READY

FORGE os 5

FANUC R-30iB Mate Plus Start Up Guide (No-DCS Safety)

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OVERVIEW

Welcome to the FANUC Start Up Guide Forge/OS 5. This guide covers the following hardware:

Robot Controller	R-30iB Mate or R-30iB Mate Plus
Safety Hardware	No DCS option, no additional hardware - integrates the READY pendant Emergency Stop to the standard robot safety I/O, but not the Key Switch or Enabling Switch. Speeds are limited by Forge/OS instead of by safety-rated hardware. *With this option, you must jog the robot from outside the safeguarded space using* ***Program mode****.*
READY Hardware	READY pendant and a READY Forge/Hub or Forge/Ctrl.

Here are the steps you will follow:

1. Connect the READY pendant.
2. Connect the IPC.
3. Power on the system.
4. Configure your robot for Forge/OS.
5. Control your robot with Forge/OS!

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HARDWARE REQUIREMENTS

Image	Part Name	Description	Vendor	Part Number
	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	
	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 Pendant	Required for setup and error recovery.	FANUC	
	Polycarbonate Enclosure or Electrical Cabinet	Protects the electrical parts in an enclosure.		
	Cat5e Shielded Ethernet Cable (x2)	▪ Connects the robot controller to a IPC. ▪ Connects the READY pendant to a IPC.		

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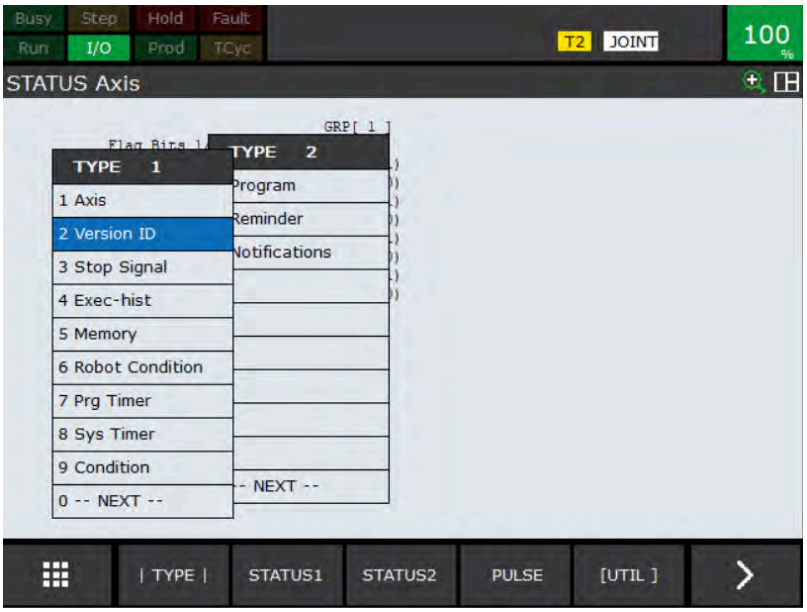
SOFTWARE REQUIREMENTS

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) or equivalent R-30iB Mate Plus Firmware: V9.10P/33 (02/2021) or equivalent	Minimum firmware version supported by Forge/OS.
RTL-R632 KAREL	Required for Forge programs to run on the robot controller.
RTL-R648 User Socket Messaging	

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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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.

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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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.

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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

Important: *The "no-DCS" safety option doesn't require the Enabling Switch or Key Switch. You will connect the Emergency Stop Button and an external safeguard (Fence) to the FANUC emergency stop board in these steps. Speeds are limited by Forge/OS instead of by safety-rated hardware. Without the DCS option, you must jog the robot from outside the safeguarded space using* ***Program mode****.*

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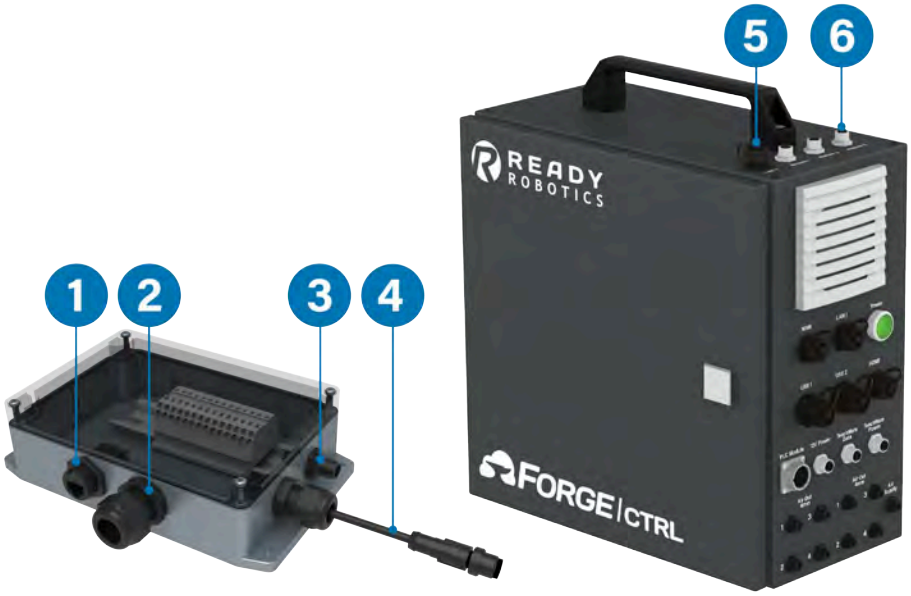
Electric Shock Warning: Disconnect all components from power sources before attempting this installation.

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.

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2. If you are using a Forge/Hub, connect the 12-Pin flying leads cable to the **Safety** port on the Forge/Hub.

3. Feed the flying leads through a controller cable entrance. Refer to FANUC documentation for cable entrance and sealing.

4. Read this information on terminal block connectors before moving on.

   a. **Terminal block connectors** are electrical connectors with ports for attaching individual wires. Each block has multiple ports and can be detached from the terminal block headers on the circuit boards.

   b. Before inserting wires, remove the terminal block by pulling the connector out of its header on the circuit board.

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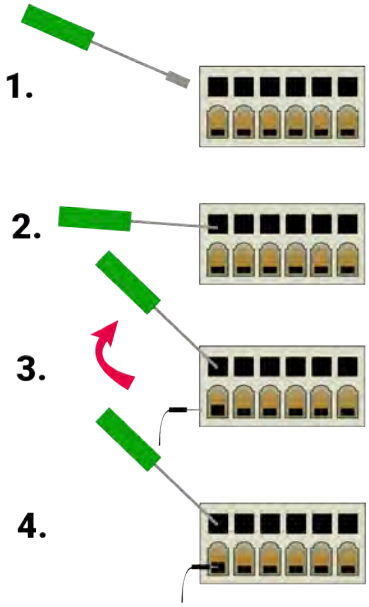
c You must hold a port open while you insert a wire into it. To open a port on the terminal block, place your terminal block screwdriver into the hole above the wire port and pry up. While applying pressure, slide a wire into the port. Once the wire is in, remove pressure to close the port.



d Pull gently on the lead to make sure it's secure in the terminal block. After inserting all the leads, fit the connector back onto its header.

5 Remove the terminal block connector from the Emergency Stop Board (TBOP13 for R-30iB or TBOP20 for Mate models).

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6 Connect the flying leads to their destination terminals in the table below.

Tip: *You will connect the Emergency Stop circuits to the Emergency Stop Board in the FANUC controller. See your FANUC Maintenance Manual to find the Emergency Stop Board and the terminals on it.*

Safety Flying Leads	Function	FANUC Controller Destination
Brown	Three-Position Enabling Switch Circuit 1	N/A
Blue	Three-Position Enabling Switch Circuit 1	N/A
White	Three-Position Enabling Switch Circuit 2	N/A
Green	Three-Position Enabling Switch Circuit 2	N/A
Pink	Emergency Stop Circuit 1	EMGIN (or EES) 1
Yellow	Emergency Stop Circuit 1	EMGIN (or EES) 11
Black	Emergency Stop Circuit 2	EMGIN (or EES) 2
Grey	Emergency Stop Circuit 2	EMGIN (or EES) 21
Red	Key Switch Circuit 1	N/A
Violet	Key Switch Circuit 1	N/A
Grey/Pink	Key Switch Circuit 2	N/A
Red/Blue	Key Switch Circuit 2	N/A

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7 Wire the external safety fencing or another safeguarding device.

a **If you are using safety fencing or another safeguard device**, connect it to the external Fence Inputs in the FANUC controller.

