SOFT ROBOTICS DEVELOPMENT KIT - UR+

USER MANUAL

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P/N 200195 (Rev C)

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1: INTRODUCTION

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1A: DEFINITIONS

SAFETY CLASSIFICATIONS

This chapter provides important instructions for your safety. Thoroughly read and follow these instructions as they are intended to prevent a hazardous situation and/or equipment damage.

These instructions indicate the level of potential hazard by symbols in conjunction with labels of "WARNING", "CAUTION", "NOTICE", or "IMPORTANT". See below for explanations of each symbol/label pairing:

LABEL	MEANING OF LABEL
	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.
	NOTICE indicates a potentially harmful situation which, if not avoided, may result in damage of the product itself or of adjacent objects.
	IMPORTANT indicates useful hints or other special information which, if not observed, could lead to a decline in operating convenience or affect the functionality. (Does not indicate a dangerous or harmful situation.)

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GENERAL SAFETY INSTRUCTIONS

	WARNING
①	The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or determines its specifications. Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analyses and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest available information with a view to giving due consideration to any possibility of equipment failure when configuring a system.
②	Only trained personnel should operate pneumatically operated equipment. A. Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators. B. Never apply compressed air directly to the human body.
③	Do not service product or attempt to remove components until safety is confirmed. A. Inspection and maintenance of product should only be performed once safety of personnel and equipment is confirmed. B. When product is to be uninstalled, first stop supplied air, exhaust the residual pressure, verify the release of air, turn the power off and confirm safety before proceeding. C. Before product is reinstalled and/or restarted, ensure safety before applying power.
④	Contact SOFT ROBOTICS, INC. before the product is used in any of the following conditions: A. Conditions and environments beyond the given specifications, or if product is used outdoors. B. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, recreation equipment, emergency stop circuits, clutch and brake circuit in press applications, or safety equipment. C. An application which has the possibility of having negative effects on people, property, or animals requiring special safety analysis.
⑤	Any customer changes or modifications to the device are strictly prohibited!
⑥	Observe the common standards and safety regulations for the installation and operation of electrical systems.
⑦	When connecting the device, observe all electrical specifications in these operating instructions or in the data sheet.

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1B: INTENDED USE

1. The SOFT ROBOTICS DEVELOPMENT KIT UR+ (SRDK-UR+) comprises the MINI SOFT ROBOTICS CONTROL UNIT (SRCU-Mini) and SOFT ROBOTICS DEVELOPMENT KIT (SRDK). These components are intended to be interfaced with a UNIVERSAL ROBOT Control System and Arm and be permanently integrated into a piece of automation machinery that operates in an indoor laboratory or light-industrial environment.
2. The SRDK-UR+ is intended only to be used in conjunction with a UNIVERSAL ROBOT Control System. A system that incorporates the SRDK-UR+ will typically be used to grasp and manipulate objects.
3. The SRDK-UR+ is intended to be installed, operated, and serviced in environments that are categorized as DRY LOCATIONS and those classified as POLLUTION DEGREE 2. The SRDK-UR+ is intended to meet an ingress protection rating of IP40 per IEC 60529 Edition 2.2.
4. The SRDK-UR+ is intended to be installed, configured, and serviced by trained professionals certified to perform such activities in the installed jurisdiction.
5. The SRDK-UR+ is intended to be physically mounted to a permanent structure using appropriate fasteners.
6. The SRDK-UR+ is not intended to be used to pressurize or evacuate air from rigid pressure vessels or control pneumatic actuators that are unspecified by SOFT ROBOTICS.
7. The SRDK-UR+ is not intended to be used in any outdoor or otherwise unspecified indoor environment.

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1C: MANUFACTURER'S INFORMATION

CONTACT INFORMATION

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P: +1 (617) 391-0612
E: support@softroboticsinc.com

REGULATORY COMPLIANCE INFORMATION

CE COMPLIANCE

We declare that we are the manufacturer of the MINI SOFT ROBOTICS CONTROL UNIT UR+ (SRCU-Mini UR+) and that the product conforms with the EMC Directive (2014/30/EU) and the Low-Voltage Directive (2014/35/EU) and meets the requirements of the following standards:

EN61326-1:2013	Electrical equipment for measurement, control and laboratory use – EMC requirements - Part 1: General requirements	
	EN 61000-4-2	ESD Immunity – 4 kV contact discharge / 8 kV air discharge
	EN 61000-4-3	Radiated Immunity – 10 V/m @ 80 MHz-1000 MHz Radiated Immunity - 3/1 V/m @ 1.4-2.7 GHz
	EN 61000-4-4	Fast Transient Immunity – 0.5 kV
	EN 61000-4-6	Conducted Immunity – 3 V @ 0.15 MHz-80 MHz
	CISPR 11	Radiated Emissions – 30 MHz-1000 MHz
IEC 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements	

The MINI SOFT ROBOTICS CONTROL UNIT UR+ is designed to be incorporated into process and factory automation systems and thus is a permanently installed part of a large fixed-location industrial tool or installation thereby exempted from EC directive on the Restriction of Hazardous Substances (RoHS) in Electrical and Electronic Equipment (2011/65 EC) by Article 2, Sections (c), (d), and (e).

The MINI SOFT ROBOTICS CONTROL UNIT UR+ complies with the EC directive for CE conformity certification.

FCC COMPLIANCE

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1D: SHIPPING CONTENTS

- Soft Robotics Mini Control Unit UR+ (SRCU-Mini UR+)
- 12mm tubing (2 meter length)
- 10mm tubing (2 meter length)
- 10-12mm push to connect coupler
- (6) 6mm tubing
- 7mm ratchet wrench
- 7mm nut driver
- Tool Center Point (TCP)
- (2) 10mm plugs
- (6) 6mm plugs
- 10mm Pneumatic tubing elbow union
- 12mm Pneumatic tubing elbow union
- USB Drive
- USB cable
- Assorted mounting hardware
- Pre-configured 6 finger gripper (with 4 accordion fingers) mounted on universal mounting plate and 6 position tool hub
- Pneumatic manifold
- Alternate air manifold with multiple ports
- 4 position tool hub
- 5 position tool hub
- 2.5mm, 3.0mm, and 4mm Metric hex screwdriver
- T20 Torx Screwdriver
- Precision Screwdriver
- (6) 3 accordion fingers
- (6) 2 accordion fingers
- IO Cable
- Power Cable

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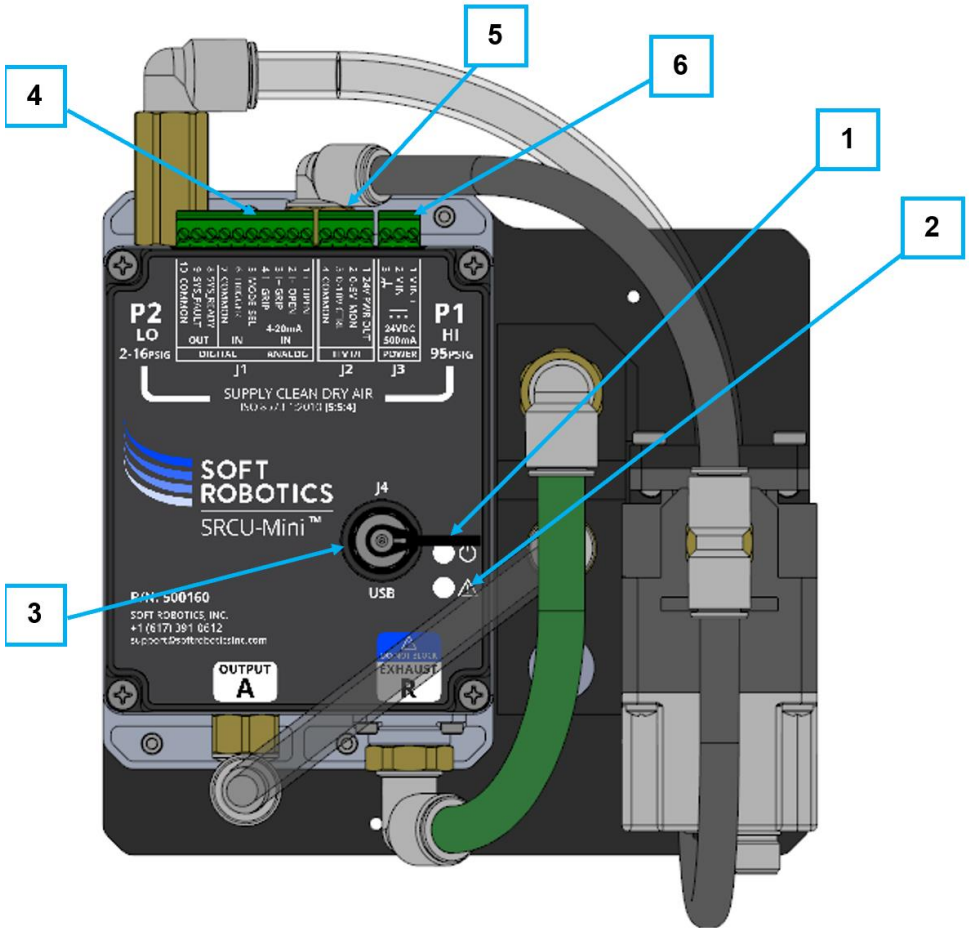
1E: PRODUCT OVERVIEW

