTML file output(T)                |                  |            | mport file reg<br>JUUU4 | jister setting(l                          | F)       |                              |                 |

KV STUDIO -[Editor: KV-8000] - [MM\_Camera\_KV \*]

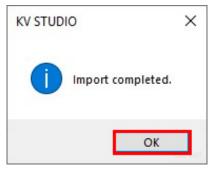
2. In the pop-up Import program window, select the CameraSignalsMove.mod, CameraT-est.mod, and ObtainPose.kfb files, and then click on *Open*.



| Import progr    | ram  |                                     |  | ×                      |
|-----------------|--|-------------------------------------|--|------------------------|
| Look in:        | New folder                                       | ~                                   | G 🏚 🖻 🖽 -                              |                        |
| e.              | Name   |                                     | Date modified                          | Туре                   |
| Recent Items    | <ul> <li>CameraSig</li> <li>CameraTes</li> </ul> |                                     | 3/31/2022 3:11 PM<br>3/31/2022 3:11 PM | Movie Cli<br>Movie Cli |
|                 | Main<br>ObtainPos                                |                                     | 3/31/2022 3:11 PM<br>3/31/2022 3:11 PM | Movie Cli<br>KFB File  |
| Desktop         | ObtainPos  | e.ktb                               | 5/51/2022 5:11 PM                      | KFD FILE               |
| A               |  |                                     |  |                        |
| Documents       |  |                                     |  |                        |
|                 |  |                                     |  |                        |
| This PC         |  |                                     |  |                        |
|                 |  |                                     |  |                        |
|                 | <  |                                     |  | >                      |
|                 | File name:                                       | "ObtainPose.kfb" "CameraSignalsM    | ove.mod" ' ~ 3                         | Open                   |
|                 | Files of type:                                   | KVS program file(*.mod;*.mcr;*.kfb) | ~                                      | Cancel                 |
| Move folder     |  | Module info                         |  |                        |
| Default folder  | (X)  |                                     |  |                        |
| O Standard fund | ction block folde                                | r(S)                                |  |                        |
| Select folde    | er(J)  |                                     |  |                        |
|                 |  |                                     |  |                        |
|                 |  |                                     |  |                        |

3. Click on OK in the **Import completed** window.





### **Download PLC Program**

1. Go back to the main interface of KV STUDIO, click on button.

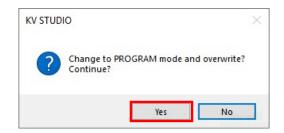
| 🞆 KV STUDIO -[Editor: KV-8000] - [MM_Camera_KV *]          |          |         |           |                  |           |                          |
|--|----------|---------|-----------|------------------|-----------|--------------------------|
| File(F) Edit(E) View(V) Program(M) ST/Script(S) Con        | nvert(A) | Monitor | /Simulato | r(N) Debug(D     | ) Opera   | ation recorder/Replay(R) |
| : 🗅 🤒 🖶 📾 🛤 🖶 🖶 💫 🔋 🔛 USB                                  |          | -       |           | 🤋 🚮 🔂 🔂 🛙        | 🛃 🕵 🗉     | 🗈 🎒 💷 🖭 i 🕂 💱            |
| i 🕼 🌐 📰 🌌 📾 🎬 🖷 🏷 💀 🛼 🔘 🕨 🕨                                |          |         | N N       |                  |           | 🕐 💷 🕴 Editor             |
| Project 📮  | × Mai    | n X     | Trans     | sfer to PLC -> M | onitor mo | ode(Ctrl+F8)             |
| Unit configuration   |          |         |           |                  |           |                          |
| [0] KV-8000  |          |         |           | 1                |           | 2                        |
| EtherNet/IP R30000 DM10000 [1] Ixxat INpact EtherNet/IP(TM |          |         |           |                  |           |                          |
| Unit configuration switching                               | '        |         |           |                  |           |                          |
| Device comment   |          |         |           |                  |           |                          |
|  | 0        | 0003    |           |                  |           |                          |
| 🗉 👔 Structure  |          |         |           |                  |           |                          |
| 🗉 🗐 Operation recorder setting                             |          |         |           |                  |           |                          |
| 🖬 🚛 ID0  |          |         |           |                  |           |                          |
| CPU system setting   |          |         |           |                  |           |                          |
| E Program: MM_Camera_KV                                    |          |         |           |                  |           | 1                        |
| Every-scan execution                                       |          |         |           |                  |           |                          |
| 🖬 🔡 Main<br>🖬 🖼 CameraTest                                 | 0        | 0004    |           |                  |           |                          |
| Cameralest   |          |         |           |                  |           |                          |
| Initialize module  |          |         |           |                  |           |                          |
| Standby module   |          |         |           |                  |           |                          |
| Fixed-period module  |          |         |           |                  |           |                          |
| Inter-unit sync module                                     |          |         |           |                  |           |                          |
| E 📑 Function Block   |          |         |           |                  |           |                          |
| 🖬 🔜 ObtainPose   |          | 0005    |           |                  |           |                          |
| 🚍 🔜 Macro  |          | 0005    |           |                  |           |                          |
| 📮 Subroutine macro   |          |         |           |                  |           |                          |
| Self-hold macro  |          |         |           |                  |           |                          |
| Device default   |          |         | 1         |                  |           |                          |

2. Keep the default settings, and click on *Execute* in the **Transfer program** window.



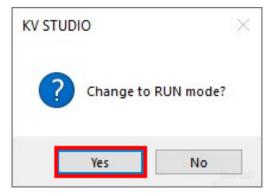
| T i   | ansfer program [Communication desti   | nation: KV-8000, route: USB] | × |
|-------|---|------------------------------|---|
| Trans | fer items(I)  |                              |   |
|       | Item  |                              |   |
|       | Unit setting info   |                              |   |
|       | Global device comments  |                              |   |
|       | Global variable   |                              |   |
|       | Structure   |                              |   |
|       | CPU system setting  |                              |   |
| 1     | Program   |                              |   |
|       | Operation recorder setting  |                              |   |
|       | Device default info   |                              |   |
|       | Logging/trace setting info  |                              |   |
|       | Ethernet/serial function setting info   |                              |   |
|       | File Register setting   | Unit setting info            |   |
|       | User document   |                              |   |
|       | Positioning unit parameter  |                              |   |
|       | Camera setting  |                              |   |
|       | Data utilization setting  |                              |   |
| ● Tra | Select all(S) Cancel all(D)<br>ear program/variable in PLC(Q)<br>ansfer in PROGRAM mode(P)<br>ansfer in RUN mode(R) |                              |   |
|       | Execute(E) Cancel(C)  |                              |   |

3. Select *Yes* in the pop-up window showing the message "Change to PROGRAM mode and overwrite?".



4. Select Yes in the pop-up window showing the message "Change to RUN mode?".





# 2.6.6 Test with Mech-Vision/Mech-Viz Project

This section introduces how to run the Mech-Vision/Mech-Viz project and obtain data from the project using the **ObtainPose** FB. For detailed information on the modules, please refer to stan-dard\_interface\_development\_profinet.

## Prerequisites

- Mech-Vision project(s):
  - Executable
  - Set to autoload
  - The **Project list** in Mech- $Center \rightarrow Deployment Settings \rightarrow Mech$ -Vision is synced by clicking

on **WW**, and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings ×                                     |
|---|
| Mech-Vision Use Mech-Vision Exec path ID Project list 1 2 |

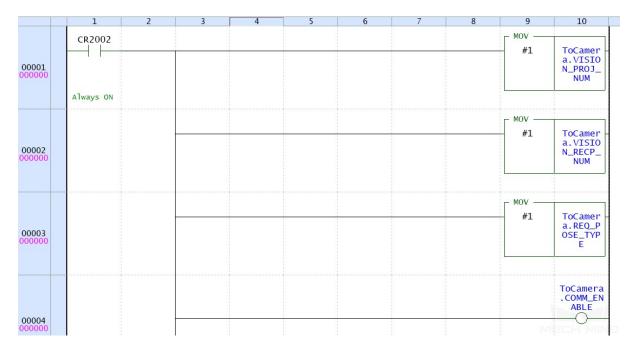
- Mech-Viz project:
  - Executable
  - Set to autoload
  - Contains a branch\_by\_service\_message Task that has been renamed to 1.



#### Run Mech-Vision Project and Obtain Vision Points

#### Parameter Settings

- 1. Set the **ToCamera.COM\_ENABLE** to be **always ON**.
- 2. Double click on the **MOV** module, set the Mech-Vision project ID the same as the one set in **Deployment Settings** in Mech-Center. For example, if the monitor value is changed to 1, then Mech-Vision project No. 1 in the **Project list** of Mech-Center will be started.
- 3. Set the number of vision points to be sent by Mech-Vision. The default value of **REQ\_POSE\_NUM** is 0, which means the Mech-Vision project will send all the vision points.



#### Start Mech-Vision Project

- 1. Go back to main interface of KV STUDIO, go to  $Project \rightarrow Program$  and double click on **CameraTest**. Double click on **VisionStart** in the FB **ObtainPose** to set the value to **1** and therefore start Mech-Vision project. Then double click again to reset the value to **0**.
- 2. Check returned status code: check the monitor value of **StatusCode**. **1102** represents that the Mech-Vision project was started successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.





## **Obtain Vision Points from Mech-Vision**

1. After the status code **1102** is returned, double click on **VisObtainStart** in the FB **ObtainPose** to set the value to **1** and therefore obtain vision points from Mech-Vision. Then double click again to reset the value to **0**. The result is shown as below. The value of SendPoseNum is 2, which means 2 vision points are obtained from Mech-Vision.





2. In the main interface of KV STUDIO, click on button to open the device value batch modify/read window.



KV STUDIO -[Monitor: KV-8000] - [MM\_Camera\_KV \*]

| File(F)       Edit(E)       View(V)       Program(M)       ST/Script(S)       Con         I       Image: Stress of the stress of   | vert(A) Monitor/Simu                  |                                      |               |                | F4 SF4 F7 SF7 F8 SI | Help(H)<br>8 <u>F9 SF9</u><br>nents Comm |
|--|---------------------------------------|--------------------------------------|---------------|----------------|---------------------|--|
| Project 4:   | K CameraTest 🗙                        | Main 🗙                               |               |                |                     |  |
| <ul> <li>Unit co Device value batch model/read window</li> <li>[0] KV-8000</li> <li>[1] KV-8000 DM10000</li> <li>[1] Ixxat INpact EtherNet/IP(TM)</li> <li>[2] Unit configuration switching</li> <li>[3] Device comment</li> </ul>   | الالالالالالالالالالالالالالالالالالا | 1<br>batch modify/re<br>PLC(P) Add d |               | 3              | 4                   | 5<br>×                                   |
| <pre>Variable Variable Variabl</pre> | Program                               | Device                               | Current value | Display format | Comments            |  |

3. Select Add device  $\rightarrow$  Batch insert and configure the device, leading No., Number, and Display format. Click on OK after configurations.

| Program | Device | Current value     | Display format  | Comments     |   |
|---------|--------|-------------------|-----------------|--------------|---|
|         | В      | Batch insert      |                 |              | × |
|         | s      | elect device(D)   | DM (data memory | )            | ~ |
|         | L      | eading No.(B)     | 20000 🔹         |              |   |
|         | N      | lumber(N)         | 22767 🔺 Ma      | x. number(M) |   |
| 00007   |        | )isplay format(F) | +/-DEC 32BIT    | ~            |   |

4. Select  $PLC \rightarrow Read all items from PLC$ .



|                   |   | <u> </u>   |   | ×  |
|-------------------|---|--|---|--|
| Read all items f  | rom PLC(R) 2 t  | Comments   |   | ^  |
| Read selected r   | ange from PLC(P)  |  |   |  |
|                   |   |  |   |  |
| Write all items t | to PLC(W)   |  |   |  |
| Write selected r  | ange to PLC(Q)  |  |   |  |
| DM20008           | 0 +/-DEC 32BIT  |  |   |  |
| DM20010           | 0 +/-DEC 32BIT  |  |   |  |
| DM20012           | 0 +/-DEC 32BIT  |  |   |  |
| DM20014           | 0 +/-DEC 32BIT  |  |   |  |
|                   | PLC(P) 1 device<br>Read all items f<br>Read selected ra<br>Write all items t<br>Write selected r<br>DM20008<br>DM20010<br>DM20012 | Read all items from PLC(R)       2       t         Read selected range from PLC(P)         Write all items to PLC(W)         Write selected range to PLC(Q)         DM20008       0       +/-DEC 32BIT         DM20010       0       +/-DEC 32BIT         DM20012       0       +/-DEC 32BIT | PLC(P)       Comments         Read all items from PLC(R)       t       Comments         Read all items from PLC(R)       2       t       Comments         Write all items to PLC(W)       Write selected range to PLC(Q)       0       1         DM20008       0       +/-DEC 32BIT       0         DM20010       0       +/-DEC 32BIT       0         DM20012       0       +/-DEC 32BIT       0 | PLC(P)         Read all items from PLC(R)         Read selected range from PLC(P)       Comments         Write all items to PLC(W)       Write selected range to PLC(Q)         DM20008       0 +/-DEC 32BIT         DM20010       0 +/-DEC 32BIT         DM20012       0 +/-DEC 32BIT |

**Hint:** This example received 2 poses. Divide the transferred values by 10000 to obtain the actual pose data.

| Program | Device  | Current value | Display format | Comments | ^ |
|---------|---------|---------------|----------------|----------|---|
| Global  | DM20000 | -4618258      | +/-DEC 32BIT   |          |   |
| Global  | DM20002 | 5623557       | +/-DEC 32BIT   |          |   |
| Global  | DM20004 | 523405        | +/-DEC 32BIT   |          |   |
| Global  | DM20006 | 1206150       | +/-DEC 32BIT   |          |   |
| Global  | DM20008 | 6075          | +/-DEC 32BIT   |          |   |
| Global  | DM20010 | -1780788      | +/-DEC 32BIT   |          |   |
| Global  | DM20012 | -3078879      | +/-DEC 32BIT   |          |   |
| Global  | DM20014 | 6498989       | +/-DEC 32BIT   |          |   |
| Global  | DM20016 | 508875        | +/-DEC 32BIT   |          |   |
| Global  | DM20018 | 1428931       | +/-DEC 32BIT   |          |   |
| Global  | DM20020 | 5581          | +/-DEC 32BIT   |          |   |
| Global  | DM20022 | -1787682      | +/-DEC 32BIT   |          |   |
| Global  | DM20024 | 0             | +/-DEC 32BIT   |          |   |
| Global  | DM20026 | 0             | +/-DEC 32BIT   |          |   |
| Global  | DM20028 | 0             | +/-DEC 32BIT   |          |   |
| Global  | DM20030 | 0             | +/-DEC 32BIT   |          |   |

#### Run Mech-Viz Project and Obtain Planned Path

#### **Parameter Settings**

1. Double click on **Reset** in the **ObtainPose** FB to set the value to 1. Then double click again to reset the value to 0.

Hint: Open the device value batch modify/read window to check if the previously obtained



#### vision data has been cleared successfully.

|                 |                    |               |                              |          |   | ObtainPosel                              |
|-----------------|--------------------|---------------|------------------------------|----------|---|--|
|                 |                    |               |                              |          |   | ObtainPose<br>EN                         |
| 🞽 device valu   | e batch modify/r   | read window   |                              | -        |   | 1. |
| File(F) Edit(E) | PLC(P) Add         | device(D)     |                              |          |   | MR000-VisionSta Targe                    |
| Program         | Device             | Current value | Display format               | Comments | ^ |  |
| Global          | DM20000            | 0             | +/-DEC 32BIT                 |          |   | MR001-VisObtain                          |
| Global          | DM20002            | 0             | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20004            | 0             | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20006            | 0             | +/-DEC 32BIT                 |          |   | MR002-VizStart                           |
| Global          | DM20008            | 0             | +/-DEC 32BIT                 |          |   | MICOZ VIZSCAI C                          |
| Global          | DM20010            | 0             | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20012            | 0             | +/-DEC 32BIT                 |          |   | WD002 Winstern                           |
| Global          | DM20014            | 0             | +/-DEC 32BIT                 |          |   | MR003-VizStop                            |
| Global          | DM20016            | 0             | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20018            | 0             | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20020            | 0             | +/-DEC 32BIT                 |          |   | MR004 BranchSet                          |
| Global          | DM20022            | 0             | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20024            | 0             | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20026            | 0             | +/-DEC 32BIT                 |          |   | MR005-VizObtain                          |
| Global          | DM20028            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20030            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20032            |               | +/-DEC 32BIT                 |          |   | FromCameDataReady                        |
| Global          | DM20034            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20036            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20038            |               | +/-DEC 32BIT                 |          |   | FromCameStatusCode                       |
| Global          | DM20040            |               | +/-DEC 32BIT                 |          |   | +1100                                    |
| Global          | DM20042            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20044            |               | +/-DEC 32BIT                 |          |   | DMO-BranchName                           |
| Global          | DM20046            |               | +/-DEC 32BIT                 |          |   | #00001                                   |
| Global          | DM20048            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20040            |               | +/-DEC 32BIT                 |          |   | DM1-BranchPort                           |
| Global          | DM20052            |               | +/-DEC 32BIT                 |          |   | #00001                                   |
| Global          | DM20052            |               | +/-DEC 32BIT<br>+/-DEC 32BIT |          |   | #00001                                   |
| Global          | DM20054            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20056            |               | +/-DEC 32BIT<br>+/-DEC 32BIT |          |   | FromCameSendPoseN                        |
| Global          |                    |               |                              |          |   | #00002                                   |
| Global          | DM20060<br>DM20062 |               | +/-DEC 32BIT                 |          |   |  |
|                 |                    |               | +/-DEC 32BIT                 |          |   | MR006-Reset                              |
| Global          | DM20064            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20066            |               | +/-DEC 32BIT                 |          |   |  |
| Global          | DM20068            | 0             | +/-DEC 32BIT                 |          |   |  |

- 2. Modify the value of DM0 register, set the value of **BranchName** to 1.
- 3. Modify the value of DM1 register, set the value of **BranchPort** to **1** , the Mech-Viz project will proceed along out port 1 of Task 1.



|                   | VizStop                       |          |   |  |  |                  |               |   |   |
|-------------------|-------------------------------|----------|---|--|--|------------------|---------------|---|---|
| MR004             | BranchSet                     | <b>M</b> | Search(S) Ctrl+F  |  |  |                  |               |   |   |
|                   |                               |          | Create cross reference(L) Space   |  |  |                  |               |   |   |
|                   |                               |          | Prev. cross reference(U) Shift+F3   |  |  |                  |               |   |   |
| MR005-VizObtain   |                               |          | Next cross reference(B) F3  |  |  |                  |               |   |   |
| FromCame          | DataReady                     |          | Correct device value(D) F2  |  |  |                  |               |   |   |
| Thomeane          |                               | )<br>H   | Registration monitor window(R)  |  |  |                  |               |   |   |
|                   |                               | 000      | Batch monitor window(A)   |  |  |                  |               |   |   |
| romCameStatusCode |                               | 66       | Display/hide watch window(M) Alt+3  |  |  |                  |               |   |   |
|                   | +0                            |          | Mnemonics list(N)   |  |  |                  |               |   |   |
| DMO               | BranchName                    |          | Real time chart monitor(H)  | -  |  |                  |               |   |   |
| Dirio             | #00000                        |          | Unit Monitor(G)   |  |  |                  |               |   |   |
|                   |                               |          |   |  |  |                  |               |   |   |
|                   |                               |          | Built-in function monitor(C)  |  |  |                  |               |   |   |
| DM1               | BranchPort                    |          | Built-in function monitor(C)  | ₩ Registration mo  | onitor   |                  |               | - 0   | × |
| DM1 ·             | BranchPort<br>#00000          | di.      | Command monitor(Y)  |  |  |                  |               | - 0   | × |
|                   | #00000                        | 4        | Command monitor(Y)  Setup device break(K)   | 😁 🗄 🖻 🕅  | E E E  | Ref. destination | Current value |   |   |
|                   | #00000<br>SendPoseN           | -        | Command monitor(Y)  Setup device break(K) Set/Cancel rung break(F)  | Program/Unit<br>Global   | Device   | Ref. destination | Current value |   |   |
|                   | #00000                        | 4        | Command monitor(Y)  Setup device break(K)   | Program/Unit<br>Global<br>Global   | The second secon | Ref. destination | -             | Display forma<br>- 1-bit BIN<br>- 1-bit BIN   |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | <b>#</b> | Command monitor(Y)  Setup device break(K) Set/Cancel rung break(F) Derivation monitor(O)  | Program/Unit<br>Global<br>Global<br>Global   | Image:                  | Ref. destination | -             | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN  |   |
|                   | #00000<br>SendPoseN<br>#00000 | <b>#</b> | Command monitor(Y)  Setup device break(K) Set/Cancel rung break(F)  | Program/Unit<br>Global<br>Global<br>Global<br>Global   | Image: The second sec                        | Ref. destination | -             | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN  |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | <b>#</b> | Command monitor(Y)  Setup device break(K) Set/Cancel rung break(F) Derivation monitor(O)  | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global   | Image:                         | Ref. destination | -             | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN  |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | _        | Command monitor(Y)  Setup device break(K) Set/Cancel rung break(F) Derivation monitor(O) Rung setting(N)  Jump(J)   | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global   | Image         Image         Device           MR0001         MR002         MR002           MR003         MR004         MR004  | Ref. destination | -             | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN   |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | <b>∛</b> | Command monitor(Y)  Setup device break(K) Set/Cancel rung break(F) Derivation monitor(O) Rung setting(N)  | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global   | The set of the se      | Ref. destination | -             | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN  |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | _        | Command monitor(Y)        Setup device break(K)        Sety/Cancel rung break(F)        Derivation monitor(O)        Rung setting(N)        Jump(J)        Relation mapping(9)     Ctrl+Shift+R   | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global   | Image         Image         Device           MR0001         MR002         MR003           MR003         MR004         MR004  | Ref. destination | -             | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN   |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | _        | Command monitor(Y)  Setup device break(K) Set/Cancel rung break(F) Derivation monitor(O) Rung setting(N)  Jump(J)   | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global   | Em C-     Device     MR000 MR001 MR002 MR003 MR004 MR004 FromCamera.DATA_READY FromCamera.STATUS_CODE DM0 MM   | Ref. destination |               | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>0 +/-DEC 32BIT  |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | _        | Command monitor(Y)        Setup device break(K)     Sety/Cancel rung break(F)       Derivation monitor(O)        Rung setting(N)        Jump(J)        Relation mapping(9)     Ctrl+Shift+R       Set display mode(I)   | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global           | Device     MR000     MR001     MR001     MR003     MR003     MR003     MR004     MR005     FromCamera.DATA_READY     FromCamera.STATUS_CODE     DM0     DM1     FromCamera.SEND_POSE_NUM   | Ref. destination |               | Display forma<br>- 1-bit BIN<br>- 1-bit B |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | _        | Command monitor(Y)     •       Setup device break(K)     Sety/Cancel rung break(F)       Derivation monitor(O)     •       Rung setting(N)     •       Jump(J)     •       Relation mapping(9)     Ctrl+Shift+R       Set display mode(I)     •       Set up ST/script(X)     • | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global | The set of  | Ref. destination |               | Display forma<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>- 1-bit BIN<br>0 +/-DEC 32BIT<br>DEC 16BIT<br>DEC 16BIT<br>0 DEC 16BIT<br>- 1-bit BIN   |   |
| FromCame          | #00000<br>SendPoseN<br>#00000 | _        | Command monitor(Y)        Setup device break(K)     Sety/Cancel rung break(F)       Derivation monitor(O)        Rung setting(N)        Jump(J)        Relation mapping(9)     Ctrl+Shift+R       Set display mode(I)   | Program/Unit<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global<br>Global           | Device     MR000     MR001     MR001     MR003     MR003     MR003     MR004     MR005     FromCamera.DATA_READY     FromCamera.STATUS_CODE     DM0     DM1     FromCamera.SEND_POSE_NUM   | Ref. destination |               | Display forma<br>- 1-bit BIN<br>- 1-bit B |   |

4. Set the value of REQ\_POSE\_TYPE to 1. This asks Mech-Viz to send joint positions (instead of TCP data).

|                 | 1      | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10                                   |
|-----------------|--------|---|---|---|---|---|---|---|----|--------------------------------------|
| 00001<br>000000 | CR2002 |   |   |   |   |   |   |   | #1 | ToCamer<br>a.VISIO<br>N_PROJ_<br>NUM |
| 00002<br>000000 |        |   |   |   |   |   |   |   |    | ToCamer<br>a.VISIO<br>N_RECP_<br>NUM |
| 00003           |        |   |   |   |   |   |   |   |    | ToCamer<br>a.REQ_P<br>OSE_TYP<br>E   |
| 00004           |        |   |   |   |   |   |   |   | ~  | ToCamera<br>.COMM_EN<br>ABLE         |



#### Start Mech-Viz Project

- 1. Double click on **VizStart** in the **ObtainPose** FB to set the value to **1** and therefore start Mech-Viz project. Then double click again to reset it to **0**.
- 2. If the value returned by the variable **StatusCode** is **2103**, it represents that the Mech-Viz project was started successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.





#### Select Branch in the Mech-Viz Project

- 1. Double click on **BranchSet** in the **ObtainPose** FB to set the value to **1** and therefore select branch in the Mech-Viz project. Then double click again to reset it to **0**.
- 2. If the value returned by the variable **StatusCode** is **2105**, it represents that the branch was selected successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.



#### **Obtain Planned Path**

- 1. Double click on **VizObtainStart** in the **ObtainPose** FB to set the value to **1** and therefore obtain planned path from Mech-Viz project. Then double click again to reset it to **0**.
- 2. If the value returned by the variable **StatusCode** is **2100**, it represents that planned path was obtained successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error. The value of **SendPoseNum** shows how many target points were received, and the target points are stored in **TargetPose**.