> ***Tip:*** *See your FANUC Maintenance Manual to find the Emergency Stop Board and the fence terminals on it.*

Function	FANUC Controller Destination
Fence Contact 11 (Circuit 1)	FENCE (or EAS) 1
Fence Contact 12 (Circuit 1)	FENCE (or EAS) 11
Fence Contact 21 (Circuit 2)	FENCE (or EAS) 2
Fence Contact 22 (Circuit 2)	FENCE (or EAS) 21

b **If you choose to NOT use a safeguard device**, jumper the external Fence Inputs to I/O power: use jumpers to connect **EAS 1** to **EAS 11**. Then connect **EAS 2** to **EAS 21**.

8 After connecting the wires, insert the terminal block connector back into place on the Emergency Stop Board.

> ***Note:*** *You can only insert the terminal block connectors one way. Match the connector to the header's orientation.*

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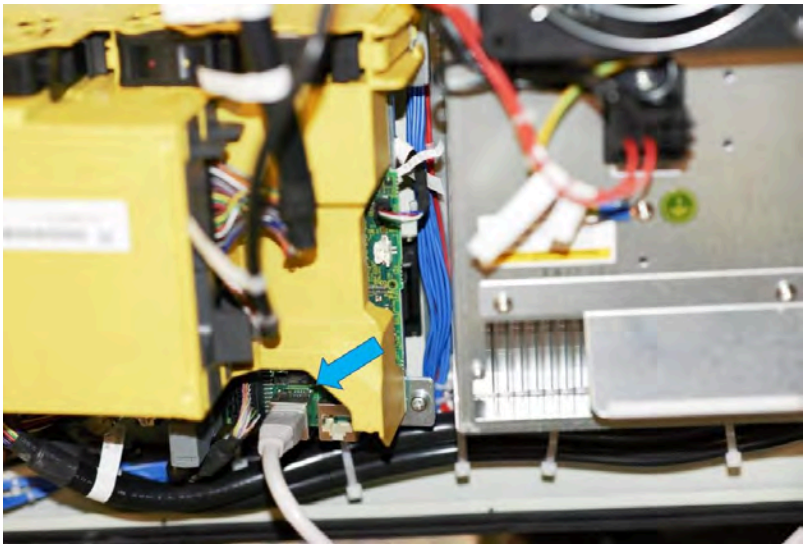
CONNECTING THE ROBOT AND IPC

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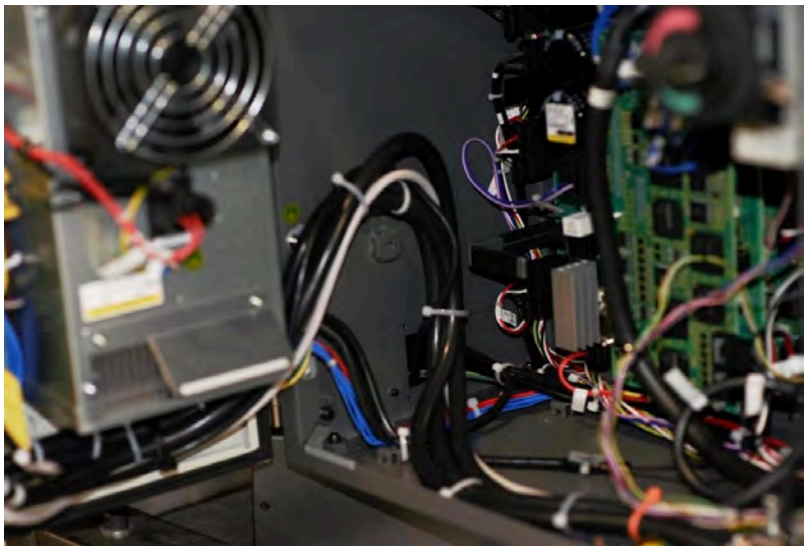
b Cut the zip ties so that the cut-ends are flush with the connectors.



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

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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**.

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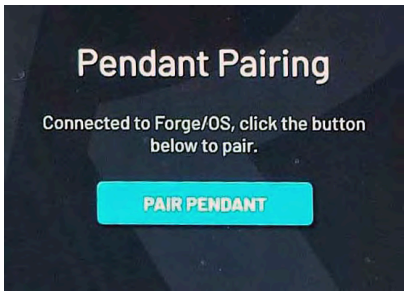
SIGNING IN TO FORGE/OS

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, then come back to these steps.

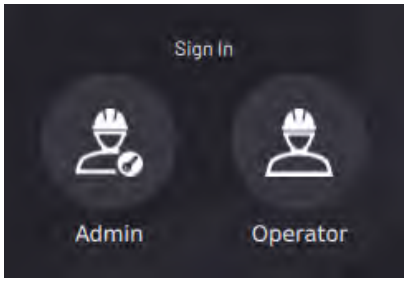
   Tip: *Forge/OS 5 is installed on all Forge/Ctrls and Forge/Hubs shipped after June 1, 2021.*

2. When you power on your READY pendant and IPC, the Pendant Pairing screen appears on the READY pendant. Tap the blue **PAIR PENDANT** button when it appears. It may take up to one minute to appear.



   Note: *If the pendant fails to pair or the **PAIR PENDANT** button is unavailable for longer than two minutes, check the Ethernet connection to the **IPC**.*

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



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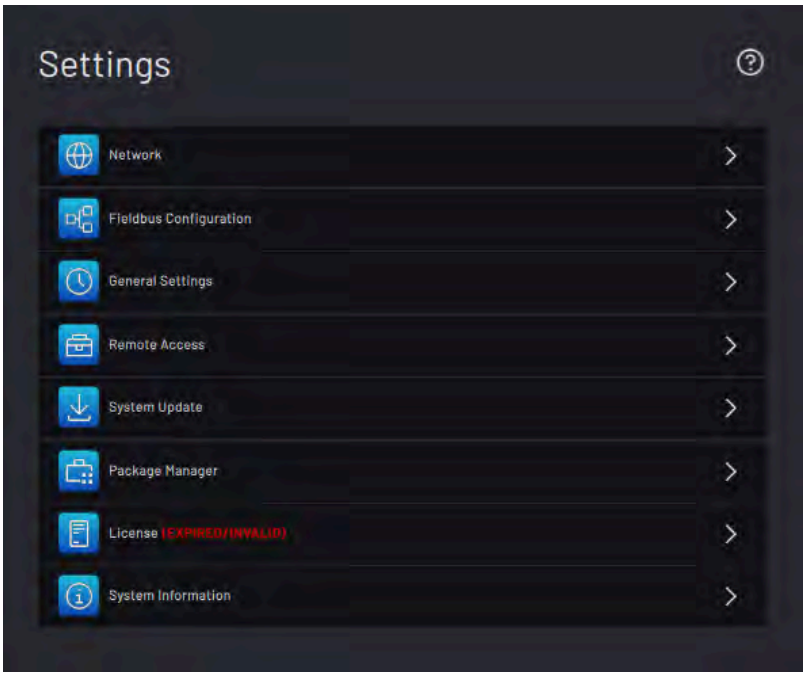
4 If Forge/OS is inactive, it opens the Settings app and prevents you from opening other apps. If you see the screen below, follow Activating Forge/OS with a License Code in Appendix A.



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

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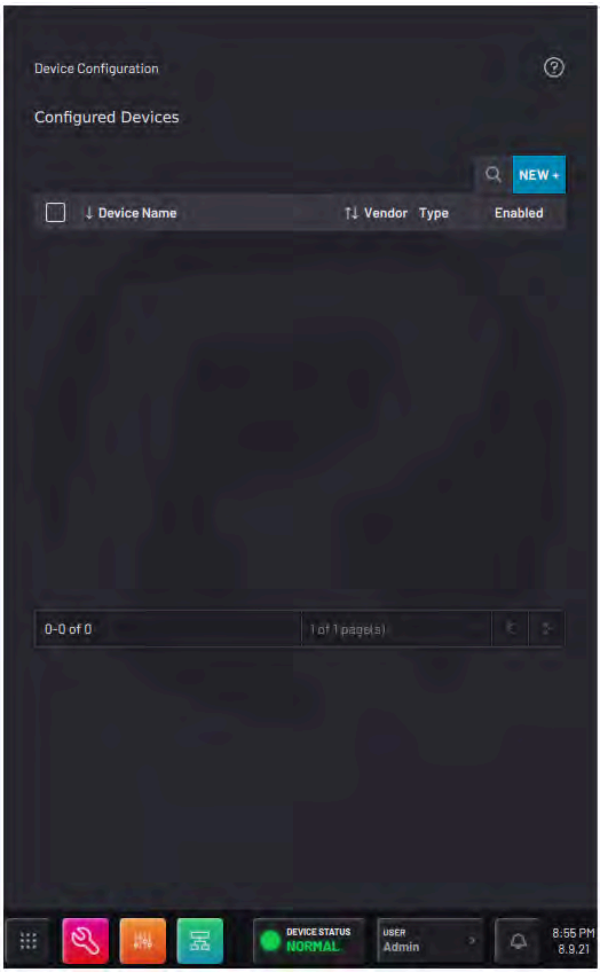
CONFIGURING THE ROBOT FOR FORGE/OS

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.



