Mech-Mind User’s Manual

Mech-Mind

Mar 06, 2023

CONTENTS

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

CHAPTER

ONE

KUKA SETUP INSTRUCTIONS

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

The process consists of the following steps:

Please have a flash drive ready at hand.

1.1 Check Controller and Software Compatibility

Compatibility requirements are as follows:

- Controller model: KUKA KR C4, C5
- Controller system software version: KSS 8.2, 8.3, 8.5 or 8.6
- Add-on software package: Ethernet KRL (V 2.2.8, 3.0.3 or 3.1.2.29)

  The correspondance between KSS and Ethernet KRL versions is as follows:

KSS version	Ethernet KRL version
8.2 or 8.3	2.2.8
8.5	3.0.3
8.6	3.1.2.29

- Mech-Mind Software Suite: latest version recommended

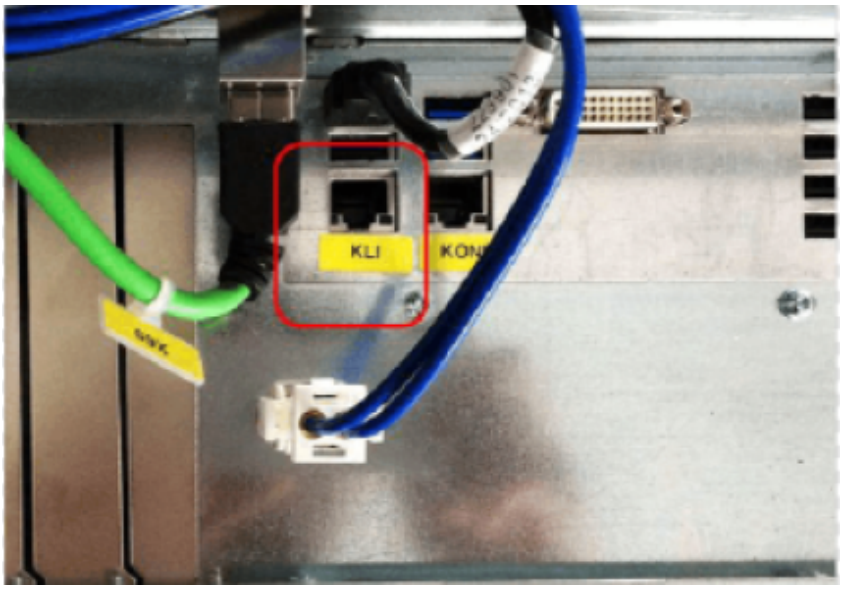
Note: All teach pendant actions in this chapter are performed on KSS 8.6. The specific steps and menu selections may differ slightly in older versions of system software.

1.2 Setup the Network Connection

1.2.1 Hardware Connection

Plug the Ethernet cable into:

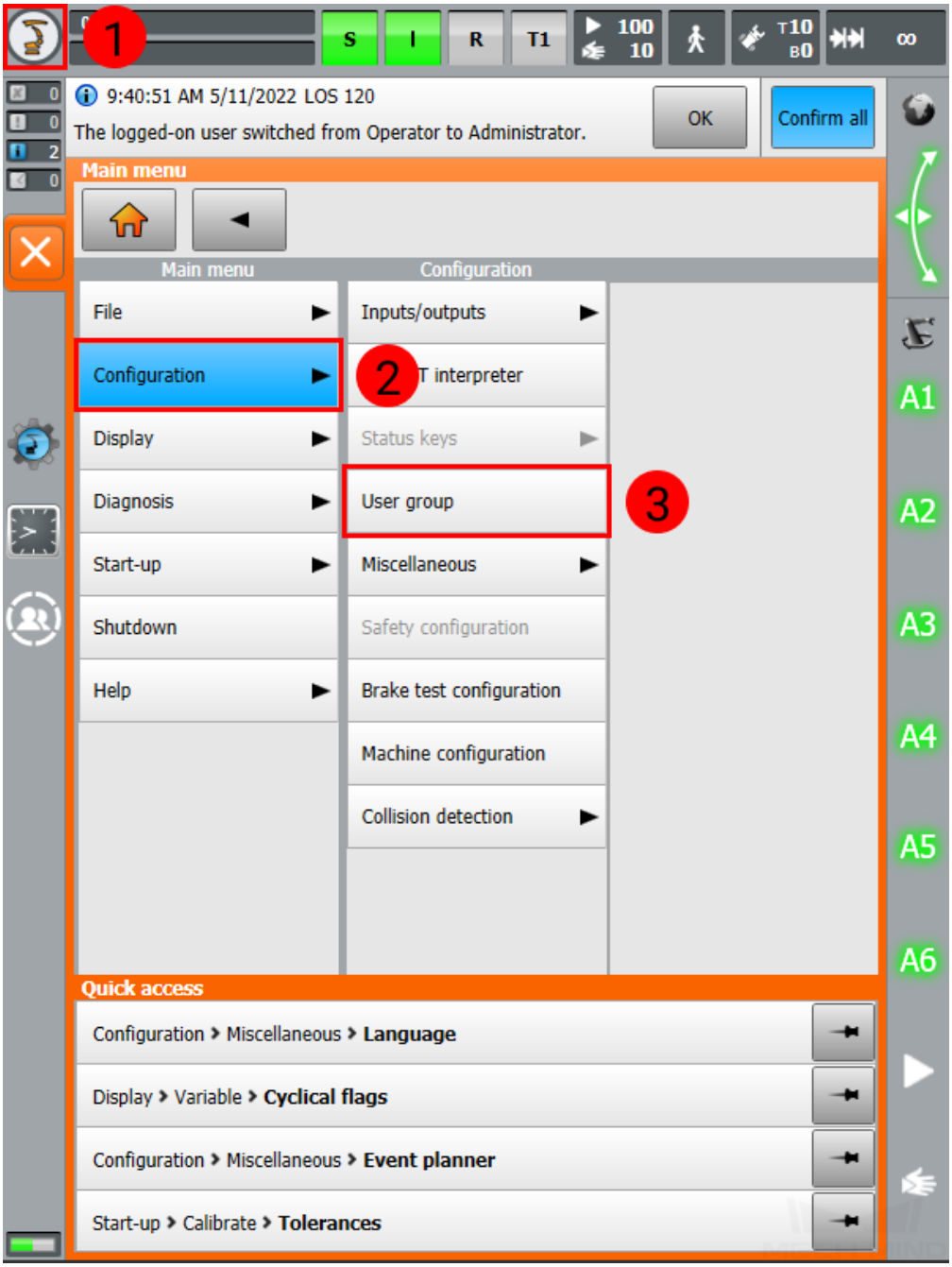
- An Ethernet port on the IPC
- The X66 port on KR C4 compact and KLI port on other KR C4 controllers



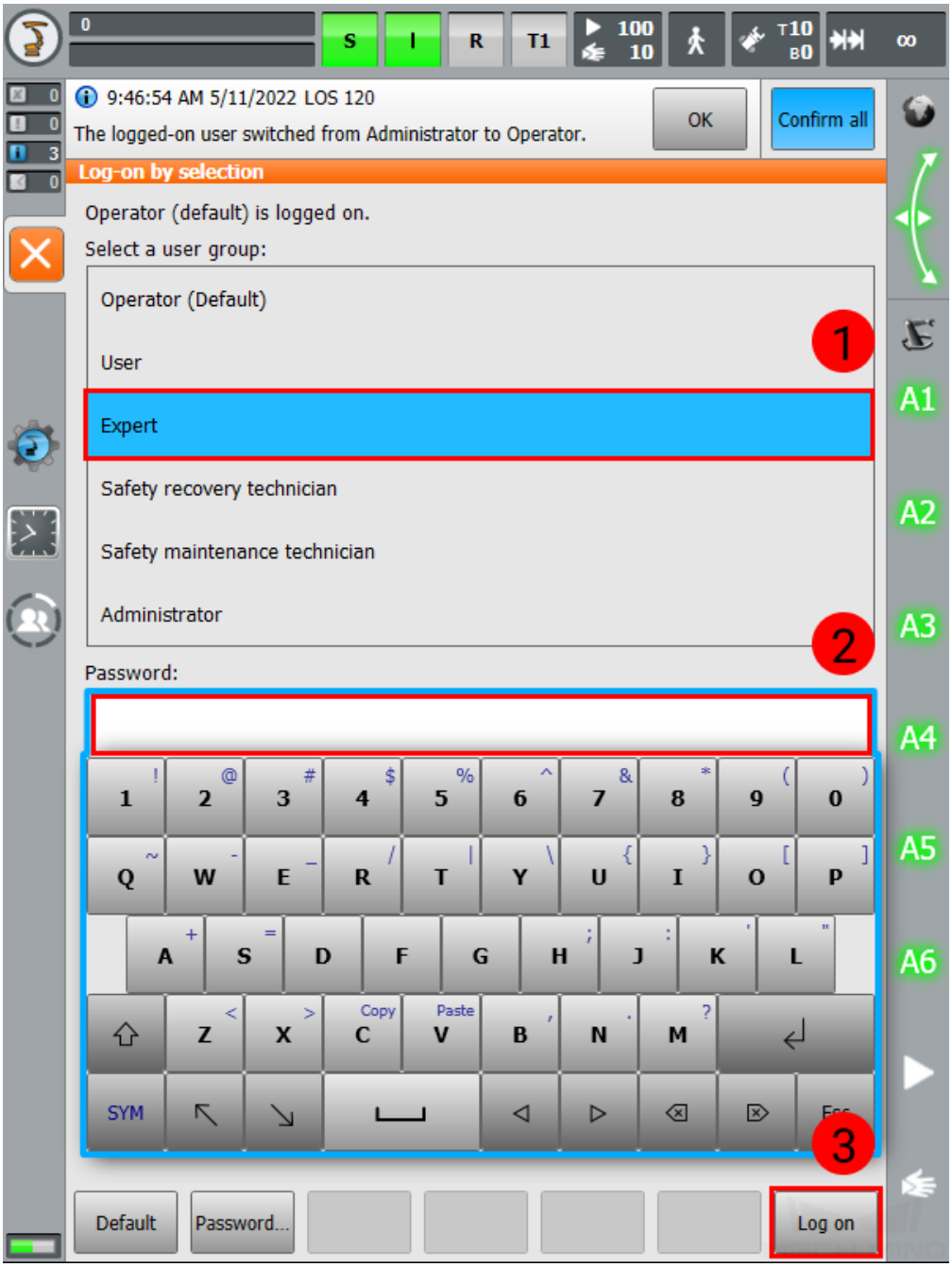
1.2.2 IP Configuration

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.

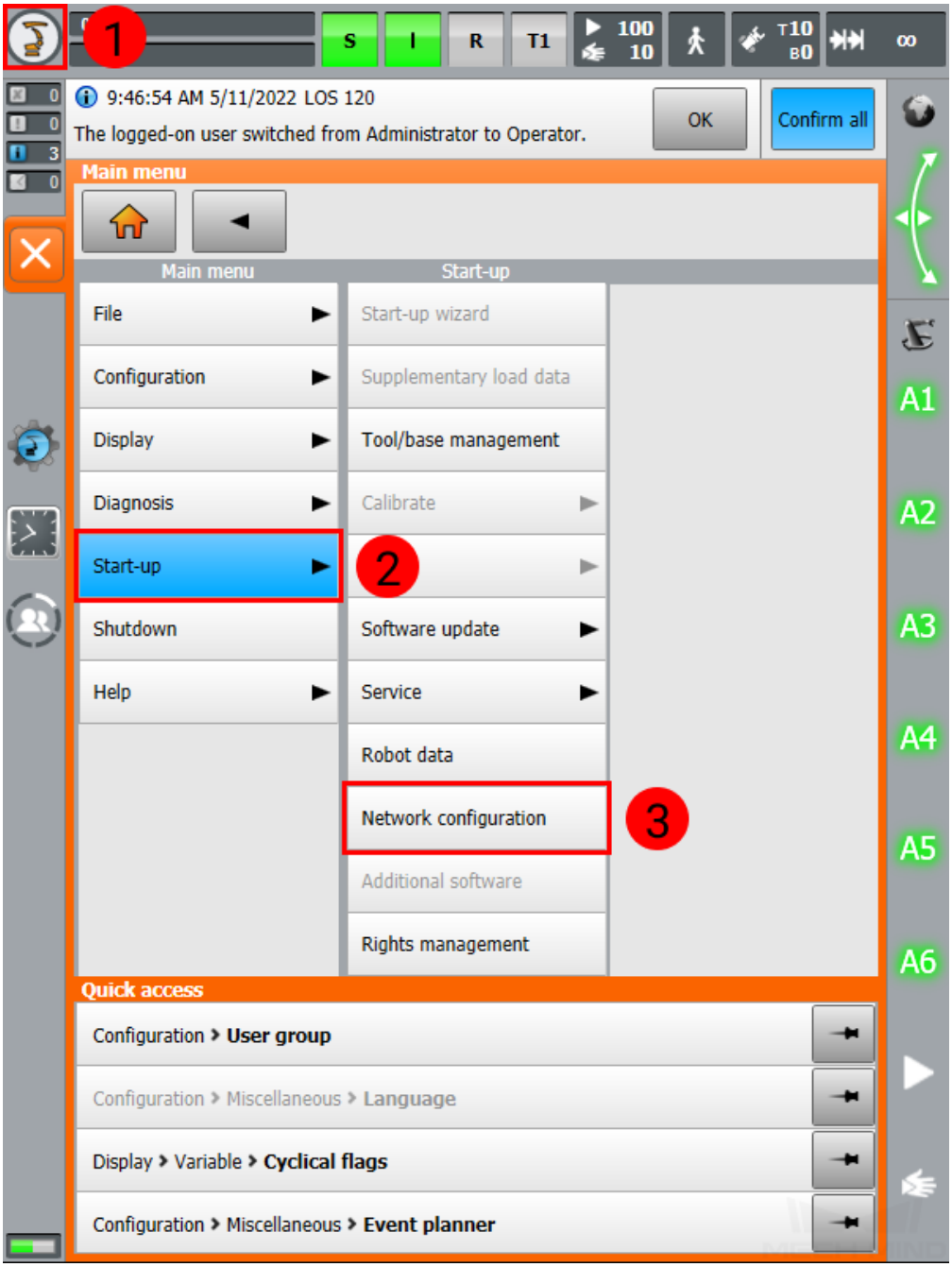
1. Check the IP address of the IPC: please use the *ipconfig* command in Command Prompt or PowerShell to check the IP address.
2. Switch to expert mode:
    1. Press on  , and then select *Configuration* → *User group*.



