FANUC R-30iB Mate Plus Start Up Guide (CIP Safety)



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Chapter 1. Overview

Robot Controller	R-30iB Mate or R-30iB Mate Plus
Safety Hardware	Third-Party Safety PLC with CIP Safety - integrates the READY pendant Key Switch, En- abling Switch, and Emergency Stop to robot safety signals through CIP Safety.
READY Hardware	READY pendant and a READY Forge/Hub or Forge/Ctrl.

Welcome to the FANUC Startup Guide. This guide covers the following hardware:

Here are the steps you will follow:

- 1. Prepare safety hardware.
- 2. Connect the READY pendant.
- 3. Connect the IPC.
- 4. Power on the system.
- 5. Program your safety hardware.
- 6. Configure your robot for ForgeOS.
- 7. Control your robot with ForgeOS!

Chapter 2. Hardware Requirements

Image	Part Name	Description	Vendor	Part Number
OR	READY IPC	Hosts Forge/OS. Note: READY of- fers two IPCs: Forge/Hub and Forge/ Ctrl (legacy)	READY Robotics	
	READY pendant	The touch screen in- terface for Forge/OS.	READY Robotics	112563
	READY pendant Junc- tion Box (Forge/Ctrl only)	Connects the READY pendant to the Forge/Ctrl and ro- bot controller.	READY Robotics	R-101257
	12-Pin M12 to Flying Leads Cable	Connects to the READY pendant Junc- tion Box or Forge/Hub to terminals.	READY Robotics	
	R-30iB-Mate or Mate Plus Robot Controller	Connects the robot arm to power and to other devices.	FANUC	

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Image	Part Name	Description	Vendor	Part Number
	FANUC Teach Pen- dant	Required for setup and error recovery.	FANUC	
	Polycarbonate Enclo- sure or Electrical Cab- inet	Protects the electrical parts in an enclosure.		
	Cat5e Shielded Ether- net Cable (x3)	 Connects the robot controller to a IPC. Connects the READY pendant to a IPC. Connects the robot controller to the CIP Safety PLC. 		
	Safety Controller with CIP Safety (see note below)*	Allows use of pen- dant safety features and other safeguard devices (i.e. safety fence).		e.g., Omron NX-I/O Series, Allen-Bradley GuardLogix

Note:

The reference material in this guide is general. The safety controller solution you choose should meet these minimum requirements:

- 4x dual channel safety inputs
- CIP over EtherNet/IP connection
- Basic Safety Logic configuration

Chapter 3. Software Requirements

This section explains how to check your FANUC software for these version and option requirements.

Required Option	Description
R-30iB Mate Firmware: V8.10P/30 (05/2018), V8.20P/33 (07/2019), V8.30P/39 (05/2018)	Minimum firmware version supported by Forge/OS.
R-30iB Mate Plus Firmware: V9.10P/33 (02/2021), V9.30P/15 (02/2021)	
RTL-R632 KAREL	Required for Forge programs to run on the robot controller.
RTL-R648 User Socket Messaging	
RTL-R859 Advanced DCS	Required to jog the robot with the READY pendant.
RTL-R713 SIT Ethernet/IP Safety	Required to connect CIP safety for pendant and fence.
RTL-R784 Ethernet/IP Adapter	

- 1. Plug the FANUC controller into a power source. Follow FANUC instructions for powering the controller.
- 2. Turn the power switch on the FANUC controller clockwise to power the controller on. Wait for the controller to boot up.
- 3. On the teach pendant keypad, press the **STATUS** button at the bottom.
- 4. In the STATUS menu, press [TYPE] (F1), then press Version ID (2).

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	TYPE	1	1000		1			
1	Axis		Progr		i			
2	2 Version	ID	Remi					
3	Stop Sig	nal	Notif	ications				
4	Exec-his	st			ii ii			
5	Memory		_					
6	Robot C	ondition	-		_			
7	Prg Time	er			_			
8	Sys Tim	er						
9	Conditio	n	_					
0	NEXT		- NE	XT				
-			_					
		TYPE	I CT	ATUS1	STATUS2	PULSE	[UTIL]	~
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5. Look for **Software Edition No.** and note the version number next to it. If your system version is older than the requirement, contact your FANUC distributor to upgrade.

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	2 :	5/W Serial 1	No.	88340				
	3 (Controller :	ID	F00000)			
	4 1	Robot No.		F00000).			
	5 1	Manufacturi	ng ID					
	6 1	Default Per	sonality (from FD)				
	7 1	ARC Mate 12	OiC	V9.10P	/33			
	8 3	Servo Code		123456	7890			
	9 (Cart. Mot. 1	Parameter	V3.00				
	10 6	Joint Mot.	Parameter	V3.00				
	11 1	DCS		V4.2.1	4			
	12 :	Stop patter	n	A				
	13	Software Ed	ition No.	V9.10P	/33			
	14 1	Jpdate Vers	ion	None				
	15 (Customizati	on Ver.	None				
	16 I	Root Version	n	V9.102	33			
	17 1	Boot MONITO	R	V0.00F	/00			
	18 1	Teach Pendan	nt	7D0D/0	1P			
	19 1	Browser Plu	gins	V9.400	83			
	20 1	IP Core Firm	mware	V9.40P	2/13			
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- 24) -								

6. Press the right arrow on the touchscreen menu bar, then press **ORDER FI**. The installed options appear with their part numbers.

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	5 M	anufacturi	ng ID					
	6 D	efault Per	sonality	(from FD)				
	7 A	RC Mate 12	OiC	V9.10P/	33			
	8 S	ervo Code		123456	1890			
	9 C	art. Mot.	Parameter	V3.00				
	10 J	oint Mot.	Parameter	V3.00				
	11 D	cs		V4.2.14	P			
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7. Look for the required options. Under "Continue displaying?", press **YES** to see more of the installed options. If any of your controller's required options are missing, contact your FANUC distributor to upgrade.



Chapter 4. Installing the Safety Controller

In a safety cabinet or polycarbonate enclosure, you will install the CIP safety controller, a power supply, and terminal blocks for connecting safety input leads.

- 1. In an enclosure (i.e., safety cabinet), install these:
 - DIN rail (as needed)
 - The safety controller
 - The 24V power supply
 - Terminal blocks (as needed)
 - DIN rail ends (to prevent terminal blocks from moving)

i Tip:

See each product's manufacturer guides for installation instructions.