FRONT PANEL VIEW



#	DESCRIPTION
1	POWER INDICATOR, LIGHT-EMITTING DIODE, GREEN
2	FAULT INDICATOR, LIGHT-EMITTING DIODE, AMBER
3	USB CONNECTOR – J4
4	10-POSITION TERMINAL BLOCK – ANALOG AND DIGITAL I/O – J1
5	4-POSITION TERMINAL BLOCK – ITV 2030 TRANSDUCER I/F – J2
6	3-POSITION TERMINAL BLOCK – POWER SUPPLY INPUT – J3

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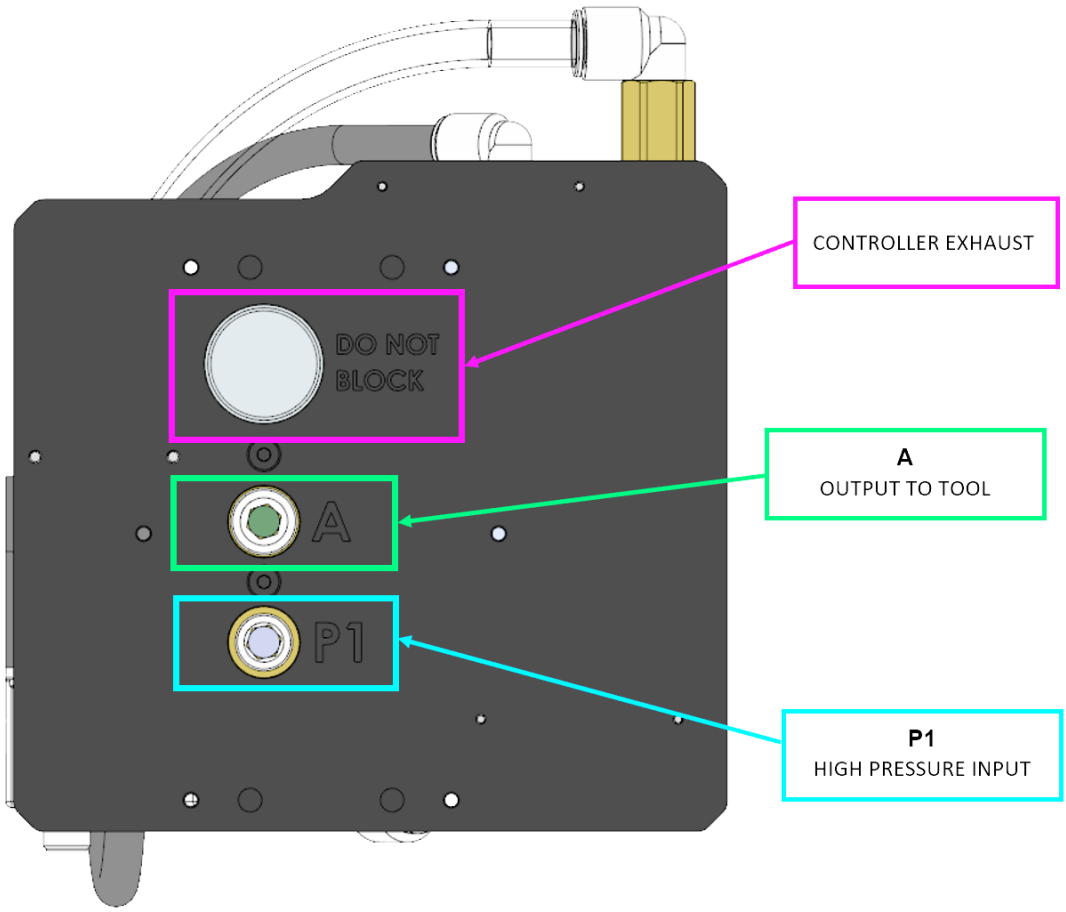
PNEUMATICS OVERVIEW



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ENVIRONMENTAL CONDITIONS

CONDITION	VALUE
LOCATION	INDOOR USE ONLY, DRY LOCATION
POLLUTION DEGREE	POLLUTION DEGREE 2
ALTITUDE	<= 2000m ABOVE MEAN SEA LEVEL
TEMPERATURE	5˚C – 40˚C
HUMIDITY	<= 80% RH (NON-CONDENSING)
OVERVOLTAGE CATEGORY	OVERVOLTAGE CATEGORY II
INGRESS PROTECTION RATING	IP40 (PER IEC 60529 REVISION 2.2)

BASIC SPECIFICATIONS

DESCRIPTION	VALUE
ENCLOSURE MATERIAL	ALUMINUM AND UL94V-0 PLASTIC
PRODUCT DIMENSIONS	21.2 cm (L) x 18.7 cm (W) x 12.5 cm (H)
PRODUCT WEIGHT	2.75 Kg
INPUT AIR PRESSURE	95 PSIG RECOMMENDED, 85-100 PSIG @ 2-8 CFM
INPUT AIR QUALITY	ISO 8573-1:2010 [5:5:4]
INPUT AIR FITTING	10MM PUSH TO CONNECT TUBE FITTING
OUTPUT TOOL PRESSURE	-10 PSIG TO 14 PSIG NOMINAL
OUTPUT AIR FITTING	12MM PUSH TO CONNECT TUBE FITTING
TOOL ACTUATION TIME	TGRASP < 125 MS / TRELEASE < 250 MS (2-FINGER TOOL)
TYPICAL TOOL CYCLIC RATE	UP TO 3.0 HZ (2-FINGER TOOL)
INPUT ELECTRICAL POWER	24 VDC +/- 10% @ 0.5A MAX.
INPUT ANALOG SIGNALS	4-20 MA @ 24 VDC NOMINAL LOOP SUPPLY
INPUT DIGITAL SIGNALS	24 VDC TOLERANT, OPTO-ISOLATED
OUTPUT DIGITAL SIGNALS	24 VDC TOLERANT, OPTO-ISOLATED, 10 MA MAXIMUM LOAD
OUTPUT ACOUSTIC NOISE	<80 DBA (W/ PROVIDED SILENCER INSTALLED)
COMMUNICATIONS PROTOCOL	USB 1.1
EXPECTED SERVICE LIFE	5 YEARS (EXCLUDING VALVES)
VALVE CYCLE ENDURANCE	>20M (WHEN COMPLIANT WITH RECOMMENDED AIR QUALITY SPECIFICATION)

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2. CREATE

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2A: SRDK TERMINOLOGY

To make the most of the SRDK it is necessary to understand how to best use the different components, what the different components are called, and how to accurately adjust the spacing of the SRDK. Below is a list of key terms and componentry;

