



SISU Cinema Robotics Installation Guide for C31 Robots

Version: 3.0

Date Issued: April 2022

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SISU

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This manual corresponds with the following: SISU Cinema Robotics Manual: 3.0, SISU Cinema Robotics Installation Guide (for C11/C14/C20 robots): v3.0, and SISU Cinema Robotics Quick Guide: v3.0.

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This document is subject to regular technical alterations.

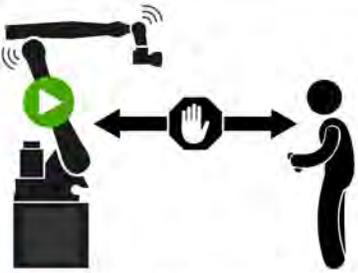
IMPORTANT SAFETY INFORMATION

The following general safety requirements and specifications must be observed during all phases of operation of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, intended use, and could void all warranty of this system. SISU assumes no liability for the customer's failure to comply with the requirements herein.

Using the SISU Cinema Robot and any of its components in a manner not specified by this manual may diminish the life of the equipment and/or personnel safety measures.

Before undertaking the installation process, carefully read the following caution notices. Protection equipment may be impaired if equipment is not used in the manner specified. **This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.**

DANGER!

		
 Avoid situations where you could become pinned by the robot	 NEVER touch the robot while it is engaged or while it is moving	 Always test programs in T1 mode before running the programs at higher speeds
		
 Stay outside of the robot's reach while running a program in ANY mode	 Always warn others BEFORE moving the robot in ANY mode	 Carefully review and follow all of the safety information given by the robot manufacturer
 ONLY SISU TRAINED OPERATORS ARE AUTHORIZED TO OPERATE THE ROBOT SAFELY		

IMPORTANT SAFETY INFORMATION



OPERATING THE ROBOT

Train ALL robot users to do the following:



1. **FIRST, AND BEFORE DOING ANYTHING ELSE:** check around the system and robot to make sure the area is clear of any people and/or objects that could come into contact with the robot.
2. **SECOND:** Anytime someone picks up the tablet to move the robot, the following needs to be spoken loudly enough for ALL people within the vicinity of the robot to hear:
 - **Main operator:** Clear to move?
 - **Assistant (or other) after verifying the area is clear:** All clear.
 - **Main operator:** Robot moves.
3. **OR,** when there is not an assistant available, the main operator will perform all of the safety calls and checks.

(**WARNINGS!** continued on next page)

IMPORTANT SAFETY INFORMATION



RUNNING THE ROBOT WARNINGS

-  **DANGER:** See robot installation and users manuals about high voltage connections to robot controller.
Voltage is hazardous to human life.
-  **DANGER:** Proper guarding and safety procedures must be in place when running robot in T2 or Auto mode.
-  **DANGER:** Secure the robot base by setting the feet and adding weights before moving the robot arm.
-  **DANGER:** Avoid situations where you could become pinned by the robot.
-  **DANGER:** NEVER touch the robot while it is engaged or while it is moving.
-  **DANGER:** Always test programs in T1 mode BEFORE running the programs at higher speeds.
-  **DANGER:** Stay outside of the robot's reach while running a program in ANY mode.
-  **DANGER:** Always warn others BEFORE moving the robot in ANY mode.

(**WARNINGS!** continued on next page)

IMPORTANT SAFETY INFORMATION



USER SAFETY WARNINGS

- ! CAUTION:** Use personal protective equipment (protective eye-ware, gloves, steel-toed shoes, etc.) when installing equipment to avoid injuries from any debris, sharp edges, or dropped equipment.
- ! CAUTION:** Observe all hazardous warning labels located on the SISU Cinema Robotics components.
- ! CAUTION:** As per OSHA recommendations, the tip angle of the robot and/or base track section while it is being moved should not exceed 10 degrees. Failing to follow these recommendations could result in the robot and/or base track section tipping over and becoming damaged.
- ! CAUTION:** Robots and equipment are heavy. Failure to follow proper lifting procedures and hoists can result in damage to people and equipment.
- ! CAUTION:** Cables and outriggers can be a trip hazard. Properly manage cabling and outriggers to prevent injury.
- ! CAUTION:** Exercise caution when closing the case lid to avoid smashing and/or otherwise injuring fingers and loose cables.
- ! CAUTION:** Prolonged use of the enable button or wand on the tablet may cause excessive strain on finger muscles; take breaks as needed.
- ! CAUTION:** The safety of any devices incorporated into the equipment during installation is the responsibility of the installer.
- ! CAUTION:** Carefully review and follow all of the safety information given by the robot and system manufacturer.

(**WARNINGS!** continued on next page)

IMPORTANT SAFETY INFORMATION



SYSTEM MAINTENANCE WARNINGS



DANGER: There is a risk of electrocution and burn while performing maintenance.



CAUTION: Do not remove protective electrical box covers or side panels during operation and servicing of the the SISU Cinema Robot components. During service of this equipment, the main AC power connector must be disconnected from the power source.



CAUTION: The SISU Cinema Robot components should be cleaned using a damp cloth with mild soap.



CAUTION: Do **not** use near liquids.



CAUTION: Dropping the tablet and/or the wand can cause damage to these components.



IMPORTANT: For any preventative maintenance of the robot, please consult the robot user manual for their specific recommendations.

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1. BEFORE YOU BEGIN

1.1 Chapter Contents

- [Icon Key - 1.2](#)
- [Intended Use - 1.3](#)
- [Inspect Before Use and Install - 1.4](#)
- [Internal Fuses - 1.5](#)
- [Service Personnel - 1.6](#)
- [Glossary Reference - 1.7](#)
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1.2 Icon Key

The following icons will be used throughout this manual



NOTE



DANGER



CAUTION



EXAMPLE



JUMP TO

1.3 Intended Use

The SISU Cinema Robotics system is to be used for controlling robot motion with a wand and tablet for the purpose of creating programs that can then be saved in SISU Lab and run automatically.

1.4 Inspect Before Use and Install

1. Check handheld parts for cracks.
2. Check tablet screen for cracks.
3. Check cables for wear.
4. Check that all cables and connectors are not damaged, and check that they are tightly connected.
5. Check joystick and trigger for cracks or breaks.



DANGER: If any issues are identified immediately cease use of the system until the maintenance issues are remedied.

1.5 Internal Fuses

- **Fuses in the SIM:** 10, 5, 4, 2, 2 Amps, mini blade fuses, automotive type

1.6 Service Personnel

The following represent product specific risks that may affect service personnel.

-  **DANGER:** **There is a risk of electrocution and burn while performing maintenance.**
- Only the SIM can be serviced (opened) onsite **by SISU certified support personnel.**



JUMP TO: To service the case, wand, and tablet please contact support listed in section [1.8 Contact Information](#).

- Power off the system and wait **10 minutes** before servicing.
- To verify correct functionality, power the system on and perform start-up procedure.

1.7 Glossary Reference

 **JUMP TO:** If, at any time during the reading of this manual, you are in need of the alphabetized glossary please reference section [4.3 Glossary of Used Terms](#).

1.8 Contact Information

For additional help or questions please contact SISU Cinema Robotics support:

- support@sisucinemarobotics.com
- 512-377-6075, extension 2



SECTION 1

COMPONENTS & INSTALLATION



2. HARDWARE COMPONENTS

2.1 Chapter Contents

- **Hardware Maps** - [2.2](#)
 - Hardware Map - Included with System - [2.2.1](#)
 - Hardware Map - Not Included with System - [2.2.2](#)
 - * Hardware Components - Links - [2.2.2](#)

- **List of Included Tools** - [2.3](#)
- **Case** - [2.4](#)
- **FIZ Motors** - [2.5](#)
- **KUKA Robot Controller** - [2.6](#)
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- **KUKA Pendant** - [2.7](#)
- **Reference Switch** - [2.8](#)
- **Robot Arms and Joints** - [2.9](#)
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- **Robot Base - for C31 robot** - [2.10](#)
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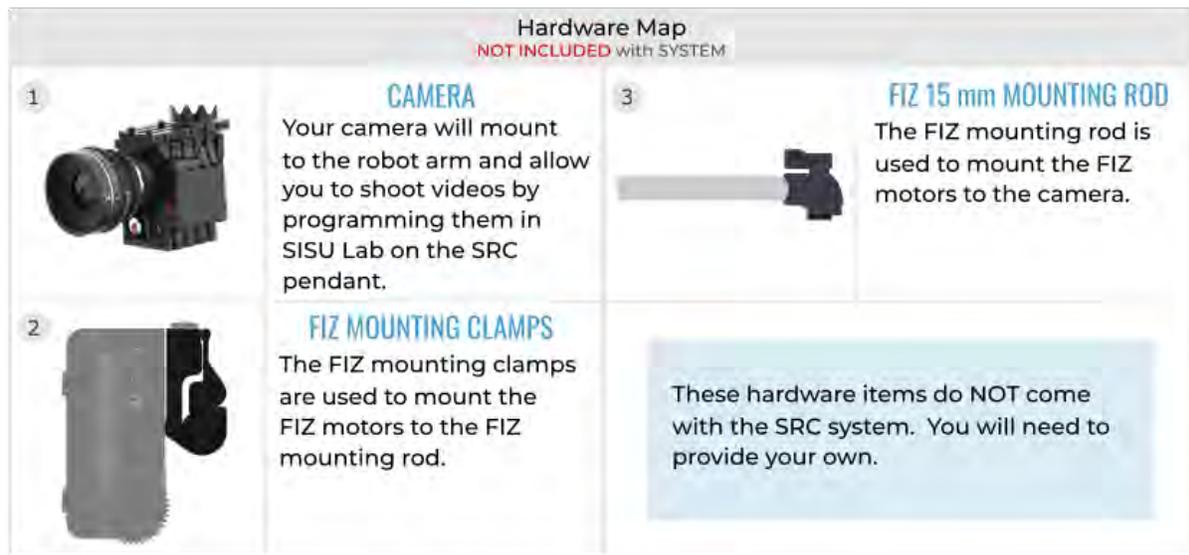
- **SIM** - [2.11](#)
- **Tablet** - [2.12](#)
- **Wand** - [2.13](#)

2.2 Hardware Maps

2.2.1 Hardware Map - Included with System

Hardware Map INCLUDED WITH SYSTEM	
1	<p>CASE</p> <p>The case houses the tablet and the wand. It must be set up at least 3 feet off of the ground.</p>
2	<p>CHEESE PLATE</p> <p>The cheese plate is attached to the end of the robot arm. The dovetail is then attached to the cheese plate.</p>
3	<p>DOVETAIL</p> <p>The dovetail is attached to the cheeseplate. The dovetail clamp is then attached to the dovetail.</p>
4	<p>DOVETAIL CLAMP</p> <p>The dovetail clamp is used to mount the camera to the dovetail/cheese plate at the end of the robot arm.</p>
5	<p>FIZ MOTORS and CLAMPS</p> <p>The FIZ motors allow you to use the SISU Lab software on the tablet to manipulate the Focus, Iris, and Zoom for each keyframe.</p>
6	<p>KRC4 COMPACT or KRC4</p> <p>The KRC4 compact comes with the C11 and C14 robot, while the KRC4 comes with the C20 and C31 robots. The KRC4 is also called the KUKA robot controller.</p>
7	<p>KUKA PENDANT</p> <p>The KUKA Pendant is used to perform mastering tests. It can also be used to move and program the robot.</p>
8	<p>REFERENCE SWITCH</p> <p>The reference switch is a sensor that verifies the robot has reached its mastering position.</p>
9	<p>ROBOT ARM</p> <p>You will control the robot arm with the wand and program it with the wand, tablet, and FIZ motors.</p>
10	<p>SIM</p> <p>The SISU Interface Module (SIM) is the network and hardware interface between the components.</p>
11	<p>TABLET & ENABLE BUTTON</p> <p>The tablet is what you will use to program the robot arm and the attached FIZ motors. The enable button engages the robot during use.</p>
12	<p>WAND</p> <p>The wand allows you to easily move and manipulate the robot arm, as well as create keyframes.</p>

2.2.2 Hardware Map - Not Included with System



Hardware Components - Links

1. **CASE:** See section [3.9 Connecting the Case, Tablet, and Wand](#). Also see section **2.4.1 How to Set Up the System** in your **SISU Cinema Robotics Manual**.
2. **CAMERA:** See section [3.15 Mounting Camera and Setting Up FIZ Motors](#). Also see sections **4.6 Setting the Camera Tools**, and **5.6 Quick Set Settings Options** in your **SISU Cinema Robotics Manual**.
3. **CHEESE PLATE:** See section [3.14 Mount Cheese Plate and Dovetail](#).
4. **DOVETAIL:** See section [3.14 Mount Cheese Plate and Dovetail](#).
5. **DOVETAIL CLAMP:** See section [3.15 Mounting Camera and Setting Up FIZ Motors](#).
6. **FIZ MOTORS:** See section [3.15 Mounting Camera and Setting Up FIZ Motors](#). Also see section **5.7 How to Move FIZ Motors** in your **SISU Cinema Robotics Manual**.
7. **KRC4 or KRC4 COMPACT:** See section [3.7 Connecting the SIM and KUKA Robot Controller](#).
8. **KUKA PENDANT:** See section [3.11 Powering ON KUKA Pendant](#).
9. **REFERENCE SWITCH:** See section [3.7 Connecting the SIM and KUKA Robot Controller](#). Also see section **4.7 Running the Mastering Check** in your **SISU Cinema Robotics Manual**.