- 2. Install cord grips through the enclosure as needed to provide strain relief for cables.
- 3. Connect the 24V power supply output to your safety controller power supply inputs.
- 4. Connect the 24V power supply to external power following power supply instructions.

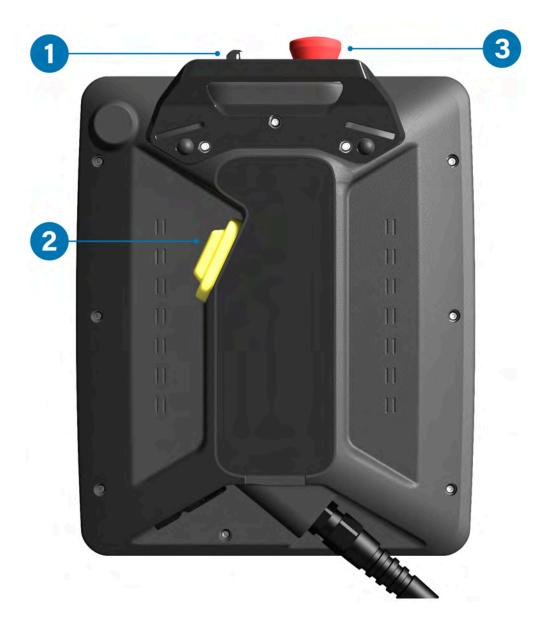
Important:

After confirming everything powers up, disconnect the power supply from external power before moving on.

Chapter 5. Connecting the READY pendant

The READY pendant includes these safety outputs:

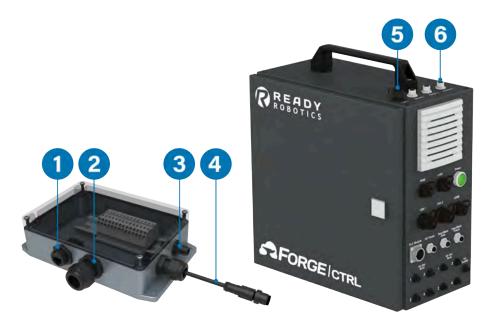
- 1. Key Switch (Robot Operation Mode)
- 2. Three-Position Enabling Switch
- 3. Emergency Stop Button





Electric Shock Warning: Disconnect all components from power sources before attempting this installation.

1. If you are using a Forge/Ctrl, prepare the READY pendant Junction Box:



- a. Connect a Cat5e STP Ethernet cable from the junction box Ethernet port (1) into a **LAN** port (5) on the Forge/Ctrl.
- b. Connect the 8-Pin power cable (4) from the junction box into one of the Module ports (6) on the Forge/Ctrl.
- c. Connect the 12-Pin flying leads cable to the safety port (3) on the junction box.
- 2. If you are using a Forge/Hub, connect the 12-Pin flying leads cable to the **Safety** port on the Forge Hub.



3. Wire the safety controller with the flying leads cable according to the table below.

Important:

Refer to safety controller documentation for proper use of safety test outputs. You can share a test output among different devices, but each channel of a device should use a different test output.

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Safety Flying Leads	Function	Destination
Brown	Enabling Switch Circuit 1	Test Output 1
Blue	Enabling Switch Circuit 1	Safety Input 3
White	Enabling Switch Circuit 2	Test Output 2
Green	Enabling Switch Circuit 2	Safety Input 4
Pink	Emergency Stop Circuit 1	Test Output 1
Yellow	Emergency Stop Circuit 1	Safety Input 1
Black	Emergency Stop Circuit 2	Test Output 2
Grey	Emergency Stop Circuit 2	Safety Input 2
Red	Key Switch Circuit 1	Test Output 1
Violet	Key Switch Circuit 1	Safety Input 5
Grey/Pink	Key Switch Circuit 2	Test Output 2
Red/Blue	Key Switch Circuit 2	Safety Input 6

- 4. Wire the external safety fencing or another safeguarding device:
 - a. **If you are using safety fencing or another safeguard device**, connect it to the safety controller following the table below.

Function	Destination
Fence Contact 11 (Circuit 1)	Test Output 3
Fence Contact 12 (Circuit 1)	Safety Input 7
Fence Contact 21 (Circuit 2)	Test Output 4
Fence Contact 22 (Circuit 2)	Safety Input 8

- b. **If you choose to NOT use a safeguard device**, jumper the safety fencing circuits: Connect safety input 7 with its test output and connect safety input 8 with its test output.
- 5. Open the FANUC controller:
 - a. Use a flat head screwdriver to turn the lock below the power switch counterclockwise.
 - b. Turn the power switch counterclockwise to release the door.
- 6. Feed one end of a Cat5e STP Ethernet cable through the foam panel on the side or back of the FANUC controller. Refer to controller documentation for proper cable sealing.
- 7. Inside the FANUC controller, connect the end of the Ethernet cable into LAN port 2 (CD38B) on the main board.
- 8. Connect the other end of the Ethernet cable to the CIP interface on your safety controller.

Chapter 6. Connecting the Robot and IPC

Forge/OS must be able to communicate with the FANUC robot controller. This section will help you connect the IPC and robot controller using a Cat5e STP Ethernet cable.

- 1. Find a Cat5e STP Ethernet cable long enough to reach from the IPC to inside the FANUC controller.
- 2. Plug one end of the Ethernet cable into a LAN port on the IPC device (or a network switch connected to the IPC).
- 3. Inside the FANUC controller, remove one of the knockouts on the foam cable panel. Feed the Ethernet cable through it.
- 4. Plug the cable into LAN Port 1 (**CD38A**) on the Main Board below the backplane.



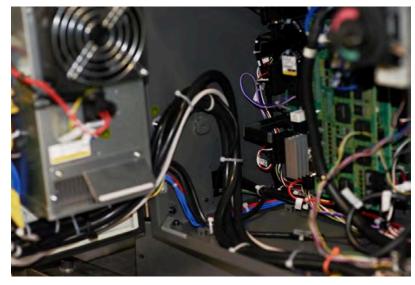
- 5. Manage the cables.
 - a. Use zip ties to bind cables at the top and bottom of the controller enclosure.

Important:

Ensure that there is enough slack for the door to open and close without creating tension.

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b. Cut the zip ties so that the cut-ends are flush with the connectors.



6. Close the controller door. Lock it using a flat head screwdriver.

Chapter 7. Powering On

In this section, you power on the system and prepare the FANUC teach pendant.