- **Tool Hubs**: The following mounting plates are provided with the SRDK; 4 Position Tool Hub, 5 Position Tool Hub, and 6 Position Tool Hub.
- **Finger Modules**: Comprised of the **Finger**, **Pneumatic Module**, and **Mounting Bracket**
- **Finger**: Comes in three sizes; 4 accordion, 3 accordion, and 2 accordion
- **Extrusion Rail**: Provides a place for the **Finger Modules** to attach and to accurately adjust **Finger** spacing
- **Pneumatic Module**: Provides support and air supply to the **Finger**
- **Pneumatic Manifolds**: Mountable pneumatic device that distributes the application airline to the **Finger Modules**
- **Mounting Bracket**: Enables the entire **Finger Module** to be attached to the **Extrusion Rail**
- **Measurement Edge**: The long edge of the **Mounting Bracket** used to accurately position the **Finger Modules**
- **Rail Screw**: The screw at the top of the **Mounting Bracket** that secures it in place on the **Extrusion Rail**
- **In Configuration**: The **Rail Screw** is not above the **Finger** accordions allowing for the widest finger tip to finger tip spacing
- **Out Configuration**: The **Rail Screw** is above the **Finger's** accordions allowing for the closest finger tip to finger tip spacing

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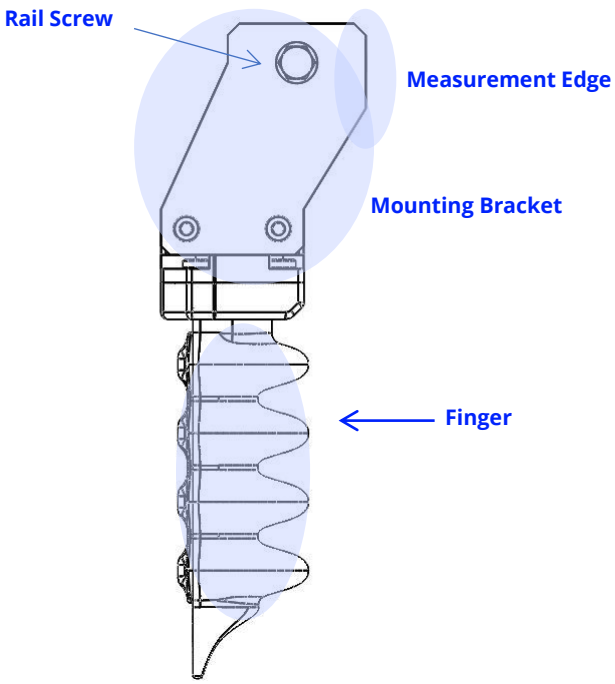

FIGURE 1
FINGER MODULE

The Mounting Bracket direction is defined by the orientation of the **Rail Screw**. The two directions are **Out Configuration** and **In Configuration**. The Mounting Bracket is configured in the **Out Configuration** when the **Rail Screw** is aligned with the **Finger** accordions and the **Finger Modules** can be spaced in the closest configuration from the perspective of the fingertip to tip spacing. The Mounting Bracket is configured in the **In Configuration** when the **Rail Screw** is not aligned with the finger accordions and the **Finger Modules** can be spaced in the widest configuration from the perspective of the fingertip to tip spacing. Examples of these two configurations are illustrated below in **Figures 2 and 3.**

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FIGURE 2
OUT CONFIGURATION

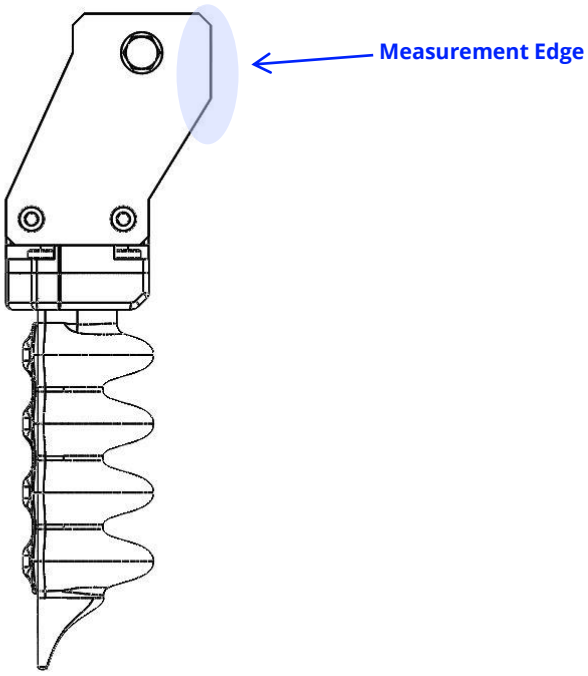
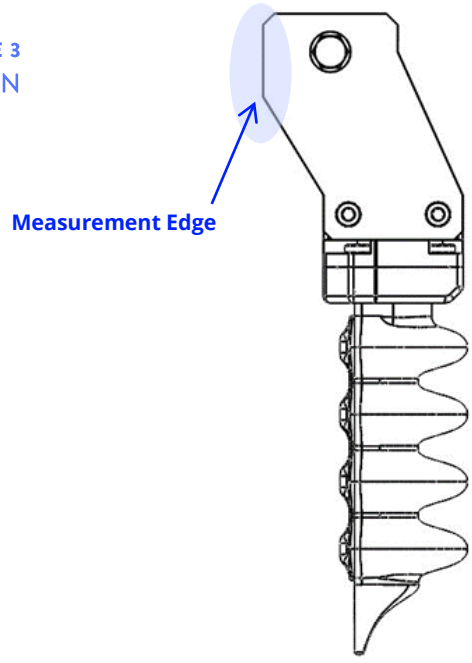


FIGURE 3
IN CONFIGURATION



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2B: APPLICATION BEST PRACTICES

When conducting application testing with an SRDK, the first step is to configure the SRDK into an End of Arm Tool, or EOAT, that grasps the product that will be used in the testing. To do this, the following four questions need to be answered;

- How many Finger Modules should be used for this application?
- How should the Finger Modules be arranged in relation to each other?
- What size Finger best suits my application?
- What Finger spacing should be used?

HOW MANY FINGER MODULES SHOULD I USE?

The number of Finger Modules necessary for the application depends on the size, shape, structural integrity, and mass of the product. With smaller products, two Finger Modules will usually be most effective, but as the size of the product grows more Finger Modules may be necessary to support the product. A pen is a great example of a smaller product that would require a 2 Finger Module EOAT. Where as in the case of a bagel, a 4 or 5 Finger Module EOAT is more appropriate.

Whether the shape of the product resembles a square, circle, rectangle, or ellipse will change the number of Finger Modules required for the application. If a product has more of a square or circular form factor an EOAT with between 2 and 5 Finger Modules would be most effective. Where a product that has more of a rectangular or elliptical form factor would require between 4 and 6 Finger Modules.

The structural integrity of the product affects the necessary number of Finger Modules by dictating how strong of a grip strength can be employed. Products such as a pen or a dinner roll have enough structure to support their own weight when grasped and will not collapse when gripped. These products would require fewer Finger Modules compared to a bag of pretzels, which would require more Finger Modules to support the collapsible structure of the bagged item.

The mass of the product also contributes to the number of Finger Modules needed for the application. If a product has a lower mass, fewer Finger Modules can be used. As the mass of the product increases, the number of Finger Modules may also need to increase to support the product.

HOW SHOULD THE FINGER MODULES BE ARRANGED?

The arrangement of the Finger Modules in relation to one another, or geometric configuration, depends on the shape of the product. Typically, products that are similar to a circle or sphere require a circular geometric configuration. Products with a square or rectangular shape require a rectangular or opposing geometric configuration.

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WHAT LENGTH FINGER SHOULD I USE?

There are three different length fingers available for our products, as depicted below in **Figure 4**, 4 accordion, 3 accordion, and 2 accordion.

FIGURE 4: FINGER SIZES

The major difference between the 4 accordion, 3 accordion, and 2 accordion finger is the amount of "wobble" in high speed applications, their grip force, product size capacity, and curvature during actuation.

Finger "wobble" is the fingers shaking or oscillating at high speed. The large fingers have the most "wobble" during high speed applications. As the length of the finger decreases so does the amount of "wobble". Finger "wobble" can be mitigated through two methods; a smaller finger size can be selected or in cases where the longer fingers are necessary due to the size or shape of the product the finger "wobble" can be partially tuned out by adjusting the acceleration and jerk of the robot motion.

The grip force that each finger size can achieve increases as the finger size decreases. If a larger amount of force is required, then a smaller finger length would be best.