3. Go back to **device value batch modify/read window**, the 10 poses are shown as below. Please divide the transferred values by 10000 to obtain the actual pose data.



| Program | Device  | Current value | Display format | Comments | ^ |
|---------|---------|---------------|----------------|----------|---|
| Global  | DM20000 |               | +/-DEC 32BIT   |          |   |
| Global  | DM20002 |               | +/-DEC 32BIT   |          |   |
| Global  | DM20004 |               | +/-DEC 32BIT   |          |   |
| Global  | DM20006 | 80000         | +/-DEC 32BIT   |          |   |
| Global  | DM20008 | 246500        | +/-DEC 32BIT   |          |   |
| Global  | DM20010 | 900000        | +/-DEC 32BIT   |          |   |
| Global  | DM20012 | 1292518       | +/-DEC 32BIT   |          |   |
| Global  | DM20014 |               | +/-DEC 32BIT   |          |   |
| Global  | DM20016 | -259905       | +/-DEC 32BIT   |          |   |
| Global  | DM20018 | 35766         | +/-DEC 32BIT   |          |   |
| Global  | DM20020 | 338369        | +/-DEC 32BIT   |          |   |
| Global  | DM20022 | 1856696       | +/-DEC 32BIT   |          |   |
| Global  | DM20024 | 1291698       | +/-DEC 32BIT   |          |   |
| Global  | DM20026 | 791000        | +/-DEC 32BIT   |          |   |
| Global  | DM20028 | -232961       | +/-DEC 32BIT   |          |   |
| Global  | DM20030 | 35098         | +/-DEC 32BIT   |          |   |
| Global  | DM20032 | 345613        | +/-DEC 32BIT   |          |   |
| Global  | DM20034 | 1856680       | +/-DEC 32BIT   |          |   |
| Global  | DM20036 | 740000        | +/-DEC 32BIT   |          |   |
| Global  | DM20038 | 684700        | +/-DEC 32BIT   |          |   |
| Global  | DM20040 | -31200        | +/-DEC 32BIT   |          |   |
| Global  | DM20042 | 0             | +/-DEC 32BIT   |          |   |
| Global  | DM20044 | 246500        | +/-DEC 32BIT   |          |   |
| Global  | DM20046 | 900000        | +/-DEC 32BIT   |          |   |
| Global  | DM20048 | 740000        | +/-DEC 32BIT   |          |   |
| Global  | DM20050 | 574700        | +/-DEC 32BIT   |          |   |
| Global  | DM20052 | -31200        | +/-DEC 32BIT   | ······   |   |
| Global  | DM20054 | 0             | +/-DEC 32BIT   |          |   |
| Global  | DM20056 | 246500        | +/-DEC 32BIT   |          |   |
| Global  | DM20058 | 900000        | +/-DEC 32BIT   |          |   |
| Global  | DM20060 | 600000        | +/-DEC 32BIT   |          |   |
| Global  | DM20062 | 574700        | +/-DEC 32BIT   |          |   |
| Global  | DM20064 | -31200        | +/-DEC 32BIT   |          |   |
| Global  | DM20066 |               | +/-DEC 32BIT   |          |   |
| Global  | DM20068 |               | +/-DEC 32BIT   |          |   |



| Global | DM20072 | 500000 +/-DEC 32BIT |
|--------|---------|---------------------|
| Global | DM20074 | 574700 +/-DEC 32BIT |
| Global | DM20076 | -31200 +/-DEC 32BIT |
| Global | DM20078 | 0 +/-DEC 32BIT      |
| Global | DM20080 | 246500 +/-DEC 32BIT |
| Global | DM20082 | 900000 +/-DEC 32BIT |
| Global | DM20084 | 400000 +/-DEC 32BIT |
| Global | DM20086 | 574700 +/-DEC 32BIT |
| Global | DM20088 | -31200 +/-DEC 32BIT |
| Global | DM20090 | 0 +/-DEC 32BIT      |
| Global | DM20092 | 246500 +/-DEC 32BIT |
| Global | DM20094 | 900000 +/-DEC 32BIT |
| Global | DM20096 | 0 +/-DEC 32BIT      |
| Global | DM20098 | 718643 +/-DEC 32BIT |
| Global | DM20100 | -52061 +/-DEC 32BIT |
| Global | DM20102 | 0 +/-DEC 32BIT      |
| Global | DM20104 | 233418 +/-DEC 32BIT |
| Global | DM20106 | 900000 +/-DEC 32BIT |
| Global | DM20108 | 0 +/-DEC 32BIT      |
| Global | DM20110 | 684720 +/-DEC 32BIT |
| Global | DM20112 | -31191 +/-DEC 32BIT |
| Global | DM20114 | 0 +/-DEC 32BIT      |
| Global | DM20116 | 246471 +/-DEC 32BIT |
| Global | DM20118 | 900000 +/-DEC 32BIT |
| Global | DM20120 | 0 +/-DEC 32BIT      |
| Global | DM20122 | 0 +/-DEC 32BIT      |
| Global | DM20124 | 0 +/-DEC 32BIT      |
| Global | DM20126 | 0 +/-DEC 32BIT      |
| Global | DM20128 | 0 +/-DEC 32BIT      |
| Global | DM20130 | 0 +/-DEC 32BIT      |

MECH MIND

# 2.7 EtherNet/IP - OMRON PLC

This section provides information on setting up communication between an OMRON PLC and Mech-Mind Software Suite via EtherNet/IP.

# 2.7.1 Overview

- Hardware and Software Requirements
- Configure IPC and Initiate Communication
- Install EDS file and Configure Communication
- Import Example Program and Download to PLC
- Test with Mech-Vision/Mech-Viz Project



# 2.7.2 Hardware and Software Requirements

#### Hardware

- OMRON PLC:
  - CJ2H-CPU6[]-EIP series
  - CJ2M-CPU3[] series
  - Other models with a CJ1W-EIP21 or CS1W-EIP21 EtherNet/IP Unit
- USB Type A Male to Type B Male cable
- Power supply unit
- HMS IXXAT INpact EIP Slave PCIe interface card installed on the IPC in Mech-Mind Vision System
- Switch
- Ethernet cables

Attention: An CJ2H CPU65-EIP model and CJ1W-PA205R power supply unit are used in the example below. The UNIT NO. is set to 0, and the NODE No. is set to 15 (in HEX; 21 in decimal numeral system).

#### Software

- CX-Programmer V9.70
- Mech-Mind Software Suite: Mech-Center 1.5.1 or above, Mech-Vision 1.5.0 or above, and Mech-Viz 1.5.0 or above
- VCI V4 (driver software for HMS IXXAT INpact 40 interface card)
- HMS IPconfig software
- Mech-Mind EDS file:
  - File name: 005A002B003A0100.EDS
  - Location: Mech-Mind/Mech-Center/mech\_interface/EthernetIP
- Example programs:
  - AUTOEXEC.OBJ
  - PROGRAMS.IDX
  - SYMBOLS.SYM
  - COMMENTS.CMT

The files are stored in Mech-Mind/Mech-Center/mech\_interface/documents/CN/欧姆龙 EtherNet IP 编程指南. Please copy and paste all files to the computer with CX-Programmer installed.



**Note:** Connect the Mech-Mind Vision System IPC, computer with CX-Programmer installed, and PLC to the same router.

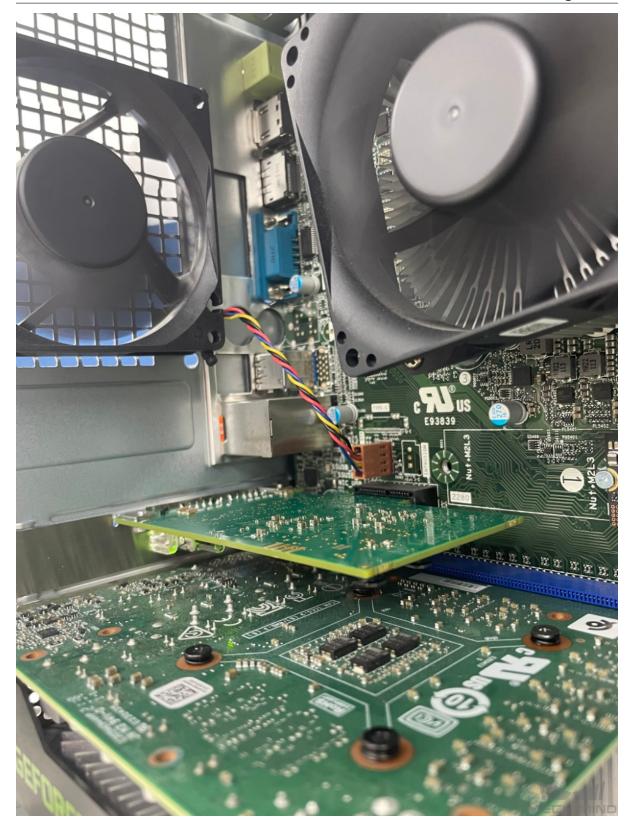
# 2.7.3 Configure IPC and Initiate Communication

## Check PCI-e Card and Driver Software

1. Please make sure that the INpact EIP Slave PCIe interface card has been pressed into the PCI-e slot of the IPC, as shown below.

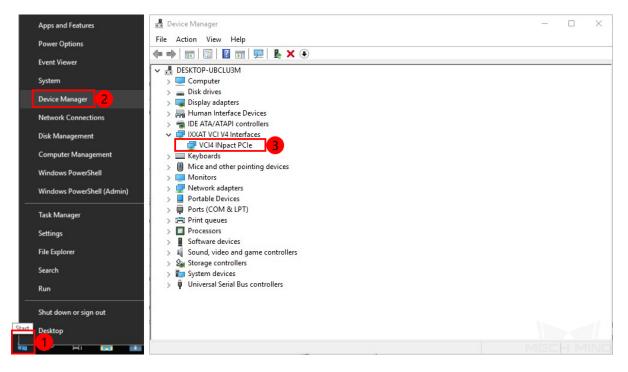


Mech-Mind Robot Integrations





2. Start the IPC, go to  $Start \rightarrow Device Manager$  and check if the driver software VCI4 INpact PCIe has been installed.



#### **Configure Mech-Interface in Mech-Center**

1. Open Mech-Center, and click on *Deployment Settings*.

| File Tool User View | / Help                      |                     |               |
|---------------------|-----------------------------|---------------------|---------------|
|                     | Vision<br>Viz               | <b>&gt;</b>         | 2             |
| Deployment Settings | Start Start Mech-Eye Viewer | Run Start Interface | Connect Robot |

2. Go to **Mech-Interface**, check **Use Mech-Interface** and select *Standard Interface*  $\rightarrow$  *ETHERNET IP*. Click on *Save* to complete configurations.



| Deployment Settings   |   | × |
|---|---|---|
| Appearance & Behavior<br>Mech-Viz<br>Mech-Vision<br>Mech-Eye Viewer<br>Robot Server<br>Mech-Interface | <ul> <li>✓ Use Mech-Interface 2</li> <li>Interface Program Folder</li> <li>Interface Service Type</li> <li>Standard Interface 3 Adapter</li> <li>Interface Options 2 ETHERNET IP 4</li> <li>Listed robot ABB ABB_IRB1200_5_09 rzyx</li> <li>Custom robot RobotVendor1 RobotType1 rzyx</li> <li>Advanced Settings</li> </ul> |   |
|   | Save 5 ancel  |   |

3. Click on *Start Interface* in the Toolbar. Then an ETHERNET IP icon will display in the service status bar.



| Mech-Center, by Mech-Mind Robotics               |                   |                                   |               |
|--|-------------------|-----------------------------------|---------------|
| File Tool User View Help                         |                   |                                   |               |
| Deployment Settings Start Start Mech-            |                   |                                   | Administrator |
| Service Status                                   |                   | Log                               |               |
| Vis Viz 💿  | EtherNet          | Max Line 10000 🗘 Open Logs Folder | Clear         |
|  |                   |                                   |               |
| 1.5.2 1.5.2 Virtual Camera ETH<br>Project Status | IERNET IP         |                                   |               |
| Project Name Status                              | Exec Time Details |                                   |               |
| Metalwork IDLE                                   |                   |                                   |               |
|  |                   |                                   |               |
| 🚾 check_collision change IDLE                    |                   |                                   |               |
|  |                   |                                   |               |
|  |                   |                                   |               |
|  |                   |                                   |               |
|  |                   |                                   |               |
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|  |                   |                                   |               |
|  |                   |                                   |               |
|  |                   |                                   |               |
|  |                   |                                   |               |

## Configure IP address of the PCI-e Card

1. Download and install **HMS IP config software** on the IPC first. Use an Ethernet cable to connect the network ports of the IPC and the INpact EIP Slave PCIe.

**Attention:** After configurating the IP and initiating communication successfully, the Ethernet cable used here can be removed.

2. Open HMS IPconfig, click on and select Ixxat INpact EtherNet/IP(TM). Then uncheck Retrieve IP settings dynamically from a DHCP server and enter the IP address and subnet mask, as shown below. After configuration, click on *Apply*.



| HMS IPconfig  | - 🗆 X  |
|---|--|
| Scanned Devices:  | Device Configuration Apply 6   |
| Ixxat INpact EtherNet/IP(TM)<br>192.168.1.10<br>00-30-11-37-47-69 | <ul> <li>DHCP Configuration</li> <li>Retrieve IP settings dynamically from a DHCP server</li> <li>IP Configuration</li> <li>IP address</li> <li>192.168.1.10</li> <li>Subnet mask</li> <li>255.255.255.0</li> <li>Default Gateway</li> </ul> |
|   | ©.0.0.0<br>DNS Configuration<br>Primary DNS<br>0.0.0.0<br>Secondary DNS<br>0.0.0.0<br>Host Name  |
|   | Search Password Password □ Change password New Password ■ Comment  |

Attention: The IP address should be the same as which is configured in the PLC.

# 2.7.4 Install EDS file and Configure Communication

## **Create PLC Project**

1. Open the CX-Programmer software, click on in the menu bar and then a **Change PLC** window will pop up. Select the **Device Type** according to the model in use, and then click on *Settings*. Select the **CPU** type in the pop-up **Device Type Settings** window. Click on *OK* to save the changes.



#### 📟 CX-Programmer

| File Edit View Insert PLC Program Simulation Tools Windo   | ow Help  |          |
|--|--|----------|
| ] <b>D (1</b> -1   🙀   🥃 🖪   X 🖻 🖻   🖷   그 오   🗛 🛱 🎖   | s 🕼 🕕 🔋 😽 📗 🛦 🎄 🍓 🗠 🖏 💷 🗉 🖾 🗗 🐼  | 2   28   |
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| 律 律   国 智   ★ % % %  |  |          |
| Change PLC<br>Device Name<br>MM_Camera_CX<br>Device Type<br>CJ2H<br>VSB<br>Settings<br>Show all<br>Comment<br>OK Cancel Help | Device Type Settings [CJ2H] X<br>General<br>CPU Type<br>CPU 65-EIP<br>Total Program Area Size<br>TOOK [Step]<br>Expansion Memory<br>32KW [4 Banks]<br>Read Only<br>File Memory<br>None<br>None<br>Make Default |          |
|  | OK 5 Cancel Help   |          |
|  |  | 1        |
|  |  |          |

2. Click on in the menu bar, a **Save CX-Programmer File** window will pop up. Select a folder to save the project file, name the file, and then click on *Save*.



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| ■毎 国 <b>当 </b> ▲%%%%  | a 11  |                |
| RewProject<br>☐- ∰ MM_Camera_CX[CJ2H] Offline<br>☐- ☐ Data Types                    | 0 [Program Name : NewProgram1]<br>[Section Name : Section1] | •              |
| Symbols<br>IO Table and Unit Setup<br>Settings                                      |   | Ŷ.             |
| Memory<br>⊟ 🍓 Programs<br>⊟ 🧙 NewProgram1 (00)                                      | Save CX-Programmer File                                     | ×              |
| 一句 Section1<br>一句 END   | Save in: EIP  |                |
|   | Name Date modified<br>No items match your search.           | Ту             |
|   | <   | >              |
|   | File name: MM_Camera 3                                      | ave 4          |

3. Click on A in the menu bar, and then select *Yes* in the pop-up window to connect to the PLC.

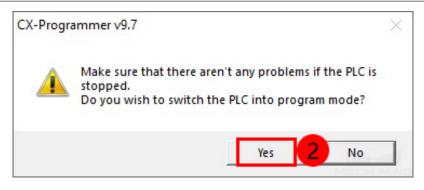


| MM_Camera - CX-Programmer - [MM_Camera_CX.NewProgram1.Section1 [Diagram]]   |
|---|
| 🏴 File Edit View Insert PLC Program Simulation Tools Window Help  |
| 」D ☞ ⊟   ଊ   ⊜ ଊ   ℁ ๒ ๒   ֎   ௨ ௨   ぬ ≋ ℁ ⅍   ① १ №   <mark>  ▲   </mark> ℁   ℁   ኤ =  |
| <u>                                     </u>  |
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|   |
| NewProject          MM_Camera_CX[CJ2H] Offline         Symbols         IO Table and Unit Setup         Settings         Memory         Programs         Symbols         Symbols         Programs         Programs |

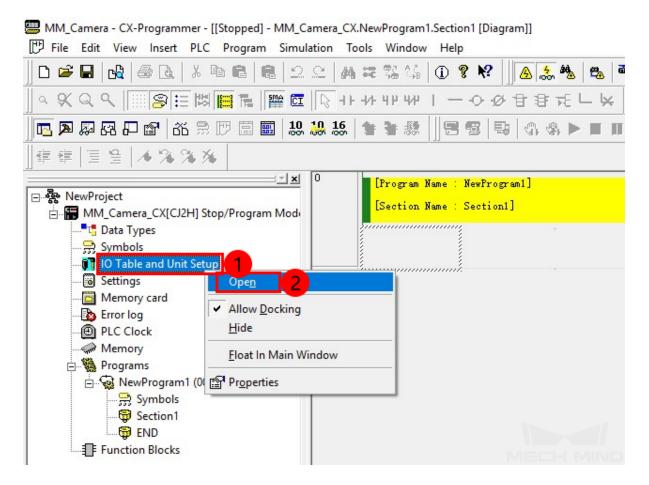
4. Click on in the menu bar. Make sure that there aren't any problems if the PLC is stopped, and then select *Yes*.

| 📟 MM_Camera - CX-Programmer - [[Running] - MM_C | amera_CX.NewProgram1.Section1 [Diagram]]                                 |                  |
|---|--|------------------|
| [ File Edit View Insert PLC Program Simu        | ation Tools Window Help  |                  |
| ]] D 🚅 🖬   🏤   🚑 🖪   🐰 ங 📾   📾   🤐              | ≙   Ma ≔ %3 %   ① ? №   ∬ <u>A</u> 🚴 %   %2   %2     11   12 D ( %2   %2 | * & 🔳 🕇 🗮 🖽      |
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| ]] 律 律   国 열   本 % % %                          |  |                  |
| × ×   | 0 [Program Name : NewFrogram1]   |                  |
| ⊡ 🌸 NewProject                                  | [Section Name : Section1]  |                  |
| MM_Camera_CX[CJ2H] Monitor Mode                 |  |                  |
|   | <u>Fannanananan</u>  |                  |
|   |  |                  |
| IO Table and Unit Setup                         |  |                  |
| - Settings                                      |  |                  |
| Memory card                                     |  |                  |





5. Select IO Table and Unit Setup  $\rightarrow$  Open in the project workspace to open the **PLC IO Table**.



6. Go to Built-in Port/Inner Board and select CJ2B-EIP21. Select *TCP/IP* in the Edit Parameters window, enter the IP address and subnet mask. Then click on *Transfer[PC to Unit]*, select *Yes* in the pop-up window to transfer parameters.



| PLC IO Table - MM_Ca             | mera_CX  | – 🗆 X            |
|----------------------------------|--|------------------|
| File Edit View Options           | s Help   |                  |
|                                  | e ≤ > LB = ¥   |                  |
| CJ2H-CPU65-EIP                   |  |                  |
| Built-in Port/Inner              |  |                  |
| [1900] CJ2B-EIP2                 | 1(Built In EtherNet/IP Port for CJ2) (Unit : 0)  |                  |
| 🕀 🌰 [0000] Main Rack             |  |                  |
| 🗈 🦔 [0000] Rack 01               | CJ2B-EIP21 [Edit Parameters]   |                  |
| (0000] Rack 02<br>(0000] Rack 03 | TCP/IP 2 Het   FINS/UDP   FINS/TCP   FTP   Auto Adjust Time   Status Area   SNMP   SNMP Trap |                  |
|                                  | IP Address   |                  |
|                                  | Use the following address  |                  |
|                                  | IP Address 192 . 168 . 1 . 21  |                  |
|                                  | Sub-net Mask 255 . 255 . 255 . 0 Secondary DNS Server 0 . 0 . 0 . 0                          |                  |
|                                  | Default Gateway 0 . 0 . 0 . 0 Domain Name  |                  |
|                                  | C Get IP address from the BOOTP server   |                  |
|                                  | The BOOTP setting is valid only for next unit  |                  |
|                                  | Then, the BOOTP setting will be cleared.   |                  |
|                                  | The obtained IP address will be automatically aved as system setting in the unit.            |                  |
|                                  | Delete   |                  |
|                                  | Broadcast  |                  |
|                                  | C All 0 (4.28SD)   |                  |
|                                  |  |                  |
|                                  |  |                  |
|                                  | Transfer[Unit to PC] Transfer[PC to Unit] Transfer[PC to Unit] Transfer[Unit to PC]          |                  |
|                                  | Set Defaults Edit Parameters X OK Cancel   |                  |
|                                  |  |                  |
|                                  | Parameters will be transferred to Unit.<br>Do you want to continue?                          |                  |
|                                  |  |                  |
|                                  |  |                  |
|                                  | Yes 5 No   |                  |
|                                  |  |                  |
|                                  |  |                  |
|                                  | CJ2H-C   | PU65-EIP Program |

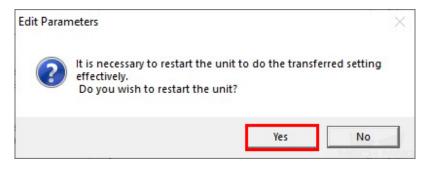
#### Note:

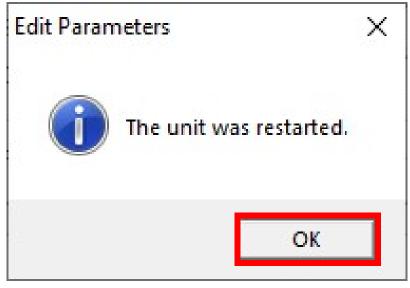
- The instructions in this step is based on a specific model of PLC. Please configure according to the actual PLC model you are using.
- The last number of the IP address should be the same as the NODE No. set on the PLC.
- 7. After transfering the parameters successfully, click on *Close*.

| Edit Parameters     |       |
|---------------------|-------|
|                     |       |
| Fransfer successful | Close |



8. Select Yes to restart the unit, and click on OK in the pop-up window.





9. Click on OK in the **Edit Parameters** window to complete configuration.

# Install EDS File and Configure Network

1. Right click on CJ2B-EIP21 in the **PLC IO Table**, and then select Start Special Application  $\rightarrow$  Start with Settings Inherited.



| PLC IO Table - MM_Camera_CX                         |                                |     |                               | 100 | ×   |
|---|--------------------------------|-----|-------------------------------|-----|-----|
| File Edit View Options Help                         |                                |     |                               |     |     |
| 🔚 🖪 🖪 🛏 🗴 🖿 🖻 🛃 🎽                                   | 🖌 🗸 🚟 🐱                        |     |                               |     |     |
| CJ2H-CPU65-EIP                                      |                                |     |                               |     |     |
| E Built-in Port/Inner Board                         |                                |     |                               |     |     |
| 🎁 [1500] CJ2B-EIP21(Built In EtherNet/IP Port for C | (J2) (Unit : 0)                |     |                               |     |     |
| [1900]Inner Board unmounted                         | Change Unit No                 | - 1 |                               |     |     |
| E 🛶 [0000] Main Rack                                | Unit Comment                   |     |                               |     |     |
| 🗄 🛶 [0000] Rack 01                                  |                                |     |                               |     |     |
| E 🛶 [0000] Rack 02                                  | Unit Setup                     |     |                               |     |     |
| 🗄 🛶 [0000] Rack 03                                  | Save Parameters                |     |                               |     |     |
|   | Load Parameters                |     |                               |     |     |
|   | Start Special Application      | >   | Start with Settings Inherited |     |     |
|   | Unit Manufacturing information |     | Start Only                    |     |     |
|   | Unit Error Log                 | 1   |                               |     |     |
|   | onic thor tog                  |     |                               |     |     |
|   |                                |     |                               |     | man |

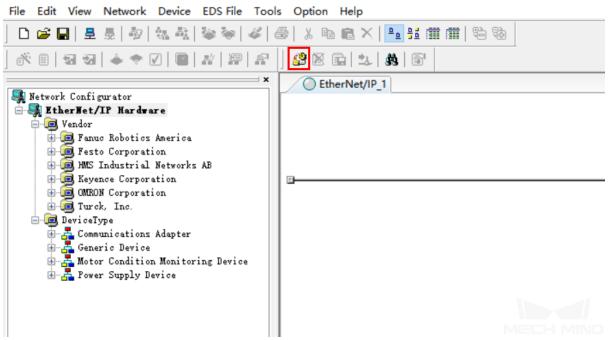
2. Select **Network Configurator** in the pop-up window, and click on *OK* to open the **Untitled** - **Network Configurator** window.

| twork Config                   | rurator                  |                  |           |
|--------------------------------|--------------------------|------------------|-----------|
|                                |                          |                  |           |
|                                |                          |                  |           |
|                                |                          |                  |           |
|                                |                          |                  |           |
| escription-                    |                          |                  |           |
| Network Conf:                  | igurator                 |                  |           |
| Application :<br>the EtherNet, | software t<br>/IP networ | o build an<br>k. | nd set up |
|                                |                          |                  |           |
|                                |                          |                  |           |
|                                |                          |                  |           |

3. Click on in the menu bar, and an Install EDS File file will pop up.



#### 💐 Untitled - Network Configurator



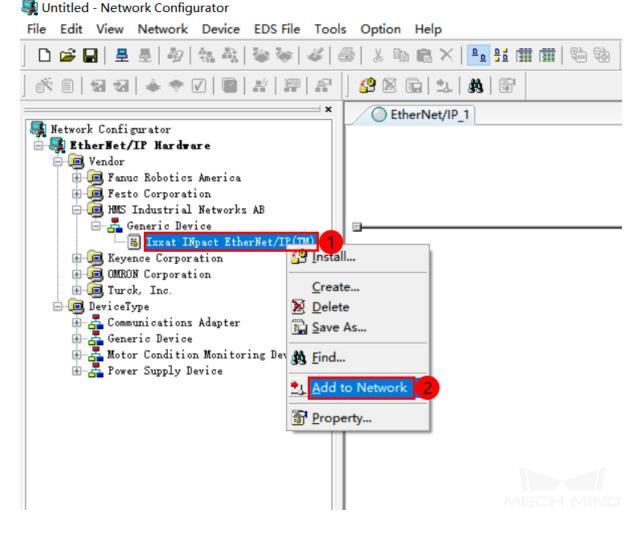
4. Locate and select the EDS file and click on Open.

| Look in:   | EthemetIP   | G Ø 1    | ≫ ▼            |        |
|--|---|----------|----------------|--------|
| Name   | ^   | Date mor | dified         | Ту     |
| 005A00   | 2B003A0100.EDS  | 4/2/2022 | 11:41 AM       | E      |
|  |   |          |                |        |
| <<br>File name:  | 005A002B003A0100  |          | Open           | ><br>2 |
| File name:   | 005A002B003A0100<br>Electronic Data Sheet(*.eds)                            | ~        | Open<br>Cancel |        |
| Fil <mark>e name</mark> :  | Electronic Data Sheet(*.eds)  | ~        |                |        |
| File name:<br>Files of type:<br>Device Info<br>Veno              | Electronic Data Sheet(*.eds)<br>rmation<br>dor : HMS Industrial Networks AB | ~        |                |        |
| File name:<br>Files of type:<br>Device Info<br>Venc<br>Device Ty | Electronic Data Sheet(*.eds)  | ~        |                | ><br>[ |



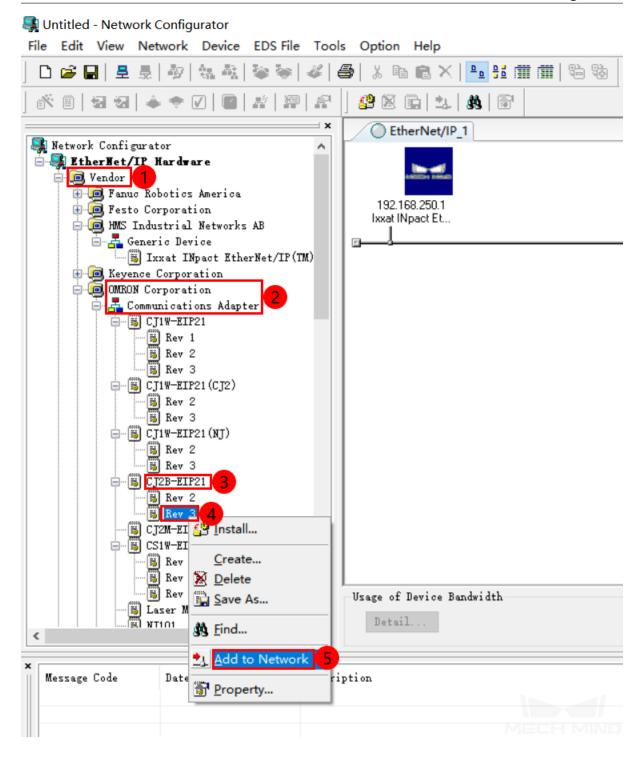
Attention: The EDS file is stored in the folder where Mech-Center is installed. The default path is Mech-Mind/Mech-Center/mech\_interface/ETHERNETIP. If CX-Programmer is not installed on the same IPC where Mech-Center is installed, you can copy and paste the ETHER-NETIP folder to the PC with CX-Programmer installed.

5. In the Untitled - Network Configurator panel, go to EtherNet→ IP HardWare→ Vendor→ HMS Industrial Networks AB→ Generic Device. Right click on Ixxat INpact Ether-Net/IP(TM) and select Add to Network in the context menu.



6. Then go to EtherNet/IP Hardware $\rightarrow$  Vendor $\rightarrow$  OMRON Corporation $\rightarrow$  Communications Adapter $\rightarrow$  CJ2B-EIP21. Right click on **Rev 3** and select **Add to Network** in the context menu.





