









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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INTRODUCTION

Welcome to Forge/OS 5, the universal operating system for the top robot brands and automation hardware.



FOR DEVELOPERS

Forge/OS 5 allows for third-party development of apps. The software developer kit (SDK) gives developers access to four layers of the Forge/OS platform:

- Hardware drivers for specific hardware (e.g., FANUC LR Mate 200iD/L or a Keyence camera).
- A hardware abstraction layer with Application Programming Interfaces (APIs). The APIs standardize the command interfaces for classes of devices (such as robot arms).
- A set of core services for app development using APIs.
- Standard apps for end-users to connect, configure, and program devices.

Visit ready-robotics.com/software/forge-os-for-developers for more details.



SAFETY OVERVIEW

Always follow corporate guidelines and regional safety regulations. For questions about device-specific safety requirements, refer to the device documentation.

Perform a comprehensive risk assessment for each task in each automation cell. Not identifying, documenting, and addressing all potential risks and hazards can lead to serious injury or death.

Some robot arms are made for collaborative applications. Never consider them inherently safe. Only use these "collaborative" robots in accordance with **ISO 10218-2:2012** and **ISO/TS 15066:2016**, and as guided by the comprehensive risk assessment.





READY PENDANT OVERVIEW

The **READY pendant** is the touch screen interface for Forge/OS. Forge/OS software runs on both the READY pendant and an **industrial PC (IPC)**. Together, they are the brain of your workcell.

SAFETY NOTICES

The READY pendant has dual-channel safety features for use with robots and other devices. Safety features include an enabling device, an emergency stop button, and a keyed mode selector switch. All safety functions comply with PL=e with structure category 4 according to EN ISO 13849-1.

Follow this manual to avoid malfunctions or damage to the pendant.

CAUTION: HANDLE WITH CARE

- Do not use the READY pendant if defective or damaged.
- Do not use outdoors.
- Do not expose to excessive dust, humidity, or electromagnetic fields.
- Do not crush or damage the cable with any object.
- Do not lay the cable over sharp edges.
- Pay careful attention to the cable to avoid falls or damage to the pendant.
- Never clean the housing, touch screen, or operating elements with solvents, scouring agents, or scrubbing sponges. Use only a soft cloth and mild detergent.
- Avoid contact with liquids.
- Make sure that no foreign objects or liquids can penetrate the device.
- Check the cables and protective covers regularly for damage.
- Do not leave near heat sources or in direct sunlight.
- Avoid dropping and don't place on unstable surfaces.
- Do not open the housing. The READY pendant is sensitive to electrostatic discharge.
- To avoid damage to the touch screen, do not place the READY pendant on a surface with the screen facing down.
- Never use sharp objects to operate the touch screen and keypad (e.g., screwdriver, ballpoint pen, etc.). Use only your fingers or a touch-pen.
- Make sure your hands or gloves are clean and free of oils or abrasive debris.



SPECIFICATIONS

READY pendant Spec	ifications
Dimensions	215(W) x 284(H) x 69(D) mm (without mounting bracket)
Weight	Approx. 1120 g
Display	10.1" TFT, Projected capacitive touch screen, multi-touch 800 x 1280 pixel (16:10) WXGA
Safety Elements	Emergency-stop button, 2 channels, IEC 60947-5-5 Compliant Enabling switch, 3 position, 2 channels, IEC 60947-5-8 Compliant Mode selector key switch, 2 positions (two keys included) (Replacement keys: IDEC AS6-SK)
Other Components	Membrane keypad, 18 buttons, 3 status LEDs
Data Transfer	Ethernet 10/100 Mbit/s communication (internal RJ45 plug) USB 2.0 transfer (port)
Cable	10 m, including 200 mm flying leads: RJ45 plug (4 wires) for Pendant communication 15 signal wires with ferrule ends
Power Supply	24V DC, up to 15 W consumption
Environmental Requirements	Operating temp: 0 °C to 45 °C Relative air humidity (non-condensing): 5 % to 95 % Vibration resistance according to IEC 60069-2-6 Shock resistance according to EN 61131-2
Mechanical Properties	Housing made of PPE/PE Dropworthiness: 1 m (on industrial floor), then at least IP54
Protection Rating	IP54

CABLE

The READY pendant cable includes an RJ45 Ethernet connector and 15 flying leads. The Ethernet connector is for communication with the IPC. The flying leads with end ferrules are for the pendant power and safety features. See the table below for a description of the leads.



Pendant Cable Lead	Signal
Brown	Three-Position Enabling Switch Circuit 1
Yellow	Three-Position Enabling Switch Circuit 1
Green	Three-Position Enabling Switch Circuit 2
Grey	Three-Position Enabling Switch Circuit 2
Pink	24V DC
Green/Brown	Emergency Stop Circuit 1
White/Green	Emergency Stop Circuit 1
Grey/Pink	Emergency Stop Circuit 2
Red/Blue	Emergency Stop Circuit 2
Black	0V DC
Violet	Key Switch Circuit 1
White/Pink	Key Switch Circuit 1
White	Key Switch Circuit 2
Blue	Key Switch Circuit 2
White/Blue	Not Connected
Shielded Communication	on Wires:
Blue, Pin 1	TD+ (Ethernet to IPC)
Orange, Pin 2	TD- (Ethernet to IPC)
White, Pin 3	RD+ (Ethernet from IPC)
Red, Pin 6	RD- (Ethernet from IPC)



FUNCTIONALITY

See the images and table below for READY pendant features.

Note: The hand strap for holding the pendant is not shown. Set up the strap for either left-handed or right-handed use.









No.	Feature	Description	
1	Emergency Stop Button	Trigger an emergency stop state with this red- Press down to open the safety circuits. This st Twist clockwise to release the button and clos	-yellow button (DPST). ops the robot and other devices. se the circuits.
2	Touch Screen	Interact with Forge/OS on this multi-touch dis	splay.
3	Mode Selector Key Switch	Insert the key and turn to select between Run Mode (clockwise) and Teach Mode (counter-clockwise).	
4	Status LEDs	 Green Power LED - Solid green means the pendant is on. Green Network LED - Solid green means a good connection to the IPC. Red Error LED - Solid red means there is a device error. Off indicates normal system status. 	• () • -[: •]
5	Jog Buttons	Jog the most recently selected robot in the selected Frame. If you select Linear in the Device Control app, these jog buttons move the robot's TCP in X, Y, Z, RX, RY, and RZ. If you select Joint , the buttons move the robot joints. Holding two buttons in the same row at one time results in no motion.	- +
6	Speed Control Buttons	Decrease Speed (left) and Increase Speed (right). While a task is running, control the runtime speed slider. While a task is not running, control the speed in the Device Control app.	



No.	Feature	Description	
7	Start/Stop Buttons	 Start (left): Use in the Task Canvas app to start the task (Run mode). Use in the Device Control app to execute a jump/ absolute position command. Stop (right): Stop Task Canvas execution and all robot motions. 	
8	Reset/Step Buttons	Reset (left): Send a reset signal to all devices to fix errors. Step (right): Execute the selected block in Task Canvas.	CM
9	Three-Position Enabling Switch	Enable robot motion control with this three- position switch (DPDT). Most robots require this enabling device when the READY pendant is in Teach Mode. To use, press the switch into the middle position (ON). If you release or squeeze the switch too tightly in Teach Mode, the robot will not move (OFF).	
		Connect USB devices to the pendant.	
10	USB Port	Tip: Connect a USB keyboard to type in field	s on the screen.

READY



Tip: If you forget what the keypad buttons do, swipe left from the right edge of the screen to see the labels!



FORGE/OS PLATFORM

SYSTEM REQUIREMENTS

An industrial computer must meet these minimum requirements to install Forge/OS:

Device Feature	Minimum Required Specification
CPU	i5 8500T / i3 8100T
Memory	8GB DDR4 RAM
Storage	128GB SATA SSD
Media	Two USB 2.0 ports
Display Adapters	One DisplayPort or HDMI
Network Adapters	Two Gigabit Ethernet ports
Temperature Rating	Recommended 0-50°C

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.



Im	nortant: 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.
	<i>Tip:</i> 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 M
	<i>Tip:</i> The key that opens the Boot Menu depends on the <i>IPC</i> model. The most common keys that do the 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.
l d	From the boot options, select Install Forge/OS to boot from the installation USB flash drive.



English Español		
Esperanto		
Français		Install Forge
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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
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Choose your IPC's host name. The host na bassword. Then click Continue . Note: The username and password that y NOT for signing into Forge/OS on the REA Who are you? Your name: Your computer's name: Pick a username: Choose a password: Confirm your password:	ame identifies the IPC on the network. Pick a usernam you create here are for accessing the IPC desktop. They ADY pendant.







S 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.

Note: The *READY pendant* IP Address is preset to 172.16.255.253. The network interface that the pendant connects to should use IP Address 172.16.255.250 and Subnet mask 255.255.255.0.



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>.



USER PROFILES

After you start up Forge/OS, sign in to a user profile. Forge/OS has two user profiles: Admin and Operator.



- The Admin profile is password-protected and has full access to apps in Forge/OS.
- The **Operator** profile does not have a password and has limited access.

Tip: The default Admin password is "forgeadmin". Change the Admin login password in General Settings.

The Operator profile CANNOT:	The Operator profile CAN:
 Access the System Settings app Access the Device Configuration app Create, modify, or remove tasks in Task Canvas 	 View Device Status and clear device errors View system notifications Control an enabled device from the Device Control app Load a task in Task Canvas Execute a task in Task Canvas Interact with user prompts in a running task



HOME SCREEN

The **Home Screen** shows all apps installed on Forge/OS. Return to the Home Screen at any time by tapping the Home button in the bottom-left corner on the Toolbar.





TOOLBAR

The **Toolbar** displays app icons, device statuses, and system information. The Toolbar is always available except during task execution.



No.	Toolbar Item	Description
1	Home Button	Return to the Home screen. The Home Button switches active apps but does not close them. Apps only close when you log out.
2-4	App Icons	Jump between the standard control apps: Device Configuration, Device Control, and Task Canvas. When you are in Remote Control mode, these app icons are replaced with the Remote Control Status icon.
5	Device Status Panel	View the operational mode or state of all devices that are configured and enabled .
6	User Button	View the current user profile name. When you tap the button to expand, you can log out, enter Remote Control mode, or exit Remote Control mode.
7	Notifications	Tap the bell to scroll through the system notification history. Tap a notification for more information about the error (such as the time stamp of when it occurred and fix instructions). Clear individual notifications by pressing "X", or tap Dismiss All to clear the entire notification history. Any ongoing status information appears in the Device Status Panel. <i>Tip: Also access the Notifications panel by swiping down from the top of the screen.</i>
8	Time and Date	The system time and date appear on the toolbar. To update the time settings, see <u>General Settings</u> .



DEVICE STATUS PANEL

The **Device Status Panel** displays the operational mode or state of all enabled devices. Expand the panel by tapping the **DEVICE STATUS** button in the Toolbar.

The possible robot states are:

Robot State	Description		
HAND GUIDE	The <i>collaborative</i> robot can be moved by hand.		
TEACH (DISABLED)	The robot is in a manual reduced speed mode, the READY pendant enabling switch is not pressed, and the motors are off.		
TEACH	The robot is in a manual reduced speed mode, the READY pendant enabling switch is pressed in the middle position, and the motors are on.		
PROGRAM	The robot is in a manual reduced speed mode where speeds are limited by Forge/OS instead of the robot safety system. The READY pendant enabling switch is not required.		
RUN 🔵	The robot is in an automatic full speed mode. It's ready to run a task.		
WARNING 🦲	The robot requires a reset from Forge/OS.		
ERROR	The robot requires a reset from Forge/OS or other actions to regain normal operation.		

For robots requiring the **Mode Selector Key Switch**, turn the key to select between **Run** (clockwise) and **Teach** (counter-clockwise).



For collaborative robots, open the Device Status Panel and tap to choose a robot mode.

Tip: You cannot toggle directly from Hand Guide mode to Run mode. First switch to Teach mode to make Run mode available.

For robots with **PROGRAM** mode, open the Device Status Panel and tap to choose a robot mode. For example, tap **PROGRAM** to change the robot to Program mode.

The possible states for other devices are:





Device State	Description
ок 🥥	The device is connected and in a normal state.
WARNING 😑	The device requires a reset from Forge/OS.
ERROR	The device requires a reset from Forge/OS or other actions to regain normal operation.



READY

Expand the panel and tap **MORE** to read possible causes and fixes.

The **RESET** button clears warnings and errors when possible. All safety conditions, such as the pendant enabling switch and key switch, must be met.



Note: For hardware errors that will not reset in Forge/OS, follow the manufacturer's error recovery procedures.

HELP VIEWER

The Help Viewer displays additional information and instructions for using features in Forge/OS.

To open the Help Viewer, tap the **?** icon in the upper-right corner of the screen or pop-up, when available.



Tip: In the Task Canvas app, select Help in the File menu.

In some cases, there are links to relevant topics within the help text. To see more contents or subtopics, tap **Contents**.





SETTINGS

The Settings app is where you access system information and settings. Sign in as an Admin to access it.



The Settings app is organized into several menus. Tap an option to enter that menu. Return to the Settings main screen by tapping the back button at the top of the screen.

ettings	3
Network	>
며 Fieldbus Configuration	>
General Settings	>
S User Accounts	>
READY Support Access	>
System Update	>
Package Manager	>
License	>
3 System Information	>

NETWORK

The Network screen is where you view available network interfaces on your IPC.





FIELDBUS CONFIGURATION

The Fieldbus Configuration screen is where you add, delete, and change the state of Fieldbus interfaces.

Note: Add fieldbus interfaces in the Settings app before adding remote I/O devices in the Device Configuration app.

There is a Status Indicator to the left of each interface. The indicator is red when the interface is stopped and green when it is running.

Tap the toggle switch in the **Enabled** column to run or stop the interface.

Tap the blue **NEW +** button to create a new Fieldbus configuration.

Choose between **Ethernet** and **Serial**, select an interface by name, and choose the protocol.

- For an Ethernet interface, your protocol options are Ethernet/IP and Modbus TCP.
- For a serial interface, Forge/OS supports Modbus RTU.

Select one or more configurations and tap **Delete** to remove them from your Fieldbus configurations list.









GENERAL SETTINGS

The General Settings screen is where you access language, unit, and time settings.

Select a **Language**. If you change the language, restart the system to display all translatable text into the selected language.

Select **Metric** or **Imperial** units of measurement. The default system of measurement is Metric, but you may change units to Imperial at any time. Changing the unit system will automatically convert numerical values of known units.

English (United State	es)		~
Units of Measure			
Measurement	O Metric) 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	CAN	NOT SET DATE/TIME, NTP IS	ACTIVE.
Select Time Zone			
America/New_YOK			

Important: Variables are not affected by changing units of measure in General Settings. You must manually update variables that are meant for length, speed, or force parameters. Example:

- If you enter 25mm in the Z field of a move block, then you switch to Imperial units, Forge/OS converts that value to 0.984in.
- If you create an integer variable with a value of 25 to use in the Z field of a linear relative move, then you switch to Imperial units, Forge/OS does NOT convert that value.



Tap **SET DATE AND TIME** to change the date and time that appears in the Toolbar.

At the top, use the dropdowns to select the current month, day, and year.

At the bottom, use the number scrolls to select the current time in hours, minutes, and seconds.

Note: You cannot set the date and time if NTP is active.

Set Date And T	îme					×
Month	Da	ite			Year	
Jul	ء د	5		٥	2022	\$
	Current time	a 4	00	09	РМ	
	CANCEL				ACCEPT	

In the **Select Time Zone** dropdown, tap the time zone that you are in.

Note: When you change the timezone, the time in the Toolbar updates to match the time difference.

sect time zone	
America/New_York	^
America/New_York	
America/Nipigon	
America/Nome	
America/Noronha	
America/North Dakota/Beulah	

USER ACCOUNTS

The User Accounts screen is where you set the Admin password and the default login settings.

< User Accounts	U ()
Login Settings	
CHANGE ADMIN PASSWOR	D
Auto login to Operator account	• ×
Auto enable Remote Control	


To change the Admin login password, tap **CHANGE ADMIN PASSWORD**.

Enter the current password, enter the new password, then enter the new password again to confirm it.

To save, tap CHANGE PASSWORD.

Note: If you forget your password, contact READY Robotics Support to reset it.

Change Password	×
Current Password	
New password	
Confirm password	
CANCEL	CHANGE PASSWORD

If you enable **Auto login to Operator account**, Forge/OS automatically signs in to the Operator profile when Forge/OS restarts. An Admin can then access the Admin profile by logging out of the Operator profile through the bottom Toolbar.

If you enable **Auto enable Remote Control**, Forge/OS automatically begins in Remote Control mode when Forge/OS restarts.

READY SUPPORT ACCESS

The READY Support Access screen is where you enable remote access for READY Robotics Support to service or troubleshoot your system. First connect your system to the Internet. The page shows the status of the remote access service.



SYSTEM UPDATE

The System Update screen is where you update Forge/OS from a USB flash drive or an online server.



Update from USB



Update from Online Server

Update from USB	Update from Online Si	erver
Forge/OS updates detected on online server. vailable Versions:		REFRESH
5.1.1-RC4		
Description: Forge 5.1.1-RC4 Internal Release Release Date: 17 March 2022 Size: 5.55 GB		0
Forge 20220322063718-experimental		
Description: Forge/OS 5.2.0 Beta for internal Release Date: 22 March 2022 Size: 6.35 GB	testing week of 3/21/2022	0
5.1.1-RC5		
Description: Release Candidate 5 of 5.1.1 Release Date: 22 March 2022 Size: 5.55 GB		0
Forge 20220323063735-experimental		
Description: Forge 20220323063735-experim Release Date: 23 March 2022 Size: 6,35 GB	ental - Internal Release	0
Forge 5.1.1-beta1		
Description: A test of the newer build process Release Date: 28 February 2022 Size: 5.53 GB		0
ize: 5.53 GB		

To update with a USB flash drive, download the update file to your USB drive and insert it into your IPC.

In the **Update from USB** tab, tap the available version that you want to update to.

Note: You must have an eligible Support plan to receive an update file. Update files are too large for the FAT32 file system. **Use an exFAT formatted USB flash drive with at least 8GB of storage**.

Important: After you transfer an update file to your USB flash drive, make sure you safely eject it from your computer. Early removal of the USB flash drive will corrupt the update file. To update with an internet-connected server, go to the **Update from Online Server** tab. Tap the available version that you want to update to.

Available online updates are based on the system's current version. They include:

- Most recent version of Forge/OS.
- Most recent minor version of the system major version.
- Most recent patch of the system version.

For example, if the system version is 5.3.0 and the latest version is 6.1.1, the options will be something like this:

- 6.1.1 (latest version of Forge/OS)
- 5.6.2 (last version in 5.x)
- 5.3.3 (last version in 5.3.x)



Wait about 20 minutes for the update to finish installing. When it is done, a pop-up asks if you want to restart now or later. Tap **Restart Now** to finish applying the update.

Tip: After you log back in, verify that the update completed successfully by checking the *Current Forge/OS Version* in the top-right corner of the *System Update* page or *System Information* page.

Important: You may need to update robot configuration files. Refer to READY's "How to Update Forge/OS" guide.

PACKAGE MANAGER

The **Package Manager** is where you install new software components from the Cloud or from a USB flash drive without requiring a new full build of Forge/OS. Components are "packaged" to contain all relevant software and configuration templates. Packages are digitally signed and verified for security and authenticity.

Note: If you are a third-party SDK Developer, send your packages to READY Robotics to have them reviewed, tested, and signed before distribution.

Only Admins can manage installed packages, but Operators can still use the package (if the package permits that).

Listed below are the different package types:

- **Application**: A package that installs a new app into Forge/OS. The app will have one or more icons present on the Home screen.
- Device: A package that installs a new device into Forge/OS. The device will appear as a configurable device in the Device Configuration app. Appearance or use in other apps depend on the content of the package. For example, a device may have additional plugin components for the Device Control app and Task Canvas app.
- **Device Configuration**: A package that provides a set of configuration JSON files that customize a device for a specific company and/or product.
- **I/O Driver**: A package that provides access to an IO communication bus (such as an item that appears under "Fieldbus" in Settings).
- Library: A package that includes libraries and files that other packages can use.
- **Plug-in**: A package that contains a shared object to extend the functionality of a Forge/OS application (such as new Task Canvas blocks).



The main Package Manager screen shows a table of installed packages.

Tap **ADD NEW PACKAGE +** to install a new package.

Tap the **Install from USB** tab if you are installing a package from a USB flash drive that you plugged into your IPC.

Tap the **Install from Online Server** tab if Forge/OS is connected to the internet and you are installing a package from the Cloud.

Select a package from the list and tap **Install** in the table header.

Tap **Details** in the table header to view more information about the selected package.