The size of the product will also dictate the appropriate finger length. In many cases, larger products will not be able to be picked by the smallest fingers because they may be too short to achieve a quality grasp.

The longer the finger is, the more curvature the fingers exhibit during actuation This can be advantageous or a detriment based on the application. With an object that is more fragile, the curvature could end up contacting the product such that the fingertip ends up pushing into the product and possibly causing the tip to "knife" or "cut" into the product. The spacing of the gripper in some applications can also minimize the "knifing" effect of the curvature by spacing the fingers closer together so that the fingertips contact the product surface on the flats of the fingertip. As the length decreases, the fingers are able to curve less, which makes the smallest finger the most paddle like.

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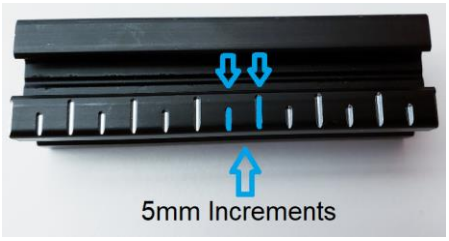
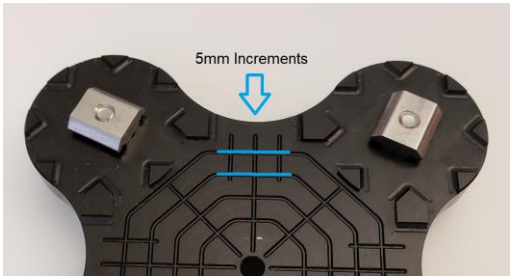
WHAT FINGER SPACING SHOULD I USE?

The optimal fingertip to fingertip spacing (in a rectangular geometric configuration) and fingertip to centerline spacing (in a circular geometric configuration) can be very important when conducting testing for an application. When the fingers are in the "neutral" state (no pressure or vacuum), the fingers will naturally hang straight down from the manifold. With the fingers in the "neutral" state, adjust the spacing of the fingers to roughly the same size as the product to be picked. During testing, the finger spacing may need to be moved in or out from this starting point, but in most cases, this will be the optimal spacing for the product. Some products based on the overall shape may require the fingers to be moved inward of the "neutral" spacing to achieve a more paddle like grasp interaction between the flat of the fingertips and the product. Other products may need the finger spacing to be moved out from the "neutral" spacing to accommodate a curved shape or to allow for the finger tips to wrap underneath the product.

2C: ASSEMBLY

When reconfiguring the SRDK, there are a few guidelines to follow. First, the **Overall Symmetry** of the SRDK configuration should be symmetrical about the center point or center line of the EOAT, based on whether the gripper is in a circular or parallel configuration. To better achieve this the markings on the Tool Hubs should be used to align the inside edge of the extrusion to known positions. The 4 finger and 5 finger Tool Hub markings are spaced in increments of 5 mm and the 6 finger Tool Hub starts close to the center with 2.5 mm increments and increases to 5 mm increments. The **Measurement Edge** of the Mounting Bracket should be aligned to the markings on the extrusion as much as possible to aid in the determination of the tip to tip finger spacing.

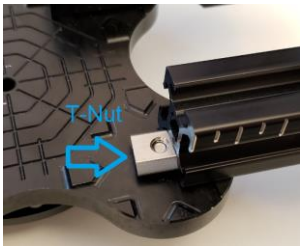




2D: RECONFIGURATION

The SRDK comes with a 6 finger EOAT that is preconfigured. In order to change the existing configuration, or to use a different Tool Hub, you will need to locate and use the tools provided in the kit.

1. To remove or rotate the finger modules w/rails that are attached to the mounting plate, use a 2.5mm hex driver to slightly loosen the screw on the top side of the mounting plate (shown left). This will allow the rail to move freely for disassembly, adjustment, or rotation.
   a. If adjusting or rotating, re-tighten screw once repositioned.
   b. If removing and moving to a different tool plate, be sure to loosen screw on plate you are changing to, align the open slot in the rail with the T-nut, slide on, and tighten screw once positioned.



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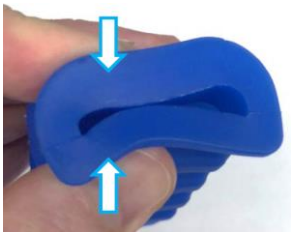
2. To adjust the position of the finger module on the rail, use your 7mm nut driver or hex wrench (depending on accessibility) to slightly loosen rail screw on either side of rail. Slide forwards or backwards to needed position. Once repositioned, tighten rail screws.

3. To swap fingers, start by loosening the 4 socket head cap screws on top of the finger module using your 2.5mm hex driver. Gently pull top module apart from the bottom taking care to not lose any of the screws. Pinch the top of the finger closest to the mounting bracket and pull downward. To insert a new finger, pinch one side of the top of a finger and insert one side at a time until finger is captured in bracket. Re-insert top bracket and tighten the 4 screws to create a strong pneumatic seal.

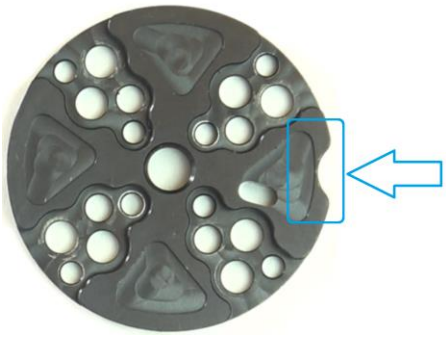


2E: PNEUMATIC ROUTING

When connecting the Pneumatic Manifold to the Pneumatic Module the appropriate air tubing length should be considered. The orientation of any air tubing should not interfere with the actuation of the EOAT. Similar length air tubing should be used to feed the Finger Modules from the Pneumatic Manifold. This will assure actuation symmetry.

2F: MOUNTING METHODOLOGY

The Universal Mounting Plate has “ISO” bolt circles; 20, 31.5, 40, 50, and 56 mm. The plate contains an indentation to provide a positive alignment feature for the orientation of the gripper. The indentation should be aligned such that when mounted to the robot it minimizes the need to program the rotation of the gripper for the specific product. This means that a gripper that is configured for a longer product would align the indentation to the either side of the gripper to minimize the need to adjust the rotation of the gripper when picking the product.



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3: CONNECT

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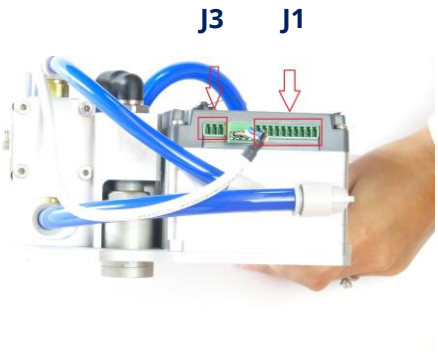
3A: PREP THE SRCU-MINI UR+



1. Install cable harnesses into SRCU-Mini UR+ controller. “J3” is the power cable, and “J1” is IO. See Section 1E: Product Overview for additional depiction of the SRCU-Mini UR+.

3B: INSTALL THE SRCU-MINI UR+ INTO THE UNIVERSAL ROBOT CONTROLLER

1. Open cabinet with UR Controller Key

2. Remove bottom access panel from UR Controller using T20 Torx Driver

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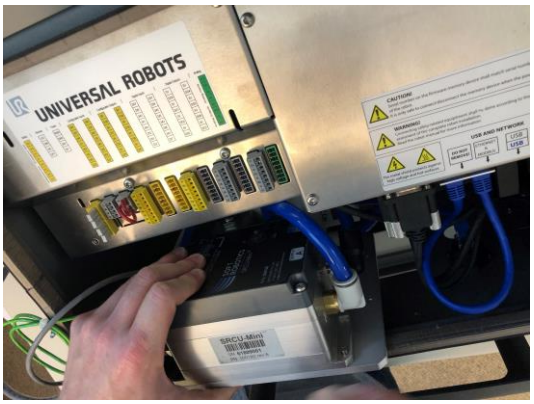
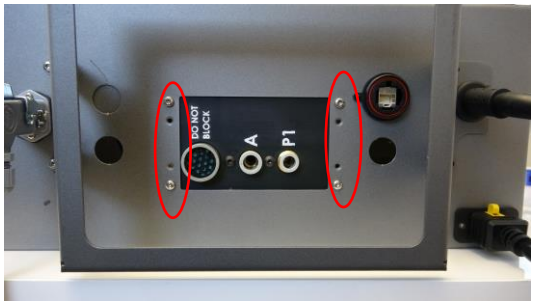


3. Carefully insert the SRCU-Mini UR+ so as to not damage pneumatic fittings or any electrical connectors. Orientation for insertion is referenced in above photos.