- 1. Reconnect the FANUC controller to power and power it on. Consult your Manufacturer's manual for instructions on powering the FANUC controller.
- 2. Power on your IPC device and other devices.

Note:

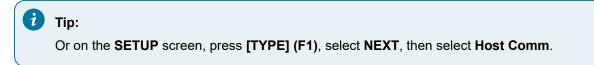
If you are using a Forge/Ctrl, turn the Power Disconnect Switch to **ON**. Then press the green power button on the other side.

- 3. If there are issues, power off each device, disconnect from power supplies, and check your wiring.
- 4. Turn the switch on the front panel of the FANUC controller to **T1** mode.
- 5. Turn the switch on the FANUC teach pendant to **ON**.

Chapter 8. Setting Up FANUC CIP Safety

In this section, you set up the FANUC controller to connect to Forge/OS and the CIP Safety PLC.

- 1. Set the switch on the front panel of the FANUC controller to **T1** mode. Turn the switch on the FANUC teach pendant to **ON**.
- 2. On the FANUC teach pendant, set the robot's Port 1 IP address for Forge/OS:
 - a. On the FANUC teach pendant, go to the Host Communication screen: Press the MENU button, then scroll down to SETUP (6). Then scroll right to Host Comm (8), which is on the second menu (titled "SETUP 2"). Press ENTER.



b. On the list of Protocols, select TCP/IP and press ENTER.



- c. For Port 1, select the line that reads Port#1 IP addr... and press ENTER.
- d. Set the IP Address and Subnet Mask according to the READY IPC you have:
 - Forge/Ctrl: set the IP Address to 172.16.255.251 and set the Subnet Mask to 255.255.255.0.
 - Forge/Hub: set the IP Address to 192.168.1.20 and set the Subnet Mask to 255.255.255.0.
- 3. Change the robot's Port 2 settings for the CIP Safety PLC:
 - a. In the TCP/IP settings, press PORT (F3) to switch to Port 2. Then select the line that reads Port#2 IP addr...
 and press ENTER. Set the IP address of this port to 192.168.2.20 using the pendant keypad Set the Subnet Mask to 255.255.255.0.
 - b. Go to the Ethernet/IP menu: press the MENU button, then choose I/O, then choose ETHERNET/IP.
 - c. Press F3 to select Safety.
 - d. Select Ethernet Interface and press [Choice] (F4). Set the Ethernet Interface to "Port 2."

- 4. Change DCS settings for CIP communication:
 - a. Go to the DCS screen by pressing the MENU button, NEXT (0), SYSTEM (6), then DCS.
 - b. Press **PREV** to ensure you are on the main DCS screen.
 - c. Select CIP Safety and press ENTER.

	Busy	Step	Hold	Fault	SSOCK_	ACCEPT LINE 169 AU	TO RUNNING JOINT	10
13 Mastering parameter: 0K 14 Pos./Speed check setup: 0K 15 GIP Safety: 0K 16 I/O Link i Slave: 0K 17 Safe I/O consistency check: 0K 18 Safe I/O device: 0K 19 Signature number: 0K		2 Safe 3 Joir 4 Joir 5 Cart 6 Cart 7 Tl m 8 User 9 Tool 10 User 11 Stop	<pre>i/o Sta i/o con t positi . positi . speed . speed . ode spee . model: frame: . frame: . positic</pre>	tus: nect: on check: check: on check: check: d check: n predict	DSBL	DR DR DR DR DR DR DR DR DR DR DR DR		€,Ξ⊞
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d. In the CIP Safety menu, set Enable/bypass to "ENABLE." Set both the input and output sizes to "2."



- e. Press PREV to return to the main DCS screen. Select Safe I/O Status and press ENTER.
- f. On the Safe I/O Status screen, press [DATA] (F2) and select CSI. Make sure the first four bits are labeled for a safety function.

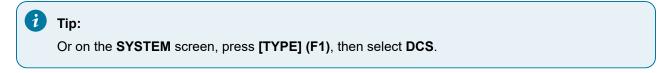
Note:

Make a note of these CSI signal comments. They may not match the image below. You will configure the safety PLC so these four bits correspond with the labeled safety functions.

CS					🗨 🗄 🗆
Safe		status			1/64
		Status	Comment		
CSI			[Forge Deadman En	abled	
CSI		ON	[In Auto Mode		
CSI		ON	[Fence Closed	1	
CSI		ON	[E Stop	1	
CSI		OFF		1	
CSI		OFF	1	1	
CSI		OFF	L.	4	
CSI		OFF	1	1	
CSI		OFF	4	1	
	101	OFF	1	1	
	[11]	OFF	1	1	
	121	OFF	1	1	
	[14]	OFF	1	1	
	15]	OFF	1		
	[16]	OFF	-	1	
	171	OFF	1		
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		-			

5. Apply changes to the FANUC DCS settings:

a. Go to the DCS screen by pressing the MENU button, NEXT (0), SYSTEM (6), then DCS.



- b. Press **PREV** to ensure you are on the main DCS screen.
- c. Press **APPLY (F2)** to confirm the settings. If you installed Forge/OS files onto the FANUC controller before, there may not be changes to apply.
- d. Enter the password (default: 1111). Confirm the settings by pressing OK (F4).
- 6. Restart the FANUC controller to apply the settings. Power the controller off, wait 5 seconds, then power it on.

Chapter 9. Programming the Safety Controller

In this section, you program your CIP Safety PLC to pass through safety inputs to the FANUC CSI signals.

- 1. On a PC, install the manufacturer configuration software for your safety controller solution. Refer to safety controller instructions.
- 2. Connect your PC to the safety controller. Refer to safety controller instructions.
- 3. Open the configuration software on your PC. Select your safety controller model and other options, if required.
- 4. Earlier you configured the FANUC Port 2 network settings IP address (**192.168.2.20**) and subnet mask (**255.255.255.0**). Configure your safety controller with compatible network settings.
 - a. Set the IP address of the safety controller to 192.168.2.10 or another address in the same subnet.
 - b. Set the subnet mask of the safety controller to 255.255.255.0.
- 5. On the safety controller, create a CIP connection between with the FANUC controller following instructions from the safety controller manufacturer and the FANUC DCS Operators Manual.

Note:

This process can be complex. Contact your safety controller distributor for support if needed.