< Package M	anager	0
Installed Packages		Q ADD NEW PACKAGE +
† Package	11 Vendor	Version

Install from USB	Insta	II from Online Server	
Forge/OS packages detected on online ser	ver.	R	EFRESH
1 item(s) selected		Install Details Can	
1 Package	11 Vendor	Versi	on
O Plugin Reference Package	READY Robotics	1.0.0	
Library Reference Package	READY Robotics	1.0.0	
O I/O Driver Reference Package	READY Robotics	1.0.0	
O Device Reference Package	READY Robotics	1.0.0	
	DEADV Debuter	100	



READY

Packages that fail to install display an error pop-up. If you are installing the package from a USB flash drive, make sure that the USB was safely ejected from the PC it downloaded the file from. If the issue is not a corrupted file, check if you have enough hard drive free space in Forge/OS.



If no errors occur, the installed package now appears in the Package Manager main screen.

To uninstall a package, select it and tap **Uninstall** in the table header.

In the pop-up, tap **UNINSTALL** to confirm the package uninstallation.







LICENSE INFORMATION

The License Information screen shows the status of your Forge/OS license. If the license is active, the page shows the license code.

You need a license code to activate or deactivate Forge/OS.

See <u>Activating Forge/OS with a License Code</u> for license activation steps.

See <u>Deactivating Forge/OS with a License Code</u> for license deactivation steps.



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	0
Network	>
Fieldbus Configuration	.
General Settings	>
Remote Access	>
System Update	>
Package Manager	>
License (EXPIRED/ UNVALID)	>
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.

		0
	License Information	
	License Status	•
	Expired	
	License Code	<empty></empty>
	License Name	Unknown License Type
	Enter License Gode:	
	ONLINE LICENSE ACT	IVATION
	OFFLINE LICENSE ACT	IVALION
a Insert the USE	8 flash drive into your IPC. Tap START WR	ITING CERTIFICATE TO USB DRIVE
a Insert the USE	B flash drive into your IPC. Tap START WR < License Info Offline License Activation	ITING CERTIFICATE TO USB DRIVE
a Insert the USE	B flash drive into your IPC. Tap START WR License Info Offline License Activation 	RITING CERTIFICATE TO USB DRIVE
a Insert the USE	3 flash drive into your IPC. Tap START WR C License Info Offline License Activation License Code STEP 1 STEP 2	RITING CERTIFICATE TO USB DRIVE
a Insert the USE	3 flash drive into your IPC. Tap START WR CLicense Info Offline License Activation License Code STEP1 STEP 2 Transfer License Activation Certificate to USB	RITING CERTIFICATE TO USB DRIVE
a Insert the USE	B flash drive into your IPC. Tap START WR C License Info Offline License Activation License Code STEP 1 STEP 2 Transfer License Activation Certificate to USB Insert a USB Flash Drive to transfer the activation certificate	RITING CERTIFICATE TO USB DRIVE
a Insert the USE	B flash drive into your IPC. Tap START WR C License Info Offline License Activation License Code STEP1 STEP2 Transfer License Activation Certificate to USB Insert a USB Flash Drive to transfer the activation certificate Click start to beg	EXITING CERTIFICATE TO USB DRIVE



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.

	< Licens				
	Offline License	Activation			
	License Code				
	STEP 1	STEP 2	STEP 3		
	Generate a License	Unlock Code using an external	computer		
	1. Plug USB into exte 2. Open the file Forg	emal computer. le: 0S-License-Activation-Cert	ificate txt and copy all of the c	contents.	
	3. Navigate to activa 4. Click Activate.	ate.ready-robotics.com and pa	ste the contents in the dialog b	00X.	
	5. If successful, cop 6. Paste the certifica 7. Save the file and e 8. Proceed to the ne	y the generated unlock certific ate into Forge_OS-License-Un eject the USB. xkt step.	ate. lock-Certificate.txt.		
Insert the USE	flash drive back into	your IPC. Tap UNL	OAD UNLOCK CER	TIFICATE FROM US	B DR
	1 1 10000	and the Martin		-	
	Licens	se Info		(?)	
				0	
	Offline License	SE INTO		0	
	Offline License	SE INTO e Activation	STEP 3	0	
	Offline License License Code STEP 1	SE INTO Activation STEP 2	STEP 3	©	
	Construction of the License Code	SE INTO e Activation STEP 2 Unlock Certificate from USB	STEP 3	0	
	Contractions of the second step 1	SE INTO e Activation STEP 2 Unlock Certificate from USB e containing the Unlock Certificate in	STEP 3	©	
	Construction of the second sec	SE INTO e Activation STEP 2 Unlock Certificate from USB e containing the Unlock Certificate in Click start to beg	STEP 3 to the Forge/OS IPC gin loading		
	Contractions Co	SE INTO e Activation STEP 2 Unlock Certificate from USB e containing the Unlock Certificate in Click start to bee LOAD UNLOCK CERTIFICA	STEP 3		
	Construction of the second sec	SE INTO a Activation STEP 2 Unlock Certificate from USB a containing the Unlock Certificate in Click start to beg LOAD UNLOCK CERTIFICA	STEP 3		
Wait for the file tap SAVE .	CICCENS Offline License License Code STEP 1 Import the License Insert the USB Hash driv Ensert the USB Hash driv	SE INTO e Activation STEP 2 Unlock Certificate from USB e containing the Unlock Certificate in Click start to bee LOAD UNLOCK CERTIFICA	STEP 3 to the Forge/OS IPC gin loading ATE FROM USB DRIVE Sfer is complete, ren	The second secon	rive al



Deactivating Forge/OS with a License Code

To transfer a Forge/OS license from one machine to another, first deactivate the license. Then activate it on the new machine.

There are two methods to deactivate Forge/OS: Online license deactivation and offline license deactivation.

The table below lists the requirements for each method.

Online License Deactivation	Offline License Dectivation
 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

Note: If you are unable to deactivate a Forge/OS license, contact READY Robotics Support.

On the Settings app main screen, tap License Info.

Settings	0
• Network	> .
Fieldbus Configuration	>
General Settings	>
Remote Login	>
System Update	>
License Info	>
System Info	

Type in your license code.



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

	< License Info		3
	License Information		
	License Status		
	Active		
	License Code		
	License Name	Production L	Līcense
	License Expiry Date Maintenance Expiry Date	01 Januar 31 Decembr	ry 2037 er 2024
	Enter License Code:		
	ONLINE LICENSE D	EACTIVATION	
	OFFLINE LICENSE D	EACTIVATION	
In the pop-up, tap D	EACTIVATE to confirm that you want	to deactivate vour license.	
If you chose online lie	cense deactivation, you're done!		
If you aboas offling li	once depativation follow these subst	2000	
		eps.	
a Insert the USB	flash drive into your IPC. Tap START	WRITING CERTIFICATE	TO USB DRIVE.
	Carl State State State		
	< License Info		0
	Offline License Deactivation		
	License Code		
	CTED 1	OTED A	
	SIEP 1	SIEFZ	
	Transfer Deactivation Certificate to USB		
	Insert a USB Flash Drive to transfer the deactivation ce	rtificate	
	The second se		
	Cilck start t	o begin writing	
	the second second		37.42
1 1	START WRITING CER	TIFICATE TO USB DRIVE	and the second sec
	START WRITING CER	TIFICATE TO USB DRIVE	
	START WRITING CER	TIFICATE TO USB DRIVE	



b When the files finish transferring, tap **NEXT**. Follow the instructions on the screen to finish deactivating the license using an internet-connected PC.

	Offline License Deactivation		
	License Code		-
	STEP 1	STEP 2	
	Transfer Deactivation Certif	icate to external computer.	
	 Plug USB into external col Open the file Forge_DS-L Navigate to deactivate.re Click Deactivate. 	nputer. icense-Deactivation-Certificate.txt and co ady-robotics.com and paste the contents	opy all of the contents. In the dialog box.
Гар FINISH .			



SYSTEM INFORMATION

The System Information screen is where you view the Forge/OS version information, pendant information, and READY Robotics Support information.

See <u>Creating a System Diagnostic File</u> for how to give diagnostic information to READY Support.

See <u>Transferring System Snapshots</u> for how to restore files from an older system version.

System Information	0
About Forge/OS	
Forge/OS Information	
Version	0.0.1+1638673780
Build Date	Sat Dec 04 2021 10:09:40 pm
Build ID	
Host Version	0.0.0-1637850711
Pendant Information Version	
Build Date	Wed Dec 31 1969 07:00:00 pm
Build ID	
Serial Number	
Support Information	
Home	www.ready-robotics.com
Support Email	support@ready-robotics.com
Support Phone	833-READY-SP (833-732-3977)
Privacy Policy	www.ready-robotics.com/forge/privacy
End User License Agreement	www.ready-tobolics.com/forge/eula
CREATE	SYSTEM DIAGNOSTIC FILE
TRANSF	ER SYSTEM SNAPSHOTS



Creating a System Diagnostic File

Follow these steps to create system diagnostic information when you have a problem with your system. Send the files to READY Robotics Support for help.





6 Find the "ready-diagnostic..." archive folder. Send this folder to READY Robotics Support with a description of the issues you are experiencing.

= _		Extract	forge-os					
File Home Share	View	Compressed Folder Tools						
← → ∽ ↑ 📕 > Me	emorex USE	3 (D:) > forge-os >				~	o ک s	earch forge-os
📌 Quick access	Nam	ne ^		Date modified	Туре		Size	
	🗹 🛄 r	eady-diagnostic-07-27-2021	-15-23-1	7/27/2021 11:23 AM	gz Archive		127 KB	

I.....

Transferring System Snapshots

A system snapshot is a backup of your files taken while updating Forge/OS. These backups record your task, device, and parameter information. READY Robotics Support can restore these backups in case something goes wrong while updating Forge/OS.

If there are snapshots available, save them on a USB flash drive by tapping **TRANSFER SYSTEM SNAPSHOTS**.





DEVICE CONFIGURATION

The Device Configuration app is where you add and manage devices in Forge/OS. Sign in as an **Admin** to access it. Supported devices include robot arms, PLCs, IO devices, end of arm tooling, and a wide range of fieldbus peripherals.



CONFIGURED DEVICES LIST

The Configured Devices List shows added devices and whether they are **Enabled** or **Disabled**. Toggle the switches in the table to enable or disable devices. When a device is enabled, the toggle is to the right and the slider is green. Control enabled devices in the Device Control app and Task Canvas app.

To edit a device, select it on the table and tap **Edit** at the top of the table. You can only edit one device at a time.

To deselect devices, tap the checkbox next to the name or tap **Cancel**.

To delete one or more devices, select the devices on the table and tap **Delete** at the top of the table.



Note: In Task Canvas, device blocks only execute when the device is **Enabled**. If you **Delete** and re-add a device, remap relevant blocks to the new device or replace them with new blocks. See <u>Task Settings</u> for more information on device remapping,

DEVICE LIBRARY

The Device Library lists all devices that Forge/OS supports. To access the Device Library, tap **New +** in the Device Configuration app. Sort and filter the list to find devices by **Name**, by **Vendor**, or by **Type**.

READY



No.	Device Library Feature	Description
1	Filter Selection	Tap the dropdown and select the type of device to add.
2	List Sorting	Tap the sort arrows next to the Device Name , Vendor , or Type columns to sort the list alphanumerically according to that column's category.
3	Device List	Search through the list of supported devices.
4	Search	Tap the search icon (a magnifying glass) and type in the search bar to find a device by name, vendor, or type. Tap the search icon again to close the search bar.
5	List Navigation	Tap the navigation arrows or the page selection dropdown to view more supported devices.

1



ADDING A ROBOT

Before adding a robot to the Device Library, install the robot and robot controller following vendor instructions. Go to **support.ready-robotics.com** to find a startup guide for your robot controller.

Filter by		
Robot		~
1 item(s) selected		Cancel
Device Name	î↓ Vendor î↓ Type	Version
O 🐨 ABB robot	Robet	1.2.0
🔿 ኛ EPSON robot	EPSON Robot	1.6.0
O 🐨 FANUC robot	FANUO Robot	1.5.0
O 😤 Kawasaki robot	Kawasaki Robot	1.0.0
O 📽 Stāubli Robot	STÄUBLI Robot	1.4.0
🔘 😤 Universal Robots robot	Robot	1.1.0
🔿 🕿 Yaskawa Motoman robot	WASKAWA Robot	1.2.0

In the Device Library, select the type of robot that you are using. Then tap **NEXT**.



Type in a **Device Name** and the device **IP Address**. A **Description** is optional. Then select your **Robot** and **Controller** models. If you are using a force sensor device, select it from the dropdown. The dropdown lists force sensor devices that are already configured on the Forge/OS system.

Note: The force sensor selection applies **only** to a force sensor that is attached to the end of the robot arm. If you are using a force sensor device elsewhere in the workcell, set that up as a separate device unrelated to the robot arm.

oniversar nob			
Device Name		IP Address	
Description			
Description			
Description		Robot Model	
Description Controller Model CB-Series	~	Robot Model UR3	
Description Controller Model CB-Series Force Sensor Device	~	Robot Model UR3	~

3

For some robot brands, you may see a prompt to insert a 2GB USB flash drive. If you do, insert a flash drive into your IPC and follow READY startup instructions to transfer files to the robot. Find vendor-specific start up guides on READY's Support page, **support.ready-robotics.com**.

Copy the Cor	figuration Files
Insert a 2GB flash complete the setu	drive into the Forge/OS IPC to copy the configuration files needed to p of your robot
	Jacast USB Stacasa device Inte Earce/OS IDC

Important: Each time you update Forge/OS, you should update the robot configuration files. For robots that need configuration files, follow update instructions at support.ready-robotics.com.

Tap **SAVE**. Wait for Forge/OS to connect with the robot.

Note: The SAVE button is only available when all required fields are filled in.



П 14 тср	Offset	NEW+
Default	(0, 0, 0) mm	
97 - 17 - 197 197		
11-61		tion of
1-1 01 1		
		Q NEW+
11 Payload	11 Mass	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Default	0 kg	



a

The TCP is the exact translational and rotational difference between the robot tool flange (default TCP) and the tip of the end effector. To add a TCP, tap **NEW +** at the top-right corner of the TCP table. Enter a name. Then enter the translational and rotational offset values relative to the default TCP. Look at the robot rendering in the left side panel for reference. Rotate the view by dragging one finger across the window. Zoom in or out by using two fingers on the window in a pinching motion.

Note: The default TCP is at the robot's tool flange.

TCP-1						
	тс	P from ro	bot tool f	lange		
	x	0.0		RX	0.0	
1	Y	0.0	mm	RY	0.0	
1 a	z	0.0		RZ	0.0	
			CLE	AR AL	6	

Note: The values for X, Y, and Z represent the TCP's position with respect to the default TCP in Cartesian coordinates. RX, RY, and RZ represent the TCP's rotational offset from each of the axes on the default TCP. To find the rotational offset values, find the rotation needed around the original X-axis (RX). Then find the rotation needed around the original Y-axis (RY). Last, find the rotation needed around the original Z-axis (RZ).

Tip: Use your right hand to visualize XYZ coordinates and to find the direction of positive rotations. Point your thumb in the direction of the positive axis (direction of the arrow). The direction that your fingers curl is the positive direction of rotation.





b The payload is the mass and center of gravity position relative to the robot's default TCP. To add a payload, tap NEW + at the top-right corner of the payload table. Enter a name and the mass and offset values relative to the tool flange. Look at the robot rendering in the left side panel for reference. The payload is represented by a sphere at the coordinates you enter. The larger the mass, the larger the sphere. Note: The default payload is a mass of zero, with the center of mass at the flange. Name Payload-1 Payload and center of gravity Mass x z CLEAR ALL Tap **NEXT**. С



6 If you have devices wired into your robot controller's Input/Output (I/O) signals, follow these substeps:

Note: Return to this screen at any time (by selecting the device in Device Configuration and tapping **Edit**) to modify I/O configuration.

	No.	Photo No.		4	200	
	Signals	Display Name	Dat	а Туре	DCP	
	CLO		E	IOOL		
	CL1		E	100L		
	CI_Z		E	IOOL		
	CL3			IOOL		
	CI_4			IOOL		
	CL_5			100L		
	CI_6		E	IOOL		
	CL-7		e	100L		
	01.0			100L		
	011		E	100L		
	DI_2.		E	100L		
	DI_3		e	100L		
	1-12 of 22		1 of 2 page(s)	~	< >	
Enter a Disp show what e	lay Name (i.e. "Open ach configured signa	Machine Door", "C I does.)pen Pneumat	ic Vise",	or "Star	t Machining Cycl
f you want a signal.	signal to appear in t	he device's Device	Control page,	tap the	DCP ch	neckbox next to th



7 Forge/OS returns to the Device Configuration home screen. Make sure that your robot appears on the configured devices list and that it is **enabled**.





ADDING A FORGE/CTRL

The Forge/Ctrl comes with an internal PLC that gives you access to 24V digital I/O, 4mm pneumatic ports, and 6mm pneumatic ports. To access the digital I/O and pneumatic features, first add the Forge/Ctrl from the Device Library.

1 In the Device Library, select Forge/CTRL (I/O Device type). Then tap NEXT. Device Library Filter by 10 Device 1 term(s) selected 0 Device Name 1 Vendor 14 Type Version 0 Device 10.0 10 Device 10.0 0 If Generic Button Presser 0 Device 10.0 10 Device 10.0 0 Device 10.0 10 Device 10.0 10

Type "Forge/Ctrl" in the **Device Name** field and add a **Description** (optional). The **IP address** is **172.16.255.252**. Then tap **NEXT**.

Forge/CTRL	٢
Device Name	
Description	
IP Address	
172.16.255.252	

3

а

2

Configure any Input/Output (I/O) signals you want to control in the Device Control app.

Tap the tabs at the top of the screen to toggle between **Input Signals** and **Output Signals**.







ADDING A ROCKWELL AUTOMATION LOGIX PAC

In Forge/OS versions prior to 5.3.0, Rockwell Automation Logix PACs connected to the **EtherNet/IP Forge/OS Adapter** network device. This provided a generic set of 132 bytes of input/output for you to define. Even though a usable connection was established, it required effort to map all process data and functions.

Now, the READY Robotics **AOP** (**Add On Profile**) streamlines this process. The AOP establishes a special Ethernet/IP Adapter connection with a defined data map, creating a deeper integration with Logix PACs than was possible with stand-alone EDS files. For an example of how pre-defined signal mapping can ease setup, see Adding a Remote Control Device.

Note: The AOP is available for download on the READY Support site.

After you install the READY Robotics AOP in Studio 5000, follow the steps in this section to connect to Forge/OS and create a **Rockwell Automation Logix PAC** device.

Note: Before creating a Rockwell Automation Logix PAC device, first add an Ethernet/IP fieldbus interface in the Settings app. See <u>Fieldbus Configuration</u> to learn more.

Once you create the device, you will be able to send and receive data to and from the Logix PAC through Check and Set blocks in Task Canvas.

1

In Studio 5000, create a new project.

Right-click the Ethernet menu and select New Module.







Forge_OS	Clear Filters		Hide
Module Type Category Filters 20 - Comm-ER Analog Communication Communication		Module Type Vendor Filters Advanced Energy Industries, Inc. BALLUFF Cognec Corporation Dialight	
Catalog Number Description Forge_OS Robot Interfa	Vendor READY Rob	Category Robot	

.....

4 Give the Device a Name. Then type in the IP Address that Forge/OS is running on.

General [®] Connection Module into Internet Protocol - Vendor	General Type: Porge_OS Robot Interface Vendor: READY Robots Corporation Parent: Local Neme: ForgeOS Description:	Ethernet Address Private Methodnet: 192:109.1. P Address: 172 + 10 - 235 - 259 Host Name:	
Status: Creating		OK Cancel Help	

6



5 Click **Change** under the module definition to select a data model type:

- Data: Transfer integer (INT), unsigned integer (UINT), and float task data.
- **Data + Robot**: Do everything that the "Data" type can do, plus transfer robot data (such as robot status, current robot position, TCP translational/ rotational velocities, and joint velocities).
- Extended Data + 2x Robot: Do everything that the "Data + Robot" type can do, but for two sets of robot data.

	ieral" General	General*
rcton # Protocel # Protocel	nection netProtocol dor 'Vendor: Perent: Nerme: Re Description: Electronic K Connection:	Connection Module Info Mernel Protocol Vendor

Click **OK** to save your module definition change. Click **OK** again to save the module.

In the Forge/OS Device Library, select **Rockwell Automation Logix PAC** (Network device type). Then tap **NEXT**.









Deleter		in Dire		
ROCKWEII AL	itomation Log	IIX PAC		
Input S	Signals	Output Signa	ls	
			Q	
Signals	Display Name	Туре	DCP	
StartTask		BODL		
Stop		BOOL		
LoadTask		BOOL		
LoadAndStartTask		BOOL		
ResetTask		BOOL		
ClearError		BOOL		
SetTaskSpeed		INT		
SetTaskID		INT		
Input_Bool_0	5	INT		
Input_Int_0		INT		
Input_Int_1		INT		
1-11 of 41	1	of 4 page(s)	< × ×	



ADDING A LIFTING GRIPPER

Follow the instructions in this section to configure a generic lifting gripper (such as a suction gripper or magnetic gripper).

