









The documentation, best practices, and recommendations provided by READY Robotics do NOT constitute safety advice. Products sold through READY Robotics are not by themselves a fully integrated workcell. As required in ISO 10218-2, READY Robotics strongly recommends performing a complete risk assessment of the integrated workcell per ISO 12100. You may wish to use the methodology found in the ANSI/RIA TR R15.306 Task-based Risk Assessment Methodology.



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OVERVIEW

This guide helps you set up your EPSON robot to work with Forge/OS 5.

You will complete these steps:

- 1. Check for the requirements.
- 2. Connect all the devices and power on.
- 3. Set up Forge/OS.
- 4. Transfer Forge/OS robot configuration files to the robot.
- 5. Configure the robot in RC+ and Forge/OS.
- 6. Program your robot with Forge/OS!

Note: This guide assumes that you have installed the robot following EPSON instructions.

Important: Before you start programming, please read the <u>Known Issues</u> section. The robot may behave unexpectedly when near a singularity. THESE ISSUES ARE NATIVE TO EPSON AND NOT AT THE FAULT OF FORGE/OS.

HARDWARE REQUIREMENTS

Image	Part Name	Description	Vendor	Part Number
Patient Patient	READY IPC	Hosts Forge/OS. Note: READY offers two IPCs: Forge/Hub and Forge/Ctrl (legacy)	READY Robotics	
	READY pendant	The touch screen interface for Forge/OS.	READY Robotics	112563
	READY pendant Junction Box (Forge/Ctrl only)	Connects the READY pendant to the Forge/Ctrl and robot controller.	READY Robotics	R-101257
	12-Pin M12 to Flying Leads Cable	Connects to the READY pendant Junction Box or Forge/Hub to terminals.	READY Robotics	



Image	Part Name	Description	Vendor	Part Number
	Robot Controller	Connects the robot arm to power and to other devices.	EPSON	
	USB A-Male to B-Male Cable	Connects a Windows PC to the robot controller.	EPSON (Included with robot)	
The second secon	Windows PC	Required to load Forge/OS configuration files to the robot controller.		
	Emergency Terminal Block Kit (with Cable)	Connects the robot controller to the READY pendant and safety devices.	EPSON	RE000975-1
	24V/2.5A Power Supply	Powers the READY pendant and other devices. Min./Max. current: 2.5/5.0 Amps.		e.g., Siemens 6EP1332-5BA00



Image	Part Name	Description	Vendor	Part Number
	Polycarbonate Enclosure or Cabinet	Protects the Terminal Block Kit and the Power Supply in an enclosure.		
	Cat5e Shielded Ethernet Cable (x2)	 Connects the robot controller to an IPC. Connects the READY pendant to an IPC. 	McMaster- Carr	7734T6
Contraction of the second seco	USB Flash Drive (with at least 2GB of available memory)	Transfers Forge/OS configuration files to the robot controller	READY Robotics (or other)	R-400030



SOFTWARE REQUIREMENTS

EPSON RC+ is the software that you use to communicate with the robot in its native language. Access to the full version of RC+ came with the purchase of your robot. Install it on a Windows PC to load Forge/OS configuration files.



Note: EPSON offers a free trial of RC+ for testing on a simulated robot. This free trial will NOT work for setting up Forge/OS.

Important: If you have built or loaded projects on the controller before, you may need to do a factory reset. Contact EPSON Support for help.

Refer to the table below for the minimum required RC+, controller firmware, and Forge/OS versions.

Controller	Minimum Software Version
	RC+ 7.0, Compiler v7.4.0.x
VT6L	Firmware v7.5.53.0

Tip: Refer to <u>Checking the Firmware Version</u> for instructions on how to check your controller firmware version.



CHECKING THE FIRMWARE VERSION

Follow these steps to check what firmware version your EPSON controller is on.

Plug the robot controller's power cable into a power outlet. Follow EPSON documentation for powering it on.

Plug the USB Cable into the robot controller's **PC** port. Plug the other end into a Windows PC with EPSON RC+ installed.



Open EPSON RC+ in Program Mode.

3

- If you see the pop-up below, click **Change To Program Mode** before the 5 second countdown expires.
- If the default boot mode is set to Program Mode, wait for the 5 second countdown to expire.

EPSON RC+ 7.0		
Auto Mod		
Control Device: Ren	note I/O	
Starting in 4 second	ds.	
Change To Program Mode	Abort	



	Change To Program Mode 🛛 💥	
	Enter Password:	
	OK Cancel	
If you see a pop-up al after Program Mode b	bout monitoring controller operation before Program Mode boots, click Yes . I boots, click No .	If you see it
	EPSON RC+ 7.0 X The controller is running tasks for the current PC project. Would you like to monitor controller operation?	
	Yes No	
If you see a pop-up al	pout starting another session, click Yes .	
	EPSON RC+ 7.0 Sessions.	

8



7 If you see a pop-up about current tasks running, select **Stop all tasks**.

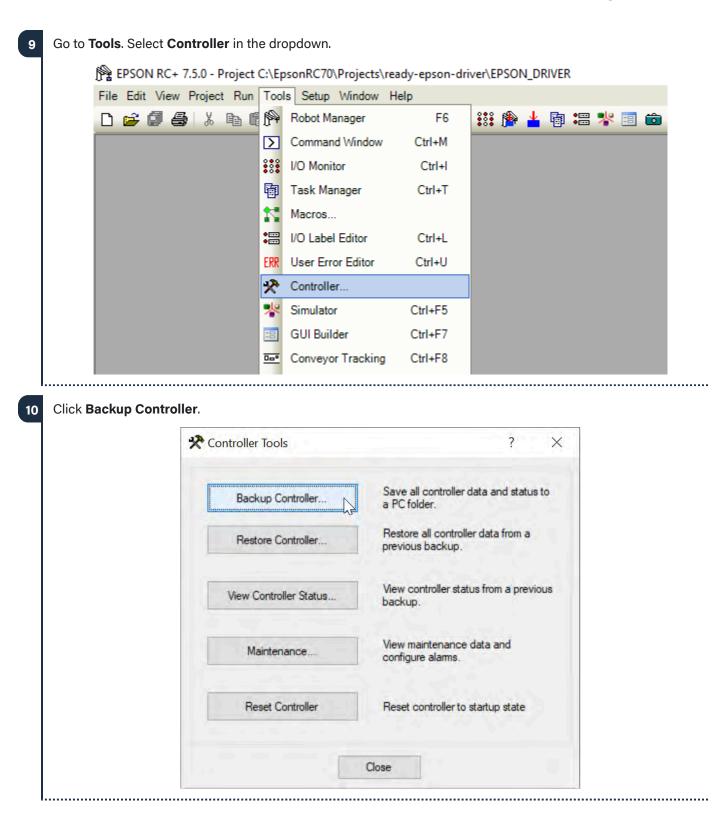
Connect
The controller is running tasks but there is no project open on the PC. What do you want to do?
O Monitor the currently running tasks
Stop all tasks
ок

In the top menu, select a **Connection** type of **USB**.

Tip: The USB option is only available when:

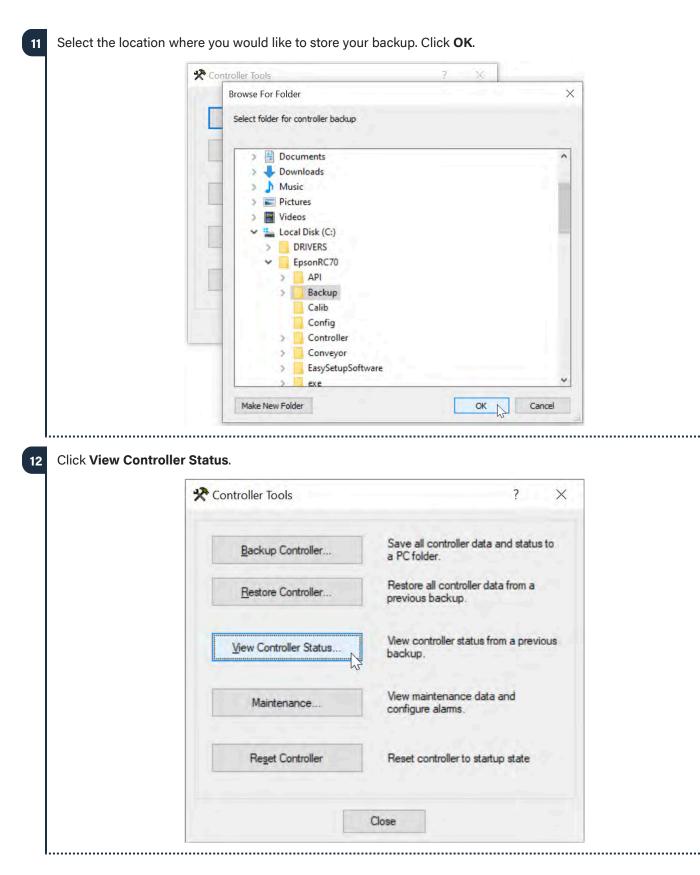
- You are using the full version of RC+.
- Your USB cable is connected to the robot controller and Windows PC.

h 🔚 🧏 🗐 🛛	Connection	USB	- ?