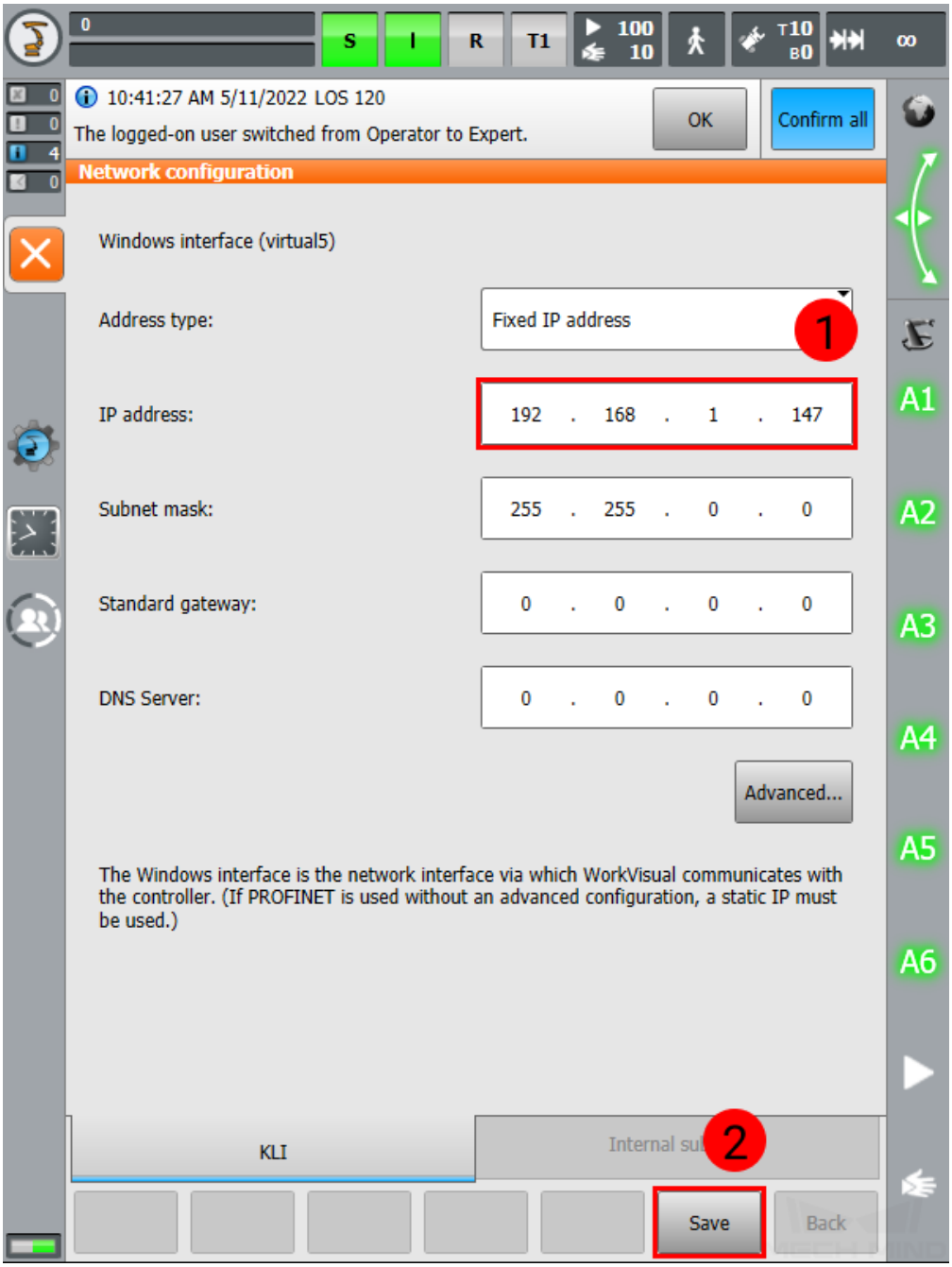
2. Select **Expert**, enter the password (the default password is **kuka**), and press on *Log on*.

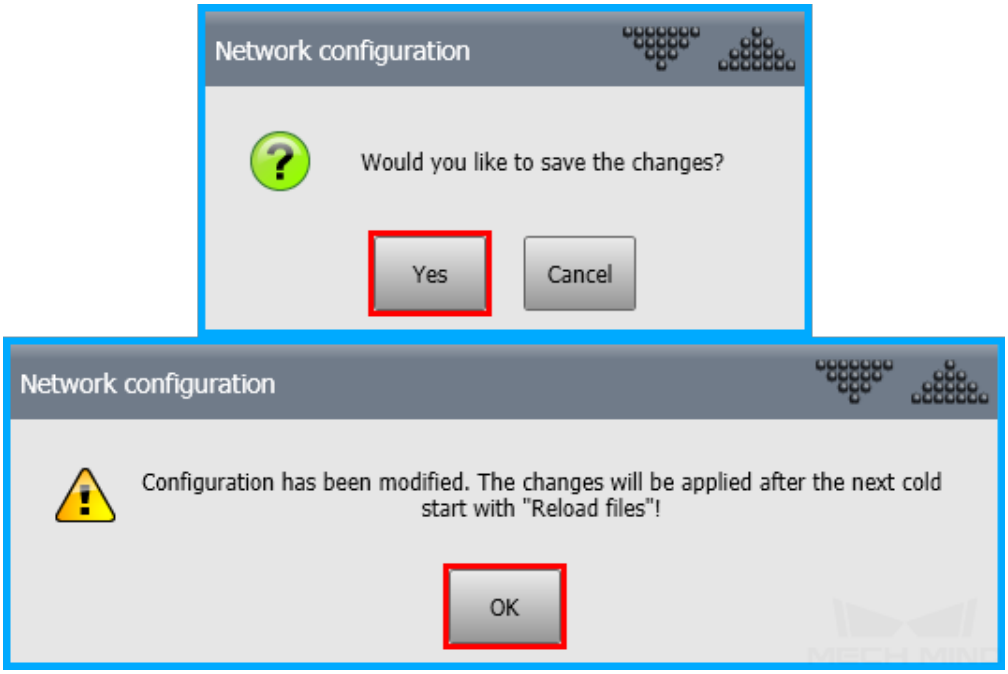


3. Press on  , and then select *Start-up* → *Network configuration*.



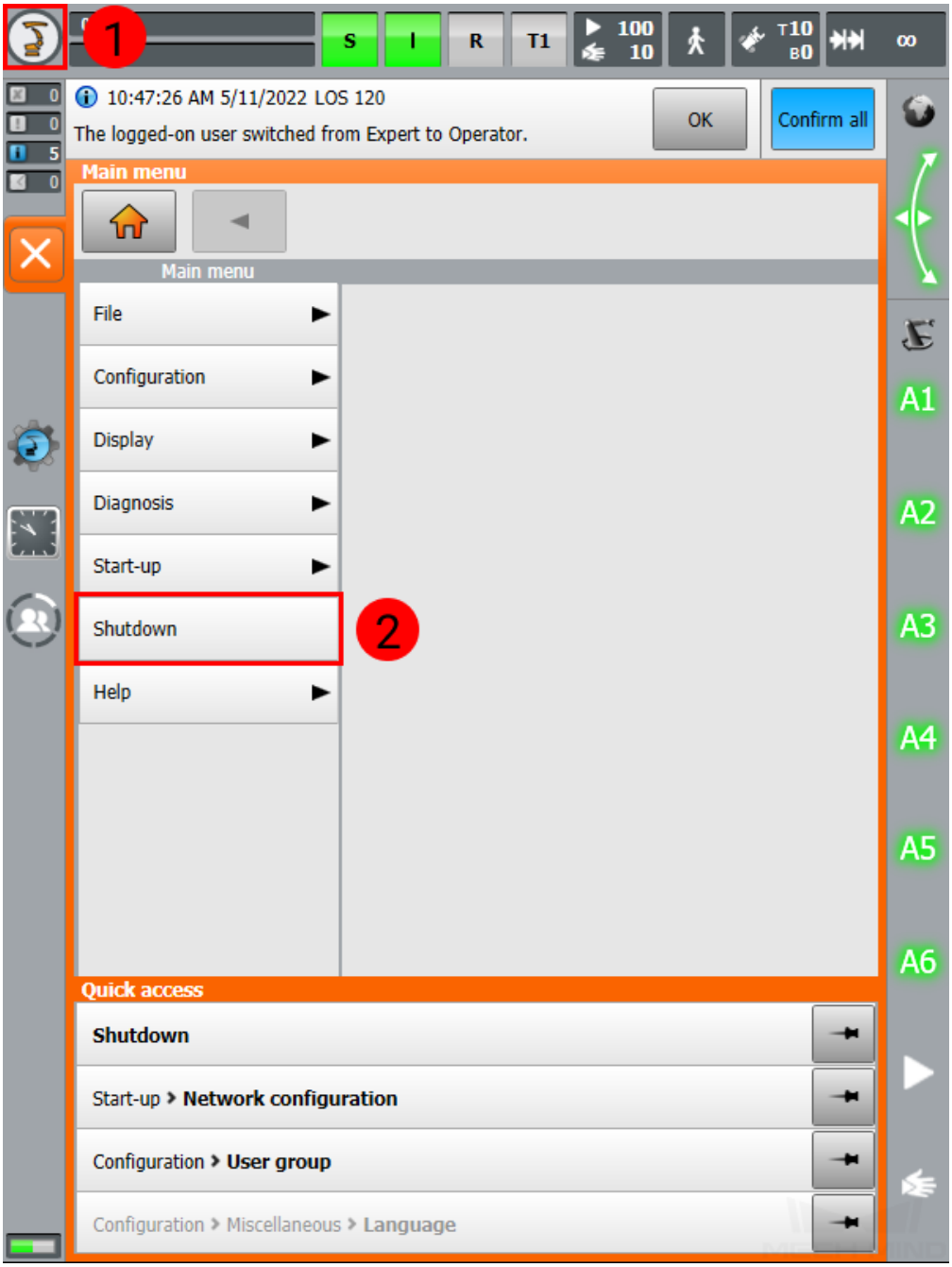
4. Input an IP address in the same subnet as that of the IPC, and then press on *Save*. In the next two pop-up windows, press on *Yes* and *OK*, respectively.


S
I
R
T1
10:41:27 AM 5/11/2022 LOS 120
The logged-on user switched from Operator to Expert.
OK
Confirm all
Network configuration
Windows interface (virtual5)
Address type:
Fixed IP address
1
IP address:
192 . 168 . 1 . 147
Subnet mask:
255 . 255 . 0 . 0
Standard gateway:
0 . 0 . 0 . 0
DNS Server:
0 . 0 . 0 . 0
Advanced...
The Windows interface is the network interface via which WorkVisual communicates with the controller. (If PROFINET is used without an advanced configuration, a static IP must be used.)
KLI
2
Save
Back
A1
A2
A3
A4
A5
A6