Note: To use a lifting gripper without robot I/O, first configure the **IPC** and I/O devices. See <u>Fieldbus</u> <u>Configuration</u> settings to learn more. Then select the signals for controlling air to the gripper.

	Device Library					
	Filter by					
	End of Arm				~	
	1 item(s) selected			Car	ncel	
	L Device Name	†↓ Vendor	î↓ Type	Version		
	🔘 🤹 Generic Clamping Gripper	R	End of Arm	1.0.0		
	🔘 🤨 Generic Lifting Gripper	R	End of Arm	1.0.0		
		BOROTIO	End of Arm	1.0.0		
er a Device Name .	A Description is optional.	KOBUTIQ			<u></u>	
er a Device Name .	A Description is optional.	KOBOING			0	
er a Device Name .	A Description is optional.	Actuation Time			0	
er a Device Name .	A Description is optional.	Actuation Time		Sec	?	
er a Device Name .	A Description is optional.	Actuation Time		3=0	?	
er a Device Name .	A Description is optional.	Actuation Time 0 ease)		340	Image: second se	
er a Device Name .	A Description is optional.	Actuation Time 0 ease)		Seco Put sign/		



3 To make sure your device has enough time to actuate on and off in a task, enter the device's estimated **Actuation Time**. The default value is zero seconds.

Note: In Task Canvas, that device's control blocks prompt you to choose whether or not the task waits for the set Actuation time.

Select device	
	
Ctrl[16]	×
Select signal:	
24V-Output-O	
24V-Output-1	
24V-Output-2	1
24V-Output-3	
24V-Output-4	
24V-Output-5	
24V-Output-6	
24V-Output-7	A.B
Air-Out-4mm-air-1	
Air-Out-4mm-air-2	
Air-Out-4mm-air-3	
Air-Out-4mm-air-4	
Air-Out-8mm-air-1	La.
Air-Out-6mm-air-2	

6





Device Name	Actuation Time	
Lifting Gripper	Û	Seconds
Description		
Description		
Description	ab / Release)	
Output signals that control the gripper (Gra	ab / Release)	ADD OUTPUT SIGNAL +

Choose which gripper state (Release or Grab) corresponds to a **HIGH** or **LOW** signal.

	Gripper Control	
Release	State	
⊊m Air-Out-4mm-air-1	Law High	
Grab	State	
ात Air-Out-4mm-air-1	LOW HIGH/	



7 Tap **SAVE** to return to the Device Configuration home screen. Make sure the Lifting Gripper appears on the configured devices list and that it is **enabled**.



.....

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



ADDING A CLAMPING GRIPPER

Follow these instructions for configuring a pneumatic or electronic clamping gripper. For an advanced clamping device, such as one with digital force control, check if it is supported in the Device Library.

Note: To use a clamping gripper without robot I/O, first configure the *IPC* and I/O devices. See <u>Fieldbus</u> <u>Configuration</u> settings to learn more. Then select the signals for controlling air to the gripper.

Select Ger	eric Clamping Gripp	er . Then tap NEXT .			
	Device	Library			
	Filter by				
	End of Arr	π			Ý
	1 item(s)	selected			Cancel
	L Device	Name	†↓ Vendor	†↓ Туре	Version
		Generic Clamping Gripper	R	End of Arm	1.0.0
	0 ∉	Generic Lifting Gripper	R	End of Arm	1.0.0
	0 ≪	Robotiq Adaptive Gripper	ROBOTIQ	End of Arm	1.0.0


				RE
Enter a Device Nar	ne. A Description is option	nal.		
	Generic Clampi	ing Gripper	(D
	Device Name	Open / Close T	īme	
		0		
	Description			
	Output clapple that control the a			-*.
	output signals that control the g	gripper (Upen / Close / Relax)		
	output signals that control the g	gripper (Upen / Close / Relax)		
	Gripper Control Signals	jripper(Upen / Close / Relax)	ADD OUTPUT SIGNAL	
	Gripper Control Signals	jripper(Upen / Close / Relax)	ADD OUTPUT SIGNAL 4	
	Gripper Control Signals	jripper(Upen / Close / Relax)	ADD OUTPUT SIGNAL	
	Gripper Control Signals	gripper(Upen / Close / Relax)	ADD OUTPUT SIGNAL	
	Gripper Control Signals	jripper(Upen / Close / Relax)	ADD OUTPUT SIGNAL	
	Guyor signals that control Signals	proper (Upen / Close / Relax) oper state and part presence (Optiona	ADD OUTPUT SIGNAL	
	Input signals that check the grip	proper (Upen / Close / Relax)	ADD OUTPUT SIGNAL 4	
	Gripper Control Signals	proper (Upen / Close / Relax)	ADD OUTPUT SIGNAL 4	
	Gripper Control Signals	pper topen / Close / Relax)	ADD OUTPUT SIGNAL	

device's estimated **Actuation Time**. The default value is zero seconds.

Note: In Task Canvas, that device's control blocks prompt you to choose whether or not the task waits for the set Actuation time.





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6	Once all air ports required for the clamping device are listed in the Gripper Control Signals table, tap NEXT .
---	---

evice Name	Open / Close	Time	
Clamping Gripper	0		
escription			
utput signals that control the gr	ripper (Open / Close / Relax)		
		ADD OUTPUT SI	SIGNAL
Gripper Control Signals		ADD OUTPUT SH	SIGNAL -
Gripper Control Signals		ADD OUTPUT SH	SIGNAL
Gripper Control Signals		ADD OUTPUT SH	SIGNAL -
Gripper Control Signals		ADD OUTPUT SH	SIGNAL
Gripper Control Signals	per state and part presence (Optio	ADD OUTPUT SH	SIGNAL
Gripper Control Signals	per state and part presence (Optio	ADD OUTPUT Sit	SIGNAL





Choose which gripper state (Open, Closed, or Relaxed) corresponds to a HIGH or LOW signal.

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ADDING A ROBOTIQ ADAPTIVE GRIPPER

Follow these instructions to add a Robotiq adaptive gripper.

Note: The Robotiq adaptive gripper requires electronic control through a serial fieldbus interface (Modbus RTU). The simplest way to control the Robotiq gripper is through an RS-485 to USB adapter. First connect the adapter to a USB port on the **IPC** and add a Modbus RTU serial interface to Forge/OS. See Robotiq instructions and <u>Fieldbus Configuration</u> settings to learn more.

Select Robotiq Adaptive	e Gripp	er , then tap NEXT .				
	Device	Library				
	Filter by					
	End of Ar	m			~	
	1 item(s)	selected			Canc	
	1 Device	a Name	†↓ Vendor	†↓ Туре	Version	
	0 ∉	Generic Clamping Gripper	R	End of Arm	1.0.0	
	0 €	Generic Lifting Gripper	R	End of Arm	1.0.0	
	⊙ ≪	Robotiq Adaptive Gripper	ROBOTIQ	End of Arm	1.0.0	

Type in a **Device Name**. Then select the serial **RS485 Interface** (the Modbus RTU interface you added in **Fieldbus Configuration**). A **Description** is optional.

Robolid Adaptive Grippe	er (j
Device Name	
Description	
Signal Name	
RS485 Interface	×
Gripper ID 9	



- 3 Choose a **Gripper ID**. Enter a unique **Gripper ID** if you are using multiple devices over the same serial interface. Leave the default ID value if you are using one serial device.
- 4 Tap **SAVE** to return to the **Device Configuration** main screen. Make sure the Robotiq Adaptive Gripper appears on the Configured Devices list and make sure it's **enabled**.

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



ADDING A FORCE SENSOR

Forge/OS 5 supports three force sensor options: A Universal Robot e-Series Integrated Force Sensor, a Robotiq FT 300 Force Torque Sensor, and a Generic Force Torque Sensor.

Device Library			
Filter by			
Force			~
			Q
1 Device Name	î↓ Vendor	†↓ Туре	Version
🔿 🗼 Generic Force Torque Sensor	R	Force	1.0.0
🔿 🧼 Robotiq FT 300 Force Torque Sensor	ROBOTIQ	Force	1.0.0
🔘 🛔 Universal Robots e-Series Integrated Force Sensor	R	Force	1.1.0

UR e-Series Integrated FT Sensor:

To add a Universal Robots e-Series Integrated Force Sensor, enter a **Device Name**, **IP Address**, and **Robot Model**. A **Description** is optional.

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Robotiq FT 300 Sensor:

To add a Robotiq force torque sensor, choose the USB communication port that the sensor is connected to with a serial-USB adapter. Enter a unique **Device ID** if you are using multiple devices over the same serial interface. Leave the default Device ID value if you are using one serial device.

Robotiq FT 300 Force Torque Sensor	0
Device Name	
Description	
Serial Interface	
	~
Device ID	
9	

Generic FT Sensor:

If you are not using an e-Series UR robot or a Robotiq Force Torque sensor, add a Generic Force Torque Sensor. Enter the specifications of your sensor, including **counts per force/torque**, **force/torque limits**, and **sampling rate**. Then select the signals for zeroing the sensor and detecting force and torque in each Cartesian direction.

Generic Force Torque S	ensor	(?
Device Name		
Description		
Signals		
Counts Per Force	Counts Per Torque	
ο μημοα	0	
Force Limit	Torque Limit	
0	0	
Zero Sensor		
2 22		
Force / Torque Values		
Fx	Tx	
R #		822
Fy	Ту	
122		822
Fz	Tz	
1228		822

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For each of these force torque sensors, select the checkbox next to the signal(s) that you want to see and zero in the device's Device Control page (**DCP**).

Inpu	t Signals	Output Signals	
			Q
Signals	Display Name	Data Type	DCP
Force-X		DOUBLE	
Force-Y		DOUBLE	
Force-Z		DOUBLE	
Torque-X		DOUBLE	
Torque-Y		DOUBLE	
Torque-7		DOUBLE	

Tap **SAVE** to return to the Device Configuration home screen. Make sure the force sensor appears on the configured devices list and that it is **enabled**.

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

1

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ADDING A GENERIC IO DEVICE

A Generic IO Device allows you to define a custom device by creating functions that can be manually controlled through the Device Control app or programmed as blocks in Task Canvas.

Filter by			
Filler by			
IO Device			~
1 (tam/s) selected			Cancel
Them(s) selected			Gancer
L Device Name	†↓ Vendor	†↓ Туре	Version
O LE Forge/CTRL	R	IO Device	1.0.0
O 1 Generic Button Presser	R	IO Device	1.0.0
O) 🔓 Generic IO Device	R	IO Device	1.0.0
O 1 Generic Pedal Presser	R	IO Device	1.0.0

Type in a **Device Name**. A **Description** is optional.

Description	
Output Signals	Input Signals
	Q ADD OUTPUT SIGNAL +











ADDING A REMOTE CONTROL DEVICE

A Remote Control Device allows you to communicate with Forge/OS from an external HMI.

You can only have one Remote Control Device enabled at a time. If you try to add another one, a pop-up reminds you to disable the existing one first.



Note: The Remote Control Device requires you to map signals. First configure a PLC or other relevant devices. Any device with IO is available to send and receive commands. Devices with pre-configured signal mapping (such as the **Rockwell Automation Logix PAC**) will have commands and outputs pre-mapped, allowing setup in just a few steps.

Select Remote Control Device, then tap NEXT.





2 Type in a **Device Name**. A **Description** is optional. In the **Select Device** dropdown, choose a device to use for remote control. Then tap **NEXT**.

Device Name		
Remote		-
Description		
Select Device		
PLC	× 1	



3 In the **Command Input Signals** tab, tap **ADD COMMAND +** to add an input command. To remove one or more input commands, select the checkbox(es) and tap **Remove**. For the input commands in the table, add device signals by tapping the variable selector to the right of the 'Select a value" field.

Command Input Sig	nais	utput S	ignals
		Q	ADD COMMAND +
1 Input Command	†↓ Device Signal		†↓ Signal Type
Clear Error	ClearError	253	BOOL
Taak Engels Load Task	الله الد LoadTask	252	BOOL
Load and Start Task	LoadAndStartTask	.235	BOOL
Reset Task	ALS ResetTask	123	BOOL
TASK GAMYAG Set speed	LE SetTaskSpeed	255	INT32
TABR CAMMAS Start Task	M StartTask	252	BOOL
TASK CANVAS Stop Task	ala Stop	78 2	BOOL
Task CANVES	17 SetTaskiD	235	INT32

Input signals (that are sent from the PLC to Task Canvas) include:

Input Command	mmand Description or Send a "Clear Error" signal to all devices (as if pressing the Reset button on the READY pendant). Note: This command is ignored if a task is executing.
Clear Error	Send a "Clear Error" signal to all devices (as if pressing the Reset button on the READY pendant).
	Note: This command is ignored if a task is executing.
Load Task	Load the current Task ID task and select the Start block.

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Input Command	Description
Load and Start Task	Load the associated task and immediately start it at 100% speed from the Start block.
	Note: If another task is currently open and executing, it stops the task and loads/ starts the called task. If the called task is currently open and NOT executing, it starts the task.
Reset Task	Reset all block states. Place the view and block selection on the Start block of the Main Task.
	Note: This command is ignored if a task is executing.
Set Speed	Set the Task Canvas speed slider speed. This can be received when a task is open regardless of whether it is executing.
	Note: Accepted values are 1-100. Any value outside the accepted range is ignored.
Start Task	Start the loaded task from the selected block.
	Note: This command is ignored if a task is not open or if a task is executing. If a block was stopped mid-execution, it is resumed and not restarted. If there are multiple paused subtasks executing, this command assumes the "Resume Simultaneous Execution" option.
Stop Task	Perform a controlled stop on an executing task (as if pressing the Stop button on the READY pendant).
	Note: This command does NOT execute a reset, but rather leaves blocks in a paused state. This command is ignored if a task is not executing.
Task ID	Specify the task to be loaded on a Load Task or Load and Start Task command. A Task's ID can be set in the Remote Task ID field in Task Settings.
	Note: A change in value does NOT immediately load the specified task, but rather just places that task "on deck" for a Load Task or Load and Start Task command.



In the Output Signals tab, tap ADD OUTPUT + to add an output. To remove one or more outputs, select the checkbox(es) and tap Remove. For the outputs in the table, add device signals by tapping the variable selector to the right of the 'Select a value" field.

Command Input Si	gnals	Dutput S	ignals
		C	ADD OUTPU
Output	†↓ Device Signal		11 Signal Type
Last Task Failed	LE TaskFailed	125	BOOL
Last Task Passed	La TaskPassed	122	BOOL
Ready to Run	LE ReadyToRun	122	BOOL
Remote Mode	RemoteModeOn	833	BOOL
Reset	LE Reset	855	BOOL
Task canvas Task Executing	LE TaskExecuting	199	BOOL
Task ID	TaskiD	822	INT32
Task Speed	TaskSpeed	888	INT32

Output signals (that are sent from Task Canvas or Forge/OS to the PLC) include:

Output Command	Description
Last Task Failed	The last task failed upon completion. This value is reset when a task is started or resumed.
Last Task Passed	The last task passed upon completion. This value is reset when a task is started or resumed.
Ready to Run	A task is open. All devices needed to execute the task are in RUN or OK mode. There are no safety errors. A block is selected to Start or Resume the task.
Remote Mode	The Remote Control toggle in the Toolbar's User button flyout is enabled (green and toggled to the right).

5



Output Command	Description
Reset	A task is open and not executing. All blocks are at their initial states. No block has the "Last Executed" icon, and the Start block of the Main Task is selected and visible.
Task Executing	A task is currently running.
Task ID	This is the integer value of the current task (as defined by the Remote Task ID field in Task Settings). This field is 0 when no task is loaded (even if the command "Task ID" has been set).
Task Speed	This is the current value of the Task Canvas speed slider. The range of possible values is 1-100. This field is null when a task is not open.

Tap **SAVE** to return to the Device Configuration home screen. Make sure the Remote Control Device appears on the configured devices list and that it is **enabled**.

Note: The SAVE button is only available when all Device Signal fields are filled in.

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

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ADDING A BUTTON/PEDAL PRESSER

Follow the instructions in this section to configure a generic button or pedal presser. These steps are for a button presser, but adding a pedal presser follows the same steps.

Note: The button/pedal presser requires pneumatic or electronic control through I/O. First configure the **IPC** and I/O devices. See <u>Fieldbus Configuration</u> settings to learn more. Then select the signals for controlling air or current to the pressing device.

	Device Library				
	Filter by				
	IO Device			~	
	1 item(s) selected			Cancel	
	1 Device Name	1↓ Vendor	î↓ Type	Version	
	O LE Forge/CTRL	R	IO Device	1.0.0	
	🔘 🚛 Generic Button Presser	R	IO Device	1.0.0	
	O 11 Generic Pedal Presser	R	IO Device	1.0.0	
be in a Device Nan	ne. A Description is optional.				
be in a Device Nan	ne. A Description is optional. Generic Button Presser			Ø	
be in a Device Nan	ne. A Description is optional. Generic Button Presser Device Name	Actuation Time		(2) Seconds	
be in a Device Nan	ne. A Description is optional. Generic Button Presser	Actuation Time		(2) Seconnus	
be in a Device Nan	ne. A Description is optional. Generic Button Presser Device Name Description	Actuation Time		©. Secontus	
be in a Device Nan	ne. A Description is optional. Generic Button Presser Device Name Description	Actuation Time 0		© Steams	
be in a Device Nan	ne. A Description is optional. Generic Button Presser Device Name Description Output signals that control the button (Press / Rel	Actuation Time 0		Steams	

3 To make sure your device has enough time to actuate on and off in a task, enter the device's estimated **Actuation Time**. The default value is zero seconds.

Note: In Task Canvas, that device's control blocks prompt you to choose whether or not the task waits for the set Actuation time.

Select device:	
Ctrl [16]	~
Select signal:	
24V-Output-0	
24V-Output-1	5
24V-Output-2	
24V-Output-3	1 al
24V-Output-4	
24V-Output-5	
24V-Output-6	
24V-Output-7	2.1
Air-Out-4mm-air-1	
Air-Out-4mm-air-2	9.0
Air-Out-4mm-air-3	
Air-Out-4mm-air-4	
Air-Out-8mm-air-1	1.7
Air-Out-6mm-air-2	

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ADDING A NETWORK I/O DEVICE

Note: To add a network-based fieldbus device, such as an EtherNet/IP or Modbus TCP device, first add the relevant fieldbus interface in the Settings app. See <u>Fieldbus Configuration</u> settings to learn more.

`	Line and the second			
	Device Library			
	Filter by			
	Network			~
				Q
	↓ Device Name	1↓ Vendor	î↓ Туре	Version
	O $ alpha_{\alpha}^{p} $ EtherNet/IP Forge/OS adapter	R	Network	1.1.0
	O $ alpha_{\alpha}^{D} $ EtherNet/IP Forge/OS device	R	Network	1.1.0
	O α_{α}^{I2} EtherNet/IP Generic Device	R	Network	1.2.0
	O $ alpha_{a}^{B} $ Modbus TCP Generic Device	R	Network	1.1.0

. .



(EtherNet/IP devices	only) Tap NE	EXT to s	set up the I	nput, Outp	ut, and	Config	signals.		
	EtherNe	t/IP G	eneric D	eric Device			0		
	Input S	lignals	Ou	tput Signals		Config S	ignals		
							Q		
	Signals		Display Na	Initial Value	Ту	/pe	DCP		
	Output-0			0	INT	~			
	Output-1			0	INT	~			
	Output-2			0	INT	~			
	Output-3	>		0	INT	×			
	Output-4			0	INT	~			
	Output-5			0	INT	~			
	Output-6			0	INT	~			
	Output-7			0	INT	~			
Note: The Config Sig	inals tab is av	railable	for the Eth	erNet/IP G	eneric	Device	only.		
(Optional): Type	in a Display I	Name f	or each sig	inal to show	v what	each si	gnal does.		
b For each Output Forge/OS conne	and Config s cts to the dev	ignal, ty /ice.	ype in an lı	nitial Value	if you	want th	e signal to	be set as soon a	as
Choose the data	Type for eac	h signa	l in the dro	op down					
d If you want a signal.	nal to appear	in the c	device's De	evice Contr	ol page	e, tap th	e DCP chec	ckbox next to th	at
I					•••••				••••



4 Tap **SAVE** to return to the Device Configuration home screen. Make sure the Network I/O device appears on the configured devices list and that it is **enabled**.



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



ADDING A SERIAL DEVICE

Note: To add a Serial-based fieldbus device, such as a Modbus RTU device, first add a serial interface to Forge/ OS in the Settings app. See <u>Fieldbus Configuration</u> settings to learn more.

1	1 Select a Serial device. Then tap NEXT .						
		Device Library					
		Filter by					
		Serial			~		
		1 item(s) selected			Cancel		
		Device Name	î↓ Vendor	î↓ Туре	Version		
		O O O O O	R	Serial	1.0.0		
2	Type in a Device Name , manufacturer's guides fo	select the Fieldbus Interface , or device setup parameters.	and enter othe	r requir	ed informat	tion. Refer to the	device
3	Tap SAVE to return to th configured devices list a	e Device Configuration home s nd that it is enabled .	creen. Make su	ire the s	erial device	e appears on the	
	Note: A device is enab	led when its switch is green and	d toggled to the	e right.			