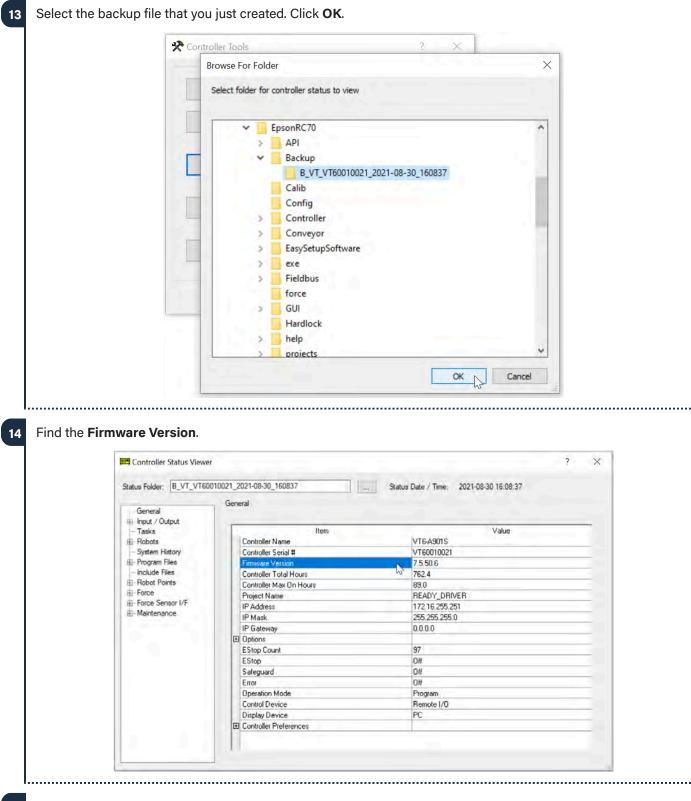
READY





15





Verify that your firmware version matches the requirement. If you need to upgrade, contact EPSON Support.



CONNECTING THE ROBOT CONTROLLER





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

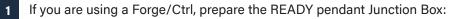


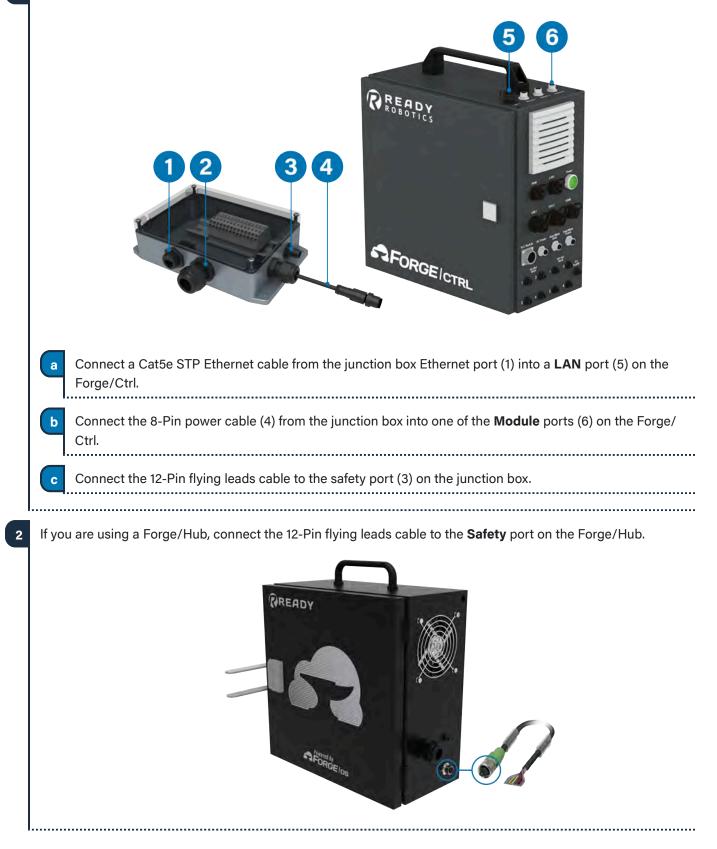
Note: For EPSON robots, you connect the *READY pendant* Emergency Stop, but not the Key Switch and Enabling Switch. Always perform a risk assessment and use appropriate safeguards, like a safety fence.



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

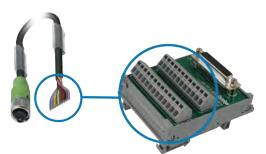








3 Wire the 12-Pin M12 Cable's flying leads to the Terminal Block Kit:



12-Pin Cable	EPSON Emergency Connector	Function
Brown	N/A	Enabling Switch
Blue	N/A	Enabling Switch
White	N/A	Enabling Switch
Green	N/A	Enabling Switch
Pink	Pin 1	Emergency Stop
Yellow	Pin 9	Emergency Stop
Black	Pin 10	Emergency Stop
Grey	Pin 14	Emergency Stop
Red	N/A	Key Switch
Violet	N/A	Key Switch
Grey/Pink	N/A	Key Switch
Red/Blue	N/A	Key Switch
	Pin 2, 3	Jumper
	Pin 15, 16	Jumper
	Pin 4, 11	Jumper
	Pin 12, 17	Jumper

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4

Wire the safeguard device (e.g., safety fence) and latching system. You can wire a button or switch to the latch release pins to control the latching mechanism. Or you can jumper the latch release inputs so the safeguard auto resets when you close the fence (shown in the table below).

EPSON Emergency Connector	External 24V Power Supply	Safeguard Device	Function
	24V	Safeguard Contact 11	Safeguard Input 1 Circuit
Pin 7		Safeguard Contact 12	Safeguard Input 1 Circuit
Pin 8	οV		Safeguard Input 1 Circuit
	24V	Safeguard Contact 21	Safeguard Input 2 Circuit
Pin 20		Safeguard Contact 22	Safeguard Input 2 Circuit
Pin 21	ov		Safeguard Input 2 Circuit
Pin 18	24V		Latch Release Input (Jumpered)
Pin 19	24V		Latch Release Input (Jumpered)

Tip: Refer to EPSON documentation for more information on safeguard wiring and pin assignments.



POWERING ON

1	Plug the robot controller's power cable into a power outlet.
2	Power on the robot controller.
3	Plug your IPC's power cable into a power outlet.
4	Power on your IPC.
	Note: If you are using a Forge/Ctrl, turn the Power Disconnect Switch to ON . Then press the green power button on the opposite side.

2



SIGNING IN TO FORGE/OS

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

If you need to install Forge/OS 5 on your IPC, stop here and follow all the steps in <u>Appendix A</u>, then come back to these steps.

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

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



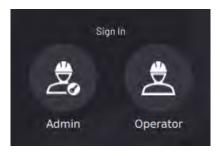
pairing, all steps become undone.

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

4

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



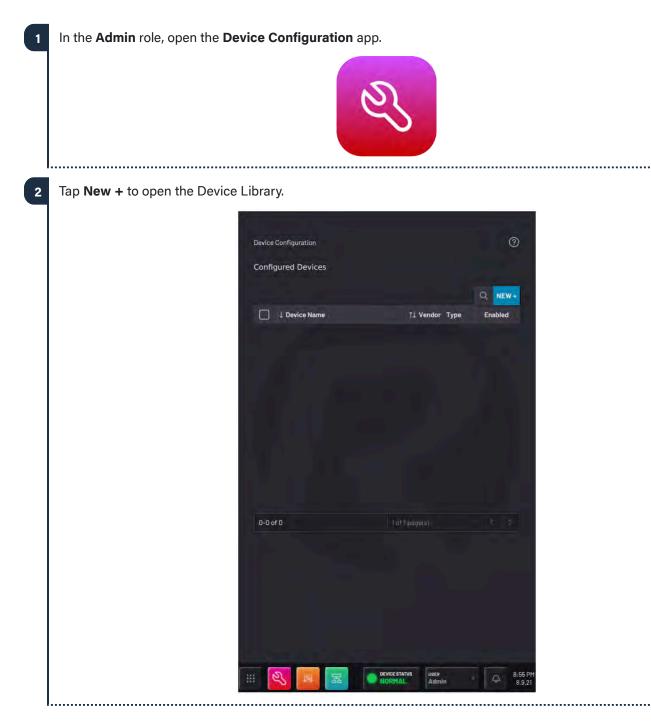
If Forge/OS is inactive, it opens the Settings app and prevents you from opening other apps. If you see the screen below, follow <u>Activating Forge/OS with a License Code</u> in Appendix A.

0
>
>
>
>
>
>
>
>

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



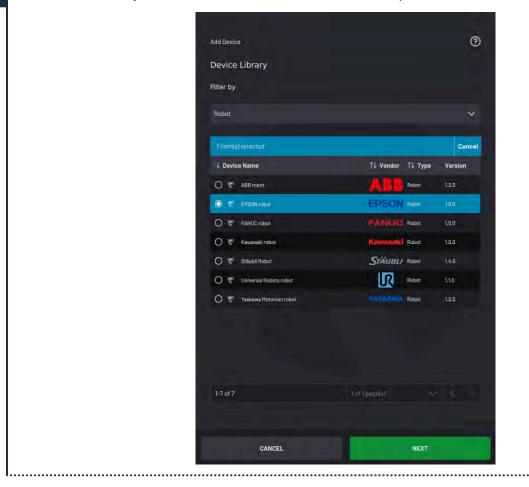
DEVICE CONFIGURATION - PT.1



3



In the Device Library list, select **EPSON industrial robot**. Then tap **NEXT**.