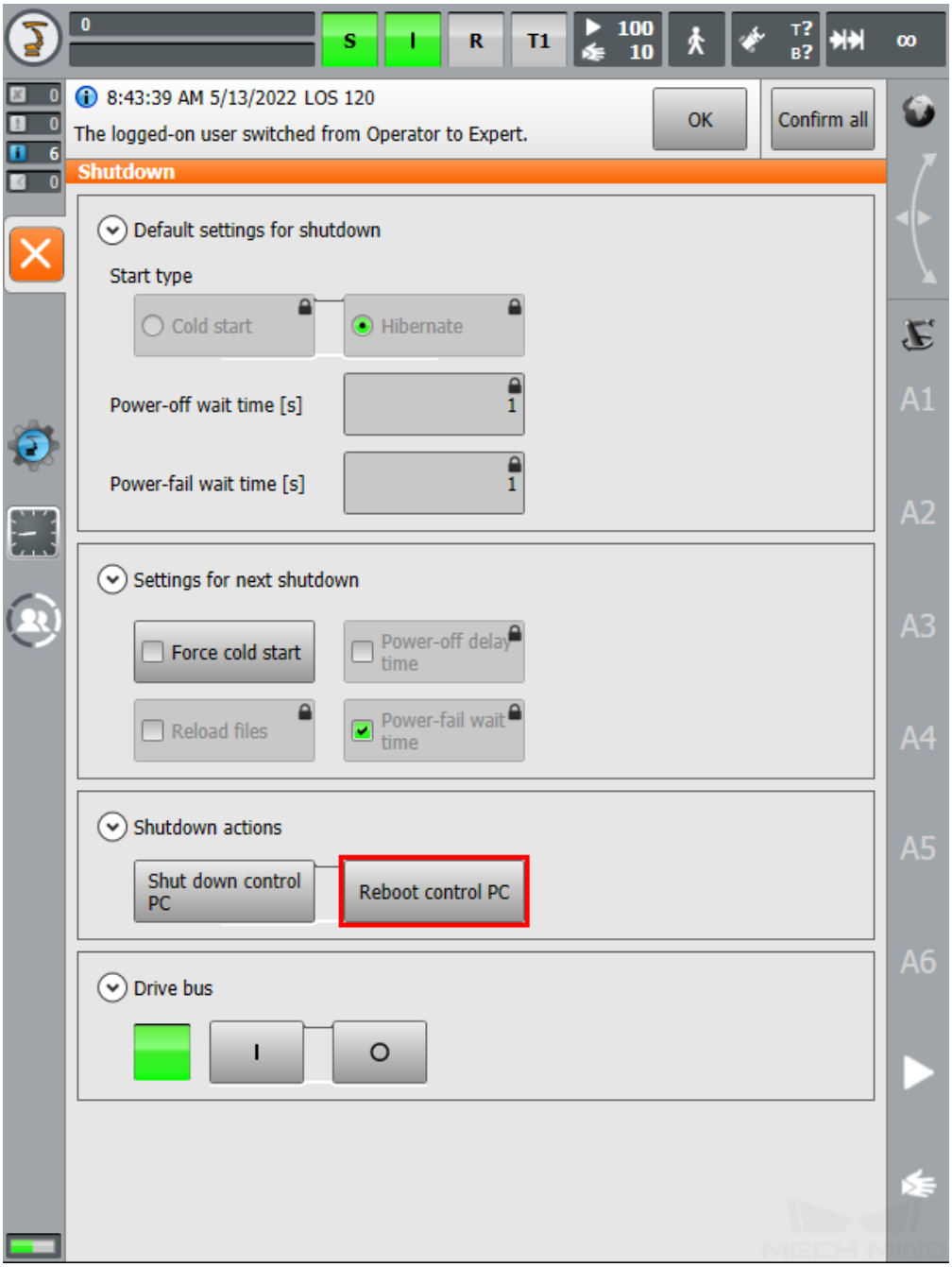


5. Restart the robot to finish setting the IP address:

   1. Press on  , and select **Shutdown**.



2. Press on *Reboot control PC*.


S
I
R
T1
100
10
8:43:39 AM 5/13/2022 LOS 120
The logged-on user switched from Operator to Expert.
OK
Confirm all
Shutdown
Default settings for shutdown
Start type
Cold start
Hibernate
Power-off wait time [s]
1
Power-fail wait time [s]
1
Settings for next shutdown
Force cold start
Power-off delay time
Reload files
Power-fail wait time
Shutdown actions
Shut down control PC
Reboot control PC
Drive bus
I
O
A1
A2
A3
A4
A5
A6

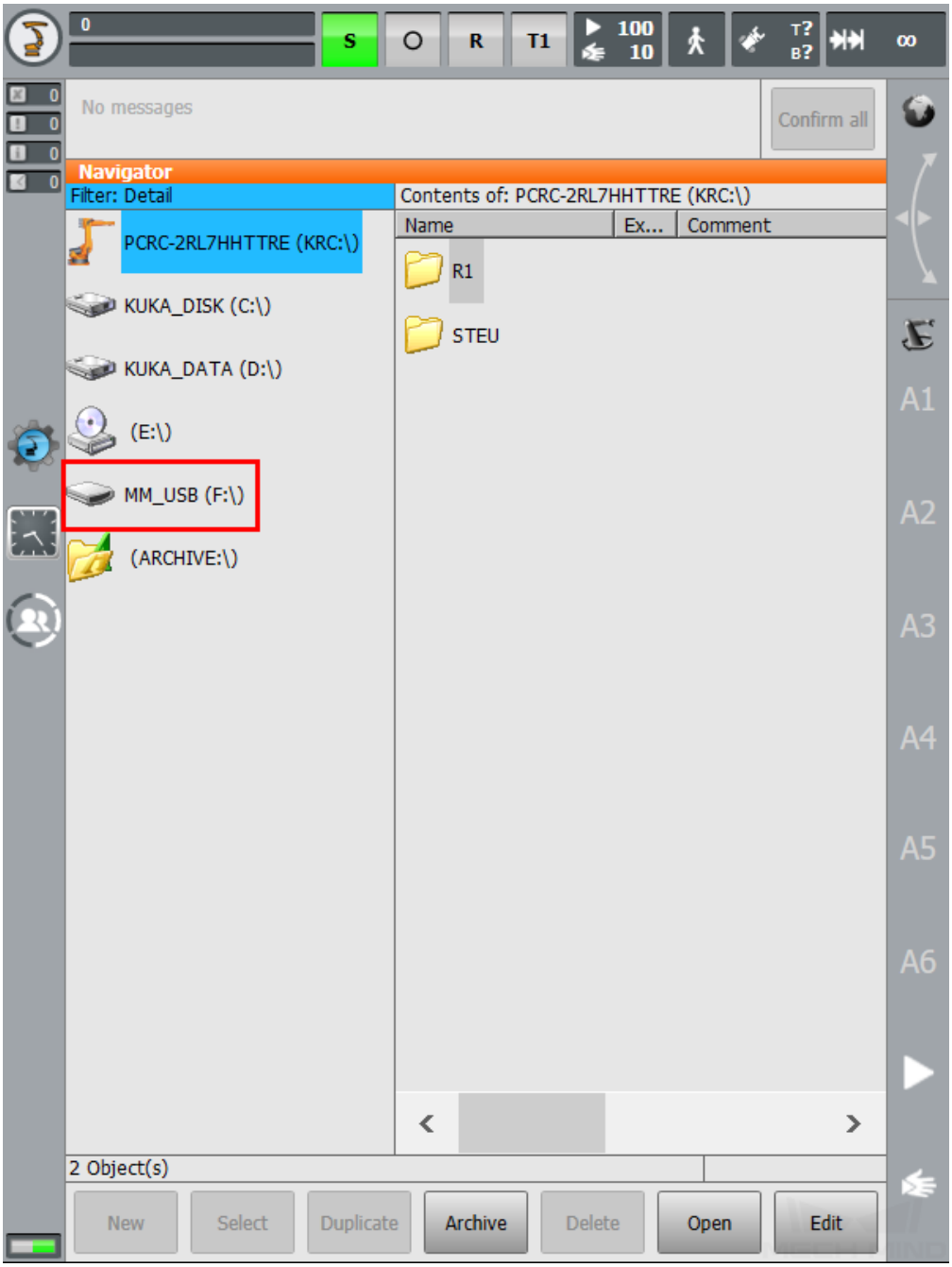
1.3 Load the Program Files

Attention: Before operating the robot, please follow the backup instructions below to back up the system.

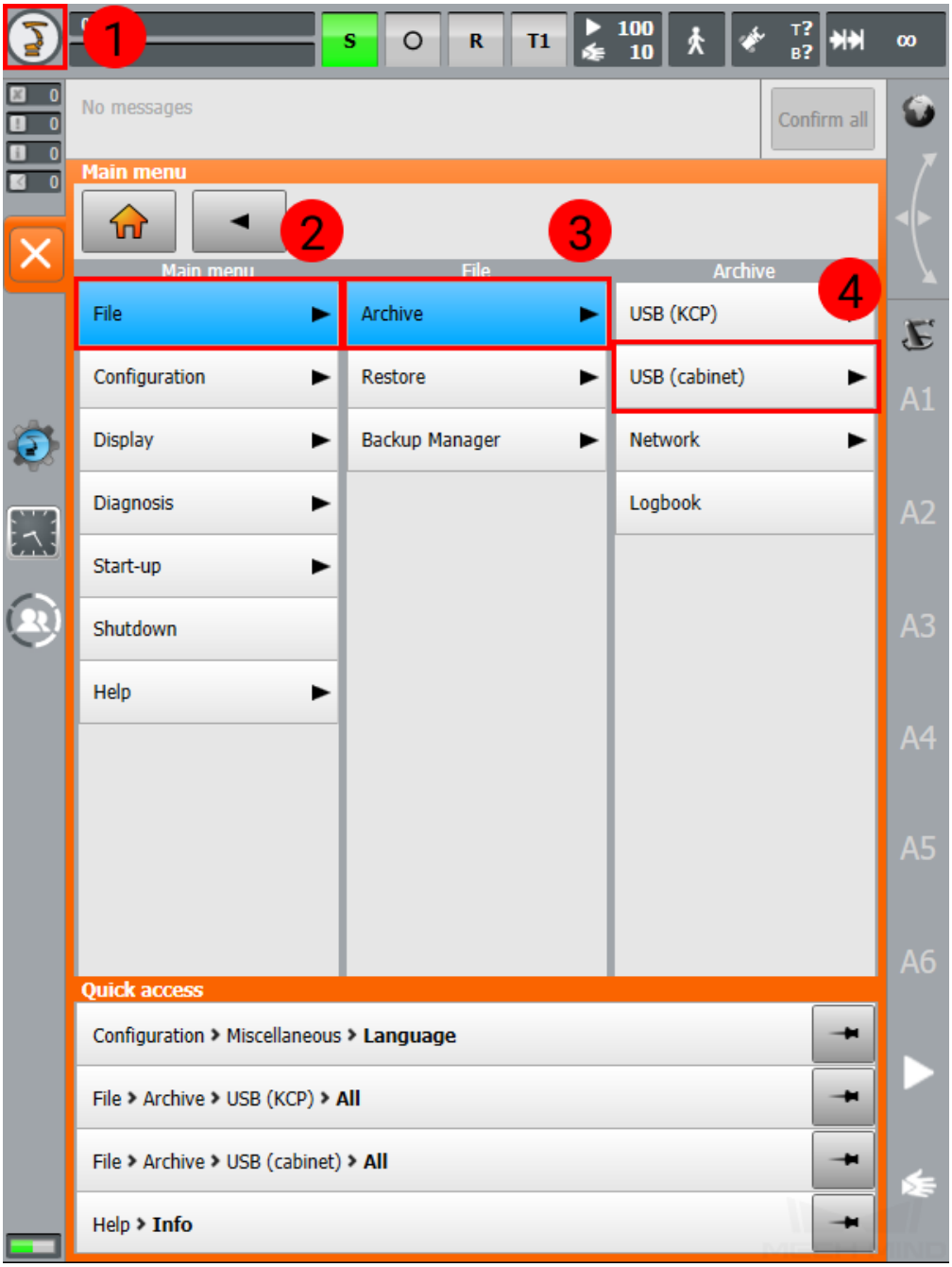
1.3.1 Backup

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

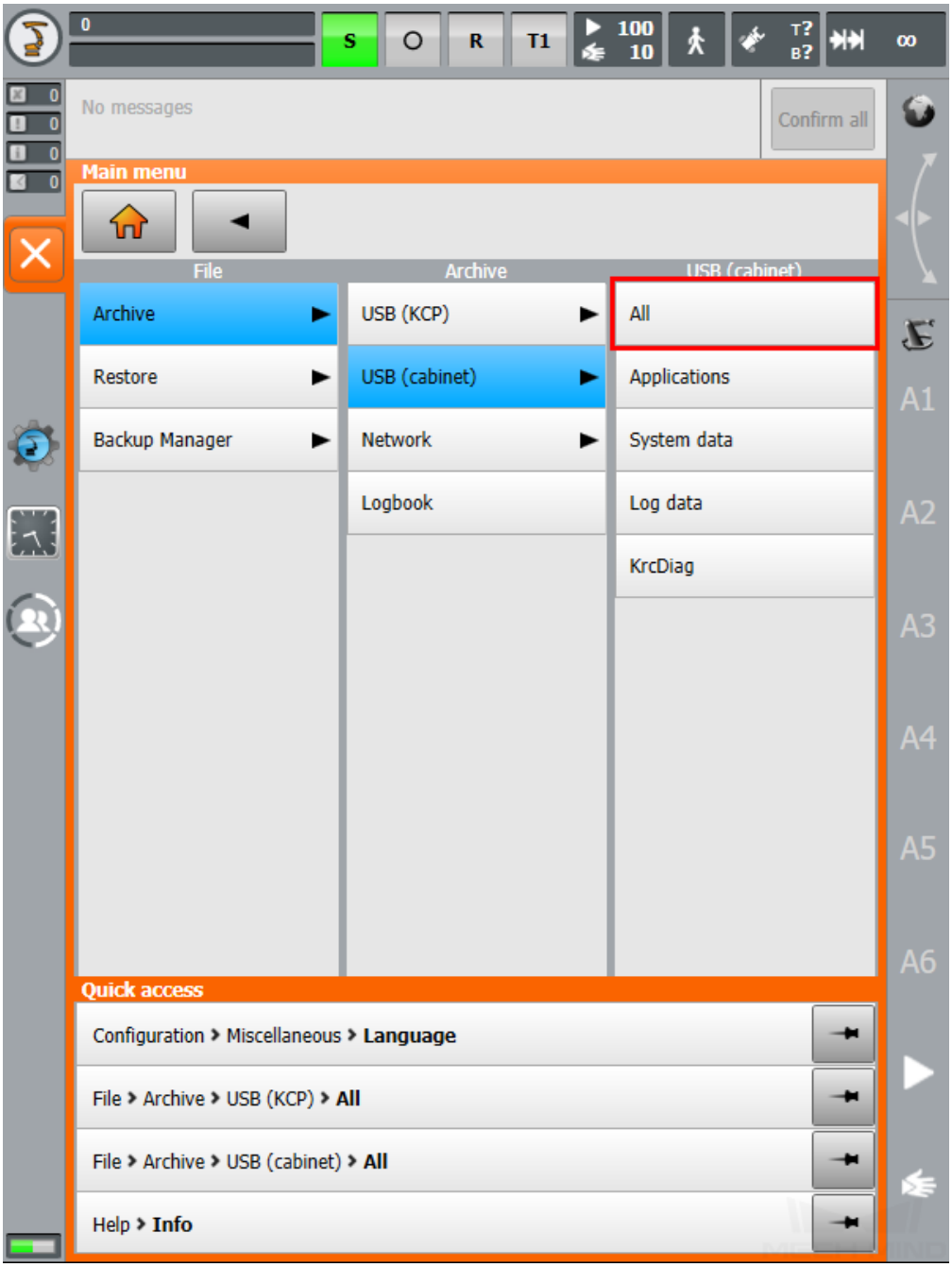
1. Plug the flash drive for storing the backup file to the controller, and make sure that the flash drive shows up on the teach pendant.