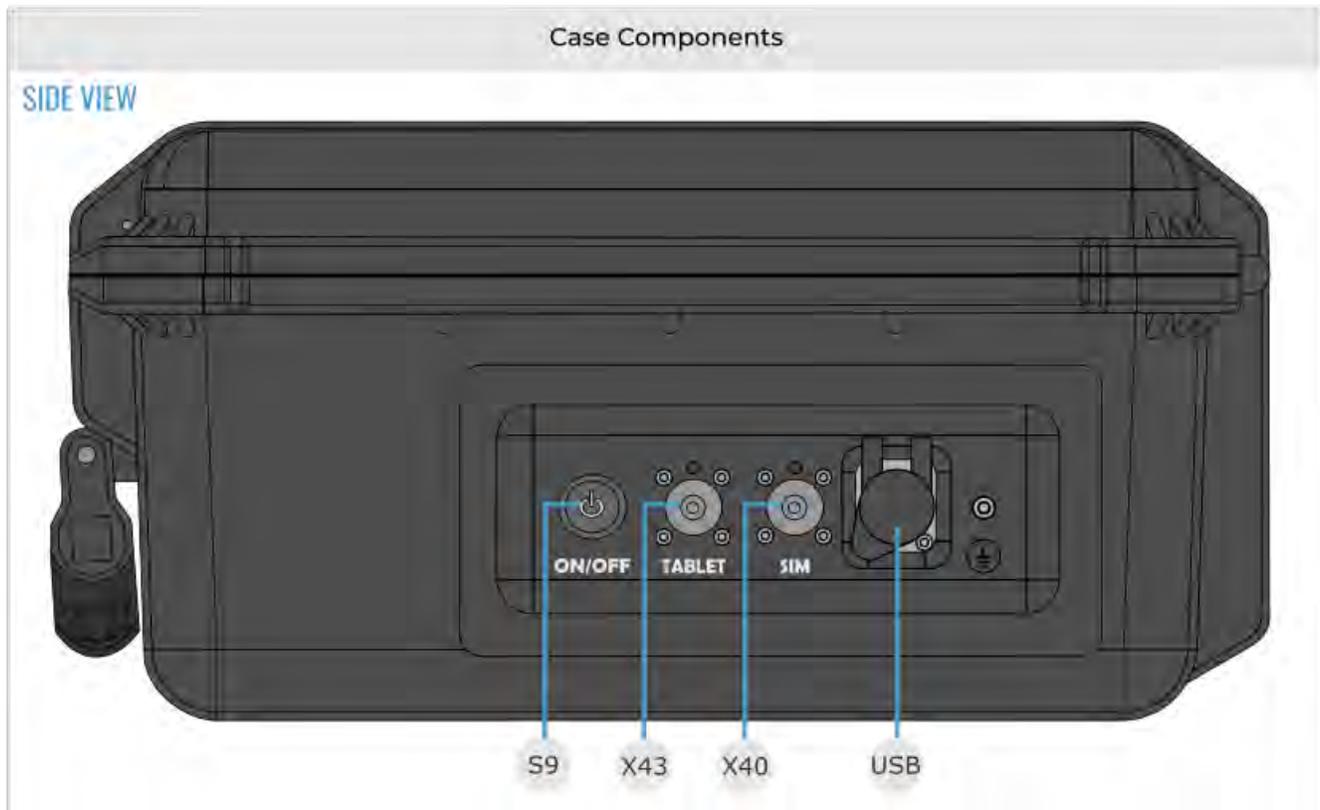
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10. **ROBOT ARM:** See section [3.6 C31 Robot Arm Connections](#). Also see section [4.10 Robot Orientation](#), and [5.2.1 Singularities - Robot Positions to Avoid](#) in your **SISU Cinema Robotics Manual**.
11. **SIM:** See section [3.7 Connecting the SIM and KUKA Robot Controller](#). Also see sections [4.12 Hooking up Digital I/O on the SIM](#), and [7.2 How to Set the Operator Modes](#) in your **SISU Cinema Robotics Manual**.
12. **TABLET:** See section [3.9 Connecting the Case, Tablet, and Wand](#). Also see sections [4.2 Using Enable Button to Engage Robot](#), and [4.5 Calibrating the Wand](#) in your **SISU Cinema Robotics Manual**.
13. **WAND:** See section [3.9 Connecting the Case, Tablet, and Wand](#). Also see section [2.6 Basics - Moving the Robot and FIZ Motors](#).

2.3 List of Included Tools

1. Mastering kit tool (for manually mastering the robot)
2. Ratchet wrench (for moving robot feet up and down)

2.4 Case



Label	Name	Description
S9	On/off button	Powers on the case
USB	USB port	Used to connect USB drives and external devices to the system
X43	Case to tablet port	Port for cable that also connects to tablet (X49)
X40	Case to SIM port	Port for cable that also connects to SIM (X26)

! PROPER CASE PLACEMENT: Place the case at least 3 feet off of the ground and away from large metal objects that can cause wand distortion.

! CASE LABELS: In some instances your case labels may read **pendant** instead of **tablet**, and/or **control** instead of **SIM**.

2.5 FIZ Motors



Label	Name	Description
A	LBUS connector	Connects the cPRO to the cforce PLUS
B	CAM connector	Connects the cPRO to the robot
C	Lower soft button	Short press to switch RF channel on/off and choose radio channel, long press (3 sec) for system info, long press (6 sec) for region settings
D	Upper soft button	Short press to select FIZ motor, long press (3 sec) to calibrate
E	Display	Screen that displays information
F	Antenna	For wireless control with a C Motion hand unit
G	Motor clamp	Mounts the FIZ motor to the FIZ mounting rod
H	Gear	Adjusts the focus, iris, or zoom on the camera



DISPLAY SCREEN: The display screen on the cforce PRO will turn off after 3 sec.

(cforce PLUS details on next page)

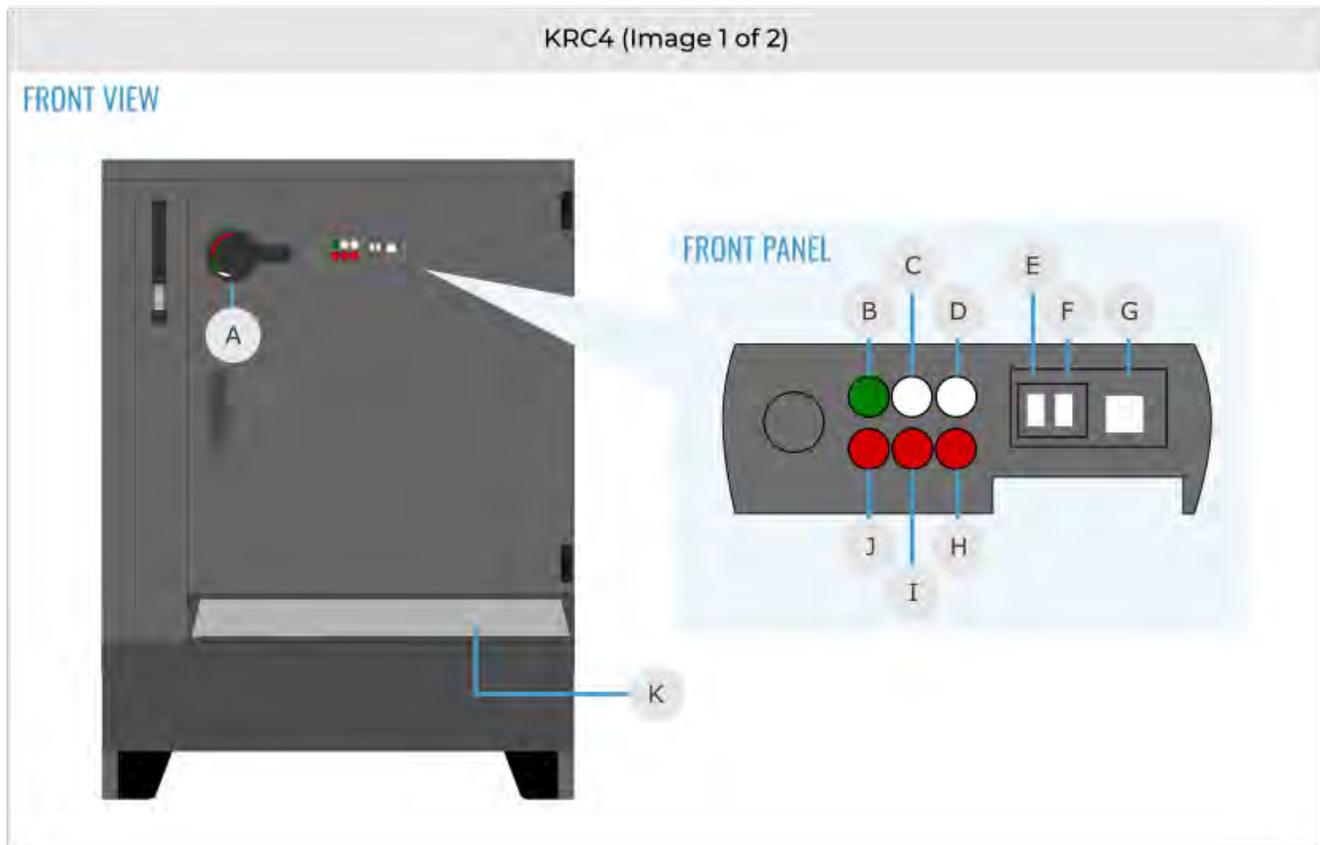


Label	Name	Description
A	LBUS connector	Connect to another FIZ motor LBUS port
B	FIZ selector button	Lets you select whether to assign the motor to focus, iris, or zoom
C	Motor clamp	Mounts the FIZ motor to the FIZ mounting rod
D	Gear	Adjusts the focus, iris, or zoom on the camera

 **FIZ MOTORS MANUAL:** For more information on how to use the FIZ motors, please read through the applicable ARRI/cMotion manufacturer manual.

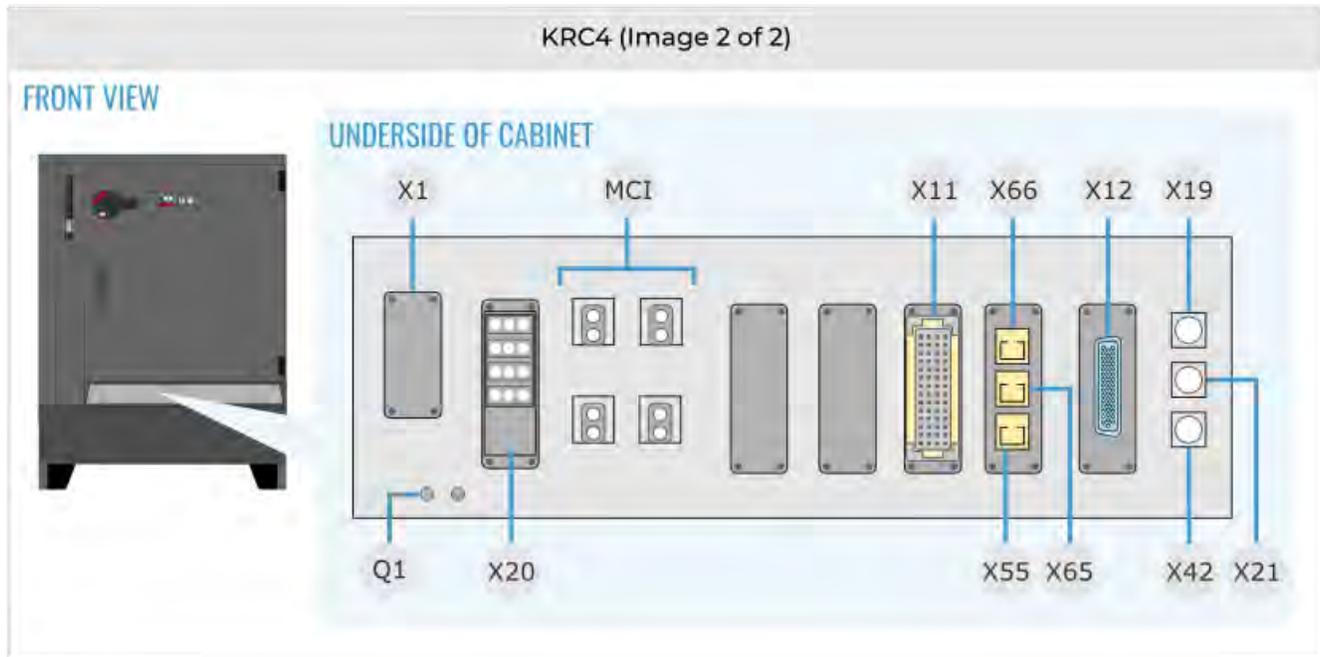
2.6 KUKA Robot Controller

2.6.1 KRC4



Label	Name	Description
A	Power switch	Powers on the KRC4
B	LED 1	Operating LED (green)
C	LED 2	Sleep LED (white)
D	LED 3	Automatic LED (white)
E	USB 1	USB port
F	USB 2	USB port
G	RJ45	KLI, KSI
H	LED 6	Error LED 3 (red)
I	LED 5	Error LED 2 (red)
J	LED 4	Error LED 1 (red)
K	Connections panel	Contains connection points for necessary cables

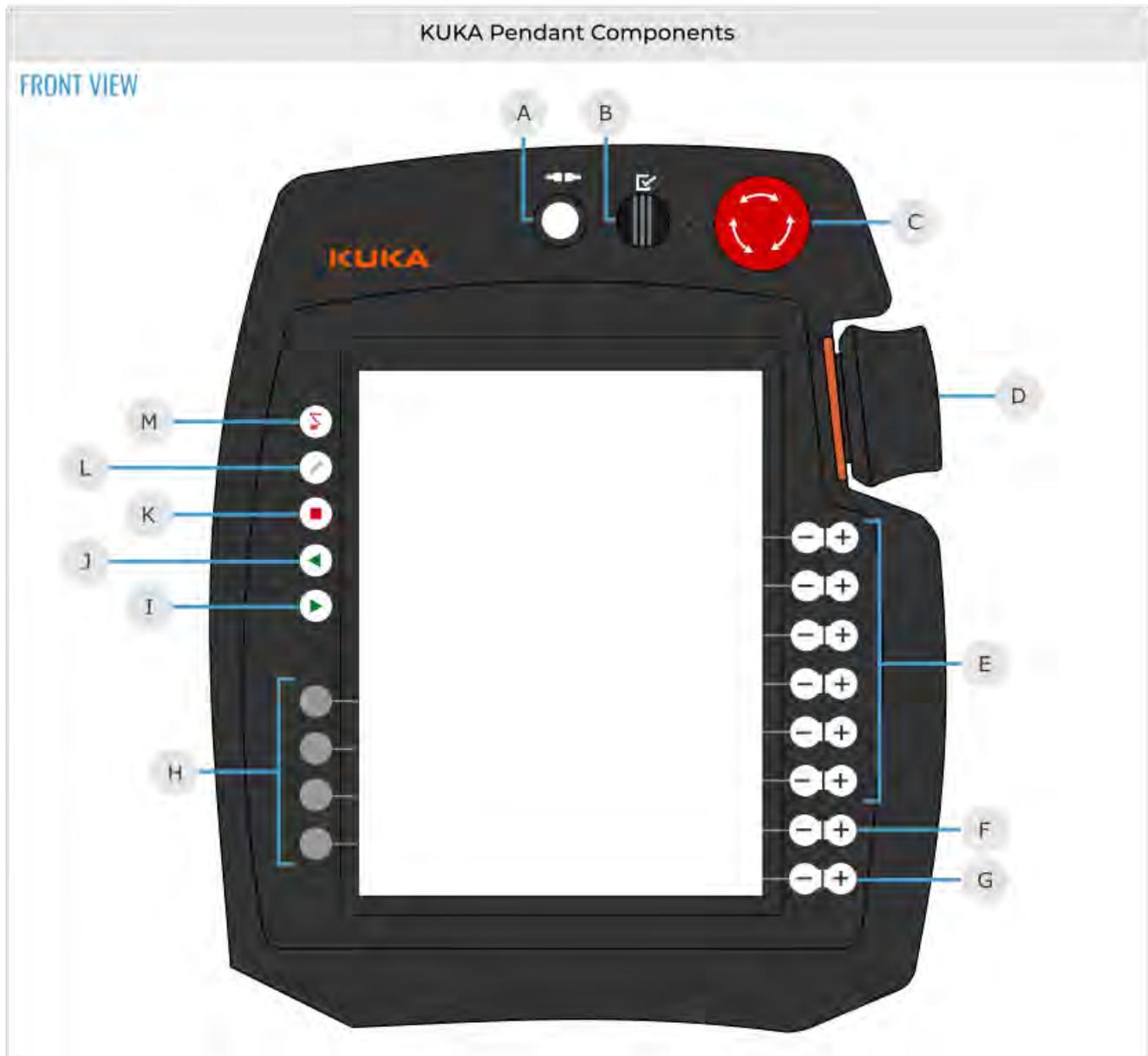
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Label	Name	Description
MCI	Motor connector interfaces	
Q1	Ground lugs	Chassis ground
X1	Power supply connection	Power supply connection (cable gland or blanking plate)
X11	Safety connector	Port covered with X11 cap for safety (only exists on robots upgraded from SRC)
X19	KUKA pendant connector	Port for cable that also connects to the KUKA pendant
X20	Power connector	Port for cable that also connects to robot (X30)
X21	Data connector	Port for cable that also connects to robot (X31)
X42	Reference switch connector	Port for cable that also connects to the reference switch near the base of the robot
X55	24 V power connector	Port covered with X55 cap for safety
X65	Ethercat	Port for cable that also connects to SIM (X65)
X66	Ethernet	Port for cable that also connects to SIM (X66)

! **KRC4 MANUAL:** For more information on how to use the KRC4, please read through the applicable KUKA manual.