4	Select VT6L for the Controller Model. Fill in the other	information later.		
	EPSON robot		0	
	Device Name	IP Address		
	Description			
	Controller Model	Robot Model		
	VT6L 🔶	VT6L	~	
	Force Sensor Device			
	Select a Force Device		× .	
	Copy the Configuration Files			
	Insert a 2GB flash drive into the Forge/OS IP complete the setup of your robot	C to copy the configuration files need	ded to	
	NOTE: USB file system must b	e formatted in one of the following	ng:	
	exFAT, FAT	16, FAT32, NTFS device into Forge/OS IPC		
	Required Field			
	and the second sec			
	CANCEL	:SAVE		
5	Insert a USB flash drive into the IPC as instructed on the	e screen. Use an e	empty flash drive with at least 20	GB of
	storage.			
	Tip: Do not connect the USB flash drive to the READY	pendant.		
	The Other Transforment description is the Calible			
6	Tap Start Transfer and wait for it to finish.			
7	Remove the USB flash drive when prompted.			

1

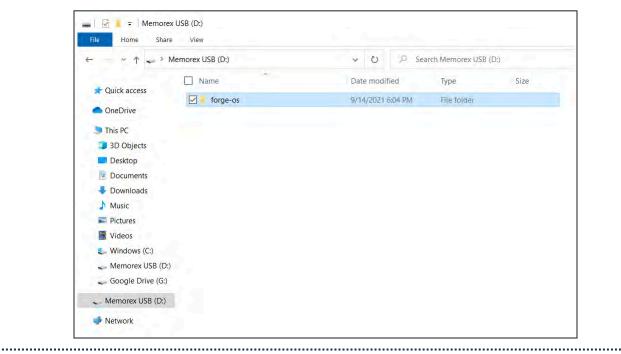
2



IMPORTING THE PROJECT IN RC+

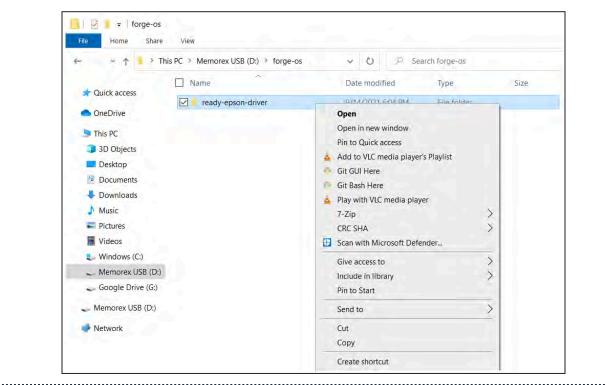
Insert the USB flash drive (that has the configuration files from the IPC) into the Windows PC.

In File Explorer, go to your USB flash drive's storage. Open the forge-os folder.

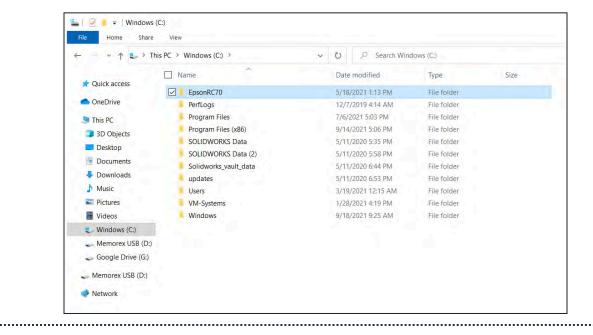




3 In that forge-os folder, right-click the ready-epson-driver folder to copy it.



In your **Windows (C:)** drive, open the **EpsonRC70** folder that was made when you installed the EPSON RC+ software.

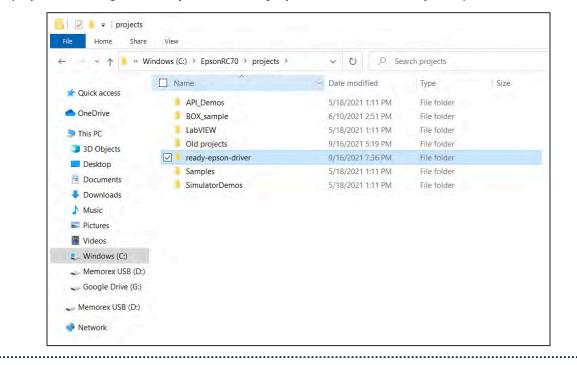




5 In that EpsonRC70 folder, open the **projects** folder.

$\leftarrow \rightarrow \checkmark \uparrow \blacksquare \rightarrow$ This	PC > Windows (C:) > EpsonRC70 >	v U 🔎 Sea	rch EpsonRC70	
Quick access	Name ^	Date modified	Туре	Siz
a quick decess	API	5/18/2021 1:11 PM	File folder	
OneDrive	Backup	6/10/2021 5:18 PM	File folder	
This PC	Calib	5/14/2021 12:36 PM	File folder	
3D Objects	Config	5/14/2021 12:36 PM	File folder	
	Controller	5/18/2021 1:11 PM	File folder	
Desktop	Conveyor	5/18/2021 1:11 PM	File folder	
Documents	EasySetupSoftware	5/18/2021 1:11 PM	File folder	
Downloads	sexe	5/18/2021 1:12 PM	File folder	
Music	Fieldbus	5/18/2021 1:11 PM	File folder	
Fictures	force	5/14/2021 12:36 PM	File folder	
📱 Videos	GUI	5/18/2021 1:11 PM	File folder	
Windows (C:)	Hardlock	5/18/2021 1:11 PM	File folder	
Memorex USB (D:)	help	5/18/2021 1:11 PM	File folder	
Google Drive (G:)	manuals	5/18/2021 1:11 PM	File folder	
Coogle Drive (d.)	projects	9/22/2021 3:48 PM	File folder	
Sector Memorex USB (D:)	security	5/18/2021 1:11 PM	File folder	
Network	Simulator	6/10/2021 2:54 PM	File folder	
- Hethork	Status	5/14/2021 12:36 PM	File folder	
	system	5/18/2021 1:11 PM	File folder	

6 In that projects folder, right-click to **paste** the **ready-epson-driver** folder that you copied.





- 7 Open RC+ in Program Mode.
 - If you see the pop-up below, click **Change To Program Mode** before the 5 second countdown expires.
 - If the default boot mode is set to Program Mode, wait for the 5 second countdown to expire.

	EPSON
	RC+ 7.0
	Auto Mode
	Control Device: Remote I/O Starting in 4 seconds.
	Change To Program Mode Abort
	enter it. Then click OK .
	Change To Program Mode 🛛 💥
	Enter Password:
	OK Cancel
	Children Children
after Program Mode bo	out monitoring controller operation before Program Mode boots, click Yes . If you see i oots, click No .
-	EPSON RC+ 7.0
	The controller is running tasks for the current PC project.
	Would you like to monitor controller operation?
	Would you like to monitor controller operation?



If you see a pop-up about starting another session, click Yes. 10 EPSON RC+ 7.0 You are already running one or more EPSON RC+ 7.0 sessions. 2 Do you want to start another session? Yes No If you see a pop-up about current tasks running, select Stop all tasks. 11 Connect The controller is running tasks but there is no project open on the PC. What do you want to do? Monitor the currently running tasks Stop all tasks OK In the menu bar across the top of EPSON RC+, open the Project tab. Click Import. 12 EPSON RC+ 7.5.0 File Edit View Project Run Tools Setup Window Help DEDE New ... Project Explorer Open... Recent Projects Close Edit. Save Save As. Rename. Delete. Import. Export. Copy Build Ctrl+B Rebuild Ctrl+Shift+B Synchronize. Properties.



Set the import location as PC. Then click Next. 13 ? X Import Project Select Import Location Import project from where? PC PC O Controller O Controller Backup Folder Cancel Next > Select a project type of EPSON RC+ 7.x. Select the copied "ready-epson-driver" project. Then click Next. 14 ? Import Project X Select Project To Import Project Type: EPSON RC+7.x v Select Drive: C: [Windows] v Select Project To Import: Demos ^ 1 LabVIEW 😥 🧰 Old projects E aready-epson-driver READY_EPS E Samples E SimulatorDemos ROX sample < 5 Cancel < Back Next >

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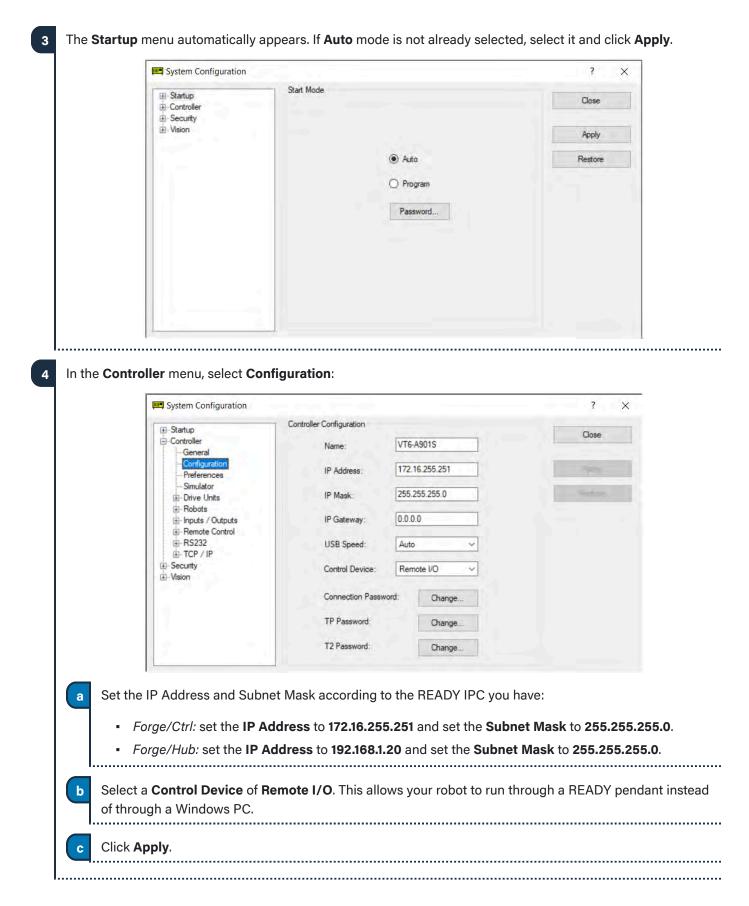
Import Project		? X
Select Destination P	roject	
	Destination Project Name:	
	EPSON_DRIVER	
	Destination Drive:	
	C: [Windows]	
	Select Project Folder:	
	Projects API_Demos LabVIEW Old projects	New Folder
	ready-epson-driver Samples General SimulatorDemos BOX_sample BOX_sample BOSN_DRIVER ✓	
Cancel	< Back Next >	Woon
Import Project	fter Import checkbox. Then click	? ×
Import		
1		
Import	Source: PC	
Import	Project: C:\EpsonRC70\Projects\rea	dy-epson-driver\R
	ation Project: C:\EpsonRC70\Projects\EP	SON DRIVER
Desur	adon ingest. C. schooline to trigects (Er	SON DUILLEN
⊠ 0	pen Destination Project After Import	
	Ready to import project files	
	Click Import to start	