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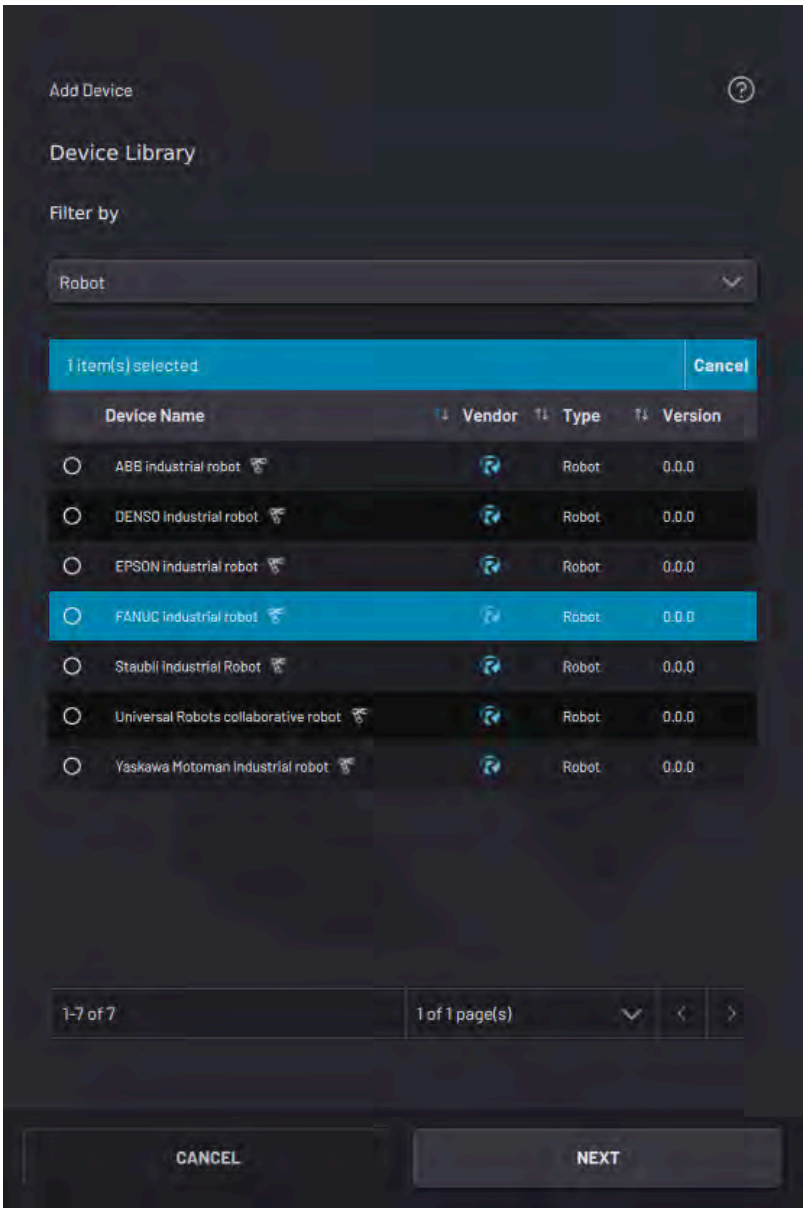
3 Select the **FANUC Robot** option. You can use the **Filter by** dropdown to show robot options. Tap **NEXT** to continue.



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.*

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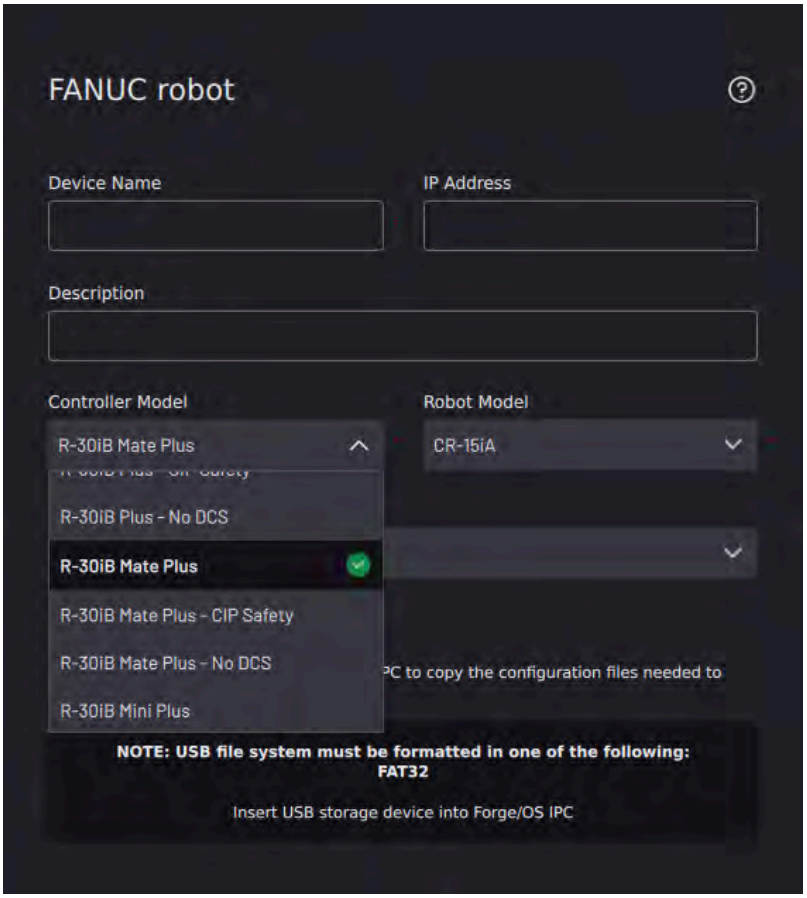
5 Select the robot **Controller Model** and **Robot Model** in the dropdown menus.

> ***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).*



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.

> ***Tip:*** *Do not connect the USB flash drive to the* ***READY pendant****.*

7 Tap **Start Transfer** and wait for it to finish.

8 Remove the USB flash drive when prompted.

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9. Insert the USB drive into the USB slot on the FANUC controller. Complete these sub-steps to install the configuration files on the FANUC controller:

   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, the Forge configuration files might not update properly. This could result in a "Specified program is in use" message during file transfer.*

   c. Press the **MENU** button on the FANUC teach pendant.

   d. Press **FILE (7)**.

   e. Press **UTIL (F5)**, highlight the **Set Device (1)** option, and press the **ENTER** button.

   f. Choose the **USB Disk (UD1:)** option.

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

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

   h. 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.**

   i. Press **Yes (F4)** for the prompt asking if you want to execute the file.

   j. 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.

      Note: *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)**.*

   k. Press **OK (F4)** and remove the USB drive from the FANUC controller.

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10 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)**. Press **ENTER.**

> ***Tip:*** *Or on the* ***SETUP*** *screen, press* ***[TYPE] (F1)****, select* ***NEXT****, then select* ***Host Comm****.*

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**.

11 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**.

12 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)**, **System (6)**, then **DCS**.

b Press **PREV**, highlight the **Collaborative Robot** option, and press **ENTER**.

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c 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.*

13

14 Confirm that the Forge/OS programs are running on the FANUC teach pendant. Press the **SELECT** button. A list of programs appears.

15 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**.

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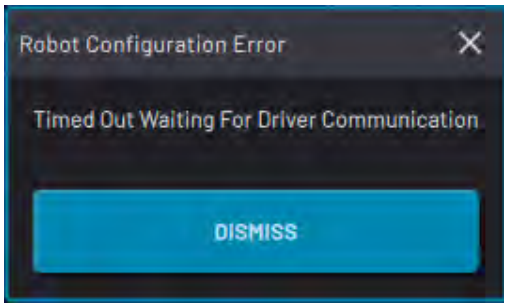
16 In Forge/OS, confirm your device settings and tap **SAVE**. Forge/OS attempts to connect with the robot controller for up to 20 seconds.