2.7 KUKA Pendant



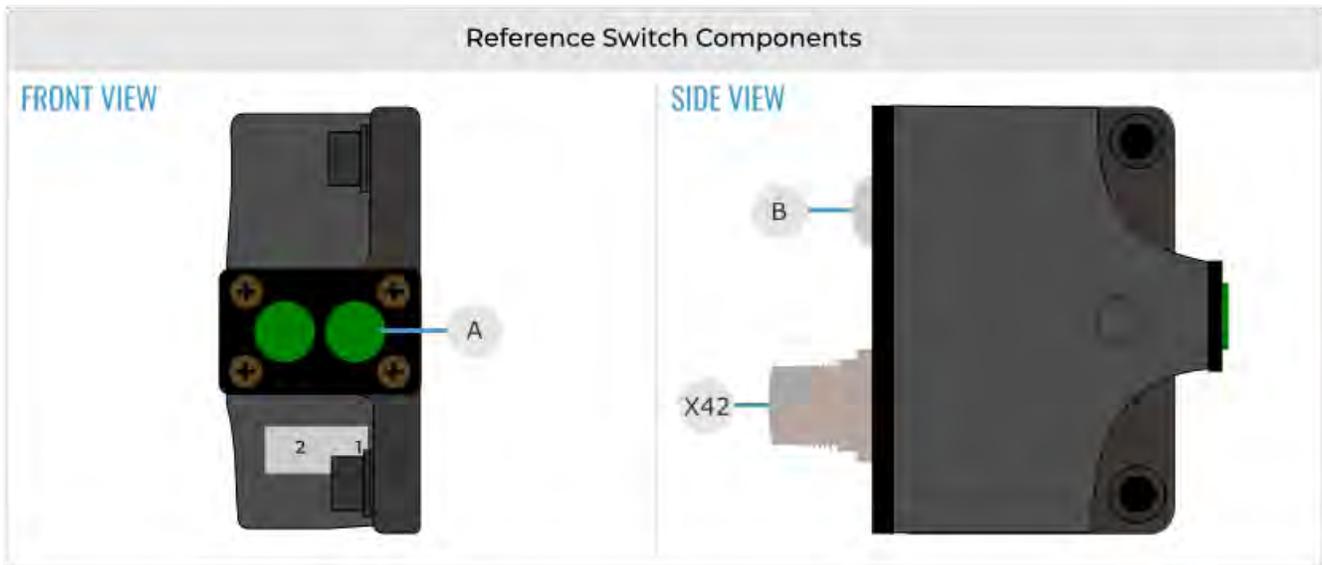
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Label	Name	Description
A	Disconnect button	Used for disconnecting the KUKA pendant
B	Mode selector switch	Available variants are: with key, and without key. In with key mode, the switch can only be turned if the key is inserted
C	E-stop	The emergency stop button locks itself in place when it is pressed
D	6D mouse	Can be used to move the robot manually
E	Jog keys	These keys are used to move the robot manually
F	Program override	Key for setting the program override
G	Job override	Key for setting the job override
H	User keys	You are able to freely program the function of the user keys. Possible uses can include controlling peripheral devices or triggering application-specific actions
I	Start	Used to start a program, manually address frames, and move robot back onto path
J	Start backwards	Lets you execute the frames in the program backwards
K	Stop	Used to stop a program that is currently running
L	Keyboard	Displays a keyboard on the KUKA pendant
M	Main menu	Shows and hides the main menu options



KUKA MANUAL: For more information on how to use the KUKA pendant, please read through the applicable KUKA smartPAD-2 manual.

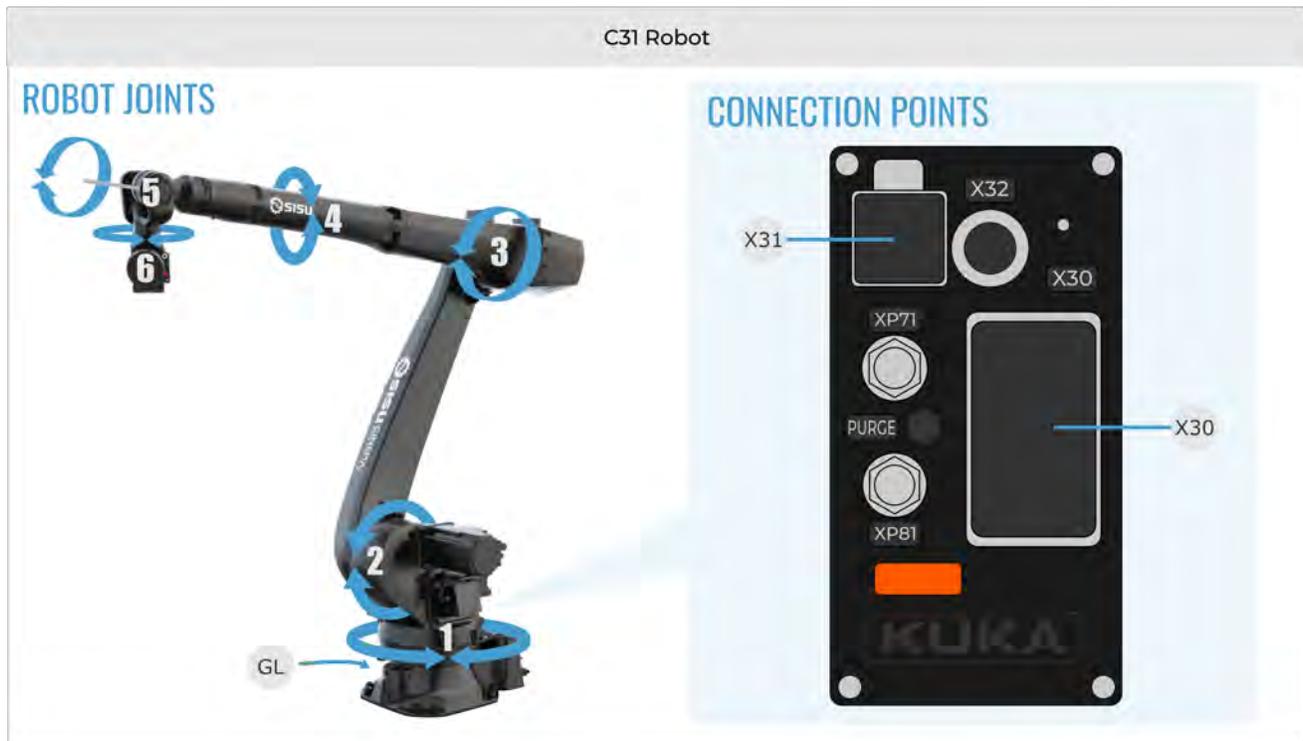
2.8 Reference Switch



Label	Name	Description
A	Inductive sensor	Senses when robot is in mastering position
B	Sensor lights	Turns off when robot is in mastering position
X42	XS_REF	Port that connects to KRC4 (X42)

2.9 Robot Arms and Joints

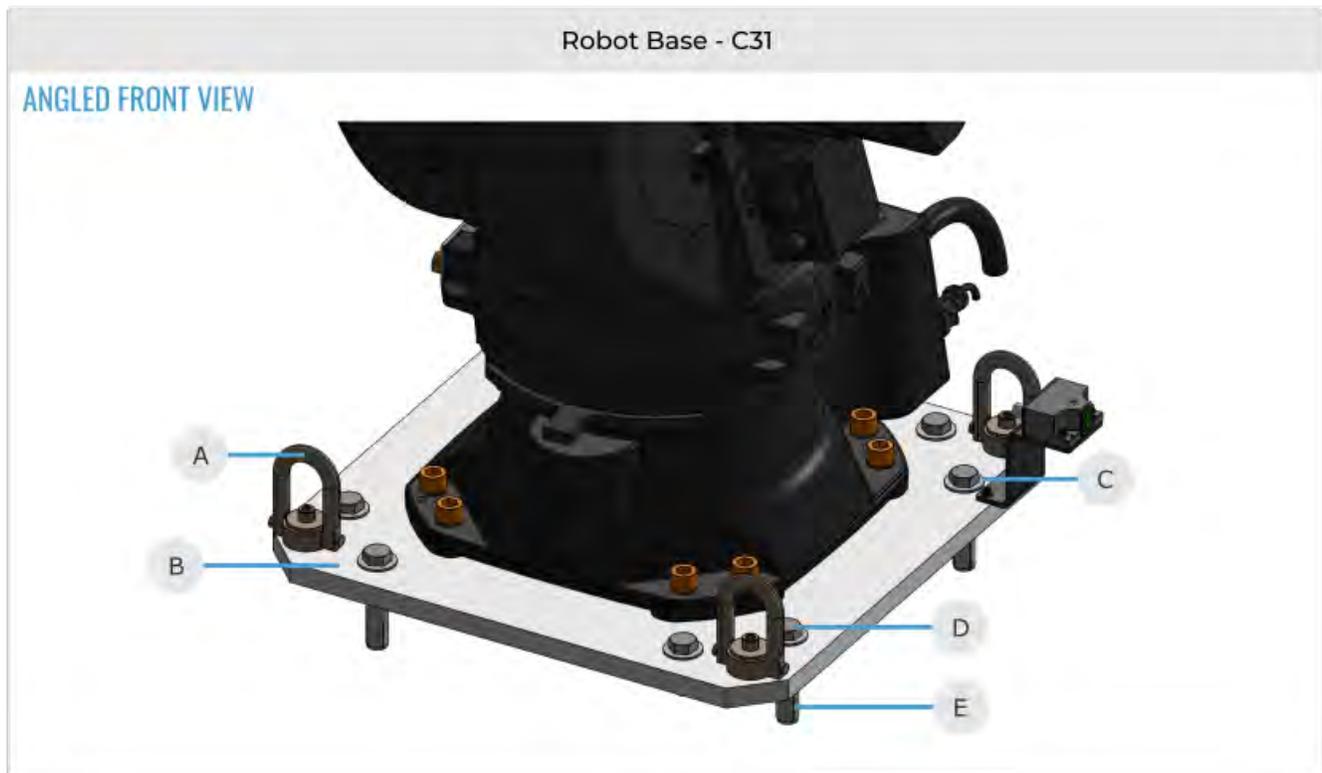
2.9.1 C31 Robot



Label	Name	Description
GL	Ground lug	Connection point for the ground cable
X30	Power connector	Port for cable that also connects to KRC4 (X20)
X31	Data connector	Port for cable that also connects to KRC4 (X21)

2.10 Robot Base - for C31 robot

2.10.1 Robot Base Plate



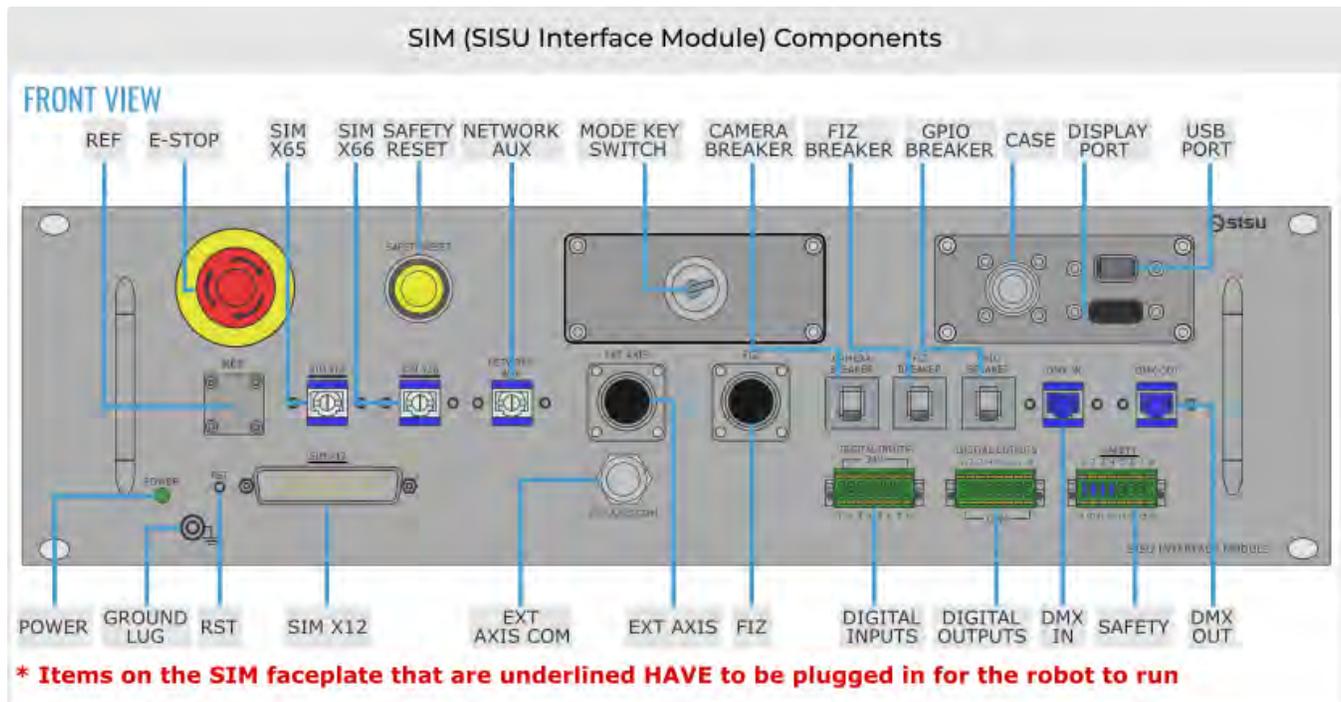
Label	Name	Description
A	Hoist ring	Used to lift the robot
B	Base plate	Plate used to attach the robot base securely to a concrete floor
C	Washers	Used in combination with the fasteners
D	Fasteners	Screw into the concrete anchors to bolt the robot base to the floor
E	Concrete anchors	Anchors that are driven in using the Anchor Setting Tool

2.10.2 Robot Base - with Weights



Label	Name	Description
A	Stop nut	Loosen these before adjusting the feet
B	Base	Attaches to the robot arm
C	Hex Lug	Attach ratchet here to lower and raise feet
D	Base feet	Used to level the robot base
E	Weight stack	Weights that can be stacked on three sides of base to hold the robot steady when moving. Can be moved with pallet jack

2.11 SIM



i SIM COLOR: The actual SIM hardware is black with white lettering. It is shown gray with black lettering in this image to better show the individual parts.