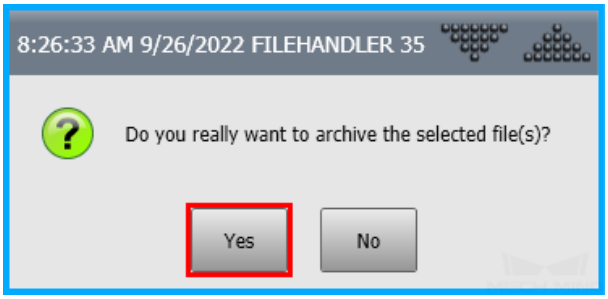
2. Press on  , and then select *File* → *Archive* → *USB (cabinet)*.



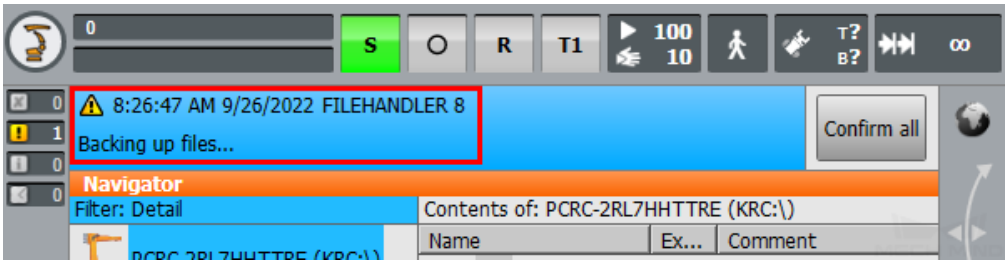
3. After selecting **USB (cabinet)**, select **All** in the last column.



4. Press on *Yes* in the pop-up window to start the backup process.



5. The following message is displayed when backup is in process. Once the backup is completed, this message disappears, and a ZIP file is created in the flash drive.



1.3.2 Prepare the Files

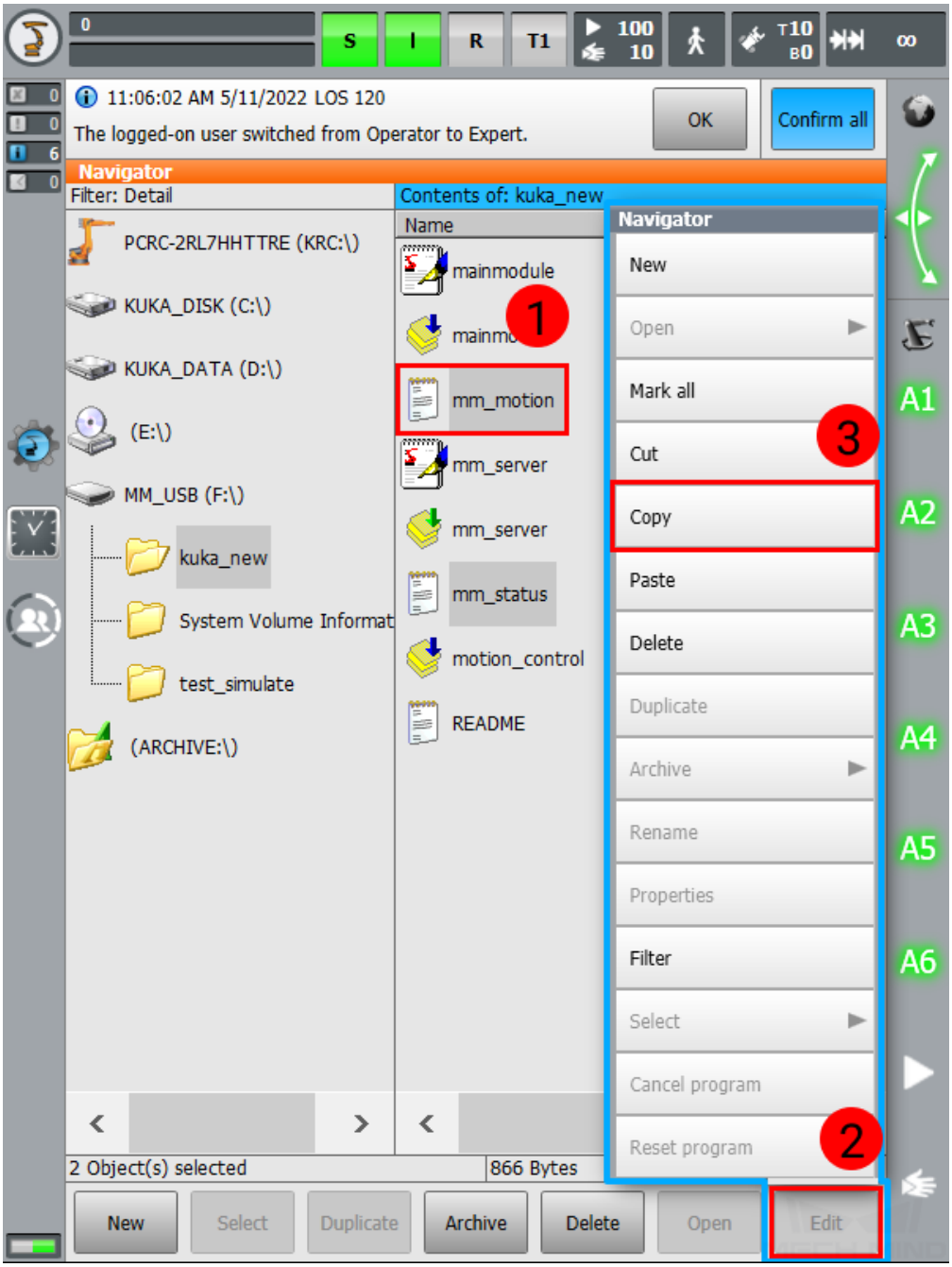
The program files are stored in the installation directory of Mech-Mind Software Suite.

Navigate to *xxx\Mech-Mind Software Suite-x.x.x\Mech-Center\Robot_Server\Robot_FullControl\kuka\kuka_new*, and copy all the program files to your flash drive.

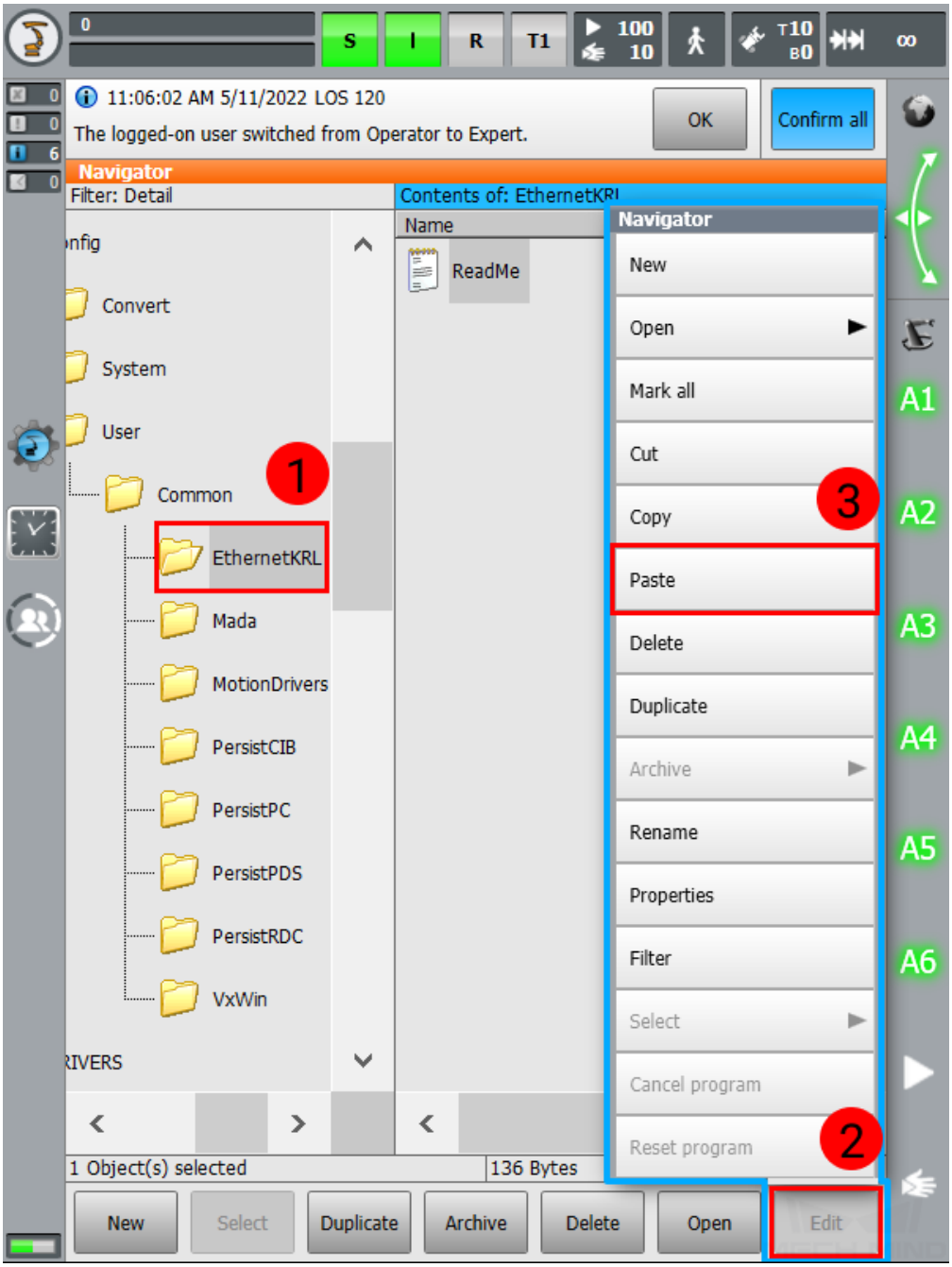
1.3.3 Load the Files to the Robot

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

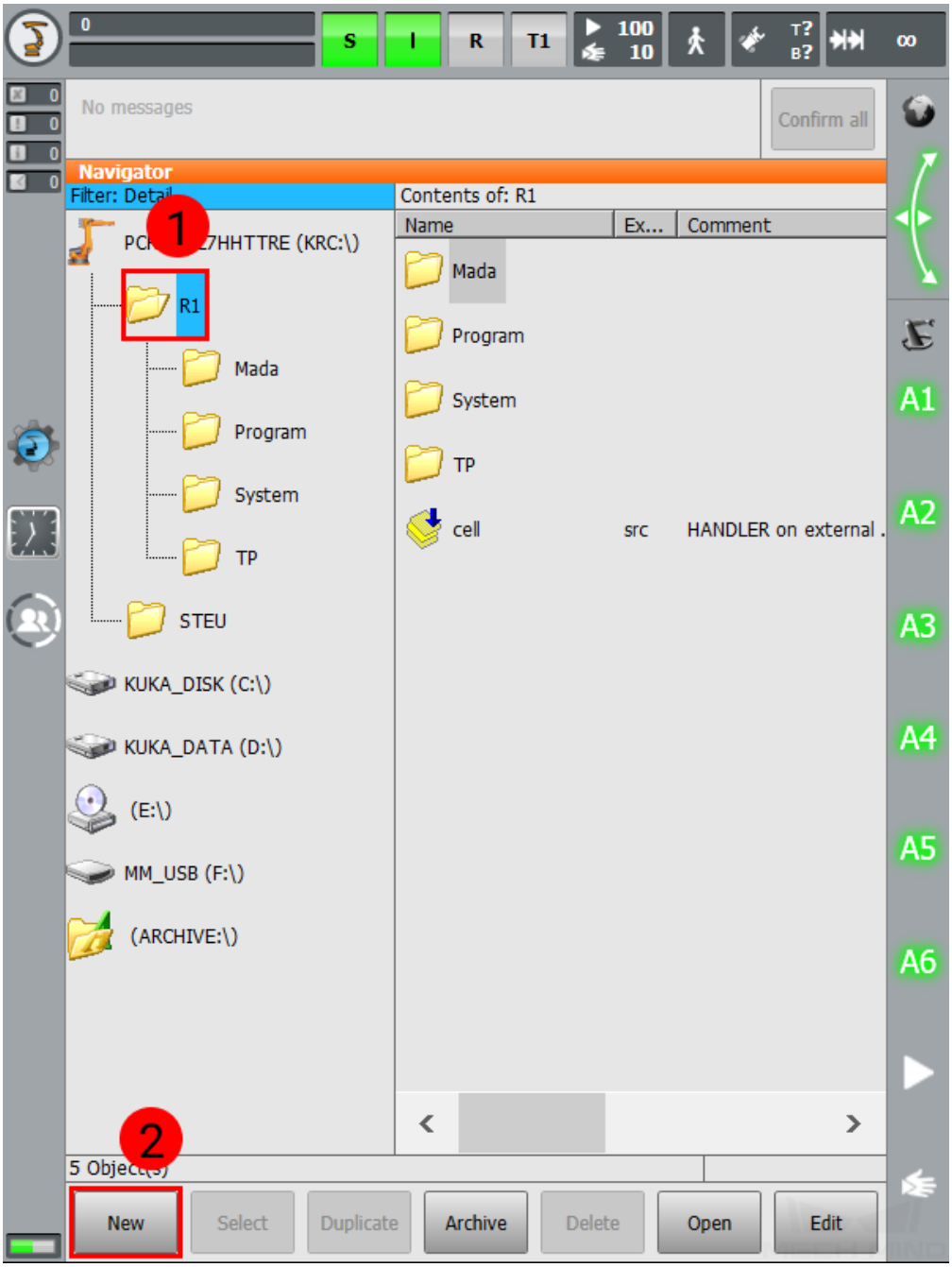
1. Plug the flash drive to the controller.
2. Select the flash drive, and locate the above files.
3. Select **mm_motion.xml**, press on *Edit*, and then select **Copy**.