DEVICE CONTROL

Use the Device Control app to manually control devices while programming a task or to recover from errors.



SELECTING A DEVICE

Tap the Select Device dropdown and choose the device you want to control. You can only choose a device that you have added and **enabled** in the Device Configuration app. When you select a device, the screen shows information and controls for that type of device.

Device Control	0
Select Device	~
Gripper	R End of Arm
Button Presser	R IO Device
🌻 🍇 Forge/Ctrl	R IO Device

In the Device Control app, you can only control one device at a time. For example, you cannot jog a robot arm and actuate a gripper at the same time. Switch between the devices using the dropdown.

Switch between the Device Control app and any other app as needed. When you leave the Device Control app and return, it still displays the controls for the most recently selected device.



CONTROLLING A ROBOT

When you select a robot, the control panel depends on the control mode you select. The available modes are **Jog**, **Jump, Absolute Position,** and **Signals**.

Note: The robot must be in **TEACH** mode or **PROGRAM** mode to control it from the Device Control app. See <u>Device Status Panel</u> for more on robot states.

When you select one of the three motion modes, the panel shows a 3D visualization of the robot arm, robot position data, and motion controls.





No.	Robot Control Feature	Description
1	Mode Selection	Enter the Jog, Jump, Absolute Position, or Signals mode.
2	TCP/ Payload Selection	Tap the dropdowns to choose the Active Tool Center Point (TCP) and/or Active Payload . Tap SET to update the active TCP and Payloads.
3	Linear/Joint Move Selection	Move the robot linearly in a Cartesian frame or in Joint space. The Jog/Jump Controls panel updates for the type of move you choose.
4	3D Visualization Window	Interact with a 3D rendering of the selected robot arm. Rotate the view by dragging one finger across the window. Zoom in or out by using two fingers on the window in a pinching motion.
		Note: The selected Frame is displayed over the 3D rendering for reference.
5	Position Data Selection	 Select a type of robot position data to view. Joints displays absolute joint position data. Frame displays the TCP pose relative to the origin of the selected frame. Base displays the TCP pose relative to the Base frame.
6	Position Data	View the robot's position for each Position Data mode selection.
7	Speed Slider	Drag the slider to scale the speed of robot moves that you execute from the Device Control app. This slider does not affect the Task Canvas speed slider.
		<i>Tip:</i> Also control speed by pressing the keypad speed buttons on the right side of the <i>READY pendant</i> .
8	Frame Selection	Choose the Frame for Jog/Jump motions. The 3D Visualization Window displays the selected Frame. Available Frames are TCP, Base, and global Frames. To learn more about Frames, see <u>Create and Manage Frames</u> .

VERSION 5.3.0



No.	Robot Control Feature	Description
	Jog Controls (Jog mode)	Press and hold the Jog buttons to move the robot in the selected Frame at the speed set by the Speed Slider. When you choose Linear Move , the Jog buttons correspond to linear and rotational motion (+/-) relative to each axis in the selected Frame. When you choose Joint Move , the Jog buttons correspond to +/- rotation for each joint on the robot arm.
9	Jump Controls (Jump mode)	Enter Jump By values and tap EXECUTE JUMP to move the robot arm relative to the position it is in. When you choose Linear Move , specify a linear or rotational distance (+/-) relative to each axis in the selected Frame. When you choose Joint Move , specify the rotational distance (+/-) for each joint on the robot arm.
	Absolute Position Controls (Absolute Position mode)	Enter Jump To values and tap EXECUTE JUMP to move the robot arm to that absolute position relative to the selected Frame, usually Base. When you choose Linear Move , specify the Cartesian coordinates of the TCP relative to the selected Frame. When you choose Joint Move , specify the absolute positions to which each joint moves.
	"Snap to" Controls	Access in the Jump and Absolute Position modes. Align the TCP Frame with the selected Frame. Use this feature to align the tool and visualize where the robot will move. You must select a Frame other than TCP. Snap +Z axis aligns the TCP's +Z axis to the selected Frame's closest axis. Snap all axes aligns all of the TCP's axes with those of the selected Frame by moving the shortest distance possible. <i>Tip: Also execute the Snap To command by pressing the keypad Start button on the READY pendant.</i>



Jogging

Jogging is when you manually move the robot by holding a directional button. There are two modes of jogging: Linear and Joint.



Linear Jog

Jog the robot's Tool Center Point (TCP) in the selected Frame along each of that Frame's coordinate axes (X, Y, Z). Rotate the TCP around each of the selected Frame's axes (RX, RY, RZ).

Frame		
TCP		~
Х		•
Y		1
Z	I.	
RX	¢.	\$
RY	5	¢.
RZ	Ç	¢

Joint Jog

Rotate the robot's joints in that joint axis's positive or negative direction.



Note: In Jog mode, the **READY pendant**'s keypad Jog buttons also move the robot. If the robot is in Teach Mode, jog the robot with the keypad Jog buttons no matter which app is open. The robot jogs with the most recently selected Frame, speed, and mode (Linear/Joint).

Tip: Jog at a low speed if you're not sure which direction is positive.



Jumping

Jumping is when you move the robot by a set distance in at least one direction. There are two modes of jumping: Linear and Joint.



Linear Jump

Move the TCP by a set distance relative to its position in the selected Frame. Rotate the TCP by a set number of degrees around the Frame's axes (RX, RY, RZ).



Joint Jump

Rotate one of more joints by a set number of degrees.



Refer to the 3D Visualization Window to see how the robot will move.

Perform the jump by pressing **EXECUTE** or by pressing the keypad **Start** button on the READY pendant.





Absolute Positioning

Absolute positioning is when you move the robot to an exact position using coordinates or joint positions. There are two modes of absolute positioning: Linear and Joint.



Linear Absolute Positioning

The coordinate boxes show the TCP's position in light gray text.

Move the TCP to a set position (X, Y, and Z) in the selected Frame. Rotate the TCP around the Frame's axes (RX, RY, RZ).



Joint Absolute Positioning

The coordinate boxes show each joint's position in light gray text.

Move one or more joints to a set position (in degrees).



Refer to the 3D Visualization Window to see how the robot will move.

Perform the jump by pressing **EXECUTE** or by pressing the keypad **Start** button on the READY pendant.





Signals

When you select the **Signals** mode, the panel shows a list of Read Only (Input) signals or a list of Writeable (Output) signals.

Toggle between input and output signals by tapping Input Signals and Output Signals.

For a signal to appear in the Device Control app, select its **DCP checkbox** in Device Configuration.

Device Control	ଉ		
	U U U U U U U U U U U U U U U U U U U		
Select Device			
🔵 ኛ UR	🗽 Robot 🗸		
Jog Jump	Absolute Positi Signals		
Input Signals	Output Signals		
	Q		
†↓ Signals	Value		
CI_0	LOW HIGH		
DILO	LOW HIGH		
DI_1	Law High		

- The **Input Signals** list shows the robot's configured Input signals in real-time. Analog signals display as float values. Digital signals display as LOW or HIGH.
- In the Output Signals list, set the values of the robot's configured Output signals. Set the value of analog signals by typing a number in the field. Set digital signals using the LOW and HIGH toggle buttons. The active LOW/HIGH toggle button appears blue.

See <u>Controlling a Network I/O Device</u> to learn more about Input/Output signal control.



Active TCP/Payload Selection

To change the **Active TCP** and/or the **Active Payload**, choose the options you want in the dropdowns. Then tap **SET**. The TCP/Payload options are the ones you add in the robot's Device Configuration (see <u>Adding a Robot</u>).



Tip: Don't forget to tap SET to change the Active TCP and Payload to the selected values.

Active TCP

The Active Tool Center Point is where the end effector interacts with objects. It's the point around which the end effector moves and rotates when the robot executes linear moves.

When you select the TCP Frame in the Linear Move mode, the Active TCP appears in the 3D Visualization for reference.

Active Payload

The Active Payload tells the robot to account for the amount of weight at the end of its arm.

Update the Active Payload whenever the actual payload changes, such as after picking up or putting down a part or tool.

Important: Forge/OS uses the Active TCP to define Waypoints and Frames. Setting the correct TCP on the robot is crucial for precise motion control in the Device Control app and in Task Canvas.

Important: A mismatch between the expected payload (Active Payload) and actual payload can cause unexpected motion and safety-related robot errors.

Note: See <u>Set TCP/Payload Block</u> to learn more about setting the Active TCP/Payload in a task.



Frame Selection

All linear moves occur at the end effector (Active TCP) relative to the selected **Frame**. Choose the Frame to control the direction of motion from the Frame dropdown. When you choose Linear Move, the 3D Visualization window shows the selected Frame for reference.



Every robot has a TCP and Base frame by default.

- The **TCP** Frame is defined by the Active TCP's orientation. Its position and orientation move whenever the robot and attached tooling move. Select the TCP Frame to move and rotate the end effector relative to the TCP.
- The **Base** Frame is at the base of the robot. It does not change orientation when the robot moves. Select the Base Frame to move and rotate the end effector relative to the Base coordinates of the robot.

Note: For information on how to view a custom Frame in the Device Control app, see Create and Manage Frames

CONTROLLING A LIFTING GRIPPER

When you select a lifting gripper, such as an end-of-arm vacuum suction gripper, the app shows controls to release or grab the part. For a suction gripper, these controls turn the suction off and on.


CONTROLLING A CLAMPING GRIPPER

The clamping gripper panel lets you open the gripper, close the gripper, or relax the gripper. The relaxed state does not apply any force to close or open. The controls are set by the device's configuration.



If you add gripper sensors to the gripper's configuration, then the indicators below the control buttons show the state of those sensor signals. If the sensors are installed and configured correctly, a green circle indicates when one of the sensors is activated.



CONTROLLING A ROBOTIQ ADAPTIVE GRIPPER

When you select a Robotiq adaptive gripper to control, the app shows the gripper position status and controls.

Select Device						
🧿 🌾 Robot	iq Adaptive Gr	ipper			ROBOTIQ End	l of Arm
l I I I 0% Open	25%	1 I I	50%	1 1	1 I I 75%	I I 100% Closed
OF	PEN GRIPPER		1	CLO	SE GRIPPER	
Position		Velocity		Fo	rce	
0.00		100.00		* 1	00.00	

To fully open the gripper, tap **OPEN GRIPPER**. To fully close the gripper, tap **CLOSE GRIPPER**.

Choose how far the gripper opens/closes, how fast it opens/closes, and how much force it uses to open/close. Enter values into the **Position**, **Velocity**, and **Force** boxes. Then tap **SET POSITION** to move the gripper with the set parameters.



CONTROLLING A FORCE SENSOR

When you select a force torque sensor, the app displays an active graph of force and torque over time.

Select Device		
🛑 📣 🛛 Force Sensor		Rorce 🗸
Fx: 0.00 N	Fy: 0.00 N	Fz: 0.00 N
🗹 Tx: 0.00 Nm	Y: 0.00 Nm	Tz: 0.00 Nm
		5
	~~ `	
4.007		r0.40
3.00-		-0.30
2.00-		-0.20
1.00-		0.10
0.00-		-0.00
-1.00-		-0.10
-2.00-		-0.20
-3.00-		-0.30
-4.00	50.00 200.00 150.00	100.00 50.00 0.00
• Fx-N	• Fy-N • Fz-N • Tx-Nm • Ty	/-Nm • Tz-Nm • Pause
START RECOR	PARSE	ZERO

By default, all components of force and torque (**Fx**, **Fy**, **Fz**, **Tx**, **Ty**, and **Tz**) are shown on the graph. Un-check any of the items that you don't want to see.

- Tap **START RECORDING** to begin reading force and torque values.
- Tap **PAUSE** to stop collecting force and torque values.
- Tap **ZERO** to zero or bias the sensor.

Look through the graph's data with the navigation tools above it. You can zoom in, zoom out, or scroll left or right. The zoom controls change the scaling of the Time axis.



CONTROLLING A GENERIC IO DEVICE

When you select a generic IO device, the app shows the status of its output and input functions.

In the **Output Functions** tab, tap **EXECUTE** next to a function that you want to run. When a function's conditions are satisfied, its EXECUTE button is greyed out and its status light is green.

For example, suppose you have a CNC mill. Two actions that you can do with its door are close it or open it. Each of these actions use the same signal, except one is set to LOW while the other is set to HIGH. When you execute the "Open the door" function, the "Close the door" function's status light turns from green to grey.



In the **Input Functions** tab, see the status of read-only input functions. Functions with satisfied conditions have a green status light.





CONTROLLING A BUTTON/PEDAL PRESSER

When you select a button presser or pedal presser, the app shows controls to press or release with force. You can also relax the pedal presser (apply no force to press or release). The controls are set by the device's configuration.





CONTROLLING A NETWORK I/O DEVICE

When you select an I/O device, the app shows selection tabs for **Input Signals**, **Output Signals**, and **Config Signals**. The Config Signals tab is available for the EtherNet/IP Generic Device only.

🔵 晶 Forge/Ctrl	6	IO Device 🗸 🗸
Input Signals	Out	out Signals
		c
†↓ Signals	Value	
24V-Output-O	LOW HIGH	
24V-Output-1	LOW HIGH	0
24V-Output-2	LÖW HIGH	0
24V-Output-3	LDW HIGH	0
24V-Output-4	LOW HIGH	0
24V-Output-5	LOW HIGH	Q
24V-Output-6	LOW HIGH	Ó
24V-Output-7	LDW HIGH	

Feature	Description
Input Signal List	View a sortable list of Read Only (Inputs) signals, including the display and signal names, real-time values, and units.
	The value of LOW/HIGH signals appears blue.
Output Signal List	View a sortable list of Writeable (Output) signals, including the display and signal names, value controls, and an active indicator.
	Set digital signals using the LOW and HIGH toggle buttons. The active LOW/HIGH toggle button appears blue.
Config Signal List	(Only available for the EtherNet/IP Generic Device .) View a sortable list of READ ONLY Config signals, including the display and signal names and real-time values.
	The value of LOW/HIGH signals appears blue.



PARAMETER MANAGER

The Parameter Manager app is where you view and modify system-wide data. Depending on what type of data you want to view, tap one of the three tabs at the top: **Global User Variables**, **Applications (Apps)**, or **Devices**.



GLOBAL USER VARIABLES

The Global User Variables tab displays data for each global variable. If a variable is **global**, you can access it in the Parameter Manager and in all Task Canvas tasks.

Note: Variables that you create in the Parameter Manager are always global. Variables that you create in a task (<u>Variable Manager</u>) are local to the task, but they can be made global.

Possible variable types are:

- Float
- Boolean
- Integer
- String

Parameter Manager			0
Global User Variables	Applications		Devices
			Q NEW+
11 Name	т↓ Туре	Value	
Variable-1	Float	0.0000	
Variable-2	Boolean	false	
Variable-3	Integer	Q	
Variable-4	String		



To edit a global variable in the Parameter Manager, select it and tap **Edit** at the top of the table.

To delete a global variable, select it and tap **Delete** at the top of the table.

Parameter Manager		0
Global User Variables	Applications	Devices
1 item(s) selected		Edit Delete Cancel
- 11 Name	11 Type	Value
Variable-4	String	
Variable-3	Integer	0
Variable-2	Boolean	false
Variable-1	Float	0.0000

APPLICATIONS

The Applications tab displays float, integer, date/time, boolean, and string data relevant to the selected app.

In the **Select Application** dropdown, select whether you want to view **Forge/OS** or **Task Canvas** data.

Parameter Manager		0
Global User Variables	Applications	Devices
Select Application		
Forge/OS		^
Forge/0S		0
Task Canvas		11



Арр	Parameter	Туре	Description	
	Date-Time	Date/ Time	The system date and time, updated every second. Displays as [month/ day/year] and [hours/minutes/seconds].	
	Weekday	String	The current weekday (not abbreviated).	
Forge/	Admin Logged In	Boolean	 True when logged in as an Admin. False when logged in as another account or on the Sign In screen. 	
03	Operator Logged In	Boolean	 True when you are logged in as an Operator. False when you are logged in as another account or on the Sign In screen. 	
	Hard Drive Free Space	Float	The amount of free space on the Forge/OS hard drive, in megabytes (MB).	
	Task Executing	Boolean	 True when a task is executing, either from the Start Task or Start From Selected options in the Runtime Menu. False when a task is stopped or a block is being Stepped. 	
	Current Task Name	String	The name of the task that is currently open in Task Canvas. Blank when no task is open.	
Task	Last Task	Boolean	 True when the last executed task finished on a "Finish" block set to "Passed". False when a task begins executing. 	
Canvas	Passed	Doolean	Note: This entry is not True when a task ends by running out of blocks or when you stop the task.	
	Last Task	Boolean	 True when the last executed task finished on a "Finish" block set to "Failed". False when a task begins executing. 	
	Failed	Doolean	<i>Note:</i> This entry is not True when a task ends by running out of blocks or when you stop the task.	



DEVICES

The Devices tab displays frame, float, double, integer, boolean, and string data relevant to the selected device.

In the **Select Device** dropdown, select which device's data you want to view. All devices added in the Device Configuration app show in the dropdown.

Parameter Manager			0
Global User Variables	Applications	Devices	
Select Device			
UR			^
UR			9
force			

Device	Parameter(s)	Туре	Description
(All Devices)	Device Status	String	The current device status as reported to the Device Status Panel. A device reports Fault when it's in an error state or it's disabled in Device Configuration.
	Global Speed Setting	Double	The percent of max speed set in the Device Control app. It is not defined by the current Task Canvas execution speed.
	Active TCP	String	The name of the active TCP.
	Active Payload	String	The name of the active payload.
6 Axis	Robot Motion Possible	Boolean	 Defined by the motor state, device status, and safety inputs (e.g., enabling switch). True if robot motion is possible. False if robot motion is not possible.
Robot	Robot in Motion	Boolean	 True if the robot is moving. False if the robot is not moving.
	TCP X, Y, Z Velocities	Double	The current velocity of the TCP in the X, Y, and Z directions of the TCP coordinate frame.
	TCP RX, RY, RZ Velocities	Double	The current rotational velocity of the TCP in the RX, RY, and RZ directions of the TCP coordinate frame.
	TCP X, Y, Z Velocities in Base Frame	Double	The current velocity of the TCP in the X, Y, and Z directions of the Base frame.



Device	Parameter(s)	Туре	Description
	TCP RX, RY, RZ Velocities in Base Frame	Double	The current rotational velocity of the TCP in the RX, RY, and RZ directions of the Base frame.
	TCP Speed	Double	The current speed of the TCP, independent of direction.
	J1-J6 Velocities	Double	The current rotational velocity of joints 1-6.
	Frame(s)	1-Point Frame or 3-Point Frame	The frame that the selected frame references.
Generic	Gripper State	String	The current state of the gripper as defined by its control signals. Possible values are grasped , released , and relaxed .
Clamping/ Lifting Gripper	Sensor State	String	The current state of the gripper sensor. Possible values are open , closed , and part present . Blank if sensor signals are not configured.
Smart Clamping Gripper	Gripper Position	Double	 The current position of the gripper fingers. 0: Fully open 100: Fully closed
Generic Button/ Pedal Presser	Presser State	String	The current state of the device as defined by its control signals. Possible values are pressed and released .



RULE ENGINE

The Rule Engine is where you link device signals, system variables, and "if...then" statements. Run these processes in the background of Forge/OS, even when a Task Canvas task isn't executing! This app is great for instructing stack lights to be one color when a task is running and another when the task is idle (and for many other uses).



When you first open the Rule Engine, the Load Ruleset screen appears. Once you create and save rulesets, they show up in the table.



At the top of the screen, view the **Active** or **Stopped** status of the ruleset that most recently ran. **Stop** an Active ruleset and **Start** a Stopped ruleset here or in that ruleset's manager.





RULESET MANAGEMENT

Inside a ruleset's manager, there is a **File menu** on the left side. The File menu lets you create or load a ruleset, save the ruleset, open ruleset settings, and access Help.

Enable the **Run on boot** toggle switch to automatically start the ruleset when Forge/OS launches.

In the table, manage the ruleset's rules. See <u>Rule Management</u>.

At the bottom of the screen, tap **Start** to begin running the ruleset's rules. Tap **Stop** to stop running the ruleset's rules.

Ruleset I		C
Run on boot		×
New Ruleset		
Load Ruleset		
Sound Duleget Me		Enable
Bulasat Sattings		<u></u>
Help		~
Rule-3		(10)
1-3 of 3	f of 1 page(s)	



New Ruleset

To create a ruleset, select **NEW +** from the Rule Engine main screen or **New Ruleset** from the File Menu.

Give the ruleset a unique name.

The ruleset will access all devices that are listed in the table. By default, the device table includes all devices that are enabled in Device Configuration.

Note: At the bottom, tap **Add Tag** to make the ruleset easier to find later. When searching for the ruleset, enter a tag to filter the search results.