Label	Name	Description
Camera breaker	Camera breaker	Fuse that will pop out if something is wrong with the camera connectors
Digital inputs	User digital inputs	General purpose inputs, HIGH: 11 - 30 VDC, LOW: -3 - 5 VDC
Digital outputs	User digital outputs	General purpose outputs, 24 VDC, 0.5 A max
Display port	Display port	Reserved for service and SISU support
DMX in	DMX in	Message from auxillary device in
DMX out	DMX out	Message to auxillary device out
E-stop	E-stop	Emergency stop button
Ext axis	External axis connector	Port that connects to the track or other SISU external devices
Ext axis com	Ext axis com	Ethercat port for service

(Continued on next page)

FIZ breaker	FIZ breaker	Fuse that will pop out if something is wrong with the FIZ connectors
GPIO breaker	GPIO breaker	Fuse that will pop out if something is wrong with the digital I/O connectors
Ground lug	Ground lug	Chassis ground
Mode key switch	Mode (key) switch	Switch allowing you to toggle between T1, T2, and AUTO
Network access	Aux ethernet	Ethernet port for service
Power	Power light	Will light up green when power is on
REF	Reference switch connector	Connects to the robot reference switch
RST	Reset button	Resets the safety controller
Safety	User safety	See Table 1
Safety reset	Safety reset	Button that resets the safety system
SIM X12	Digital I/O port	Port for cable that also connects to KRC4 (X12)
SIM X65	Ethercat	Port for cable that also connects to KRC4 (X65)
SIM X66	KUKA ethernet	Port for cable that also connects to KRC4 (X66)
USB port	USB port	Reserved for service and SISU support
X88	FIZ Connector	Port that connects to the FIZ motors

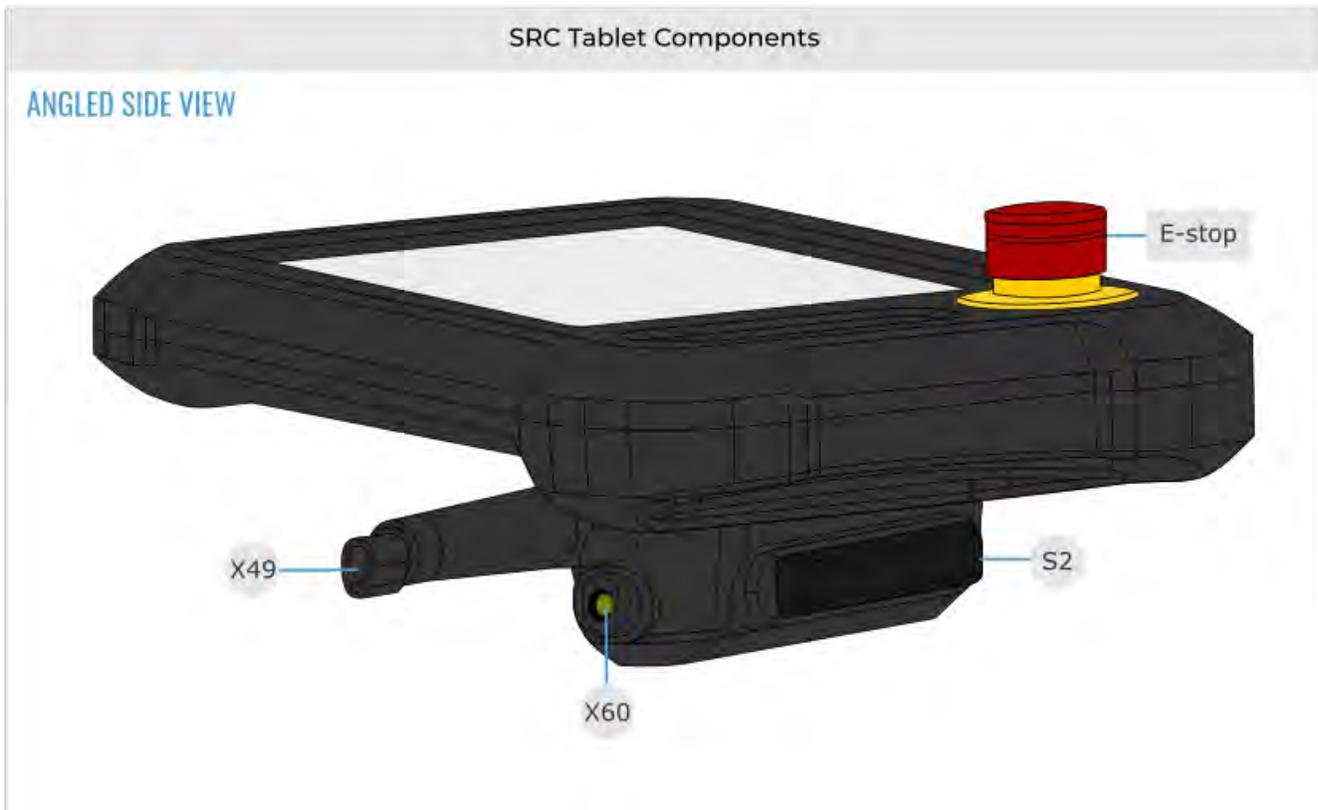
Table 1: User Safety Table. See X17 in Table 2.11.

	Positive (+)	Negative (-)
E-STOP Channel A	Pin 1	Pin 9
E-STOP Channel B	Pin 2	Pin 10
Operator Safety Channel A	Pin 3	Pin 11
Operator Safety Channel B	Pin 4	Pin 12
Safe Output 1 Channel A	Pin 5	Pin 13
Safe Output 1 Channel B	Pin 6	Pin 14
Safe Output 2 Channel A	Pin 7	Pin 15
Safe Output 2 Channel B	Pin 8	Pin 16



DANGER: Do not modify or operate without these connections. Failure to do so could negate the system safety and could result in personal injury.

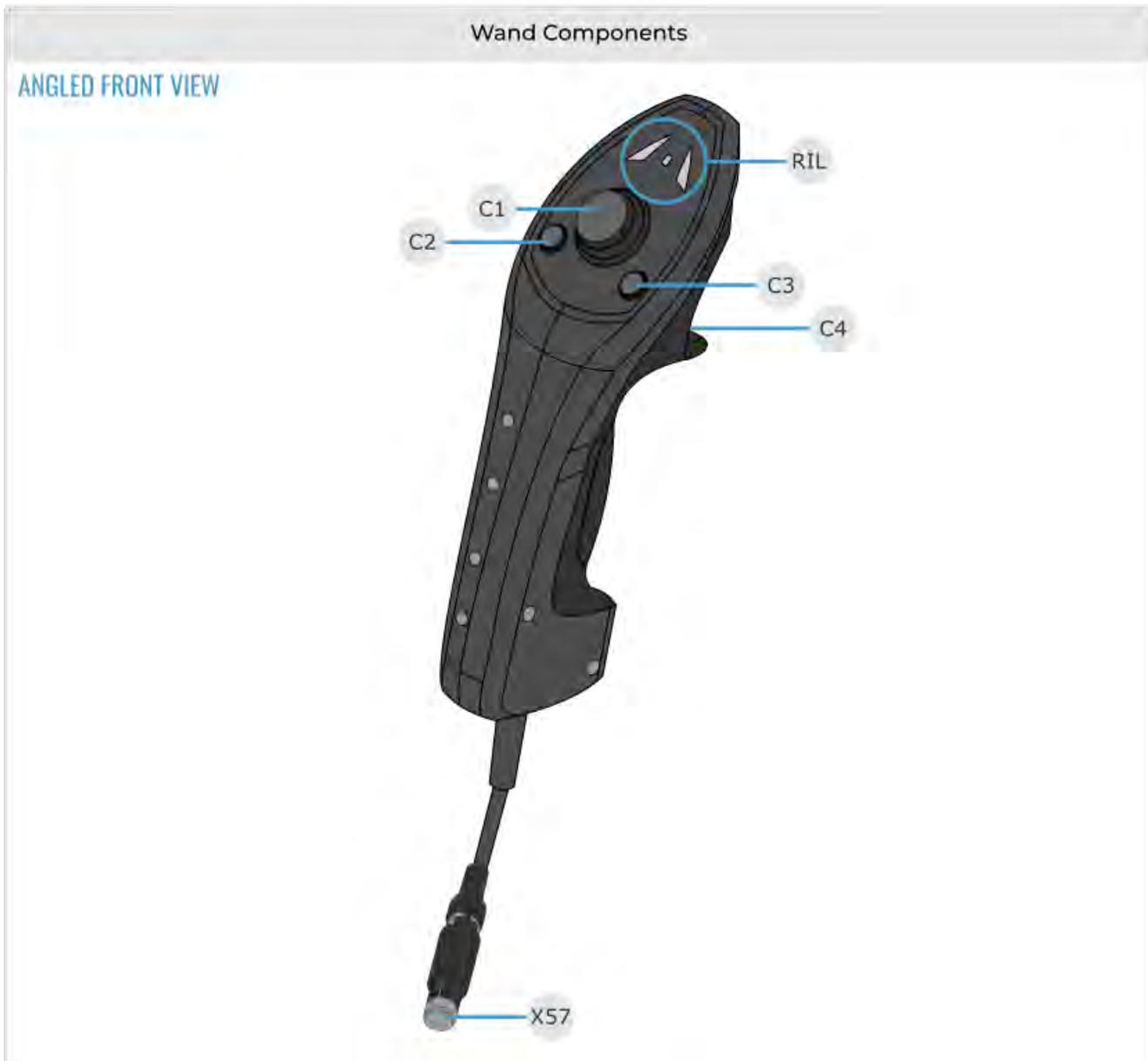
2.12 Tablet



Label	Name	Description
E-stop	E-stop button	Emergency stop button
S2	Enable button (operator presence)	Enables manual control of the robot in modes T1 and T2
X49	Tablet to case port	Cable connector to case (TABLET)
X60	Wand port	Port for cable that also connects to wand (X57)

 **JUMP TO:** See step #3 in section [3.13 Testing Robot Motion](#) for instructions on how to use the enable button.

2.13 Wand



Label	Name	Description
C1	Joystick	Moves robot and FIZ motors
C2	Left mode button	Captures robot program keyframes
C3	Right mode button	Takes you in and out of Joint Control mode
C4	Trigger	Controls robot speed and moves robot
X57	Power	Wand to tablet port (X60)
RIL	Ready indicator lights	Lights that shows when robot is engaged and ready to move

3. INSTALLATION AND SETUP PROCEDURES

3.1 Chapter Contents

- **Robot Setup Training Video** - [3.2](#)
- **Uncrating the Robot** - [3.3](#)
- **Robot Base Set Up** - [3.4](#)
 - Adding Weights and Setting Feet - [3.4.1](#)
 - Bolting C31 Base Plate to the Ground - [3.4.2](#)
- **Bringing in Remaining Hardware** - [3.5](#)
- **C31 Robot Arm Connections** - [3.6](#)
- **Connecting the SIM and KUKA Robot Controller** - [3.7](#)
- **Hooking Up Digital I/O on the SIM** - [3.8](#)
- **Connecting the Case, Tablet, and Wand** - [3.9](#)
- **Powering ON the System** - [3.10](#)
- **Powering ON KUKA Pendant** - [3.11](#)
- **Testing E-stop Functionality** - [3.12](#)
- **Testing Robot Motion** - [3.13](#)
- **Mount Cheese Plate and Dovetail** - [3.14](#)
- **Mounting Camera and Setting up FIZ Motors** - [3.15](#)
- **Transporting the Robot** - [3.16](#)
 - Shipping the Robot - [3.16.1](#)
 - Moving the Robot to a New Location - [3.16.2](#)

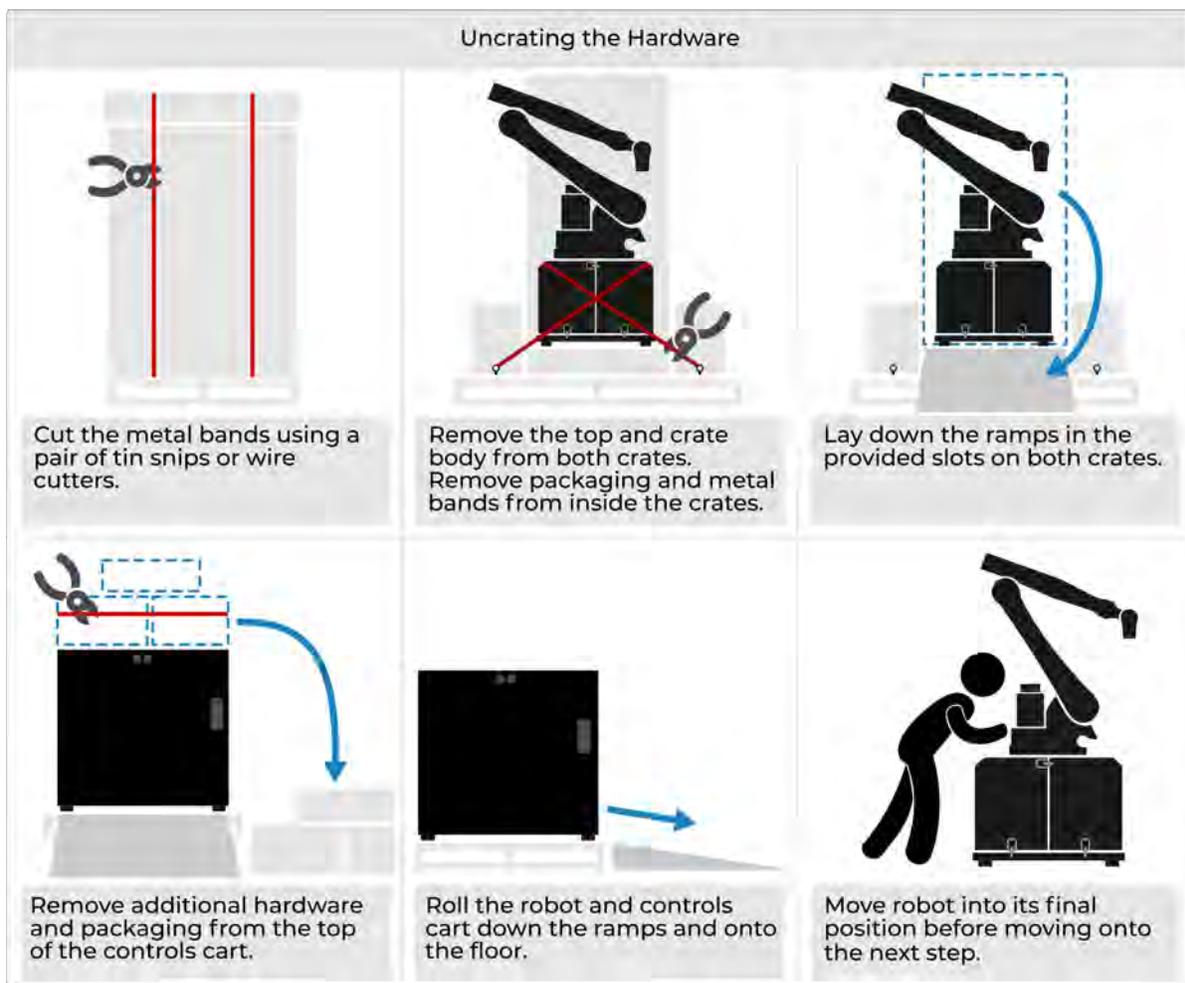
3.2 Robot Setup Training Video

Before going through these instructions, please watch the following video: [Robot Setup: SISU Cinema Robotics Pre-Training Series](#).