4. Re-use the UR Controller Cabinet access panel screws to mount the SRCU-Mini UR+ to the cabinet. Please note, depending on your Universal Robot series, your access panel may have (8) or (6) holes.

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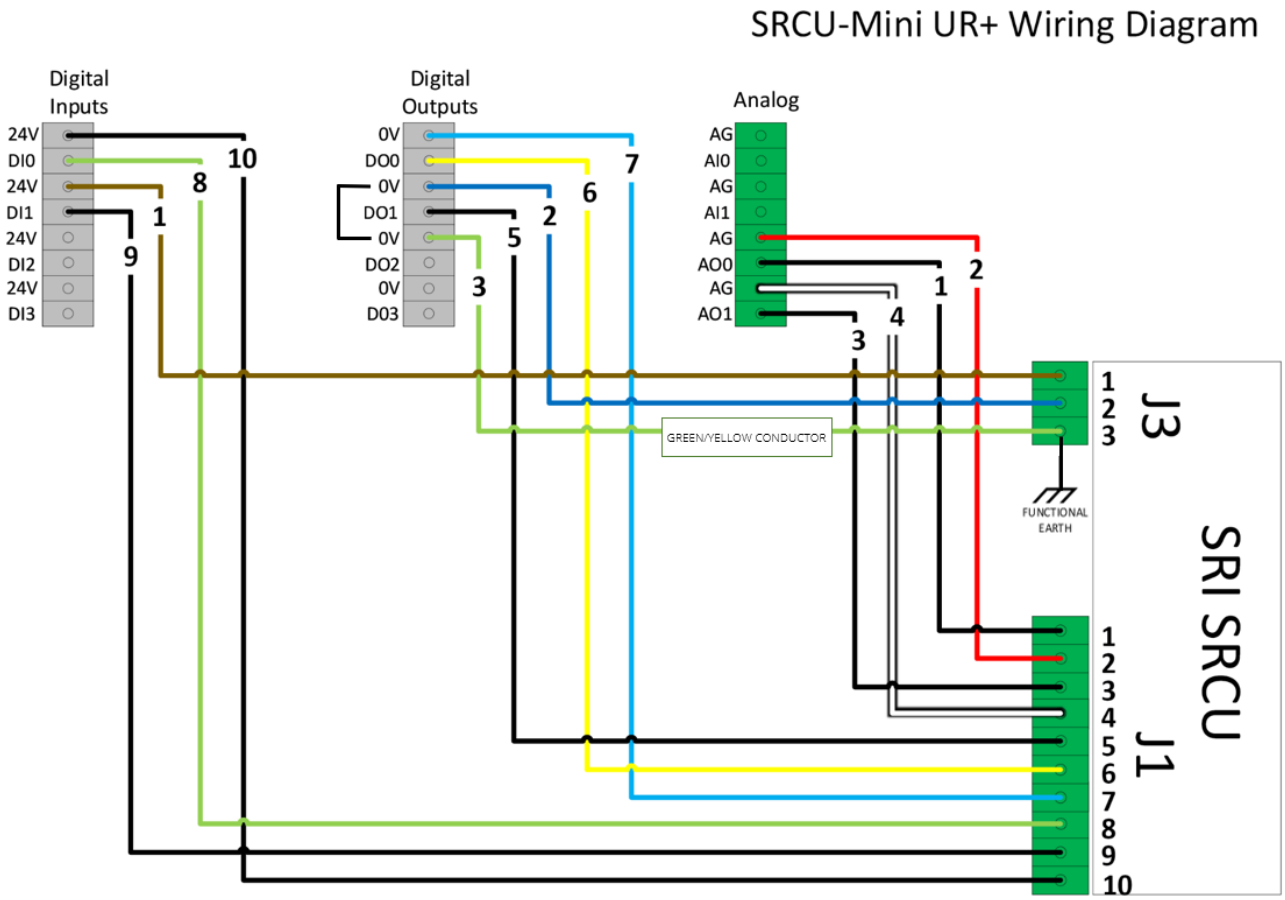
3C: CONNECT THE SRCU-MINI UR+ TO UNIVERSAL ROBOT CONTROLLER

1. Remove Universal Robot Controller Terminals “Analog”, “Digital Inputs” and “Digital Outputs”, that correspond with below wiring diagram, from the Universal Robot Controller.

2. Install SRCU-Mini UR+ harnesses (above) according to wiring diagram (below) for each UR Controller terminal strip. Secure wires after insertion using Precision Screwdriver.



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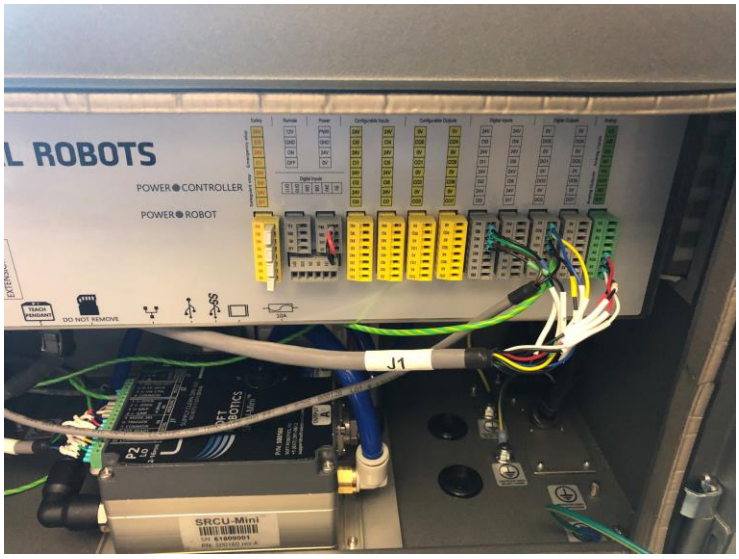

3. Reconnect terminal strips to appropriate locations on Universal Robot Controller.

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3D: CONNECT SRDK – UR+ TOOL AND SUPPLY AIR

STEPS FOR PLUMBING SRCU-MINI UR+

WARNING – DO NOT CONNECT ANY RIGID PRESSURE VESSEL OR UNSPECIFIED PNEUMATIC ACTUATOR TO THE SOFT ROBOTICS DEVELOPMENT KIT UR+.

WARNING – THE COMPRESSED AIR SUPPLY USED TO FEED THE SOFT ROBOTICS DEVELOPMENT KIT UR+ SHOULD BE NOMINALLY 95 PSIG AND SHALL NOT UNDER ANY CIRCUMSTANCE EXCEED 100 PSIG.

CAUTION – SOUND LEVEL FROM EXHAUST PORT 'R' WILL BE LESS THAN 80 dBA WITH PROVIDED SILENCER INSTALLED. IF SILENCER IS REMOVED OR ALTERED, SOUND LEVEL MAY EXCEED 80 dBA AND MAY PRESENT A HEARING HAZARD WITH PROLONGED EXPOSURE.

NOTICE – THE COMPRESSED AIR SUPPLY USED TO FEED THE PRODUCT SHOULD BE COMPLIANT WITH ISO 8573-1:2010 [5:5:4]. FOR FURTHER GUIDANCE, PLEASE SEE SOFT ROBOTICS APPLICATION NOTE AN001 *"ENSURING AIR QUALITY IN SYSTEM DESIGN"*.

NOTICE – DO NOT BLOCK EXHAUST PORT R OR DAMAGE TO PRODUCT MAY RESULT.

INFORMATION – FOR BEST PERFORMANCE LIMIT TOTAL OUTPUT TUBE LENGTH TO 260cm. EXCEEDING THE RECOMMENDED MAXIMUM LENGTH MAY RESULT IN SLUGGISH OR INCONSISTENT TOOL OPERATION.