> ***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.

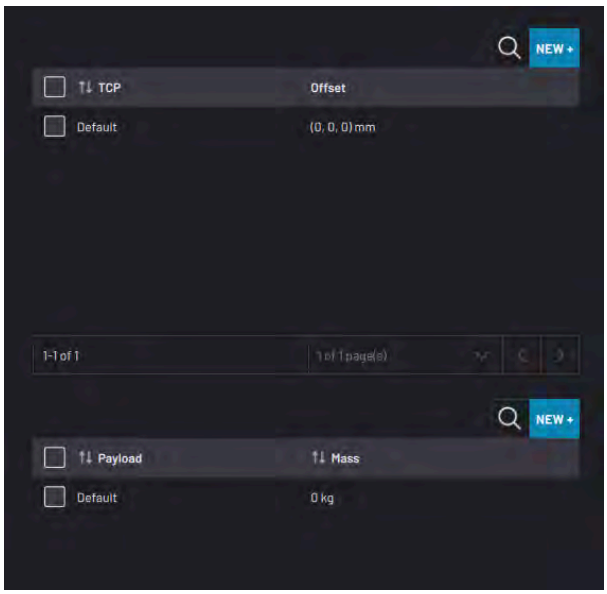


Click **DISMISS**, do the following, then try to tap **SAVE** again:

- 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.

17 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.*



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

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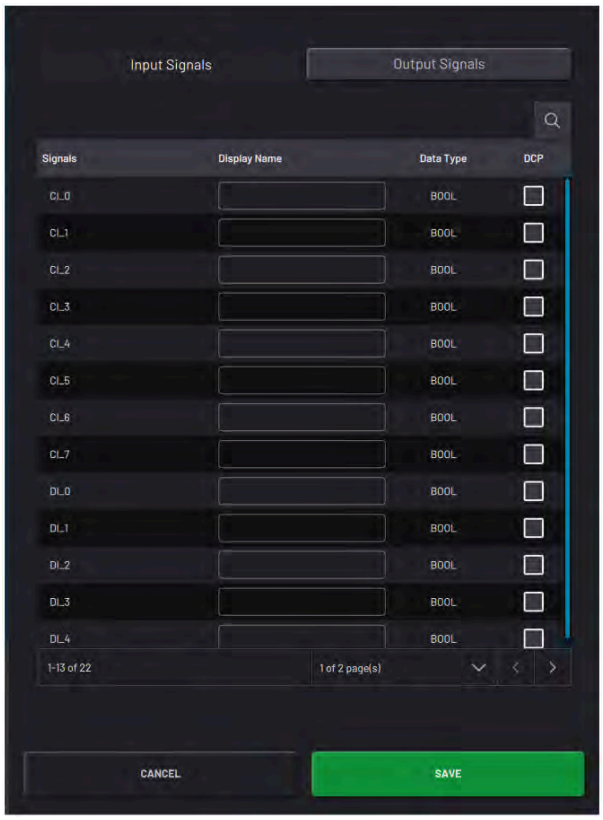
Canvas.



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.

> ***Note:*** *To use these I/O signals, integrate your I/O devices with the robot controller.*

c. Tap **SAVE**. Forge/OS returns to the Configured Devices list, which shows the new robot as **enabled**.

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

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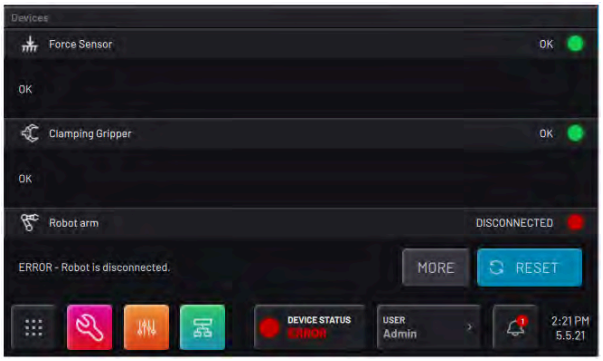
19 Follow these steps to clear robot errors:

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.

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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.

1 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.

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

Tip: *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.

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.*

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

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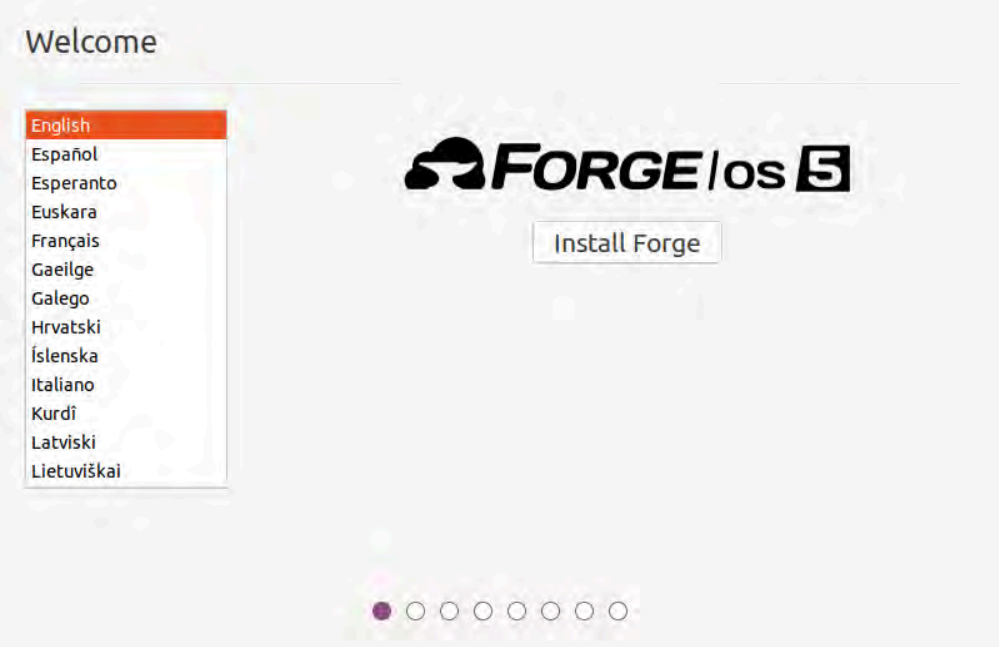
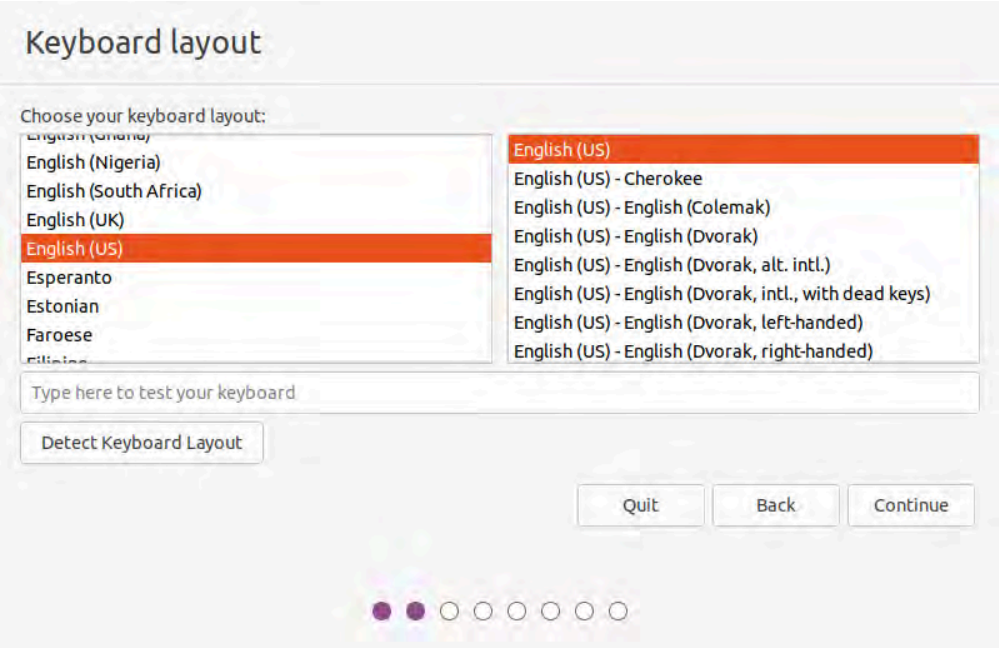
e The installer may take several minutes to load. Wait until the installation wizard opens.

f Select your language. Then click **Install Forge**.