 **JUMP TO:** Steps after 5:45 m in the video link do NOT apply to SISU Lab. For Wand Calibration, Mastering Check, Brake Check, Robot Orientation, and Moving the Robot instructions see your **SISU Cinema Robotics Manual**. For Camera and FIZ mounting, see section [3.15 Mounting Camera and Setting Up FIZ Motors](#).

3.3 Uncrating the Robot

Instructions for uncrating the robot:



3.4 Robot Base Set Up

3.4.1 Adding Weights and Setting Feet

 **JUMP TO:** This section is applicable if you have a robot base with weights. If, instead, you have a base plate to secure to the floor, see section [3.4.2 Bolting C31 Base Plate to the Ground](#).

Adding Weights and Setting Feet
for C31 ROBOTS

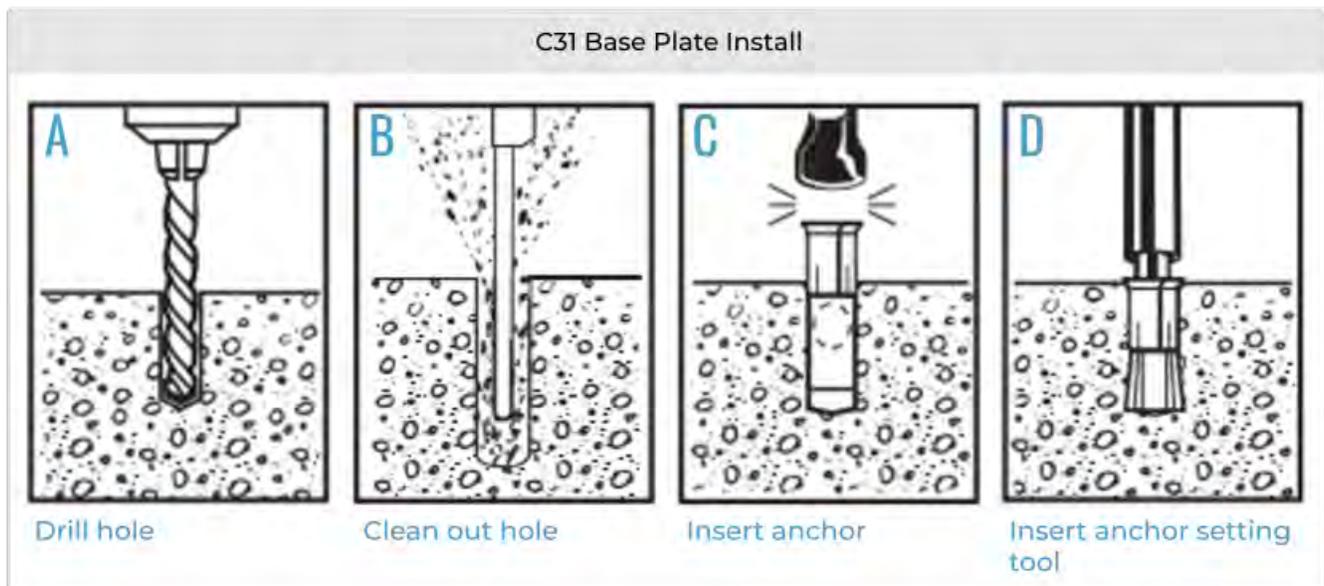
 <p>Place robot pedestal and arm on the ground in the desired location. Place a level on the robot.</p>	 <p>To level the robot base, start by loosening the stop nuts on each base foot.</p>	 <p>Next, use a ratchet to raise and / or lower the feet.</p>
 <p>When feet are adjusted and robot is level, tighten the stop nuts on the feet.</p>	 <p>Once robot is level and feet are set, use a pallet jack to slide the weights onto the robot base.</p>	 <p>Double check that the robot is level before moving on.</p>

3.4.2 Bolting C31 Base Plate to the Ground

 **JUMP TO:** This section is applicable if you have a base plate that secures to the floor. If, instead, you have a robot base with weights, see section [3.4.1 Adding Weights and Setting Feet](#).

 **STRUCTURAL ENGINEER CHECK:** **Before installing your C31, check with a structural engineer to determine whether or not your concrete is suitable for robot installation.**

 **PPE:** Always wear personal protective equipment (PPE) per OSHA standards when performing this installation process.



Instructions for bolting the C31 base plate to a concrete ground:

1. Move the C31 robot arm to the exact location on the concrete where you would like to install it.
2. If applicable, deattach everything that you attached to the hoist rings when you moved the robot into position.
3. There will be 8 holes in the base plate. Locate the first hole that you want to work with.

(Continued on next page.)

- Using a concrete, carbide-tipped drill bit, drill a 1" diameter hole. **The depth of the hole should be equal to OR deeper than the minimum embedment depth of 3-3/16"** (the length of the anchor). **See image A above.**

 **MOUNTING HOLES DIAMETER:** The mounting holes are 1" diameter, which is the same size as the drill bit you should use.

- Clean out the new hole with a wire brush, vacuum, or compressed air. **See image B above.**
- Place a **concrete anchor** into the drilled hole and hammer it in as deep as you can. **See image C above.**

 **THREADED END OF ANCHOR:** The threaded end of the anchor **MUST** be facing upwards when installed.

- Using the provided 3/4" **anchor setting tool**, insert the SMALLER diameter end of the anchor setting tool into the threaded part of the anchor. **See image D above.**
- Holding the **anchor setting tool** firmly, strike the end of the anchor setting tool with a hammer until the anchor is level with the top of the concrete and set in place. **See image D above.**
- Repeat steps 4 - 8 to install the remaining anchors.
- Insert a provided washer and 3/4" bolt into each of the installed anchors.

 **BOLT TORQUE:** All bolts should be fastened to a torque of 80 ft. lbs.

3.5 Bringing in Remaining Hardware

Instructions for bringing in the remaining hardware:

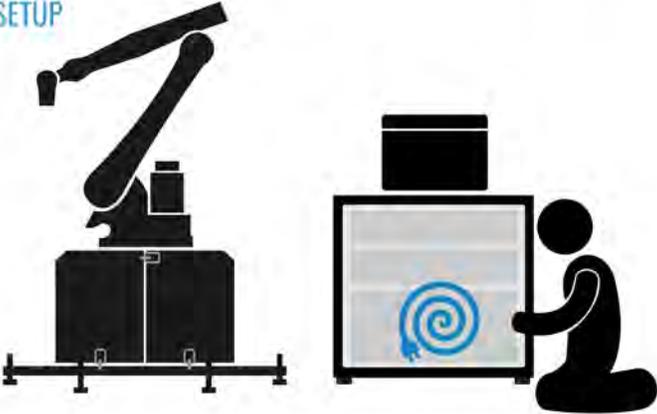
Bringing in Remaining Hardware

FRONT OF SETUP



Carefully bring in the controls cart and the case. It's a good idea to have the front of the cart facing away from the robot and towards where the operator will be standing.

BACK OF SETUP



Open the back of the controls cart and carefully uncoil the cables.

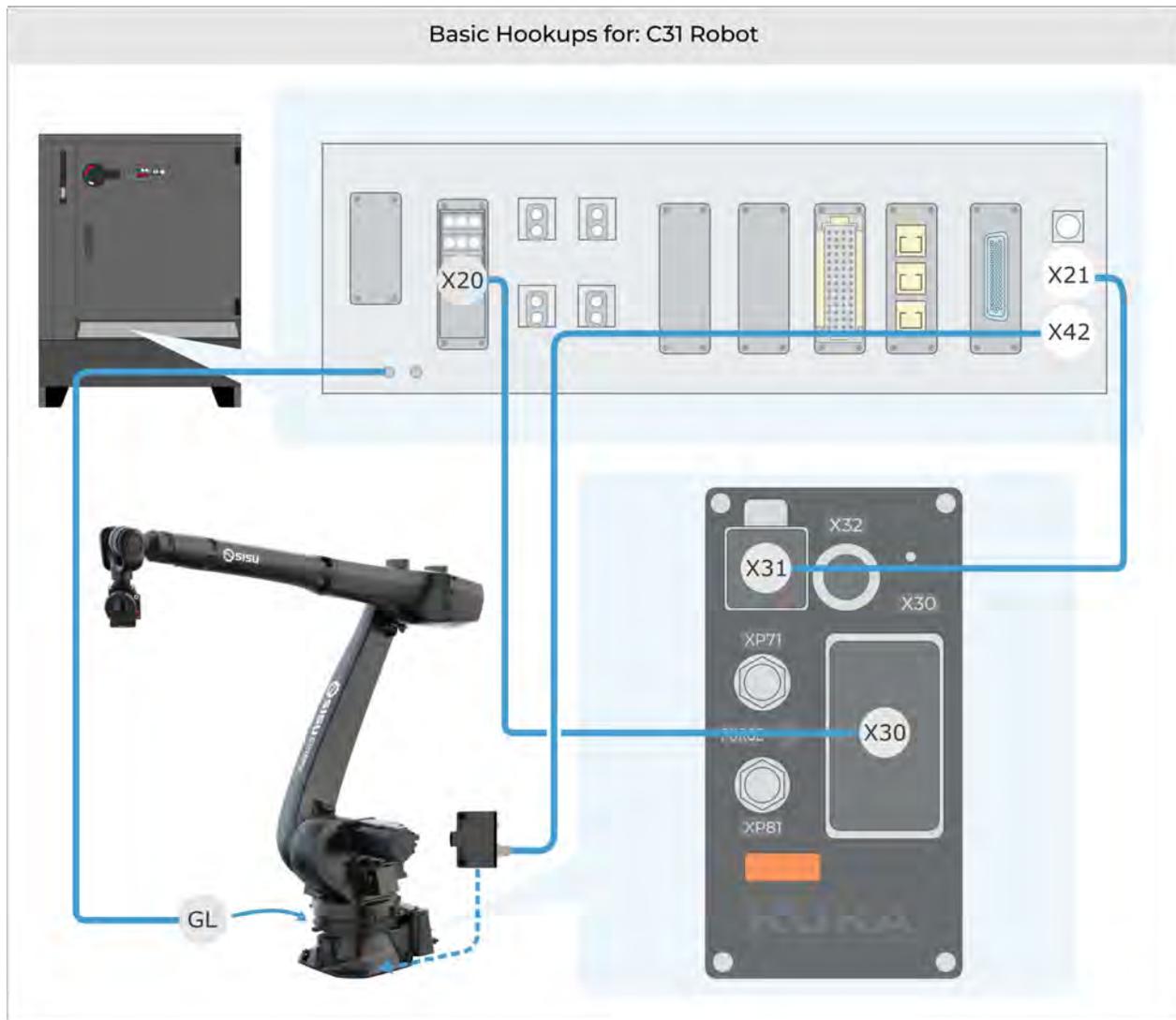


DO NOT plug in power at this point. We will get to that step later.

! **C20 and C31 CONTROLS CART:** The controls cart for the C11 and C14 is pictured in the above images. The controls cart for the C20 and C31 robots will be larger.

(Continued on next page.)

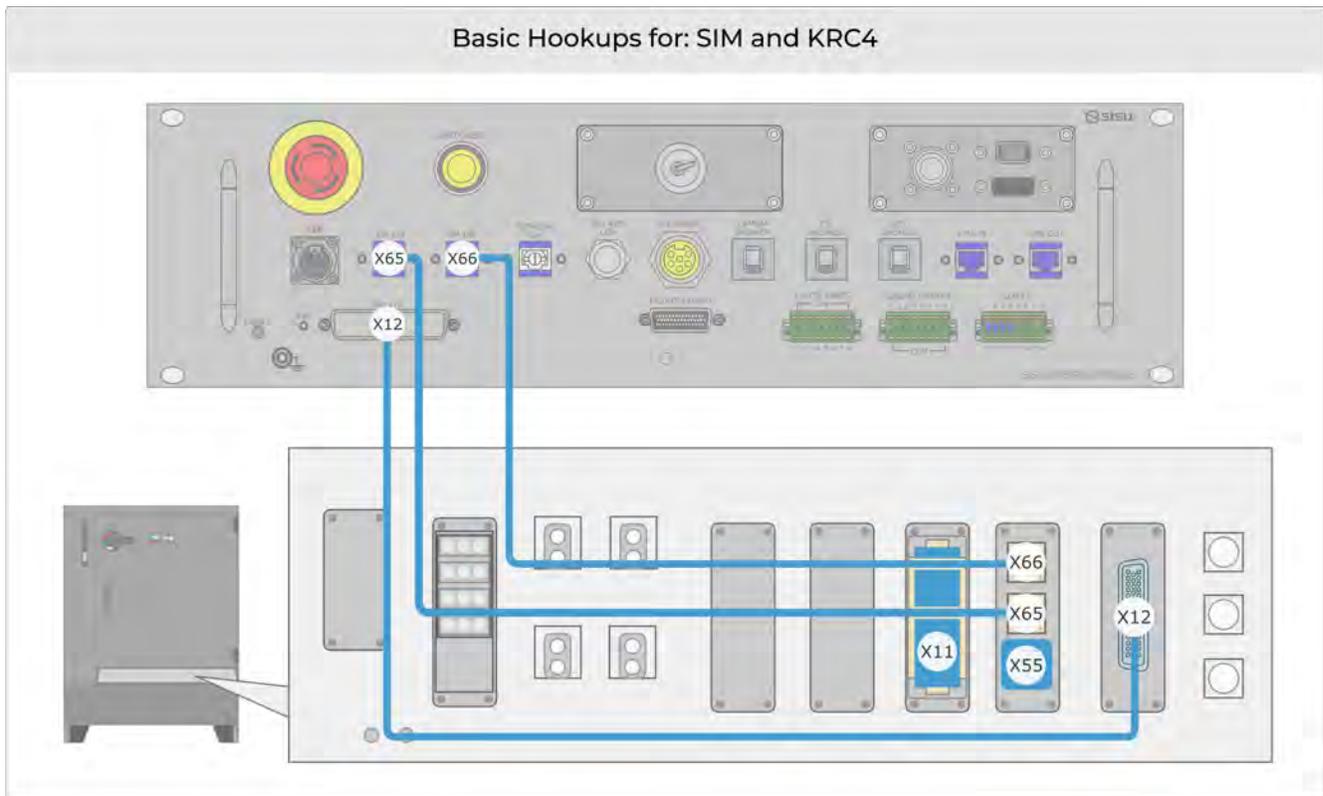
3.6 C31 Robot Arm Connections



Instructions for securing C31 robot arm connections:

1. Locate the ground wire. Plug one end into the base of the robot arm (GL), and plug the other end into the KRC4 compact.
2. Locate the robot power cable. Plug one end into X20 on the KRC4 compact, and plug the other end into X30 on the robot arm.
3. Locate the robot data cable. Plug one end into X21 on the KRC4 compact, and plug the other end into X31 on the robot arm.
4. Locate the X42 reference switch cable connector. Plug it into X42 on the KRC4 by first pushing it in and then screwing it in until the connection is made. Plug the other end into the reference switch and screw it on.

