Mech-Mind User's Manual

Mech-Mind

Mar 06, 2023

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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

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:

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

Please have a flash drive ready at hand.

1.1 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 Power-Shell to check the IP address.
- 2. Switch to expert mode:
 - 1. Press on \bigcirc and then select Configuration \rightarrow User group.

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	(i) 9:40:51 AM 5/11/2022 LOS The logged-on user switched fro	120 m Operator to Administrator.	ОК	Confirm all	٢		
	Main menu Main menu Main menu	Configuration					
	File 🕨	Inputs/outputs			Æ		
	Configuration	2 T interpreter			Δ1		
\odot	Display 🕨	Status keys					
	Diagnosis User group						
لاست	Start-up 🕨 Miscellaneous 🕨						
۲	Shutdown	Safety configuration			A3		
	Help 🕨	Brake test configuration					
		Machine configuration			A4		
		Collision detection			A5		
					A6		
	Configuration > Miscellaneous	> Language		-			
	Configuration > Miscellaneous	> Event planner		-	۲		
	Start-up > Calibrate > Tolera	nces		-			

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

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	 9:46:5 	4 AM 5/11	/2022 LO	5 120				OK		onfirm all	
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	Default	Passw	ord							Log on	

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

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X	Main menu	Start-un			
	File ►	Start-up wizard			
S	Configuration	Supplementary load data	-		æ
	Display 🕨	Tool/base management	-		A1
***	Diagnosis 🕨	Calibrate	-		٨2
	Start-up	2			AZ
	Shutdown	Software update	•		A3
	Help 🕨	Service 🕨	•		
		Robot data			A4
		Network configuration	3		
		Additional software			AS
		Rights management			A6
	Quick access				
	Configuration > User group			-	
	Configuration > Miscellaneous	> Language		-	
	Display > Variable > Cyclical	flags		-	s.
	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.



	Network configuration	-88885				
	🕜 Would you li	ke to save the change	s?			
	Yes	Cancel				
Network config	uration					
Configuration has been modified. The changes will be applied after the next cold start with "Reload files"!						
		ок				

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



3	- S I R T1 ≥ 100 ★ ★ 100 HH	00
	(i) 10:47:26 AM 5/11/2022 LOS 120 The logged-on user switched from Expert to Operator.	٢
	Main menu Main menu	
	File	E
	Configuration	A1
•	Display ►	
	Diagnosis	A2
	Start-up	
Θ	Shutdown 2	A3
	Help	A4
		A5
	Quick agrees	A6
	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 $	ø
0 0 6	8:43:39 AM 5/13/2022 LOS 120 The logged-on user switched from Operator to Expert. OK Confirm all	9
0	Shutdown	
×	Default settings for shutdown Start type	
	O Cold start	E
<u> </u>	Power-off wait time [s]	A1
	Power-fail wait time [s]	A2
	Settings for next shutdown	
۲	Force cold start Power-off delay time	A3
	Reload files Power-fail wait	A4
	Shutdown actions	A5
	Shut down control PC Reboot control PC	
	Orive bus	A6
		Æ

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.

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Navigator Filter: Detail	Contents of: PC	RC-2RL7HHTTRE	E (KRC:\)	
PCRC-2RL7HHTTRE (KRC:\)	Name	Ex	Comment	
KUKA_DISK (C:\)				
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(E:\)				Al
MM_USB (F:\)				۵2
(ARCHIVE:\)				~~
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2 Object(s)				*
New Select Duplica	te Archive	Delete	Open Edit	

2. Press on \bigcirc and then select *File* \rightarrow *Archive* \rightarrow *USB* (*cabinet*).

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	Main menu Main menu	3	Archive	
	File ►	Archive	USB (KCP)	X.
	Configuration	Restore	USB (cabinet)	A1
$\overline{\mathbf{O}}$	Display 🕨	Backup Manager 🕨 🕨	Network	
E 7	Diagnosis 🕨 🕨		Logbook	
	Start-up			
۲	Shutdown			
	Help 🕨			
				A4
				A5
	Quick access			A6
	Configuration > Miscellaneous	> Language	-*	
	File > Archive > USB (KCP) > 4	All	-	
	File > Archive > USB (cabinet)	> All	-	4
	Help > Info		-	