Ruleset Name			
Ruleset Devices			
☐ 1↓ Device Name	1↓ Vendor	†↓ Type	Version
🔲 🥥 🤹 Finger	R	End of Arm	1.0.0
🔲 🌖 C Suction	R	End of Arm	1.0.0
01 🛺 🧔 🔲	R	IO Device	1.0.0
🔲 🥥 📽 UR Robot	IR	Robot	1.5.0
1-K of K			
1-4 01 4	(or (page(s)		
Ruleset Tags + Add Tag			



Create a ruleset with no devices or with many.

Remove devices by selecting each unwanted device and tapping **Remove**.

Note: Tapping Remove here hides the selected device(s) from this ruleset's list of devices. It does NOT remove the device(s) from the Device Configuration app.

			Remove	Gance
EN	Device Name	†1 Vendor	†L Type Ve	rsion
		R		
	🔓 Gripper	R	IO Device 1.0	
	Confirmation		×	
	Are you sure you want to remo Suction	ve the following device(s)?	
	CANCEL	ACCEPT		

To add a device to the ruleset, tap **ADD** +. Select the checkbox next to each device that you want to add and tap **ADD**.

Tip: You can add or remove more devices later from <u>Ruleset Settings</u>.

Tap **CREATE RULESET**. Forge/OS directs you that ruleset's manager.





Load Ruleset

Load a ruleset from the Rule Engine main screen or from the File Menu. The Load Ruleset screen displays the list of saved rulesets.

Select a ruleset in the table and tap **LOAD** to open it.

Tap **Duplicate** in the table header to create a copy of the selected ruleset(s).

Tap **Delete** in the table header to remove the selected ruleset(s).



Save Ruleset

From the File menu, tap **Save Ruleset** to save the changes you made to the open ruleset. You can then load another ruleset without losing your work.

Tap **Save Ruleset As** to save the ruleset with a new name. After saving a ruleset with a new name, you are editing the new ruleset.



Ruleset Settings

From the File Menu, tap Ruleset Settings to change the settings of your open ruleset.

In the Name field, type in a name to rename the ruleset.

To add a device to the ruleset, tap **ADD** +. Select the checkbox next to each device that you want to add and tap **ADD**.

In the Ruleset Devices table, select the checkboxes of devices that you want to remove. In the table header, tap **Remove**.

Note: Removing a device here does NOT remove it from other rulesets or from the Device Configuration app.

Tap **APPLY AND SAVE** to save the changes and return to the ruleset's manager.

Name			
Ruleset			
Ruleset Devices			
			Q ADD
1 Device Name	71 Vendor	1↓ Туре	Version
🔲 🥥 🦿 Finger	R	End of Arm	1.0.0
🔲 🥥 🎕 Suction	R	End of Arm	1.0.0
🔲 🥥 Tĩ 10	R	10 Device	1.0.0
🔲 🔵 😵 UR Robot	R	Robot	1.5.0
1-4 of 4	T dt i page(s)		
1-4 of 4 Ruleset Tags	Tofipage(s)		
1-4 of 4 Ruleset Tags + Add Tag	1 nf i page(s)		
1-4 of 4 Ruleset Tags + Add Tag	1 at 1 page(s)		
1-4 of 4 Ruleset Tags Ŧ Add Tag	1 of 1 page(s)		

RULE MANAGEMENT

Inside a ruleset's manager, create, enable, edit, and delete that ruleset's rule(s).



Tap **NEW +** to create a new rule.



Decide if you want to add a "While condition is met", "When event occurs", or "Linked values" rule.





Select "While condition is met" to create a "While this... do this" rule with an optional "else" rule that executes while conditions are met.

In the **When this** tab, tap **ADD +** to add conditions. In the **Conditions met when** dropdown, select:

- All match: All lines must pass to perform the "Do this" assignment.
- Any match: Any of the lines must pass to perform the "Do this" assignment.

In the **Do this** tab, tap **ADD +** to assign actions for while the conditions are met. For example, turn a stack light one color while a task is running.

In the **Else** tab, tap **ADD** + to assign alternative actions if the conditions are not met. For example, turn a stack light another color while a task is not running.

To see which conditions are satisfied and which ones are not, tap **Evaluate**. Conditions that pass have a green light next to them. Conditions that fail have a yellow light next to them.

To delete a condition, select it in the table. The ADD + button turns into a red trash can. Tap the trash can and confirm **DELETE**.

ame	
Rule-1	
Rule	Active 📿
While this 🥥 Do this 🥥	Else
1 Condition passed Conditions met when	
Any match 🗸 🚺	Evaluate ADD +



Select "**When event occurs**" to create a "When this... do this" rule that executes once when a state change occurs.

In the **When this** tab, tap **ADD +** to add conditions. In the **Conditions met when** dropdown, select:

- All match: All lines must pass to perform the "Do this" assignment.
- Any match: Any of the lines must pass to perform the "Do this" assignment.

In the **Do this** tab, tap **ADD +** to assign actions for as soon as the conditions are met. For example, set the value of Variable 2 as soon as Variable 1 reaches a certain value.

To see which conditions are satisfied and which ones are not, tap **Evaluate**. Conditions that pass have a green light next to them. Conditions that fail have a yellow light next to them.

To delete a condition, select it in the table. The ADD + button turns into a red trash can. Tap the trash can and confirm **DELETE**.

lame	
Rule-2	
Rule	Active 🧭 🔿
When this 🧧	Do this 🔵
🛑 1 Condition passed	
Conditions met when	
Any match	V Evaluate ADD +
Catiable-)	

READY

Select "Linked values" to link two parameters together so that one parameter is always equal to the other.

Tap **ADD** + to add assignments. Set the **Target** and **Source** fields. For example, set the value of Variable 1 to equal Variable 2.

To delete an assignment, select it in the table. The ADD + button turns into a red trash can. Tap the trash can and confirm **DELETE**.

ame Rule- <u>3</u>					
Rule				Active	(
					ADD +
	Target		urce		
	Ro Variable-1	=	Ri ekoenu Varia	uter virikele ble- <mark>2</mark>	822
Requi	red Field				



Tap **SAVE RULE** for the rule to appear in that ruleset's manager.

To make a rule active when the ruleset is run, toggle the **Enable** switch next to that rule in the ruleset's manager. Or toggle the **Active** switch in the rule's editor.

To edit a rule, select it in the table and tap **Edit** in the table header.

To remove one or more rules, tap **Delete** in the table header.

File		• *
		Dejete Edit Cance
Ξ	L Title	Enable
	Link	20
		00
	Confirmation	×
	Are you sure you want to remove the Variable Check	following rule(s)?
		100707



TASK CANVAS

OVERVIEW

The Task Canvas app is where you program and execute tasks using your configured devices. Task Canvas controls devices using **blocks**. **Paths** link blocks together to form a **flowchart**. The flowchart executes each block until you stop the task or until the flowchart reaches a final block.



When you open Task Canvas, the Load Task screen appears. This is where you create or load a task. Once you create and save tasks, they show up in the Load Task table.





While creating a task, you'll see the **Task Bar**, the **Canvas Menu**, the **Canvas**, the **Runtime Controls Menu**, and the **Navigation Tools**.



No.	Section	Description
1	Task Bar	See the name of the open task and subtasks. Create subtasks by tapping the + sign in the right-hand corner. As you add subtasks, this bar fills with tabs that allow you to access those subtasks.
2	Canvas Menu	Access the File Menu, Data Menu, Select Mode Toggle, and Block Editor.
3	Canvas	Add and organize blocks in a flowchart to create the task.
4	Navigation Tools	Navigate the Canvas like a map. Reset the view, zoom in or out, go back to the Start block or last executed block, and Search existing blocks.
5	Runtime Controls Menu	Execute the task.



CANVAS MENU

The Canvas Menu includes the File Menu, Data Menu, Select Mode Toggle, and Block Editor.



No.	Name	Description
1	File Menu	 Tap New Task to create a new task. Tap Load Task to open the Load Task screen. Tap Save Task to save the open task. Tap Save Task As to save the open task as a new file and open the new task. Tap Task Settings to change the task information (name, devices, and tags). Save the task to commit the updated settings. Tap Help to browse information about Task Canvas. Tap New Subtask to create a new subtask in the open task. The subtask appears in a tab across the top of the menus. Tap Rename Subtask to rename the open subtask. To rename the Main task, use Task Settings. Tap Duplicate Subtask to duplicate the open subtask, including its entire flowchart. Tap Export Subtask to export the open subtask as a new task file. This exports the flowchart and any parameters used in it. Tap Import Subtask to import an existing task or subtask into the open task as a new subtask.
2	Data Menu	 Tap Waypoint Manager to view, create, and modify waypoints local to the open task. Tap Frame Manager to view, create, and modify reference frames local to the open task. Tap Variable Manager to view, create, and modify variables local to the task. It also displays variables owned by devices (like fieldbus devices).
3	Select Mode Toggle	Toggle to tap/select multiple blocks. Delete, skip, or unskip multiple blocks at one time.



No.	Name	Description
		Change a selected block's settings, rename it, change its execution state, add comments, or delete it.
		On the right, tap the arrow labeled More/Close to expand or collapse the menu. In the expanded section:
		• Tap Undo to undo an action (such as block creation, block deletion, or path change).
4	Block Editor	<i>Note:</i> Undo stores up to 32 steps that can be undone.
		 Tap Redo to redo an action that was previously undone.
		 Cut/Copy the highlighted block. Tap the location where you want the new block to be and tap Paste Here. Tap the green check mark labeled Paste to confirm.
		 Skip a block. Choose if the task moves on to that block's bottom or right path. Tap Unskip to restore the block.

CANVAS NAVIGATION

Drag a finger or stylus across the touch screen to pan and scroll. You can also use the Canvas Navigation Tools at the bottom of the screen. There are two Navigation Tool menus. **Zoom** provides canvas view settings. **Jump** centers the view on a specific block.



Zoom Menu	Description
Reset	Reset the view to the default zoom level.
Zoom Out	Zoom out to view more of the flowchart.
Zoom In	Zoom in to get a closer view of the flowchart.





Jump Menu	Description
Search	 Search for blocks on the canvas. Type an entry to search through: Block types (e.g. Count or Absolute Move) Custom block names (from the "Rename" button) Block devices Internal parameters (e.g. variables or waypoints)
Back to Start	Jump to the Start block.
Last Executed	Jump to the Last Executed block. The Last Executed block is tagged with a magenta "Step" icon.

RUNTIME CONTROLS

The Runtime Controls menu allows you to execute the task. Tap the **Runtime Controls** button to open or close the menu. The menu remains expanded when a task is executing.

For more on executing a task, see Running a Task.



No.	Feature	Description
1	Start Time	View the time that one of the execution buttons was last pressed (Start Task , Start Subtask , or Step).
2	Duration	View the total execution time of the task. Like a stopwatch, it resets to 0 when you tap Start Task or Start Subtask and pauses when the task stops.
3	Follow Task	Tap the Follow Task toggle to center the view on the executing block during Task execution. Follow Task toggles ON whenever a task stops, but you can toggle it OFF before execution.



No.	Feature	Description					
4	Reset States	Tap Reset States to set all incremental blocks (e.g., Wait, Count, Timer, Grid, and Array blocks) to their initial states. This button also removes any paused states (such as paused Continuous Move blocks) and resets the values of task variables.					
5	Reset All to Start	Tap Reset All to Start to do everything that Reset States can do plus jump to the Main Task's Start block.					
6	Start Task OR Start Subtask OR Resume	 Tap Start Task to start the task from the selected block with the current block states. For this button to be available, you must have a block selected. If there are any blocks with errors, you must Skip them. All referenced devices must be enabled. If you are using a robot, you must put it in Run mode. If you have a subtask open, this button reads Start Subtask. In this case, only the visible flowchart will run. If you've executed blocks and have not tapped Reset All to Start, the button reads Resume. If you are working with subtasks, a pop-up may ask which subtask(s) to resume. 					
7	Step	Tap Step to execute only the selected block.					
8	Stop	Tap Stop to stop the execution of a block or the Main Task and all subtasks. Stopping a task or block maintains the iterative state of any blocks. The Stop button executes a controlled stop, which is the easiest stop method on mechanical devices in the task. <i>Important:</i> Never use the Stop button in an emergency or when an operator's safety is at risk. In such cases, use the emergency stop (E-Stop) button.					
9	Speed Slider	Use the Speed Slider to scale the speed of all robot motion in the task for all robots. If you program an Absolute Move block with 60% acceleration and 80% speed, then you set the Speed Slider to 50%, the block executes with 30% acceleration and 40% speed. When devices in the task are in Teach mode, the speed slider defaults to 25% speed. When devices are set to Run , the speed slider defaults to 100% speed.					
10	Runtime Controls Button	Tap the Runtime button to expand or hide the Runtime Controls.					



TASK MANAGEMENT

On the left side of the Canvas Menu is the **File menu**. The File menu lets you create or load a task, save the task, open task settings, access Help, and manage subtasks.

Main Task							+
	Ľ	ණ	Ia	-¢-	Ð	Ū	~
New Task	Select	Edit Block	Rename	State	Comment	Delete	More
Load Task							
Save Task							
Save Task As							
Task Settings							
Help							
New Subtask			CANVAS				
Rename Subtask		F	Start				
Duplicate Subtask							
Delete Subtask							
Export Subtask							
Import Subtask							



New Task

To create a task, select **NEW +** from the Task Canvas Load Task screen or **New Task** from the File Menu.

Give the task a unique name.

Note: Your task name cannot include one or more of the following characters: ` ~ ! # %^ & * \ | ' ":; ? / < >

The task will access all devices that are listed in the table.

By default, the device table includes all devices that are enabled in Device Configuration.

If you are using Remote Control mode, type in a **Remote Task ID** to allow the Remote Control Device to identify which task to load. The ID must be a unique, positive integer.

Tip: At the bottom, tap *Add Tag* to make the task easier to find later. When searching for the task, enter a tag to filter the search results.

Q ADD 4
and the second
↓ Type Version
obot 1.7.0



Create a task with no devices or with many.

Remove devices by selecting each unwanted device and tapping **Remove**.

Note: Tapping **Remove** here hides the selected device(s) from this task's list of devices. It does NOT remove the device(s) from the Device Configuration app.



To add a device to the task, tap **ADD +**. Select the checkbox next to each device that you want to add and tap **ADD**.

Note: You can add or remove more devices later from <u>Task Settings</u>.

Tap **CREATE TASK**. Forge/OS directs you to a blank Canvas.





Load Task

Load a task from the Task Canvas main screen or from the File Menu. The Load Task screen displays the list of saved tasks.

Select a task in the table and tap **LOAD** to open it.

View an automatic backup of the selected task by tapping **Show Autosave** at the top of the table. If you load an autosave file and tap **Save** from the File Menu, it saves over the main file for that task.

Note: Every task has an autosave version that updates after every change. If you lose power to your system without saving your task, the autosave version contains the most recent changes.

Remove the selected task by tapping **Delete** at the top of the table.

Task Canvas - Load Task	0
1 item(s) selected	Show Autosave Delete Cancel
Name	14 Modified
Task-1	11/18/21 9:57 AM
Task-2	11/22/21 4:47 PM
10-00	
1-2 01 2	TRE [page15)
	LOAD
···· 🔌 📖 📰	DEVICE STATUS TEACH Admin D2:40 PM 12:40 PM 12:20.21

Important: Deleting a task cannot be undone. The only way to recover a deleted task is to load the autosave within 14 days and save it as a new file.



3

To import or export a task, use a USB flash drive that has at least 1 GB of storage and is formatted to FAT32, NTFS, or ext4.

Tap USB Import/Export at the top of the table.

USB Import/Export
Show Autosave
NEW+

I Name
11

Task-1
11/15/211:33 PM

Task-2
11/15/215:18 PM

Import Task(s) from USB

Import Task(s) from USB storage to Task Canvas

Import a task or tasks from USB storage to Task Canvas

Import a task or tasks from Task Canvas to USB storage

Choose if you want to import or export a task. Then tap **NEXT**.

Importing Tasks

Imported tasks include all local and global parameters used in the task. The imported file is a copy, so the original file stays on the USB flash drive.

Task Canvas - Load Task

Plug the USB flash drive into your IPC.Once the system detects your USB flash drive, tap **NEXT**. Select the task(s) you want to import. Then tap **NEXT**.

Use the System Devices dropdowns to map the task's devices to your system's configured devices. The remapped device must be of the same device class (e.g., robot, gripper, sensor, etc.) as the original device. Then tap **NEXT**.

Important: If you are remapping to a different type of robot, update waypoints in the task's Waypoint Manager to avoid collisions, singularities, or joint limits. Some parameters (such as Set blocks for robot I/O) may require manual reassignment in that block's settings.



🛃 Import Tasks	-		import Tasks		a	
Select the tasks on the USB storage d	levice to copy to Task Canvas.	إند	Select existing devices or signal address.	this system to map their function	to. Devices with I/O signals w	ill map by
1 item(s) selected		Cancel				0
V I Name		1⊥ Modified	Device Name	1. Device Class	Sustem Devices	Q
Task-2		11/15/21 6:18 PM	Force Sensor	Force	Force Sensor	~
			UR	Robot	UR	~
			1-2 of 2			
1-1 of 1		~ 3 3				
					Sector Se	

Review your task and device selections. Tap **BACK** if you need to make any changes. If everything looks correct, tap **CONFIRM IMPORT**. Once the import is complete, tap **FINISH**. Then remove the USB flash drive.





Exporting Tasks

Exported tasks include all local and global parameters used in the task. The exported file is a copy, so the original file stays on the READY pendant.

Plug the USB flash drive into your IPC.Once the system detects your USB flash drive, tap **NEXT**. Select the task(s) you want to export. Then tap **CONFIRM EXPORT**. Once the export is complete, tap **FINISH**. Remove the USB flash drive.



Select tasks for export. Item(s) selected Cancel I Name I Modified Task-1 IU/IS/21 I:33 PM Task-2 IV/IS/21 5:18 PM	📕 Export Tasks			
Ittem(s) selected Cancel I Name 1 Modified Task-1 11/15/211:33 PM Task-2 11/15/215:39 PM	Select tasks for export.			
Image: Image	Titem(s) selected			Cancel
IV15/211:33 PM IV15/211:33 PM IV15/211:33 PM	- Vame		†⊥ Modified	
Image: Prime intervention	Task-1		11/15/21 1:33 PM	
1+2 of 2 Tert ======	Task-2			
H2 of 2 Tert Hait				
I-2of2 Inflamenti				
H2 of 2 Tettamini				
I-2 of 2 Tort section				
1-2 of 2. Tot Typesial BACK CANCEL CONFIRM EXPORT				
I-2 of 2 Tort secold BACK CANCEL CONFIRM EXPORT				
1-2 of 2. Tot Taxanisi BACK CANCEL CONFIRM EXPORT				
1-2 of 2 Tort secold				
1-2 of 2 1st 1 section 1				
1-2 of 2 Tot 1 section				
H-2 of 2 Ist 1 seeds 1				
BACK CANCEL CONFIRM EXPORT				
BACK CANCEL CONFIRM EXPORT	1-2 of 2	1of1pagels)		
BACK CANCEL CONFIRM EXPORT				
	BACK	CANCEL	CONFIRM EXP	DRT

Save Task

From the File menu, tap **Save Task** to save the changes you made to the open task. You can then load another task without losing your work.

Tap **Save Task As** to save the task with a new name. After saving a task with a new name, you are editing the new task.

Task Settings

From the File Menu, tap Task Settings to change the settings of your open task.


In the Task Name field, type in a name to rename the task.

Note: Your task name cannot include one or more of the following characters: ` ~ ! # %^ & * \ | ' ":; ? / < >

To add a device to the task, tap **ADD** +. Select the checkbox next to each device that you want to add and tap **ADD**.

If you are using Remote Control mode, type in a **Remote Task ID** to allow the Remote Control Device to identify which task to load. The ID must be a unique, positive integer.

Tip: At the bottom, tap *Add Tag* to make the task easier to find later. When searching for the task, enter a tag to filter the search results.

			Q ADD+
	11 Vendor	1↓ Туре	Version
	ي ا	Robot	1.7.0
) of 1	(page(s)		
	Fort	Tortpage(s)	Tof Tpegels)

In the Task Devices table, select the checkboxes of devices that you want to remap or remove.

Note: Removing a device here does NOT remove it from other tasks or from the Device Configuration app.

Task Settings	0
Task Name	
task1	
Task Devices	
Task Devices 1 item(s) selected	Remap Remove Cancel
Task Devices 1 item(s) selected T 1 Device Name	Remap Remove Cancel †1 Vendor †1 Type Version



Tap **Remap** to reassign one or more devices to another device. Select the new device from the **System Devices** dropdown.

The remapped device must be of the same device class (e.g., robot, gripper, sensor, etc.) as the original device.

To save the device remap, tap **CONFIRM REMAP**.

Select existing devices o by signal address.	n this system to map their functi	on to. Devices with I/O signals will ma
		a
👃 Device Name	1↓ Device Class	System Devices

Important: If you are remapping to a different type of robot, update waypoints in the task's Waypoint Manager. Some parameters (such as Set blocks for robot I/O) may require manual reassignment in that block's settings.