3.7 Connecting the SIM and KUKA Robot Controller



Instructions for connecting the SIM, Reference Switch, and KRC4:

1. Locate the ground wire in the kit. Plug one end into the GND port on the SIM, and plug the other end into Q1 on the KRC4.
2. Locate the two identical D-SUB cables, W23 and W22. Plug one end of W23 into X12 on the KRC4, and plug the other end into X12 on the SIM.
3. Locate the W2 ethernet cable. Plug one end into X65 on the KRC4. Plug the other end into X65 on the SIM. Secure the connector with the screw after plugging it in.
4. Locate the W6 ethernet cable. Plug one end into X66 on the KRC4, and plug the other end into X66 on the SIM.
5. A loopback connector should be plugged into X55 on the KRC4.

(Continued on next page)

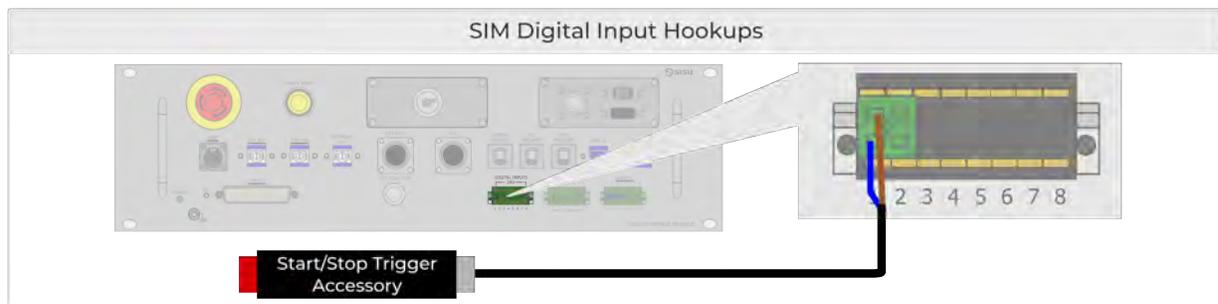
3.8 Hooking up Digital I/O on the SIM

Instructions for hooking up Inputs:

1. Plug one wire for your accessory into an empty spot on the top row of X15 on the SIM.

! **SIM INPUT VOLTAGE:** The top row of the input header supplies a constant 24V to power accessories.

2. Plug the ground wire for your accessory into the bottom row of X15 on the SIM directly beneath the one you just plugged into the top row.

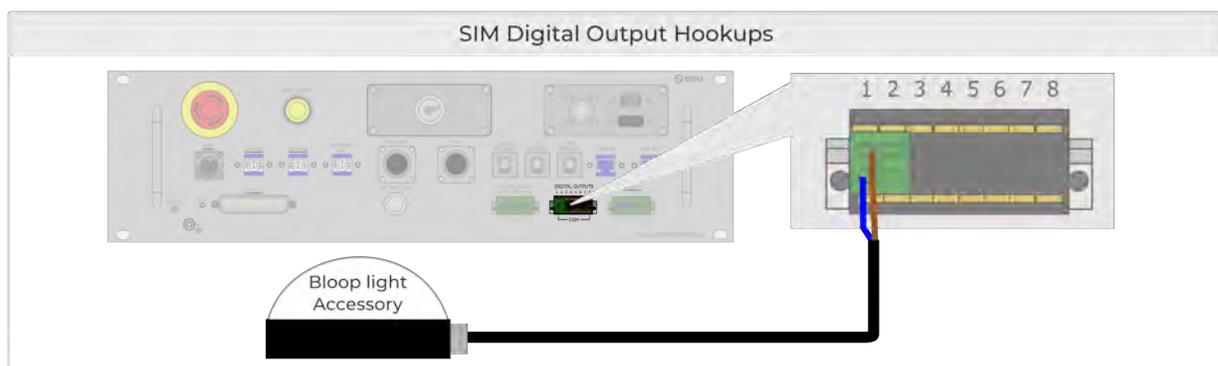


Instructions for hooking up Outputs:

1. Plug one wire for your accessory into an empty spot on the top row of X16 on the SIM.

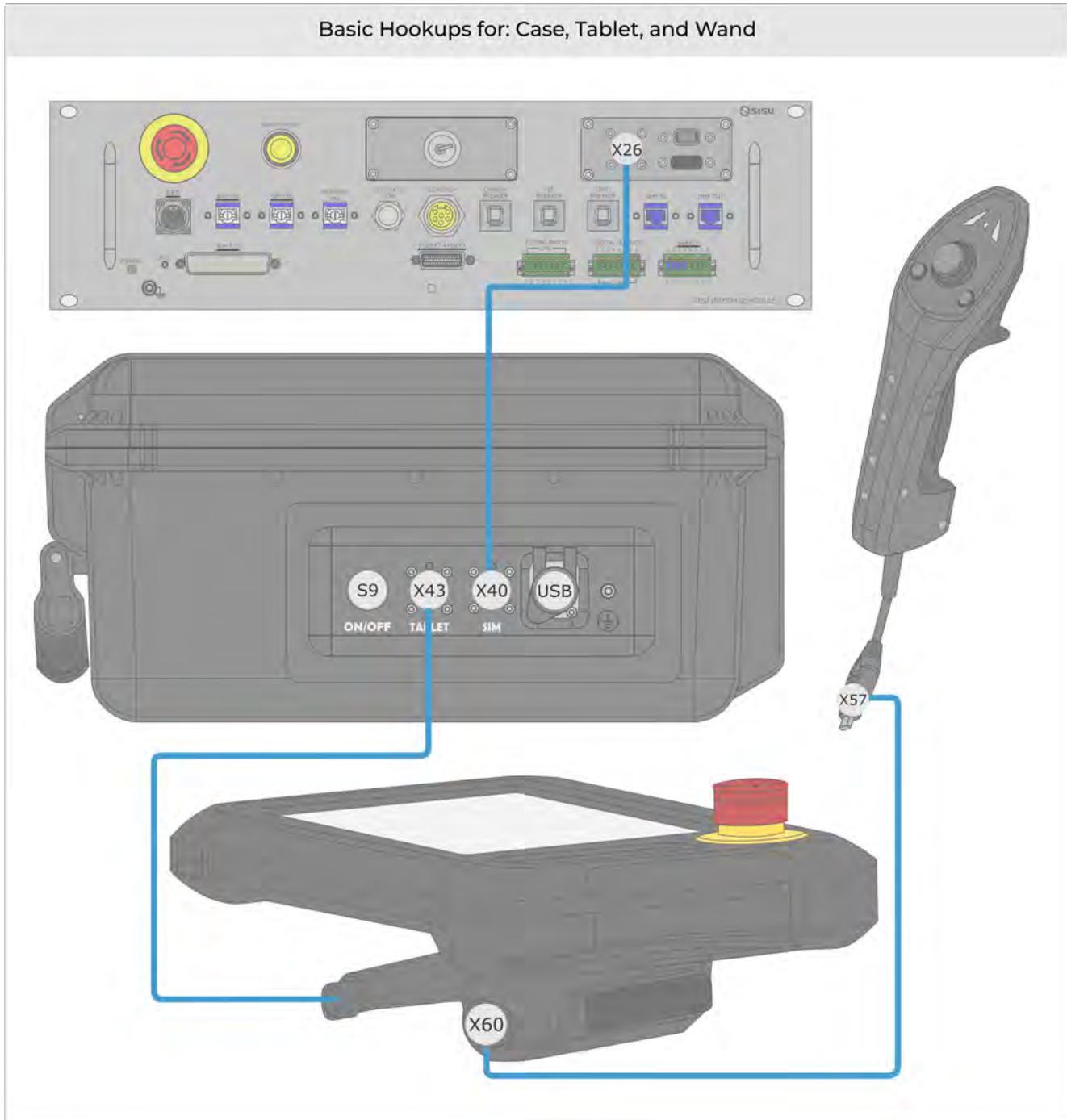
! **SIM OUTPUT:** The top row of the outputs supplies a 27V pulse when set to high, and 0V when set to low. The digital output provides .5A per channel.

2. Plug the ground wire for your accessory into the bottom row of X16 on the SIM directly beneath the one you just plugged into the top row.



🔗 JUMP TO: See section 6.6.1: **How to Add a Channel - Adding TRIGGER CHANNEL** in your **SISU Cinema Robotics Manual** for information on programming your input and output channels.

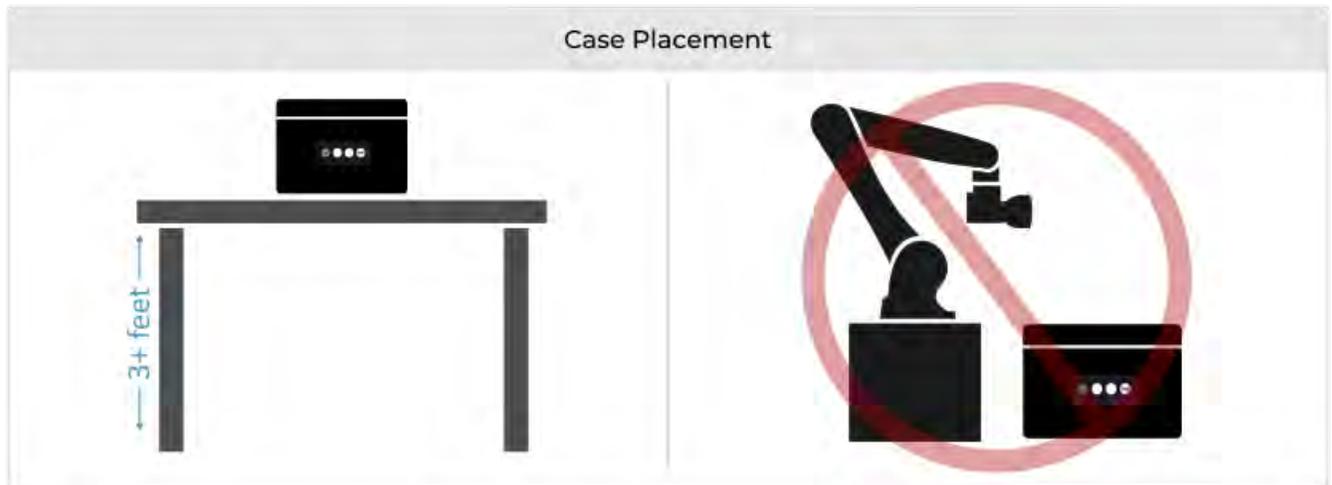
3.9 Connecting the Case, Tablet, and Wand



(Continue reading for numbered list of instructions)

Instructions for connecting the case, tablet, and wand:

1. Place the case at least 3 feet off the ground.



2. Locate the W24 cable. Plug one end into X26 on the SIM, plug the other end into X40 on the case.
3. Plug the W38 cable connected to the tablet into the TABLET (X43) port on the case.
4. Plug the wand X57 into X60 on the tablet.

3.10 Powering ON the System

1. If you have a KRC4, plug the cable coming out of the top of the unit into your transformer or power source.
2. **Now you can plug your main power cable into the wall.**
3. Flip the power switch on the KRC4 to ON. (The switch is on the OUTSIDE of the controller.)
4. Power on the controls cart by plugging the SIM into power.

(Continued on next page)

- Press the small RST button on the SIM. After a few minutes, if the yellow Safety Reset button on the SIM is flashing you need to press it to clear it.

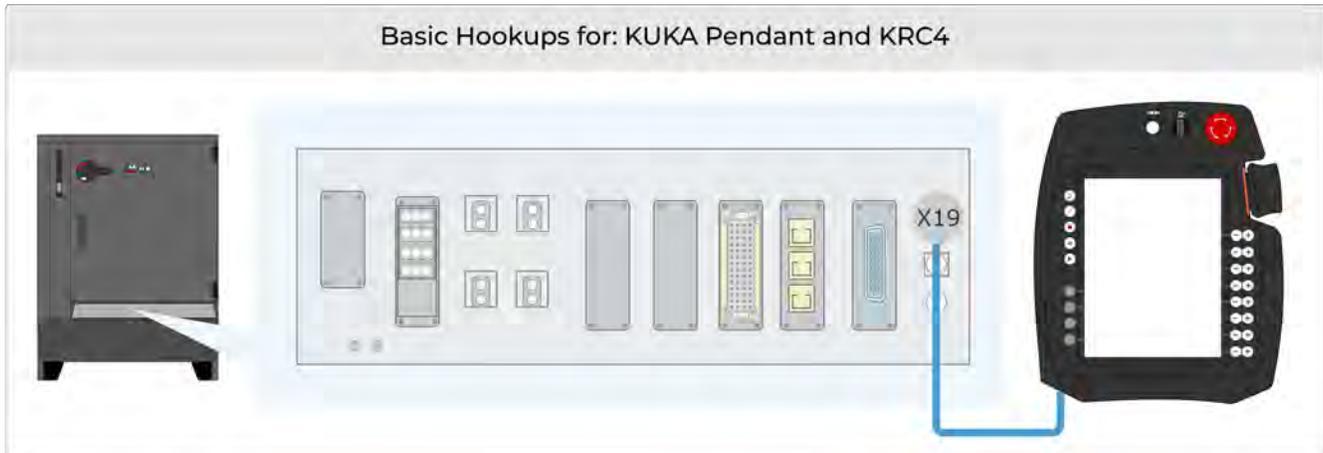


- Once the LED lights on the wand are on or flashing, press the power button (S9) on the case.



! TABLET SCREEN: The tablet screen will not come on until the power button on the case is solid, and the screen may initially take up to 30 seconds to power on.

3.11 Powering ON KUKA Pendant



Instructions for powering ON the KUKA pendant:

1. Plug the KUKA pendant cable into X19 on the KRC4.

3.12 Testing E-stop Functionality

Test the 3 E-stops for functionality by doing the following:

1. Press the E-stop button until it clicks.
2. Check that the yellow Safety Reset button on the SIM is flashing AND check that the robot no longer engages when the Enabling button on the tablet is pushed.



3. Pull the E-stop back out to release it.
4. Push the blinking yellow Safety Reset button on the SIM in.
5. Repeat the process for each of the 3 E-stop buttons (SIM, tablet, KUKA pendant).