6. Configure the safety controller to pass the safety input signals through to these CIP safety outputs:

Safety Device	CIP Safety Output (bit)	FANUC CIP Input
Pendant Enabling Switch (HIGH=Enabled)	0.0	CSI [1]
Pendant Key Switch (HIGH=in Auto)	0.1	CSI [2]
Safety Fence (HIGH=Closed)	0.2	CSI [3]
Pendant Emergency Stop Switch (HIGH=Released)	0.3	CSI [4]

- 7. In the configuration software, login or connect to the safety controller and transfer your configuration onto it.
- 8. If applicable, set the safety controller to "Run" or "Auto" mode.
- 9. Disconnect your PC from the safety controller.

Chapter 10. Signing In to Forge/OS

Follow these steps to pair the READY pendant with the IPC and sign in to Forge/OS 5.

1. If you need to install Forge/OS 5 on your IPC, stop here and follow all the steps in Appendix A *(on page 33)*, then come back to these steps.

Tip:

Forge/OS 5 is installed on all Forge/Ctrls and Forge/Hubs shipped after June 1, 2021.

- 2. The READY pendant automatically finds and pairs with the IPC. The three LEDs on the screen help you track the status:
 - **Pendant Network Connection**: This condition is satisfied when the READY pendant has a valid network connection (i.e., the Ethernet cable is plugged in).
 - Forge/OS IPC Detected: This condition is satisfied when the READY pendant detects a Forge/OS IPC on the network.
 - **Forge/OS IPC Paired**: This condition is satisfied when the READY pendant successfully pairs with the IPC. If pairing fails, it is automatically retried indefinitely.

When a condition is not satisfied, the LED is red. When a condition is in progress of becoming satisfied, a spinner around a READY logo appears to the right of the text. When a condition becomes satisfied, the LED turns green.

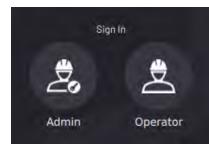


The UI shows the real-time state of each step. For example, if the pendant loses its network connection during pairing, all steps become undone.

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If the READY pendant spends more than 60 seconds on any step, troubleshooting text displays. Common things to check are if the READY pendant network cable is plugged in, if the IPC is powered on, if the READY pendant and IPC are connected to the same network, and if there's only one READY pendant and one IPC on that network.

3. Tap Admin and sign in. The default Admin password is "forgeadmin".



4. If Forge/OS is inactive, it opens the Settings app and prevents you from opening other apps. If you see the screen below, follow Activating ForgeOS with a License Code (*on page 40*) in Appendix A.

Settings	0
Network	>
Fieldbus Configuration	>
General Settings	>
Remote Access	>
System Update	>
Package Manager	>
License IEXPIREO/INVALID)	>
System Information	>

5. With Forge/OS active, move on to the next section.

Chapter 11. Configuring the Robot for Forge/OS

This section shows you how to add a robot in the Forge/OS Device Configuration app and configure the FANUC controller. Make sure the FANUC controller and Forge/OS devices are powered on.

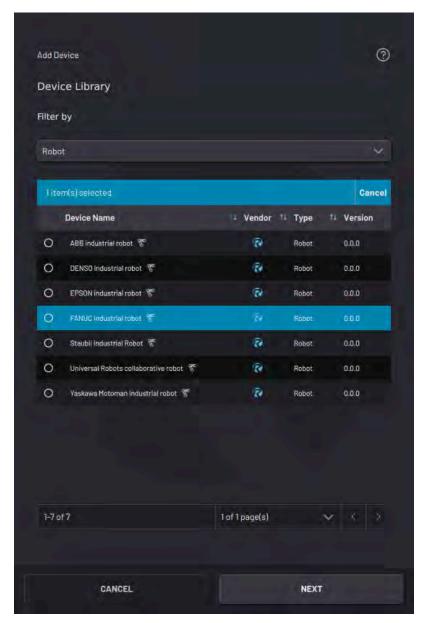
1. In the Admin role, open the Device Configuration app.



2. Tap **New +** to open the Device Library.

Device Configuration Configured Devices		0
Device Name	ț↓ Vendor Type	Q NEW+ Enabled
0-0 of 0	T of T page(s)	
	DEVICE STATUS USÉR NORMAL Admin	> A 8:55 PM 8.9.21

3. Select the **FANUC Robot** option. You can use the **Filter by** dropdown to show robot options. Tap **NEXT** to continue.



4. Give the robot a Device Name and enter the IP Address.

Note:

Enter the same IP address that you set on the FANUC controller.

5. Select the robot Controller Model and Robot Model in the dropdown menus.

🚺 Tip:

Some FANUC controllers have multiple hardware options for connecting the READY pendant safety devices. Select the one that matches your setup:

- "CIP Safety" You are using a CIP Safety PLC instead of the FANUC Safety I/O Board.
- "No DCS" You are using Forge/OS software-driven safety instead of DCS.
- Neither You installed the FANUC Safety I/O add-ons (except for the CRX, R-30iB Mini Plus).

Device Name		IP Address	
Description			
Controller Model		Robot Model	
R-30iB Mate Plus	^	CR-15iA	×
R-30iB Plus - No DCS			
R-30iB Mate Plus	0		Ý
R-30iB Mate Plus - CIP Safety			
R-30iB Mate Plus - No DCS R-30iB Mini Plus	3	C to copy the configuration	files needed to

6. Insert a USB flash drive into the IPC as instructed on the screen. Use an empty flash drive with at least 2GB of storage.



- 7. Tap Start Transfer and wait for it to finish.
- 8. Remove the USB flash drive when prompted.
- 9. Insert the USB drive into the USB slot on the FANUC controller.
- 10. Complete these substeps to stop currently-running programs (so that you can later run the ForgeOS installation script):
 - a. Press the SELECT button. A list of programs appears.
 - b. Press MONITOR (F4) to show the list of running programs. If any programs appear, press the FCTN button.
 Then press 1 to ABORT (ALL). Press 1 and ABORT (ALL) at least one more time to make sure that all running programs stop.

Note:

If you do not abort all running programs, you may have issues with the Forge installation process (such as a "Specified program is in use" message).

- 11. (**OPTIONAL**): If you are setting up a FANUC controller that was using remote control through a User Operator Panel (UOP), complete these substeps. Otherwise, you may have issues with the Forge installation process:
 - a. Press the **MENU** button on the FANUC teach pendant
 - b. Press IO.
 - c. Press TYPE (F1) then UOP.