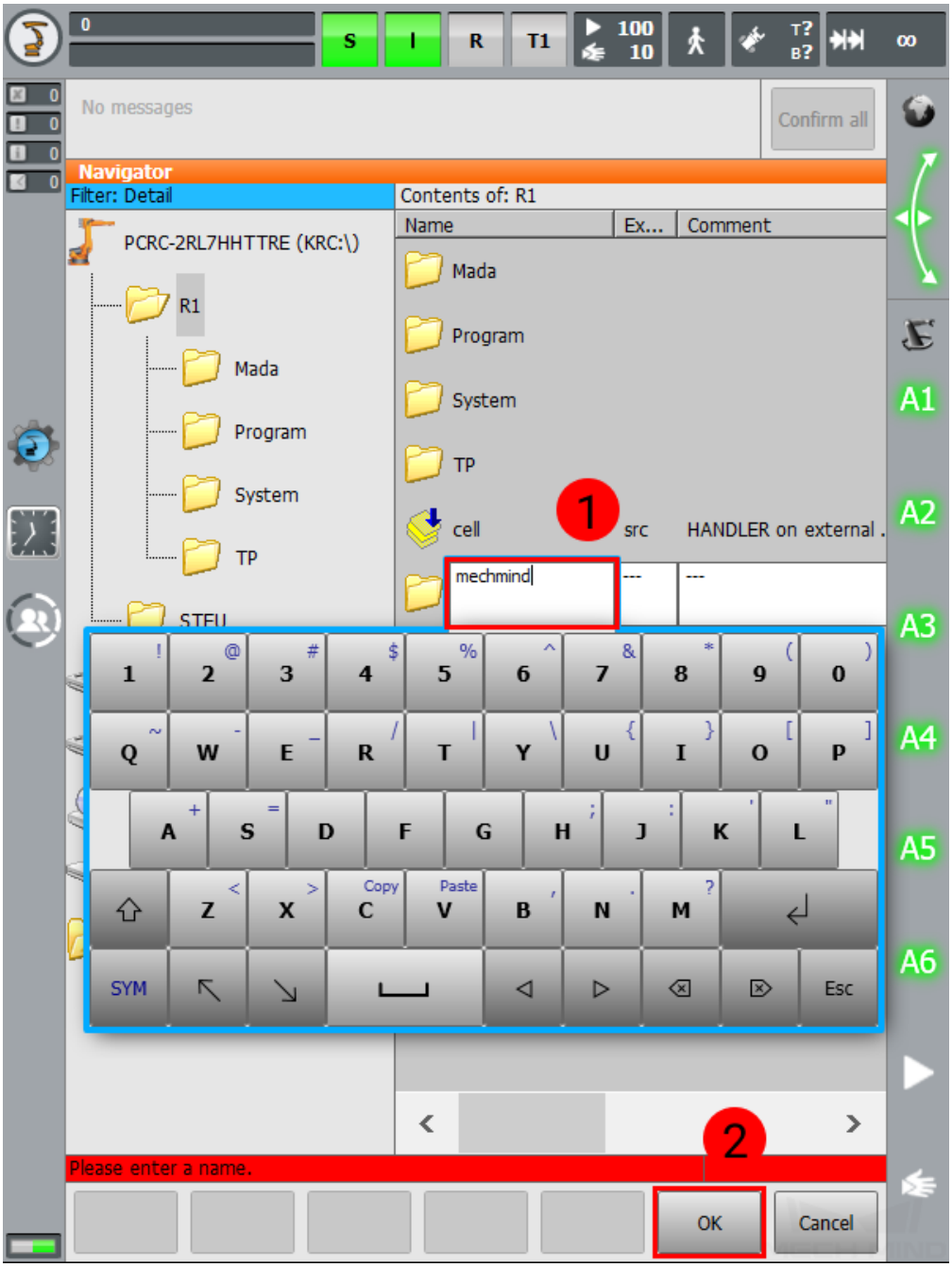
4. Navigate to *C:/KRC/ROBOTER/Config/User/Common/EthernetKRL*, press on *Edit*, and then select Paste.



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*.

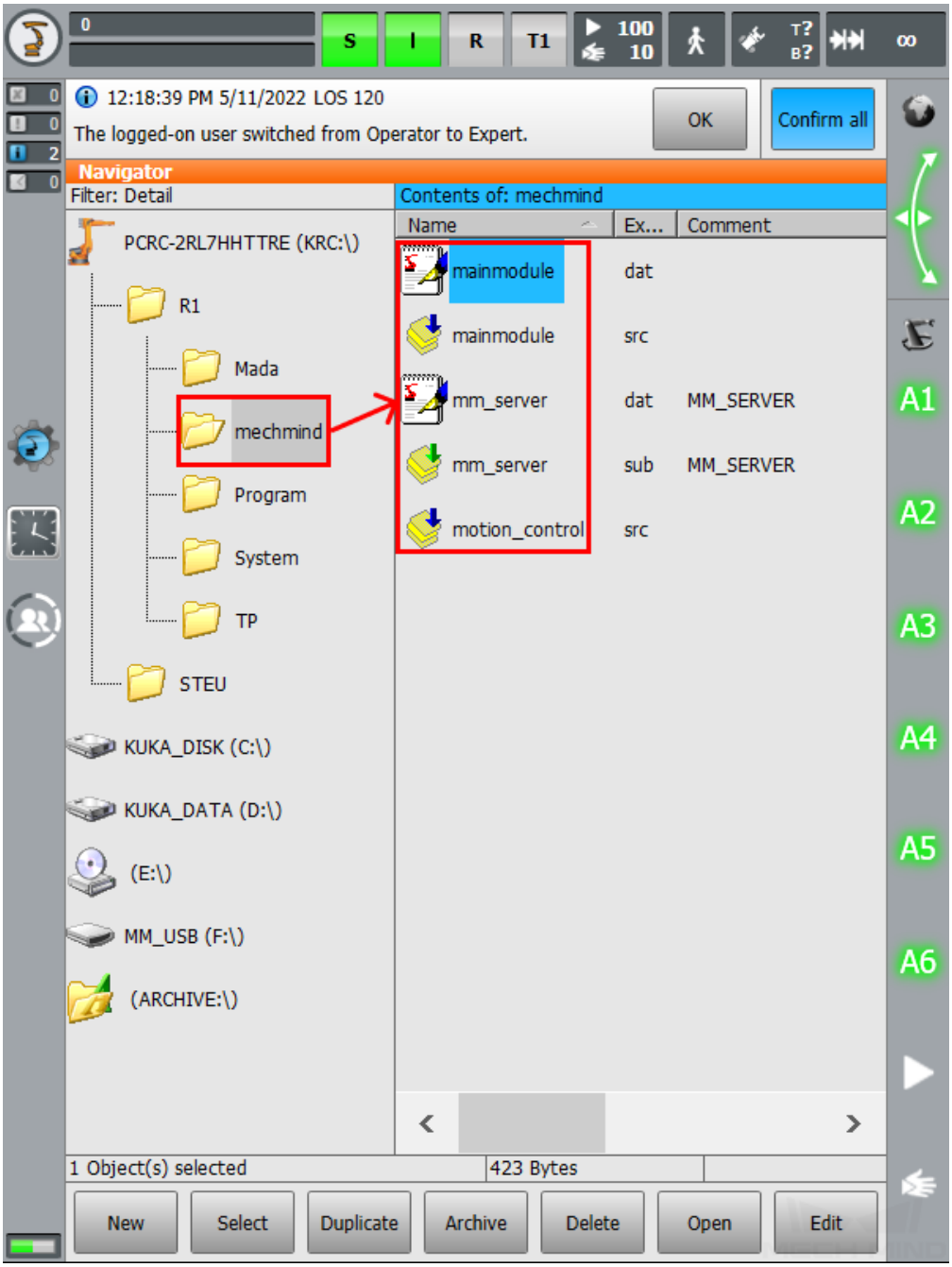


7. Input **mechmind** for the folder name, and press on *OK*.



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

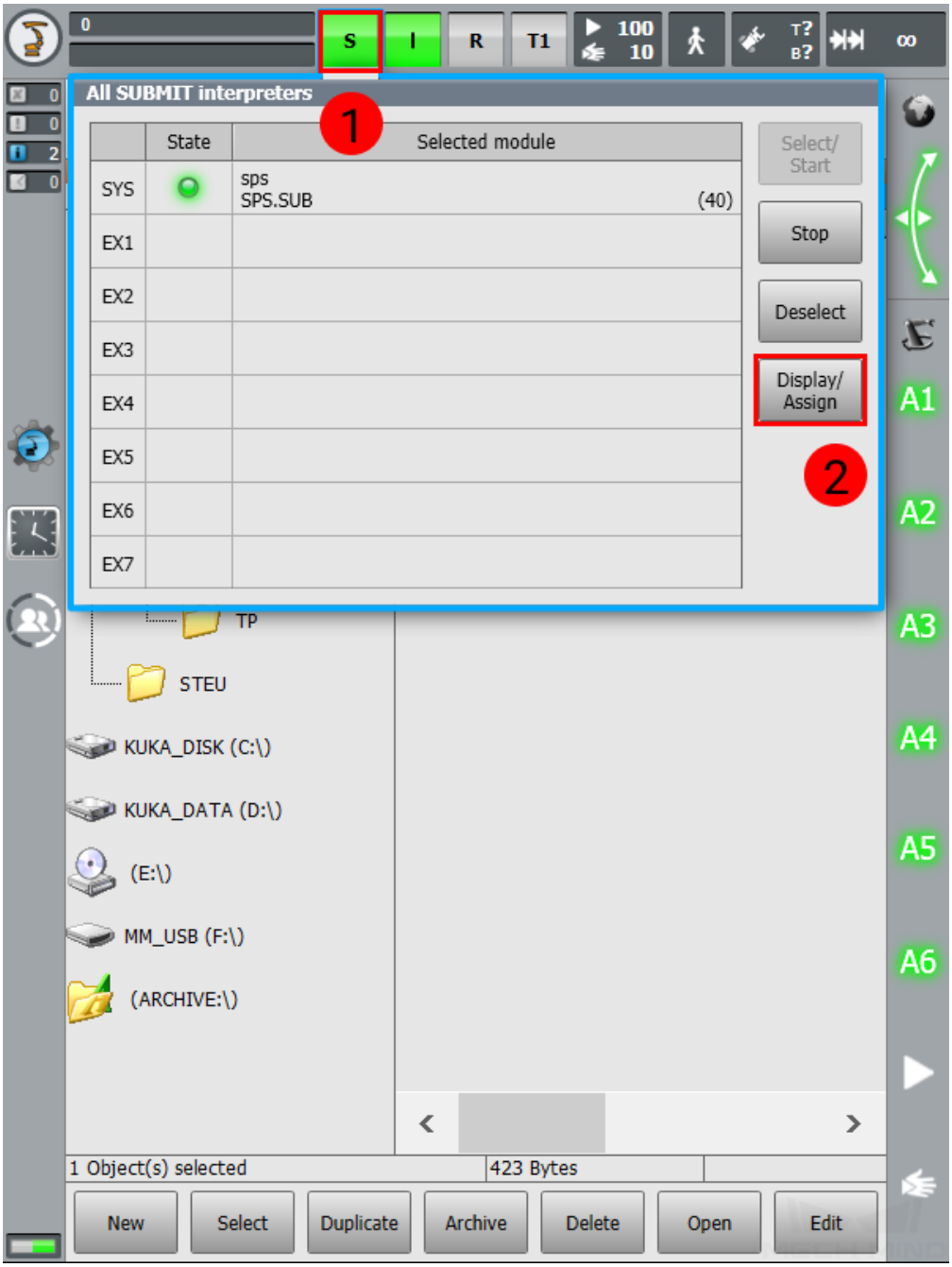
> **Note:** Long-press and drag to select multiple adjacent files.