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



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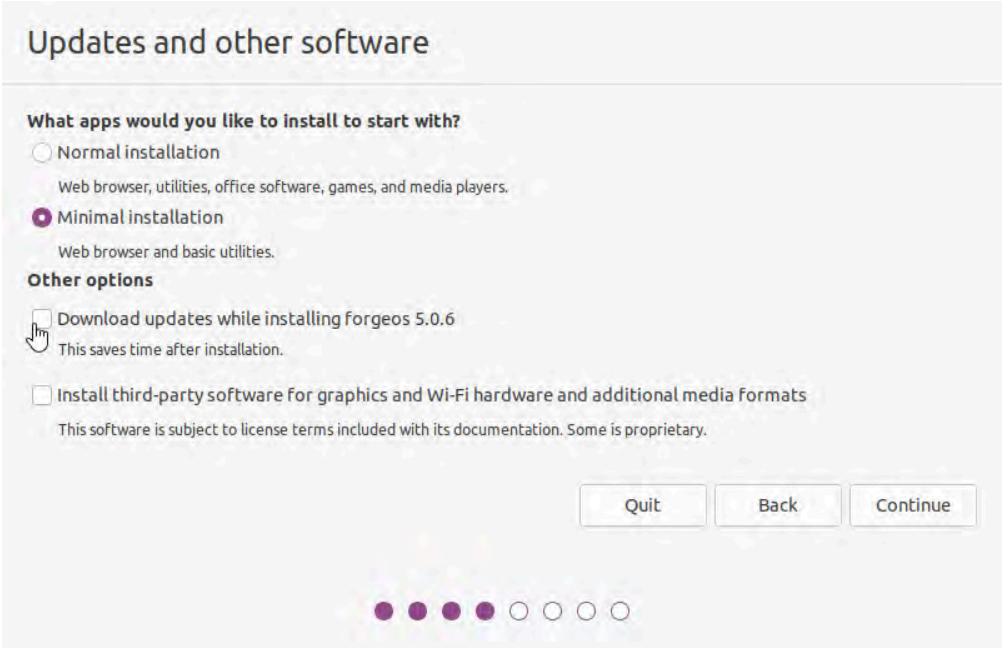
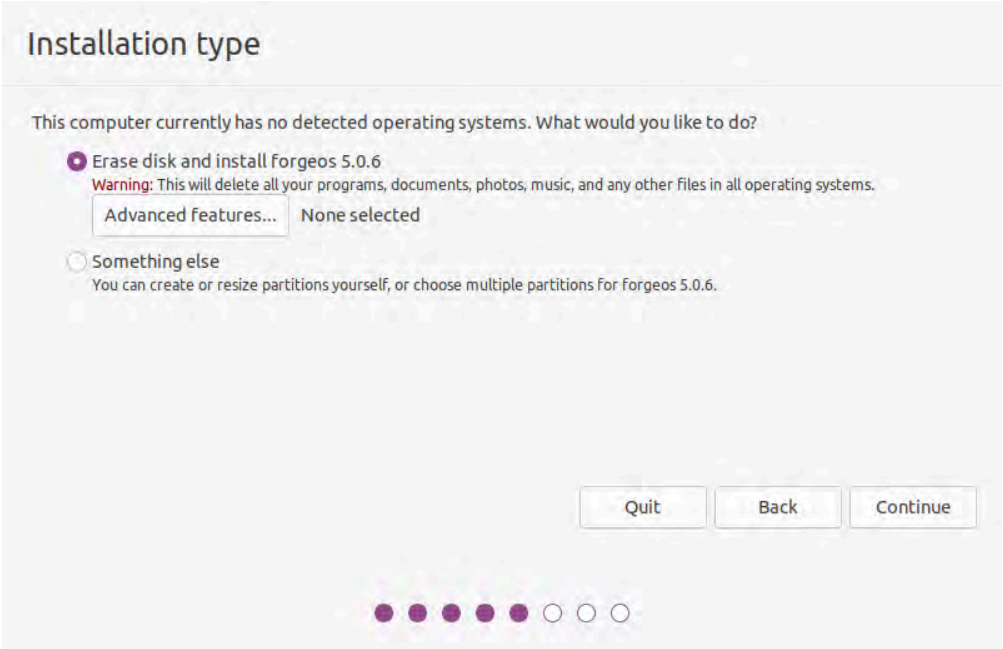
h Select **Minimal installation**. Uncheck **Download updates while installing forgeos**. Then click **Continue**.



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

Note: *If Forge/OS is already installed, the installation wizard will show additional options. The goal is to erase the entire disk for a brand new installation.*



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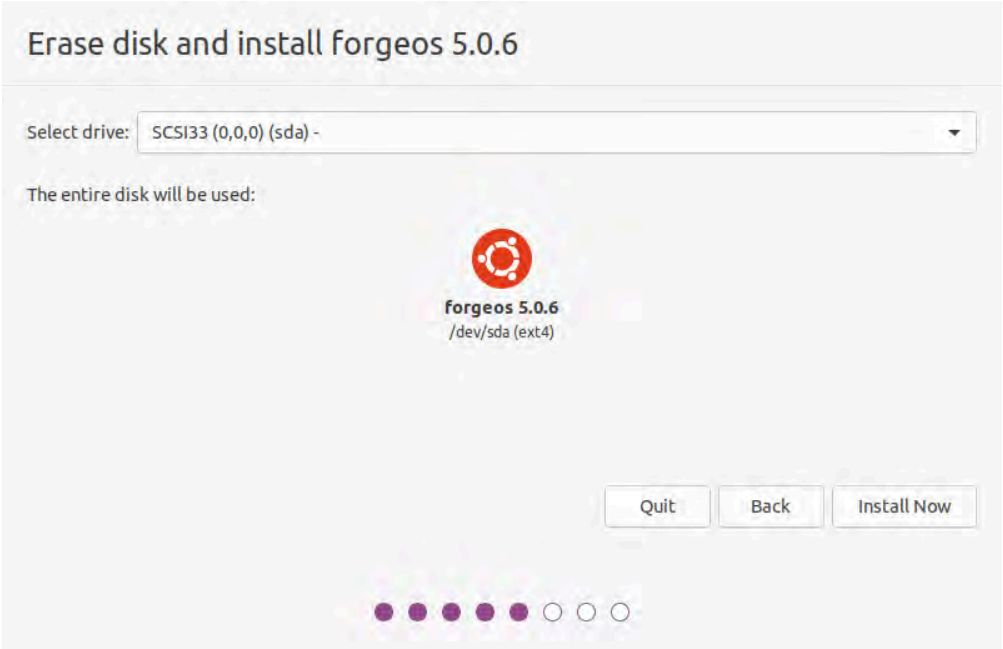
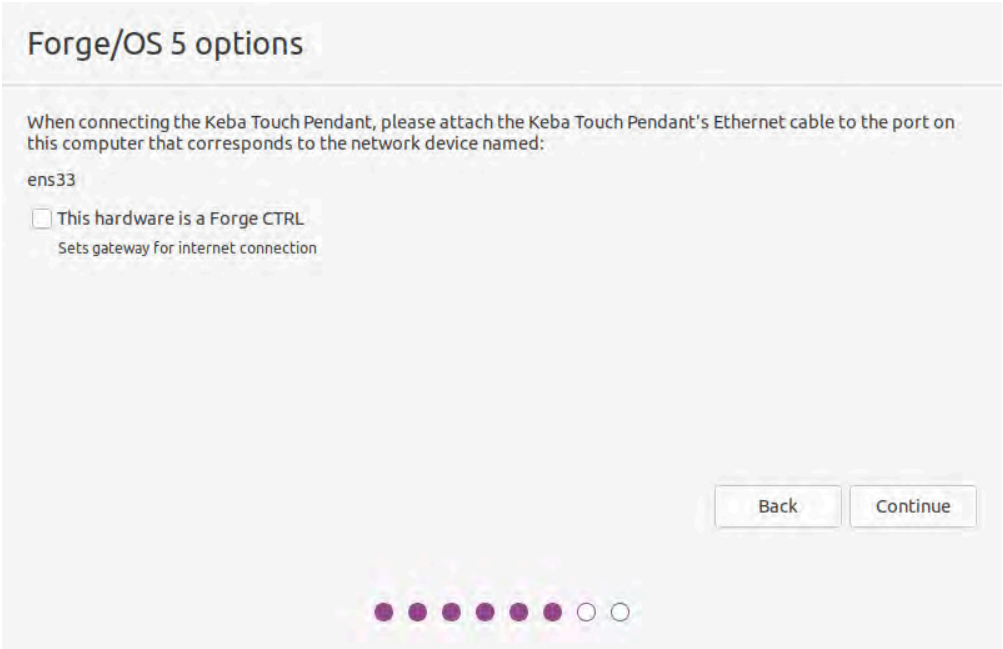
j Select the IPC hard drive for Forge/OS and click **Install Now**.



k Confirm that you want to erase the entire disk by clicking **Continue**.

l 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**.