Busy	Ste		Hold	Fault	and the				100
Run	I/C)	Prod	TCyc	FORGE_	OS LINE 0 A	UTO ABORTE	D JOINT	100
I/O U	OP	Out							• E
	-	#	STATU	IS		1/20			
	100	1]		// [Cm	d enabled	1			
	100	2]		1		1			
	100	3]		1		1			
	100	41		1		1			
	100	5]	-	<u> </u>		1			
	not	6]		E [Fa	ult	1			
	100	71		1		1			
	100	8]	_	<u> </u>		1			
	lon	91	03		tt alarm	1			
	100	10]	05	f [Bu	sy	1			
	100	11]		1		1			
	100	12]		1		1			
	100	13]		1		1			
	lon	14]		1 B		1			
	100	15]		· [1			
	lon	16]		1		1			
	100	17]				1			
	100	18]		1		3			
	100	19]		E		1			
-	100	201				-1			
5	orted	БУ	port nu	under.					
		(TYPE	1	CONFIG	IN/OUT	ON	OFF	>

d. Press CONFIG (F2). If the STAT field is ACTIV for any entry, set the RACK, SLOT, and START fields to zero.

GE RACK S - 1] 35 - 2] 48 - 3] 35 - 4] 48 - 5] 48 - 6] 48	SLOT START STAT. 1 1 ACTIV 1 21 ACTIV 1 1 ACTIV 1 22 ACTIV 1 22 ACTIV	1/12
- 1] 35 - 2] 48 - 3] 35 - 4] 48 - 5] 48	1 1 ACTIV 1 21 ACTIV 1 1 ACTIV 1 22 ACTIV	1/12
- 1] 35 - 2] 48 - 3] 35 - 4] 48 - 5] 48	1 1 ACTIV 1 21 ACTIV 1 1 ACTIV 1 22 ACTIV	
- 21 48 - 31 35 - 41 48 - 51 48	1 21 ACTIV 1 1 ACTIV 1 22 ACTIV	
- 31 35 - 41 48 - 51 48	1 1 ACTIV 1 22 ACTIV	
- 4] 48 - 5] 48	1 22 ACTIV	
- 51 48		
- 61 48		
	1 23 ACTIV	
- 7] 0	0 0 UNASG	
- 8] 48	1 24 ACTIV	
	1 25 ACTIV	
	0 0 UNASG	
- 18] 0	0 0 UNASG	
: Always ON		
	- 12] 48 - 16] 0 - 17] 48 - 18] 0	- 12] 48 1 25 ACTIV - 16] 0 0 0 UNASG - 17] 48 1 23 ACTIV - 18] 0 0 0 UNASG

e. Press IN/OUT to repeat the above substep with other signals.



- f. Press the **MENU** button on the FANUC teach pendant.
- g. Press SETUP.
- h. Press TYPE (F1) then BG LOGIC. If this option is not visible, press NEXT (0).
- i. If the status of any task is RUN, change it to STOP.

Normal mode sca		e	1/	8
PROGRAM	STATUS	MODE		5
1 2	Stop	Normal Normal		
3	Stop	Normal		
4	Stop	Normal		
5 6 7	Stop	Normal		
6	stop	Normal Normal		
8	Stop	Normal		

- j. Press the **MENU** button on the FANUC teach pendant.
- k. Press NEXT (0) then SYSTEM.
- I. Press TYPE (F1) then CONFIG.
- m. Change "Enable UI Signals" to FALSE.



n. Change "Remote/Local Setup" to LOCAL.

23	Maximum of ACC instruction: 100	42/65
24	Ninimum of ACC instruction: 0	
25	WJNT for default motion: ******	
26	Auto display of alarm menu: FALSE	
27	Force Message: ENABLE	
28	Allow Force I/O in AUTO mode: TRUE	
29	Allow chg. ovrd. in AUTO mode:TRUE	
30	Signal to set in AUTO mode DO[0]	
31	Signal to set in T1 mode D0[0]	
32	Signal to set in T2 mode D0[0]	
33	Signal to set if E-STOP DO[0]	
34	Set if INPUT SIMULATED DO[0]	
35	Set if OUTPUT SINULATED DO[0]	
36	Sim. Input Wait Delay: 0.00 sec	
37	Set if Sim. Skip Enabled: DO[0]	
38	Set when prompt displayed: DO[0] Output when WAIT on Input:<*DETAIL*>	
40	Signal if OVERRIDE = 100 DO[0]	
41	Hand broken : <*GROUPS*>	
42		

- o. Restart the FANUC controller to apply these new settings.
- 12. Complete these substeps to install the configuration files on the FANUC controller:
 - a. Press the **MENU** button on the FANUC teach pendant.
 - b. Press FILE (7), then FILE (1).
 - c. Press UTIL (F5), highlight the Set Device (1) option, and press the ENTER button.
 - d. Choose the USB Disk (UD1:) option.

Note:

If you inserted the USB drive into the teach pendant, choose the **UT1:** option.

e. Highlight the All Files option by using the arrow keys and press ENTER.



If you have trouble accessing the contents of the USB drive, try unplugging the USB and re-inserting it.

f. The contents of the USB drive will appear. Use the arrow keys and the ENTER key to find and highlight FORGE-OS > READY-FANUC-DRIVER > FORGE_INSTALL, then press ENTER.



The menu may sometimes already display the correct folder in the USB file structure. Check the "UT1:" file path displayed at the top of the FANUC pendant screen.

- g. Press Yes (F4) for the prompt asking if you want to execute the file.
- h. The FANUC Controller first displays **# Backing Up Controller Config #**. Wait for the FANUC Controller to say **Execution is completed successfully**. At a later time, you may copy the backup files in the FANUC Backup folder off of the USB drive.

i Tip:

If you get a "Specified program is in use" message instead of "Execution is completed successfully", try aborting all programs again. Press **FCTN** then **1** for **ABORT (ALL)**.

Tip:

If running **FORGE_INSTALL.CM** fails in the backup step, reboot the controller and run **FORGE_INST_NOBACK.CM** instead. This install file doesn't include the backup step, allowing you to bypass the failure.

- i. Press **OK (F4)** and remove the USB drive from the FANUC controller.
- 13. Apply changes to the FANUC DCS settings:
 - a. Go to the DCS screen by pressing the MENU button, NEXT (0), SYSTEM (6), then DCS.



b. Press **PREV** to ensure you are on the main DCS screen.