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

3		S O R T1		00
	No messages		Confirm all	٥
	Main menu			
	File	Archive	USB (cabinet)	
	Archive	USB (KCP)	All	E
	Restore	USB (cabinet)	Applications	Δ1
\odot	Backup Manager 🛛 🕨	Network	System data	
		Logbook	Log data	
572			KrcDiag	
۲				
				A5
				A6
	Quick access			
	Configuration > Miscellaneous	> Language		
	File > Archive > USB (KCP) > A	All	-	
	File > Archive > USB (cabinet)	> All	-+	Æ
	Help > Info		-	

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.

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0	Navigator	Contractor & Indexes		
	PIRCET: Detail	Name	Navigator New	
	WIKA_DISK (C:\)	mainm	Open 🕨	E
	WIKA_DATA (D:\)	mm_motion	Mark all	A1
Ð	(E:\)	mm_server	Cut 3	
		mm_server	Сору	A2
		mm_status	Paste	42
\sim		imotion_control	Delete	AS
		README	Duplicate	A4
			Archive 🕨	
			Rename	A5
			Properties	
			Filter	<mark>A6</mark>
			Select 🕨	
			Cancel program	
	2 Object(s) selected	866 Bytes	Reset program	se.
	New Select Duplicate	Archive Delet	te 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	R T1	▶ 100 ≰ 10	★ ★ ^{T?} B? ₩	00
	No messages			Confirm all	۵
	Navigator Filter: Detail	Contents of: R1			
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		Program			E
	📁 Mada	System			A1
$\overline{\mathbf{O}}$	🎾 Program				
	📁 System				Δ2
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					43
\sim					
	KOKA_DISK (C:/)				M
	WIKA_DATA (D:\)				AT
	(E:\)				AE
	✓ MM_USB (F:\)				AD
	(ARCHIVE:\)				
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	5 Objector	<		>	
	New Select Duplicate	Archive	Delete	Open Fdit	Æ
					- IIINICO

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.



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**.

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- 0 100 т? в? ₩₩ Τ1 ķ s R 00 10 12:21:16 PM 5/11/2022 LON 3 0 1 Confirm all OK ! 0 Incorrect password entered! UBMIT interpreter < 0 Available modules Autostart SYS sps E 2 • EX1 A1 EX2 -Ξ EX3 A2 ζ, v Q. Current display/assignment Cold start configuration A3 Navigator Filter: Detail Contents of: mechmind 1 Name Ex... Comment A4 PCRC-2RL7HHTTRE (KRC \land mainmodule dat R1 mainmodule src A5 Mada m_server dat MM_SERVER mechmind A6 mm server MM_SERVER sub Program motion_control src System V < < > > 1 Object(s) selected 423 Bytes New Select Duplicate Archive Delete 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.



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.



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.



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.



)		S O R T1 ≥ 100 & 10	★ * ^T ? ++	œ
	Motion condition	o Notion enable from Safety	Confirm all Comment MM_SERVER	• • • • •
	System	motion_control src	MM_SERVER	A2
۳ ج	STEU KUKA_DISK (C:\)			A3 A4
	<pre>KUKA_DATA (D:\) (E:\) MM_USB (F:\)</pre>			A5
	(ARCHIVE:\)			A6
	lect(s) selected	441 Bytes Duplicate Archive Delete	Open Edit	æ

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





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

100 0 т10 ₩ 00 夵 S R Aut 10 в0 /R1/MOTION_CONTROL 12:33:26 PM 5/11/2022 LOS 120 10 OK Confirm all The logged-on user switched from Expert to Operator. 19 INIT()

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
mo-	Foreground program for controlling and moving the robot
tion_control.src	
mainmod-	Foreground main module of the master-control program
ule.src	
mainmod-	Data file for the main module
ule.dat	
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)	\$0UT[1]-\$0UT[16]
DI (64)	\$IN[1]-\$IN[64]
DO (64)	\$0UT[1]-\$0UT[64]