CONFIGURING THE ROBOT

	File Edit View Project Run Tools Se	stup Window Help 🖫 📲 🚛 🚛 🌆 🏫 💽 🎎 隆 🛓 🕸 🕽 📽 😵 🗐 📾 🛏 Connection: USB 🔹 🥊 📒
	Project Explorer Project	
	Program Files Source of the service of the	C4 Sample G6 Sample N2 Sample CAD To Point CTP For ECP Box Sample T6 Sample V
np: In	e USB option is only availab	
• Ya	o menu bar, select Setup . G	to the robot controller and Windows PC. Go into System Configuration .
• Ya	our USB cable is connected o menu bar, select Setup . G Martin EPSON RC+ 7.5.0 - Project C:	to the robot controller and Windows PC. Go into System Configuration .
• Ya	our USB cable is connected o menu bar, select Setup . G P EPSON RC+ 7.5.0 - Project C: ¹ File Edit View Project Run T	to the robot controller and Windows PC. The into System Configuration . \EpsonRC70\Projects\EPSON_DRIVER Tools Setup Window Help
• Ya	our USB cable is connected o menu bar, select Setup . G Martin EPSON RC+ 7.5.0 - Project C:	to the robot controller and Windows PC. Go into System Configuration .





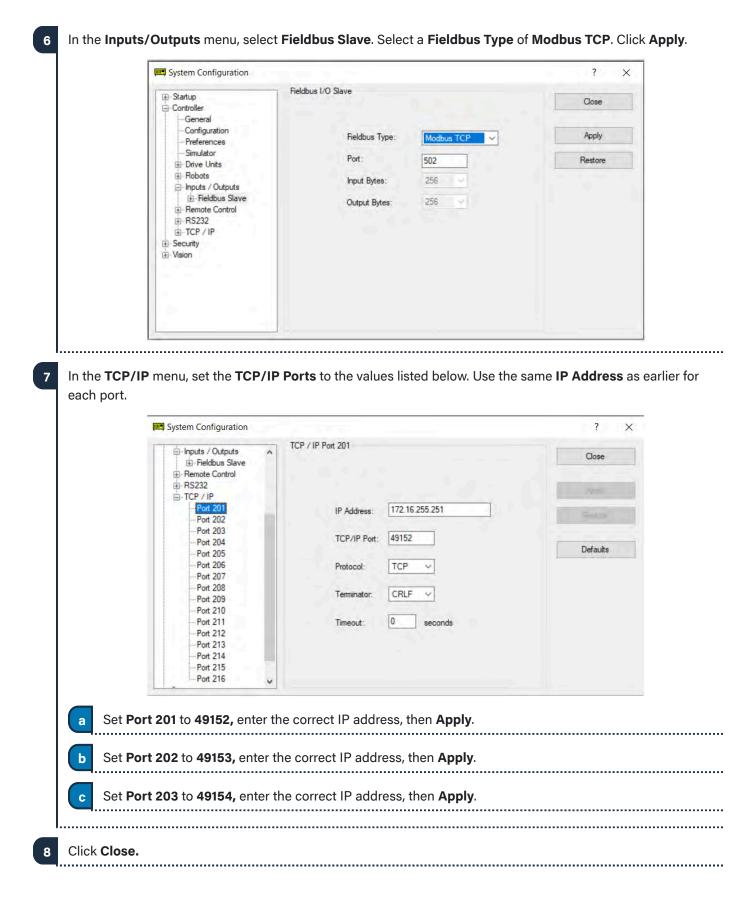
5

In the Controller menu, select Preferences:

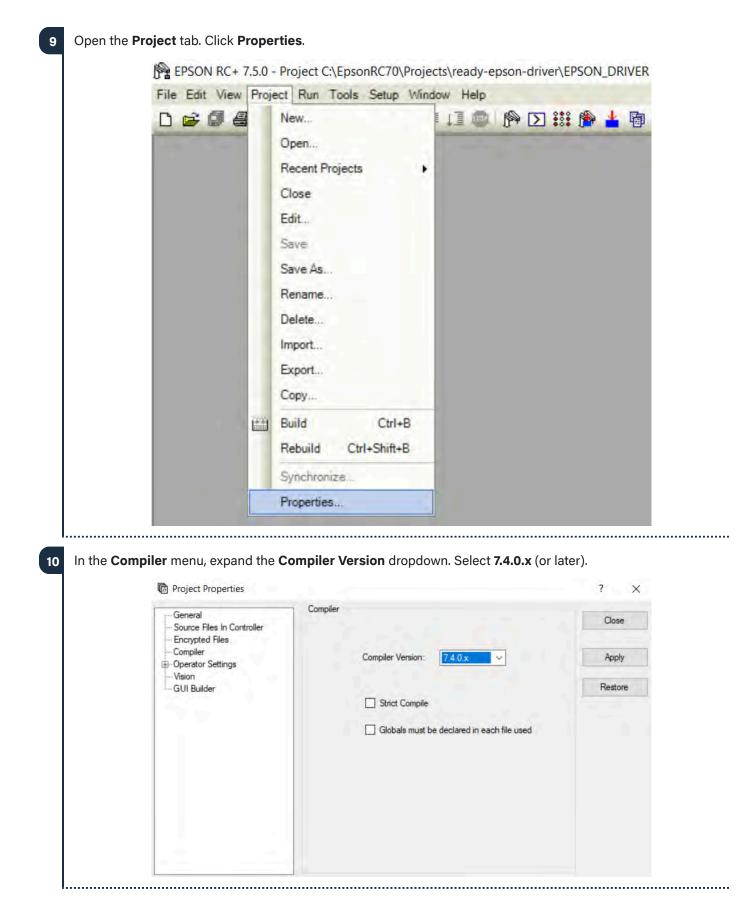


Image: Controller Image: Controller Image: Controler Image: Controller <	-Controller	Controller Preferences	
Configuration Preferences Simulator Outputs off during emergency stop Brobots Walk stops for output commands Brobots Dry run Brobots Include project files when status exported Brobots Safeguard open stops all tasks Brobots Safeguard open stops all tasks Brobots Clear globals when MainXX function started Brobots Clear globals when MainXX function started Brobots Enable davanced task store Brobots Enable davanced tasks for API: Brobots Reserved tasks for API:			Close
Configuration Preferences Simulator Allow motion with one or more joints free Walk stops for output commands Preferences Botive Units Propy run Hobots Virtual I/O Botots Preferences Breader Control Safeguard open stops all tasks Breader Control Safeguard open stops all tasks Brow Scienty Clear globals when MainXX function started Brable advanced task commands Enable advanced task commands Brable advanced tasks for API: Reserved tasks for API: Or Mincheck Virtual I/O to disable it.	General	Beset command turns off outputs	
Image: State of the state	Preferences	Outputs off during emergency stop	Apply
Include project files when status exported Bernote Control Res232 TCP / IP Security Security Security Reserved tasks for API: O	⊞-Drive Units	Dry run	Restore
Auto safeguard position recovery	- Inputs / Outputs	Include project files when status exported	Defaults
Clear globals when MainXX function started Frable background tasks Frable advanced tasks commands Enable CP - PTP connection when CP is on Auto LIM (Least Joint Motion) Disable LJM in Teach Mode Reserved tasks for API: 0	-RS232	Auto safeguard position recovery	
Provening Provening			
Enable CP - PTP connection when CP is on Auto LJM (Least Joint Motion) Disable LJM in Teach Mode Reserved tasks for API: O		Enable background tasks	
Auto LJM (Least Joint Motion)			
Reserved tasks for API: 0		Auto LJM (Least Joint Motion)	
Incheck Virtual I/O to disable it.		Disable LJM in Teach Mode	
Jncheck Virtual I/O to disable it.		Provendente for API	
elect Independent mode .			
Select Enable background tasks.	heck Auto safeguard p e ect Independent mode .	osition recovery to disable it.	
Select Enable advanced task commands .	heck Auto safeguard p o	osition recovery to disable it.	
	heck Auto safeguard p ect Independent mode . ect Enable background	osition recovery to disable it. tasks.	