- c. Press **APPLY (F2)** to confirm the settings. If you installed Forge/OS files onto the FANUC controller before, there may not be changes to apply.
- d. Enter the password (default: 1111). Confirm the settings by pressing OK (F4).
- 14. Restart the FANUC controller to apply the settings (power the controller off, then power it on). While the controller is restarting, set the switch on the front panel of the FANUC controller to **AUTO** mode. Turn the switch on the FANUC pendant to **OFF**.
- 15. For a **collaborative** robot, follow these sub-steps to confirm the payload each time the controller boots up and each time a READY pendant notification tells you to.
 - a. Go to the Collaborative Robot DCS screen by pressing the MENU button, NEXT (0), then SYSTEM (6). If available, select the DCS option in the secondary menu; otherwise, press TYPE (F1) and select the DCS option.
 - b. Ensure nothing is contacting the robot.
 - c. Press PREV, highlight the Collaborative Robot option, and press ENTER.
 - d. Press CONFIRM (F2). Enter the password (default 1111) and follow the prompts by answering YES (F4).

Note:

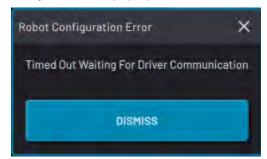
Each time a FANUC collaborative robot is turned off and then on again, the payload must be confirmed. If possible, wait for 30 minutes after booting. It can take up to 30 minutes for the Force Sensor to calibrate.

- 16. Confirm that the Forge/OS programs are running on the FANUC teach pendant. Press the **SELECT** button. A list of programs appears.
- 17. Press **MONITOR (F4)** to show the list of running programs. There should be three "FOS" programs running. If nothing happens when you press **MONITOR (F4)** or you see fewer than three "FOS" programs on the monitor, follow these sub-steps.
 - a. Turn the switch on the FANUC teach pendant back to **ON**.
 - b. On the FANUC teach pendant, press the **PREV** button to return to the list of saved programs.
 - c. Use the arrow keys to highlight the program labeled Forge_OS.
 - d. Hold down one of the three-position enabling switches on the back of the FANUC pendant to the middle position.
 - e. While holding down the enabling switch, press and hold the **SHIFT** button and then press the **FWD** button once. Then release **SHIFT** and the enabling switch.
 - f. Check the monitor again. Press MONITOR (F4). There should be three programs listed.
 - g. Set the switch on the front panel of the FANUC controller to **AUTO** mode. Switch the FANUC teach pendant to **OFF**.
- 18. In Forge/OS, confirm your device settings and tap **SAVE**. Forge/OS attempts to connect with the robot controller for up to 20 seconds.

Note:

When you first connect to a robot, it's normal to see some robot errors and/or warnings on the READY pendant. Ignore these for now. You will clear them after you finish adding the robot to Forge/OS.

a. If the robot controller fails to connect, you see this pop-up.



Click **DISMISS**, do the following, then try to tap **SAVE** again:

- Check the Ethernet connection between the robot controller and IPC.
- Check the network settings on the robot controller.
- Check if the robot controller is on and in the correct operating mode (in auto or remote mode).
- Select the correct robot controller and robot models in Device Configuration.
- 19. When the robot connects, you can add Tool Center Points (TCPs) or Payloads for the robot. You can come back to this later by editing the device's configuration. Tap **SAVE** to continue.

Note:

The default TCP is at the robot's tool flange. The default Payload is zero.

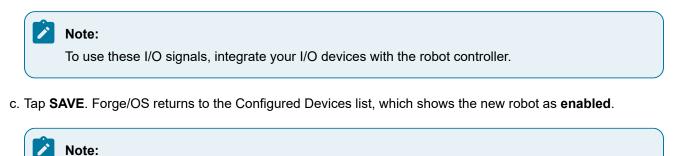
- TCP	Offset	Active On Boot
Default	(0, 0, 0) mm, (0, 0, 0) °	6
TCP-1	(0, -146.81, 268.73) mn	n, (45, 0, 0)°
TCP-2	(-146.81, 0, 268.73) mn	n, (0, -45, 0)°
TCP-3	(146.81, 0, 268.73) mm	, (0, 45, 0)°
1-4 of 4	1item selected of 1 page	
1-4 of 4	1 item selected Tof 1 page	
1-4 of 4	1item selected Tof Tpage TJ Mass And Offset	Q, NEW Active On Boot
		Q NEW Active On Boot

20. (Optional): Set up the robot controller's Input/Output (IO) signals for use in the Device Control Panel and Task Canvas.

				c
Signals	Display Name		Data Type	DCP
CI_O			BOOL	
CL1			BOOL	
CI_2			BOOL	
CI_3			BOOL	
CL_4			BOOL	
CL5			BOOL	
CI_6			BOOL	
CL_7			BOOL	
DL_0			BOOL	
DL1			BOOL	
DI_2			BOOL	
DL3			BOOL	
DL4			BOOL	
1-13 of 22		1 of 2 page(s)		

- a. Enter a **Display Name** (i.e. "Open Machine Door", "Open Pneumatic Vise", or "Start Machining Cycle") to show what each signal does in other apps.
- b. If you want a signal to appear in the Device Control Panel, check the **DCP** box next to that signal.

A device is **enabled** when its switch is green and toggled to the right.



21. Follow these steps to clear robot errors:

a. Tap the **Device Status** button on the Toolbar to expand the Device Status Panel. The robot is listed with two buttons: **MORE** and **RESET**.



- b. Tap **RESET** to try to recover from the errors. If you can't **RESET** an error, tap **MORE** to get more details and instructions.
- 22. If you added TCPs/payloads, follow the FANUC Tool Loading Steps in Appendix B (*on page 45*). You need to perform the Tool Loading Steps each time you add TCPs and/or payloads.

Chapter 12. Appendix A: Setting Up Forge/OS

Installing ForgeOS

Follow these steps to install ForgeOS and sign in to the Admin role. Installation takes about 30 minutes, depending on the resources of the IPC.

1. To install ForgeOS, follow these substeps. You need a ForgeOS installation USB flash drive. Contact your READY Robotics distributor for an installation USB drive.



Important:

Installing ForgeOS will erase all data on the target hard drive.

a. Connect a monitor, keyboard, and mouse to the IPC where you want to install ForgeOS.



b. Plug the ForgeOS installation USB flash drive into the IPC.



If you need more USB ports, use a USB 3.0 hub.

c. Restart the IPC. While the IPC is powering on, press the keyboard hotkey that takes you to the Boot Menu.



The key that opens the Boot Menu depends on the IPC model. The most common keys that do this are ESC, F10, F11, or F12. Refer to your computer's documentation for boot options.