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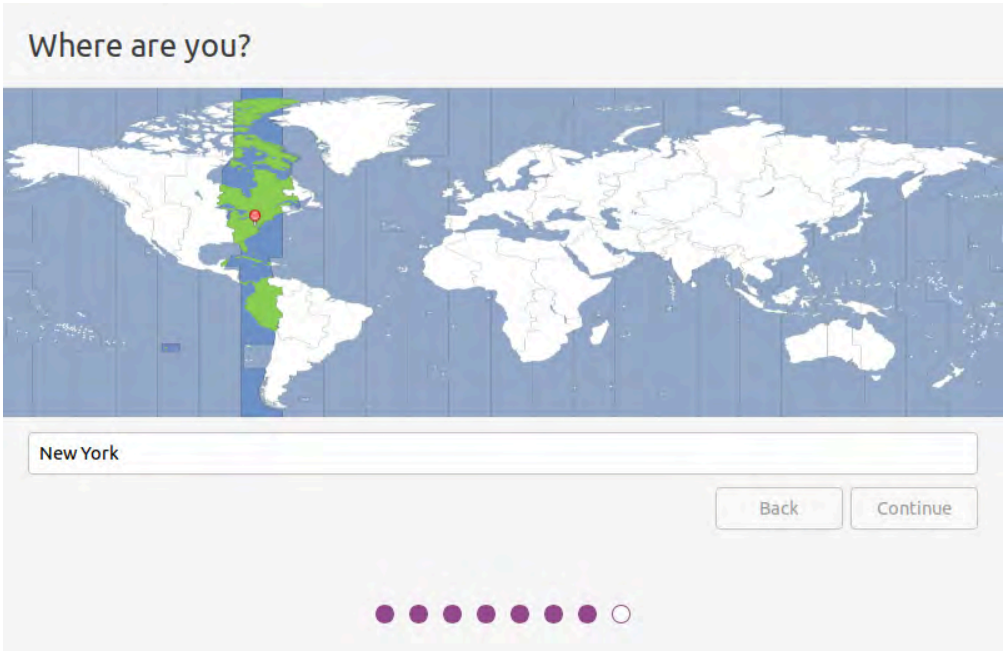
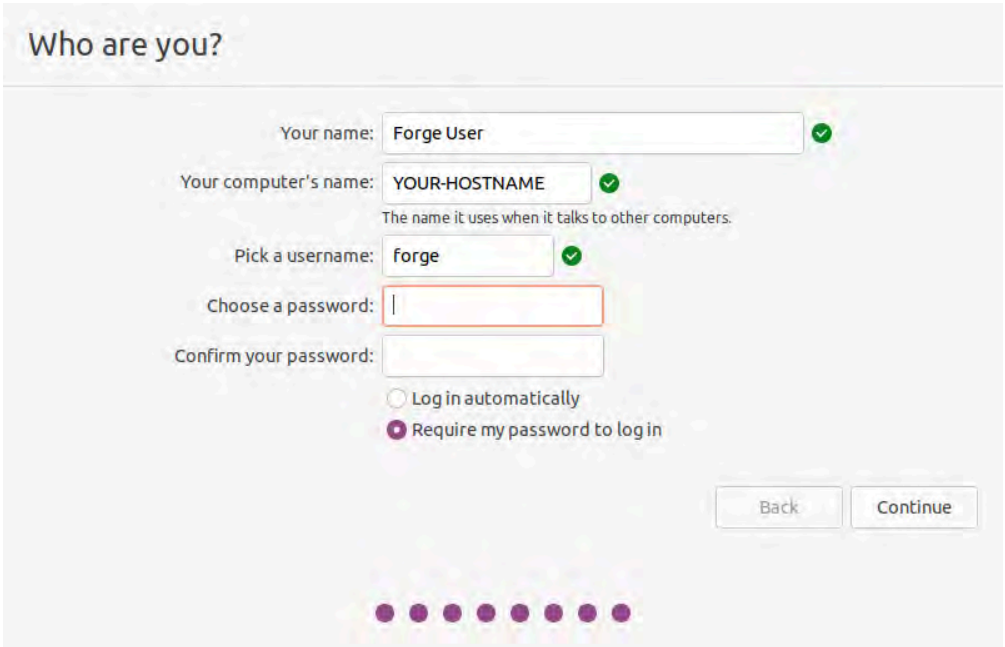
m Choose your timezone. Then click **Continue**.



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 Forge/OS on the* ***READY pendant****.*



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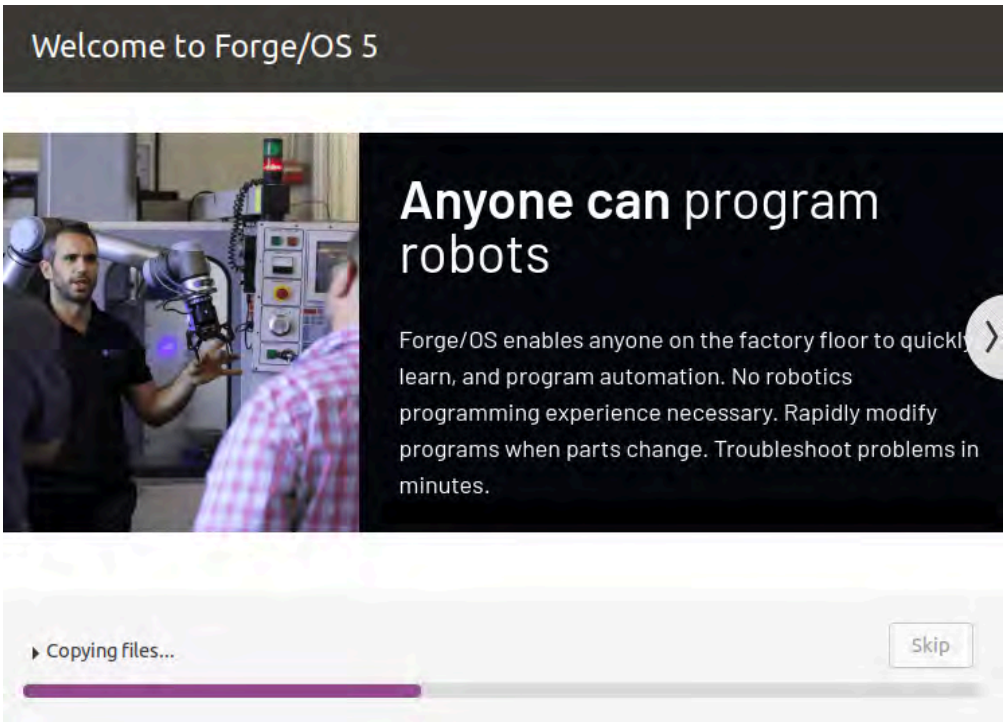
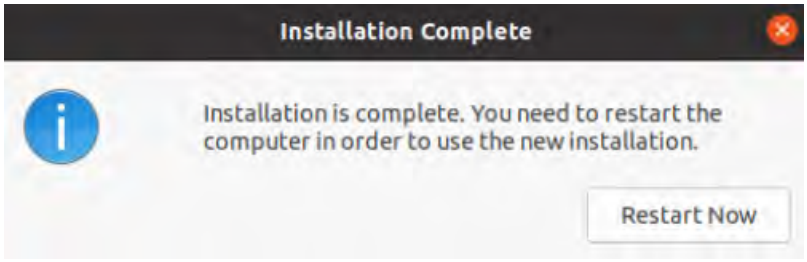
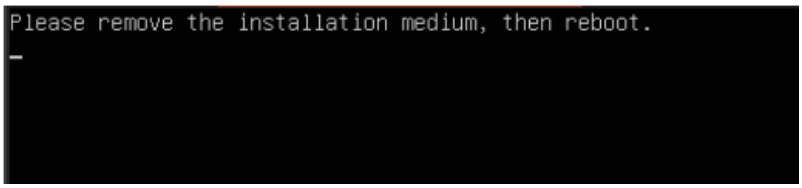
o Wait for the installer to copy and install Forge/OS.



p Once the installation completes, click **Restart Now**.