INFORMATION – IF A TUBING REDUCER IS REQUIRED TO CONNECT TO A SOFT ROBOTICS SPECIFIED TOOL, OPTIMAL PERFORMANCE WILL BE OBTAINED BY PLACING REDUCER AS CLOSE AS PRACTICAL TO THE TOOL.

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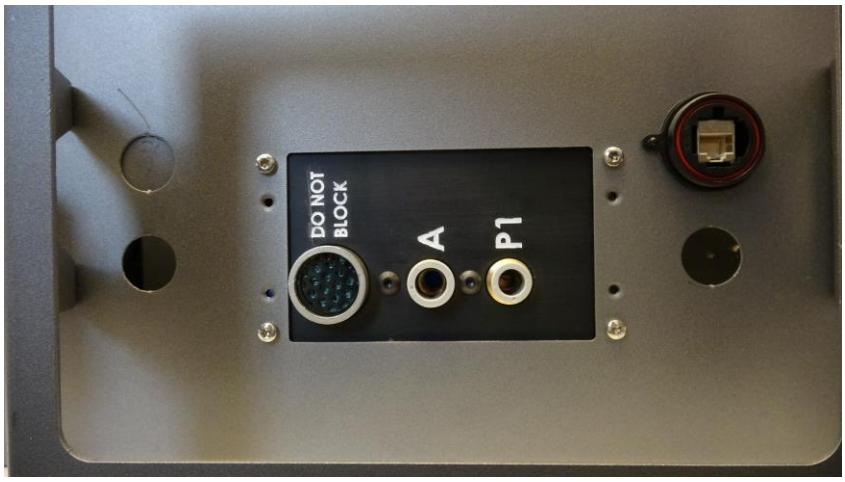

1. Cut and connect ~50mm of the provided 10mm and 12mm tubing to the exposed SRCU-Mini UR+ fittings. 10mm tubing connects to "**P1"** and 12mm tubing connects to "**A**." Ensure tubing is secure in ports.

2. Use the provided 10mm and 12mm elbow fittings to connect to the other end of each ~50mm long piece of tubing.

3. Connect clean, dry, compressed air to port "**P1**" with 10mm tubing at ~95psi. Ensure air quality meets ISO 8573-1:2010 specifications, a filter is required. *please refer to Soft Robotics Air Quality Note for full requirements and details

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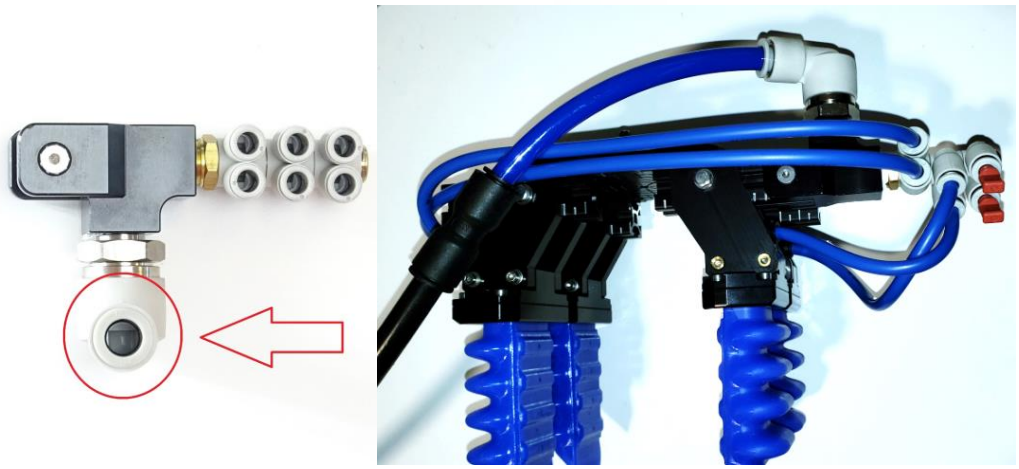
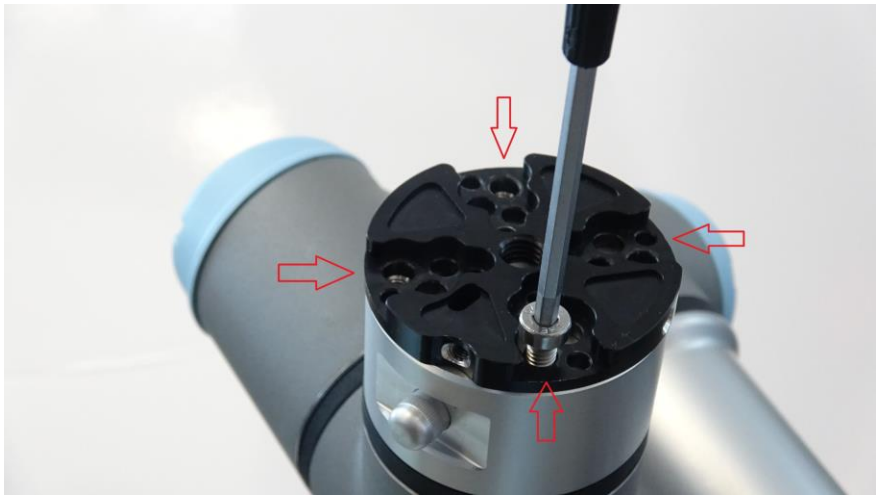
4. Connect 12mm tubing from "**A**" port to 10-12mm reducer fitting. Cut and connect a very short piece of 10mm tubing to the 10mm fitting on the Pneumatic Manifold (optimal performance is obtained by minimizing the length of the 10mm tube section).



3E: CONNECT SRDK – UR+ TOOL TO UNIVERSAL ROBOT

1. Mount robot-side Universal Mounting Plate to Universal Robot using (4) M6x12 low head socket cap screws. See below photo for orientation reference.



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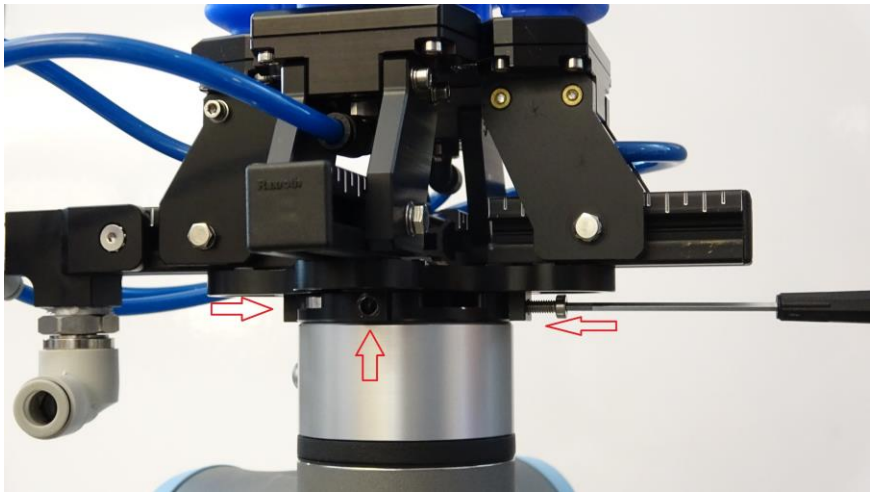
2. Mount preconfigured SRDK EOAT to robot side Universal Mounting Plate using (4) M4x16 socket head cap screws and aligning key way. Use the 2.5mm hex screwdriver for mounting.