Note:

If you're installing Forge/OS on a **Forge/Ctrl**, press F11. You may need to enter the **BIOS Admin password**. Contact READY Support if you run into this issue.

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- d. From the boot options, select **Install ForgeOS** to boot from the installation USB flash drive.
- e. The installer may take several minutes to load. Wait until the installation wizard opens.
- f. Select your language. Then click Install Forge.

English	
Español	
Esperanto Euskara	Der Onterlos E
Français	Install Forge
Gaeilge	install Forge
Galego	
Hrvatski	
Íslenska	
Italiano	
Kurdî	
Latviski	
Lietuviškai	

g. Choose a keyboard layout. Then click **Continue**.

Choose your keyboard layout:				
English (Nigeria) English (South Africa) English (UK)	English	(US) - Cherokee (US) - English (C	olemak)	
English (US) Esperanto Estonian Faroese	English English English	(US) - English (D (US) - English (D	worak) worak, alt. intl.) worak, intl., with worak, left-hand worak, right-han	n dead keys) led)
Type here to test your keyboard				
Detect Keyboard Layout				
		Quit	Back	Continue

h. Select Minimal installation. Uncheck Download updates while installing forgeos. Then click Continue.

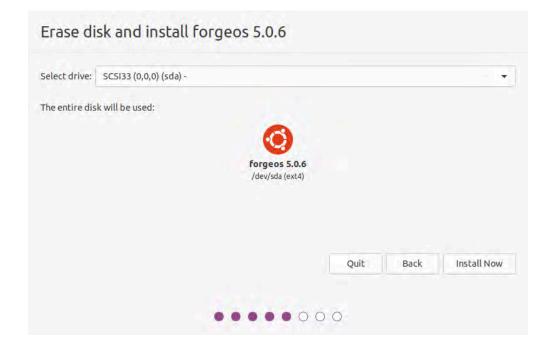
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What apps would you like to install to start with?			
Web browser, utilities, office software, games, and media play	arr		
Minimal installation	c13,		
Web browser and basic utilities.			
Other options			
Download updates while installing forgeos 5.0.6 This saves time after installation.			
Install third-party software for graphics and Wi-Fi h	ardware and additional me	dia formats	
This software is subject to license terms included with its docu	mentation. Some is proprietary.		
	Quit	Back	Continue

i. Select Erase disk and install forgeos. Then click Continue.

operating systems. What would you like to do? 5
a de la casa de la cas
5
s, documents, photos, music, and any other files in all operating systems.
ected
lf, or choose multiple partitions for forgeos 5.0.6.
e

j. Select the IPC hard drive for ForgeOS and click Install Now.



- k. Confirm that you want to erase the entire disk by clicking **Continue**.
- I. Make a note of the pendant instructions. If you're using a Forge/Ctrl, select the checkbox next to **This** hardware is a Forge CTRL.

When connecting the this computer that co	Keba Touch Pend prresponds to the	ant, please attac network device	h the Keba Touch named:	Pendant's El	thernet cable I	to the port of
ens33						
This hardware is a	Forge CTRL					
Sets gateway for inte	ernet connection					
					Back	Continue

m. Choose your timezone. Then click Continue.



n. Choose your IPC's host name. The host name identifies the IPC on the network. Pick a username and password. Then click **Continue.**

Note:	
The username and password that you create here are for accessing the IPC desktop. They are NOT	
for signing into ForgeOS on the READY pendant.	
Who are you?	

Your name:	Forge User	0	
Your computer's name:	YOUR-HOSTNAME		
	The name it uses when it talks to other co	mputers.	
Pick a username:	forge		
Choose a password:			
Confirm your password:			
	O Log in automatically		
	Require my password to log in		
		Back	Continue

o. Wait for the installer to copy and install ForgeOS.

Welcome to Forge/OS 5



Anyone can program robots

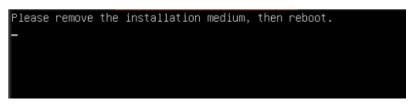
Forge/OS enables anyone on the factory floor to quickly learn, and program automation. No robotics programming experience necessary. Rapidly modify programs when parts change. Troubleshoot problems in minutes.



p. Once the installation completes, click Restart Now.



q. When prompted, remove the installation flash drive. Then reboot.



r. Wait for ForgeOS to finish booting.

s. When you see the login screen with the ForgeOS 5 logo, ForgeOS is ready to run on the READY pendant! You don't need to sign in to the desktop. Disconnect the monitor, keyboard, and mouse that you used to install ForgeOS.



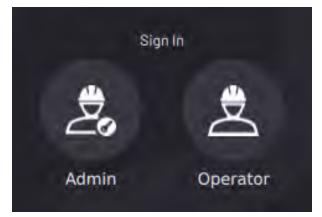
- 2. The READY pendant automatically finds and pairs with the IPC. The three LEDs on the screen help you track the status:
 - **Pendant Network Connection**: This condition is satisfied when the READY pendant has a valid network connection (i.e., the Ethernet cable is plugged in).
 - ForgeOS IPC Detected: This condition is satisfied when the READY pendant detects a Forge/OS IPC on the network.
 - ForgeOS IPC Paired: This condition is satisfied when the READY pendant successfully pairs with the IPC. If pairing fails, it is automatically retried indefinitely.

When a condition is not satisfied, the LED is red. When a condition is in progress of becoming satisfied, a spinner around a READY logo appears to the right of the text. When a condition becomes satisfied, the LED turns green.



The UI shows the real-time state of each step. For example, if the pendant loses its network connection during pairing, all steps become undone. If the READY pendant spends more than 60 seconds on any step, troubleshooting text displays. Common things to check are if the READY pendant network cable is plugged in, if the IPC is powered on, if the READY pendant and IPC are connected to the same network, and if there's only one READY pendant and one IPC on that network.

3. Tap Admin and sign in. The default Admin password is "forgeadmin".



Note:

After installation, you have limited access to ForgeOS until you activate it with a license code. See Activating ForgeOS with a License Code (on page 40).

Activating ForgeOS with a License Code

There are two methods to activate ForgeOS: Online license activation and offline license activation.

The table below lists the requirements for each method.

Online License Activation	Offline License Activation
 An internet-connected ForgeOS A valid ForgeOS license code 	 A 2GB or larger USB flash drive An internet-connected PC A valid ForgeOS license code

Tip:

i

Connect a USB keyboard to the port on the bottom of the READY pendant to type in any text field in ForgeOS.