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



r Wait for Forge/OS to finish booting.

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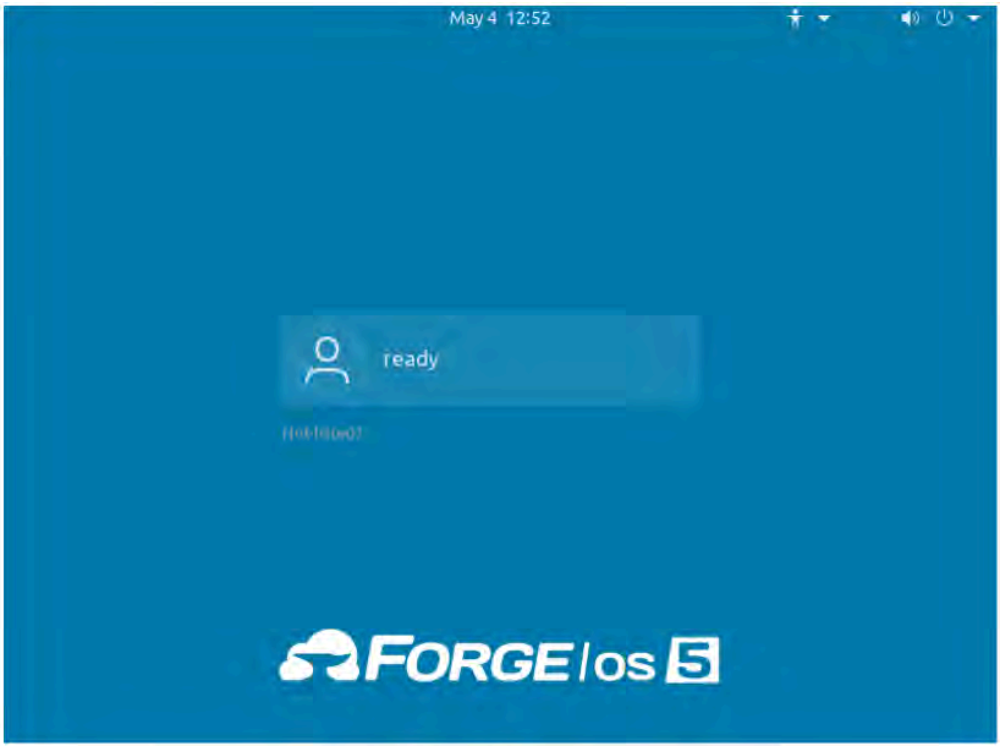
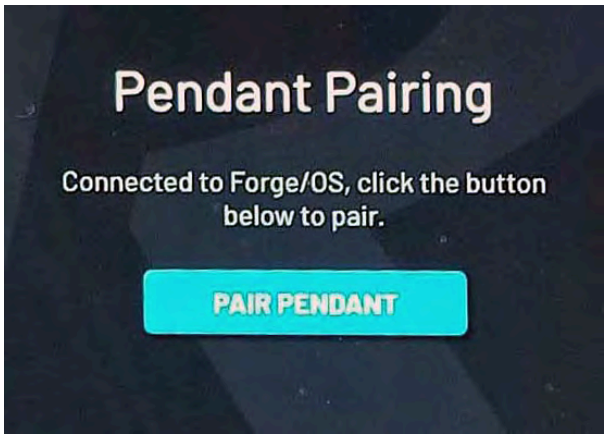
5 When you see the login screen with the Forge/OS 5 logo, Forge/OS is ready to run on the READY pendant! You don't need to sign in to the desktop. Disconnect the monitor, keyboard, and mouse that you used to install Forge/OS.



2 On the READY pendant, the Pendant Pairing screen appears. This is where you connect the pendant to Forge/OS each time you reboot. Tap the blue **PAIR PENDANT** button when it appears. It may take up to two minutes to appear.



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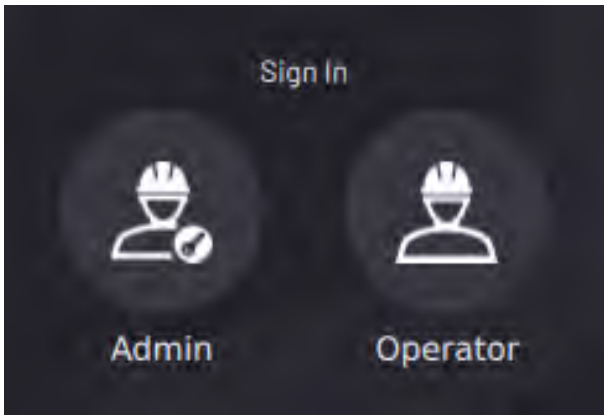
3 Tap **Admin** and sign in. The default Admin password is "forgeadmin".



Note: *After installation, you have limited access to Forge/OS until you activate it with a license code. See Activating Forge/OS with a License Code.*

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ACTIVATING FORGE/OS WITH A LICENSE CODE

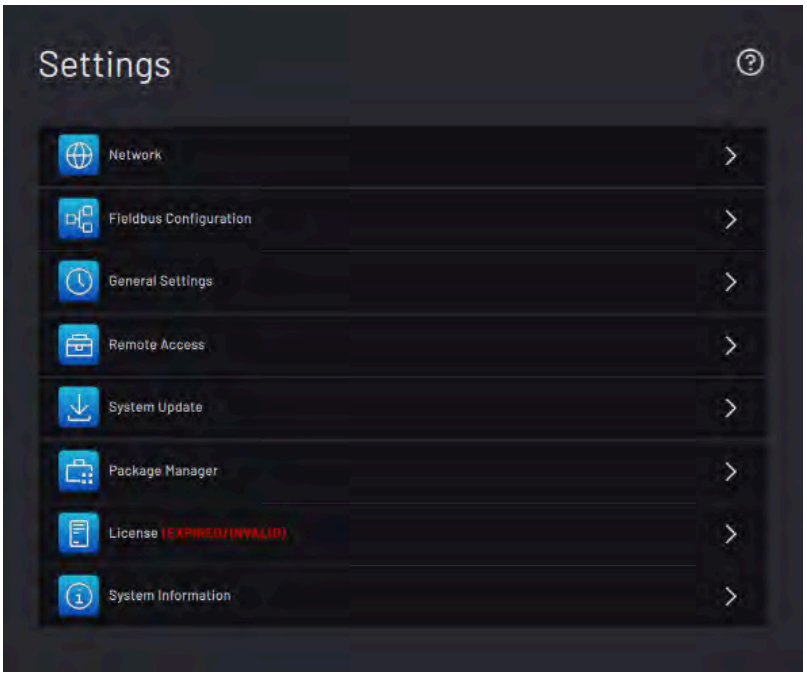
There are two methods to activate Forge/OS: **Online license activation** and **offline license activation**.