S
I
R
T1
100
10
12:18:39 PM 5/11/2022 LOS 120
The logged-on user switched from Operator to Expert.
OK
Confirm all
Navigator
Filter: Detail
Contents of: mechmind
Name
Ex...
Comment
PCRC-2RL7HHTTRE (KRC:\)
R1
Mada
mechmind
Program
System
TP
STEU
KUKA_DISK (C:\)
KUKA_DATA (D:\)
(E:\)
MM_USB (F:\)
(ARCHIVE:\)
mainmodule
dat
mainmodule
src
mm_server
dat
MM_SERVER
mm_server
sub
MM_SERVER
motion_control
src
A1
A2
A3
A4
A5
A6
1 Object(s) selected
423 Bytes
New
Select
Duplicate
Archive
Delete
Open
Edit

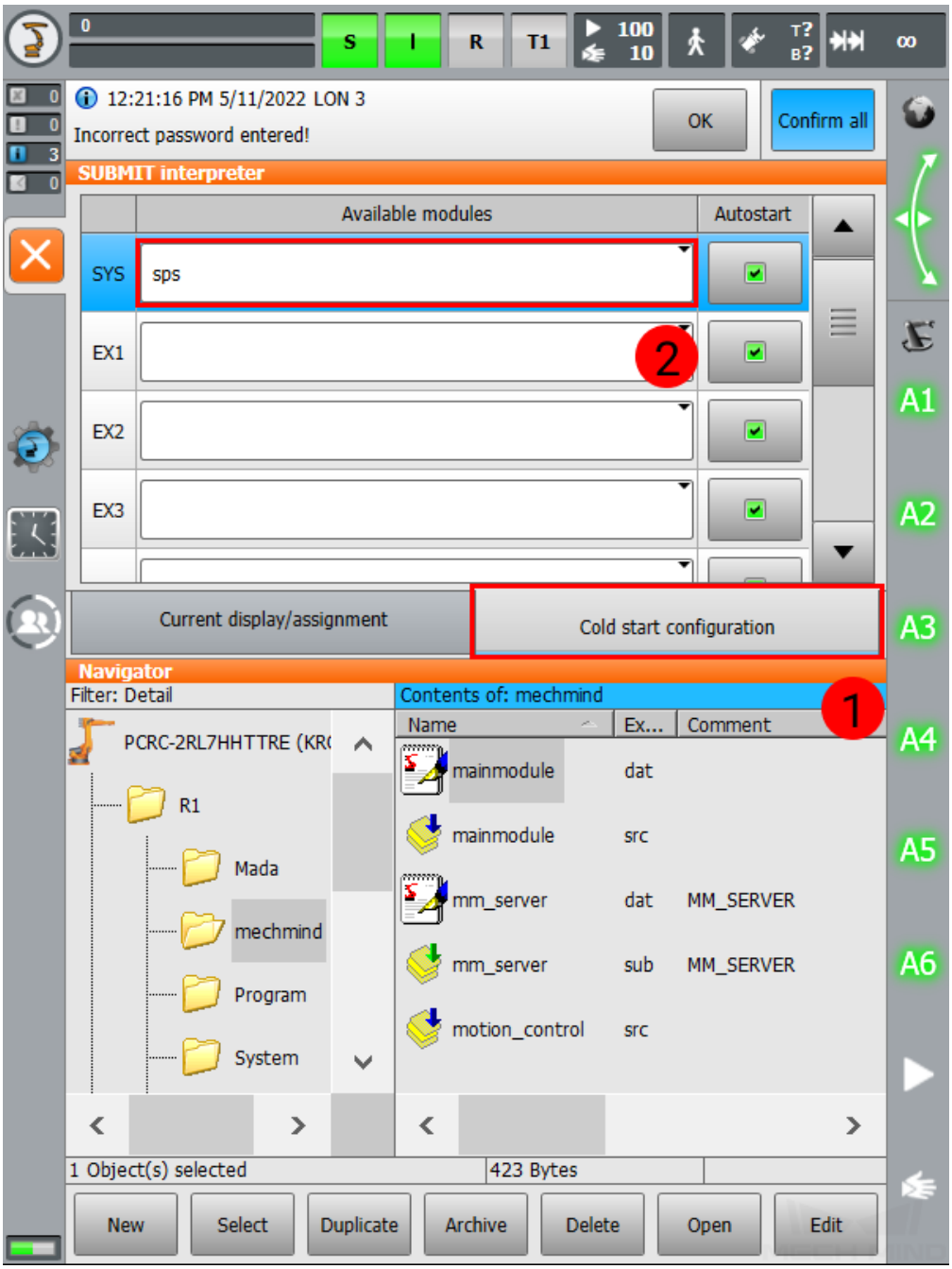
1.3.4 Set Autostart for Background Porgram

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

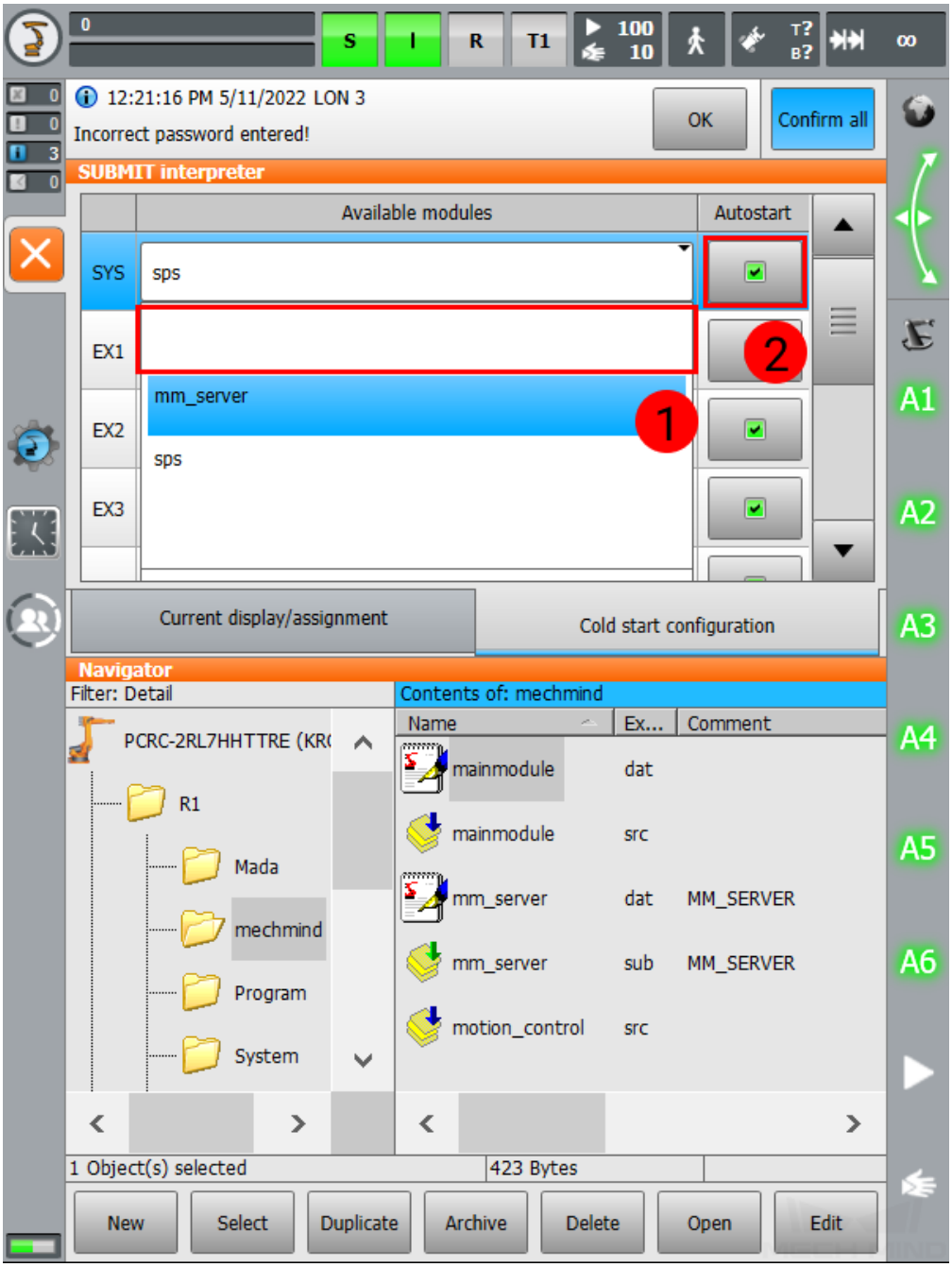
1. Press on S and then *Display/Assign*.



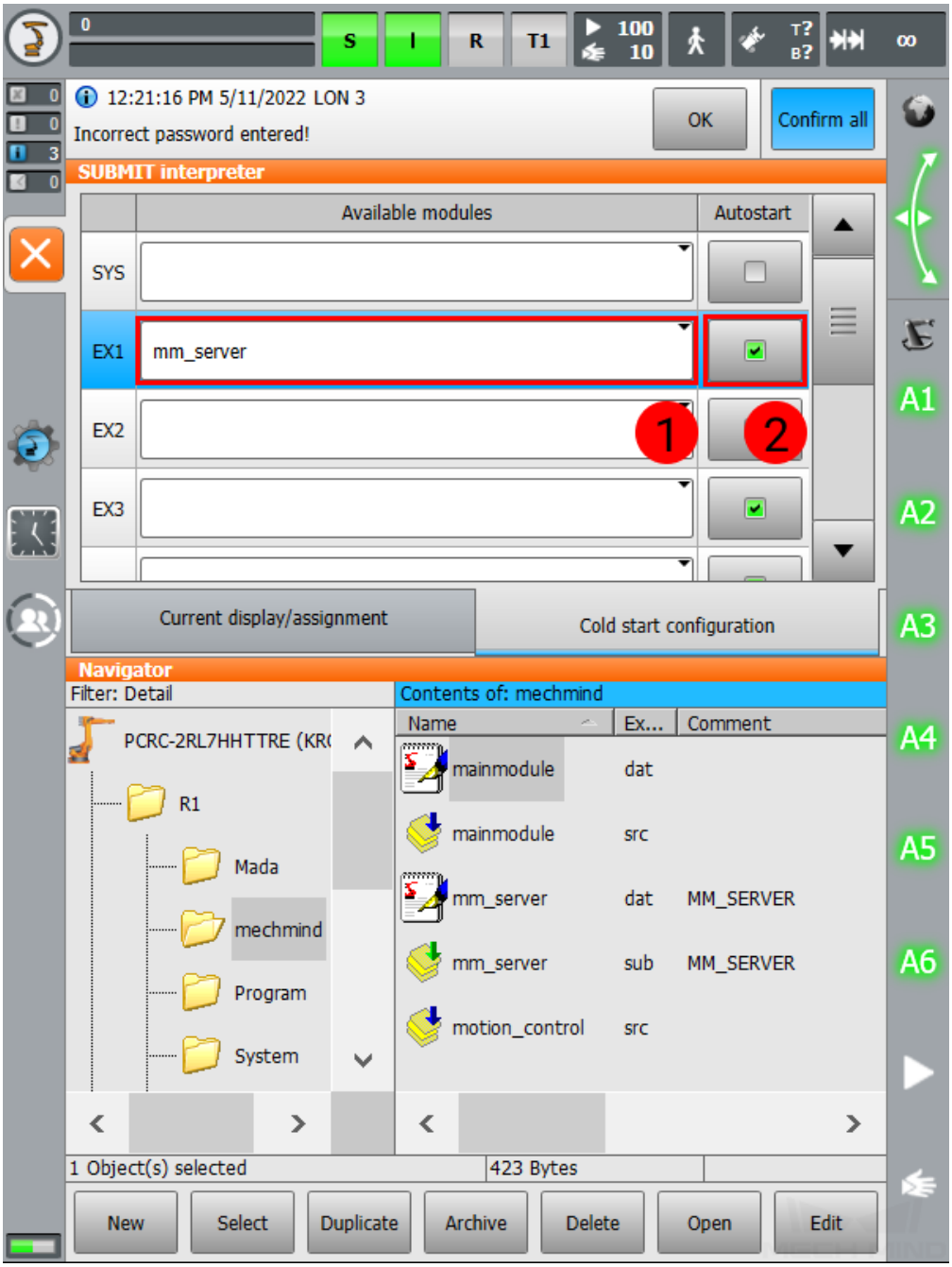
2. Press on **Cold start configuration**, and then press on the text box to the right of **SYS**.