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4: CONFIGURE

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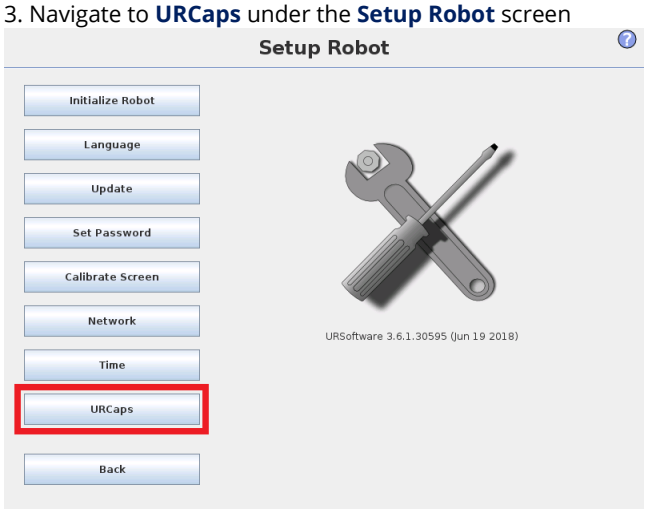
4A: SRI TOOL CONTROL CAP INSTALL AND CONTROL

IMPORTANT!: Before powering system, make sure that you have compressed air flowing to the SRCU-Mini UR+ "P1" port. Failure to do this will result in errors on the SRCU-Mini UR+ controller and a power cycle will be required.

1. Power on system by pressing power button on Universal Robot teach pendant. The SRCU-Mini UR+ will only power up once the teach pendant has completed booting and entered the home screen.

2. Insert provided flash drive into USB port on teach pendant.

3. Navigate to **URCaps** under the **Setup Robot** screen



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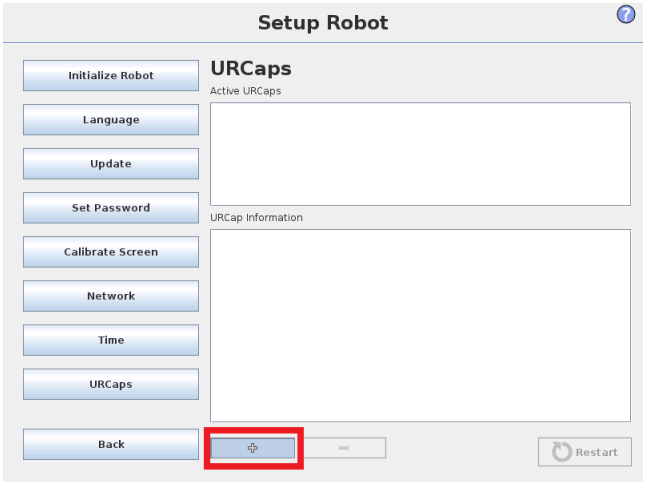
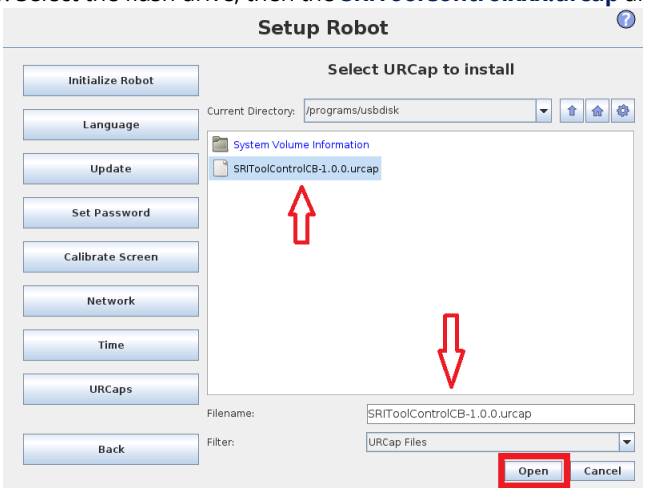
4. Press the **+** sign to add the Soft Robotics URCap



5. Select the flash drive, then the **SRIToolControlxxx.urcap** and press **Open**



6. Once you have successfully opened the Soft Robotics URCap, you will be prompted to restart. Press **Restart** and wait for Pendant to re-boot.

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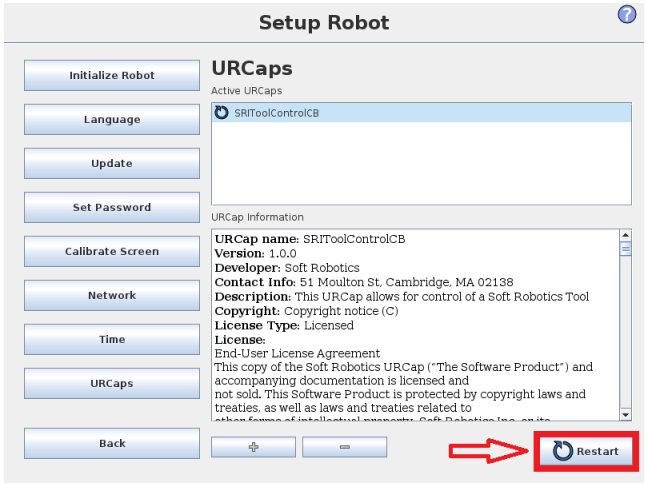
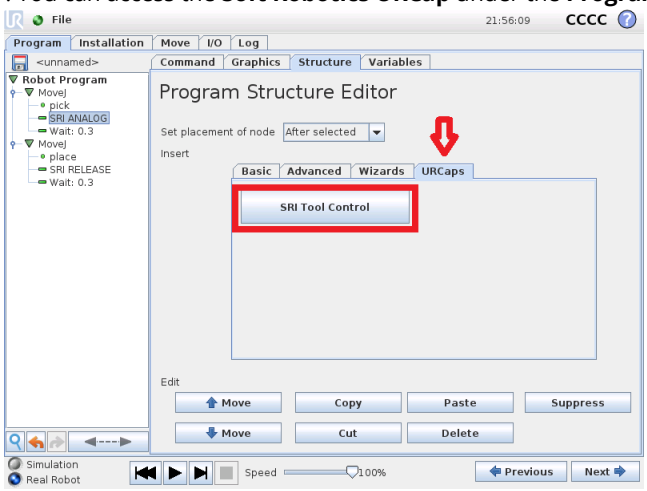


At this point, you are now ready to program your application. For assistance with programming the Universal Robot, please reach out to the Universal Robot support team.

7. You can access the **Soft Robotics URCap** under the **Program → Structure → URCaps** tab.



8. There are (3) different options for controlling the SRDK EOAT. **Grip** is used to pick an object. **Release** is used when placing an object. **Analog** is used to change your **Grip Strength** and/or **Opening Amount** prior to reselecting **Grip Node** or **Release Node**.

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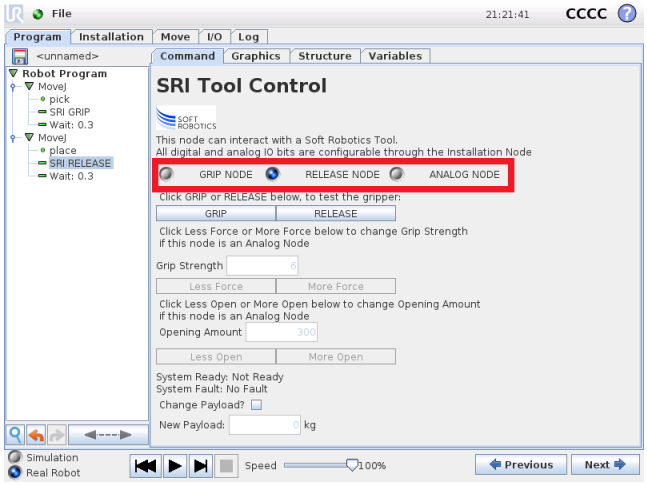
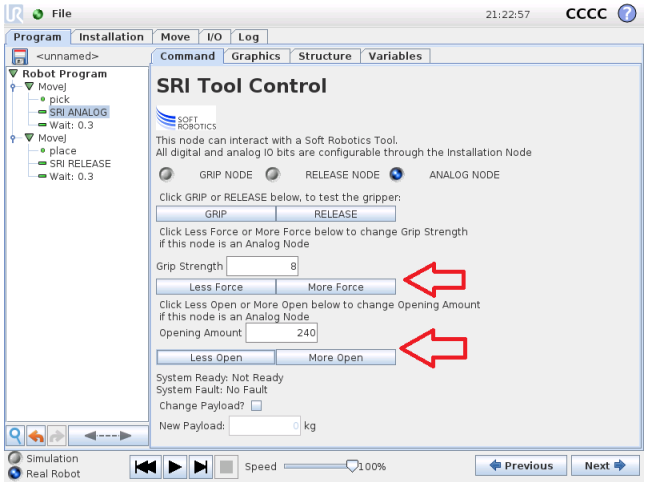
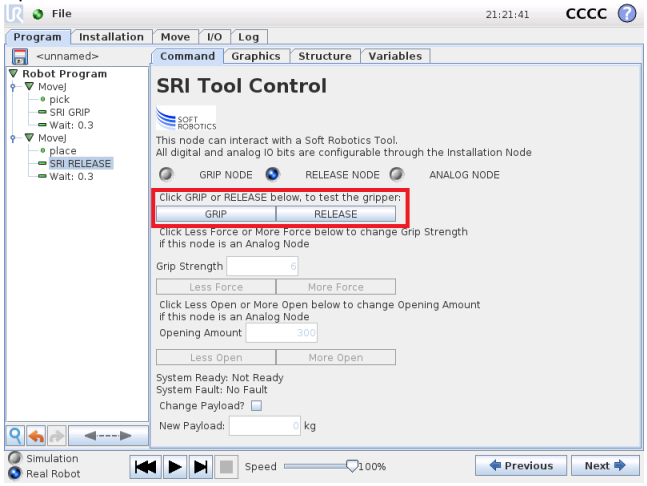