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.*

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



2. Type in your license code.

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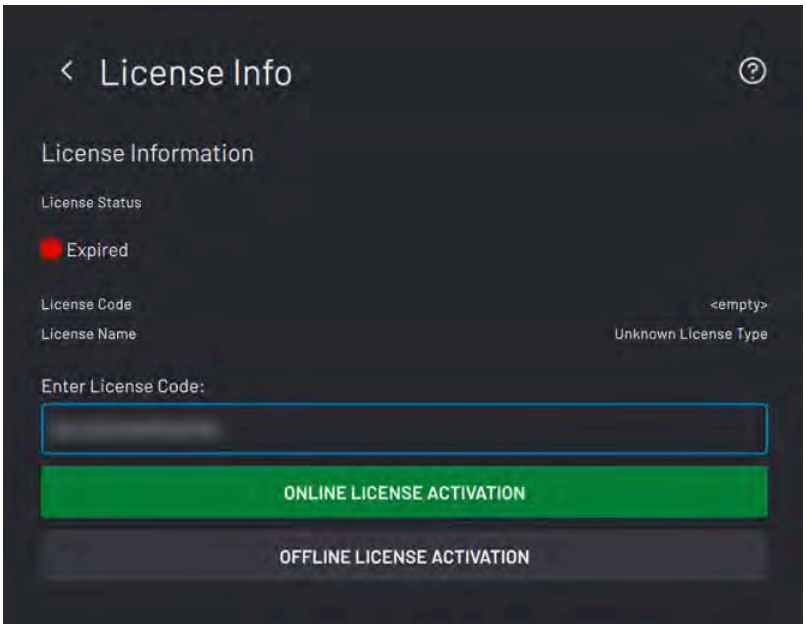
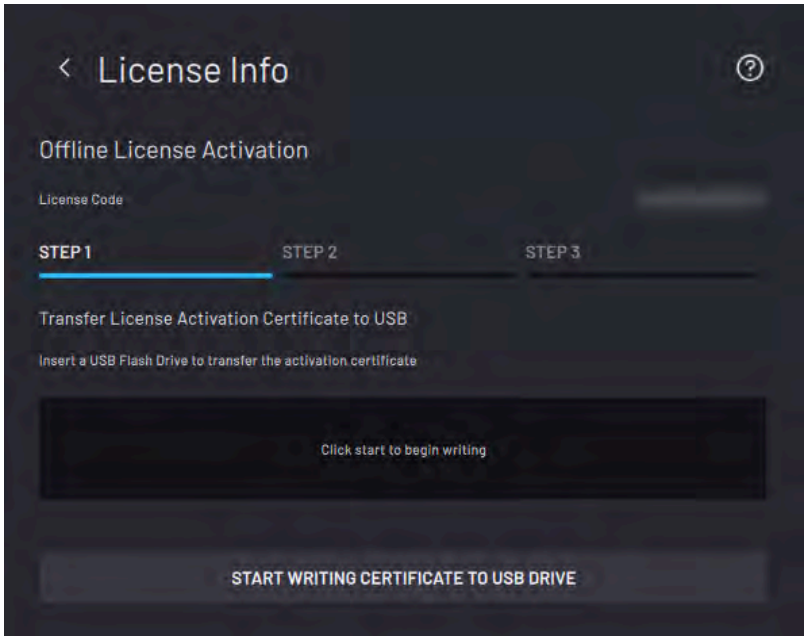
3 Choose **ONLINE LICENSE ACTIVATION** if Forge/OS is connected to the internet. If not, choose **OFFLINE LICENSE ACTIVATION**.



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**.



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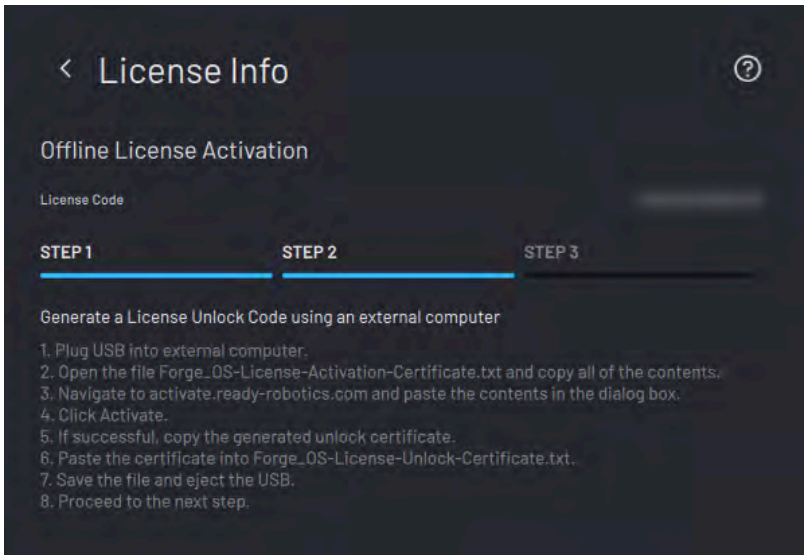
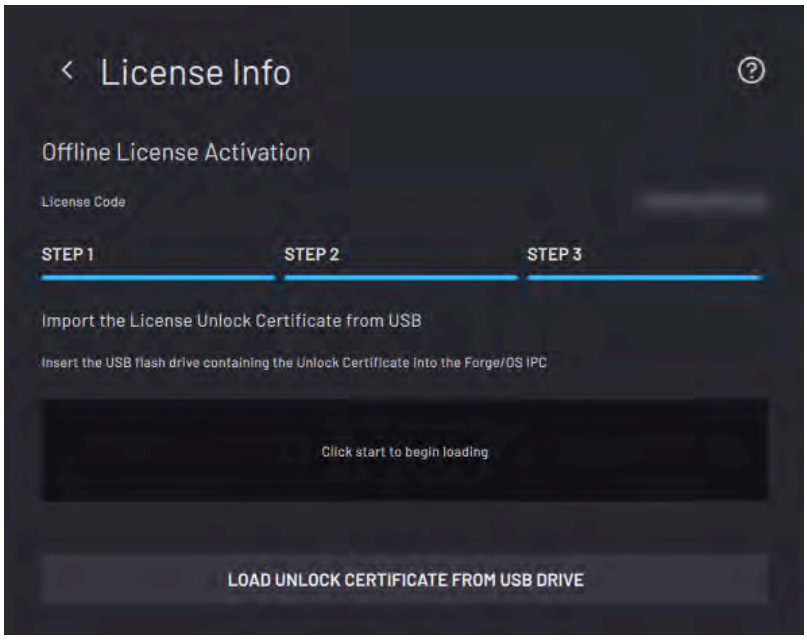
b When the files finish transferring, tap **NEXT**. Follow the instructions on the screen to convert the Activation Certificate to an Unlock Certificate using an internet-connected PC.



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 Forge/OS 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.

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CHOOSING PREFERENCES

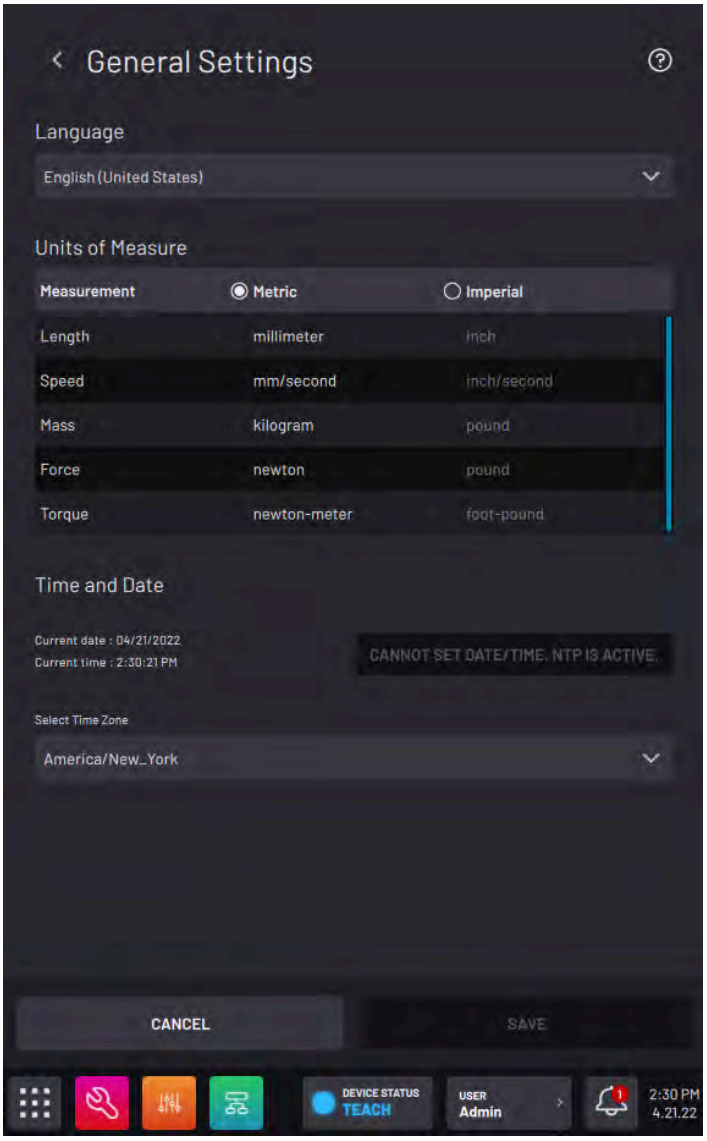
These steps help you choose system preferences, including language, units, time, and network settings.

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

   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.

   > ***Note:*** *If you later forget your password, contact READY Robotics to reset it.*



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

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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 (ready-robotics.com/resources) 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

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