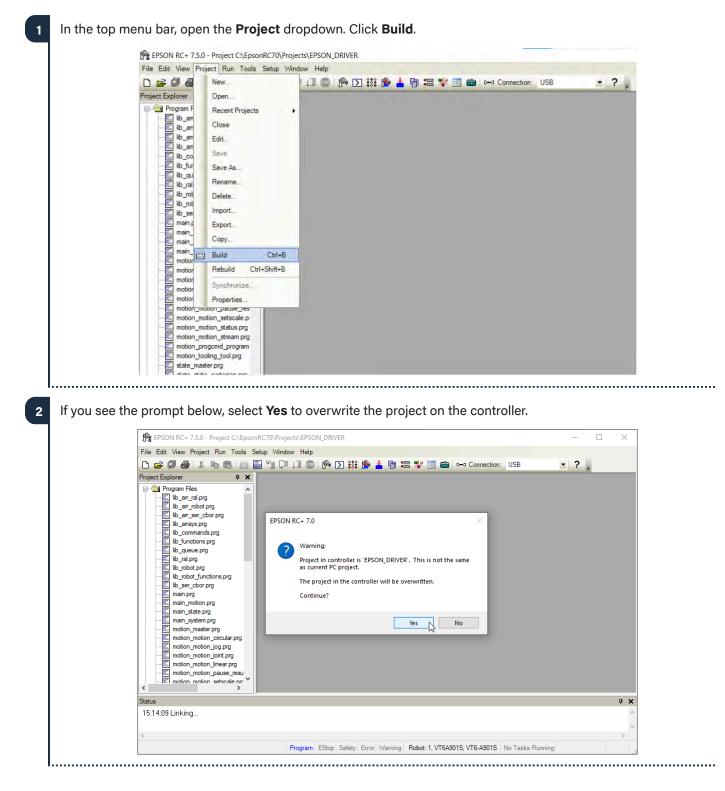
nnly th out of th 11

1	Click Apply, then Close out of the pop-up.



BUILDING THE DRIVER

It's time to build the driver. This step sends the program files to the robot.





3 Check that you have a successful build by looking for a "**Build complete, no errors**" message in the **Status** window.

15:32:26 Sending tests_language_strings_test_strings.prg	
15:3776 Sending tests language strings test string asculorg	
15:32:26 Sending tests_language_strings_test_string_ascii.prg 15:32:26 Sending tests_language_strings_test_string_compare.p	ora
15:32:26 Sending tests_language_strings_test_string_concat.prg	
15:32:27 Sending tests_language_strings_test_string_operations	s.prg
15:32:27 Sending lib_ral.prg	
15:32:27 Sending lib_ser_cbor.prg	
15:32:27 Sending system_state_allcommands.prg	
15:32:27 Sending lib_arr_ser_cbor.prg	
15:32:27 Sending lib_arr_ral.prg	
15:32:28 Sending lib_arr_robot.prg	
15:32:28 Sending lib_queue.prg	
15:32:28 Sending robot1.pts	
15:32:28 Sending EPSON_DRIVER.sprj	
15:32:28 Sending EPSON_DRIVER.obj	
15:32:29 Sending IOLabels.dat	
15:32:29 Sending UserErrors.dat	
15:32:29 Sending EPSON_DRIVER.vis	
15:32:29 Sending EPSON_DRIVER.fg	
15:32:29 Loading project in controller	
15:32:30 Build complete, no errors	

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Tip: If you see build errors, refer to Appendix C: Troubleshooting.



STARTING THE DRIVER

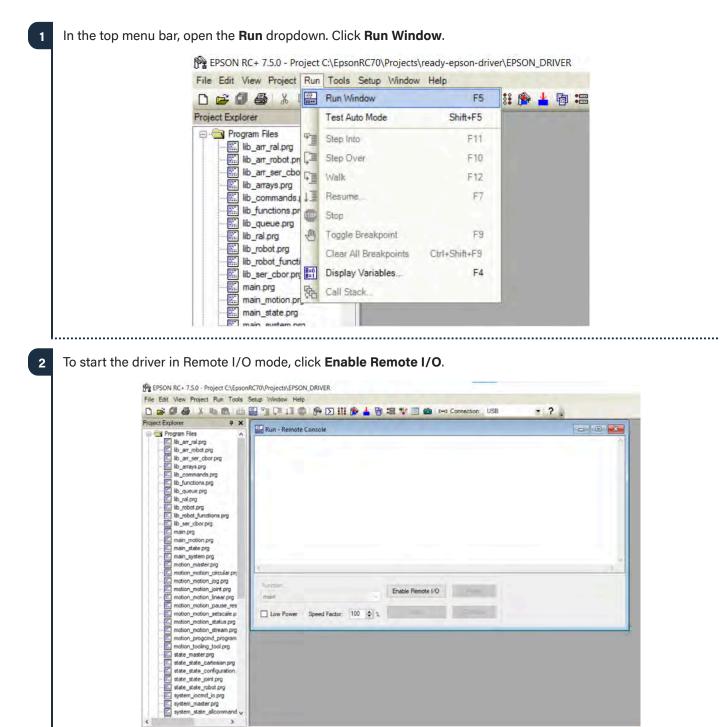
3

plete, no errors

16:08:08 Sending EPSON_DRIVER.vis 16:08:08 Sending EPSON_DRIVER fg 16:08:08 Loading project in controller...

Status

16:08:09 Euild cor





Proced Exclore u x Proced Exclore u x Proced Exclore u x Proced Exclore u x Proced Exclore u u x Proced Exclore u u u u x Proced Exclore u <thu< th=""> u u</thu<>	Source program Source p		
date state_configuration: date_state_configuration: date_state_configuration: date_state_configuration: date_state_configuration: date_state_configuration: date_state_configuration: date_state_configuration: date_state_configuration: date_state_configuration:	 Burjebat functions prg Burjebat function	Fundoor main V Enable Remote 1/0	Function BGMain (main background task) exists. Would you also like to start BGMain?

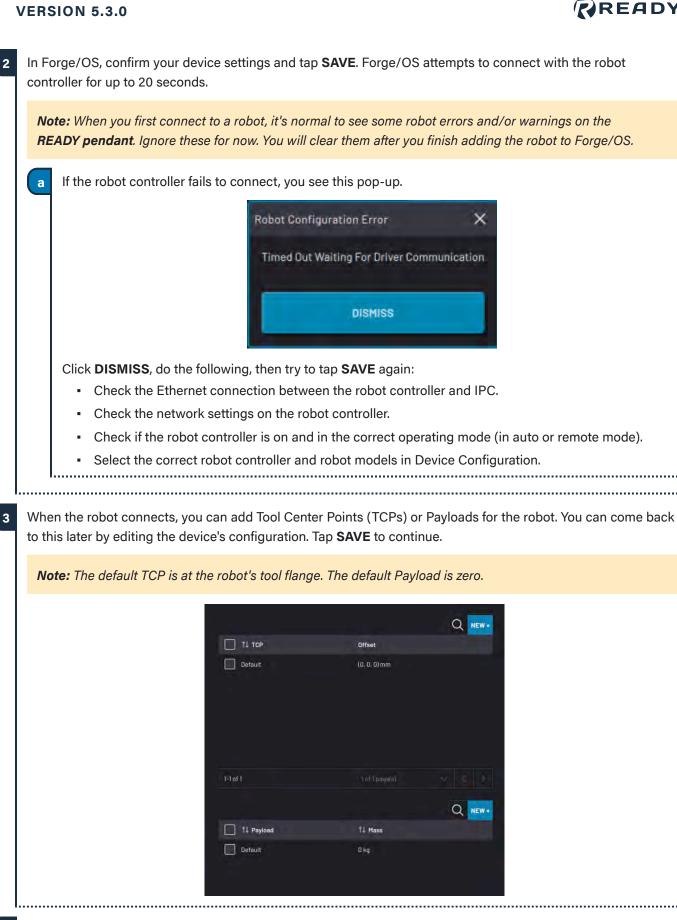


DEVICE CONFIGURATION - PT.2

In these steps, you save the robot in the Device Configuration app and finish the setup.

different, enter that.	e/Hub, enter the IP Address		, , , , , , , , , , , , , , , , , , ,	
	EPSON robot	· · · · · · · · · · · · · · · · · · ·	®	
	Device Name	IP Address		
	Description			
	Controller Model VT6L	Robot Model	~	
	Force Sensor Device Select a Force Device		~	
	Copy the Configuration Files Insert a 2GB flash drive into the Forge/O complete the setup of your robot NOTE: USB file system mus	t be formatted in one of the follow		
		AT16, FAT32, NTFS age device into Forge/OS IPC		





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



Canvas.

	Input Signals		Output Signals	
	inpat organic			Q
	Signals	Display Name	Data Type	DCP
	CI_0		BOOL	
	CL1		BOOL	
	CL_2		BOOL	
	CI_3		BOOL	
	CL_4		BOOL	
	CL_5		BOOL	
	CL6		BOOL	
	CL-7		BOOL	
	DL.0		BOOL	
	DL1		BOOL	
	DI2		BOOL	
	DL.3		BOOL	
	DL4		BOOL	
	1-13 of 22	1 of 2 page(s)		3 ×
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ou want a signal ote: To use these SAVE. Forge/O	e I/O signals, integrate y	<i>our I/O devices</i> ured Devices lis	<i>with the</i> t, which	<i>robot con</i> shows the

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and instructions.

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5 Follow these steps to clear robot errors:

Devices		
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ок		
Clamping Gripper	ок 🔵	
ак		
😴 Robat arm	DISCONNECTED	
ERROR - Robot is disconnected.	MORE S RESET	

S

DEVICE STATUS

Tap RESET to try to recover from the errors. If you can't RESET an error, tap MORE to get more details

Congratulations! You are ready to control your robot in the Device Control Panel and Task Canvas apps.

USER Admin

.....