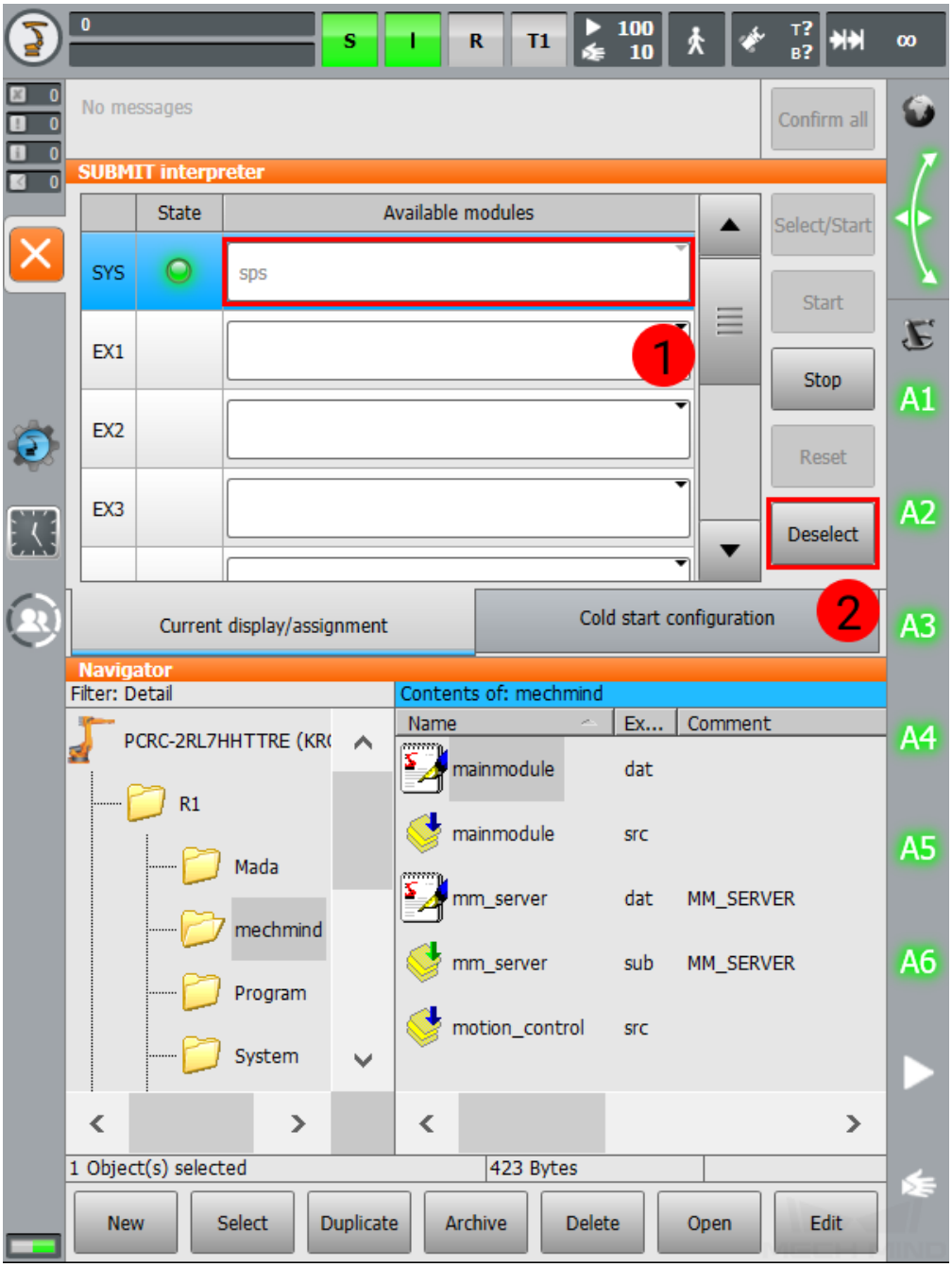
3. Select the blank in the drop-down menu, and then press on the check-box in **Autostart** to uncheck it.



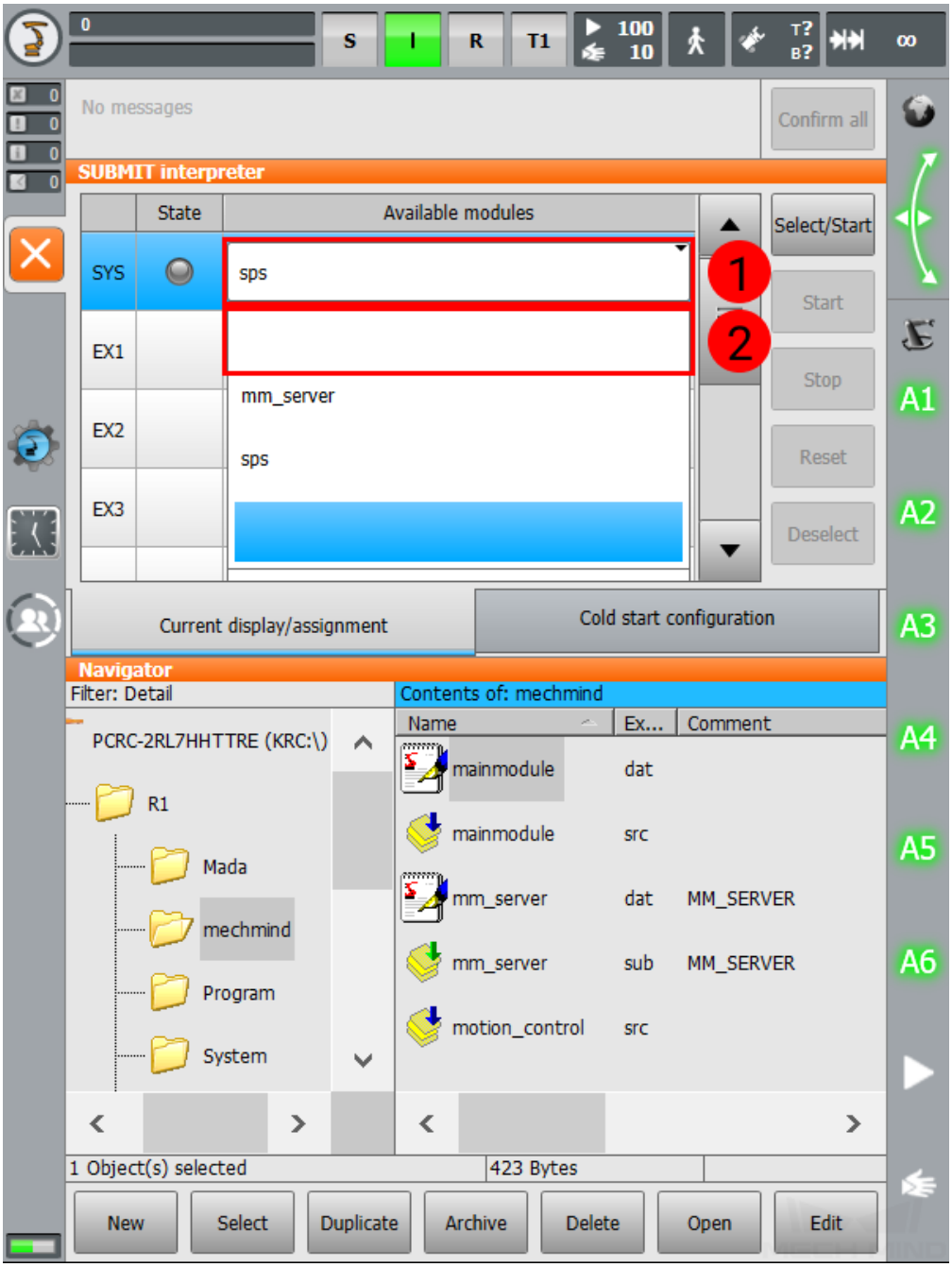
4. Similarly, select **mm_server** from the drop-down menu for **EX1**, and make sure **Autostart** is checked.



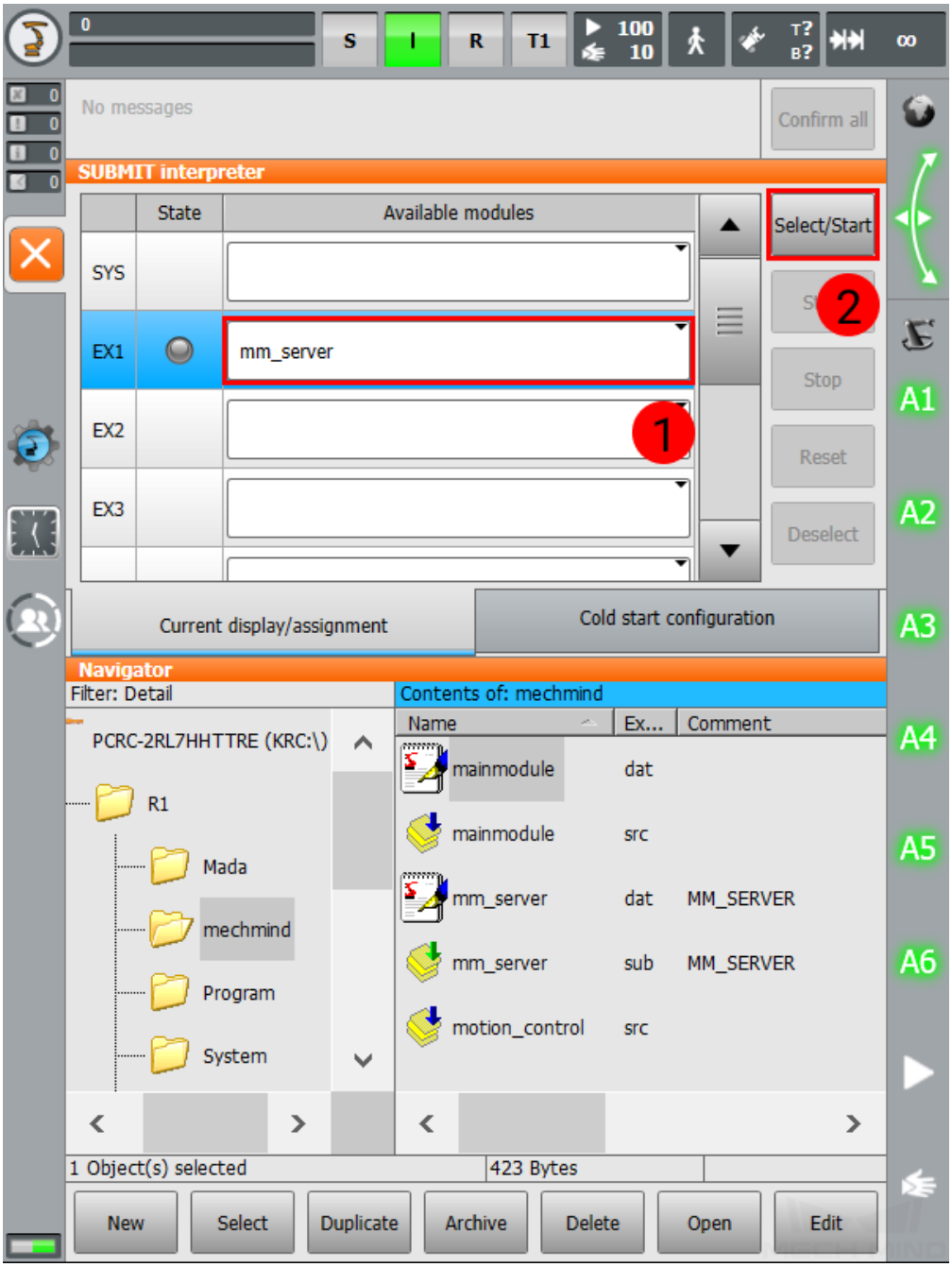
5. Press on **Current display/assignment**, press on the text box to the right of **SYS**, and then press *Deselect*.