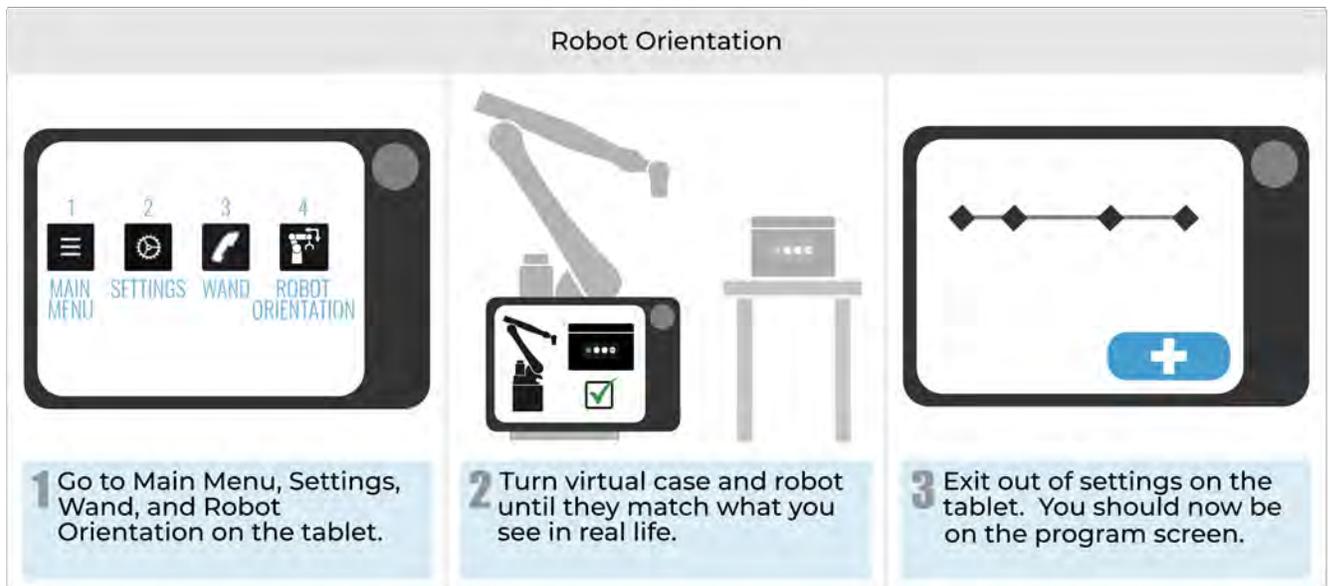


3.13 Testing Robot Motion

Instructions for testing the robot motion:

DANGER: Never test the robot with a camera attached. Make sure there is nothing on the end of the robot arm before you begin testing.

1. Set the robot orientation (follow steps in graphic below).

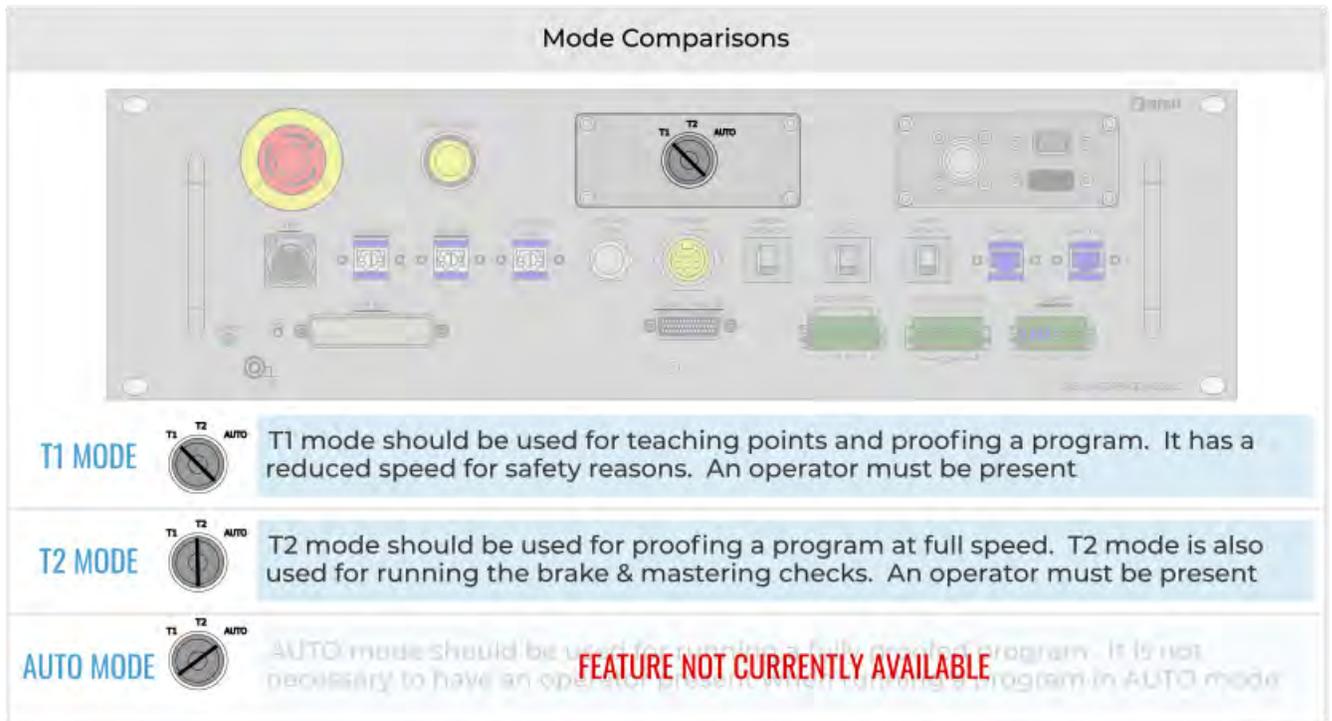


2. Use the mode key switch to set the system to T1 mode (on the SIM or controls cart).

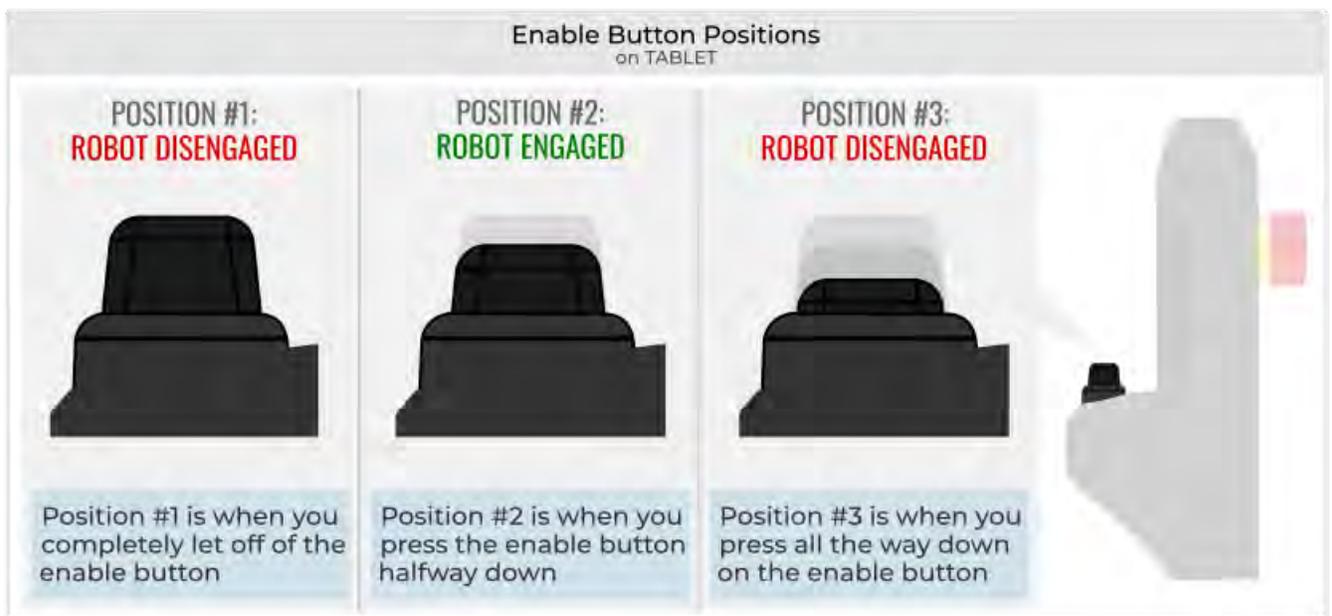
FLASHING RESET BUTTON: If the yellow reset button on the SIM is flashing you will need to reset the safety controller. Do this by pushing down on the yellow reset button.



(T1, T2, and Auto mode notes continued on next page)



- Pull the enable button on the tablet into the enable position to engage the robot. You should hear a clicking noise when this is properly done.

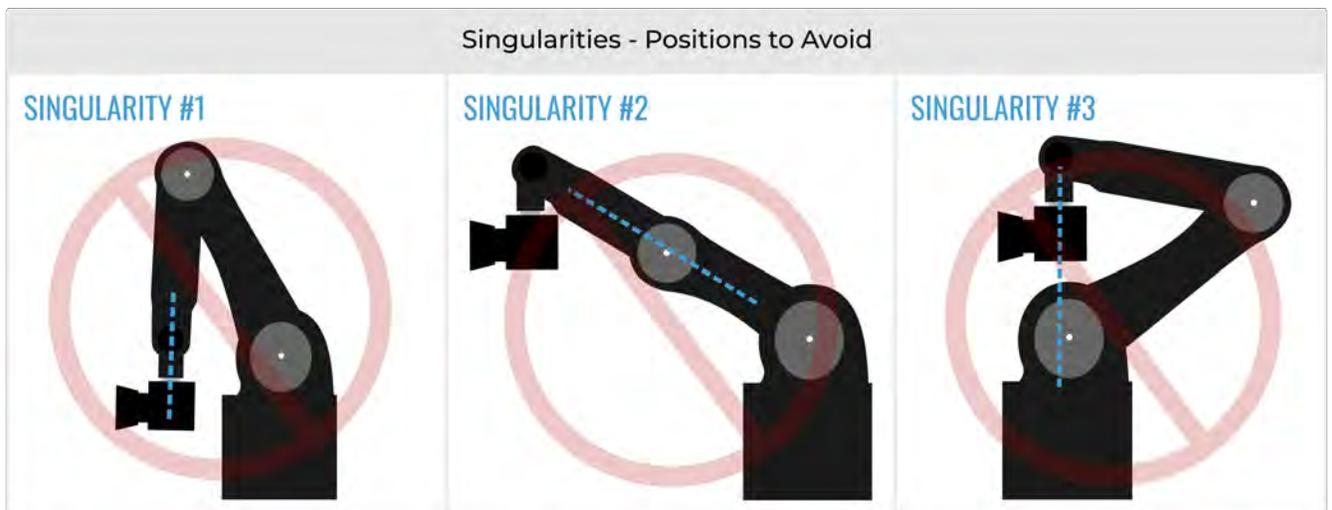


(Continued on next page)

4. The robot is now ready to move.

 **SINGULARITIES - ROBOT POSITIONS TO AVOID:** Carefully review the image below which shows which robot positions you need to avoid. Moving your robot into one of these positions can cause you to encounter a singularity, which can cause your robot to become stuck.

 **MOVING THROUGH SINGULARITIES:** Making the move a **joint** move will allow you to move through singularities.

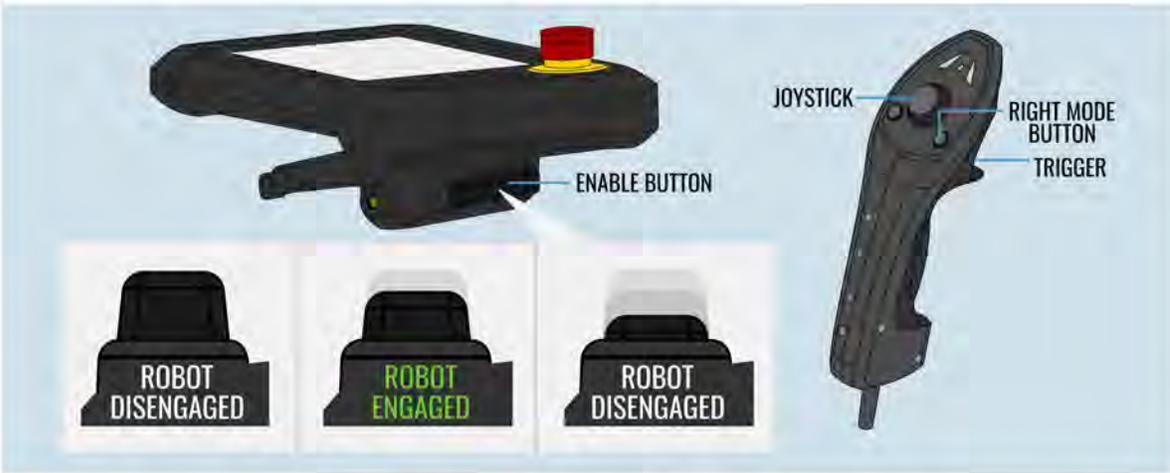


 **STUCK ROBOT:** If the robot will not move or becomes stuck, see chapter [A Appendix A - Troubleshooting Known Issues](#).

(Continue reading for instructions on how to move the robot.)

5. Try pulling the trigger on the wand, moving the wand through the air, and experimenting with the joystick.

How to Move the Robot



IMPORTANT: Enable button will only engage the robot if it is pressed halfway down, as shown in the image above

TRIGGER CONTROL INSTRUCTIONS

- 1 Hold down the enable button on the tablet
- 2 Hold down the trigger on the wand
- 3 Move the wand around as desired; the robot will mimic your movements

JOYSTICK CONTROL INSTRUCTIONS

- 1 Hold down the enable button on the tablet
- 2 Push the joystick on the wand in the desired direction. The robot will move in the same direction that you are pushing the joystick

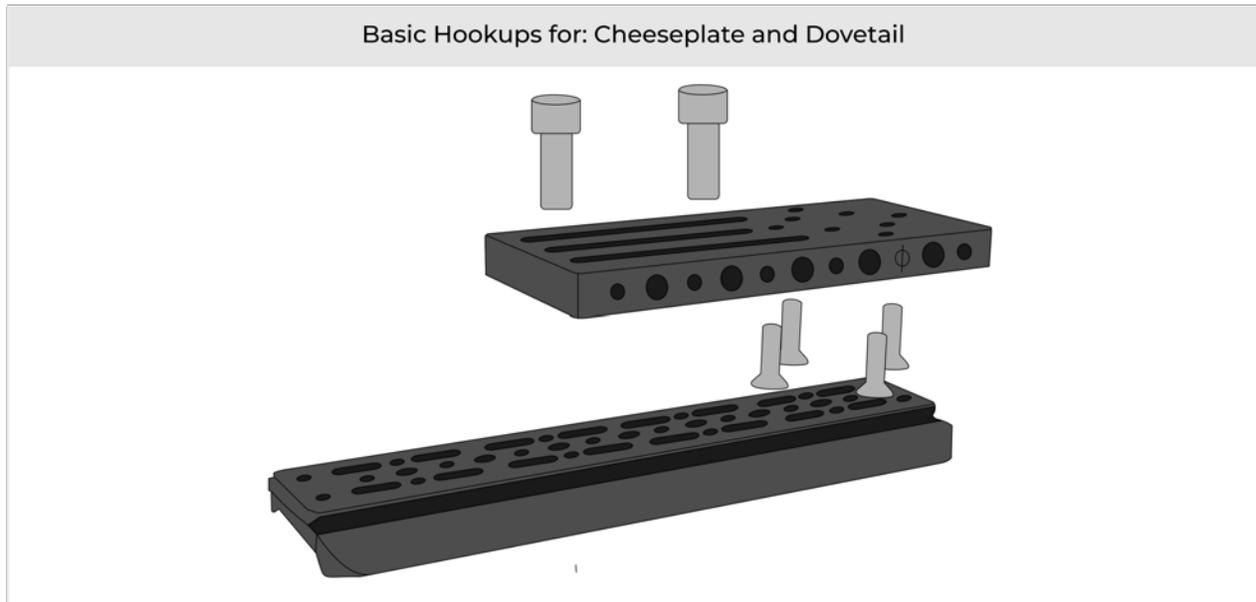
JOINT MODE INSTRUCTIONS

- 1 Open the joint mode page by clicking the right wand button or the tablet's joint mode button
- 2 Select the joint and direction that you want to move the robot
- 3 Hold down the enable button on the pendant and trigger on the wand to move the robot in the correct direction