1. On the Settings app main screen, tap **License**.

Settings	0
Metwork	>
Fieldbus Configuration	>
General Settings	>
Remote Access	>
System Update	>
Package Manager	
License (EXPIRED/INVALID)	>
System Information	>

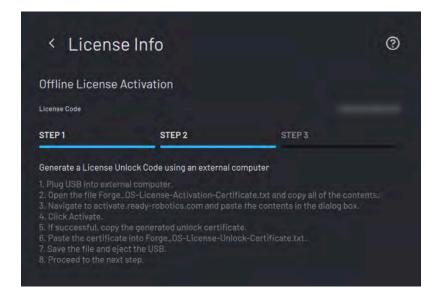
- 2. Type in your license code.
- 3. Choose ONLINE LICENSE ACTIVATION if ForgeOS is connected to the internet. If not, choose OFFLINE LICENSE ACTIVATION.

<empt;< th=""></empt;<>
Unknown License Typ

- 4. If you chose online license activation, you're done!
- 5. If you chose offline license activation, follow these substeps:
 - a. Insert the USB flash drive into your IPC. Tap **START WRITING CERTIFICATE TO USB DRIVE**.

< Licens	se Info		0
Offline License	Activation		
STEP 1	STEP 2	STEP 3	
Transfer License Ad	ctivation Certificate to USB		
	ctivation Certificate to USB to transfer the activation certificate Click start to begi	n writing	

b. When the files finish transferring, tap **NEXT**. Follow the instructions on the screen to convert the Activation Certificate to an Unlock Certificate using an internet-connected PC.



c. Insert the USB flash drive back into your IPC. Tap UNLOAD UNLOCK CERTIFICATE FROM USB DRIVE.

- d. Wait for the file to finish transferring. When the file transfer is complete, remove the USB flash drive and tap **SAVE**.
- e. ForgeOS returns to the licensing home screen and shows an active license. If the license status isn't active, restart these license activation steps. Double-check your license code.

Choosing Preferences

These steps help you choose system preferences, including language, units, time, and network settings.

To change preferences for the first time, go to General Settings:

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- a. On the Settings app main screen, tap **General Settings**.
- b. Change the Units of Measure, Time and Date settings, or the Admin login password.

LanguageEnglish (United States)Units of MeasureMeasurementImperialLengthmillimeterSpeedmm/secondMasskilogramPorcenewtonTorquenewton-meterfoot-pound		
Measurement Imperial Length millimeter Inch Speed mm/second inch/second Mass kilogram pound Force newton pound		the second s
MeasurementMetricImperialLengthmillimeterinchSpeedmm/secondinch/secondMasskilogrampoundForcenewtonpound	English (United States)	× 1
Length millimeter inch Speed mm/second inch/second Mass kilogram pound Force newton pound	Units of Measure	
Speed mm/second inch/second Mass kilogram pound Force newton pound	Measurement Metric Imperial	
Mass kilogram pound Force newton pound	Length millimeter inch	
Force newton pound	Speed mm/second inch/second	
	Mass kilogram pound	
Torque newton-meter foot-pound	Force newton pound	
	Torque newton-meter foot-pound	
Current date : D4/21/2022 Current time : 2:30:21 PM CANNOT SET DATE/TIME. NTP IS ACTIVE.	Current date : 04/21/2022	NTP IS ACTIVE.
Select Time Zone	Select Time Zone	
America/New_York	America/New_York	~

c. Tap **SAVE** to save changes and exit the General Settings menu.

Chapter 13. Appendix B: Tool Loading Steps

Follow these steps to add new TCPs/Payloads in Forge/OS and update the configuration on the FANUC controller.

Here is an outline of the tool loading process:

- Add TCPs/Payloads to the robot's configuration in Forge/OS and save.
- Apply DCS parameters.
- Restart the FANUC controller.
- · Confirm the Collaborative DCS settings (collaborative only).
- Reset the controller from Forge/OS.
- 1. In Forge/OS, go to the Device Configuration app and find the FANUC robot under Configured Devices. Select the device and tap **Edit** to open the robot configuration.
- 2. Tap TCP AND PAYLOAD CONFIGURATION.



3. Add all the TCPs and Payloads you need for your workcell and tap SAVE.

		n Boot Edit Delete Cance
- 1 ТСР	Offset	Active On Boot
Default	(0, 0, 0) mm, (0, 0, 0) °	6
TCP-1	(0, -146.81, 268.73) mm. (45, 0, 0) °	
TCP-2	(-146.81, 0, 268.73) mm, (0, -45, 0)°	
TCP-3	(146.81, 0, 268.73) mm, (0, 45, 0) °	
1-4 of 4	litem selected fof i page	
	11 Mass And Offset	Active On Boot
Payload		
□ ↓ Payload □ Default	0 kg, (0, 0, 0) mm	6

- 4. Tap **SAVE** to exit the robot configuration. Forge/OS uploads the tool data to the FANUC controller. Forge/OS shows an error for the robot: *FANUC Error SYST-212: DCS settings not applied*.
- 5. Install your end of arm tooling on the robot.
- 6. Apply changes to the FANUC DCS settings:

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a. Go to the DCS screen by pressing the MENU button, NEXT (0), SYSTEM (6), then DCS.

Tip: Or on the SYSTEM screen, press [TYPE] (F1), then select DCS.

- b. Press **PREV** to ensure you are on the main DCS screen.
- c. Press **APPLY (F2)** to confirm the settings. If you installed Forge/OS files onto the FANUC controller before, there may not be changes to apply.
- d. Enter the password (default: 1111). Confirm the settings by pressing OK (F4).
- 7. For a **collaborative** robot, the controller will boot to the DCS **Collaborative robot** screen. Follow these sub-steps to confirm the collaborative DCS settings:
 - a. Press CONFIRM (F2).

i

- b. Enter the password (default: 1111) and follow the prompts by answering YES (F4).
- 8. On the READY pendant, tap the **Device Status** button to expand the Device Status Panel, then tap the **RESET** button on the list next to the robot. This clears the faults on the robot and gives you control of it.

Chapter 14. Contacting READY

Visit READY.academy for FREE hands-on courses to help you deploy a robotic system.

Visit our Support site for robot startup guides, FAQs, and more.

If you encounter a problem and need to talk to someone, reach out to us.

- Email READY Robotics: support@ready-robotics.com
- Call READY Robotics: +1-833-732-3977