7. In EtherNet/IP\_1 window, right click on the SJ2B-EIP21 device icon, select Change Node Adress in the context menu, and then configure the IP address to 192.168.1.21.



# 💐 Untitled - Network Configurator

| le Edit View Network Device EDS File Too  | ls Option Help                            |                                |
|---|---|--------------------------------|
| 🗅 📽 🖬   星 👼   松   🍇 🍇   🕸 😽   🎸   | 😂   🕺 🖻 🖻 🗙   🏊 🗄 🏛                       |                                |
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| ×   | EtherNet/IP_1                             |                                |
| Network Configurator      EtherNet/IP Hardware      Vendor      Fanuc Robotics America      Festo Corporation | 192.168.250.1<br>Ixxat INpact Et CJ28-EIP |                                |
| ing HMS Industrial Networks AB  |   | Parameter •                    |
| 🔚 Ixxat INpact EtherNet/IP(TM)  |   | 蟚 <u>M</u> onitor              |
| in-100 Keyence Corporation<br>100 OMRON Corporation   |   | <u>R</u> eset                  |
| in a communications Adapter<br>in ∰ CJ1W-EIP21  |   | Maintenance Information        |
|   |   | Register to other Device       |
|   |   | External Data                  |
| B Rev 2   |   | X Cut                          |
|   |   | В Сору                         |
| 5 Rev 2   |   | × Delete                       |
| □ B CJ2B-EIP21  |   | Change Node <u>A</u> ddress    |
|   |   | Change Device C <u>o</u> mment |
|   |   | 響 Edit I/O <u>C</u> omment     |
| Rev 1   |   | Synchronize <u>I</u> dentity   |
| 5 Rev 2   | Usage of Device Bandwidth                 | Change <u>D</u> evice Type     |
|   | Detail                                    | Property                       |

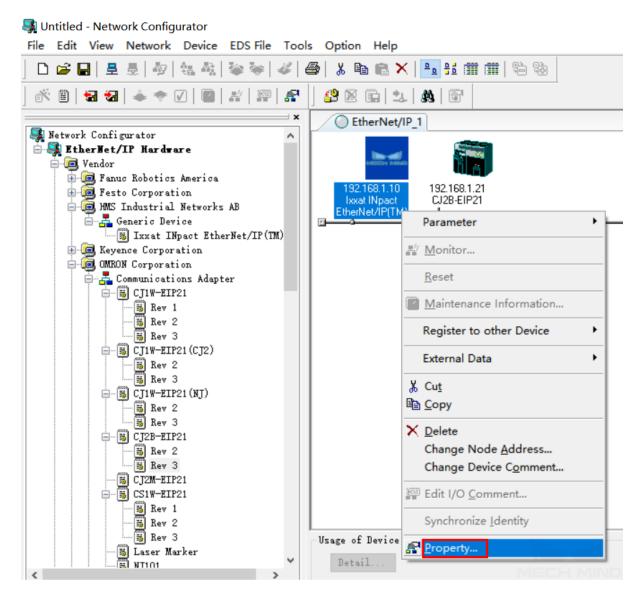
| New IP | Address : | 192 . 168 . 1 . 2 |
|--------|-----------|-------------------|
|--------|-----------|-------------------|

8. Right click on Mech-Mind visual device icon, select **Change Node Adress** in the context menu, and then configure the IP address to 192.168.1.10.





9. Right click on Mech-Mind visual device icon, and select **Property**.



10. In the **Property** window, click on *I/O Information* to check the I/O size, and then click on *Close*.



| 💐 Untitled - Network Configurator                              |          |              |                                       |        |         |
|--|----------|--------------|---------------------------------------|--------|---------|
| File Edit View Network Device EDS File                         | Tools    | Option       | Help                                  |        |         |
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| 🖄 🗒   🗃 😼   🔶 🗢 🗸   🔤   💥   🦉                                  | 8        | <b>g</b> X ( | à   24   <b>8</b>   🕾                 |        |         |
|  | <b>×</b> | C Ethe       | erNet/IP_1                            |        |         |
| Network Configurator Hetwork Configurator Hetwork Configurator | ^        |              |                                       |        |         |
| e e Vendor   |          |              |                                       |        |         |
| 🖶 🧓 Fanuc Robotics America                                     |          | 192.16       | 8.1.10 192.168.1.21                   |        |         |
| E TE Festo Corporation   |          | Ixxat INp    |                                       |        |         |
| e Generic Device   |          |              |                                       |        |         |
| 📓 Ixxat INpact EtherNet/IP(1                                   | IM)      |              | Ixxat INpact EtherNet/IP(TM) Property |        | ×       |
| Keyence Corporation     Gungo OMRON Corporation                |          |              |                                       |        | ~       |
|  |          |              | General I/O Information               |        |         |
|  |          |              |                                       |        |         |
| Rev 1  |          |              | Name                                  | Out/In | Size    |
| 55 Kev 2   |          |              | Cutput_150                            | Out    | 118Byte |
| 🖨 🐻 CJ1W-EIP21 (CJ2)   |          |              | 🖅 Input_100                           | In     | 114Byte |
| Rev 2  |          |              |                                       |        |         |
|  |          |              |                                       |        |         |
| <b>1 1 1 1 1 1 1 1 1 1</b>                                     |          |              |                                       |        |         |
|  |          |              |                                       |        |         |
| EJ2B-EIP21   |          |              |                                       |        |         |
| Rev 2  |          |              |                                       |        |         |
| CJ2M-EIP21   |          |              |                                       |        |         |
| ES1W-EIP21   |          |              |                                       |        |         |
|  |          |              |                                       |        |         |
| 🐻 Rev 3  |          | Usage of     |                                       |        |         |
| Laser Marker   | ~        | Detail       |                                       |        |         |
|  | >        | Derdi.       |                                       |        |         |
|  |          |              |                                       |        |         |
| × Message Code Date  | Descript | ion          |                                       |        |         |
|  |          |              |                                       |        |         |
|  |          |              |                                       | -      | 2 Close |
|  |          |              |                                       |        |         |

11. In EtherNet/IP\_1 window, double click on the CJ2B-EIP21 icon. Select *Tag Sets* in the pop-up Edit Device Parameters window, and then click on *Edit Tags*.



| Name |        |        | Over | Size | Bit      | ID           |
|------|--------|--------|------|------|----------|--------------|
|      |        |        |      |      |          |              |
|      |        |        |      |      |          |              |
|      |        |        |      |      |          |              |
|      |        |        |      |      |          |              |
|      |        |        |      |      |          |              |
|      |        |        |      |      |          |              |
|      |        |        |      |      |          |              |
| New  | Edit [ | lelete |      | Fyr  | nand All | Collapse All |
|      |        |        |      |      |          |              |
| New  | Edit D | lelete |      | Eq   | pand All | Collapse All |

12. Select *In-Consume*, and click on *New*. Then edit the tag according to actual situation. Click on *Regist* and *Close*.



| ame                   | Ove     | Size | Bit |
|-----------------------|---------|------|-----|
| dit Tag               |         |      | ×   |
| Name : D15100         | 3       |      |     |
| Size : 114            | 4       |      |     |
| Use Bit Data<br>Bit 0 | × 1     |      |     |
| Bit 0                 | Bi1     |      |     |
| Over Load<br>Disabl   | le 💿 En | able |     |
| Regis                 | t Cla   | )se  |     |
| - 5                   |         |      |     |
|                       |         |      |     |
|                       |         |      |     |

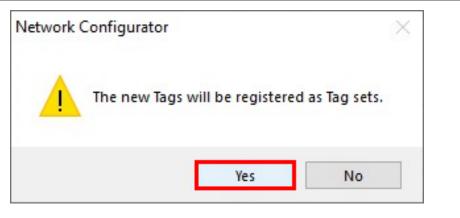
13. Select Out-Produce and edit the tag in the same way. Click on OK in the Edit Tags window in the end.



| Name         |                | Ove  | Size | Bit |
|--------------|----------------|------|------|-----|
| Edit Tag     |                |      |      | ×   |
| Name : D     | 16100          | 3    |      |     |
| Size :       | 118 🚔          | 4    |      |     |
| Use B<br>Bit | it Data<br>0 🌲 | Bit  |      |     |
| Over Load    | )Disable       | • En | able |     |
|              | Regist         | cl.  |      |     |
|              |                |      |      |     |
|              |                |      |      |     |

14. Select Yes in the pop-up window.





15. Select Ixxat INpact EtherNet/IP(TM) in the Unregister Device List, click on the double click on Ixxat INpact EtherNet/IP(TM) in the Register Device List.



|                        | 2.168.1.21 CJ2B-EIP21  |             |                 |              |
|------------------------|------------------------|-------------|-----------------|--------------|
| nnections Tag Sets     |                        |             |                 |              |
| Inregister Device List |                        |             |                 |              |
| #                      | Product Name           |             |                 |              |
| 🏈 192.168.1.10         | lxxat INpact EtherNet/ | IP(TM)      |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
| onnections: 0/256(0    | 0 T·0)                 | 2           |                 |              |
| Register Device List   | 0,1:0)                 |             |                 |              |
| Product Name           | 192.168.1.21 CJ2B-EIF  | 21 Variable | Target Variable |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
|                        |                        |             |                 |              |
| New Edit               | Delete Edit All        | Change T    | arget Node ID   | To/From File |

16. A Ixxat INpact EtherNet/IP(TM) Edit Connection window showing Input and Output will appear. Configure the tag sets as shown below. Click on *Regist* and *Close* to close the window.



| 192.168.1.10 Ixxat INpact EtherNet/IP(TM) Edit   | Connection X   |
|--|--|
| It will add a connection configuration to or<br>Please configure the Tag Set each of origina |  |
| Connection I/O Type Exclusive owner  | $\sim$   |
| Originator Device  | Target Device  |
| Node Address 192.168.1.21  | Node Address 192.168.1.10  |
| Comment : CJ2B-EIP21   | Comment : Ixxat INpact   |
| Input Tag Set dit Tag Set:   | Output Tag Set   |
| D15100 - [114Byte]<br>Connection<br>Type : Point to Point connection                         | <pre>     Input_100 - [114Byte]</pre>                                    |
| Output Tag Set dit Tag Set:  | Input Tag Set  |
| Z D16100 - [118Byte]<br>Connection<br>Type : Point to Point connection                       | <ul> <li>✓ &lt;■</li> <li>Output_150 - [118Byte] ✓</li> <li>✓</li> </ul> |
| Hide Detail  |  |
| Detail Parameter   |  |
| Packet Interval 50.0 ms (1.0 - 3   | 200.0 ms   |
| Timeout Value : Packet Interval (RPI) x  | Constantion News   |
| Connection Structure   |  |
| 192. 168. 1. 21 CJ2B-EIP21 *   |  |
|  | 4  |
|  | 3 Regist Close   |

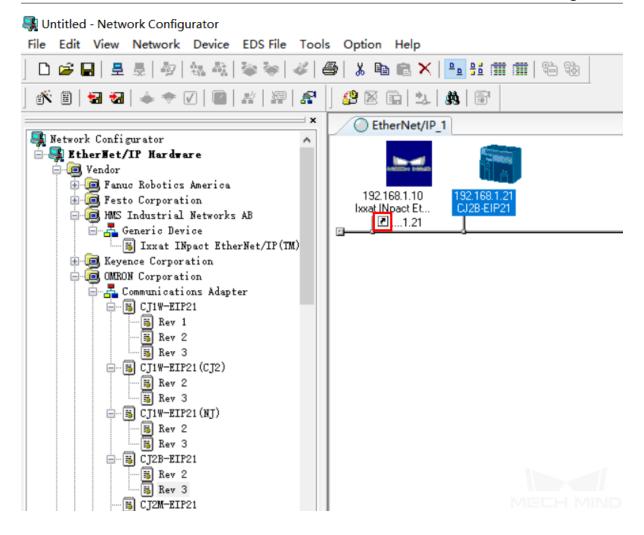
17. Now the tag sets will appear in the **Register Device List**, then click on *OK*.



| nnections Tag Sets   |              |  |
|--|--------------|--|
| Unregister Device List   |              |  |
| #  | Product Name |  |
| Connections : 2/256 (O :<br>Register Device List<br>Product Name | 2, T : 0)    | Target Variable                                |
| 192.168.1.10 (#010)  |              |  |
| default_001 [Input   |              | Input_100                                      |
| default_001 [Outp  |              | Output_150                                     |
|  | ut] D16100   | Output_150<br>ange Target Node ID To/From File |

18. After the IPC is connected, a small arrow will appear as shown below.

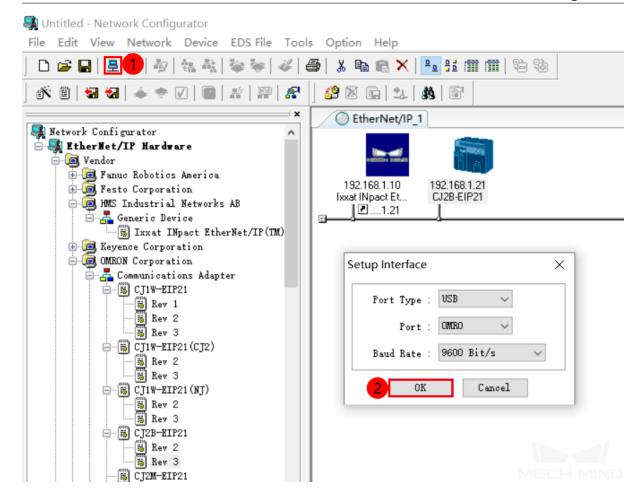




### Download Hardware Configuration to PLC

1. Click on in the **Network Configurator** window. Then select *OK* in the pop-up **Setup Interface** window.





2. Now you can see a **Select Connect Network Port** window. Select  $BackPlane \rightarrow \#0 CJ2B-EIP21 \rightarrow TCP:2$ , and then click on OK.



| Browse   |        |
|--|--------|
| BackPlane<br>0 NewPLC1<br>0 NewPLC1<br>0 UnewPLC1<br>0 UnewPLC1<br>0 UnewPLC1<br>0 UnewPLC1<br>0 UnewPLC1<br>0 UnewPLC1<br>0 UnewPLC1<br>0 UnewPLC2<br>0 UnewPLC |        |
| Device Information<br>Vendor ID : Product Name<br>Device Type Revision :   |        |
| Refresh  | Option |

3. Select Using the existing network  $\rightarrow$  EtherN IP\_1 in the Select Connected Network window and click on OK.

| Please select a network where the | connected network wa |
|-----------------------------------|----------------------|
| Target Network                    |                      |
| ○Create new network.              |                      |
| • Use the existing network.       |                      |
| EtherNet/IP_1 2                   | ~                    |
| ЗОКС                              | ancel                |
|                                   | MECHN                |

4. Click on in the **Network Configurator** window, and select *Yes* to start dowloading parameters.



#### Strate - Network Configurator File Edit View Network Device EDS File Tools Option Help 🗅 🖨 🖬 | 토 🜷 | 🏘 | 🍇 🕸 | 📚 🔁 🍊 🚭 | 상 ங 🛍 🗙 | 🏪 태 蕭 | 🏪 18 of 8 3 3 3 ♦ ♦ 7 8 4 8 8 6 12 8 8 8 6 12 8 8 8 8 × C EtherNet/IP\_1 Network Configurator ^ 🗐 间 Vendor 🗐 📵 HMS Industrial Networks AB Generic Device Ixxat INpact EtherNet/IP(TM) OMEON Corporation 192.168.1.21 CJ2B-EIP21 192.168.1.10 Ixxat INpact Et... 2 .... 1.21 E Communications Adapter ■ ● ● ■ CJ1W - EIP21(CJ2) Network Configurator In order to enable new configuration, downloading 4 parameters to all devices will start. OK? - 🐻 Rev 2 - 🐻 Rev 3 - 🗑 CJ1W-EIP21 (NJ) Rev 2 2 Yes No GJ2B-EIP21 Rev 2 CJ2M-EIP21

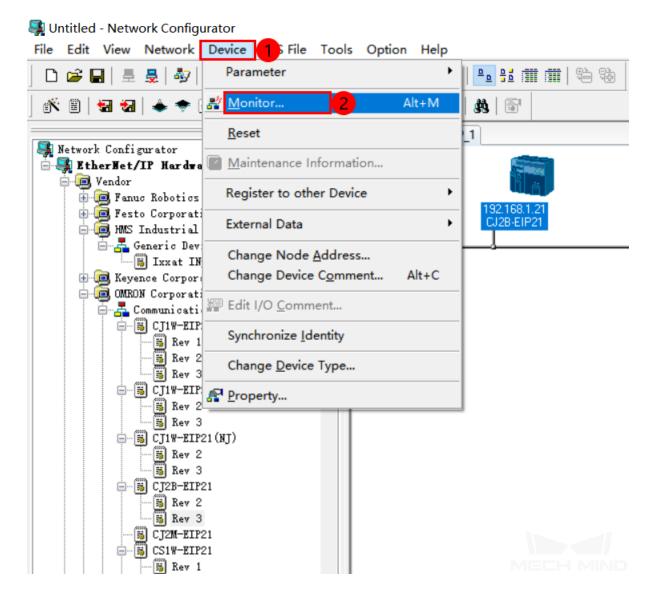
5. After the dowload is completed, click on OK.

| Network C | Configurator                    | × |
|-----------|---------------------------------|---|
| 1         | Network download was completed. |   |
|           | ОК                              | ] |



#### Check Communication

1. In the **Untitled-Network Configurator** window, go to  $Device \rightarrow Monitor$ .



2. A **Monitor Device** window will appear. Click on *Connection*. If the connection is successful, the status indicator will be blue.



| controller Errol  | r History         |    | Status    |         | net Information |
|-------------------|-------------------|----|-----------|---------|-----------------|
| Status 1          | Status 2          |    | Connectio | n 🚺     | Error History   |
| arget Node Statu  | IS                |    |           |         |                 |
| 010               |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
| tart Connection   | Stop Connectio    | on |           |         |                 |
| onnection Status  |                   |    |           |         |                 |
| Connection Status |                   |    | Туре      | Status  |                 |
|                   | #010) default_001 |    | Out/In    | 00:0000 |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         | _               |
|                   |                   |    |           |         | _               |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |
|                   |                   |    |           |         |                 |



3. The PLC is successfully connected to Mech-Center if the following message is displayed in Mech-Center Log panel:

Mech-Center, by Mech-Mind Robotics × \_ Vision Viz -Start Stop Interface Deployment Settings Run Connect Robot Administrator Service Status Max Line 10000 🤤 Open Logs Folder Vis Viz Virtual Camera ETHERNET IP Project Status Project Name Details Metalwork IDLE 🚾 check\_collision change

Connect to ETHERNET IP controller successfully

Note: If you don't see this log message, please check if:

- The hardware are properly connected;
- If Mech-Interface has been started by clicking on *Start Interface* in the Toolbar;
- If the hardware configuration has been downloaded to the PLC.



## 2.7.5 Import Example Program and Download to PLC

**Note:** Before you add the example program to a project already in use, it is recommended to import it to a new project and test it first. In the following steps, the project created earlier is used to import and test the example program.

#### Import Example Program Files

1. Open CX-Programmer, right click on  $MM\_Camera\_CX[CJ2H]$  Offline and select Transfer  $\rightarrow$  From File.



|  | M_Camera_CX.NewProgram1.Section1 [Diagram]]<br>Program Simulation Tools Window Help<br>💼 💼 🖄 🗠 🖌 🏭 😨 🐝 🎲 🕕 🍞 🛠 📗 🕭 🎄 🎭 👼 🍶 非 💷   |
|--|--|
|  |  |
|  | a the transformed and the transformed at the transf |
|  | ·  |
| ] 律 律   国 ≌   ▲ % % %                  | I Program Name : NewProgram1]  |
| □                                      |  |
| Data Types                             | Change   |
| 🚔 Symbols<br>🗊 IO Table and Unit Setup | Insert Program   |
|  | <ul> <li> <u> <u>         Work Online</u><br/><del> <u> </u>         Start PLC-PT Integrated Simulation<br/><u> <del> </del>         Work Online Simulator  </u></del></u></li> </ul>  |
| ⊢ 🥵 NewProgram1 (00)<br>👷 Symbols      | 팀a <u>P</u> LC Error Simulator   |
|  | Operating Mode ►   |
|  | Memory Allocation  |
|  |  |
|  | Trans <u>f</u> er 2  |
|  | Compare Program  |
|  | X Cut     To File  |
|  | ✓ Allow Docking<br>Hide  |
|  | Eloat In Main Window   |
|  | Properties   |
|  |  |

2. Check **Programs**, **Program Index**, **Symbols** and **Program comments**. Then click on  $\cdots$  next to the **File name** under **Programs**, select the OBJ file, and click on *Open*. If other files are stored in the same folder, they will be auto filled. Click on *OK* in the end.



| MM_Camera - CX-Prog  |  |                           |         |                               |   | ]]   |                          |                        |                     |       |                |
|--|--|---------------------------|---------|-------------------------------|---|--|--------------------------|------------------------|---------------------|-------|----------------|
| File Edit View In  |  | and the second procession |         |                               |   |  | - 6A                     |                        |                     |       | DA CO          |
|  |  |                           |         | € \$£ \$;                     |   | 11   |                          |                        |                     |       |                |
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| n 🔁 🖉 🖉 🖉 🔁  |  |                           |         |                               |   | <b>5</b>   <b>5</b>   <                          | n & ►                    |                        | <b>&gt;&gt; 발 발</b> | I → 2 | <b>X</b>  ]] = |
| ]]律律 国일  14  | * * *                                      | and and the               |         |                               |   |  |                          |                        |                     |       |                |
| □       Image: Symbols         □       Image: Symbols         Image: Symbols       Image: Symbols      < | d Unit Setup<br>gram1 (00)<br>bols<br>ion1 |                           |         | Sectio<br>Tran<br>모<br>모<br>모 | n Name : S<br>sferfromf<br>Programs<br>'ile name<br>Comment:<br>Program I<br>'ile name<br>Symbols<br>'ile name<br>Program o | ile<br>: [C:\Users<br>: [C:\Users<br>: [C:\Users | \CTOS\Docu<br>\CTOS\Docu | uments\EI<br>uments\EI | P\SYMBOLS.          |       | 2              |
| []   | 📟 Transfer 1                               | irom file                 |         |                               |   |  |                          | ×                      |                     |       |                |
|  | _  |                           |         |                               |   | l d Bre  | -4 <b>—</b>              |                        |                     |       |                |
|  | Look in:                                   | Desktop                   |         |                               | •   |  | r 📰                      |                        |                     |       |                |
|  | Name                                       |                           | Size    |                               | Item typ  |  | Date m                   |                        | 8                   |       |                |
|  | 03 Ether                                   | Net IP                    |         |                               | File fold   |  | 5/26/20                  |                        |                     |       |                |
|  | JIETU                                      | 12                        |         |                               | File fold<br>File fold  |  | 3/30/20                  |                        |                     |       |                |
|  | JIETU051                                   |                           |         |                               | File fold   |  | 5/18/20                  |                        |                     |       |                |
|  | AUTOEX                                     |                           | 1       | 10 KB                         | OBJ File  |  |                          | 022 4 🗸                |                     |       |                |
|  | <  |                           |         |                               |   |  |                          | >                      |                     |       |                |
|  | File name:                                 | AUTOEXEC                  |         |                               |   | 2  | Оре                      | en                     |                     |       |                |
|  | Files of type:                             | Object Files              | (*.obj) |                               |   | •  | Can                      | cel                    |                     |       |                |

3. Select OK in the pop-up window to load the example program.



| 📟 MM_Camera - CX-Programmer - [MM_Camera_CX.N               | ewProgram1.Section1 [Diagram]]                                      |
|---|---|
| 🕑 File Edit View Insert PLC Program Simul                   | ation Tools Window Help   |
| 0 🛩 🖬 🖓 🎒 🕼 🕺 🛍 📾 📾 🕰                                       | 으 🛯 🗛 🚟 🍇 🕼 🕕 🔋 🕺 📗 🛆 🎄 🐴 🛛 📆 🛼 💷 🖻 양                               |
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| ]] 藓 藓   亘 읠   ▲ % % %                                      |   |
| <u> </u>  | 0 [Program Name : NewProgram1]                                      |
| ⊡ ॡ NewProject  | [Section Name : Section1]   |
| □ 🎬 MM_Camera_CX[CJ2H] Offline                              |   |
|   |   |
|   |   |
| Settings  |   |
| Memory  |   |
| Programs  | CX-Programmer v9.7 X  |
| NewProgram1 (00)  |   |
| Bymbols   | Loading C:\Users\CTOS\Desktop\AUTOEXEC.OBJ to PLC                   |
|   | All existing programs and/or symbols will be deleted.               |
| END   |   |
| Function Blocks   |   |
|   | OK Cancel   |
|   |   |
|   |   |
|   | MECH MIND   |
|   |   |

## Download PLC Program

1. Right click on *MM\_Camera\_CX[CJ2H] Offline* and select **Work Online** in the context menu to switch the project to monitor mode.



| 📟 MM_Camera - CX-Programmer   |  |
|---|--|
| File Edit View Insert PLC Pr  | rogram Simulation Tools Window Help  |
| D 🗃 🖬 🗟 🎒 🗔 👗   | ▣ ▣     # ≂ % ¼   ① ? №   ] A &  |
| ] < ≪ < <   <b>⊞</b> 8 <b>⊞</b>  ¤  | ■ 〒      = □   □ ++ ++ ++ ++    ● 日 日 元 L L L      =    ◎  |
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| ]] 律 律   国 열   本 % % %  |  |
|   |  |
| NewProject MM_Camera_CX[CJ2H] O To Data Types Symbols IO Table and Unit Setures Settings Memory Programs NewProgram1 (00) Symbols CameraTest END E-T Function Blocks ObtainPose | Insert Program   Insert Program     Insert Program     Insert Program     Image: |
|   | Properties   |
|   | MECH MIND  |

2. Right click on MM\_Camera\_CX[CJ2H] Monitor Mode and select Transfer  $\rightarrow$  To PLC.



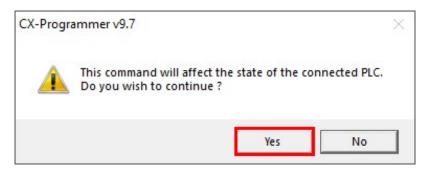
| ) 🚅 🖬 🙀 🎒 🔂 🐇 🖻                                 | B B 2 2 A # # % 0 ?                | 🛯 💦 🧶 📇 💁 🖑 II 🖸      |
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| <br>  |                                    |                       |
|   | <u> </u>                           |                       |
| - RewProject<br>□ IIII MM_Camera_CX[CJ2H] Monit | or Mode                            |                       |
| Data Types                                      | Change                             |                       |
| Symbols   | Insert Program                     | •                     |
| 🗊 IO Table and Unit Setup                       | 🙆 Work Online                      |                       |
| Memory card                                     | Start PLC-PT Integrated Simulation |                       |
| Error log                                       | 🖅 Work Onl <u>i</u> ne Simulator   |                       |
| 🕮 PLC Clock                                     | E PLC Error Simulator              | _                     |
| Programs  | Operating <u>M</u> ode             | •                     |
| 🖃 🤯 NewProgram1 (00) Ru                         | & Monitoring                       |                       |
|   |                                    | •                     |
| - 🛱 CameraTest                                  | Compile <u>A</u> ll PLC Programs   |                       |
| END   | Validate Symbols(ALL)              | -                     |
| E Function Blocks                               | Transfer                           |                       |
|   |                                    | ▶ Em To PLC 3         |
|   | မြို့ Compa <u>r</u> e Program     | Compare with PLC      |
|   | Х Cu <u>t</u>                      | To File               |
|   | ■ <u>C</u> opy                     | From File             |
|   | Paste Dalate                       |                       |
|   | Delete                             | -                     |
|   | Allow Docking                      |                       |
|   | Hide                               | _                     |
|   | Eloat In Main Window               |                       |
|   | Properties                         |                       |

3. Click on *OK* in the **Download Options** window.



| Download Options  | ×   |
|---|---|
| PLC: MM_Camera_CX   | OK  |
| Includ:<br>Program(s)/Network symbols<br>Settings   | Cancel  |
| Image: Symbol s         Image: Symbol | Transfer All  |
| <ul> <li>Clear program memor</li> <li>Clear automatic allocation area and</li> <li>Exclude Port(HostLink, Peripheral) of<br/>from the transfer target.<br/>(Check when transferring CPU unit se<br/>port settings changed by NT Link aut<br/>CPU unit parameter edit of CX-Integr</li> <li>Note: PLC Memory areas(CIO, Timer/Count<br/>memory, etc.) is not transferred. Pleas<br/>Memory areas from the PLC Memory window</li> </ul>   | of PLC Settings<br>rial comms<br>co-online or<br>ator.)<br>eer, Data<br>se transfer PLC |

4. Click on Yes if the safety of connected devices can be ensured. Click on OK after dowloading the program successfully.





| Download                             | ×         |
|--------------------------------------|-----------|
| Program Download to PLC MM_Camera_CX |           |
|                                      |           |
|                                      |           |
|                                      |           |
|                                      |           |
|                                      |           |
| Download successful                  |           |
|                                      |           |
|                                      | OK        |
|                                      | MECH MIND |

## 2.7.6 Test with Mech-Vision/Mech-Viz Project

This section introduces how to run the Mech-Vision/Mech-Viz project and obtain data from the project using the **ObtainPose** FB. For detailed information on the modules, please refer to stan-dard\_interface\_development\_profinet.