Tap **APPLY AND SAVE** to save the changes and return to the Canvas.



FEATURES OF A TASK

Create a **task** by combining blocks into a **flowchart**. Create additional flowcharts as **subtasks** to execute functions inline or at the same time as the main task. For more information about subtasks, see <u>Multitasking with</u> <u>Subtasks</u>.

CANVAS	
Start .	
Lineer move to home	
Image: Second Apple Open Gripper	
Robot Arm.DD.g - true	
ROBOT AIRM	
Check Gripper Open Robot Arm UL 2 = true	
Continuous Move	
T continuous motions	
ROUT ARM	
Close Gripper Robot Arm. 00. 0 = false	
SOBOT APH	

Every flowchart begins with a **Start** block and follows the path of execution. Task Canvas performs each block's function before moving on to the next block. A flowchart ends with a **Finish** block or when there are no more blocks to execute.



Blocks

Each block is a function that Task Canvas executes. On the Canvas, a block displays several pieces of important information:



No.	Block Information	Description
1	Device	The device that owns the block and receives the command when the block executes.
2	Block Name	The name given to the block. By default, each block is named after its block type or function. Rename blocks for reference while programming a task.
3	Block Type (Icon)	Shows the type of block for quick reference. Icons and colors depend on the block type and device type.
4	Modifiers	Any internal settings that change the way the block executes. Highlighted white if the block uses the modifier.
5	Execution State or Parameters	If the block is state-based (e.g., Timer, Count, Grid Move), this shows the execution state of the block. If the block isn't state-based (e.g., Absolute Move or Set), this shows the parameters that the block uses to execute.

In the image above, the block device is "ROBOT ARM". The block name and function is "Absolute Move". There is no Force modifier available because there is no force sensor configured for that robot. The Offset modifier isn't highlighted because there are no offset values entered. The parameter defining where the robot moves to is "Waypoint-1".

Program Paths

Paths connect blocks together to form the flowchart. Each block may have one or more paths leading to it. The number of possible exit paths from a block depends on the type of block.

Some blocks have two possible outcomes: a bottom gray path or a right orange path. Other blocks have one possible outcome: the bottom gray path.



See the images below for an example. The block named "Check Gripper Open" connects to the Continuous Move block through the bottom gray path and to the Wait block through the right orange path. In this case, the Check Gripper Open block is checking the state of gripper sensors. It follows the gray path if the gripper is open (Checks Passed) or it follows the right orange path if the gripper is closed (Checks Not Passed).



Check Gripper Open	+ Checks Not Passed
obot Arm.DI_0 = true	2.0 second(s)
+ Checks Passed	
+	· · · · · · · · · · · · · · · · · · ·
ROBOT ANM	TANVA8
Continuous Move	User Decision
continuous motions	RESET

When you place a new block on the exit path of an existing block, Task Canvas creates the path connecting them. For information on how to create loops, disconnect paths, or reconnect paths, see <u>Block Programming</u>.

Special Block States

An incremental or robot motion block that was stopped midway through its execution displays a yellow **paused** icon. Press the **Last Executed** button in the Canvas Navigation menu to select and center the screen on the paused block.



If the last block that was executed finished its execution when stopping (or stepping through) a task, it displays a magenta **Last Executed** icon. Press the **Last Executed** button in the Canvas Execution menu to select and center the screen on the last executed block.





A block that can't be traced back to the Start block through paths is a **Detached block**. You can modify and step Detached blocks, but they don't execute as part of a task since there is no path to them on the flowchart. Add a Detached block back to the task by connecting a path to it.

If you don't want your task to execute a block, but you're not ready to delete it, skip the block. A **Skipped block** stays connected to the flowchart, but it is passed over during task execution. Choose to skip to an available bottom or right path. Restore a block by tapping Unskip in the Block Editor.





READY

A block that is missing a key parameter or device needed to execute is a **Template block**. A template block appears transparent with a red exclamation point. Template blocks can prevent the task from executing until you **Skip** them.

Tap the red exclamation point to view the block's error message. Tap **BACK TO BLOCK** to center the screen on that template block. Tap **X** to close the error message.



To restore a Template block:

- Fill in the missing parameters in that block settings.
- Enable the referenced device in Device Configuration.
- Remap the missing device to another device in <u>Task Settings</u>.

MULTITASKING WITH SUBTASKS

Task Canvas lets you create more than one canvas within a single task. Each of these canvases, or **subtasks**, has its own flowchart that can run inline or parallel to your **Main Task**. Use subtasks to multitask or to organize blocks into a functional group.

- A **parallel subtask** starts when a **Start: Parallel** block executes. The parallel subtask executes as the Main Task continues to run.
- An inline subtask starts when a Start: Inline block executes. The inline subtask executes its entire flowchart before the Main Task continues to run. An inline subtask returns control to the calling task through an Exit block. The Exit block decides if the calling subtask moves on to the bottom path or the right path from the Start: Inline block.

Some devices can execute commands across parallel subtasks, such as setting a digital output or variable value.

Some devices, including robots, can only receive a command from one flowchart at a time. For those devices, the block in one subtask queues and waits for the executing block in another to finish.

To add a subtask, tap the **+** icon in the topright corner of Task Canvas or select **New Subtask** from the File menu. A new canvas appears for you to create the subtask flowchart.





More

To rename a subtask, open the subtask you want to rename and select **Rename Subtask** in the File Menu. Type in the new name and then tap the green Rename checkmark in the top menu.

To duplicate a subtask, open the subtask you want to copy and select **Duplicate Subtask** in the File Menu.

To delete a subtask, open the subtask you want to delete and select **Delete Subtask** in the File Menu.

Note: You cannot delete the Main Task.

To export a subtask to the Load Task screen, select **Export Subtask** in the File Menu. Name the subtask and enter tags for easier finding later. Select **Include Unused Parameters** to export all waypoints, frames, and variables with the subtask.

Note: If you don't select the *Include Unused Parameters* box, the exported file only contains waypoints, frames, and variables that are in use on the canvas.



Subtask Rename

X

Cancel

 \bigcirc

Rename

C*

0





To import a subtask into another task, open the new task and select **Import Subtask** in the File Menu. Find the subtask by name, select it, and tap **IMPORT**.

Note: Changes that you make to the imported subtask do not affect the original file that you exported from.

	1 Name	1 Modified	Tags
0	First Task	5 May 2021 14:42:59	
0	Subtask-2	5 May 2021 15:39:37	subtask, stacklight. status
0	Task 2 - Grid Training	5 May 2021 14:33:04	
0	Task 3	5 May 2021 14-51-30	inspection, assemb
		5 Hay 2021 44 91 40	epson
1.4 at			epson
1-4 of	14	Tot (page(s)	epson



BLOCK PROGRAMMING

Add Blocks

To add a block, tap an existing block and then **+ Add**. This reveals the **Block Menu**. Task Canvas organizes the block menu by the devices that a block can control.



Tap any block on the canvas to display the available paths. When you create a new task, tap the Start block to add your first block.

Blocks in the **Canvas** category are not specific to any device. Some of them can control multiple devices and others control flowchart logic or variables.

Add blocks through the bottom or right paths of existing blocks. You can add blocks on the path between existing blocks. Task Canvas inserts the new block and connects all the blocks.



Edit Blocks

To edit a block, tap the block to select it and tap the **Edit Block** icon in the Block Editor Menu.



In the pop-up, modify the block's settings and parameters.

For example, in the Absolute Move block, change the waypoint, speed, and offset parameters.

In robot move blocks, use the **TRY IT OUT** section to preview the move. Tap **STEP BLOCK** to move the robot to the set position. Drag the **Speed** slider to determine how fast the robot moves. Tap **RESET POSITION** to move the robot to the position it was in when you opened the block.

Tap **CANCEL** to close the block without saving the changes or **ACCEPT** to close the block and save the changes.





Rename Blocks

Naming blocks can be useful to identify the function that a block performs. For example, rename a Set block to "Turn on machine" or a Continuous Move block to "Motion exiting machine".

To rename a block, tap the block to select it and tap the **Rename** icon on the Block Editor Menu.

Type in the name and tap the green check mark to confirm.



Change Block Execution State

Some blocks take on different states while the task is running. These states are called Execution States.

For example, the execution state of a Count block that has counted to 4 is "4".

The execution state of a 30 second Wait block that is stopped at 20 seconds is "20 seconds".

When you execute a task from **Start Task From Selected** or **Step**, these blocks resume where they left off.



Note: A Count block with the execution state "Count 4" resumes by counting to "Count 5". A Grid block with an execution state "Move to 14" resumes by moving to the 14th position in the grid. A Wait block with an execution state of 20 seconds resumes by counting down from 20 seconds.

Important: When you execute a task from **Start Task**, all iterative blocks reset their state and start from 0. If you want to start a task from the beginning but use custom execution states, set the states of your blocks. Then select the Start block and execute with **Start Task From Selected**.



To set the execution state of a block, select the block and tap **State**. In the pop-up, type in the state and tap **UPDATE**.

Count Block	sk State	×
Count:	a	

Add Comments to Blocks

Add comments to blocks to keep track of what each block does.

Tap a block to select, then tap **Comment**.

In the pop-up, type in a Title and choose a comment color (yellow, red, or blue). In the Comment box, type additional details. Tap **ACCEPT** to save.

To edit or delete the comment, select the block and tap Comment again. Make changes and **ACCEPT**, or tap **DELETE COMMENT**.

To view a comment, tap the colored icon at the top-right corner of the block. Tap **BACK TO BLOCK** to center the screen on the commented block. Tap **X** to close the comment.





Delete Blocks

To remove a block from the Canvas, tap the block to select it and tap the **Delete** icon on the Block Editor Menu.



Task Canvas reconnects paths that were going to and from that block. The app notifies you if you need to manually reconnect some paths.

Note: Deleting a block from the canvas does not delete the parameters used in the block, such as waypoints or variables. To delete task parameters, use the correct data manager in the Data Menu.



Skip Blocks

A "skipped" block means that it doesn't execute at runtime.

Select a block and choose **Skip Down** or **Skip Right** to skip the block and instruct Task Canvas which path to follow instead.

Choose **Unskip** on a skipped block to restore it to execution.

Important: Be careful not to skip a function necessary for later actions to execute. For example, don't skip a block that opens a machine door before the robot moves into the machine.



Select Multiple Blocks

To select multiple blocks, toggle the multi-select mode. Tap the **Select** icon on the Block Editor Menu to toggle it on (blue). Tap Select again to toggle multi-select off (gray).



While the multi-select mode is on, select one or multiple blocks by tapping them. Task Canvas highlights selected blocks with a blue outline.

To deselect a block, tap it again.

Note: You cannot access block settings, rename blocks, or change block states in the multi-select mode. You can only Delete, Skip, or Unskip selected blocks in the multiselect mode.

File Data Select Delete	More
CANVAS Start	
UR Rómor Absolute Move	
Linear move to Waypoint-1	
Variable-3 = 0	

Cut/Copy and Paste Blocks

Move or duplicate a block using the **Cut/Paste** and **Copy/Paste** features in the expanded Block Editor Menu. Cut and Copy do not affect the parameters or custom text used by a block. You can cut or copy only one selected block at a time.

Select the block on the canvas you want to move or duplicate, then tap **Cut** or **Copy**. Select the target block after which you want to place the cut or copied block, then select the path on which to place the block.

Finish by tapping **Paste** on the top bar.

Note: Cut removes the block from its previous location when pasting it to the new one. This may break existing paths at the previous location in a way that requires you to reconnect them.



Connect Blocks

To create a path between existing blocks, select an exit path of the first block. Then tap **Connect To** from the Block Menu.

Select the second block where path goes, then tap **Connect** on the top menu.



RESET



Detach Blocks

To remove a path between two existing blocks, select the exit path from the first block. Then select **Detach** from the Block Menu.

Note: Detached blocks do not execute with the task. Be sure to reconnect the blocks where you want them before executing the task.

Check Grippe Open	r	+ Checks Not Passe
Robot Arm.DL_0 = true		
BLOCKS	~	
DEVICES	,	
Robot Arm	>	
PATH OPTIONS		
Connect to	•	
Detach	%	
Close Gripper		





Undo/Redo

Use the Undo and Redo buttons in the expanded Block Editor Menu to undo or restore actions like creating a block, deleting a block, or modifying paths.

Tap **Undo** to undo an action in the Canvas.

Tap **Redo** to redo an action that was previously undone.





DATA MANAGEMENT

The Canvas Data menu is where you modify data used by blocks in the task, including robot positioning data and variables.



Create and Manage Waypoints

A **Waypoint** defines the **pose** (position and orientation) of the robot relative to the origin of a **Frame**. Define waypoints using the **Base Frame** (at the base of the robot) or a **custom Frame**.



Waypoint defined by the Base Frame

Waypoint defined by a Custom Frame



Tap **NEW** in any robot command block waypoint field to create a waypoint.

In the New Waypoint pop-up, choose how to define the waypoint (**Linear** or **Joint**).



	Linear Waypoint	Joint Waypoint	
What type of data	The robot saves the pose and orientation of the Active TCP with respect to the chosen Frame . If you choose a custom Frame and that Frame moves, the waypoint moves based on the new Frame origin.	The robot saves the positions of each of its	
does it save?	Important: If the Active TCP is different from the one used to create a waypoint, the end effector may not move to the expected position.	TCP.	
When should you choose this type of waypoint?	When you need the robot to travel the shortest, straight-line path to the waypoint. Depending on where the robot is moving from, several joint positions may be possible for the same TCP pose.	When a straight-line travel to the waypoint would cause the robot to collide with itself. Or when you need to go to the same joint positions every time (i.e., to avoid tangling cables).	

When creating a new waypoint, the **Positions** fields fill in with the robot's current position. Move the robot to the position you want to save or enter your own values in the Positions fields. For each field you don't type a value, the field tracks the current position of the robot until you save the waypoint.

To save the waypoint, tap **ACCEPT**.



👩 New Waypoint		×	Modify Waypoint			×
Name		i i i i i i i i i i i i i i i i i i i	Name			
New Waypoint			New Waypoint			
O Linear O Joint			O Linear O Jan			
Frame			Frame			
Base		• •	Base			•
TCP			TCP			
Default			Default			
Positions			Positions			
X -120.55 mm	RX 178:6	-	X -120.55	mm RX	(175	
Y -431.64 mm	RY 1.4	m J	Y -431.64	mm RY	0	
Z 146.07 mm	RZ 180.0		Z 146.07	mm RZ	180.0	
CLE	AR ALL			CLEAR A	ALL	
			UPDA	TE TO CURRE	ENT POSITION	
14 h						
TRY IT OUT			TRY IT OUT			
🔚 моче то	TESET POSITION		器 MOVE TO		T RESET POSITION	
	1		2			
CANCEL	ACCEPT		CANCEL		UPDATE WAYPOINT	

After you save a waypoint, tap the **EDIT** button to make changes to it. There are two ways that you can edit a waypoint:

1. In the **Positions** fields, type in new values. Then tap **UPDATE WAYPOINT** to save.

Note: Do not tap **UPDATE TO CURRENT POSITION**. That button changes the Positions fields to the current robot position.

2. Move the robot in the Device Control app. Overwrite the old position values by tapping **UPDATE TO CURRENT POSITION**. Then tap **UPDATE WAYPOINT** to save.

In the New Waypoint or Modify Waypoint windows, tap **CLEAR ALL** to erase your input in all Positions fields. The fields then track the current position of the robot until you save the waypoint.

Waypoint Manager

Use the **Waypoint Manager** to create and manage Waypoints in Task Canvas. The Waypoint Manager lists saved waypoints for the selected robot device in the open task. A waypoint created with one robot can't be used for a different robot.

READY

Listed for each waypoint is the Waypoint Name, the Frame, and the Active TCP at the time you saved the waypoint.

To find waypoints, use the search button, sort them by name, or navigate using the page navigation buttons.

At the bottom of the manager, use the **TRY IT OUT** section to preview a selected waypoint. Tap **MOVE TO** to move the TCP to the waypoint. Drag the **Speed** slider to determine how fast the robot moves. Tap **RESET POSITION** to move the robot to the position it was in when you opened the Waypoint Manager.



To create a new waypoint, tap the **NEW +** button at the top of the table.

To make waypoints global, select them on the table and tap **Make Global** at the top of the table. Global waypoints are accessible to other tasks and apps. If you change a global waypoint, it changes everywhere it is used. Global waypoints have a globe icon next to them in the table.

Important: Once you make a waypoint global, you cannot make it local again.



To reassign the Frame and TCP for selected waypoints, tap **Set Frame** or **Set TCP**.

] item(s) selected	Set Frame Set TCP	Edit Delete Cancel
- 1 Waypoint Name	11 Frame	14 TCP
Waypoint-1	Base	Default
Waypoint-2	🚯 Base	Default

A dropdown appears to let you choose the new frame or TCP.



Re-assigning the TCP or Frame for a waypoint does NOT change the position of the waypoint. For example:

- If you change Waypoint-2's defining Frame to Frame-1 instead of Base, Waypoint-2's position won't change.
 Waypoint-2's position will change if you modify the coordinates of Frame-1.
- If some waypoints use a 100mm long tool, but you want to switch to a 300mm long tool, add a new TCP for that tool. Then use Set TCP to reassign the TCP for each waypoint.

Important: You can set the Active TCP in the Device Control app or with a Set TCP/Payload block in Task Canvas. If the Active TCP is different from the one used to create a waypoint, the end effector may not move to the expected position.

To edit a waypoint (change its name or position), select it on the table and tap **Edit**. You can only edit one waypoint at a time.

1 item(s) selected	Make Global S	et Frame Set	TCP Edit	Delete Cancel
11 Waypoint Name		11 Global	11 Frame	TI TCP
Waypoint-1			Base	Default
Waypoint-2			Base	Default
Waypoint-3			Base	Default
home			Base	Default

To remove one or more waypoints from the task, select them on the table and tap **Delete**.

To remove all unused waypoints from the task, select none of the waypoints and tap **Clear Unused**. A prompt lists all the unused local variables and asks you to confirm before deleting them.

Unused waypoints are not referenced by any blocks on the canvas.

2 item(s)selected	Make Global Set Frame	Set TCP	Delete Cancel
🔲 🏦 Waypoint Name	71 Global	†1 Frame	TL TCP
Waypoint-1		Base	Default
Waypoint-2		Base	Default
Waypoint-3		Base	Default
home		Base	Default

14 Frame	1↓ тср
Base	Default
	II Frame Base Base Base Base Base





Create and Manage Frames

Frames are Cartesian reference frames for moving the robot and defining **Waypoints**. Every robot has a default Base Frame and TCP Frame. You can also create custom 1-point or 3-point Frames.

	Base Frame	TCP Frame	Custom Frame
Image			
Location	The base of the robot	The active Tool Center Point (TCP)	Wherever you define, relative to the Base Frame or another custom Frame
Can you use it to define Waypoints?	Yes	No	Yes
Can you use it to define Frames?	Yes	No	Yes
Can you view it in the Device Control app?	Yes	Yes	If you make the Frame "Global" in the Frame Manager



Why use custom frames? Custom Frames allow you to define a new coordinate system along an inclined tray, workbench, grid, or more! Here are the differences between 1-point frames and 3-point frames:

	1-Point Frames	3-Point Frames
Description	Define a 3D coordinate system based on the position and orientation of the TCP.	Define a 3D coordinate system based on three positions of the TCP.
How do you create one?	Define with values or position the TCP at the "Origin" you want with each of the TCP axes pointing along the desired X, Y, and Z axes.	Position the TCP at (or choose existing waypoints for) the "Origin", the "X point", then the "Y point" (OR) Choose existing waypoints to define the "Origin", the "X point", then the "Y point".
What are the advantages?	Because 1-point frames only reference one position, so they are slightly faster to create.	Because 3-point frames reference three positions, so they are much more accurate.

Frame Manager

Use the Frame Manager to create and manage custom Frames for the selected robot.

Note: The Base and TCP Frames are not in the Frame Manager. You cannot modify or remove them.



Some frames have icons to the right of their name to show what type of frame it is:

- 1-Point Frame: No icon
- **3-Point Frame**: Coordinate system icon with the number "3"
- Global 1-Point Frame: Globe icon
- Global 3-Point Frame: Globe icon and the coordinate system icon with the number "3"



To create a new Frame, tap **NEW +** at the top of the table. Decide if you want to create a **1-POINT FRAME** or a **3-POINT FRAME**.





To create a 1-point Frame, enter a **Name** and choose a **Frame** from which to define the new frame. Except for special cases, select the **Base** Frame. If the active TCP is not the TCP that you want to use, switch to a different one in the Device Control app. Then move the TCP to the desired location of the new Frame or enter values in the **Positions** fields. To save the Frame, tap **ACCEPT**.