2:21 PM

.....

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1

2

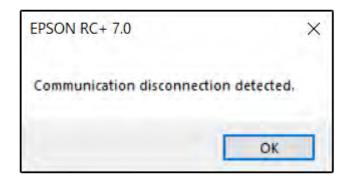
а



CLOSING RC+

You can now control the robot arm with just the READY pendant. Follow these steps to disconnect your PC from RC+.

Unplug the USB cable from your Windows PC and robot controller. A "Communication disconnection detected" pop-up appears in RC+.



Check the READY pendant for errors, such as the "Communication Disconnection Between RC+ and Controller" error. Follow these substeps to resolve it:

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

OK OK DISCONNECTED Construction MORE ERROR - Robot is disconnected. MORE Image: Construction Image: Construction	🗘 Clamping Gripper	ok 🌔
ERROR - Robot is disconnected.	ок	
	😤 Robot arm	DISCONNECTED
	ERROR - Robot is disconnected.	MORE S RESET
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APPENDIX A: SETTING UP FORGE/OS

INSTALLING FORGE/OS

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

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

Important: Installing Forge/OS will erase all data on the target hard drive.

a Connect a monitor, keyboard, and mouse to the IPC where you want to install Forge/OS.



Plug the Forge/OS installation USB flash drive into the IPC.

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

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

Tip: 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.

From the boot options, select Install Forge/OS to boot from the installation USB flash drive.

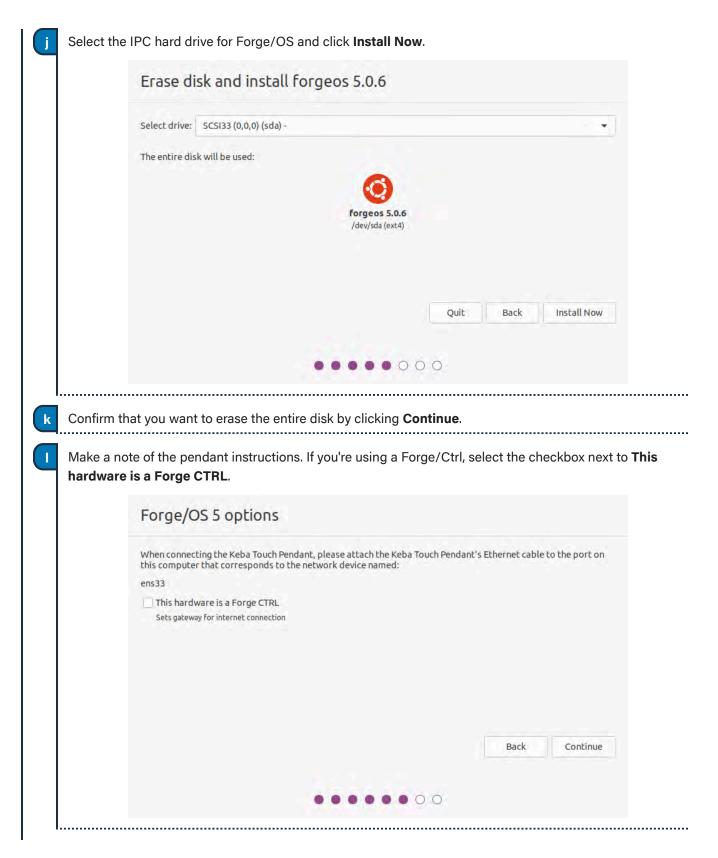


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	English Español Esperanto Euskara Français Gaeilge Galego Hrvatski Íslenska Italiano Kurdî Latviski Lietuviškai	FORGE IOS 5
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Choos	e a keyboard layout. Then click Continue Keyboard layout	e.
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Choos	Keyboard layout	English (US) English (US) - Cherokee English (US) - English (Colemak) English (US) - English (Dvorak) English (US) - English (Dvorak, alt. intl.) English (US) - English (Dvorak, alt. intl.) English (US) - English (Dvorak, intl., with dead keys) English (US) - English (Dvorak, left-handed) English (US) - English (Dvorak, right-handed)
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	Updates and other software
	What apps would you like to install to start with?
	Web browser, utilities, office software, games, and media players. O Minimal installation
	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 hardware and additional media formats This software is subject to license terms included with its documentation. Some is proprietary.
	Quit Back Continue
Vote:	rase disk and install forgeos. Then click Continue. If Forge/OS is already installed, the installation wizard will show additional options. The g the entire disk for a brand new installation.
Note:	If Forge/OS is already installed, the installation wizard will show additional options. The g
Note:	If Forge/OS is already installed, the installation wizard will show additional options. The gethe entire disk for a brand new installation. Installation type This computer currently has no detected operating systems. What would you like to do?
Note:	If Forge/OS is already installed, the installation wizard will show additional options. The g the entire disk for a brand new installation. Installation type
Note:	If Forge/OS is already installed, the installation wizard will show additional options. The gethe entire disk for a brand new installation. Installation type This computer currently has no detected operating systems. What would you like to do? Erase disk and install forgeos 5.0.6 Warning: This will delete all your programs, documents, photos, music, and any other files in all operating systems.
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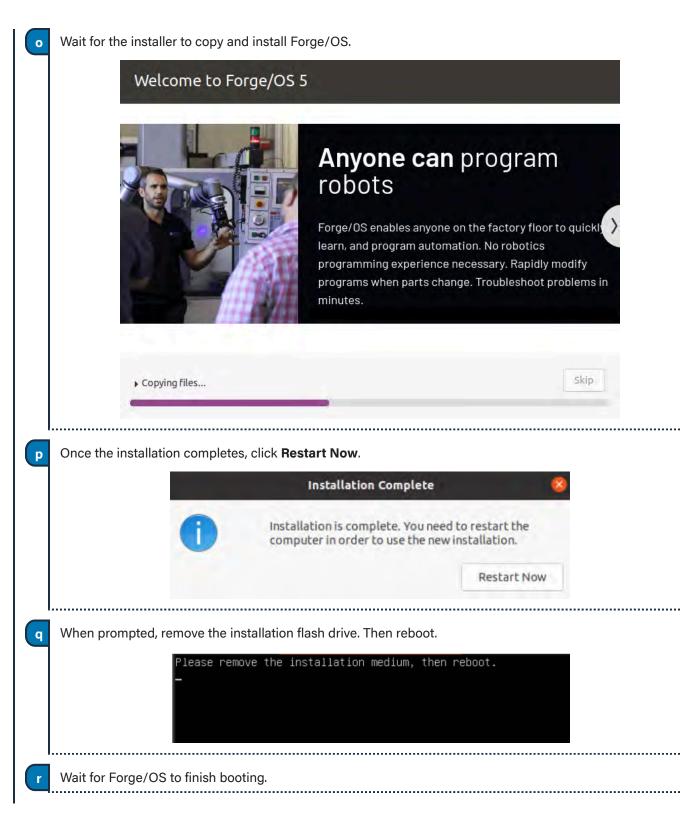






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password. Then click Continue.	you create here are for accessing the IPC desktop. They
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Note: The username and password that yes NOT for signing into Forge/OS on the REA Who are you? Your name:	You create here are for accessing the IPC desktop. They ADY pendant. Forge User YOUR-HOSTNAME The name it uses when it talks to other computers. Forge
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Note: The username and password that ye NOT for signing into Forge/OS on the REA Who are you? Your name: Your computer's name: Pick a username: Choose a password:	You create here are for accessing the IPC desktop. They ADY pendant. Forge User YOUR-HOSTNAME The name it uses when it talks to other computers. forge
Note: The username and password that ye NOT for signing into Forge/OS on the REA Who are you? Your name: Your computer's name: Pick a username: Choose a password:	You create here are for accessing the IPC desktop. They ADY pendant. Forge User YOUR-HOSTNAME The name it uses when it talks to other computers. Forge Independent of the image of the
Note: The username and password that ye NOT for signing into Forge/OS on the REA Who are you? Your name: Your computer's name: Pick a username: Choose a password:	You create here are for accessing the IPC desktop. They ADY pendant. Forge User YOUR-HOSTNAME The name it uses when it talks to other computers. forge I Log in automatically Require my password to log in







When you see the login screen with the Forge/OS 5 logo, Forge/OS 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 Forge/OS.



- 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.

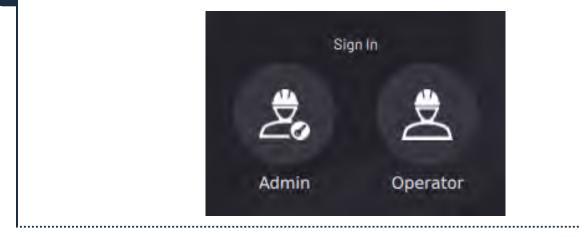


The UI shows the real-time state of each step. For example, if the pendant loses its network connection during pairing, all steps become undone.

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 Forge/OS until you activate it with a license code. See <u>Activating Forge/OS with a License Code</u>.



ACTIVATING FORGE/OS WITH A LICENSE CODE

There are two methods to activate Forge/OS: 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 Forge/OS A valid Forge/OS license code 	 A 2GB or larger USB flash drive An internet-connected PC A valid Forge/OS license code

Tip: Connect a USB keyboard to the port on the bottom of the **READY pendant** to type in any text field in Forge/OS.

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

Settings	© >
Fieldbus Configuration	>
General Settings	>
Rémote Access	>
System Update	>
Package Manager	>
License 15XPIRED/INVALID	>
System Information	>

Type in your license code.



3	Choose ONLINE LICENSE ACTIVATION if Forge/OS is connected to the internet. If not, choose OFFLINE
	LICENSE ACTIVATION.

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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.