#### Prerequisites

- Mech-Vision project(s):
  - Executable

on

- Set to autoload
- The **Project list** in *Mech-Center*  $\rightarrow$  *Deployment Settings*  $\rightarrow$  *Mech-Vision* is synced by clicking

and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings |   |              | × |
|---------------------|---|--------------|---|
| Mech-Vision         | <ul> <li>✓ Use Mech-Vision</li> <li>Exec path</li> <li>Project path 11</li> <li>ID</li> <li>1</li> <li>2</li> </ul> | Project list |   |
|                     |   |              |   |



- Mech-Viz project:
  - Executable
  - Set to autoload
  - Contains a branch\_by\_service\_message Task that has been renamed to  ${\bf 1}.$

### Run Mech-Vision Project and Obtain Vision Points

#### **Parameter Settings**

- 1. Set the **ToCamera.COM\_ENABLE** to be **always ON**.
- 2. Double click on the **MOV** module, set the Mech-Vision project ID the same as the one set in **Deployment Settings** in Mech-Center. For example, if the monitor value is changed to 1, then Mech-Vision project No. 1 in the **Project list** of Mech-Center will be started.
- 3. Set the number of vision points to be sent by Mech-Vision. The default value of **REQ\_POSE\_NUM** is 0, which means the Mech-Vision project will send all the vision points.

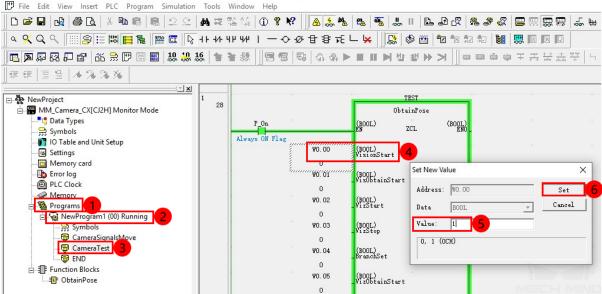
| P_On           | +          |    | <u>.</u> | *:        | * |                | 1                   |
|----------------|------------|----|----------|-----------|---|----------------|---------------------|
| Always ON Flag |            | а. | *        | ∳1        |   | MOV(021)       | Move<br>Source word |
|                | 23         | 2  |          | ₹2<br>900 | + | ToCamera.VIS   | Destination         |
|                |            | *  | ÷        | λ.        | * |                |                     |
|                |            |    | *        | •         |   | MOV(021)<br>&1 | Move<br>Source word |
|                | <b>.</b> . | 15 | 5.       | 52        |   | ToCamera.VIS   | Destination         |
|                |            |    | 2        | 20        |   | *              |                     |
| D15100.        |            |    |          |           | * | MOV(021)<br>&1 | Move<br>Source word |
|                |            | *  |          | *4        |   | ToCamera.REQ   | Destination         |
|                | D15100.00  | а  | 1        |           |   | ¥1.00          | HeartBeat           |
|                |            | 3  | .11      | 51        | * | ToCamera. COMM |                     |

### Start Mech-Vision Project

Open CX-Programmer, go to Programs → NewProgram1(00) Running and double click on CameraTest. Double click on the input port of VisionStart in the FB ObtainPose. Set the value to 1 in the Set New Value window and then click on Set to start Mech-Vision project and trigger camera to capture images. Then reset the value to 0.



MM\_Camera - CX-Programmer - [[Running] - MM\_Camera\_CX.NewProgram1.CameraTest [Diagram]]



2. Check returned status code: check the monitor value of **StatusCode**. **1102** represents that the Mech-Vision project was started successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.

|              | -                    | TEST    |                     |  |  |
|--------------|----------------------|---------|---------------------|--|--|
|              | ObtainPose           |         |                     |  |  |
|              | (BOOL)<br>EN         | ZCL     | (BOOL)<br>ENO       |  |  |
| WO.00        | (BOOL)<br>VisionStar | t       |                     |  |  |
| 1            |                      |         |                     |  |  |
| WO.01        | (BOOL)<br>VisObtainS | start   |                     |  |  |
| 0            |                      |         |                     |  |  |
| WO. 02       | (BOOL)<br>VizStart   |         |                     |  |  |
| 0            |                      |         |                     |  |  |
| WO. 03       | (BOOL)<br>VizStop    |         |                     |  |  |
| 0            | TALETOP              |         |                     |  |  |
| WO.04        | (BOOL)<br>BranchSet  |         |                     |  |  |
| 0            |                      |         |                     |  |  |
| WO.05        | (BOOL)<br>VizObtainS | *       |                     |  |  |
| 0            | . virobraine         | , car L |                     |  |  |
| FromCamera.D | (BOOL)<br>DataReady  |         |                     |  |  |
| 0            | nataveadà            |         |                     |  |  |
| FromCamera.S | (DINT)<br>StatusCode | 57<br>- |                     |  |  |
| +1102, D     | Stardscode           |         | And a second second |  |  |



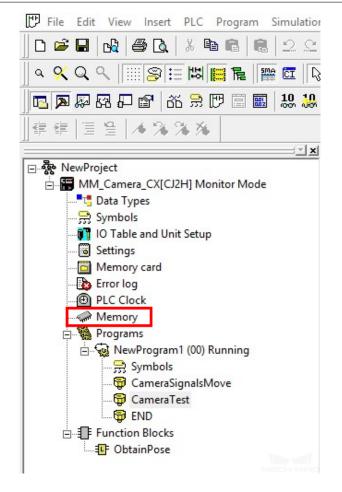
#### **Obtain Vision Points from Mech-Vision**

1. After the status code **1102** is returned, double click on the input port of **VisObtainStart** in the FB **ObtainPose**, and set the value to **1** in the **Set New Value** window and then click on *Set* to obtain vision points from Mech-Vision. Then reset the value to **0**. The result is shown as below. The value of SendPoseNum is 3, which means 3 vision points are obtained from Mech-Vision.

|              |                     | TEST       |               |
|--------------|---------------------|------------|---------------|
|              |                     | ObtainPose |               |
|              | (BOOL)<br>EN        | ZCL        | (BOOL)<br>ENO |
| WO. 00       | (BOOL)<br>VisionSta |            |               |
| 0            | _VisionSta          | rt         |               |
| WO.01        | (BOOL)<br>VisObtain |            |               |
| 1            | _ VISUDTAIN         | Start      |               |
| ¥0.02        | (BOOL)<br>VizStart  |            |               |
| 0            |                     |            |               |
| WO.03        | (BOOL)<br>VizStop   |            |               |
| 0            |                     |            |               |
| WO.04        | (BOOL)<br>BranchSet |            |               |
| 0            |                     |            |               |
| WO.05        | (BOOL)<br>VizObtain | Start      |               |
| 0            | - The second        | Juli       |               |
| FromCamera.D | (BOOL)<br>DataReady |            |               |
| 0            |                     |            |               |
| FromCamera.S | (DINT)<br>StatusCod | •          |               |
| +1100, D     | Diatascou           | 5          |               |
| DO           | (UINT)<br>BranchNam | ڻ<br>ه     |               |
| 80           | - Di atciti all     | -          |               |
| D1           | (UINT)<br>BranchPor | +          |               |
| 80           | and and a           | -          |               |
| FromCamera.S | (UINT)<br>SendPoseN | -          |               |
| 83           | Denti Osen          |            |               |
| WO.06        | (BOOL)<br>Reset     |            |               |
| 0            | ALESEL              |            |               |

2. Double click on **Memory** in the project workspace, and a **PLC Memory** window will appear.





3. Double click on **D**, set the **Start** to **10000**, click on **D**, **b** to set the data format as signed decimal and double word, and then click on **b** to start monitoring.



| E PLC Memory - NewPLC1 - [ | [D]          |              |          |          |           |         |
|----------------------------|--------------|--------------|----------|----------|-----------|---------|
| 🛹 File Edit View Grid      | Online V     | Vindow H     | elp      |          |           |         |
|                            | 8            |              |          |          |           |         |
| 2 🛄 10 10 3 6 a 皆          | 2 <b>2</b> w | <u>م الح</u> | <u> </u> |          |           |         |
|                            |              |              |          |          |           |         |
| ₩ <u><u></u></u>           |              |              |          |          |           |         |
|                            | Start        | 100          | 201 2 In | Off      | SetValue  |         |
| CJ2H - CPU65-EIP           | ChangeOr     | rder         | ForceOn  | ForceOff | ForceCanc | ĺ       |
| - CIO                      |              | +0           | +2       | +4       | +6        | +8      |
| - 🖓 A                      | D10000       | -4275767     | 5794439  | 575313   | 178914    | 11535   |
| — 🥋 Т                      | D10010       | 1785612      | -4016414 | 6552402  | 507487    | 1527968 |
| - 💮 C                      | D10020       | 3210         | -1786176 | -3978062 | 5152634   | 561197  |
| IR                         | D10030       | -1699805     | 29028    | 1792865  | 0         | 0       |
|                            | D10040       | 0            | 0        | 0        | 0         | 0       |
| DR                         | D10050       | 0            | 0        | 0        | 0         | 0       |
| - 😹 D 🚺                    | D10060       | 0            | 0        | 0        | 0         | 0       |
| TK                         | D10070       | 0            | 0        | 0        | 0         | 0       |
| - H                        | D10080       | 0            | 0        | 0        | 0         | 0       |
|                            | D10090       | 0            | 0        | 0        | 0         | 0       |
| - 🛹 W                      | D10100       | 0            | 0        | 0        | 0         | 0       |
| Ė                          | D10110       | 0            | 0        | 0        | 0         | 0       |
|                            | D10120       | 0            | 0        | 0        | 0         | 0       |
|                            | D10130       | 0            | 0        | 0        | 0         | 0       |
|                            | D10140       | 0            | 0        | 0        | 0         | 0       |
| E2                         | D10150       | 0            | 0        | 0        | 0         | 0       |
| E3                         | D10160       | 0            | 0        | 0        | 0 MEC     | 0       |

**Hint:** This example received 3 poses. Divide the transferred values by 10000 to obtain the actual pose data.

#### Run Mech-Viz Project and Obtain Planned Path

#### **Parameter Settings**

1. Open CX-Programmer, double click on input port of **Reset** in the **ObtainPose** FB, set the value to **1** in the **Set New Value** window and then click on *Set* to clear the previously obtained vision data. Then reset the value to **0**.



| PLC Memory - MM_Camera_   | CX - [D]         |           |          |          |           |    |
|---|------------------|-----------|----------|----------|-----------|----|
| File Edit View Grid C   | nline Wi         | ndow Help |          |          |           |    |
|   | 8                |           |          |          |           |    |
| 2 🛄 10 10 🔐 16 a 🖢  | 2W 4V            | 1 🗐 🔍     | <u> </u> |          |           |    |
| <u>a M B. J. C. S.</u>  |                  |           |          |          |           |    |
| <u>₩<u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u> |                  |           |          |          |           |    |
| × ×   | Start            | 1000      | 0 On     | Off      | SetValue  | 1  |
| CJ2H - CPU65-EIP  | ChangeO          | rder      | ForceOn  | ForceOff | ForceCanc | i  |
| CIO   |                  | +0        | +2       | +4       | +6        | +8 |
|   | <b>D</b> 40000   | +0        |          |          |           |    |
| — 🛹 Т   | D10000<br>D10010 | 0         | 0        | 0        | 0         | 0  |
| - c   | D10010           | 0         | 0        | 0        | 0         | 0  |
| - R   | D10020           | 0         | 0        | 0        | 0         | 0  |
| DR  | D10030           | 0         | 0        | 0        | 0         | 0  |
| - 🛃 D   | D10040           | 0         | 0        | 0        | 0         | 0  |
| TK  | D10060           | 0         | 0        | 0        | 0         | 0  |
|   | D10070           | 0         | 0        | 0        | 0         | 0  |
|   | D10080           | 0         | 0        | 0        | 0         | 0  |
| - 🔛 W   | D10090           | 0         | 0        | 0        | 0         | 0  |
| 🖮 🧰 E   | D10100           | 0         | 0        | 0        | 0         | 0  |
|   | D10110           | 0         | 0        | 0        | 0         | 0  |
| E1  | D10120           | 0         | 0        | 0        | 0         | 0  |
|   | D10130           | 0         | 0        | 0        | 0         | 0  |
| E3  | D10140           | 0         | 0        | 0        | 0         | 0  |
|   | D10150           | 0         | 0        | 0        | 0         | 0  |

- 2. Modify the value of D0 register, set the value of **BranchName** to 1.
- 3. Modify the value of D1 register, set the value of **BranchPort** to **1** , the Mech-Viz project will proceed along out port 1 of Task 1.

| ¥0.04        | (BOOL)<br>BranchSet    | 100 C      |         | 1.<br>1. |        |
|--------------|------------------------|------------|---------|----------|--------|
| 0            |                        |            |         |          |        |
| WO.05        | (BOOL)<br>VizObtainSta | r+         |         |          |        |
| 0            | Titoblambla            |            |         |          |        |
| FromCamera.D | (BOOL)<br>DataReady    |            |         |          |        |
| 0            |                        |            |         |          |        |
| FromCamera.S | (DINT)<br>StatusCode   |            |         |          |        |
| +1100, D     |                        | Set New Va | lue     |          | X      |
| DO           | (UINT)<br>BranchName   | Set New Va | lue     |          | ^      |
| &1           |                        | Address:   | D1      |          | Set    |
| D1<br>&O     | (UINT)<br>BranchPort   | Data       | UINT    |          | Cancel |
| 80           |                        | Data       | OTMI    |          |        |
| FromCamera.S | (UINT)<br>SendPoseNum  | Value:     | 1       |          |        |
| &3           |                        | 0 to 6553  | 5 (1CH) |          |        |
| ₩0.06        | (BOOL)<br>Reset        |            |         |          |        |
| 0            |                        | L          |         |          |        |



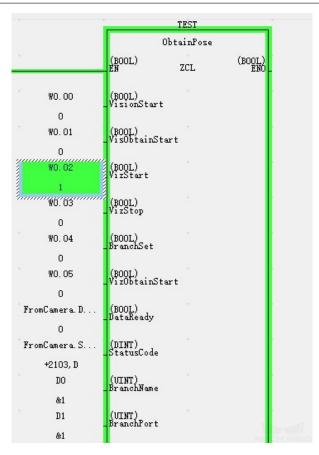
4. Set the value of REQ\_POSE\_TYPE to 1. This asks Mech-Viz to send joint positions (instead of TCP data).

| P_On           |           |   | *i         | *   | (A             | .[                  |
|----------------|-----------|---|------------|-----|----------------|---------------------|
| Always ON Flag | 21 - St   | * | \$7        |     | MOV(021)<br>&1 | Move<br>Source word |
| 5 - P          | S 2       | * | <b>*</b> 2 |     | ToCamera.VIS   | Destination         |
| 2 )e           | a a       |   | ×          | *   |                |                     |
| 8              |           | X |            |     | MOV(021)<br>&1 | Move<br>Source word |
| 0. 12          |           | * | •);        | 181 | ToCamera.VIS   | Destination         |
| 5              | 51 B      | * | 23         |     |                |                     |
| 8              |           | × | ÷.         |     | MOV(021)<br>&1 | Move<br>Source word |
| 5              | i i i     | • | *:         | *   | ToCamera.REQ   | Destination         |
| i ai           | D15100.00 | 1 | ¥.1        |     | ¥1.00          | - HeartBeat         |
|                | S 2       |   | \$3.       | *   | ToCamera. COMM |                     |

#### Start Mech-Viz Project

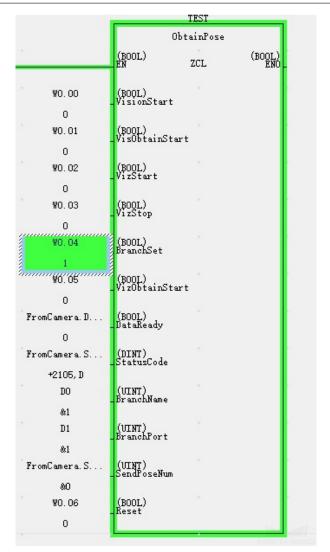
- 1. Double click on the input port of **VizStart** in the **ObtainPose** FB, set the value to **1** in the **Set New Value** window to start Mech-Viz project and then reset it to **0**.
- 2. If the value returned by the variable **StatusCode** is **2103**, it represents that the Mech-Viz project was started successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.





#### Select Branch in the Mech-Viz Project

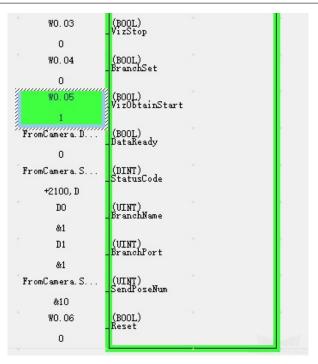
- 1. Double click on the input port of **BranchSet** in the **ObtainPose** FB, set the value to **1** in the **Set New Value** window to select branch in the Mech-Viz project and then reset it to **0**.
- 2. If the value returned by the variable **StatusCode** is **2105**, it represents that the branch was selected successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.



## **Obtain Planned Path**

- 1. Double click on the input port of **VizObtainStart** in the **ObtainPose** FB, set the value to **1** in the **Set New Value** window to obtain planned path from Mech-Viz project and then reset it to **0**.
- 2. If the value returned by the variable **StatusCode** is **2100**, it represents that planned path was obtained successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error. The value of **SendPoseNum** shows how many target points were received, and the target points are stored in **TargetPose**.





3. Go back to **PLC Memory** window, the 10 poses are shown as below. Please divide the transferred values by 10000 to obtain the actual pose data.



| PLC Memory - MM_Camera   | CX - [D]  |           |          |            |           |         |
|--------------------------|-----------|-----------|----------|------------|-----------|---------|
| Grid File Edit View Grid | Online Wi | ndow Help |          |            |           |         |
|                          |           |           |          |            |           |         |
| 2 🛄 10 10 🔐 16 a         | 2W 4V     | i 🗐 🔍     | <u> </u> |            |           |         |
|                          |           |           |          |            |           |         |
| ₩ <u>₹ 91 01</u> ×+      |           |           |          |            |           |         |
| <u>_</u>                 | Start     | 1000      | 0 On     | Off        | SetValue  | 1       |
| CJ2H - CPU65-EIP         | Change0   | rder      | ForceO   | n ForceOff | ForceCanc | ĺ       |
|                          |           | +0        | +2       | +4         | +6        | +8      |
|                          | D10000    | 740000    | 574700   | -521200    | 80000     | 246500  |
|                          | D10000    | 900000    | 1292518  | 825172     | -259905   | 35766   |
| C C                      | D10020    | 338369    | 1856696  | 1291698    | 791000    | -232961 |
| - R                      | D10030    | 35098     | 345613   | 1856680    | 740000    | 684700  |
| DR                       | D10040    | -31200    | 0        | 246500     | 900000    | 740000  |
|                          | D10050    | 574700    | -31200   | 0          | 246500    | 900000  |
| TK                       | D10060    | 600000    | 574700   | -31200     | 0         | 246500  |
|                          | D10070    | 900000    | 500000   | 574700     | -31200    | 0       |
|                          | D10080    | 246500    | 900000   | 400000     | 574700    | -31200  |
|                          | D10090    | 0         | 246500   | 900000     | 0         | 718643  |
| <b>⊡⊡</b> E              | D10100    | -52061    | 0        | 233418     | 900000    | 0       |
| E0                       | D10110    | 684720    | -31191   | 0          | 246471    | 900000  |
| E1                       | D10120    | 0         | 0        | 0          | 0         | 0       |
| E2                       | D10130    | 0         | 0        | 0          | 0         | 0       |
| E3                       | D10140    | 0         | 0        | 0          | 0         | 0       |
|                          | D10150    | 0         | 0        | 0          | 0         | 0       |

# 2.8 PROFINET - Siemens SIMATIC S7 PLC

This section provides information on setting up communication between a Siemens SIMATIC S7 PLC and Mech-Mind Software Suite via PROFINET.

## 2.8.1 Overview

- Hardware and Software Requirements
- Configure IPC and Initiate Communication
- Install GSD file and Configure Communication
- Import Example Program and Download to PLC
- Test with Mech-Vision/Mech-Viz Project



## 2.8.2 Hardware and Software Requirements

#### Hardware

- Siemens SIMATIC S7 PLC:
  - S7-300 (with PROFINET interface or CP 343-1 integrated to function as a PROFINET IO controller)
  - S7-400 (with PROFINET interface or CP 443-1 integrated to function as a PROFINET IO controller)
  - S7-1200
  - S7-1500
- AC 220 V to DC 24 V power adapter
- HMS IXXAT INpact 40 interface card installed on the IPC in Mech-Mind Vision System
- Switch
- Ethernet cables

#### Software

- Siemens TIA Portal V15.1
- Mech-Mind Software Suite: Mech-Center 1.5.1 or above, Mech-Vision 1.5.0 or above, and Mech-Viz 1.5.0 or above.
- VCI V4 (driver software for HMS IXXAT INpact 40 interface card)
- Mech-Mind GSD file:
  - File name: GSDML-V2.35-Mech-Mind Robotics Technologies Ltd-MechMind-PIR-20220315.xml (The version number and date in the file name may differ.)
  - File location: Mech-Mind/Mech-Center/mech\_interface/PROFINET (the installation directory of Mech-Center)

Note: Copy this file to the computer with Siemens TIA Portal installed.

- Example programs:
  - File name: **PLC sample.zip**
  - File location: Mech-Mind/Mech-Center/mech\_interface/documents/CN/Siemens PROFINET 编程指南 (the installation directory of Mech-Center)

**Note:** Copy this ZIP file to the computer with Siemens TIA Portal installed, and unzip it to get the following files: **Camera\_IO.scl**, **ObtainPose.scl**, **PLCTags.xlsx**.

**Note:** Connect the Mech-Mind Vision System IPC, computer with Siemens TIA Portal installed, and PLC to the same router.

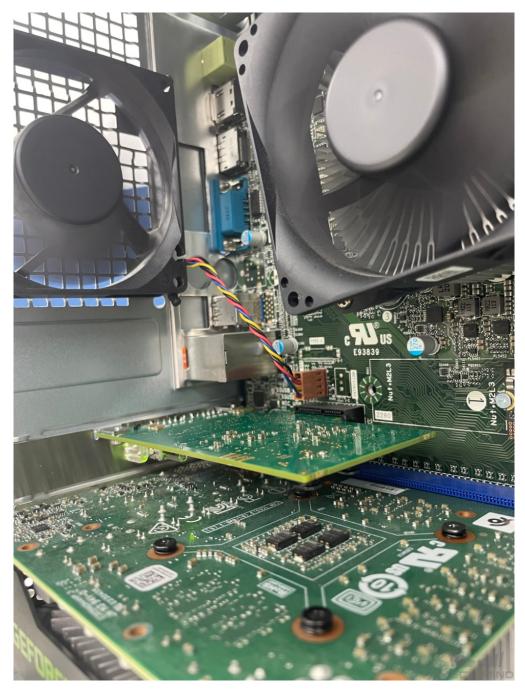




## 2.8.3 Configure IPC and Initiate Communication

## Check PCI-e Card and Driver Software

1. Check the PCI-e slot on the IPC and make sure the HMS IXXAT INpact 40 interface card is installed.



2. Make sure the driver software is installed on the IPC: in **Device Manager**, find **VCI4 INpact PCIe** under **IXXAT VCI V4 Interfaces**.



| 📇 Device Manager  |  | $\times$ |
|---|--|----------|
| File Action View Help   |  |          |
|   |  |          |
| V 🗄 DESKTOP-UBCLU3M   |  |          |
| > 🛄 Computer  |  |          |
| > 🔜 Disk drives   |  |          |
| > 🏣 Display adapters  |  |          |
| > 🕅 Human Interface Devices   |  |          |
| > 📷 IDE ATA/ATAPI controllers   |  |          |
| 🗸 🚍 IXXAT VCI V4 Interfaces   |  |          |
| 🚽 VCI4 INpact PCIe  |  |          |
| > 🔤 Keyboards   |  |          |
| > 🚺 Mice and other pointing devices   |  |          |
| > Monitors  |  |          |
| > 📮 Network adapters  |  |          |
| > 📃 Portable Devices  |  |          |
| > 🛱 Ports (COM & LPT)   |  |          |
| > 🚍 Print queues  |  |          |
| > Processors  |  |          |
| > Software devices  |  |          |
| > 👖 Sound, video and game controllers   |  |          |
| > 🍇 Storage controllers   |  |          |
| > 🏣 System devices  |  |          |
| > 🏺 Universal Serial Bus controllers  |  |          |
| Court - Management of Applied Court Applied Court Applied Court Applied Court |  |          |
|   |  |          |
|   |  |          |
|   |  |          |
|   |  |          |
|   |  |          |

## Configure Mech-Interface in Mech-Center

- 1. Open Mech-Center, and click on Deployment Settings.
- 2. Go to Mech-Interface, check Use Mech-Interface and select Standard Interface.



| Deployment Settings |                                | $\times$ |
|---------------------|--------------------------------|----------|
|                     |                                |          |
|                     | Vise Mech-Interface            |          |
|                     | Interface Service Type         |          |
|                     | Standard Interface     Adapter |          |
|                     |                                |          |
| Mech-Interface      |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     |                                |          |
|                     | Save                           | Cancel   |

3. In Interface Options, select **PROFINET-IRT**, and then click on *Save*.



| Deployment Settings |  |              |         |      | $\times$ |
|---------------------|--|--------------|---------|------|----------|
|                     |  |              |         |      |          |
|                     | ✓ Use Mech-Interface                           |              |         |      |          |
|                     | Interface Service Type<br>• Standard Interface |              | Adapter |      |          |
| Mech-Interface      | Interface Options                              | PROFINET-IRT |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         |      |          |
|                     |  |              |         | 2    |          |
|                     |  |              |         | Save | Cancel   |

4. Click on *Start Interface* in the Toolbar.

# 2.8.4 Install GSD file and Configure Communication

#### Create PLC Project and Set IP Address

Hint: If needed, click on *Save project* to save the changes to the project.

- 1. Open TIA Portal and click on **Create new project**.
- 2. Put in **Project name** and **Path**, and then click on *Create*. Click on **Open the project view** in the pop-up page.



| HA Si | emens         |   |                          |                    | _ # X                                   |
|-------|---------------|---|--------------------------|--------------------|---|
|       |               |   |                          |                    | Totally Integrated Automation<br>PORTAL |
| s     | tart          |   |                          | Create new project |   |
|       |               |   | Open existing project    | Project name:      | MM_Camera_EN                            |
|       |               |   | Open existing project    | Path:              | E:IProfinet test                        |
|       |               |   | 🔵 Create new project 🛛 🚺 | Version:           | V15.1 *                                 |
|       |               |   |                          | Author:            | admin                                   |
|       |               |   | Migrate project          | Comment:           |   |
|       |               |   |                          |                    |   |
|       |               | - |                          |                    | Y                                       |
|       |               |   |                          |                    | Greate                                  |
|       | Visualization | 1 | Welcome Tour             |                    |   |

3. In the **Project tree** panel, double-click on **Add new device**. In the new window, click on *Controller*, and find the CPU module you are using, and name it in **Device name**. Click on *OK* to confirm adding the device. Here, the device is named **PLC\_1**.