	New Frame					1
Nam	ne					
Fra	ame-1					
Fran	ne					
Ba	se				0	~
TCP						
De	fault					
Posi	itions					
х	-120.11		RX	178.6		
Y			RY			
z	146.07	unm	RZ	-180.0		
		CLE	AR AI	L		
TRYI	TOUT			Speed		25%
	🔄 MOVE TO			RESET POSITION		
	CANCEL		1	ADDEDT		

READY

To create a 3-point Frame, enter a **Name** and choose a **Frame** from which to define the new frame. Except for special cases, select the **Base** Frame. If the active TCP is not the TCP that you want to use, switch to a different one in the Device Control app. Move the TCP to the desired **Origin** of the new frame or select an existing waypoint. Repeat this process for the **X-point** and the **Y-point**. To save the Frame, tap **ACCEPT**.



To make one or more Frames global, select them and tap **Make Global** at the top of the table. A global Frame is accessible to other tasks and apps (including the Device Control app). If you change a global Frame, it changes everywhere.



Important: Once you make a Frame global, you cannot make it local again.



To reassign the defining Frame for selected Frames, tap Set Frame.

Note: Re-assigning the Frame changes the defining Frame WITHOUT changing the Frame's position. For example, if you change Frame-2's defining frame to be Frame-1 instead of Base, Frame-2's position will not change. Frame-2's position will change if you modify the coordinates of Frame-1.

To edit a Frame (change its name or orientation), select it on the table and tap **Edit**. You can only edit one Frame at a time.

To remove one or more Frames from the task, select them on the table and tap **Delete**. A prompt asks you to confirm before deleting them.

To delete all unused Frames, select none of the Frames and tap **Clear Unused** at the top of the table. A prompt lists all the unused local variables and asks you to confirm before deleting them. Unused Frames are Frames with zero waypoint references.

At the bottom of the manager, use the **TRY IT OUT** section to preview a selected Frame. Tap **MOVE TO** to move the TCP to the selected Frame. Drag the **Speed** slider to determine how fast the robot moves. Tap **RESET POSITION** to move the robot to the position it was in when you opened the Frame Manager.



Create and Manage Variables

Variables store and transmit values between blocks and devices. Use variables for decision-making with **Check** blocks. Use **Set** and **User Input** blocks to change variable values. Four types of variables are possible:

Туре	Description
Boolean	"True" or "False"
Integer	Positive and negative whole numbers, including zero (i.e. 7) Min/max values are: -2147483648 and +2147483647
Float	Positive and negative numbers up to 5 decimal places (i.e108.64) Min/max values are: -3.4028E+38 and +3.4028E+38
String	Alphanumeric text value (i.e. 'Hello world') Maximum character length is 255 characters

Enter a variable into compatible block parameters so the block uses the variable when it executes. For example, use a variable in the distance field in a robot Relative Move block or the seconds field in a Wait block. If the variable changes somewhere in the task, these blocks may behave differently each time they execute.

Note: Variables are unitless in Forge/OS. The parameter field determines the unit.

Variable Manager

Use the Variable Manager to create and manage variables.

Listed for each existing variable are its **Name**, current **Value**, **Default Value**, and **Type**.

To find variables, use the search button, sort them by name, or navigate using the page navigation buttons.

Variable Manager				0 >
			Q Clea	r Unused NEW +
11 Variable Name		11 Value	†↓ Default	11 Туре
Variable-4	ø			String
Variable-3	ø	0	Ó	Integer
Variable-2	•	false	false	Boolean
Variable-1	0	0.0000	0.0000	Float



To add a new variable, tap **NEW+** at the top of the table and enter that variable's information.

Important: Once you create a variable, you can't change the type of variable it is.

Float	~
Name	
Variable-4	
Value	Default
0.0	0.0

To access a variable in other tasks and in the <u>Parameter Manager</u>, select it on the table and tap **Make Global**. A pop-up asks you to confirm your decision.

Important: Once you make a variable global, you cannot make it only local again.

To edit a variable, select it on the table and tap **Edit**. You can rename the selected variable, change its current value, or change its default value. You cannot change the variable's type.

1 item(s) selected		Mak	e Global Edit	Delete Cancel
- 11 Variable Name		†↓ Value	†↓ Default	†1 Туре
Variable-4	Ø			String
Variable-3	0	0		Integer
Variable-2	0	false	false	Boolean
Variable-1	0	0.0000	0.0000	Float
Local-Variable		10.0000	10.0000	Float

Modify Variable		×
Туре		
Name		
Variable_Rename		
Value	Default	
	TIL.	



To remove one or more variables, select them and tap **Delete**. A prompt asks you to confirm before deleting them.

To delete all unused variables, select none of the variables and tap **Clear Unused** at the top of the table. A prompt lists all the unused local variables and asks you to confirm before deleting them. Unused variables are variables with zero block references.

				?
			Q Clear	Unused NEW
U Variable Name		1), Value	1. Default	TL Type
	Ø			
	0			
Variable-2	0		talse	
Variable-1	0			
Local-Variable				Float
Delete Unused Variables			85 B	×
This action will delete all varial sure you want to delete the fol Local-Variable	bles that are r lowing variabl	not referenced les?	l in the active tas	k. Are you
CANCEL			ACCEPT	

READY

RUNNING A TASK

The Runtime Controls menu is where you execute the task.

Tap the **Runtime** button in the bottom-right corner to open or close the menu. See <u>Runtime</u> <u>Controls</u> for more info on each button.

TOEVIC	E STATUS	i								ź
	IME CONT	ROLS								
Start Tim	e: Septembo	er 13 2022	at 03:00	04 PM				Duration: (00d:00h:I	00m:00s
မို	Γ ₂ ν							Follow Task		<u>~</u>
Reset States	Reset All to Start			Resume	Step	Stop	Speed	-•		25%
€ Zoom	»	Jump	»						Runtime	$\dot{\sim}$

Tip: You can only access some runtime controls under certain conditions:

- Start Task/ Start Subtask/ Resume is available when a block is highlighted and all devices in <u>Task</u> <u>Settings</u> are enabled and in OK or RUN modes. All Template blocks must be skipped.
- **Step** is available when the highlighted block is not a Template block and the referenced device (if any) is in OK, RUN, PROGRAM or TEACH mode.

For more info on Template blocks, see "Special Block States" in Features of a Task.

When you have the Main Task tab open (and either have not executed blocks yet or have tapped **Reset All to Start**), the **Start Task** button executes the task from the selected block with the current block states.

When you have a subtask tab open, the Start Task button changes to **Start Subtask**, which executes only that subtask.

If you've executed blocks and have not tapped **Reset All to Start**, the Start Task/ Subtask button reads **Resume**. If you are working with subtasks, a pop-up may ask which subtask(s) to resume. In the **Block** column, see where in the flowchart the subtasks will resume from. Toggle the **Enable** switch to specify which subtasks to run (toggle to the right) and which subtasks not to run (toggle to the left). A subtask that was paused from a Pause Subtask block has a yellow paused icon, and if you enable that subtask, it will resume in a paused state until it gets called by a Resume Subtask block. In the table header, tap **Disable All** to quickly disable all subtasks or **Enable All** to quickly enable all subtasks. You must have at least one subtask enabled to tap **RESUME SELECTED SUBTASKS**.



ForgeOS Demo	Subtask-1	Subtask-2	+	🚺 Resume From Selected	() •		×
File Data	Ct L Ia Select Edit Block Renam	e State Comment Da	elote More	The following subtasks will	be resumed:	Q	Disable All Enable All
	_			1 Task/Subtask	Block	k.	Enable
	Start			Main Task	Wait		
	+ Add			Subtask-1	II. Wait		
5 c Ve	UR ROBOT Continuous Move continuous motions CANVAR Check Table-1 = 0 CANVAR Set Table-2 = 1	Variable-2 = 0					
				1-2 of 2		1of1page(s)	
	S						
Start Time:	Start Subtask	ep Stop Speed	Duration: 00d:00h:00m:00s Follow Task	1 These tasks/subtasks w	vill resume execution	on in a paused state.	
€ » ⊑	⊒ , ≫		Runtima A		RESUME SELE	CTED SUBTASKS	

When you start or resume a task, the task executes until one of these events:

- The task reaches a Finish block.
- The task reaches the last block in the flowchart.
- You stop the task with the Stop button.
- One of the devices enters an error state, including emergency stop.



USING REMOTE CONTROL MODE

Remote Control mode allows you to communicate with Forge/OS from an external HMI.

After you configured and enabled this HMI as a **Remote Control Device** in Device Configuration, you can use it in Task Canvas.

Enter and exit Remote Control mode in the Toolbar's **USER** button flyout. When you are in Remote Control mode, the **Remote Control Status** button replaces the Toolbar's app icons.

While in Remote Control mode, there is limited on-screen interaction with the READY pendant. The Remote Control device sends and receives data, based on what signals you configured for its inputs and outputs.

ForgeOS Demo	Subtask-1	Subtask-2			
	CANVAS				
	Start				
	CANVAS Start Su Parallel	ibtasks:			
	Multiple Subtasks				
	and the second s	Ø			
		e Move			
	Linear move to Wa	aypoint-1			
	UR ROBOT Absolut	e Move			
	Joint move to Way	/point-3			
C DEVICE STATUS					
RUNTIME CONTROL					
Start Time:			Dura	ation: 00d:00	h:00m:00s
\$2 F2	►		Follo	ow Task	<u>~</u>
Reset Reset All States to Start	Start Task		Speed		
⊕ _{Zoom} ≫ ⊟	₽ ≫				
REMOTE CO ACTIVE	NTROL	DEVICE STATUS	user Admin	· A	10:32 PM 9/16/22



BLOCK GLOSSARY

The types of **blocks** available in Task Canvas depend on the devices you added in Task Settings.

Add blocks to a task from the **Block Menu**. The Block Menu organizes block types by device, except for the Canvas blocks. **Canvas** blocks are not specific to any device. Some of them can control multiple devices and others control flowchart logic or variables.

CANVAS Start	
BLOCKS	
2 Canvas	>
DEVICES	
10 Test	>
2 CNC Door	>
C Suction	>
217 Conveyor	>
🐨 UR Robot	>


Canvas Blocks

The Canvas blocks include Check, Cout, Finish, Math, Set, Timer, User Decision, User Input, Wait, and Subtask blocks. The Subtask blocks allow for multitasking with subtasks. They include, Exit, Start, Pause, Resume, and Stop.



Check Block

The Check block compares chosen parameters or inputs to expected values.

If the inputs meet the expected conditions, the task moves on through the bottom path (**Checks Passed**).

If the inputs don't meet the expected conditions, the task moves on through the right path (**Checks Not Passed**).





In the Check block settings, choose the check conditions.

Tap the **Block passes when** dropdown to choose:

- All match: All comparisons must be true for the block to follow the bottom path.
- Any match: At least one of the conditions must be true for the block to follow the bottom path.

neck Block Settings					0
Enable Timer 🌖					
Timer duration:	0			10.00	
Block passes when:					
All match					×
		ļ	ADD +		
Block passes when:					
All match					1
All match					ę
Any match					

By default, a Check block performs the check right away. To make the Check block check continuously for a set period of time, toggle the **Enable Timer** switch and enter a timer duration. When the conditions are met, the block passes to the bottom path and the timer resets for the next execution. If the conditions are not met before the time expires, the block moves to the right path and the timer resets for the next execution.

Tap **ADD+** to add a condition to the block.

Conditions display as:

[Parameter or Signal] [Operator] [Value].

To remove a line, tap the red Delete button.



The Check block can perform these checks:

Parameter or Signal	Operator	Checked Value
Digital Input, digital output	=,≠	High, low, Boolean variable, digital signal
Analog input, analog output	=, ≠, <, ≤, >, ≥, ≈, ≉	Numerical value, numerical variable, analog signal
Integer or Float variable	=, ≠, <, ≤, >, ≥, ≈, ≉	Numerical value, numerical variable, analog signal, Waypoint or Frame component
String variable	=, ≠	String variable
Boolean variable	=, ≠	High, low, Boolean value, digital signal



Parameter or Signal	Operator	Checked Value
Waypoint or Frame	≈, ≉	Waypoint or Frame (on the same robot)

Check a Waypoint or Frame

Use the Check block to check if a Waypoint or Frame has changed or if the current position is at a Waypoint or Frame.

The approximate comparisons, \approx and \approx , check if a Waypoint or Frame is almost equal to another one position. Use them to see if one position is close enough to another position within your defined tolerance. You can compare a linear position to another linear position or a joint position to another joint position.

For example, in the image below we check if the Current Robot Position is approximately at the same position as Waypoint-2, within +/-0.5 mm and +/-1 degree.



When you compare *linear positions*, you enter a Linear Tolerance and Rotation Tolerance. The **Linear Tolerance** defines the allowed linear distance from the checked position. The **Rotation Tolerance** defines the allowed rotation for each axis (RX, RY, RZ) from the checked position. The Check block fails if you use \approx and any one of the axis rotations is off by more than the tolerance.



When you compare **joint positions**, you enter a Joint Tolerance. The Joint Tolerance defines the allowed rotation for each joint from the checked position's joint values. The Check block fails if you use \approx and any one of the joint values is off by more than the tolerance.





Count Block

The Count block counts up from zero to a chosen number.

Each time the block executes, the count increases by one, then the path taken depends on the count value.

The task follows the right **Count <** path when the count is less than the chosen value.

The task follows the bottom **Count =** path after the count reaches the chosen value.

0	CANVAN Count	+ Count < 10
Cour	t 0 of 10	
	+ Count = 10	

By default, the count resets to "0" after reaching the chosen value. Then the next time the task executes the block, it counts to "1" and follows the right path.

In the Count block settings, choose the **Count** to value. Leave the **Run Once** checkbox checked or unchecked.

When the Run Once checkbox is checked, the Count does not reset when the Count to value is reached.

After it reaches its maximum value, it reads "Count X complete". If the task executes the block again, it follows the bottom path.





To repeat a section of blocks with a Count block, add the Count block **at the end of the section** and **Connect** the right path of the Count block to the **start of the section**. Use Count blocks to create repeating loops in a task. Use the defined value to set how many times the loop repeats before moving on in the task.

A Count block must have a right path. If there is no right path, the task ends as soon as the Count block is executed.



Finish Block

The Finish block marks the end of the task.

A task doesn't need a Finish block to end, but use a Finish block to mark where you expect the task to end. Depending on the complexity of your task, it may use multiple Finish blocks.



Note: A Finish block in any subtask stops the entire task, including the Main Task and all subtasks. Only use the Finish block when you want to stop the entire task.

In the Finish block settings, type in a custom message that appears when the Finish block executes.





Expand the **Message Type** dropdown to choose the pop-up that appears when the task completes, passes, or fails.

Fask Complete	^
Task Complete	
Passed	

Math Block

The Math block executes mathematical expressions to set the values of variables.

For example, use the Math block to increment a variable as a task runs.



Tap **ADD+** to add an operation to the block.

You may add multiple operations to execute. The Math block executes each operation in order from top to bottom.

Tap the red **Delete** button to remove a line.





	ADD +		10
Select a value		227	=
o	122 + V Q	NEW	1 m
		EXISTING	



Tap the **Selection** button in any field to select an existing variable or signal to change.

Note: You can choose *Float* and *Integer* variables in the Math block. You cannot choose non-numerical variables.



The mathematical expressions are defined in the form:

[Variable] = [# or Variable] [Operator] [# or Variable].

The types of operations you can choose from are addition, subtraction, multiplication, division, and modulo (mod).



Set Block

The Set block sets the values or states for chosen variables and parameters.



In the Set block settings, add Set expressions for the block to execute.

Tap **ADD+** to add a Set expression to the block.

Tap the **Selection** button in the left field to select an existing variable or signal.



READY

After you select a variable or signal, enter the value to set it to or tap the **Selection** button to select another variable or signal for the first one to match.

To add multiple variables and/or signals to set, tap the **ADD+** button. The Set block executes operations in order from top to bottom.

Tap the red **Delete** button to remove a line.

Set Block Settings			(9 X
	4	DD +		
TASK VARIABLE Float-variable	122 =	2.5	222	Û
TASK VARIABLE Interger-variable	<u> 337 = = = = = = </u>	10	822	Ō
UR 00.1	123 =	LOW HIGH INVE	RT 📆	Ō

The block can set these values:

Type of Variable or Output	Set Value
Digital output	Low, High, Invert, variable value, or digital signal value
Analog output	Rational numbers, variable value, or analog signal value
Float variable	Rational numbers, variable value, or analog signal value
Integer variable	Whole numbers (positive and negative) or variable value
String variable	Alphanumeric string with special characters
Boolean variable	Low, High, Invert, variable value, or digital signal value
Waypoint/Frame	Another Waypoint/Frame (from the same device)

READY

Subtask > Exit: Inline Subtask Block

The Exit block completes an inline subtask and exits to the canvas where the subtask was called. Without an Exit block in an inline subtask, the subtask and the calling task finish after executing the last available block.

When an Exit block is executed, the task returns to the Start Subtask: Inline block that called the subtask and follows the chosen path (bottom or right).

Note: The Exit block is not the same as the Finish block. The Finish block stops all subtasks, including the main task. Only use the Finish block to stop all activity in your task.

In the Exit block settings, choose whether the subtask exits to the Bottom or Right path of the **Start Subtask: Inline** block it returns to.



Exit Inline Block Settings	0 ×
Select exit path for inline subtask	
Bottom path	^
Bottom path	0
Right path	

Subtask > Start Subtask: Inline Block

The Start Subtask: Inline block starts an inline subtask of your choice.

When the block is executed, execution enters and starts the inline subtask.

If the inline subtask executes an Exit block, the task returns to the Start Subtask: Inline block and follows the path set in the Exit block.

If you don't include an Exit block in the inline subtask, the subtask and the calling task finish after executing the last available block.





In the block settings, use the dropdown selector in the **Main** tab to select which inline subtask to start.



In the **Subtask Behavior** tab, enable the toggle next to **Reset values of incremental and stateful blocks** to reset all blocks in the subtask before it starts to execute. This resets Count, Timer, Grid, and other state-based blocks before the subtask executes again.

Subtask > Start Subtasks: Parallel Block

The Start Subtasks: Parallel block starts one or more parallel subtasks of your choice.

When the block is executed, the parallel subtasks start execution while the task continues along the bottom path.

The subtasks you start execute at the same time as the Main Task until you stop it or until the subtasks reach final blocks.

In the **Main** tab of the block settings, tap **ADD** + to select which parallel subtasks to start.





In the **Subtask Behavior** tab, enable the toggles to:

- Restart the subtasks if they were running when this block executes.
- Reset the state of counting blocks (like Count and Grid) before the subtask executes again.
- Ignore pauses during User Decision and User Input blocks (or continue the subtask even when a pause takes place in another subtask).
- Ignore pauses during robot safety stops (or continue the subtask even when a robot safety stop occurs).



Subtask > Pause Subtasks Block

The Pause Subtasks block pauses one or more subtasks until you resume them with a Resume Subtasks block.

In the block settings, tap **ADD** + to select one or more subtasks to pause at the block's execution.



11 Subtask Name

Subtask-1



Subtask > Resume Subtasks Block

The Resume Subtasks block resumes one or more subtasks that you paused with a Pause Subtasks block.



In the Resume Subtasks block settings, tap **ADD +** to select one or more subtasks to resume at the block's execution.

Subtask > Stop Subtasks Block

The Stop Subtasks block stops one or more selected subtasks and immediately continues along the bottom path.

Subtask-1

Use this block to stop subtasks from another subtask when they no longer need to run.

For example, you may stop a subtask that runs a conveyor if you run out of parts.



In the block settings, tap **ADD** + to select the subtasks to stop.



Timer Block

The Timer block starts a timer that counts down while the task moves on.

The timer begins when the Timer block is executed, and it continues until the time reaches zero.

When the block is executed again, the path taken depends on the timer value.

The task follows the right **Elapsed** < path while the timer is running. When the timer reaches zero, the task follows the bottom **Elapsed** = path.

CANVAS Timer	+ Elapsed < 10.0sec
10.0sec + Elapsed = 10.0sec	

By default, the countdown resets to the defined length of time after it reaches zero. The next time you execute the Timer, it starts the countdown over.

In the Timer Block settings, choose the **Timer duration**. Leave the Run Once checkbox checked or unchecked.

When the **Run Once** checkbox is checked, the Timer countdown runs only the first time you execute the block. Then next time the block is executed, the task follows the bottom path.



To create a loop of blocks that executes while the timer is running, set the looped blocks on the Timer block's **Elapsed <** path. Then connect the end of the loop back to the Timer block. A Timer block must have a right path. If there is no right path, the task ends as soon as the timer starts.



User Decision Block

The User Decision block pauses execution until you instruct the task to resume or stop.

When executed, the User Decision block displays custom text and prompts you to choose which path to follow (the bottom path or the right path).



When the block is executed, a pop-up pauses execution and prompts you with the custom message and path choices. Tap one of the buttons to do that action.





In the User Decision block settings, you enter a message and path button texts.

Add text to the **User decision message** box to display when the block executes at runtime.

By default, the buttons are labeled **BOTTOM PATH, RIGHT PATH**, and **STOP TASK**. Tap the Bottom Path and Right Path text boxes to customize the runtime button text.

User Decision Block Settings	@ ×
User decision message	
This is a custom message What do you want to do?	
Bottom path button text	46 charácters remaining
Right path button text	46 tharaitters remaining

User Input Block

The User Input block pauses execution and prompts you to choose the values of task variables before moving on.