	Offline License	Activation		
	License Code			
	STEP 1	STEP 2	STEP 3	
	Generate a License I	Unlock Code using an external	computer	
		e_OS-License-Activation-Cer	tificate.txt and copy all of the c	
	4. Click Activate.	ate.ready-robotics.com and pa y the generated unlock certific	ste the contents in the dialog b cate.	ox.
	 6. Paste the certificant 7. Save the file and e 	ate into Forge_OS-License-Un eject the USB.		
	8. Proceed to the ne	xt step.		
Insert the USI	B flash drive back into	your IPC. Tap UNL	OAD UNLOCK CER	TIFICATE FROM USB
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		Activation	STEP 3	
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	License Code STEP 1 Import the License			
	License Code STEP 1 Import the License	STEP 2 Unlock Certificate from USB		
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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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On the Settings app main screen, tap **General Settings**.

b Change the Units of Measure, Time and Date settings, or the Admin login password.

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Language			
English (United Stat	ies)		~
Units of Measure	2		
Measurement	Metric	O Imperial	
Length	millimeter		
Speed	mm/second	inch/second	
Mass	kilogram	pound	
Force	newton	pound	
Torque	newton-meter	foot-pound	
Current date : 04/21/2022 Current time : 2:30:21 PM Select Time Zone	CAT	INOT SET DATE/TIME. NTP IS ACTI	VE.
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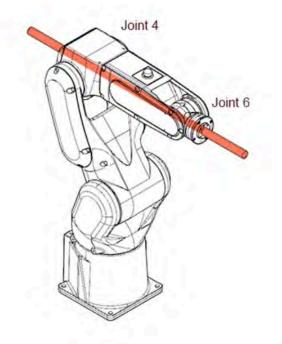
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APPENDIX B: KNOWN ISSUES

You may encounter programming issues when the EPSON robot comes near a singularity. **THESE ISSUES ARE NATIVE TO EPSON AND ARE NOT CAUSED BY FORGE/OS.**

What is a singularity? A singularity is a position that prevents a robot from making certain movements. A singularity can occur when two or more joint axes are co-linear, such as the axes of Joint 4 and Joint 6.



In a singularity, a robot cannot reach a specified waypoint due to physical limitations. This doesn't mean that it can't reach the waypoint, but it is unable to move to the position in that way.

Important: When you move a robot near a singularity, the robot may move unexpectedly, speed up, or enter an error state.

Two behaviors you may see near a singularity are excess jogging and rejected stop requests.

EXCESS JOGGING AT A SINGULARITY

When you jog the robot near a singularity, the robot may move for an extra 1-2 seconds after letting go of the jog button.

This issue is the common with linear jogs on EPSON robots. Linear jogs move the robot's tool center point (TCP) in the Cartesian space (X, Y, Z, Rx, Ry, Rz). Use joint moves around singularities.

When jogging the robot near objects, use a low speed to avoid unpredictable collisions.



STOP REQUESTS REJECTED BY THE ROBOT

When the robot is moving through a singularity, it might not immediately stop with the READY pendant **Stop** button or with an external safety device (such as a light curtain or a safety fence). However, the robot will always immediately stop with the E-Stop.

Important: In emergency situations, ALWAYS hit an emergency stop button that is wired to the emergency stop circuit of the EPSON controller.

For example, if you execute a circle move that has an arc point near a singularity, the robot might finish its entire path of programmed motion regardless of any stop signal it receives (other than the E-Stop).

To minimize risk, use a low speed as you first build out your task. This will help avoid unpredictable collisions.



APPENDIX C: TROUBLESHOOTING

Use this section to recover from an unresponsive robot or from build errors.

DRIVER KILL SWITCH FOR UNRESPONSIVE ROBOT

If a port fails to configure when you load the driver, you may lose all connection to the robot when you reboot.

To shut down an unresponsive driver, set **IO23** (pin 27) to **HIGH** by making these connections:

- 0V to Pin 14 (Input common)
- 24V to Pin 27 (Input No. 23)

Pin No.	Signal Name	Pin No.	Signal Name
1	Input No. 0 (Start)	15	Input No. 1 (SelProg1)
2	Input No. 2 (SelProg2)	16	Input No. 3 (SelProg4)
3	Input No. 4 (Stop)	17	Input No. 5 (Pause)
4	Input No. 6 (Continue)	18	Input No. 7 (Reset)
5	Input common No. 0 to 7	19	Input common No. 8 to 15
6	Input No. 8	20	Input No. 9
7	Input No. 10	21	Input No. 11
8	Input No. 12	22	Input No. 13
9	Input No. 14	23	Input No. 15
10	Input No. 16	24	Input No. 17
11	Input No. 18	25	Input No. 19
12	Input No. 20	26	Input No. 21
13	Input No. 22	27	Input No. 23
14	Input common No. 16 to 23	28	Not Used

Remote function inside () in the table above is initially assigned to input from 0 to 7. For further details, refer to Setup & Operation 14. I/O Remote Settings.

Tip: To check if IO23 is set to HIGH, open the *I/O Monitor* from the *Tools* menu. In the pop-up, select *All Inputs*. Check if there's a red dot next to input *23*.

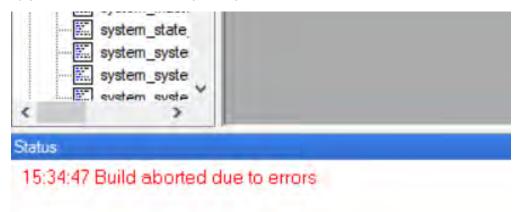
While IO23 is set to HIGH, restart the robot. This setting prevents the driver from launching when the robot powers up, allowing you to reconfigure the robot. The Runtime Controls window reads "Kill switch enabled, disable to start driver" until you set **IO23** back to **LOW** (turning the red dot off).



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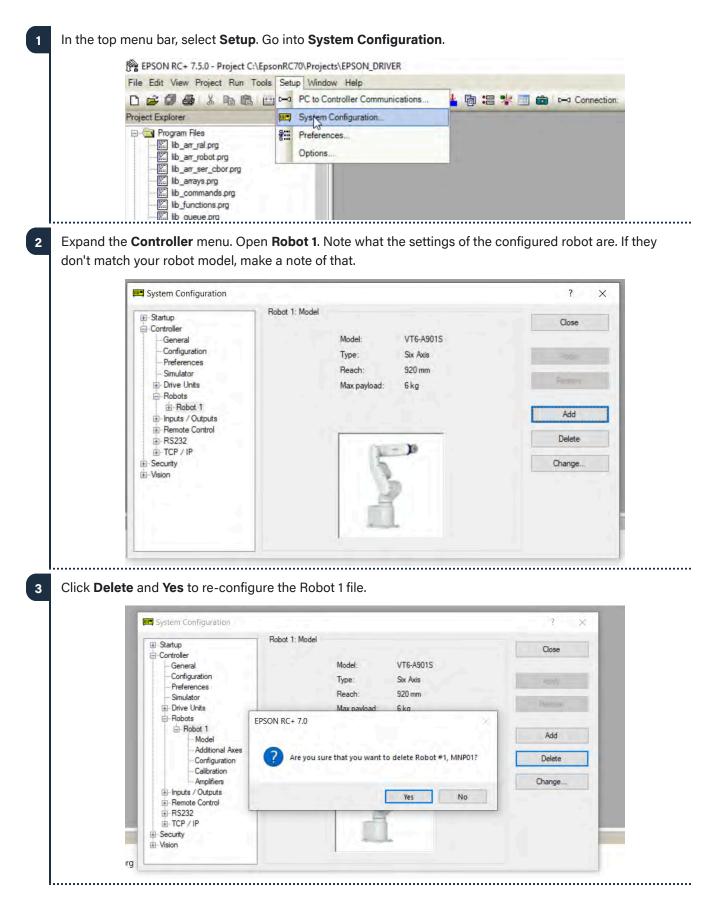
INITIAL DEVICE CONFIGURATION ERROR

When you set up your robot for the first time, you may see build errors.



Try deleting and re-adding the robot in System Configuration.





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READY

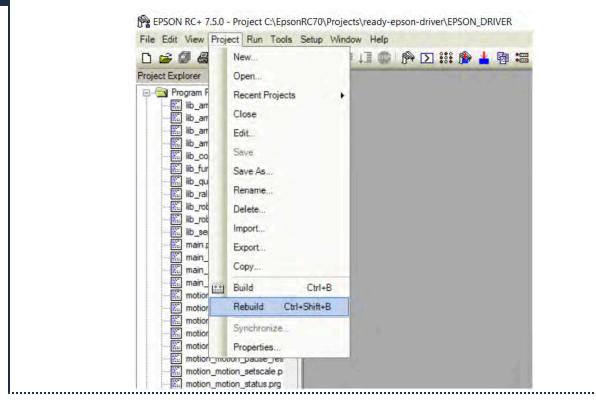


REBUILDING THE SOURCE CODE

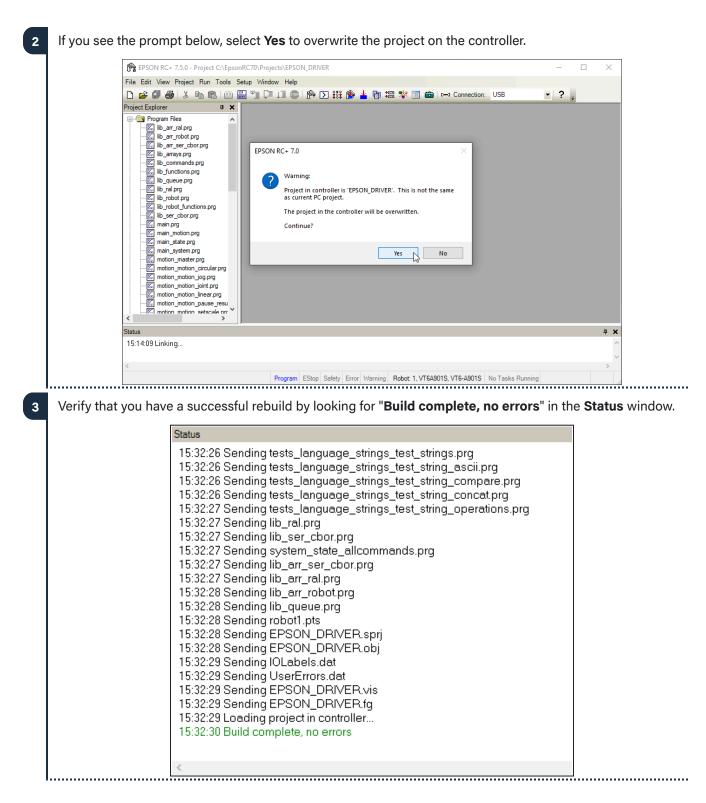
You need to rebuild the source code:

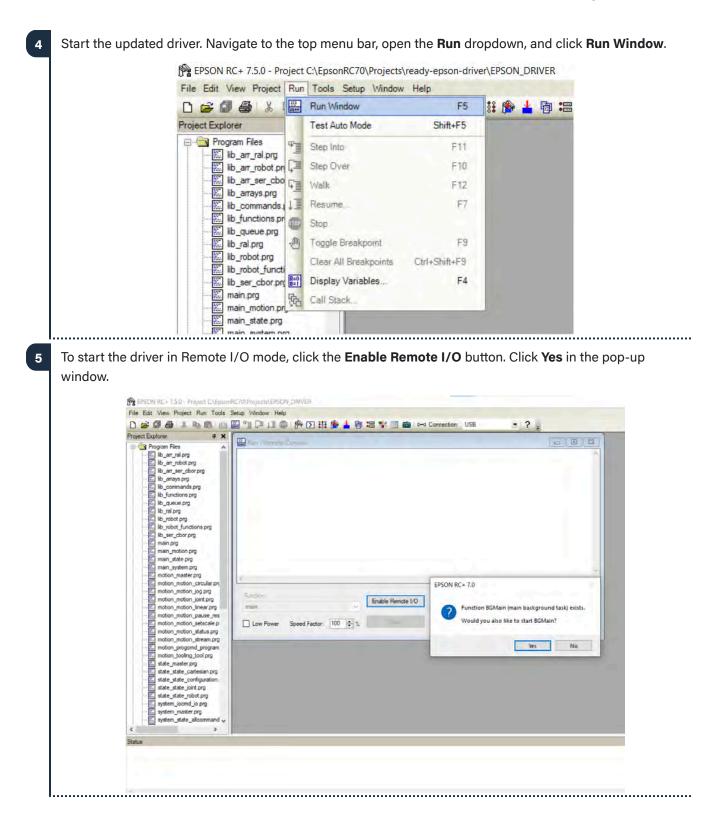
- after you resolve a build error.
- if the Epson encounters a stack error in the Epson logs while you are running a task. When this happens, you will receive a Forge/OS message asking you to rebuild.

1 In the top menu bar, open the **Project** dropdown. Click **Rebuild**.









READY



DIGITAL OUTPUT CONFIGURED AS SYSTEM OUTPUT ERROR

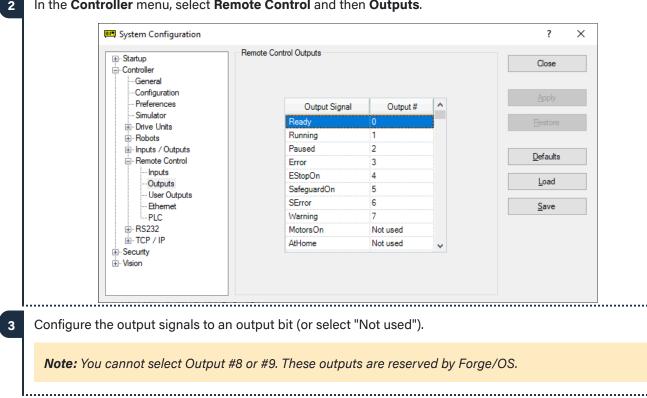
You may see a "Digital Output Configured as System Output" error in Forge/OS or an "Error 2342: Cannot change the status for output bit configured as remote output" in RC+.

For example, suppose you have Output 0 linked to the "Ready" signal. In the **I/O Monitor**, output bit #0 has the label "Ready". On the READY Pendant, if you select the **DCP** checkbox next to Output 0 in the robot's device configuration and then try to change the state of Output 0 in the robot's **Signals** tab in the Device Controls app, you will get an error.

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Follow these steps to unlink Output 0 (or other outputs) in RC+.

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2 In the Controller menu, select Remote Control and then Outputs.



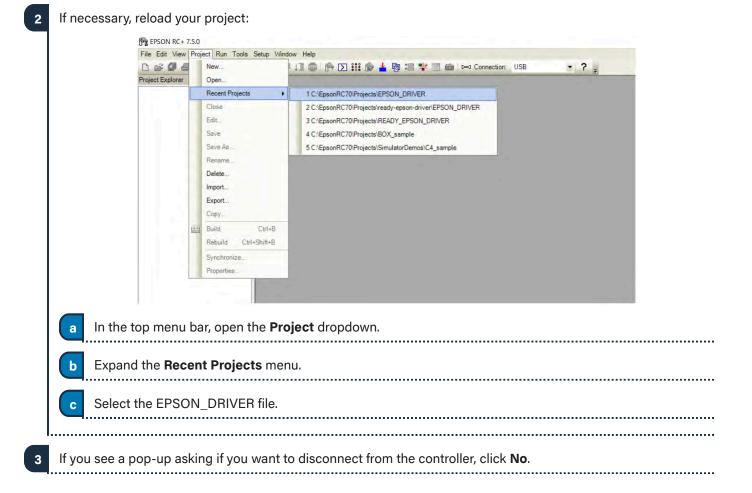


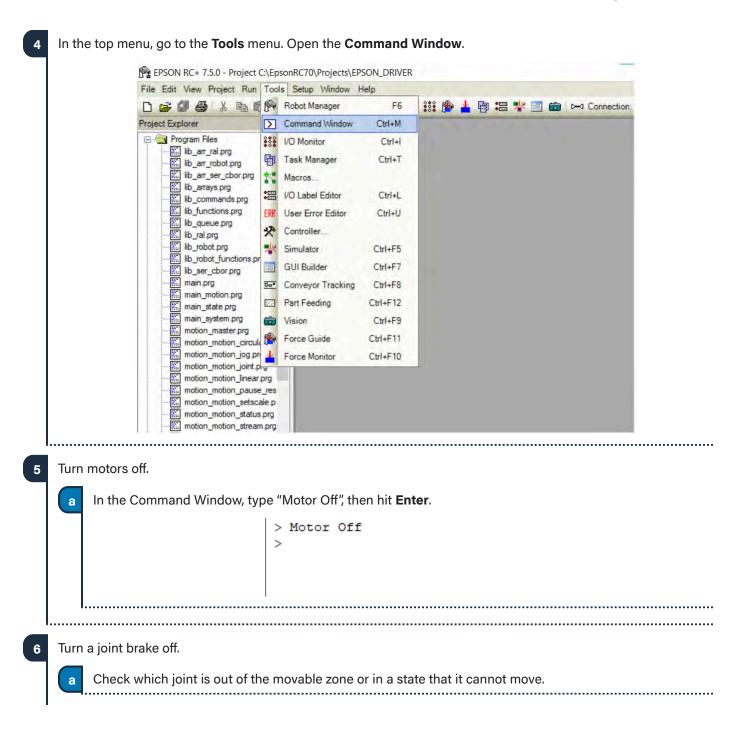
APPENDIX D: ERROR RECOVERY

Some errors are not recoverable from Forge/OS. One such error is Error 4066: "Motion Command was attempted in the prohibited area depended on joint combination." This error occurs when you move the robot outside of its joint limits.

In these situations, the robot is not movable in Forge/OS or in the EPSON RC+ Robot Manager. In this case, use the instructions below to recover your robot to an operable state.

Restart RC+ by closing out of it and re-opening it in **Program Mode**.





READY



	In the Command Window, type "Brake Off, [JOINT#]", then hit Enter . For example, to release the joint 3 brake:
	Note: Depending on which joint that you are releasing the brake for and what position that joint is in, you may need to catch the robot as it falls. Avoid damage to the robot and any nearby objects that it might collide with.
	> Brake Off, 3 >
7 M	ove the joint and turn its brake back on.
	Use your hands to move the joint back within the movable zone.
	In the Command Window, type "Brake On, [JOINT#]", then hit Enter. > Brake Off, 3 > Brake On, 3 >
8 Tu	rn motors on.
	> Motor On >
9 Re	start the driver in Auto Mode .



RESOURCES

Want to learn more about how Forge/OS can empower you?

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

Visit READY.market (market.ready-robotics.com) for products and services offered by READY and our partners.

Visit our **Support** site (support.ready-robotics.com) for robot startup guides, FAQs, and more.

Visit our **Resources** page (<u>ready-robotics.com/resources</u>) for articles, whitepapers, and other resources.

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