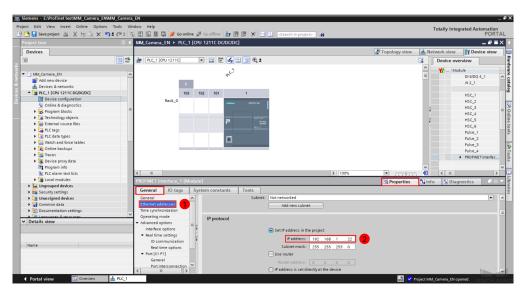
| Ж   | Siemens - E:\Profinet test\MM_Camera_EN\MM_Camera_EN  |                    |   |     |                                 |  |     |
|-----|---|--------------------|---|-----|---------------------------------|--|-----|
| P   | roject Edit View Insert Online Options Tools Window H | lelp               |   |     |                                 |  |     |
|     | 🛉 🎦 🗐 Save project 📑 🐰 🗐 🗊 🗙 🍤 ± (や ± 🐻 🛄 月           | 🛛 🔲 🖾 🕼 Go onlir   | ne 🔊 Go offline 🎝 🖪 🖪 🗶 🛁   | mir | Search in projec                | 15 Ba  |     |
| _   | Project tree  | Add new device     |   | _   |                                 | >  | K – |
|     |   | Device name:       |   |     |                                 |  |     |
|     | Devices   |                    |   | _   |                                 |  |     |
|     | 11 II I              | PLC_1              |   | _   |                                 |  |     |
|     |   |                    |   |     |                                 |  |     |
|     | MM_Camera_EN  |                    | Controllers     SIMATIC \$7-1200  | ^   | Device:                         |  |     |
| E I | Add new device  |                    |   |     |                                 | 10 Test  |     |
| N N | Devices & networks                                    |                    | CPU 1211C AC/DC/Rly   |     |                                 |  |     |
|     | Generation     Generation                             | Controllers        | CPU 1211C DC/DC/DC  |     |                                 | •  |     |
|     | Common data   |                    | 6ES7 211-1AD30-0XB0   |     |                                 | CPU 1211C DC/DC/DC   | I.  |
|     | Documentation settings                                |                    | 6ES7 211-1AE31-0XB0   |     |                                 | cro 1211c bobobc   | E   |
|     | Languages & resources                                 |                    | 6ES7 211-1AE40-0XB0   |     | Article no.:                    | 6ES7 211-1AE40-0XB0  | Ŀ   |
|     | Online access   | HM                 | CPU 1211C DC/DC/Rly      The control of the co |     |                                 |  | l.  |
|     | Card Reader/USB memory                                | HMI                | CPU 1212C ACDORI      CPU 1212C DC/DC/DC  |     | Version:                        | V4.2 💌   |     |
|     |   |                    | CPU 1212C DC/DC/Rly   | =   | Description:                    |  |     |
|     |   |                    | CPU 1214C AC/DC/Rly   |     | Work memory                     | 50 KB; 24VDC power supply with                                       |     |
|     |   |                    | CPU 1214C DC/DC/DC  |     | DI6 x 24VDC S                   | SINK/SOURCE, DQ4 x 24VDC and AI2                                     |     |
|     |   |                    | CPU 1214C DC/DC/Rly   |     | with digital si                 | igh-speed counters (expandable<br>gnal board) and 4 pulse outputs on |     |
|     |   | PC systems         | CPU 1215C AC/DC/Rly   |     | board; signal                   | board expands on-board I/O; up to                                    | b   |
|     |   |                    | CPU 1215C DC/DC/DC  |     |                                 | on; 0.04 ms/1000 instructions;                                       |     |
|     |   | 20                 | CPU 1215C DC/DC/Rly   |     | PROFINET inte<br>PLC to PLC cor | rface for programming, HMI and                                       |     |
|     |   | - TO -             | CPU 1217C DC/DC/DC      The control of the con |     | FLC to FLC Co                   |  |     |
|     |   |                    | CPU 1212FC DC/DC/Rly  |     |                                 | Short description of the   | dev |
|     |   | Drives             | CPU 1214FC DC/DC/DC   |     |                                 |  |     |
|     |   |                    | CPU 1214FC DC/DC/Rly  |     |                                 |  |     |
|     |   |                    | CPU 1215FC DC/DC/DC   |     |                                 |  |     |
|     |   |                    | CPU 1215FC DC/DC/Rly  |     |                                 |  |     |
|     | ✓ Details view  |                    | CPU SIPLUS  | ~   |                                 |  | E   |
|     |   |                    |   |     |                                 |  |     |
|     |   |                    |   |     |                                 | <b>U</b>   |     |
|     |   | 🔽 Open device view |   |     |                                 | OK Cancel  |     |
|     | Name  | - optimiter free   |   |     |                                 |  | ct  |
|     |   |                    |   |     |                                 |  |     |
|     | 1   | · · · · · · · · ·  | r 1   |     |                                 |  | -   |

4. In **Device view**, click on **Device** is **PLC\_1**. If you don't see the following interface, first click on **Device configuration** under **PLC\_1** in the **Project tree** panel, and then click on **Device view** tab on the right.



| Project Edit View Insert Online Options |        |                            | Go offline 🔐 🖪 🕼 🗙 🚍 | Search in project>                       |                                       | Totally Integ  | rated Automation<br>PORT/ |
|---|--------|----------------------------|----------------------|--|---------------------------------------|----------------|---------------------------|
| Project tree                            | □ < MM | I_Camera_EN → PLC_1 [CPU   | 1211C DC/DC/DC]      |  |                                       |                | _ • • • •                 |
| Devices                                 |        |                            |                      |  | 🛃 Topology view                       | A Network view | 🛐 Device view             |
| <u></u> B                               | 🔲 🖻 🏄  | PLC_1 [CPU 1211C]          | - 🗄 🖾 🎜 🗄 🛄 Q. ±     |  |                                       | Device over    | rview                     |
|   |        |                            |                      |  |                                       | A Mod          | ule                       |
| <ul> <li>MM_Camera_EN</li> </ul>        | ^      |                            | R.C.)                |  |                                       | -              |                           |
| Add new device                          |        |                            |                      |  |                                       |                | DI 6/DQ 4_1<br>AI 2_1     |
| d Devices & networks                    |        |                            |                      |  |                                       |                |                           |
| PLC_1 [CPU 1211C DC/DC/DC]              |        | 103 10                     | 02 101 1             |  |                                       |                | HSC 1                     |
| Device configuration                    |        | Rack 0                     |                      |  |                                       |                | HSC_2                     |
| Conline & diagnostics                   |        |                            | DEMON DESCRIPTION    |  |                                       |                | HSC_3                     |
| Program blocks                          |        |                            |                      |  |                                       |                | HSC 4                     |
| Technology objects                      |        |                            | *11                  |  |                                       |                | HSC_5                     |
| External source files                   |        |                            | i** :::::            | 2  |                                       | -              | HSC 6                     |
| PLC tags                                |        |                            |                      |  |                                       |                | Pulse 1                   |
| PLC data types                          |        |                            | 3                    |  |                                       |                | Pulse_2                   |
| Watch and force tables                  |        |                            |                      |  |                                       |                | Pulse 3                   |
| Online backups                          |        |                            |                      | -  |                                       |                | Pulse 4                   |
| Traces                                  |        |                            |                      |  |                                       |                | PROFINET interfac         |
| Device proxy data                       |        |                            |                      |  |                                       |                | - reorine rintenac        |
| 22 Program info                         |        |                            |                      |  |                                       | ~              | -                         |
| PLC alarm text lists                    | <      |                            |                      | > 100%                                   | · · · · · · · · · · · · · · · · · · · | . 🕘 < 💷        | >                         |
| Local modules                           | PRO    | OFINET interface 1 [Module | 1                    |  | Q Properties                          | Info Diagr     | nostics                   |
| Ungrouped devices                       |        |                            |                      |  | s Properties                          | Linto Diagr    | iostics                   |
| Security settings                       | G      | General IO tags Syst       | tem constants Texts  |  |                                       |                |                           |
| Unassigned devices                      | G      | Seneral A                  | Subnet               | Not networked                            |                                       |                |                           |
| Common data                             | 6      | themet addresses           |                      | Add new subnet                           |                                       |                |                           |
| Documentation settings                  | 1      | ime synchronization        |                      |  |                                       |                |                           |
| Languager & recourses                   | × 0    | Operating mode             | IP protocol          |  |                                       |                |                           |
| ✓ Details view                          | - A    | Advanced options           | ir protocor          |  |                                       |                |                           |
|   |        | Interface options          |                      | Set IP address in the project            |                                       |                |                           |
|   |        | Real time settings         |                      |  |                                       |                |                           |
|   |        | IO communication           |                      | IP address: 192 . 168 . 1 . 22           |                                       |                |                           |
| Name                                    |        | Real time options          |                      | Subnet mask: 255 . 255 . 255 . 0         |                                       |                |                           |
|   |        | • Port [X1 P1]             |                      | Use router                               |                                       |                |                           |
|   |        | General                    |                      |  |                                       |                |                           |
|   |        | Port interconnection       |                      | Router address: 0 . 0 . 0 . 0            |                                       |                |                           |
|   | <      |                            |                      | IP address is set directly at the device |                                       |                | line (                    |

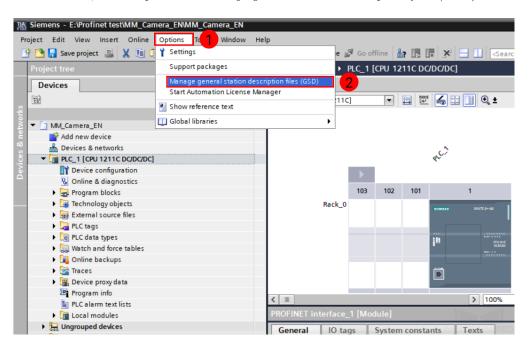
5. Down in the *Properties*  $\rightarrow$  *General* tab, click on **Ethernet address** to set the IP address of the PLC.





#### Install GSD File and Configure Network

1. In the menu bar, select  $Options \rightarrow Manage general station description files (GSD).$ 



2. In the pop-up window under **Installed GSDs** tab, click on … to the right of **Source path**. Locate the path where the Mech-Mind GSD file is stored. Check this file in **Content of imported path**, and then click on *Install*. Close the window after the installation completes.

| Manage general station description files                                  |         | ×        |
|---|---------|----------|
| Installed GSDs 1 in the project   |         |          |
| Source path: D:\Mech-Mind\Mech-Center\mech_interface\PROFINET             |         |          |
| Content of imported path  |         | 2        |
| 🗹 File  | Version | Language |
| GSDML-V2.35-Mech-Mind Robotics Technologies Ltd-MechMind-PIR-20220315.xml | V2.35   | English  |
|   |         |          |
| 3   |         |          |
|   |         |          |
|   |         |          |
|   |         |          |
|   |         |          |
|   |         |          |
|   |         |          |
| < III   | 4       | >        |
| Delete  | Install | Cancel   |

3. Return to Device configuration, and go to Network view tab. Click on Hardware catalog,



and double-click on **DAP** under *Other field devices/PROFINET IO/General/Mech-Mind Robotics Technologies Ltd/MechMind-PIR* to display **mechmind-pir** in **Network view**.

| MM_Camera_EN → Devices & networks     |                  |  | _ • • ×   | Hardware catalog 📰 🗊                            | •            |
|---------------------------------------|------------------|--|-----------|---|--------------|
|                                       | 🚰 Topology view  | 🚠 Network view 📗 1                     | vice view | Options   |              |
| Network Connections HMI connection    | • 🖬 🛛            | Network overview                       |           |   | Hardwa       |
|                                       | ^                | Y Device                               | Туре      | ✓ Catalog                                       | Wa           |
|                                       | =                | <ul> <li>\$7-1200 station_1</li> </ul> | \$7-120   | a [ 460 ]                                       | it ē         |
| PLC 1                                 |                  | ▶ PLC_1                                | CPU 12    | Filter Profile: <all></all>                     | a            |
| CPU 1211C                             |                  |  |           | Drives  |              |
|                                       |                  |  |           | Finders   | <u> </u>     |
|                                       |                  |  |           | Gateway   | 51           |
|                                       |                  |  |           | <ul> <li>✓ General</li> </ul>                   |              |
|                                       |                  |  |           | ABB Robotics                                    | nli          |
|                                       |                  |  |           | Graco Inc.                                      | ne           |
|                                       |                  |  |           | HMS Industrial Networks                         | Online tools |
|                                       |                  |  |           | IAl Corporation                                 | 5            |
|                                       |                  |  |           | Kistler Instrumente AG                          |              |
|                                       |                  |  |           |   | Tasks        |
|                                       |                  |  |           | MechMind-PIR                                    | as           |
|                                       |                  |  |           | DAP 3   | ks           |
|                                       |                  |  |           | SEIKO EPSON CORPORATION                         |              |
|                                       |                  |  |           | • 🛅 I/O   | ~ 💾          |
|                                       | ~                |  |           | Information                                     | - <u></u>    |
| < III > 100% <                        |                  | <                                      | >         |   | Libraries    |
| \$7-1200 station_1 [\$7-1200 Station] | 🔍 Properties     | 🚺 Info 🔒 🗓 Diagnostics                 |           | Device:   | <u> </u>     |
| General IO tags System constants T    | exts             |  |           |   |              |
| General                               |                  |  | ^         |   |              |
| General                               |                  |  |           |   | -            |
|                                       |                  |  |           |   | -            |
| Project information _                 |                  |  |           | DAP   |              |
|                                       |                  |  |           |   |              |
|                                       | Name: \$7-1200 s | tation_1                               |           | Article no.: MechMind-PIR                       |              |
| •                                     | Comment:         |  | ~         | Version: (GSDML-V2.35-MECH-MIND ROBOTIC         |              |
|                                       |                  |  |           |   |              |
|                                       |                  |  |           | Description:                                    |              |
|                                       |                  |  | ×         | Supports RT, IRT and non-cyclic communications. | ×1           |
| Desidence de ser                      |                  |  |           |   |              |
| Devices & ne                          |                  |  |           | 🔜 💙 The project MM_Camera_EN was saved          | ЛIND         |

4. In **Network view**, click on **ID** in **PLC\_1** and drag it to **ID** in **mechmind-pir**, and release the button when a black connection line appears.

| 鳽        | Siemens - E:\Profinet test\MM_Camera_EN\MM_Cam | iera_EN |                    |                 |                     |            |              |
|----------|--|---------|--------------------|-----------------|---------------------|------------|--------------|
|          | oject Edit View Insert Online Options Tools    |         | ·                  |                 |                     |            |              |
|          | 출 📑 🔚 Save project 📕 🐰 🏢 🛅 🗙 🏷 ± (여 ±          | 🖥 🛄 🖬   | 🖳 🔝 💋 Go or        | nline 🚀 Go offi | line 🔐 📘 📘          | × 🗄 🛄 🗠    | Search in    |
|          | Project tree                                   |         | MM_Camera_E        | N > Devices     | & networks          |            |              |
|          | Devices  |         |                    |                 |                     | 📲 Тор      | ology vi     |
|          | <br>Bř   | 🔲 🖻     | Network            | Connections     | HMI connection      | -          |              |
| orks     |  |         |                    |                 |                     |            |              |
| Ě.       | MM_Camera_EN                                   | ^       |                    |                 |                     |            |              |
| Ĕ        | 🌁 Add new device                               |         |                    | _               |                     |            |              |
| 8        | n Devices & networks                           |         | PLC_1<br>CPU 1211C |                 | mechmind-pir<br>DAP |            |              |
| <u>e</u> | ▼ 1 [CPU 1211C DC/DC/DC]                       |         | CPU 1211C          |                 |                     | MELCH MIND |              |
| Ş        | Device configuration                           |         |                    | -               | Not assigned        |            |              |
|          | 😼 Online & diagnostics                         |         |                    |                 |                     |            |              |
|          | Program blocks                                 | =       |                    |                 |                     |            |              |
|          | Technology objects                             |         |                    |                 |                     |            | _            |
|          | External source files                          |         |                    |                 |                     |            |              |
|          | PLC tags                                       |         |                    |                 |                     |            |              |
|          | PLC data types                                 |         |                    |                 |                     |            | -11          |
|          | Watch and force tables                         |         |                    |                 |                     |            |              |
|          |  |         |                    |                 |                     |            | COLUMN AND A |

A successful connection should look like this:



| oject Edit View Insert Online Options To<br>P 🔁 🔒 Save project 昌 🐰 🏥 🛅 🗙 崎 🛨 | ools Window Help<br>(* 2 🖥 🗓 🚰 🔛 🙀 💋 Go online 🖉 Go offline 🏭 🖪 🖪 🗶 🖃 🛄 | <search in<="" th=""></search> |
|--|---|--------------------------------|
| Project tree   | MM_Camera_EN > Devices & networks                                       |                                |
| Devices  |   |                                |
| <br>۲  | 🗐 🗟 💦 Network 👫 Connections 🛛 HMI connection 💌 🗛 F                      | Relations                      |
|  | <b>4</b>  | IO system                      |
| MM_Camera_EN   | <u>^</u>  |                                |
| 📑 Add new device   |   |                                |
| 🛱 Devices & networks   | PLC_1 mechmind-pir  | -                              |
| PLC_1 [CPU 1211C DC/DC/DC]   |   |                                |
| Device configuration   | PLC_1   | _                              |
| 🚱 Online & diagnostics   |   |                                |
| Program blocks   | E PLC_1.PROFINET IO-Syste   |                                |
| 🕨 🙀 Technology objects   | - FEG_T.FROT INETTO-System  |                                |
| External source files  |   |                                |
| 🕨 🌄 PLC tags   |   |                                |
| PLC data types   |   |                                |
| Watch and force tables   |   |                                |

5. Click on  $\blacksquare$  in mechanind-pir, down in the *Properties*  $\rightarrow$  *General* tab, click on Ethernet address to set the IP address of the IPC. This IP address should be in the same subnet as that of the PLC. Make sure Generate PROFINET device name automatically is checked.

| MM_Camera_EN      | • Device   | s& 1  | networks         |                  |         |                 |               |             |         |       |                |          | _∎≡×      |
|-------------------|------------|-------|------------------|------------------|---------|-----------------|---------------|-------------|---------|-------|----------------|----------|-----------|
|                   |            |       |                  |                  |         |                 | a To          | opology v   | iew     | 👗 N   | etwork view    | 🚺 Dev    | ice view  |
| Network           | onnections | HM    | connection       | Relation         |         | ₩ 🖽 🛄           | 🔍 ±           | -           |         | Netwo | rk overview    |          | • •       |
|                   |            |       |                  | <b>џ</b> IO sys  | tem: PL | C_1.PROFINE     | T IO-Syst     | em (100)    |         | 🐈 De  | vice           |          | Туре      |
|                   |            |       |                  |                  |         |                 |               |             | -       | -     | S7-1200 statio | on_1     | \$7-120   |
| PLC_1             |            | n     | mechmind-pir     | _                |         |                 |               |             |         |       | PLC_1          |          | CPU 12    |
| CPU 1211C         |            |       | DAP              |                  |         |                 |               |             |         | -     | GSD device_1   |          | GSD dev   |
|                   |            | E     | PLC_1            |                  |         |                 |               |             | -       |       | mechmind       | l-pir    | DAP       |
|                   |            |       |                  |                  |         |                 |               |             |         |       |                |          |           |
|                   |            |       |                  |                  |         |                 |               |             |         |       |                |          |           |
|                   | PLC        | _1.PR | ROFINET IO-Syste |                  |         |                 |               |             |         |       |                |          |           |
|                   |            |       |                  |                  |         |                 |               |             |         |       |                |          |           |
|                   |            |       |                  |                  |         |                 |               |             | _       |       |                |          |           |
| <                 |            |       |                  | > 1009           |         |                 |               |             | i i     | <     |                |          | >         |
| Interface [IE1]   |            |       |                  |                  | _       |                 |               | Properti    | _       | 1 Inf | o 👔 🖁 Dia      | gnostics | Ì∎∎▼      |
| General 10        | ) tags     | Syst  | tem constants    | Texts            |         |                 |               |             |         |       |                | -        |           |
| General           | ago [      | Π     |                  | . Chub           | 💿 Set I | IP address in t | the project   | t           |         |       |                |          | ^         |
| Ethernet addresse | es 1       |       |                  |                  | ~       | IP address      |               | 168.1       | .10     | 1     |                |          |           |
| Advanced options  |            |       |                  |                  |         | Subnet mask     | _             | 255 . 255   | _       |       |                |          |           |
|                   |            |       |                  |                  |         | chronize route  |               |             |         | _     |                |          |           |
|                   |            |       |                  |                  |         |                 | rsettings     | with to cor | troller | r     |                |          |           |
|                   |            |       |                  |                  |         | router          |               |             |         | -     |                |          | ≡         |
|                   |            |       |                  |                  |         | outer address   |               | 0.0         | . 0     |       |                |          |           |
|                   |            | •     |                  |                  | O IP ad | ddress is set o | directly at t | the device  |         |       |                |          |           |
|                   |            | •     | PROFINET         |                  |         |                 |               |             |         |       |                |          |           |
|                   |            |       |                  |                  | 🛃 Gene  | erate PROFINI   | ET device r   | name autoi  | matica  | ally  |                |          |           |
|                   |            |       | PROFIN           | IET device name: | mechm   | nind-pir        |               |             |         |       |                |          |           |
|                   |            |       | 0                | Converted name:  | mechm   | nind-pir        |               |             |         |       |                |          |           |
|                   |            |       |                  | Device number:   | 1       |                 |               |             |         |       |                |          | •         |
|                   |            |       |                  |                  |         |                 |               |             |         |       |                |          |           |
|                   |            |       |                  |                  |         |                 |               |             |         |       |                |          | shi Mir 🗸 |

6. Click on the green connection line, and then click on  $\mathbf{\underline{w}}$ .



| Siemens - E:\Profinet test\MM_Camera_EN\MM_Camera_E | EN     |   |
|---|--------|---|
| Project Edit View Insert Online Options Tools Wind  | low He | elp   |
| 📑 🎦 🛃 Save project 📑 🐰 🗉 🗊 🗙 🏷 🛨 🌁                  |        | 📱 🖫 💋 Goonline 🖉 Gooffline   🏭 🖪 🖪 🕺 🚍 🛄 <earch in="" project=""> 🖓</earch> |
| Project tree  |        | MM_Camera_EN      Devices & networks  |
| Devices   |        |   |
| - ES  | 💷 🛃    | 💦 Network 🔛 Connections 🕅 Connection 💌 🗛 Relations 🕎 😨 🖽 🛄 👁                |
| ž   |        | 4 IO system - PLC_1.PROFINET IO   |
| 💈 🔻 📄 MM_Camera_EN                                  | ^      | s <u>2</u>  |
| 🚆 📑 Add new device                                  |        |   |
| 😤 📩 Devices & networks                              |        | PLC_1 mechmind-pir  |
| 🗄 🔻 🛅 PLC_1 [CPU 1211C DC/DC/DC]                    |        | CPU 1211C   |
| Device configuration                                |        | PLC_1   |
| Online & diagnostics                                |        |   |
| Program blocks                                      | =      | PLC 1.PROFINETIO-Syste  |
| Technology objects                                  | -      | PLC_1.PROFINETIO-Syste  |
| External source files                               |        |   |
| PLC tags  |        |   |
| LG PLC data types                                   |        | MECH MIND   |
|   |        |   |

- 7. In the pop-up window, select **mechmind-pir** for **PROFINET device name**, and then click on *Update list*.
- 8. When the device appears in the list, check whether the **PROFINET device name** is **mechmindpir**. If not, click on *Assign name*. Once **Status** is **OK**, click on *Close* to close the window.

|                     |                          | Configure d DDOE      |                    |                           |        |             |
|---------------------|--------------------------|-----------------------|--------------------|---------------------------|--------|-------------|
|                     |                          | Configured PROFI      |                    |                           |        |             |
|                     |                          | PROFINET device       |                    | mind-pir                  |        |             |
|                     |                          | Devic                 | e type: DAP        |                           |        |             |
|                     |                          | Online access         |                    |                           |        |             |
|                     |                          | Type of the PG/PC int | erface: 🖳 PN/      | IE                        |        |             |
|                     |                          | PG/PC int             | erface: 🔝 Rea      | ltek PCIe GbE Family Cont | roller | - 🖲 🖪       |
|                     |                          | Device filter         |                    |                           |        |             |
|                     |                          | 🛃 Only show de        | evices of the sam  | e type                    |        |             |
|                     |                          | Only show de          | evices with bad pa | arameter settings         |        |             |
|                     |                          | _ ·                   | evices without na  | -                         |        |             |
|                     |                          | _ Only show de        | evices without ha  | ines.                     |        |             |
|                     | Accessible devi          | ices in the network:  |                    |                           |        |             |
|                     | IP address               | MAC address           | Device             | PROFINET device name      | Status |             |
|                     | 192.168.1.10             | 00-30-11-37-47-69     | MechMind-PIR       | mechmind-pir              | 💙 ОК   |             |
|                     |                          |                       |                    |                           |        |             |
|                     |                          |                       |                    |                           |        |             |
|                     |                          |                       |                    |                           |        |             |
| 🔤 Flash LED         |                          |                       |                    |                           |        |             |
|                     | <                        |                       |                    |                           |        | _           |
|                     |                          |                       |                    | Update                    | liet   | Assign name |
|                     |                          |                       |                    | opulate                   |        | Assignmente |
|                     |                          |                       |                    |                           | 2      |             |
|                     |                          |                       |                    |                           | -      |             |
| nline status inform | ation:                   |                       |                    |                           |        |             |
| Search comp         | leted. 1 of 2 devices we | ere found.            |                    |                           |        |             |
| Search comp         | leted. 1 of 2 devices we | ere found.            |                    |                           |        |             |
| Search comp         | leted. 1 of 2 devices we | ere found.            |                    |                           |        |             |
|                     |                          |                       | Ш                  |                           |        | >           |
|                     |                          |                       |                    |                           |        |             |
|                     |                          |                       |                    |                           |        |             |
|                     |                          |                       |                    |                           |        |             |

9. Double-click on **mechmind-pir** to enter **Device view**. You can see all the available modules listed.



|            | Wice overview Module CONTROL_INPUT_1 | Rack |      |                     |               |
|------------|--------------------------------------|------|------|---------------------|---------------|
| anning his |                                      |      | Slot | I address Q address | Type          |
|            |                                      | 0    | 1    | 1                   | CONTROL_INPUT |
| admin.     | CONTROL_I_RESV_1                     | 0    | 2    | 2                   | CONTROL_I_RE  |
|            | CALIB_ROB_STATUS_1                   | 0    | 3    | 64                  | CALIB ROB ST  |
| ne         | ROBOT_POSE_TYPE_1                    | 0    | 4    | 65                  | ROBOT_POSE    |
|            | REQ POSE NUM 1                       | 0    | 5    | 66                  | REQ POSE NUM  |
|            | REQ_POSE_TYPE_1                      | 0    | 6    | 67                  | REQ_POSE_TYPE |
|            | VISION_PROJ_NUM_1                    | 0    | 7    | 68                  | VISION_PROJ   |
|            | VISION_RECP_NUM_1                    | 0    | 8    | 69                  | VISION_RECP   |
|            | VIZ_TASK_NAME_1                      | 0    | 9    | 70                  | VIZ_TASK_NAME |
|            | VIZ_TASK_VALUE_1                     | 0    | 10   | 71                  | VIZ_TASK_VAL  |
|            | RESV_INPUT_1_1                       | 0    | 11   | 7275                | RESV_INPUT_1  |
|            | RESV_INPUT_2_1                       | 0    | 12   | 7679                | RESV_INPUT_2  |
|            | RESV_INPUT_3_1                       | 0    | 13   | 8083                | RESV_INPUT_3  |
|            | RESV_INPUT_4_1                       | 0    | 14   | 8487                | RESV_INPUT_4  |
| ,          | COMMAND_1                            | 0    | 15   | 8891                | COMMAND       |
|            | ROBOT_POSE_JPS_1                     | 0    | 16   | 92115               | ROBOT_POSE    |
|            | ROBOT_POSE_TCP_1                     | 0    | 17   | 116139              | ROBOT_POSE    |
|            | EXT_INPUT_DATA_1                     | 0    | 18   | 140179              | EXT_INPUT_DA  |
|            | CONTROL_OUTPUT_1                     | 0    | 19   | 1                   | CONTROL_OU    |
|            | CONTROL_O_RESV_1                     | 0    | 20   | 2                   | CONTROL_O_R   |
|            | CALIB_CAM_STATUS_1                   | 0    | 21   | 68                  | CALIB_CAM_S   |
|            | SEND_POSE_NUM_1                      | 0    | 22   | 69                  | SEND_POSE_N   |
|            | SEND_POSE_TYPE_1                     | 0    | 23   | 70                  | SEND_POSE_T   |
|            | VISUAL_PT_INDEX_1                    | 0    | 24   | 71                  | VISUAL_PT_IN  |
|            | DO_LIST_1                            | 0    | 25   | 310                 | DO_LIST       |
|            | DI_LIST_1                            | 0    | 26   | 1118                | DI_LIST       |
|            | NOTIFY_MSG_1                         | 0    | 27   | 7275                | NOTIFY_MSG    |
|            | RESV_OUTPUT_1_1                      | 0    | 28   | 7679                | RESV_OUTPUT_1 |
| ► 100%     | RESV_OUTPUT_2_1                      | 0    | 29   | 8083                | RESV_OUTPUT_2 |