When "ANALOG NODE" is selected, "Grip Strength" and "Opening Amount" can be adjusted. Valid values for **Grip Strength** are **0** and **2 to 14**. Valid values for **Opening Amount** are **0 to 480**.



You can manually actuate your SRDK-UR+ EOAT using the **GRIP** and **RELEASE** buttons as shown below. This is for real time testing of grip and release functionality. The radio buttons, i.e. "GRIP NODE", control the runtime operation of the node.



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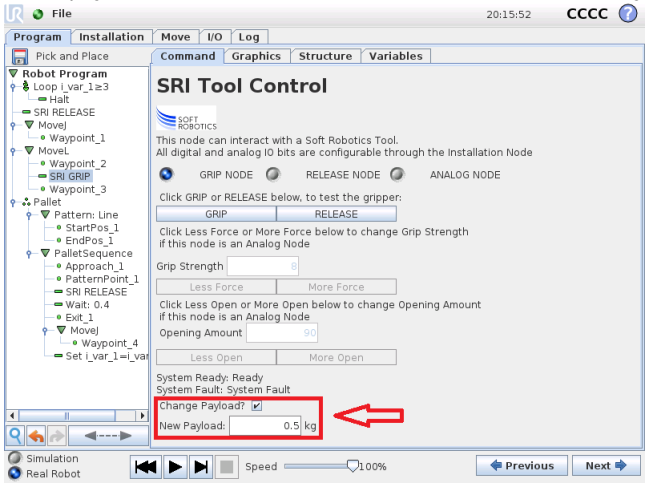
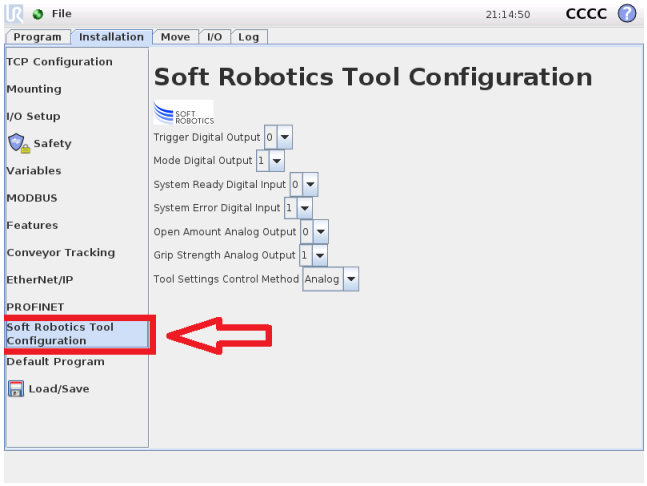
If the “Change Payload?” checkbox is CHECKED, the value in the “New Payload” field will be set as the current robot payload. This is the total mass of the EOAT and the Payload.



If you need to change any IO settings based on wiring into different inputs and outputs on the Universal Robot Controller due to availability, you can do so under the **Installation** tab, and by selecting **Soft Robotics Tool Configuration** as shown below. For further assistance please reference the SRCU-Mini Instructions for Use document found on your USB flash drive.



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CONGRATULATIONS!

YOU HAVE SUCCESSFULLY SET UP YOUR SRDK-UR+ AND YOU'RE READY TO AUTOMATE AN INFINITE NUMBER OF SOLUTIONS.

PLEASE SHARE YOUR SOLUTIONS WITH THE SOFT ROBOTICS ECOSYSTEM ON SOCIAL MEDIA USING #SRDKGRIPPERCHALLENGE OR EMAIL US: MARKETING@SOFTROBOTICSINC.COM

NEED TECHNICAL SUPPORT OR ASSISTANCE WITH THIS SET UP? EMAIL US: SUPPORT@SOFTROBOTICSINC.COM

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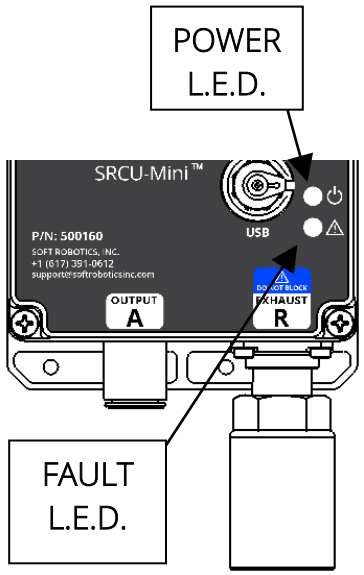
5: TROUBLESHOOTING

POWER-ON SYSTEM-TEST (P.O.S.T) AND RUN-TIME FAULT TESTS

POWERING UP THE SOFT ROBOTICS CONTROL UNIT



1) ENSURE THAT ALL ELECTRICAL AND PNEUMATIC CONNECTIONS HAVE BEEN MADE IN ACCORDANCE WITH SECTIONS VII AND VIII ABOVE.
2) APPLY 24 VDC POWER SOURCE TO SRCU TO BEGIN POWER ON SELF TEST (P.O.S.T.).

ℹ INFORMATION – IF USB IS NOT CONNECTED, UPON POWER APPLICATION, BOTH THE GREEN POWER L.E.D. AND AMBER FAULT L.E.D. WILL ILLUMINATE FOR APPROXIMATELY ONE (1) SECOND BEFORE P.O.S.T. BEGINS.

3) UPON THE START OF P.O.S.T., THE GREEN POWER L.E.D. WILL BEGIN FLASHING AND WILL CONTINUE TO FLASH FOR THE DURATION OF THE TEST (~30 SEC).

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4) THE STATE OF THE VISUAL INDICATORS ON THE FRONT PANEL AND OUTPUT SIGNALS WILL REFLECT THE STATUS OF THE SYSTEM DURING AND IMMEDIATELY AFTER POWER ON SELF TEST. SEE TABLE BELOW FOR REFERENCE:

P.O.S.T. STATUS	VISUAL INDICATORS		OUTPUT SIGNALS	
	GREEN POWER L.E.D.	AMBER FAULT L.E.D.	SYSTEM READY OUTPUT	SYSTEM FAULT OUTPUT
NOT RUNNING/NOT STARTED/NO PWR	OFF	OFF	DEASSERTED	DEASSERTED
RUNNING, PRIOR FAULT	FLASHING	SOLID ON OR FLASHING	DEASSERTED	ASSERTED
RUNNING, NO PRIOR FAULT	FLASHING	OFF	DEASSERTED	DEASSERTED
COMPLETE - PASS	ON	OFF	ASSERTED	DEASSERTED
COMPLETE - RECOVERABLE FAULT	ON	FLASHING CODE	ASSERTED	ASSERTED
COMPLETE - IRRECOVERABLE FAULT	ON	ON	ASSERTED	ASSERTED

FOR FURTHER TROUBLESHOOTING ASSISTANCE, PLEASE REFERENCE THE SRCU-MINI INSTRUCTIONS FOR USE FOUND ON YOUR USB FLASH DRIVE.

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