Note: You can choose *Float, Integer,* and *String* variables in the User Input block. You cannot choose a *Boolean* variable.

When the User Input block is executed, a popup prompts you to provide a value for each selected variable.

For each listed variable, choose to keep its **Current** value, **Reset** it to its default value, or **Set** it to another value. Or tap **STOP TASK**.



In the User Input block settings, add variables for you to set when the block is executed.

To add a variable to the table, click **ADD +** and select it from the Variable Selector.





Wait Block

The Wait block pauses execution for a defined length of time.

When the Wait block is executed, the count down begins. When the Wait block ends, the task continues through the bottom path.

By default, the countdown resets to the defined length of time after it reaches zero. The next time you execute the Wait, it starts the countdown over.

In the Wait Block Settings, choose the Wait duration. Leave the Run Once checkbox checked or unchecked.

When the Run Once checkbox is checked, the Wait countdown runs only the first time you execute the block.







Robot Command Blocks

The Robot Command blocks are available in the block menu for active robot devices. They include robot move blocks, robot IO blocks, and other robot command blocks.



All robot move blocks share a few common features:

The Main Tab

Set waypoints and other robot motion parameters. Requirements vary based on the block.



READY

The TRY IT OUT Section

Preview the move. Tap **STEP BLOCK** to move the robot to the set position. Drag the **Speed** slider to determine how fast the robot moves. Tap **RESET POSITION** to move the robot to the position it was in when you opened the block.

The Travel Speed Tab

Set the speed of the motion. Select in the dropdown how you want to define the speed. All robots have the option of defining speed by Overall Percent (0%-100%) of the robot's maximum speed. Some robots also have the options of defining speed by Velocity, Acceleration, Deceleration, or Time to Completion.

TRY IT OUT		
	Speed	25%
STEP BLOCK		
CANCEL	ACCEPT	

Absolute Move :	UR Robot			@ ×
Main	Travel Speed	Pause While	Stop If	Offset
Define speed b	y			
Overall Perce	nt			^
Overall Perce	ent			0
Velocity, Acc	eleration			
Time to Com	pletion			
Range: 0.00-10	0.00 %			

Note: If you define motion by velocity, acceleration, deceleration, or time to completion and then import the task to another robot that doesn't support those parameters, the block may show an error until you correct and save the block.

The Pause While Tab

Set conditions that pause the block while all conditions are met or while any conditions are met. Enable the "**Pause block while conditions met**" toggle to use this feature. If this toggle is enabled, you must have conditions listed for the **ACCEPT** button to be available. Add conditions with the **ADD +** dropdown.

Absolute Move :	UR Robot				@ ×
Main	Travel Speed	Pause	While	Stop If	Offset
Pause block wi Block pauses v	hile conditions met				
All match		4.01			~
		ADI			
			Magnitud	e	
Force exceede	d at end of arm senso	or 📿	10		

Note: If you have a force sensor listed in the robot's configuration in Device Configuration, enable the "**Force exceeded at end of arm sensor**" toggle. In the **Magnitude** field, set the force threshold that would pause the block.

READY

The Stop If Tab

Set conditions that stop the block while all conditions are met or while any conditions are met. When this occurs, the task proceeds down the block's right path. Enable the "**Stop block and take right path if conditions met**" toggle to use this feature. If this toggle is enabled, you must have conditions listed for the **ACCEPT** button to be available. Add conditions with the **ADD +** dropdown.

Absolute Move :	UR Robot			@ ×
Main	Travel Speed	Pause While	Stop If	Offset
Stop block and Block stops wł	I take right path if con nen:	ditions met 🛛 🤜 📿		
All match				~
		ADD +		
		Magnitu	de	
				954

Note: If you have a force sensor listed in the robot's configuration in Device Configuration, enable the "**Force exceeded at end of arm sensor**" toggle. In the **Magnitude** field, set the force threshold that would stop the block.

The Offset Tab

Enable the Move to Offset toggle to offset the motion. An offset defines a relative position from the waypoint(s) to which the robot moves. Use the Frame dropdown to set the Frame in which the offset applies. Use the value fields to set the offset from the waypoint along the axes of that Frame.

ute Move :	UR Robot					C	D X
Main	Travel Speed	Paus	e While	•	Stop If	Offse	et
e to Offset	@						
ne							
							~
0		822	RX	Ö			T27
0		155	RY	Ö			782
0		222	RZ	0			122
	Main Main e to Offset ne D D O O	ute Move : UR Robot Main Travel Speed a to Offset Contraction a to Offset Contraction b 0 mm 0 mm	ute Move : UR Robot Main Travel Speed Paus a to Offset Contract Speed Paus a to Offset Paus a to O	ute Move : UR Robot Main Travel Speed Pause While a to Offset Contract Pause While a to Offset RX Pause While Pause While RX Pause While Pause While RX Pause While Pause While Pause While Pause While Pause While Pause While RX Pause Pause While Pause Pause While Pause Pause P	ute Move : UR Robot Main Travel Speed Pause While a to Offset D mm M2 RX D 0 mm M2 RX D 0 mm M2 RZ O	ute Move : UR Robot Main Travel Speed Pause While Stop If a to Offset D RX 0 0 mm 122 RY 0 0 mm 122 RY 0	ute Move : UR Robot (Main Travel Speed Pause While Stop If Offset a to Offset (D mm 122 RX 0 0 RX 0 0 0 mm 122 RY 0 0 RX 0 0

Robot I/O Blocks

The Check and Set blocks are the same as the Canvas Check and Set blocks, but the device is filtered to the robot device.

Check

See Canvas Blocks > Check.

Set

See Canvas Blocks > Set.

READY

Absolute Move Block

The Absolute Move block performs a motion to a single position defined by a waypoint.

In the **Main** tab, tap the **Waypoint selector** to create a new waypoint or choose an existing waypoint.

Tap **Linear Move** or **Joint Move** to select the motion that the robot performs to the waypoint.

- A Linear move tells the robot to take the shortest path to the programmed TCP pose. Depending on where the robot is moving from, several joint positions may be possible for the same TCP pose.
- To guarantee that the robot moves to the same joint positions every time, choose Joint.



UR Robot			@ ×
Travel Speed	Pause While	Stop If	Offset
nt-1			929
e 🔾 Joint Move			
	UR Robot Travel Speed	UR Robot Travel Speed Pause While	UR Robot Travel Speed Pause While Stop If

See Robot Command Blocks for more info on the other block features.

Relative Move Block

The Relative Move block performs a motion relative to the robot's position when the block executes. Because the motion is relative, the ending position depends on the starting position.

In the Main tab, tap Linear Target or Joint Target.



READY

- Linear lets you select a Frame and program a motion along and around the Frame's axes.
- Joint lets you program how far one or more joints rotate.

See <u>Robot Command Blocks</u> for more info on the other block features.



Circular Move Block

The Circular Move block performs an arc motion (with a constant radius) relative to the robot's position when the block executes.

In the **Main** tab, tap the **Intermediate Waypoint** and **End Waypoint** selectors to choose the waypoints that define those points on the arc.



Note: The block does not define a starting position, so the robot's position defines the arc when the block executes. The same block can execute different motions from different start positions.

The Intermediate Waypoint cannot be at the same location as the Start or the End Waypoint.

Note: Forge/OS calculates circular moves using the TCP. You can only select Linear waypoints. You cannot select Joint waypoints.





Use the **Tool Orientation Mode** dropdown to choose how the tool moves through the arc. **Align to End** moves the Tool Center Point (TCP) through the arc, so it finishes the motion in the exact orientation of the End Waypoint. **Maintain Tangency** keeps the TCP orientation relative to the arc center point the same as the start position. If you select Maintain Tangency, the TCP's orientation at the end may be different than the End Waypoint orientation.

See Robot Command Blocks for more info on the other block features.

Continuous Move Block

The Continuous Move block performs a fluid and unbroken motion through all the programmed positions and relative motions.

Use a Continuous Move to program a motion that requires more than one move type or multiple points to define the motion.

The **advantages** of using a Continuous Move are:

- A cleaner Canvas: Instead of a complex motion with 10 waypoints requiring 10 Absolute Move blocks, a single Continuous Move block can contain all 10 waypoints.
- Smoother and faster motion: The robot executes changes in direction more fluidly and doesn't need to come to a complete stop between targets.



Continuous Move : UR I	Robot			@ ×
Main	Travel Speed	Pause While	Stop	f
		Q	Reverse Order	ADD +
Target		Motion Type	Offset	
Waypoint-1		Linear		
Waypoint-2		Linear		
Waypoint-3		Joint		
Waypoint-4		Joint		
Waypoint-5		Linear		



In the **Main** tab, the **Target** table shows the list of positions and motions that the robot executes.

Tap **ADD** + to select a motion to add to the table.

From the dropdown, select an option.

Tip: To program Grid or Array Moves into a Continuous Move, look for the **Resolve** *Position to Waypoint* feature in those block descriptions.



Motion Type	Description
Absolute Move with New Waypoint	Create a new waypoint and add it to the table as an Absolute Move. Choose the motion type and set an offset.
Absolute Move with Existing Waypoint	Choose an existing waypoint and add it to the table as an Absolute Move. Choose the motion type and set an offset.
Relative Move	Program a relative motion using linear or joint values. The starting point of the relative motion is the previous position in the Target table.
Circular Move	Program a circular motion using an intermediate and end waypoint. The starting point of the circular motion is the position before it in the Target table.



After programming a motion, it appears in the table on the Main tab. Select a single target in the table to edit it or change its order using the **Up and Down arrows**.

To reverse the order of all targets, deselect all targets and tap **Reverse Order**. Use this when you want to duplicate and reverse a Continuous Move you programmed earlier.

1 item(s) selected	Duplicate Edit Delete Cancel
- Target	Motion Type Offset
Waypoint-1	Linear
Waypoint-2	Linear
Waypoint-3	Jaint
Waypoint-4	Joint
Waypoint-5	Linear

To edit a target, select it on the table and tap Edit. You may edit one target at a time.

To remove one or more targets from the Continuous Move, select them and tap **Delete**.

To duplicate a target in the Continuous Move, select that target in the table and tap Duplicate.

In the **Travel Speed** tab, **Motion Smoothing** defines how much the robot attempts to smooth the transition between the motions. A large blend radius creates a more fluid motion, but it increases the curving near targets. A small blend radius creates longer, more precise motions to each target before changing directions.

See <u>Robot Command Blocks</u> for more info on the other block features.

Grid Move Block

The Grid Move block creates a repeating pattern of positions that the robot moves to, one at a time. Each time the block executes, the robot moves to the next position in the grid and then continues to the next block. This continues until the robot has moved to all the positions (which prompts it to restart at the beginning of the grid).





In the **Main** tab, choose the grid type from the dropdown, either **Line** (one-dimensional) or **Plane** (two-dimensional).

For a linear grid, choose the start and end waypoints and the number of positions along the line. The block fills in intermediate positions with equal spacing.



For a planar grid, choose the three corner waypoints and the number of positions between corners 1 and 2, and corners 1 and 3. Use the grid visualization to make sure your corners are in the correct positions. By default, the robot moves first along the row from corner 1 to corner 2, then starts the next row.

	1 Contractor				Lana A
Main	Travel Speed	Pause While	Stop If	Offset	Grid Inde
hoose grid	d type				
Plane					~
		Corner 1 way	/point (Start)		
1	2	Select a val		¥7.e	
		Corner 2 way	ypoint		
		Select a val	lue		122
		Corner 3 way	ypoint		
3	4	Select a val	lue		122
s	paces along 1-2		Spac	ces along 1-3	
	3		3		



In the **Grid Index** tab, customize the indexing behavior of the Grid Move. The **Index Variable** field is where you choose an integer variable to decide which index the Grid Move moves to when it executes. When you use an index variable, your task must update the variable with other blocks.

Choose a waypoint in the **Resolve Grid Position to Waypoint** field to update that waypoint with the next grid position each time the block executes.

rid Move : U	R Robot		-	<i>.</i>	@ ×
Main	Travel Speed	Pause While	Stop If	Offset	Grid Index
Index variab	le 🔘 ×				
					327
Resolve Grid	Position to Wayp	oint			
Select a va	lue				825
Select a val	tom Brid Order				574
Luit the bus	toni ond order	CUSTOM	ORDER		
Edit the Cus	tom Grid Order	CUSTOM	ORDER		

Note: When there is a waypoint in the Resolve field, the grid block does **not** move the robot. It saves the chosen waypoint at that grid position. Then you may use this waypoint in other move blocks, like the Continuous Move. Execute the Grid Move block to update the waypoint with the next position in the grid.

Tap **CUSTOM ORDER** to set the order that the robot moves through the grid. Select a position coordinate on the table and use the up and down arrows to move it earlier or later in the sequence.

tem(s) selecte	d	Delete Duplicate Edit Cancel
Index	Corners 1-2	Corners 1-3
] 1	1	1
z	2	1 🗙 🛪
] 3	3	1
4	1	2
] 5	2	2
6	3	2
7	1	3
] 8	2	3
of 9		1 of 2 page(s) 😽 😽 📏

Modify Index	
Index	
2	
Corners 1-2	
2	
Corners 1-3	
1	
CANCEL	ACCEPT



Tap **Delete** at the top of the table to remove the selected position from the sequence.

Tap **Duplicate** to copy the selected position.

Tap Edit to enter a new row or column coordinate.

To add a new index, tap **ADD +**. Enter the Index and the row and column coordinates. By default, the Index field fills in as one integer value larger than the last table entry. If you type in a smaller value, the new entry is added at that order of the sequence. The existing position that used to have that index (and everything after it) are pushed down.

To undo your re-ordering, deletion, duplication, and coordinate changes, select none of the positions and tap **Reset** at the top of the table.

See Robot Command Blocks for more info on the other block features.

Array Move Block

The Array Move specifies a custom list of waypoints that the robot moves to, one at a time, each time the block executes.



In the **Main** tab, the Target table shows the list of targets that the robot moves to during the Array Move. The order that the robot visits these targets is the order they appear in the table. After the robot has moved through all the positions, it starts over from the top.

Tap **ADD** + to select a waypoint to add to the table. From the dropdown, select a new or existing waypoint.

ay Move :	UR Robot					@ ×
Main	Travel Speed	Pause While	Stop If	Offs	et Arr	ay Index
				Q Re	verse Order	ADD +
Targ	et		Motio	in Type		
Way	point-1		Linea			
Way	point-2		Linea	r		
Way	point-3		Joint			



In the **Array Index** tab, customize the indexing behavior. The **Index Variable** field is where you choose an integer variable to decide which index the Array Move moves to when it executes. When you use an index variable, your task must update the variable with other blocks.

Choose a waypoint in the **Resolve Array Position to Waypoint** field to update that waypoint with the next array position each time the block executes.

and the second second	RRODOL				(?) X
Main	Travel Speed	Pause While	Stop If	Offset	Array Index
Index variable	2 🔘 ×				
					I.12
Resolve Array	Position to Way	point			
Select a valu	ie				858

Note: When there is a waypoint in the Resolve field, the Array block does **not** move the robot. It saves the chosen waypoint at the grid position. Then you may use this waypoint in other move blocks, like the Continuous Move. Execute the Array Move block to update the waypoint with the next position in the list.

See Robot Command Blocks for more info on the other block features.

Set TCP/Payload Block

The TCP/Payload block sets the robot's Active Tool Center Point (TCP) and Active Payload. While the task is running, the Active TCP and Payload stay as the values set until another TCP/Payload block is executed.

Note: First add the TCPs and Payloads to a robot's configuration in Device Configuration.





3 X

When you add a TCP/Payload block, choose whether or not to change the Active TCP and/ or Active Payload.

Check the box labeled "**Do not update**" to maintain the active TCP or Payload at the time when the block executes.

Use the dropdown menus to select the configured TCP and/or Payload you want the block to make active.

	~
Do not update	
Active Payload	
	~
Uo not update	
VPayload : UR10	0
Set the Active Tool Center Point and Payload for robot motion.	
Active TCP	
Active TCP	~

Important: When executing waypoint motion blocks, the **Active TCP** on the robot should match the TCP defined for that waypoint. If not, the position the robot moves to won't match the expected position. Use the TCP/Payload block in a task to update the Active TCP before moving to that waypoint.

Gripper

TCP/Payload : UR10

Important: The *Active Payload* instructs the robot to account for the amount of inertia at the end-of-arm when it is moving. A mismatch between the expected payload (Active Payload) and actual payload at the end-of-arm can cause errors. Use the TCP/Payload block in a task to update the Active Payload when the actual payload at the end-of-arm changes. For example, change the payload after picking up or putting down a part or a tool.



Forge/Ctrl Blocks

The Forge/Ctrl includes an internal PLC for Digital I/O control. The Check and Set blocks are the same as the Canvas Check and Set blocks, but the device is filtered to the Forge/Ctrl.

Check

See Canvas Blocks > Check.

Set

See Canvas Blocks > Set.

Network I/O Device Blocks

Add network-based Fieldbus devices to check and set I/O device states. These blocks work the same as Canvas Check and Set blocks, but the device is filtered to the Fieldbus device.

Check

See Canvas Blocks > Check.

Set

See Canvas Blocks > Set.

Serial Device Blocks

Add serial Fieldbus devices to check and set I/O device states and sensors. These blocks work the same as Canvas Check and Set blocks, but the device is filtered to the serial device.

Check

See Canvas Blocks > Check.

Set

See <u>Canvas Blocks > Set</u>.



Smart Gripper Blocks

The Smart Gripper blocks include **Close Gripper, Open Gripper, Check Part Present**, and **Granular Control**.



The **Close Gripper** block closes the smart gripper fully. The **Open Gripper** block opens the gripper fully. In each block, the **Wait for gripper to finish** checkbox adds a delay so the gripper can fully open or close before moving on.



Note: Make sure you add the proper delay to gripper in Device Configuration and check the wait box in the gripper block. Without the added delay, the task could move on or finish before the gripper completes its action.



The **Check Part Present** block acts as a Check block, but you don't have to edit any parameters. It checks the force exerted by the gripper to see if it is holding a part.

- If a part is present, the task continues on the bottom path.
- If a part is not present, the task continues on the right path.

The **Granular Control** block sets the gripper to a specified position with your chosen velocity and force. To create a Granular Control block, enter a number between 0-100 (%) in the **Position** field. Then enter numbers between 0-100 (%) in the **Velocity** and **Force** fields.

Select the **Wait for gripper to finish action** checkbox to make sure the task doesn't move on until after the gripper moves to the position you chose.

Use the **TRY IT OUT** section to preview the action. Tap **MOVE TO** to move the gripper to the chosen position. Tap **RESET POSITION** to move the gripper to the position it was in when you opened the block.

C Gri Par	otio adaptive gr pper Check rt Present	+	Part not Present
+ P:	art Present		

ranular Control : Robotiq Adaptive Gripper		2
Gripper Parameters		
Position (Closed = 100%)		
100		
Velocity		
60		
Force		
50		
TRY IT OUT		
TRY IT OUT	RESET POSITION	



Force Sensor Blocks

The Force Sensor blocks include Check and Zero Sensor. The Check block is the same as the Canvas Check block, but the device is filtered to the Force Sensor. See <u>Canvas Blocks > Check</u>.

Note: To use force in a move block, add a force sensor to the robot in Device Configuration, then find the **Force** tab in a move block (see <u>Robot Command Blocks</u>).

Zero Sensor Block

The Zero Sensor block zeroes or biases the sensor when it executes. There are no editable settings.



Clamping Gripper Command Blocks

The Clamping Gripper blocks include **Close Gripper**, **Open Gripper**, and **Relax Gripper**.





Enable delay to wait for the time specified in the device configuration before the task moves on.

Delay after gripper is opened

Note: Make sure you add the proper delay to gripper in Device Configuration and check the wait box in the gripper block. Without the added delay, the task could move on or finish before the gripper completes its action.

Lifting Gripper Command Blocks

The Lifting Gripper blocks include **Grab Part** and **Release Part**.



Enable delay to wait for the time specified in the device configuration before the task moves on.



Note: Make sure you add the proper delay to gripper in Device Configuration and check the wait box in the gripper block. Without the added delay, the task could move on or finish before the gripper completes its action.



Generic IO Device Blocks

The Generic IO Device blocks include menus for calling that device's **Output Functions** and **Input Functions**.



Button Presser Blocks

The Button Presser blocks include **Press Button** and **Release Button**.



Enable delay to wait for the time specified in the device configuration before the task moves on.



Note: Make sure you add the proper delay to gripper in Device Configuration and check the wait box in the gripper block. Without the added delay, the task could move on or finish before the gripper completes its action.


Pedal Presser Blocks

The Pedal Presser blocks include **Press Pedal**, **Release Pedal**, and **Relax Pedal**.



Enable delay to wait for the time specified in the device configuration before the task moves on.

Delay after pedal is pressed

Note: Make sure you add the proper delay to gripper in Device Configuration and check the wait box in the gripper block. Without the added delay, the task could move on or finish before the gripper completes its action.



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