6. Press on the text box to the right of **SYS** again, and select the blank in the drop-down menu.

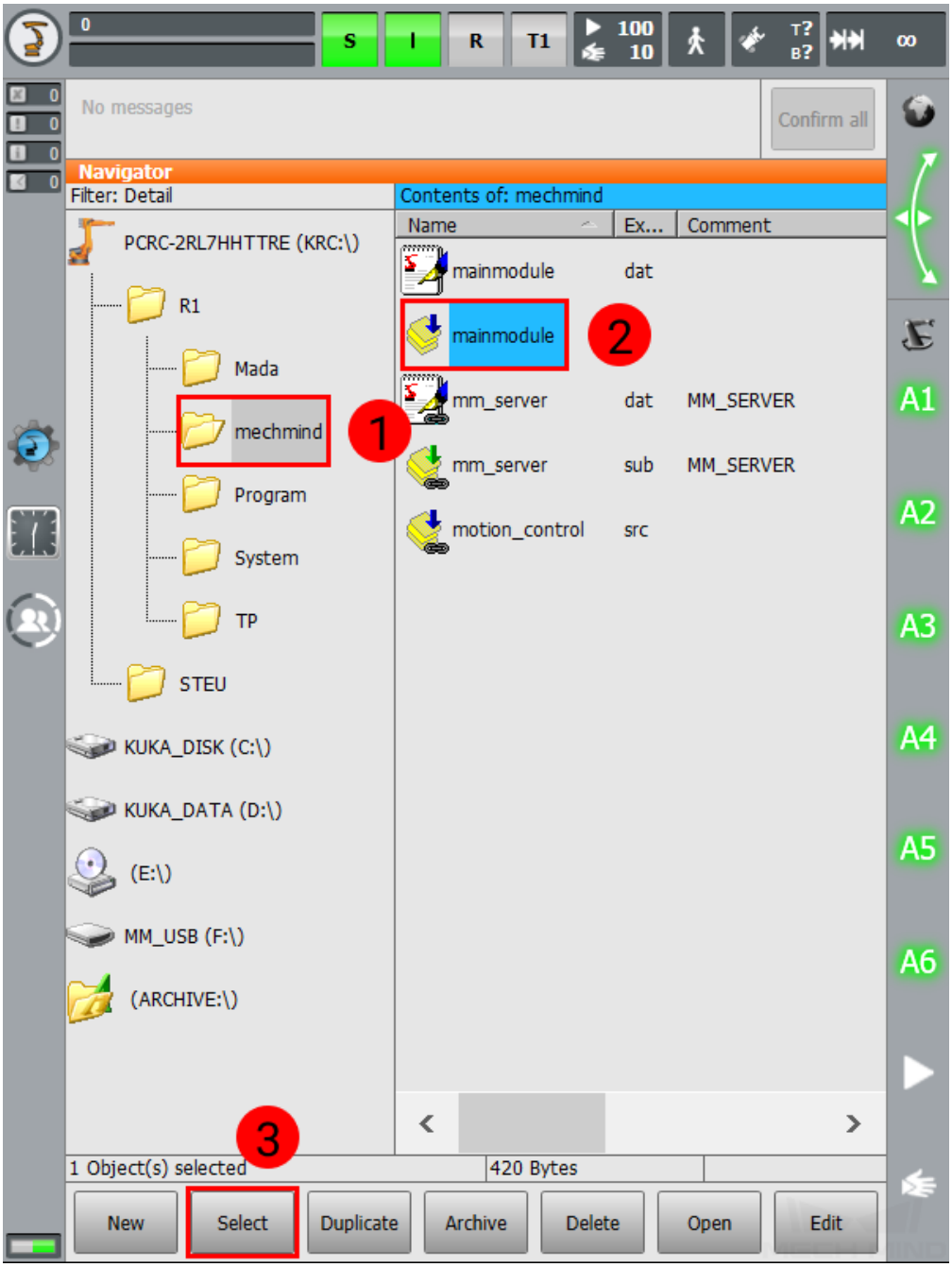


7. Similarly, select **mm_server** from the drop-down menu for **EX1**, and press on *Select/Start*.

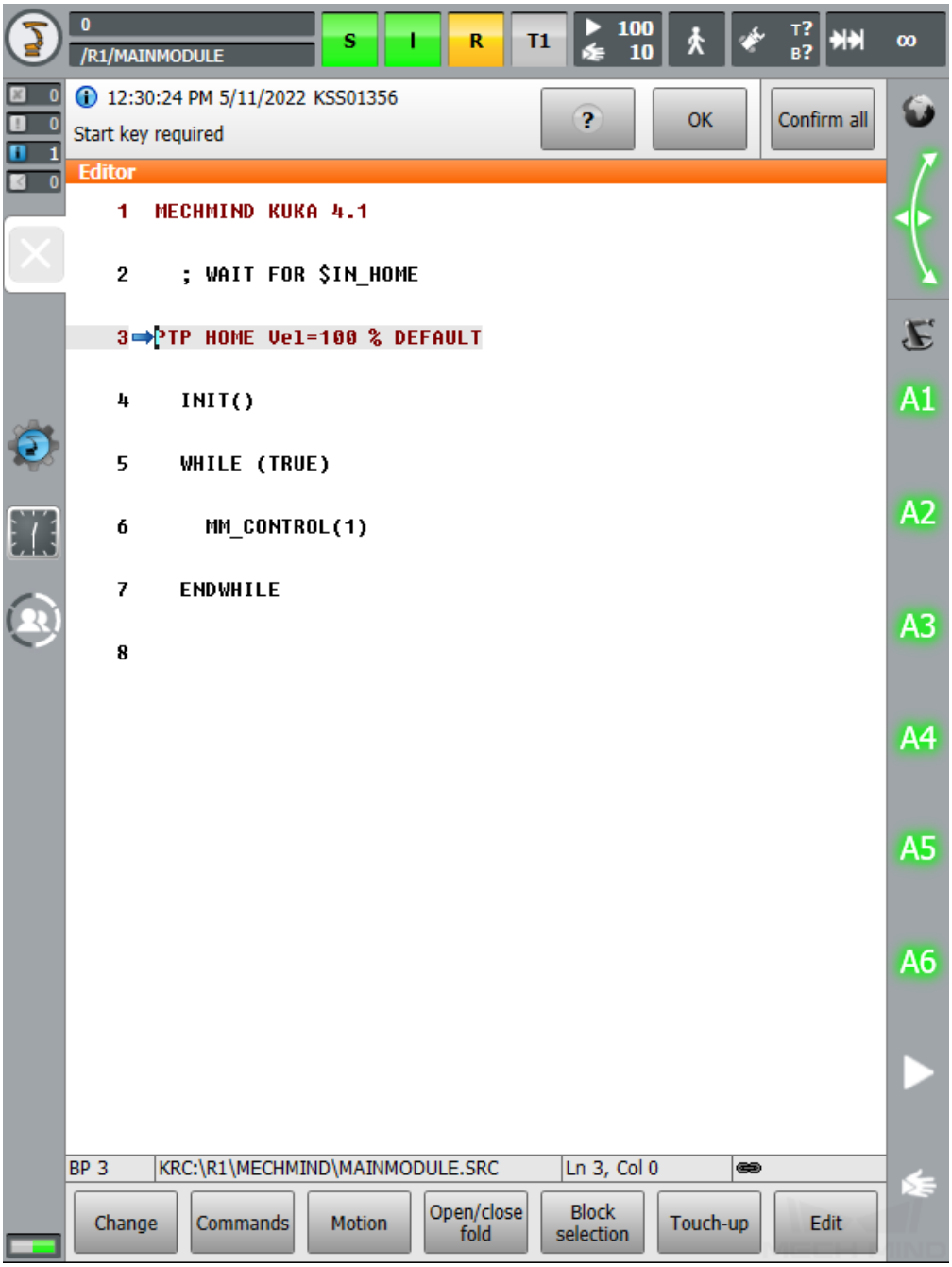

No messages
Confirm all
SUBMIT interpreter
State
Available modules
SYS
EX1
mm_server
EX2
EX3
Select/Start
Stop
Reset
Deselect
1
2
Current display/assignment
Cold start configuration
Navigator
Filter: Detail
Contents of: mechmind
PCRC-2RL7HHTTRE (KRC:\)
R1
Mada
mechmind
Program
System
Name
Ex...
Comment
mainmodule
dat
mainmodule
src
mm_server
dat
MM_SERVER
mm_server
sub
MM_SERVER
motion_control
src
1 Object(s) selected
423 Bytes
New
Select
Duplicate
Archive
Delete
Open
Edit

1.3.5 Select Foreground Program

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



2. The following should appear on the screen.

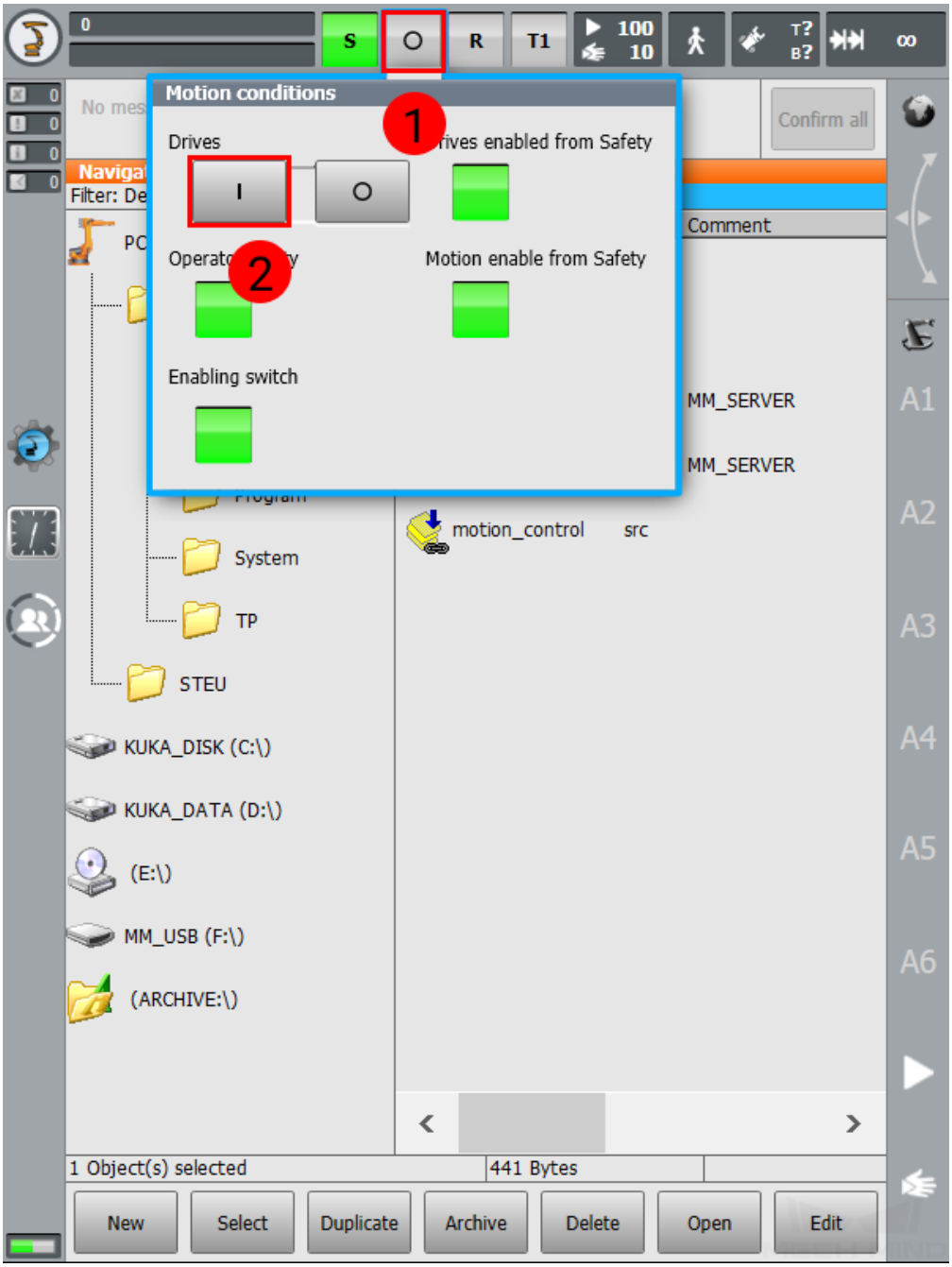

0
/R1/MAINMODULE
S
I
R
T1
100
10
12:30:24 PM 5/11/2022 KSS01356
Start key required
?
OK
Confirm all
Editor
1 MECHMIND KUKA 4.1
2 ; WAIT FOR $IN_HOME
3 PTP HOME Vel=100 % DEFAULT
4 INIT()
5 WHILE (TRUE)
6 MM_CONTROL(1)
7 ENDWHILE
8
A1
A2
A3
A4
A5
A6
BP 3
KRC:\R1\MECHMIND\MAINMODULE.SRC
Ln 3, Col 0
Change
Commands
Motion
Open/close fold
Block selection
Touch-up
Edit

1.3.6 Run Program in AUT Mode

1. Turn the key switch to horizontal, select **T1** on the screen, and then turn the switch back to vertical.

2. Check the icon to the right of  :

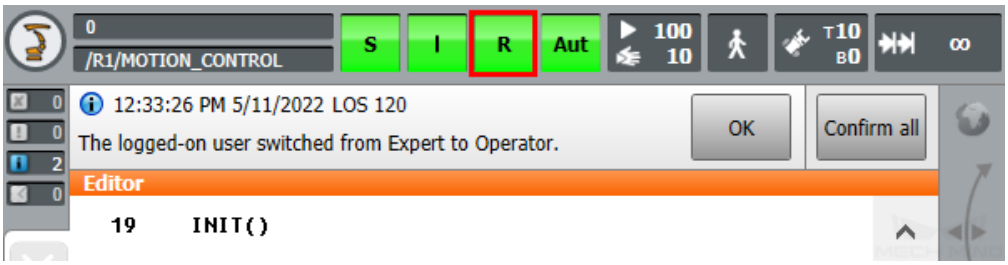
   - If it looks like  , then skip this step.
   - If it looks like  , then press on it and select  in the drop-down window.



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 message saying **Programmed path reached (BCO)**, and  turns red, release the enabling switch and 

Note: Set an appropriate velocity 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  to start running the master-control program ( should turn green).



1.4 Test Robot Connection

1.4.1 Configure Robot in Mech-Viz

1. Open Mech-Viz, click *New project* to create a new project.
2. Select the robot model in use in the next page.
3. Save the project by pressing `Ctrl` + `S`.
4. In the toolbar, change the **Vel.** (velocity) and **Acc.** (acceleration) parameters to **5%**.
5. Right-click the project name in **Resources** and select **Autoload Project**.

1.4.2 Configure Settings in Mech-Center

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 next to **Robot type in Mech-Viz project** matches the one in use.
4. Set the Robot IP address, and click **Save**.

1.4.3 Connect to Robot in Mech-Center

1. Click *Connect Robot* in the Toolbar.
2. The robot is successfully connected if:
   - A message saying **Robot: server connected to the robot** shows up in the **Log** panel, and
   - A robot icon with the robot model shows up in the **Service Status** panel.

1.4.4 Move the Robot

1. In Mech-Viz, click *Sync Robot* in the toolbar to synchronize the pose of the real robot to the simulated robot. Then, click *Sync Robot* again to disable the synchronization.
2. Click the **Robot** tab in the lower right, and change the joint position of J1 slightly (for example, from 0° to 3°). The simulated robot will move accordingly.
3. Click *Move real robot*, the real robot should move accordingly.

> **Attention:** When moving the robot, please pay attention to safety hazards. In the case of an emergency, press the emergency stop button on the teach pendant!

CHAPTER

TWO

KUKA PROGRAM DESCRIPTION

2.1 Master-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
motion_control.src	Foreground program for controlling and moving the robot
mainmodule.src	Foreground main module of the master-control program
mainmodule.dat	Data file for the main module
mm_status.xml	Configuration file for communicating robot status
mm_motion.xml	Configuration file for communicating robot motion

2.2 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

2.3 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]