### Download Hardware Configuration to PLC

1. In **Project tree** panel, right-click on **PLC\_1**, and select *Download to device*  $\rightarrow$  *Hardware configuration*.



| K Siemens - E:\Profinet test\W                                    | 1M_Camera_EN\MM_Camera_      | EN         |                                      |
|---|------------------------------|------------|--------------------------------------|
| Project Edit View Insert  | Online Options Tools Wind    | dow He     | lp                                   |
| 📑 📑 🔚 Save project 昌 🐰  |                              |            | 🖳 🔝 💋 Go online 🖉 Go offline   🏦 🖪   |
|   |                              |            |                                      |
| Project tree  |                              |            | MM_Camera_EN → Ungrouped devices →   |
| Devices   |                              |            |                                      |
| Ê   |                              | 💷 🛃        | 🔐 🚾 mechmind-pir [DAP]               |
| ž   |                              |            |                                      |
| MM_Camera_EN  |                              | ^          |                                      |
| Add new device  |                              |            | Rectminder                           |
| Devices & networks  |                              |            | mint                                 |
| PLC_1 [CPU 1211C DC   |                              |            | nech                                 |
| Device configurati  |                              |            | Print preview                        |
| Conline & diagnost  |                              |            | Export CAx data                      |
| <ul> <li>Online &amp; diagnost</li> <li>Program blocks</li> </ul> | Open in new editor           |            | Export module labeling strips        |
| <ul> <li>Frogram blocks</li> <li>Technology object</li> </ul>     |                              | F7         |                                      |
| External source file  |                              |            | Reperties Alt+Enter                  |
|   | 90                           | Ctrl+X     |                                      |
| PLC tags     PLC data types                                       | Copy                         | Ctrl+C     |                                      |
|   | 📺 Paste                      | Ctrl+V     |                                      |
| Watch and force ta  | X Delete                     | Del        |                                      |
| <ul> <li>Online backups</li> <li>Traces</li> </ul>                | Rename                       | F2         |                                      |
|   | 🚽 Go to topology view        |            |                                      |
| Device proxy data     Program info                                | Go to network view           |            |                                      |
| PLC alarm text list   | Compile                      | •          |                                      |
| <ul> <li>FLC alarm text list</li> <li>In Local modules</li> </ul> | Download to device           |            | Hardware and software (only changes) |
| <ul> <li>Distributed I/O</li> </ul>                               | Backup from online device    |            | Hardware configuration               |
|   | So online                    | <b>a</b> 2 | Software (only changes)              |
| Ungrouped devices   | Go offline                   | Ctrl+M     | Software (all)                       |
| Security settings   | 🗓 Online & diagnostics       | Ctrl+D     |                                      |
| Common data   | Snapshot of the actual value | ec         |                                      |
| Languages & resource  |                              |            |                                      |
| <ul> <li>Online access</li> </ul>                                 | Load start values as actual  |            |                                      |
|   | Copy snapshots to start valu |            |                                      |
| ✓ Details view  | ata Compare                  |            |                                      |
| Module  | Search in project            | Ctrl+F     |                                      |
|   |                              |            |                                      |
| News  | Cross-references             | F11        |                                      |
| Name  | Call structure               |            | 00%                                  |
| Device configuration  | Assignment list              |            |                                      |
| Online & diagnosti  | 🗞 Update program             |            | m consta                             |
| <ul> <li>Portal view</li> </ul>                                   | 昌 Print                      | Ctrl+P     | MECH                                 |
|   |                              |            |                                      |

2. In the pop-up window, select **Show all compatible devices** for **Select target device**, and then click on *Start search*.



| Extended do   | wnload to   | device                |                          |        |                   |                      |                      |
|---------------|-------------|-----------------------|--------------------------|--------|-------------------|----------------------|----------------------|
|               |             | Configured access n   | odes of "PLC_1"          |        |                   |                      |                      |
|               |             | Device                | Device type              | Slot   | Interface type    | Address              | Subnet               |
|               |             | PLC_1                 | CPU 1211C DC/D           | 1 X1   | PN/IE             | 192.168.1.22         | PN/IE_1              |
|               |             |                       | Type of the PG/PC inte   | rface: | PN/IE             |                      |                      |
|               |             |                       | PG/PC inte               |        |                   | bE Family Controller |                      |
|               |             | Cor                   | nnection to interface/su |        | Direct at slot '1 | x1'                  | • •                  |
|               |             |                       | 1st gat                  | eway:  |                   |                      | -                    |
|               |             | Select target device: |                          |        |                   | Show all compatible  | devices 💌            |
|               |             | Device                | Device type              |        | 2 T               | dress                | Target device        |
| на.<br>  <br> |             | -                     | -                        | PN/IE  | Act               | ess address          | -                    |
| Flash L       | ED          |                       |                          |        |                   |                      |                      |
|               |             |                       |                          |        |                   |                      | <u>S</u> tart search |
| Online status | information | :                     |                          |        |                   | Display only error   | messages 2           |
|               |             |                       |                          |        |                   |                      |                      |
|               |             |                       |                          |        |                   |                      |                      |
|               |             |                       |                          |        |                   | Load                 | <u>C</u> ancel       |

3. Select the corresponding device in the search result, and click on Load.



| xtended download to  | device                          |                         |         |                |                       |                      |
|--|---------------------------------|-------------------------|---------|----------------|-----------------------|----------------------|
|  | Configured access nod           | es of "PLC_1"           |         |                |                       |                      |
|  | Device                          | Device type             | Slot    | Interface typ  | e Address             | Subnet               |
|  | PLC_1                           | CPU 1211C DC/D          | 1 X1    | PN/IE          | 192.168.1.22          | PN/IE_1              |
|  |                                 | Type of the PG/PC inter | face:   | PN/IE          |                       |                      |
|  |                                 | PG/PC inter             | face:   | Realtek PCIe   | GbE Family Controller |                      |
|  | Conn                            | ection to interface/su  | bnet:   | Direct at slot | '1 X1'                | •                    |
|  |                                 | 1st gate                | eway:   |                |                       |                      |
|  | Select target device:<br>Device | Device type             | Interfa | ice type A     | Show all compatible   | e devices 🔹          |
| ····   | PLC_1                           | CPU 1211C DC/D          | PN/IE   | 1              | 92.168.1.22           | PLC_1                |
| 5  | -                               | -                       | PN/IE   | /              | Access address        | -                    |
| Flash LED  |                                 |                         |         |                |                       |                      |
|  |                                 |                         |         |                |                       | <u>S</u> tart search |
| Online status information:   | :                               |                         |         |                | Display only error    | messages             |
| 🚹 Found accessible dev   |                                 |                         |         |                |                       | ^                    |
| Scan completed. 1 co   |                                 | ccessible devices fou   | nd.     |                |                       | =                    |
| <ul> <li>Retrieving device info</li> <li>Scan and information</li> </ul> |                                 |                         |         |                |                       | 2 ~                  |
|  |                                 |                         |         |                | Loa                   | _                    |

## **Check Communication**

1. Return to the project, and click on **PLC\_1** in the **Project tree** panel. Then, click on *Go online* in the toolbar.



| Project Edit View Insert Online Options Tools Window Help   |               |
|---|---------------|
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| Project tree II   |               |
| Devices   |               |
|   |               |
| 📓 🗃 🔐 (mechmind-pir [DAP] 🔍 🖽 💹 🍙   | 🛄 🔍 ±         |
| **  |               |
| MM_Camera_EN  |               |
| Add new device  |               |
| MM_Camera_EN     Add new device     Devices & networks     Urit CPU 1211C DC/DC/DC     Mathematical Statement (Statement (Stat  |               |
|   |               |
| Device configuration  |               |
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| Karal Sector Secto | 1             |
| External source files   | IIND          |
| Cardination and a second se   |               |
| Call PLC data types      Match and force tables   |               |
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| Carline backups      Carline backups      Carline backups   |               |
| Industry  |               |
| Program info  |               |
| LC alarm text lists   |               |
| Local modules   |               |
| Distributed I/O   |               |
| Ungrouped devices   |               |
| ► Security settings   |               |
| ▶ 🙀 Common data   |               |
| Impocumentation settings  |               |
| 🕨 🔚 Languages & resources   |               |
| Dine access   |               |

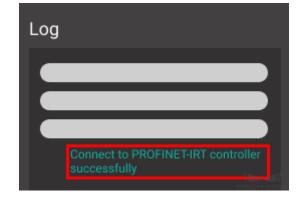
2. In the **Project tree** panel, click on **Device configuration**, and then click on **Device view** tab on the right. Select **mechmind-pir**. In **Device overview**, check marks with a green background in front of module names indicate normal connection.

|                                  |          |                | 📲 Top         | ology vie | w 🚠  | Network   | view      | Device view   | -   |
|----------------------------------|----------|----------------|---------------|-----------|------|-----------|-----------|---------------|-----|
| mechmind-pir [DAP] 💌 📃 🕎 🐇 🛄 🍳 生 | 3        | Device overvie | w             |           |      |           |           |               | -   |
|                                  | <u> </u> | Wodule         |               | Rack      | Slot | I address | Q address | Туре          | Ų   |
| methodate                        |          | CON            | ROL_INPUT_1   | 0         | 1    |           | 1         | CONTROL_INPUT | r . |
| indt                             | =        | CON            | ROL_I_RESV_1  | 0         | 2    |           | 2         | CONTROL_I_RE  | į   |
| ath                              |          | CALIE          | ROB_STATUS_1  | 0         | 3    |           | 64        | CALIB_ROB_ST  |     |
|                                  |          | ROB(           | T_POSE_TYPE_1 | 0         | 4    |           | 65        | ROBOT_POSE    |     |
|                                  | 2        | REQ_           | POSE_NUM_1    | 0         | 5    |           | 66        | REQ_POSE_NUM  | Л   |
|                                  |          | REQ_           | POSE_TYPE_1   | 0         | 6    |           | 67        | REQ_POSE_TYPE |     |
|                                  |          |                | N_PROJ_NUM_1  | 0         | 7    |           | 68        | VISION_PROJ   |     |
|                                  |          |                | N_RECP_NUM_1  | 0         | 8    |           | 69        | VISION_RECP   |     |
|                                  | 2        | VIZ_1          | ASK_NAME_1    | 0         | 9    |           | 70        | VIZ_TASK_NAME | ĺ   |
|                                  |          | VIZ_1          | ASK_VALUE_1   | 0         | 10   |           | 71        | VIZ_TASK_VAL  |     |
|                                  |          | RESV           | _INPUT_1_1    | 0         | 11   |           | 7275      | RESV_INPUT_1  |     |
|                                  |          | RESV           | _INPUT_2_1    | 0         | 12   |           | 7679      | RESV_INPUT_2  |     |
|                                  |          | RESV           | _INPUT_3_1    | 0         | 13   |           | 8083      | RESV_INPUT_3  |     |
|                                  |          |                | _INPUT_4_1    | 0         | 14   |           | 8487      | RESV_INPUT_4  |     |
|                                  |          |                | MAND_1        | 0         | 15   |           | 8891      | COMMAND       |     |
|                                  | _        |                | T_POSE_JPS_1  | 0         | 16   |           | 92115     | ROBOT_POSE    | į   |
|                                  |          | ROBO           | T_POSE_TCP_1  | 0         | 17   |           | 116139    | ROBOT_POSE    | ĺ   |
|                                  |          | EXT_           | NPUT_DATA_1   | 0         | 18   |           | 140179    | EXT_INPUT_DA  |     |
|                                  |          | CON            | ROL_OUTPUT_1  | 0         | 19   | 1         |           | CONTROL_OU    |     |
|                                  |          | CON            | ROL_O_RESV_1  | 0         | 20   | 2         |           | CONTROL_O_R   | ĺ   |
|                                  |          |                | CAM_STATUS_1  | 0         | 21   | 68        |           | CALIB_CAM_S   |     |
|                                  |          | SEN0           | _POSE_NUM_1   | 0         | 22   | 69        |           | SEND_POSE_N   | ĺ   |
|                                  |          | SEND           | POSE_TYPE_1   | 0         | 23   | 70        |           | SEND_POSE_T   | j   |
|                                  |          |                | AL_PT_INDEX_1 | 0         | 24   | 71        |           | VISUAL_PT_IN  |     |
|                                  |          | 🗹 DO_l         | .IST_1        | 0         | 25   | 310       |           | DO_LIST       |     |
|                                  |          | V DI_LI        | ST_1          | 0         | 26   | 1118      |           | DI_LIST       |     |
|                                  |          | моті           | FY_MSG_1      | 0         | 27   | 7275      |           | NOTIFY_MSG    |     |
|                                  |          |                | _OUTPUT_1_1   | 0         | 28   | 7679      |           | RESV_OUTPUT_1 | Í   |
|                                  | ~        |                | _OUTPUT_2_1   | 0         | 29   | 8083      |           | RESV_OUTPUT_2 | 2   |
| > 100%                           | 🗉 👘      | <              |               |           |      |           |           | >             | į   |

3. The PLC is successfully connected to Mech-Center if the following message is displayed in Mech-Center Log panel:

Connect to PROFINET-IRT controller successfully





Note: If you don't see this log message, please check if:

- The hardware are properly connected;
- If Mech-Interface has been started by clicking on *Start Interface* in the Toolbar;
- If the hardware configuration has been downloaded to the PLC.

# 2.8.5 Import Example Program and Download to PLC

**Note:** Before you add the example program to a project already in use, it is recommended to import it to a new project and test it first. In the following steps, the project created earlier is used to import and test the example program.

#### Import Example Program Files

1. Select **PLC\_1** in the **Program tree** panel, and then click on *Go offline* in the toolbar.



| Kiemens - E:\Profinet test\MM_Camera_EN\MM_Camera           | ra_EN               |   |
|---|---------------------|---|
| Project Edit View Insert Online Options Tools V             | Mindow Hel          | p   |
| 📑 🍞 🔜 Save project 🚐 🐰 🏥 🖆 🗙 🏷 🛨 📿 🗄                        | 유 10 16             | 🖳 🙀 💋 Go online 💋 Go offline 🛔 🖪 🖪 🥵 📥 🛄 <earch in="" proj<="" td=""></earch> |
| Project tree  |                     | MM_Camera_EN   Ungrou   |
| Devices   |                     |   |
|   | 💷 🖻                 | 🔐 mechmind-pir [DAP] 🔻 🖽 🕎 💥 🖌 🔛 🔍 🛨  |
| 2   |                     |   |
|   |                     |   |
| ₹ MM_Camera_EN  | <b>2</b> • <b>^</b> | metrointerit  |
| Add new device  |                     | wind.   |
| Devices & networks  |                     | rectivi   |
| Device configuration  |                     |   |
| Configuration   |                     |   |
| Grine & diagnostics   |                     |   |
| Technology objects  |                     |   |
| External source files                                       |                     |   |
| <ul> <li>La PLC tags</li> </ul>                             |                     |   |
| Let ags      Let ags      Let ags      Let ags      Let ags | -                   |   |
| Watch and force tables                                      |                     |   |
| Online backups  |                     |   |
| Traces  |                     |   |
| Device proxy data   |                     |   |
| Program info  |                     |   |
| PLC alarm text lists  |                     |   |
| Local modules   | <b>V</b>            |   |
| Distributed I/O   | <b>_</b>            |   |
| Ungrouped devices   |                     |   |
| Security settings   |                     |   |
| Common data   |                     |   |
| Documentation settings                                      |                     |   |
| Languages & resources                                       |                     |   |
| Online access   | ~                   | MECH MIND   |

2. In **Network view**, double-click on **mechmind-pir** to enter **Device view**. Change the I addresses and Q addresses according to your actual needs. Here, **500** is used as the lowest module start address.

**Note:** For a module occupying multiple bytes, the addresses assigned must be continuous, and the module start address must be of an even number.



|   | vice overview      |      |      |           |           |                  |             |               |         |  |
|---|--------------------|------|------|-----------|-----------|------------------|-------------|---------------|---------|--|
| 4 | Module             | Rack | Slot | I address | Q address |                  | Article no. | Firmware      | Comment |  |
|   | CONTROL_INPUT_1    | 0    | 1    |           | 500       | CONTROL_INPUT    |             |               |         |  |
|   | CONTROL_I_RESV_1   | 0    | 2    |           | 501       | CONTROL_I_RESV   |             |               |         |  |
|   | CALIB_ROB_STATUS_1 | 0    | 3    |           | 502       | CALIB_ROB_STATUS |             |               |         |  |
|   | ROBOT_POSE_TYPE_1  | 0    | 4    |           | 503       | ROBOT_POSE_TYPE  |             |               |         |  |
|   | REQ_POSE_NUM_1     | 0    | 5    |           | 504       | REQ_POSE_NUM     |             |               |         |  |
|   | REQ_POSE_TYPE_1    | 0    | 6    |           | 505       | REQ_POSE_TYPE    |             |               |         |  |
|   | VISION_PROJ_NUM_1  | 0    | 7    |           | 506       | VISION_PROJ_NUM  |             |               |         |  |
|   | VISION_RECP_NUM_1  | 0    | 8    |           | 507       | VISION_RECP_NUM  |             |               |         |  |
|   | VIZ_TASK_NAME_1    | 0    | 9    |           | 508       | VIZ_TASK_NAME    |             |               |         |  |
|   | VIZ_TASK_VALUE_1   | 0    | 10   |           | 509       | VIZ_TASK_VALUE   |             |               |         |  |
|   | RESV_INPUT_1_1     | 0    | 11   |           | 510513    | RESV_INPUT_1     |             |               |         |  |
|   | RESV_INPUT_2_1     | 0    | 12   |           | 514517    | RESV_INPUT_2     |             |               |         |  |
|   | RESV_INPUT_3_1     | 0    | 13   |           | 518521    | RESV_INPUT_3     |             |               |         |  |
|   | RESV_INPUT_4_1     | 0    | 14   |           | 522525    | RESV_INPUT_4     |             |               |         |  |
|   | COMMAND_1          | 0    | 15   |           | 526529    | COMMAND          |             |               |         |  |
|   | ROBOT_POSE_JPS_1   | 0    | 16   |           | 530553    | ROBOT_POSE_JPS   |             |               |         |  |
|   | ROBOT_POSE_TCP_1   | 0    | 17   |           | 554577    | ROBOT_POSE_TCP   |             |               |         |  |
|   | EXT_INPUT_DATA_1   | 0    | 18   |           | 578617    | EXT_INPUT_DATA   |             |               |         |  |
|   | CONTROL_OUTPUT_1   | 0    | 19   | 500       |           | CONTROL_OUTPUT   |             |               |         |  |
|   | CONTROL_O_RESV_1   | 0    | 20   | 501       |           | CONTROL_O_RESV   |             |               |         |  |
|   | CALIB_CAM_STATUS_1 | 0    | 21   | 502       |           | CALIB_CAM_STATUS |             |               |         |  |
|   | SEND_POSE_NUM_1    | 0    | 22   | 503       |           | SEND_POSE_NUM    |             |               |         |  |
|   | SEND_POSE_TYPE_1   | 0    | 23   | 504       |           | SEND_POSE_TYPE   |             |               |         |  |
|   | VISUAL_PT_INDEX_1  | 0    | 24   | 505       |           | VISUAL_PT_INDEX  |             |               |         |  |
|   | DO_LIST_1          | 0    | 25   | 506513    |           | DO_LIST          |             |               |         |  |
|   | DI_LIST_1          | 0    | 26   | 514521    |           | DI_LIST          |             |               |         |  |
|   | NOTIFY_MSG_1       | 0    | 27   | 522525    |           | NOTIFY_MSG       |             | Article numbe | er      |  |
|   | RESV_OUTPUT_1_1    | 0    | 28   | 526529    |           | RESV_OUTPUT_1    |             |               |         |  |
|   | RESV_OUTPUT_2_1    | 0    | 29   | 530533    |           | RESV_OUTPUT_2    |             |               |         |  |
|   | RESV_OUTPUT_3_1    | 0    | 30   | 534537    |           | RESV_OUTPUT_3    |             |               |         |  |
|   | STATUS_CODE_1      | 0    | 31   | 538541    |           | STATUS_CODE      |             |               |         |  |
|   | TARGET_POSE_1      | 0    | 32   | 542565    |           | TARGET_POSE      |             |               |         |  |
|   | TARGET_LABEL_1     | 0    | 33   | 566569    |           | TARGET_LABEL     |             |               |         |  |
|   | TARGET_SPEED_1     | 0    | 34   | 570573    |           | TARGET_SPEED     |             |               |         |  |
|   | EXT_OUTPUT_DATA_1  | 0    | 35   | 574613    |           | EXT_OUTPUT_DATA  |             |               |         |  |
|   |                    | 0    | 36   |           |           |                  |             |               |         |  |
|   |                    | 0    | 37   |           |           |                  |             |               |         |  |

3. In **Project tree** panel, double-click on **PLC tags** under **PLC\_1**, and then double-click on **Show** all tags to open the **PLC tags** window. Then, click on to import tags.



|    | Siemens - E:\Profinet test\MM_Camera_EN\MM_Car<br>oject Edit View Insert Online Options Tools<br>F 💁 🗔 Save project 进 🔀 🗐 籠 🗙 崎 🛎 🍊 | Window Hel |                      | Go offline 🛔 🔒 🚺 |
|----|---|------------|----------------------|------------------|
|    | Project tree  |            | MM_Camera_EN > PL    | C_1 [CPU 1211C   |
|    | Devices   |            |                      |                  |
|    | <br>B   | 🔲 🖻        | 🥩 👻 🖻 🗄 (3)          | e e              |
| Ð  |   | , <u> </u> | PLC tags             |                  |
| i. | MM_Camera_EN  | ^          | Name Import          |                  |
| am | 📑 Add new device  |            | 1 <add new=""></add> |                  |
| ođ | Devices & networks  |            |                      |                  |
| E. | PLC_1 [CPU 1211C DC/DC/DC]  |            |                      |                  |
| FC | Device configuration  |            |                      |                  |
|    | 😓 Online & diagnostics  |            |                      |                  |
|    | Program blocks  | ≡          |                      |                  |
|    | 🕨 🙀 Tecl 🚺 gy objects   |            |                      |                  |
|    | External source files   |            |                      |                  |
|    | 🕶 🎑 PLC tags  |            |                      |                  |
|    | lange 🔁 Show all tags   |            |                      |                  |
|    | 📑 Add new tag table   |            |                      |                  |
|    | Default tag table [70]  |            |                      |                  |
|    | PLC data types  |            |                      |                  |
|    | Watch and force tables  |            |                      |                  |
|    | 🕨 📴 Online backups  |            |                      |                  |
|    | 🕨 🔀 Traces  |            | M                    |                  |

4. Click on ••• to the right of the input field, and locate the **PLCTags.elsx** file. Click on OK to import the PLC tags.

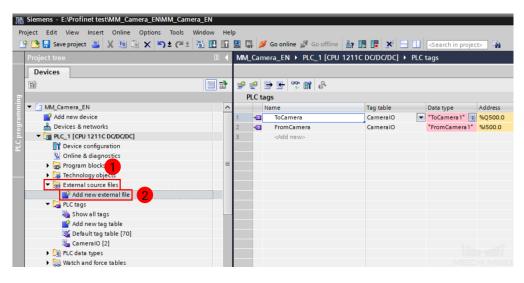
| 渦 | Siemens - E:          | Profinet test                    | MM_Camera_  | EN\MM_Cam | era_EN |   |       |                     |                 |             |         |                |         |
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|   | Project tree          |                                  |             |           | 01     |   | MM_Ca | imera_EN → PLC_     | 1 [CPU 1211C    | DC/DC/DC] • | PLC     |                |         |
|   | Devices               | ]                                |             |           |        |   |       |                     |                 |             |         |                |         |
|   | 1<br>1<br>1<br>1<br>1 |                                  |             |           |        | 2 | # #   | 🖻 🕑 📽 🛍             | e^              |             |         |                |         |
|   |                       |                                  |             |           |        |   |       | tags                |                 |             |         |                |         |
|   | ▼ 🛅 MM_Cam            |                                  |             |           |        | ^ |       | Name                |                 | Tag table   |         | Data type      | Addres  |
|   |                       | new device                       |             |           |        |   | 1     | <add new=""></add>  |                 |             | -       |                |         |
|   |                       | es & network                     |             |           |        |   |       |                     |                 |             |         |                |         |
|   |                       | 1 [CPU 1211C                     |             |           |        |   | Impo  | ort                 |                 |             | _       |                | ×       |
|   |                       | evice configur<br>nline & diagno |             |           |        |   |       |                     |                 |             |         |                |         |
|   |                       | ogram blocks                     |             |           |        |   |       | h of import file :  |                 |             |         |                |         |
|   | _                     | chnology obje                    |             |           |        |   | ech   | _interface\document | s\CN\Siemens PF | ROFINET     | IPLC sa | mple\PLCTags.> | dsx     |
|   |                       | dernal source                    |             |           |        |   |       | Elements to be      | imported: 🖂     | Tags        |         |                |         |
|   | 👻 🚂 PL                | .C tags                          |             |           |        |   |       |                     |                 | Constants   |         |                |         |
|   | 2                     | Show all tag                     | S           |           |        |   |       |                     |                 |             |         |                |         |
|   |                       | Add new tag                      |             |           |        |   |       |                     |                 |             | ОК      | Cano           | al      |
|   |                       | Default tag t                    | able [70]   |           |        |   |       |                     |                 |             | UK      | Canc           |         |
|   |                       | C data types                     |             |           |        |   |       |                     |                 |             | - (     | 2              | Ľ,      |
|   |                       | atch and force                   | e tables    |           |        |   |       |                     |                 |             |         | MIECH          |         |
|   |                       | nline hackune                    |             |           |        |   |       |                     |                 |             |         |                |         |

5. The following tags should be imported. Change the address of **ToCamera** and **FromCamera** to the same as those of **CONTROL\_INPUT\_1** and **CONTROL\_OUTPUT\_1** modules, respectively.



| Project Edit View Insert Online Options Tools Wir | ndow H         | telp |       |                         |                            |      |                   |            |          |       |       |         |
|---|----------------|------|-------|-------------------------|----------------------------|------|-------------------|------------|----------|-------|-------|---------|
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| Project tree                                      |                |      |       | nera_EN 	 PLC_1 [CP     |                            |      |                   |            |          |       |       |         |
| Devices   |                | Г    |       |                         |                            |      |                   |            |          |       | -00   | Tags    |
|   |                |      | -     |                         |                            |      |                   |            |          |       |       | Ĵ       |
| n   |                |      | PLC t |                         |                            |      |                   |            |          |       |       |         |
| MM Camera EN                                      |                | ^    |       | Name                    | Tag table                  |      | Data type         | Address    | Retain   | Acces | Writa | Visibl. |
| Add new device                                    |                | 1    | -0    | ToCamera                | CameralO                   | -    | "ToCamera 1"      | %Q500.0    |          |       |       |         |
| b Devices & networks                              |                | 2    | -0    | FromCamera              | CameralO                   |      | "FromCamera1"     | %1500.0    | <b>N</b> |       |       |         |
| PLC_1 [CPU 1211C DC/DC/DC]                        |                | 3    |       | <add new=""></add>      |                            |      |                   |            |          |       |       |         |
| Device configuration                              |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| Q Online & diagnostics                            |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| Program blocks                                    |                | =    |       |                         |                            |      |                   |            |          |       |       |         |
| Technology objects                                |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| External source files                             |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| 🔻 🔁 PLC tags                                      |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| a Show all tags                                   |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| 📑 Add new tag table                               |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| 💥 Default tag table [70]                          |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| 🖳 CameralO [2]                                    |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| Eg PLC data types                                 |                |      |       |                         |                            |      |                   |            |          |       |       |         |
| Watch and force tables                            |                |      |       |                         |                            |      |                   |            |          |       |       |         |

6. In the **Project tree** panel, double-click on **External source files**, and then double-click on **Add new external file**.



- 7. In the pop-up window, locate and select the **Camera\_IO.scl** and **ObtainPose.scl** files. Click on *Open* to import these files.
- 8. Select the two imported external files and then right-click on these files. In the right-click menu, select **Generate blocks from source**.



| Siemens - E:\Profinet    | test\MM_Cam     | era_El | N\MM_Cam                      | era_EN    |           |            |
|--------------------------|-----------------|--------|-------------------------------|-----------|-----------|------------|
| Project Edit View In:    | sert Online     | Option | ns Tools                      | Window    | Help      |            |
| 📑 📑 🔚 Save project       |                 |        |                               |           |           | RT 💋       |
|                          |                 | ~      | <b>-1</b> - (                 | 1         |           |            |
| Project tree             |                 |        |                               | ۵         |           | I_Came     |
| Devices                  |                 |        |                               |           |           |            |
| ÊŃ                       |                 |        |                               |           | i 🌮       | 1. Sec. 1. |
| 2                        |                 |        |                               | ,         |           | PLC ta     |
| ▼ MM_Camera_EN           |                 |        |                               |           | ^         | N          |
| Add new devic            | e               |        |                               |           | 1         |            |
| 🖥 🚠 Devices & net        | works           |        |                               |           | 2         | -00        |
| 🚊 🔹 🙀 PLC_1 [CPU 12      | 11C DC/DC/DC]   |        |                               |           | 3         |            |
| Pevice con               | figuration      |        |                               |           |           |            |
| 😵 Online & di            | agnostics       |        |                               |           |           |            |
| 🕨 🔒 🕞 🕨 🕨                | ocks            |        |                               |           | =         |            |
| 🕨 🕨 🕨 🕨 🕨 🕨              | objects         |        |                               |           |           |            |
| 🔻 📷 External so          | urce files      |        |                               |           |           |            |
|                          | v external file |        |                               |           |           |            |
| Camera                   | _IO.scl         |        |                               |           |           |            |
| Dbtain P                 | ose.scl         |        | Open                          |           |           |            |
| 🔻 🚂 PLC tags             |                 | V      |                               |           | Ctrl+)    | _          |
| a Show a                 |                 |        | Cut<br>Copy                   |           | Ctrl+0    |            |
| 📑 Add nev                | -               |        | Paste                         |           | Ctrl+\    |            |
|                          | tag table [70]  | _      |                               |           |           | _          |
| 🐫 Camera                 |                 | ×      | Delete                        |           | De        |            |
| PLC data ty              |                 |        | Rename                        |           | F2        | 2          |
| Watch and                |                 | 1      | Go online                     |           | Ctrl+k    | (          |
| Online bac               | kups            | 1      | Go offline                    |           | Ctrl+N    | 1          |
| 🕨 🔀 Traces               |                 | - Q.   | Search in pr                  | oject     | Ctrl+F    | -          |
| Device prov              |                 |        | Generate bl                   | ocks from | source    |            |
| Program in               |                 | 1.0    |                               |           |           |            |
| PLC alarm     Local mode |                 | _      | Cross-refere<br>Call structur |           | 2         |            |
|                          | uies.           |        | Assignment                    |           | -         |            |
| ✓ Details view           |                 |        | -                             |           | 100 m - 1 | 11         |
|                          |                 | Q      | Properties                    |           | Alt+Ente  | r _        |
|                          |                 |        |                               |           |           |            |

9. Three program blocks should be generated: **Camera\_IO** FC, **ObtainPose** FB, and **CameraIO** DB.



| Siemens - E:\Profinet test\MM_Camera_EN\MM_  |              |       |                          |                  |       |                  |         |  |
|--|--------------|-------|--------------------------|------------------|-------|------------------|---------|--|
| oject Edit View Insert Online Options To   |              |       |                          |                  |       |                  |         |  |
| 🎦 🔚 Save project 📕 🐰 🛅 🗂 🗙 🏹 🛨 (   | (#±  🖥 🛄 🔟 🖢 |       | ダ Go online 🚀 Go offline | h? 🖪 📕 🗶 🗔       |       | ≪earch in projec | t> 🖬    |  |
| Project tree   | □ ◀          | MM_Ca | imera_EN → PLC_1 [CPU 1  | 211C DC/DC/DC] > | PLC 1 | tags             |         |  |
| Devices  |              |       |                          |                  |       |                  |         |  |
|  |              |       |                          |                  |       |                  |         |  |
| 11 Alexandream A | <b></b>      |       | 🖻 🗄 🙄 🛍 🚱                |                  |       |                  |         |  |
|  |              | PLC   | tags                     |                  |       |                  |         |  |
| ▼ 🔄 MM_Camera_EN   | ^            |       | Name                     | Tag table        | _     | Data type        | Address |  |
| Add new device   |              |       | ToCamera                 | CameralO         | •     | "ToCamera1"      |         |  |
| devices & networks   |              | 2 🖪   | FromCamera               | CameralO         |       | *FromCamera1*    | %1500.0 |  |
| ▼ [] PLC_1 [CPU 1211C DC/DC/DC]  |              | 3     | <add new=""></add>       |                  |       |                  |         |  |
| Device configuration Q Online & diagnostics  |              |       |                          |                  |       |                  |         |  |
| Gonine & diagnostics     Program blocks  |              |       |                          |                  |       |                  |         |  |
| Add new block  |              |       |                          |                  |       |                  |         |  |
| Main [OB1]   |              |       |                          |                  |       |                  |         |  |
| Camera_IO [FC1]  |              |       |                          |                  |       |                  |         |  |
| DotainPose [FB1]   |              |       |                          |                  |       |                  |         |  |
| CameralO [DB1]   |              |       |                          |                  |       |                  |         |  |
| System blocks  |              |       |                          |                  |       |                  |         |  |
| Technology objects   |              |       |                          |                  |       |                  |         |  |
| <ul> <li>External source files</li> </ul>  |              |       |                          |                  |       |                  |         |  |
| 🌁 Add new external file  |              |       |                          |                  |       |                  |         |  |
| Camera_IO.scl  |              |       |                          |                  |       |                  |         |  |
| ObtainPose.scl   |              |       |                          |                  |       |                  |         |  |
| 👻 📜 PLC tags   |              |       |                          |                  |       |                  |         |  |
| a Show all tags  |              |       |                          |                  |       |                  |         |  |
| 📑 Add new tag table  |              |       |                          |                  |       |                  |         |  |
| 🝯 Default tag table [70]   |              |       |                          |                  |       |                  |         |  |
| CameralO [2]   |              |       |                          |                  |       |                  |         |  |

# 2.8.6 Build Program and Download to PLC

1. In the **Program tree** panel, double-click on the **Main** OB in **Program blocks** to open it. Then, select **Camera\_IO** FC and drag it to **Network 1**.

| TIA  | Siemens - E: | Profinet tes   | t\MM_Cam     | era ENV                                 | <b>MM</b> Came | ra EN    |      |                        |       |        |              |           |              |
|------|--------------|----------------|--------------|---|----------------|----------|------|------------------------|-------|--------|--------------|-----------|--------------|
| Pr   | oject Edit \ |                |              |   |                |          | elo  |                        |       |        |              |           |              |
|      | -            |                |              | - 1 - L - L - L - L - L - L - L - L - L |                |          |      |                        |       | St.c.  |              | 0. 0      |              |
|      | 🛉 📑 🔚 Save   | project 📑      | <b>% 🗉</b> 🗉 | x -                                     | ) <b>⊻</b> (≃≚ |          | _    |                        |       |        |              |           |              |
|      | Project tree |                |              |   |                |          | M    | M_Camera_              | EN 🕨  | PLC_1  | [CPU         | 1211C     | DC/DC/D      |
|      | Devices      | 1              |              |   |                |          |      |                        |       |        |              |           |              |
|      | 1<br>Teni    |                |              |   |                |          |      | i <mark>⊾</mark> X ∌ ∈ |       | = 2    | 1 = 1        |           | + 99 + K     |
|      |              |                |              |   |                | <u> </u> | - RO | i koi = - =            | -1    |        |              |           | ∸ -(all ∸ -( |
| l ii | ▼ 📄 MM_Can   | ENI            |              |   |                |          |      |                        |       |        |              |           |              |
| E    |              | new device     |              |   |                | -        |      | н <u>ни</u> –о         |       | ↦      | _ <b>t</b> _ |           |              |
| l B  |              | ces & network  |              |   |                |          | L    |                        |       |        |              |           |              |
| 2    |              | 1 [CPU 12110   |              |   |                |          |      | Block title:           | "Main | Progra | m Swe        | ep (Cycle | e)"          |
| 2    |              | evice configu  |              |   |                |          |      | Comment                |       |        |              |           |              |
| •    |              | nline & diago  |              |   |                |          | -    | Network                | 1:    |        |              |           |              |
|      |              | rogram b       |              |   |                |          |      | Comment                |       |        |              |           |              |
|      | _            | Add new blo    | ock          |   |                |          | 1.   | connient               |       |        |              |           |              |
|      |              | Main [OB1]     |              |   | 2              |          |      | %FC                    | 1     |        |              |           |              |
|      | -            | Camera_IO      | [FC1]        |   |                |          |      | Camera                 | _10"  |        |              |           |              |
|      |              | - ObtainPose   | [FB1]        |   |                |          |      | EN                     | ENO   |        |              |           |              |
|      |              | CameralO [     | DB1]         |   |                |          |      |                        |       |        |              |           |              |
|      | ► B          | System blog    | :ks          |   |                |          |      |                        |       |        |              |           |              |
|      |              | echnology obj  |              |   |                |          |      | Network                | 2     |        |              |           |              |
|      |              | xternal source |              |   |                |          |      | Network                | 2:    |        |              |           |              |
|      | _            | Add new ex     |              |   |                |          | ι.   | Comment                |       |        |              |           |              |
|      | -            | Camera_IO      |              |   |                |          |      | L                      |       |        |              |           |              |
|      | -            | ObtainPose     | .scl         |   |                |          |      |                        |       |        |              |           |              |
|      | 🔹 🔽 P        | -              |              |   |                |          |      |                        |       |        |              |           |              |
|      | *            | Show all tag   | gs           |   |                |          |      | 1                      |       |        |              |           |              |

2. Select **ObtainPose** FB and drag it to **Network 2**. A window will pop-up when you release the

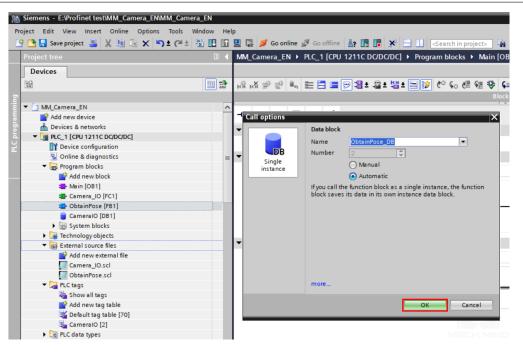


mouse button.

| TA Company FURE first testillar Company FUELD Company FU | _        |   |
|--|----------|---|
| Siemens - E:\Profinet test\MM_Camera_EN\MM_Camera_EN     |          |   |
| Project Edit View Insert Online Options Tools Window     |          | •                                       |
| 📑 📴 🔚 Save project 📕 🐰 🏢 🛍 🗙 🏷 ± (주 ± 🐻 🗓                |          | 🖳 🔝 💋 Go online 🖉 Go offline  🏭         |
| Project tree   |          | MM_Camera_EN → PLC_1 [CPU 1211          |
| Devices  |          |   |
|  | 1        |   |
|  | <b>.</b> | м м 🖻 🖹 🐛 🖿 🚍 💬 🕾                       |
|  |          |   |
| ▼ MM_Camera_EN   | ^        |   |
| Add new device   |          |   |
| E Devices & networks                                     |          | ▼ Block title: *Main Program Sweep (Cyc |
| ▼ [] PLC_1 [CPU 1211C DC/DC/DC]                          |          | Comment                                 |
| Z Device configuration                                   |          |   |
| 🖳 Online & diagnostics                                   | ≡        | Network 1:                              |
| <ul> <li>Program blocks</li> </ul>                       |          | Comment                                 |
| Add new block  |          |   |
| Hain [OB1]   |          | %FC1                                    |
| Camera_IO [FC1]  |          | "Camera_IO"                             |
| DotainPose [FB1]   |          | EN ENO                                  |
| CameralO [DB1]   |          |   |
| System blocks  |          |   |
| Technology objects                                       |          | Network 2:                              |
| External source files                                    |          |   |
| Add new external file                                    |          | Comment                                 |
| Camera_IO.scl  |          |   |
| ObtainPose.scl   |          |   |
| ✓ Cags   |          |   |
| a Show all tags  |          |   |
| Add new tag table  |          |   |
| 🗳 Default tag table [70]                                 |          |   |
| CameralO [2]   |          | MECH MIND                               |

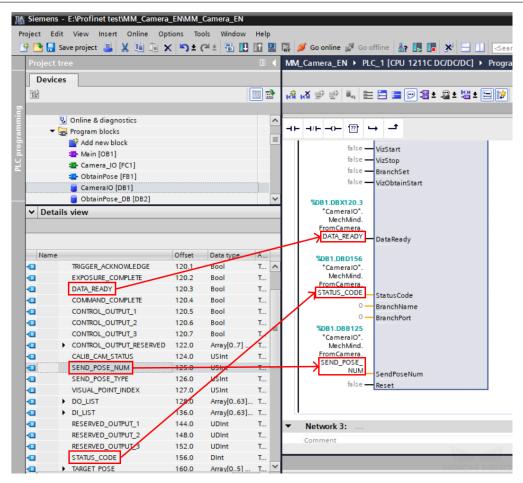
3. In the pop-up window, keep the default options and click on  $OK\!.$ 





4. Click on CameraIO DB, and under the Details view, drag DATA\_READY, SEND\_POSE\_NUM and STATUS\_CODE to the input ports with the same names on the left side of ObtainPose FB.





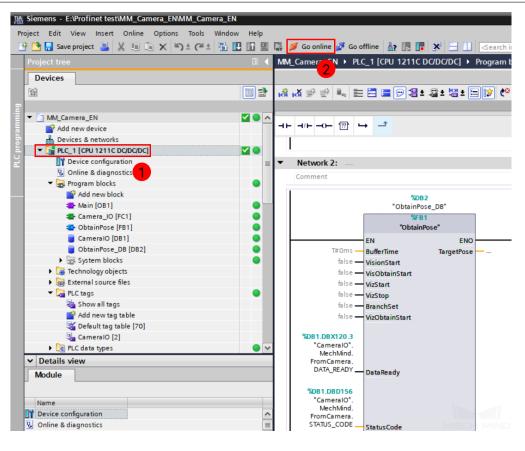
5. In the **Program tree** panel, right-click on **PLC\_1**, and select *Download to device*  $\rightarrow$  *Hardware and software (only changes)*. Refer to steps 2 and 3 in *Download Hardware Configuration to PLC* above and download the program to the PLC.



| Siemens - E:\Profinet test\MM_Camera_EN\MM_Camera_EI  | EN   |      |
|---|--|------|
| Project Edit View Insert Online Options Tools Windo   | ow Help  |      |
| 📑 📑 🔒 Save project 블 🐰 🤖 🛍 🗮 🗙 🍤 🛨 (주 🛨 🐻 )   | 🔃 🚹 🖳 🧖 Go online 🖉 Go offline  🏭 📘                      | 2    |
| Project tree  | □  | DC/I |
| Devices   |  |      |
|   | ta kă să să să ta    | 2    |
| 5 <b>-</b>  |  |      |
| ▼ MM_Camera_EN  | <u> </u>   | _    |
| 🗧 📑 Add new device  |  |      |
| Devices & networks  | false — VizStart   |      |
| Change device   | Print preview  |      |
| Device configuration  | Export CAx data  |      |
| Online & diagnostics     Open     Open     Open in new editor   | Export module labeling strips     art                    |      |
| Add new block Open block/PLC data type  |  |      |
| Main [OB1]  | Ctrl+X   |      |
| Tamera_IO [FC1]   | Ctrl+C   |      |
| 💶 ObtainPose [FB1] 📋 Paste  | Ctrl+V   |      |
| CameralO [DB1] X Delete   | Del  |      |
| ObtainPose_DB [DB2 Rename   | F2   |      |
| System blocks   |  |      |
| Contrology objects     Contrology object |  |      |
| Compile   | •  |      |
| Show all tags   | <ul> <li>Hardware and software (only changes)</li> </ul> |      |
| Add new tag table Backup from online device   |  |      |
| Default tag table [70   | C Software (only changes) 3                              |      |
| Go offline  | Ctrl+M Software (all)                                    |      |
| Le PLC data types   |  |      |
| Details view     Details view     Load snapshots as actual  |  |      |
| Module Load start values as actu  |  |      |
| Copy snapshots to start v   |  |      |
| Name 🔂 Compare  | •  |      |
| 🔐 Device configuration  | Ctrl+F   |      |
| Cross-references  | F11 MECH MI  | ND   |

6. After downloading, select **PLC\_1** in the **Program tree** panel, and click on *Go online*.





7. In the **Program tree** panel, double-click on *Program blocks* → *CameraIO* and then click on Double-click to expand *MechMind* → *FromCamera*. If the monitor value of **HEARTBEAT** keeps changing, then the I/Q addresses of modules in **mechmind-pir** have been successfully transferred to the **CameraIO** FB.

| Siemens - E:\Profinet test\MM_Camera_EN\MM_Camera | a_EN       |          |      |                            |                     |           |                    |              |
|---|------------|----------|------|----------------------------|---------------------|-----------|--------------------|--------------|
| Project Edit View Insert Online Options Tools W   | índow Help | <b>)</b> |      |                            |                     |           |                    |              |
| 📑 🎦 🔒 Save project 🚢 🐰 🗎 🗊 🗙 🌱 ± 🍊 ±              | a 🛛 🖬      |          | ø G  | o online 💋 Go offline  🏭 🖪 | 🛠 📃 🔝 < earch in pr | roject> [ | in .               |              |
| Project tree                                      |            | ▲ M      |      |                            |                     |           |                    |              |
| Devices   |            |          |      |                            |                     |           |                    |              |
| - Bi  |            | 2        | 9 ⊴9 | 🔍 🛃 🗮 😨 💋 actual values    | 🔒 Snapshot 🛰 🖳      | Copysna   | pshots to start va | lues 🛃 🛃     |
| 2<br>   |            |          |      | eralO                      |                     |           |                    |              |
| ▼ MM_Camera_EN                                    | 🗹 🔍        | ^        | N    | ame                        | Data type           | Offset    | Start value        | Monitor valu |
| Add new device                                    |            | 1        |      | Static                     |                     |           |                    |              |
| 🗟 📩 Devices & networks                            |            | 2        |      | MechMind 3                 | "CameraData1"       | 0.0       |                    | -            |
| PLC_1 [CPU 1211C DC/DC/DC]                        | 🗹 🔍        | 3        | -00  | ToCamera                   | Struct              | 0.0       |                    | - 6          |
| Device configuration                              |            | ≡ 4      | -00  | ■ ▼ FromCamera 4           | Struct              | 120.0     |                    |              |
| 🖳 Online & diagnostics                            |            | 5        | -00  | HEARTBEAT                  | Bool                | 120.0     | false              | TRUE         |
| 🔻 🔜 Program blocks                                | •          | 6        | -00  | TRIGGER_ACKNOWLEDGE        | Bool                | 120.1     | false              | FALSE        |
| Add new block                                     |            | 7        | -00  | EXPOSURE_COMPLETE          | Bool                | 120.2     | false              | FALSE        |
| - Main [OB1]                                      | •          | 8        | -00  | DATA_READY                 | Bool                | 120.3     | false              | FALSE        |
| Camera_IO [FC1]                                   | •          | 9        | -00  | COMMAND_COMPLETE           | Bool                | 120.4     | false              | FALSE        |
| ObtainPose [FB1]                                  | •          | 10       |      | CONTROL_OUTPUT_1           | Bool                | 120.5     | false              | FALSE        |
| CameralO [DB1]                                    | •          | 11       | -00  | CONTROL_OUTPUT_2           | Bool                | 120.6     | false              | FALSE        |
| ObtainPose_DB [DB2]                               | •          | 12       |      | CONTROL_OUTPUT_3           | Bool                | 120.7     | false              | FALSE        |
| System blocks                                     | •          | 13       |      | CONTROL_OUTPUT_RESERVED    | Array[07] of Bool   | 122.0     |                    |              |
| Technology objects                                |            | 14       | -00  | CALIB_CAM_STATUS           | USInt               | 124.0     | 0                  | 0            |
| External source files                             |            | 15       | -00  | SEND_POSE_NUM              | USInt               | 125.0     | 0                  | 0            |
| 🖛 🏣 PLC tags                                      | •          | 16       |      | SEND_POSE_TYPE             | USInt               | 126.0     | 0                  | 0            |
|   |            |          |      |                            |                     |           |                    |              |

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### 2.8.7 Test with Mech-Vision/Mech-Viz Project

This section introduces how to run the Mech-Vision/Mech-Viz project and obtain data from the project using the **ObtainPose** FB. For detailed information on the modules, please refer to stan-dard\_interface\_development\_profinet.

### Prerequisites

- Mech-Vision project(s):
  - Executable
  - Set to autoload
  - The Project list in Mech-Center → Deployment Settings → Mech-Vision is synced by clicking on , and the order of Mech-Vision projects have been adjusted according to actual needs.

| Deployment Settings |  |            | $\times$ |
|---------------------|--|------------|----------|
|                     | ✓ Use Mech-Vision<br>Exec path<br>Project path |            |          |
| Mech-Vision         |  | oject list |          |
|                     | 2  |            |          |

- Mech-Viz project:
  - Executable
  - Set to autoload
  - Contains a branch\_by\_service\_message Task that has been renamed to 1.

#### Run Mech-Vision Project and Obtain Vision Points

- 1. Enable communication: in the **CameraIO** DB, double-click on the monitor value of **COMM\_ENABLE** in **ToCamera**. If a warning message pops up, click on *Yes* to confirm changing the monitor value.
- 2. Set Mech-Vision project ID: change the monitor value of **VISION\_PROJ\_NUM** to the ID of the Mech-Vision project you wish to run. For example, if the monitor value is changed to 1, then Mech-Vision project No. 1 in the **Project list** of Mech-Center will be started.
- 3. Set the number of vision points to be sent by Mech-Vision: change the monitor value of **REQ\_POSE\_NUM**. If the value is set to **0**, the Mech-Vision project will send all the vision points.



| MM_Camera → PLC_1 [CPU 1211C DC/DC/DC] → Program blocks → CameralO [DB1] |         |          |     |                            |                   |        |                 |                  |  |
|--|---------|----------|-----|----------------------------|-------------------|--------|-----------------|------------------|--|
|  |         |          |     |                            |                   |        |                 |                  |  |
| Ú,   | , State | <b>.</b> | R/  | 🗧 😤 Keep actual values 🏻 🔋 | a Snapshot 🛰 🖷    | Copy : | napshots to sta | art values 🛛 🖳 🖳 |  |
|  | Cam     | eral     | С   |                            |                   |        |                 |                  |  |
|  | N       | lame     |     |                            | Data type         | Offset | Start value     | Monitor value    |  |
| 1  | -       | Sta      | tic |                            |                   |        |                 |                  |  |
| 2  |         | •        | Me  | chMind                     | "CameraData1"     | 0.0    |                 | 1                |  |
| 3  |         |          | •   | ToCamera                   | Struct            | 0.0    |                 |                  |  |
| 4  |         |          | •   | COMM_ENABLE                | Bool              | 0.0    | false           | TRUE             |  |
| 5  | -       |          | •   | TRIGGER                    | Bool              | 0.1    | false           | FALSE            |  |
| 6  | -       |          |     | RESET_EXPOSURE             | Bool              | 0.2    | false           | FALSE            |  |
| 7  | -       |          | •   | DATA_ACKNOWLEDGE           | Bool              | 0.3    | false           | FALSE            |  |
| 8  | -       |          |     | CLEAR_NOTIFY               | Bool              | 0.4    | false           | FALSE            |  |
| 9  |         |          |     | CONTROL_INPUT_1            | Bool              | 0.5    | false           | FALSE            |  |
| 10   |         |          |     | CONTROL_INPUT_2            | Bool              | 0.6    | false           | FALSE            |  |
| 11   |         |          |     | CONTROL_INPUT_3            | Bool              | 0.7    | false           | FALSE            |  |
| 12   |         |          | •   | CONTROL_INPUP_RESERVED     | Array[07] of Bool | 2.0    |                 |                  |  |
| 13   | -       |          | •   | CALIB_ROB_STATUS           | USInt             | 4.0    | 0               | • 2              |  |
| 14   | -       |          |     | ROBOT_POSE_TYPE            | USInt             | 5.0    | 0               | 0                |  |
| 15   |         |          |     | REQ_POSE_NUM               | USInt             | 6.0    | 0               | 0                |  |
| 16   | -       |          |     | REQ_POSE_TYPE              | USInt             | 7.0    | 0               | 0                |  |
| 17   | -       |          | •   | VISION_PROJ_NUM            | USInt             | 8.0    | 0               | 1                |  |
| 18   | -       |          | •   | VISION_RECIPE_NUM          | USInt             | 9.0    | 0               | 0                |  |
| 19   |         |          | •   | VIZ_TASK_NAME              | USInt             | 10.0   | 0               | • 3              |  |
| 20   | -       |          | •   | VIZ_TASK_VALUE             | USInt             | 11.0   | 0               | 0                |  |
| 21   |         |          | •   | RESERVED_INPUT_1           | UDInt             | 12.0   | 0               | 0                |  |
| 22   |         |          |     | RESERVED_INPUT_2           | UDInt             | 16.0   | 0               | 0                |  |
| 23   | -       |          | •   | RESERVED_INPUT_3           | UDInt             | 20.0   | 0               | 0                |  |
| 24   |         |          | •   | RESERVED_INPUT_4           | UDInt             | 24.0   | 0               | 0                |  |
| 25   | -       |          | •   | COMMAND                    | DInt              | 28.0   | 0               | 0                |  |
| 26   | -       |          | •   | ROBOT_POSE_JPS             | Array[05] of Dint | 32.0   |                 |                  |  |
| 27   | -       |          | •   | ROBOT_POSE_TCP             | Array[05] of DInt | 56.0   |                 |                  |  |
| 28   |         |          | •   | EXT_INPUT_DATA             | Array[09] of Dint | 80.0   |                 |                  |  |
|  |         |          |     |                            |                   |        |                 |                  |  |

4. Set the hold time of signals sent to the IPC: double-click on **ObtainPose\_DB** DB, and click on **P**. Under **Input** group, change the monitor value of **BufferTime** to **500MS**.



| MN | N_C           | am  | era_EN 🔸 PLC_1 [Cl | PU 1211C DC/DC/D | C] 🕨 Program bl | ocks 🕨 ObtainPo     | se_DB [DB2     |  |  |  |  |
|----|---------------|-----|--------------------|------------------|-----------------|---------------------|----------------|--|--|--|--|
|    |               |     |                    |                  |                 |                     |                |  |  |  |  |
| -  | 1             | è I | 🐛 🋃 🔚 😨 Кеер       | actual values 🔒  | Snapshot 👒 🖳    | , Copy snapshots to | o start values |  |  |  |  |
|    | ObtainPose_DB |     |                    |                  |                 |                     |                |  |  |  |  |
|    |               | Na  | me                 | Data type        | Start value     | Monitor value       | Retain         |  |  |  |  |
| 1  |               | •   | Input              |                  |                 |                     |                |  |  |  |  |
| 2  |               | •   | BufferTime         | Time             | T#Oms           | T# 500MS            |                |  |  |  |  |
| 3  |               |     | VisionStart        | Bool             | false           | FALSE               |                |  |  |  |  |
| 4  |               | •   | VisObtainStart     | Bool             | false           | FALSE               |                |  |  |  |  |
| 5  |               | •   | VizStart           | Bool             | false           | FALSE               |                |  |  |  |  |
| 6  | -             | •   | VizStop            | Bool             | false           | FALSE               |                |  |  |  |  |
| 7  |               | •   | BranchSet          | Bool             | false           | FALSE               |                |  |  |  |  |
| 8  | -0            | ٠   | VizObtainStart     | Bool             | false           | FALSE               |                |  |  |  |  |
| 9  |               | •   | DataReady          | Bool             | false           | FALSE               |                |  |  |  |  |
| 10 |               | •   | StatusCode         | DInt             | 0               | 0                   |                |  |  |  |  |
| 11 |               | •   | BranchName         | USInt            | 0               | 0                   |                |  |  |  |  |
| 12 |               | •   | BranchPort         | USInt            | 0               | 0                   |                |  |  |  |  |
| 13 | -             | •   | SendPoseNum        | USInt            | 0               | 0                   |                |  |  |  |  |
| 14 |               | •   | Reset              | Bool             | false           | FALSE               |                |  |  |  |  |
| 15 | -             | •   | Output             |                  |                 |                     |                |  |  |  |  |
| 16 |               | •   | TargetPose         | Array[019, 05] d | o               |                     | H MIRD         |  |  |  |  |

- 5. Start the Mech-Vision project: in the **ObtainPose\_DB** DB, double-click on the monitor value of **VisionStart** to change it to **TRUE**. Then, reset the monitor value to **FALSE**.
- 6. Check returned status code: check the monitor value of **StatusCode**. **1102** represents that the Mech-Vision project was started successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.

| MI | N_C | am  | era_EN → PLC_1 [C | PU 1211C DC/DC/E    | )C] ▶ Program bl | ocks 🕨 ObtainPo   | se_DB [DB2     |
|----|-----|-----|-------------------|---------------------|------------------|-------------------|----------------|
| Ť  |     |     |                   | p actual values 🛛 🔒 | Snapshot 🧤 🙀     | Copy snapshots to | o start values |
|    | Ob  | tai | nPose_DB          |                     |                  |                   |                |
|    | -   | Na  | me                | Data type           | Start value      | Monitor value     | Retain         |
| 1  | -00 | •   | Input             |                     |                  |                   | 1              |
| 2  |     | •   | BufferTime        | Time                | T#0ms            | T#500MS           |                |
| З  |     | •   | VisionStart       | Bool                | false            | FALSE             |                |
| 4  |     | •   | VisObtainStart    | Bool                | false            | FALSE             |                |
| 5  | -   | •   | VizStart          | Bool                | false            | FALSE             |                |
| 6  | -   | •   | VizStop           | Bool                | false            | FALSE             |                |
| 7  | -   | •   | BranchSet         | Bool                | false            | FALSE             |                |
| 8  | -   | •   | VizObtainStart    | Bool                | false            | FALSE             | 2              |
| 9  |     |     | DataReady         | Bool                | false            | FALSE             |                |
| 10 | -   | •   | StatusCode        | DInt                | 0                | 0                 |                |
| 11 |     | •   | BranchName        | USInt               | 0                | 0                 |                |
| 12 | -   | •   | BranchPort        | USInt               | 0                | 0                 |                |
| 13 | -   | •   | SendPoseNum       | USInt               | 0                | 0                 |                |
| 14 | -   | •   | Reset             | Bool                | false            | FALSE             |                |
| 15 | -   | •   | Output            |                     |                  |                   |                |
| 16 | -00 |     | TargetPose        | Array[019, 05]      | 0                |                   | H MIRD         |



7. Obtain vision points from the Mech-Vision project: in the **ObtainPose\_DB** DB, double-click on the monitor value of **VisObtainStart** to change it to **TRUE**. Then, reset the monitor value to **FALSE**.

| Ť |     |    |                | actual values 🔒 | Snapshot ඁ 🖣 | , Copy snapshots to | start value |
|---|-----|----|----------------|-----------------|--------------|---------------------|-------------|
|   | Ob  |    | nPose_DB       |                 |              |                     |             |
|   |     | Na | me             | Data type       | Start value  | Monitor value       | Retain      |
| 1 | -   | •  | Input          |                 |              |                     |             |
| 2 | -   | •  | BufferTime     | Time            | T#Oms        | T# 500MS            |             |
| 3 | -00 | •  | VisionStart    | Bool            | false        | FALSE               |             |
| 1 | -0  | •  | VisObtainStart | Bool            | false        | FALSE               |             |
| 5 | -0  | •  | VizStart       | Bool            | false        | FALSE               |             |
| 5 | -   | •  | VizStop        | Bool            | false        | FALSE               |             |
| 7 |     | •  | BranchSet      | Bool            | false        | FALSE               |             |
| } | -   | •  | VizObtainStart | Bool            | false        | FALSE               |             |
| ) | -00 | •  | DataReady      | Bool            | false        | FALSE               |             |
| 0 | -   |    | StatusCode     | DInt            | 0            | 0                   |             |
| 1 | -   | •  | BranchName     | USInt           | 0            | 0                   |             |
| 2 | -0  | •  | BranchPort     | USInt           | 0            | 0                   |             |
| 3 | -   |    | SendPoseNum    | USInt           | 0            | 0                   |             |
| 4 | -   |    | Reset          | Bool            | false        | FALSE               |             |

8. Check the received vision points: the monitor value of **SendPoseNum** shows how many vision points were received, and the vision points are stored in **TargetPose**. Divide the monitor values by 10000 to obtain the actual pose data.



| MN  | N_C | am  | era 🔸 PLC_1 [CPU 121                | 1C DC/DC/DC] 🕨 P | rogram blocks | ObtainPose_DB        | [DB2]      |
|-----|-----|-----|-------------------------------------|------------------|---------------|----------------------|------------|
| ji) |     |     |                                     | tual values 🔒 Sn | apshot 🐂 🖷    | Copy snapshots to st | art values |
|     | Ob  | tai | nPose_DB                            |                  |               |                      |            |
|     |     | Na  | me                                  | Data type        | Start value   | Monitor value        | Retain     |
| 1   |     | •   | Input                               |                  |               |                      |            |
| 2   |     | •   | BufferTime                          | Time             | T#Oms         | T#500MS              |            |
| 3   |     | •   | VisionStart                         | Bool             | false         | FALSE                |            |
| 4   | -   | •   | VisObtainStart                      | Bool             | false         | FALSE                |            |
| 5   | -   | •   | VizStart                            | Bool             | false         | FALSE                |            |
| 6   |     | •   | VizStop                             | Bool             | false         | FALSE                |            |
| 7   |     | •   | BranchSet                           | Bool             | false         | FALSE                |            |
| 8   | -   | •   | VizObtainStart                      | Bool             | false         | FALSE                |            |
| 9   | -   | •   | DataReady                           | Bool             | false         | FALSE                |            |
| 10  | -   | •   | StatusCode                          | DInt             | 0             | 1100                 |            |
| 11  | -   | •   | BranchName                          | USInt            | 0             | 0                    |            |
| 12  |     | •   | BranchPort                          | USInt            | 0             | 0                    |            |
| 13  | -   | •   | SendPoseNum                         | USInt            | 0             | 2                    |            |
| 14  | -   | •   | Reset                               | Bool             | false         | FALSE                |            |
| 15  | -   | •   | Output                              |                  |               |                      |            |
| 16  |     | •   | <ul> <li>TargetPose</li> </ul>      | Array[019, 05] o |               |                      |            |
| 17  | -   |     | <ul> <li>TargetPose[0,0]</li> </ul> | DInt             | 0             | -4618258             |            |
| 18  | -   |     | <ul> <li>TargetPose[0,1]</li> </ul> | DInt             | 0             | 5623557              |            |
| 19  |     |     | <ul> <li>TargetPose[0,2]</li> </ul> | DInt             | 0             | 523405               |            |
| 20  | -   |     | <ul> <li>TargetPose[0,3]</li> </ul> | DInt             | 0             | 1206150              |            |
| 21  |     |     | <ul> <li>TargetPose[0,4]</li> </ul> | DInt             | 0             | 6075                 |            |
| 22  | -   |     | <ul> <li>TargetPose[0,5]</li> </ul> | DInt             | 0             | -1780788             |            |
| 23  | -   |     | <ul> <li>TargetPose[1,0]</li> </ul> | Dint             | 0             | -3078879             |            |
| 24  | -   |     | <ul> <li>TargetPose[1,1]</li> </ul> | Dint             | 0             | 6498989              |            |
| 25  | -   |     | <ul> <li>TargetPose[1,2]</li> </ul> | Dint             | 0             | 508875               |            |
| 26  | -   |     | <ul> <li>TargetPose[1,3]</li> </ul> | Dint             | 0             | 1428931              |            |
| 27  | -   |     | <ul> <li>TargetPose[1,4]</li> </ul> | DInt             | 0             | 5581                 |            |
| 28  | -   |     | <ul> <li>TargetPose[1,5]</li> </ul> | Dint             | 0             | -1787682             |            |
| 29  | -   |     | <ul> <li>TargetPose[2,0]</li> </ul> | Dint             | 0             | 0                    |            |
| 30  | -   |     | <ul> <li>TargetPose[2,1]</li> </ul> | Dint             | 0             | 0 MECH               | MBD        |

### Run Mech-Viz Project and Obtain Planned Path

1. Clear last obtained data: in the **ObtainPose\_DB** DB, double-click on the monitor value of **Reset** to change it to **TRUE**. Then, reset the monitor value to **FALSE**.



| MN | <b>ı</b> _C | am  | era_EN → PLC_1 [CPU | 1211C DC/DC/DC]     | Program blo | cks 🕨 ObtainPos   | e_DB [DB2    |
|----|-------------|-----|---------------------|---------------------|-------------|-------------------|--------------|
|    |             |     |                     |                     |             |                   |              |
| Ť  |             | è I | 🐛 🋃 🚞 🎇 Keep a      | ctual values 🛯 🔒 Si | napshot 🦄 🖳 | Copy snapshots to | start values |
|    | Ob          | tai | nPose_DB            |                     |             |                   |              |
|    |             | Na  | me                  | Data type           | Start value | Monitor value     | Retain       |
| 1  | -           | •   | Input               |                     |             |                   |              |
| 2  |             | •   | BufferTime          | Time                | T#Oms       | T#500MS           |              |
| З  | -           | •   | VisionStart         | Bool                | false       | FALSE             |              |
| 4  | -           | •   | VisObtainStart      | Bool                | false       | FALSE             |              |
| 5  | -           | •   | VizStart            | Bool                | false       | FALSE             |              |
| 6  | -           | •   | VizStop             | Bool                | false       | FALSE             |              |
| 7  | -           | •   | BranchSet           | Bool                | false       | FALSE             |              |
| 8  | -           | •   | VizObtainStart      | Bool                | false       | FALSE             |              |
| 9  | -           | •   | DataReady           | Bool                | false       | FALSE             |              |
| 10 | -           | •   | StatusCode          | DInt                | 0           | 0                 |              |
| 11 | -           | •   | BranchName          | USInt               | 0           | 0                 |              |
| 12 | -           | •   | BranchPort          | USInt               | 0           | 0                 |              |
| 13 |             |     | SendPoseNum         | USInt               | 0           | 0                 |              |
| 14 |             | •   | Reset               | Bool                | false       | FALSE             |              |
| 15 | -           | •   | Output              |                     |             |                   |              |
| 16 | -           |     | TargetPose          | Array[019, 05] o    |             |                   | - MIR-D      |

2. Set the branch to take in the Mech-Viz project:

- Set Task name: in the **ObtainPose\_DB** DB, change the monitor value of **BranchName** to **1**. This tells Mech-Viz that you are trying to select the out port for the Task named **1**.
- Select out port: change the monitor value of **BranchPort** to the out port you would like the Mech-Viz project to take in Task 1. For example, if you set the value of **BranchPort** to 1, the Mech-Viz project will proceed along out port 1 of Task 1.



| MN | MM_Camera > PLC_1 [CPU 1211C DC/DC/DC] > Program blocks > ObtainPose_DB [DB2 |                                    |                     |             |               |  |  |  |  |  |  |
|----|--|------------------------------------|---------------------|-------------|---------------|--|--|--|--|--|--|
|    |  |                                    |                     |             |               |  |  |  |  |  |  |
|    | 🚔 🐳 👢 🛃 🚬 🅎 Keep actual values 🔒 Snapshot 🦄 🥦 Copy snapshots to start va     |                                    |                     |             |               |  |  |  |  |  |  |
|    | ObtainPose_DB  |                                    |                     |             |               |  |  |  |  |  |  |
| _  |  | Name                               | Data type           | Start value | Monitor value |  |  |  |  |  |  |
| 1  |  | ▼ Input                            |                     |             |               |  |  |  |  |  |  |
| 2  | -00  | <ul> <li>BufferTime</li> </ul>     | Time                | T#Oms       | T# 500MS      |  |  |  |  |  |  |
| 3  |  | <ul> <li>VisionStart</li> </ul>    | Bool                | false       | FALSE         |  |  |  |  |  |  |
| 4  | -00  | VisObtainStart                     | Bool                | false       | FALSE         |  |  |  |  |  |  |
| 5  | -00  | <ul> <li>VizStart</li> </ul>       | Bool                | false       | FALSE         |  |  |  |  |  |  |
| 6  | -  | <ul> <li>VizStop</li> </ul>        | Bool                | false       | FALSE         |  |  |  |  |  |  |
| 7  | -00  | <ul> <li>BranchSet</li> </ul>      | Bool                | false       | FALSE         |  |  |  |  |  |  |
| 8  | -00  | <ul> <li>VizObtainStart</li> </ul> | Bool                | false       | FALSE         |  |  |  |  |  |  |
| 9  | -00  | DataReady                          | Bool                | false       | FALSE         |  |  |  |  |  |  |
| 10 | -  | StatusCode                         | DInt                | 0           | 0             |  |  |  |  |  |  |
| 11 |  | <ul> <li>BranchName</li> </ul>     | USInt               | 0           | 1             |  |  |  |  |  |  |
| 12 | -  | <ul> <li>BranchPort</li> </ul>     | USInt               | 0           | 1             |  |  |  |  |  |  |
| 13 | -  | SendPoseNum                        | USInt               | 0           | 0             |  |  |  |  |  |  |
| 14 | -  | Reset                              | Bool                | false       | FALSE 2       |  |  |  |  |  |  |
| 15 |  | <ul> <li>Output</li> </ul>         |                     |             |               |  |  |  |  |  |  |
| 16 |  | <ul> <li>TargetPose</li> </ul>     | Array[019, 05] of D | lint        |               |  |  |  |  |  |  |

3. Set data type: in the **CameraIO** DB, change the monitor value of **REQ\_POSE\_TYPE** to **1**. This asks Mech-Viz to send joint positions (instead of TCP data).

| M  | M_Ca | mera     | a )  | PLC_1 [CPU 1211C DC/DC/D | C] > Program block | cs 🕨 Can | neralO [DB1]     |                   |
|----|------|----------|------|--------------------------|--------------------|----------|------------------|-------------------|
|    |      |          |      |                          |                    |          |                  |                   |
| -  | , Ež | <b>.</b> | B/   | 🖌 🚬 😤 Keep actual values | 🔒 Snapshot 🌇       | Copy :   | napshots to star | rt values 🛛 🖳 Loa |
|    | Cam  | eral     | 0    |                          |                    |          |                  |                   |
|    | N    | lame     |      |                          | Data type          | Offset   | Start value      | Monitor value     |
| 1  |      | • St     | atic |                          |                    |          |                  |                   |
| 2  |      | •        | Me   | echMind                  | "CameraData1"      | 0.0      |                  |                   |
| 3  |      |          | •    | ToCamera                 | Struct             | 0.0      |                  |                   |
| 4  |      |          | •    | COMM_ENABLE              | Bool               | 0.0      | false            | TRUE              |
| 5  |      |          | •    | TRIGGER                  | Bool               | 0.1      | false            | FALSE             |
| 6  |      |          | •    | RESET_EXPOSURE           | Bool               | 0.2      | false            | FALSE             |
| 7  |      |          | •    | DATA_ACKNOWLEDGE         | Bool               | 0.3      | false            | FALSE             |
| 8  |      |          | •    | CLEAR_NOTIFY             | Bool               | 0.4      | false            | FALSE             |
| 9  |      |          | •    | CONTROL_INPUT_1          | Bool               | 0.5      | false            | FALSE             |
| 10 |      |          | •    | CONTROL_INPUT_2          | Bool               | 0.6      | false            | FALSE             |
| 11 |      |          | •    | CONTROL_INPUT_3          | Bool               | 0.7      | false            | FALSE             |
| 12 |      |          | •    | CONTROL_INPUP_RESERVED   | Array[07] of Bool  | 2.0      |                  |                   |
| 13 | -00  |          | •    | CALIB_ROB_STATUS         | USInt              | 4.0      | 0                | 0                 |
| 14 |      |          | •    | ROBOT_POSE_TYPE          | USInt              | 5.0      | 0                | 0                 |
| 15 |      |          | •    | REQ_POSE_NUM             | USInt              | 6.0      | 0                | 0                 |
| 16 |      |          | •    | REQ_POSE_TYPE            | USInt              | 7.0      | 0                | 1                 |
| 17 | -00  |          | •    | VISION_PROJ_NUM          | USInt              | 8.0      | 0                | 1                 |
| 18 | -    |          |      | VISION RECIPE NUM        | USInt              | 9.0      | 0                | 0                 |

4. Start the Mech-Viz project: in the **ObtainPose\_DB** DB, double-click on the monitor value of **VizStart** to change it to **TRUE**. Then, reset the monitor value to **FALSE**.



5. Check returned status code: check the monitor value of **StatusCode**. **2103** represents that the Mech-Viz project was started successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.

| MN | 1_C | ame | era 🕨 PLC_1 [CPU 121           | 1C DC/DC/DC] 	Progr    | am blocks 🕨 O | btainPose_DB [DB2       |
|----|-----|-----|--------------------------------|------------------------|---------------|-------------------------|
| Ē  |     |     |                                | tual values 🔒 Snapsh   | ot 💐 🖏 Cop    | y snapshots to start va |
|    | Ob  |     | Pose_DB                        | 1                      |               |                         |
|    |     | Nam | ne                             | Data type              | Start value   | Monitor value           |
| 1  | -00 | •   | Input                          |                        |               |                         |
| 2  | -00 | •   | BufferTime                     | Time                   | T#Oms         | T#500MS                 |
| 3  | -00 | •   | VisionStart                    | Bool                   | false         | FALSE                   |
| 4  | -   | •   | VisObtainStart                 | Bool                   | false         | FALSE                   |
| 5  | -   | •   | VizStart                       | Bool                   | false         | FALSE                   |
| 6  | -   | •   | VizStop                        | Bool                   | false         | FALSE                   |
| 7  | -   | •   | BranchSet                      | Bool                   | false         | FALSE                   |
| 8  | -00 | •   | VizObtainStart                 | Bool                   | false         | FALSE 2                 |
| 9  | -00 | •   | DataReady                      | Bool                   | false         | FALSE                   |
| 10 | -   | •   | StatusCode                     | DInt                   | 0             | 2103                    |
| 11 | -   | •   | BranchName                     | USInt                  | 0             | 1                       |
| 12 | -   | •   | BranchPort                     | USInt                  | 0             | 1                       |
| 13 |     | •   | SendPoseNum                    | USInt                  | 0             | 0                       |
| 14 | -00 | •   | Reset                          | Bool                   | false         | FALSE                   |
| 15 | -00 | • ( | Output                         |                        |               |                         |
| 16 | -   | •   | <ul> <li>TargetPose</li> </ul> | Array[019, 05] of Dint |               |                         |

- 6. Select branch in the Mech-Viz project: in the **ObtainPose\_DB** DB, double-click on the monitor value of **BranchSet** to change it to **TRUE**. Then, reset the monitor value to **FALSE**. This asks the Mech-Viz project to proceed along the branch set in step 2.
- 7. Check returned status code: check the monitor value of **StatusCode**. **2105** represents that the branch was selected successfully. For other values, please refer to standard\_interface\_status\_codes for the corresponding error.



| MN | MM_Camera → PLC_1 [CPU 1211C DC/DC/DC] → Program blocks → ObtainPose_DB [DB2 |      |                                |                        |             |                        |  |  |
|----|--|------|--------------------------------|------------------------|-------------|------------------------|--|--|
|    |  |      |                                |                        |             |                        |  |  |
| ġ, |  | ;    | 🖣 🛃 🚞 🚏 Keep ac                | tual values 🛛 🔒 Snapsh | ot 🛰 🖳 Cop  | ysnapshots to start va |  |  |
|    | Ob   | tain | Pose_DB                        |                        |             |                        |  |  |
| _  |  | Nam  | ne                             | Data type              | Start value | Monitor value          |  |  |
| 1  |  | •    | Input                          |                        |             |                        |  |  |
| 2  | -  | •    | BufferTime                     | Time                   | T#Oms       | T#500MS                |  |  |
| 3  |  | •    | VisionStart                    | Bool                   | false       | FALSE                  |  |  |
| 4  |  | •    | VisObtainStart                 | Bool                   | false       | FALSE                  |  |  |
| 5  |  | •    | VizStart                       | Bool                   | false       | FALSE                  |  |  |
| 6  |  | •    | VizStop                        | Bool                   | false       | FALSE                  |  |  |
| 7  |  | •    | BranchSet                      | Bool                   | false       | FALSE                  |  |  |
| 8  | -  | •    | VizObtainStart                 | Bool                   | false       | FALSE                  |  |  |
| 9  | -  | •    | DataReady                      | Bool                   | false       | FALSE                  |  |  |
| 10 |  | •    | StatusCode                     | DInt                   | 0           | 2105                   |  |  |
| 11 |  | •    | BranchName                     | USInt                  | 0           | 1                      |  |  |
| 12 | -00  | •    | BranchPort                     | USInt                  | 0           | 1 2                    |  |  |
| 13 | -00  | •    | SendPoseNum                    | USInt                  | 0           | 0                      |  |  |
| 14 | -  | •    | Reset                          | Bool                   | false       | FALSE                  |  |  |
| 15 | -  | •    | Output                         |                        |             |                        |  |  |
| 16 |  | •    | <ul> <li>TargetPose</li> </ul> | Array[019, 05] of DInt |             |                        |  |  |

8. Obtain planned path from the Mech-Viz project: in the **ObtainPose\_DB** DB, double-click on the monitor value of **VizObtainStart** to change it to **TRUE**. Then, reset the monitor value to **FALSE**.

| MN | ∕LC | am   | era 🔸 PLC_1 [CPU 121           | 1C DC/DC/DC] 🕨 Progi    | ram blocks 🕨 O | btainPose_DB [DB2]       |
|----|-----|------|--------------------------------|-------------------------|----------------|--------------------------|
|    |     |      |                                |                         |                |                          |
|    | Ĩ   | 6    | 🔩 🋃 🚞 🍞 Keepa                  | ctual values 🛛 🔒 Snapsł | not ඁ 🖣 🔍 Cop  | py snapshots to start va |
|    | Ob  | taiı | nPose_DB                       |                         |                |                          |
|    |     | Nar  | me                             | Data type               | Start value    | Monitor value            |
| 1  | -00 | •    | Input                          |                         |                |                          |
| 2  | -00 | •    | BufferTime                     | Time                    | T#Oms          | T#500MS                  |
| 3  | -   | •    | VisionStart                    | Bool                    | false          | FALSE                    |
| 4  | -00 | •    | VisObtainStart                 | Bool                    | false          | FALSE                    |
| 5  | -00 | •    | VizStart                       | Bool                    | false          | FALSE                    |
| 6  | -00 | •    | VizStop                        | Bool                    | false          | FALSE                    |
| 7  |     | •    | BranchSet                      | Bool                    | false          | FALSE                    |
| 8  | -   | •    | VizObtainStart                 | Bool                    | false          | FALSE                    |
| 9  | -00 | •    | DataReady                      | Bool                    | false          | FALSE                    |
| 10 | -00 | •    | StatusCode                     | DInt                    | 0              | 2100                     |
| 11 | -   | •    | BranchName                     | USInt                   | 0              | 1                        |
| 12 | -00 | •    | BranchPort                     | USInt                   | 0              | 1                        |
| 13 | -00 | •    | SendPoseNum                    | USInt                   | 0              | 10                       |
| 14 |     | •    | Reset                          | Bool                    | false          | FALSE                    |
| 15 |     | •    | Output                         |                         |                |                          |
| 16 | -   | •    | <ul> <li>TargetPose</li> </ul> | Array[019, 05] of DInt  |                |                          |



9. Check the received target points: the monitor value of **SendPoseNum** shows how many target points were received, and the target points are stored in **TargetPose**. Divide the monitor values by 10000 to obtain the actual pose data.

| j) | Ť   | è 🔒  | , 🛃 🗮 🚏 Keep a  | ctual values 🔒 Snap    | shot ඁ 🐴 C  | Copy snapshots to start va |
|----|-----|------|-----------------|------------------------|-------------|----------------------------|
|    | Ob  | tain | Pose_DB         |                        |             |                            |
|    |     | Nam  | e               | Data type              | Start value | Monitor value              |
| 1  | -   | ▼ 1  | nput            |                        |             |                            |
| 2  | -   | •    | BufferTime      | Time                   | T#Oms       | T# 500MS                   |
| 3  | -   | •    | VisionStart     | Bool                   | false       | FALSE                      |
| 4  |     | •    | VisObtainStart  | Bool                   | false       | FALSE                      |
| 5  |     | •    | VizStart        | Bool                   | false       | FALSE                      |
| 6  | -00 | •    | VizStop         | Bool                   | false       | FALSE                      |
| 7  | -00 | •    | BranchSet       | Bool                   | false       | FALSE                      |
| 8  | -00 | •    | VizObtainStart  | Bool                   | false       | FALSE                      |
| 9  |     | •    | DataReady       | Bool                   | false       | FALSE                      |
| 10 | -   | •    | StatusCode      | DInt                   | 0           | 2100                       |
| 11 | -   | •    | BranchName      | USInt                  | 0           | 1                          |
| 12 | -00 | •    | BranchPort      | USInt                  | 0           | 1                          |
| 13 | -   | •    | SendPoseNum     | USInt                  | 0           | 10                         |
| 14 |     | •    | Reset           | Bool                   | false       | FALSE                      |
| 15 | -   | • 0  | Dutput          |                        |             |                            |
| 16 | -00 | •    | TargetPose      | Array[019, 05] of DInt |             |                            |
| 17 | -   |      | TargetPose[0,0] | DInt                   | 0           | 740000                     |
| 18 | Ð   |      | TargetPose[0,1] | DInt                   | 0           | 574700                     |
| 19 | -   |      | TargetPose[0,2] | DInt                   | 0           | -521200                    |
| 20 | -0  |      | TargetPose[0,3] | DInt                   | 0           | 80000                      |
| 21 | -0  |      | TargetPose[0,4] | DInt                   | 0           | 246500                     |
| 22 |     |      | TargetPose[0,5] | DInt                   | 0           | 900000                     |
| 23 | -   |      | TargetPose[1,0] | DInt                   | 0           | 1292518                    |
| 24 | -0  |      | TargetPose[1,1] | DInt                   | 0           | 825172                     |
| 25 | -0  |      | TargetPose[1,2] | DInt                   | 0           | -259905                    |
| 26 | -   |      | TargetPose[1,3] | DInt                   | 0           | 35766                      |
| 27 | -   |      | TargetPose[1,4] | DInt                   | 0           | 338369                     |
| 28 | -   |      | TargetPose[1,5] | Dint                   | 0           | 1856696                    |