6. Now that you have moved the robot successfully, you are ready to mount the cheese plate and dovetail.

3.14 Mount Cheese Plate and Dovetail

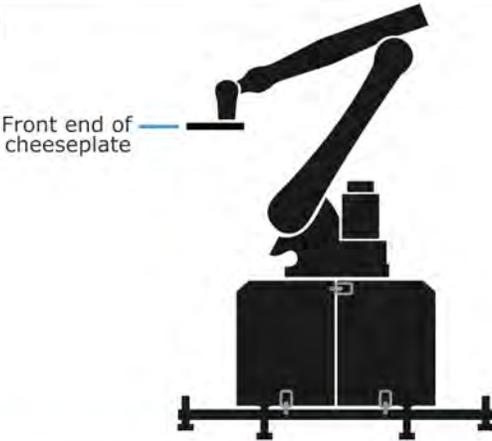


Instructions for mounting the cheese plate and dovetail:

1. Move your robot into the proper position using the image and instructions below as your guide.

Robot and Cheeseplate Alignment

CORRECT ROBOT POSITION



Front end of cheeseplate

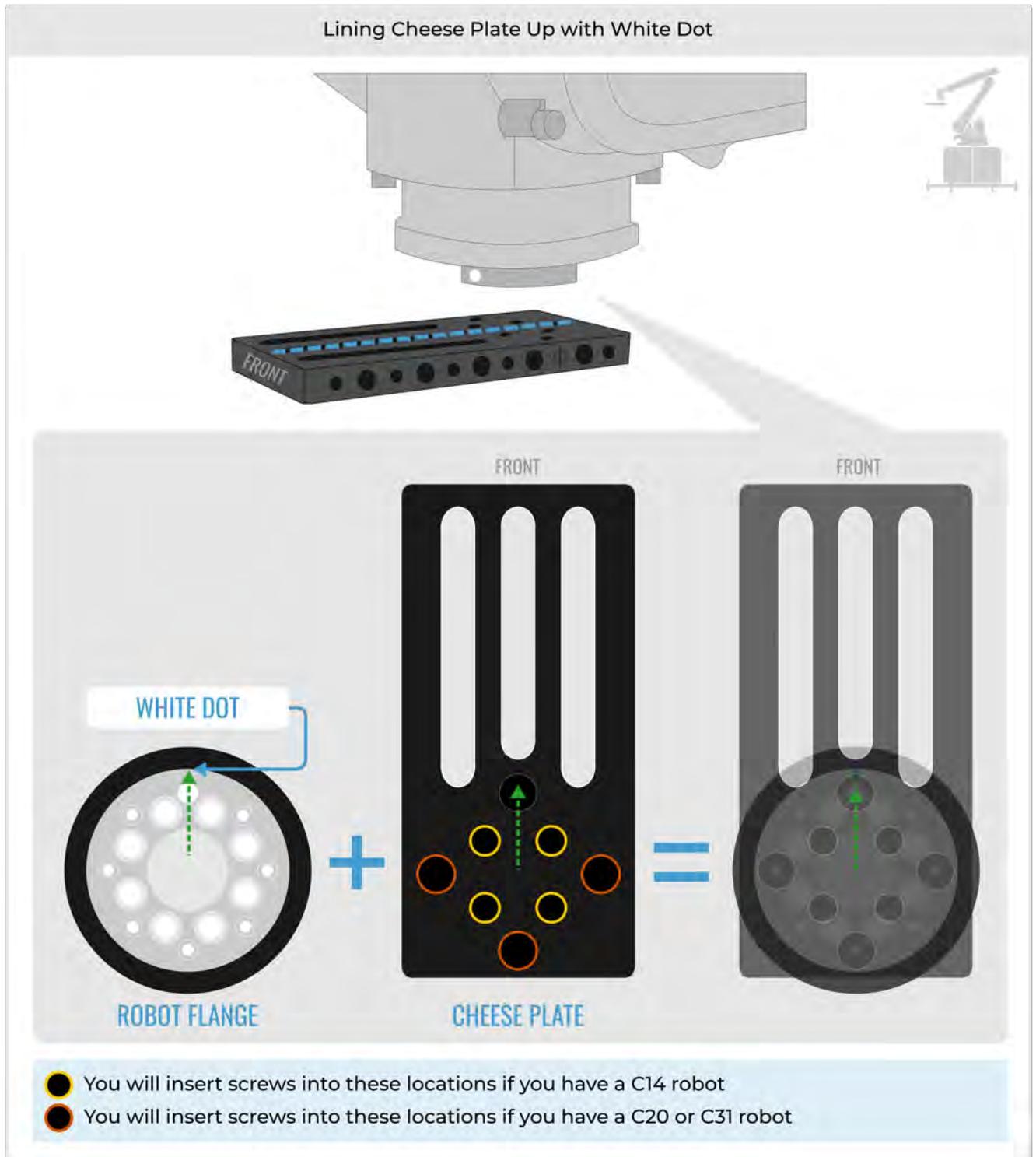
C20/C31	J1	0.0 deg	J2	-80.0 deg	J3	110.0 deg
	J4	0.0 deg	J5	60.0 deg	J6	0.0 deg

C11/C14	J1	0.0 deg	J2	-60.0 deg	J3	110.0 deg
	J4	0.0 deg	J5	30.0 deg	J6	0.0 deg

Using **Joint Mode Control** on your tablet, move your robot close to the positions pictured in this text box. When at this position, the cheese plate should be facing AWAY from the robot base and cables (**the top image is for C11/C14 robots, the bottom image is for C20/C31 robots**).

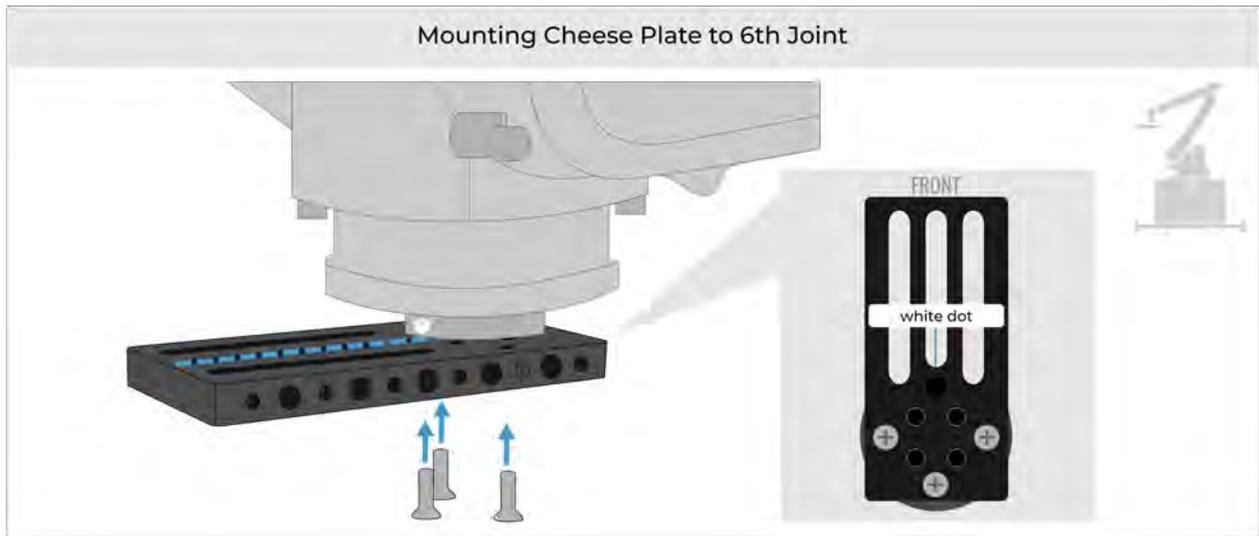
(Continue reading for numbered list of instructions)

- Align the center of your cheese plate up with the **white dot** marked on the robot flange, as seen in the picture. (Instructions for bolting the two pieces together are in the next step.)



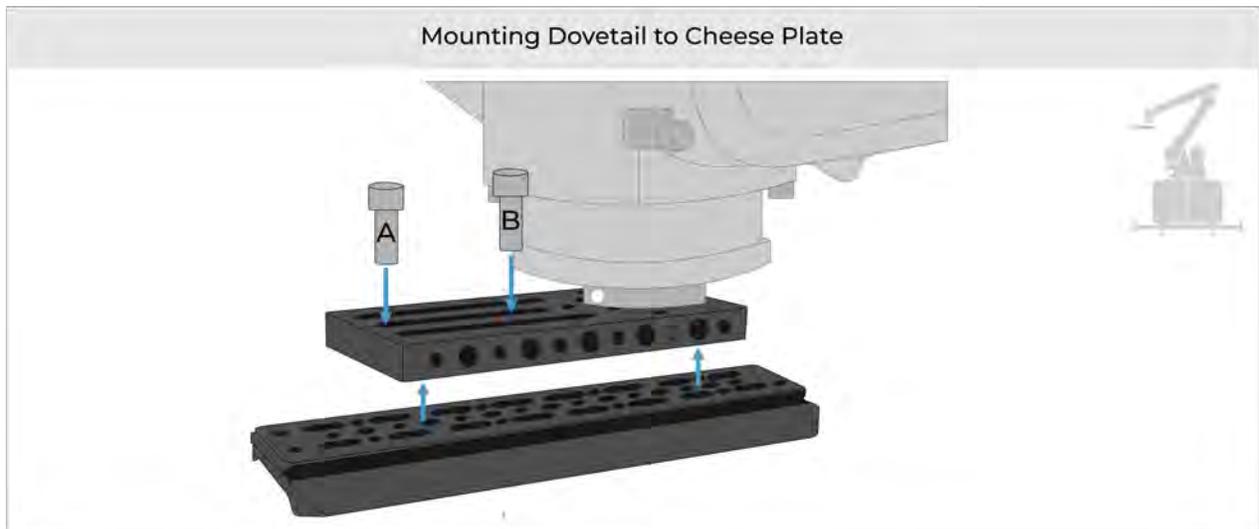
(Continued on next page)

3. Bolt the cheese plate to the joint with the appropriate sized screws.



! **NUMBER OF SCREWS:** Depending on your robot you may only be able to put in 3 screws instead of 4.

4. Mount the dovetail to the cheese plate using appropriately sized bolts.



! **OPTIMAL BOLT PLACEMENT:** Bolts A and B should be placed as **far apart** as possible. This will help to minimize shakiness in the video.

📄 JUMP TO: **It is imperative to optimal robot/camera performance that you install the cheese plate and dovetail correctly.** To ensure that you have installed it correctly, see section [A.2.5 ISSUE: Target tracking does not work \(or goes wild\) when running your program.](#)

3.15 Mounting Camera and Setting Up FIZ Motors

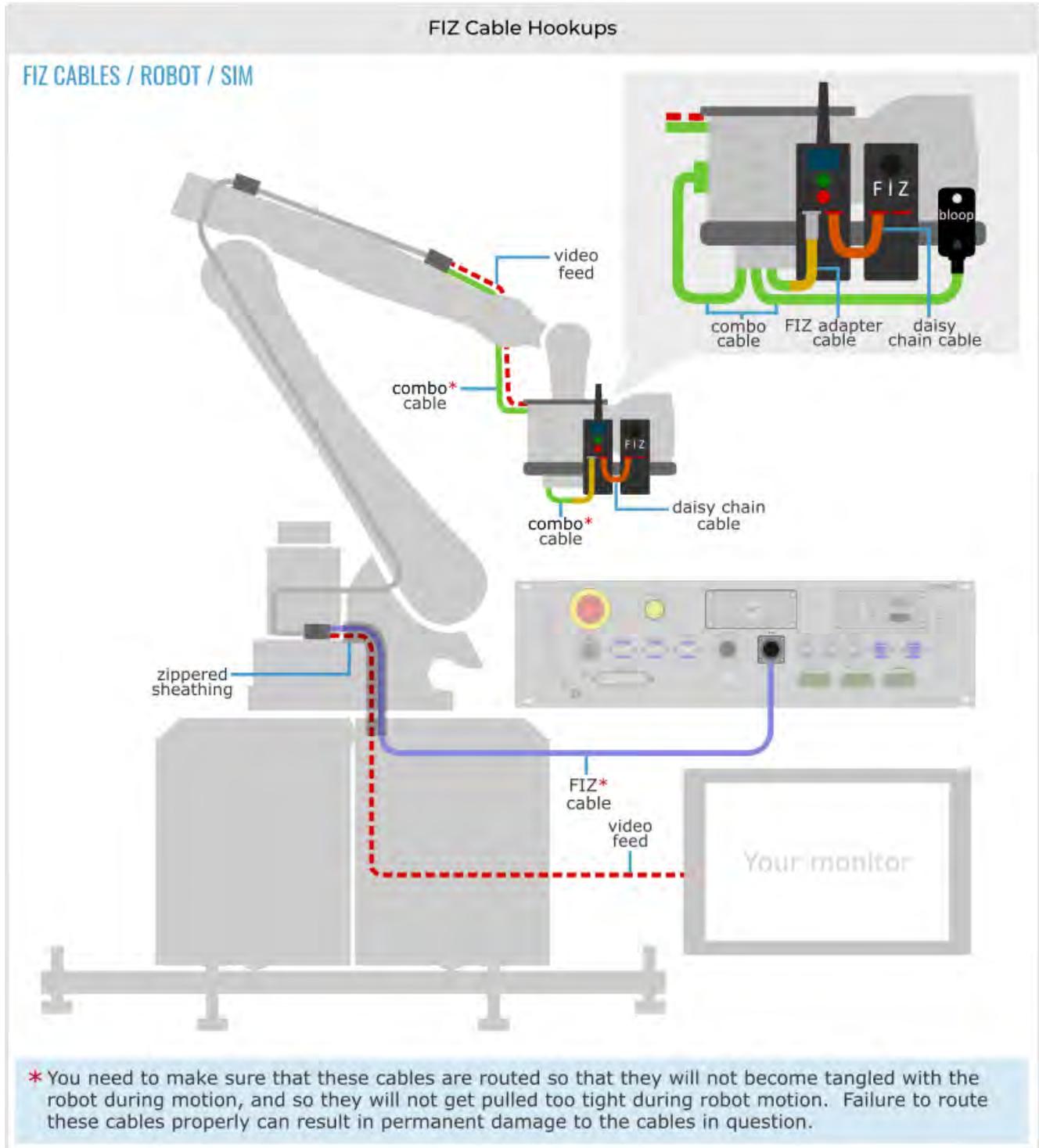
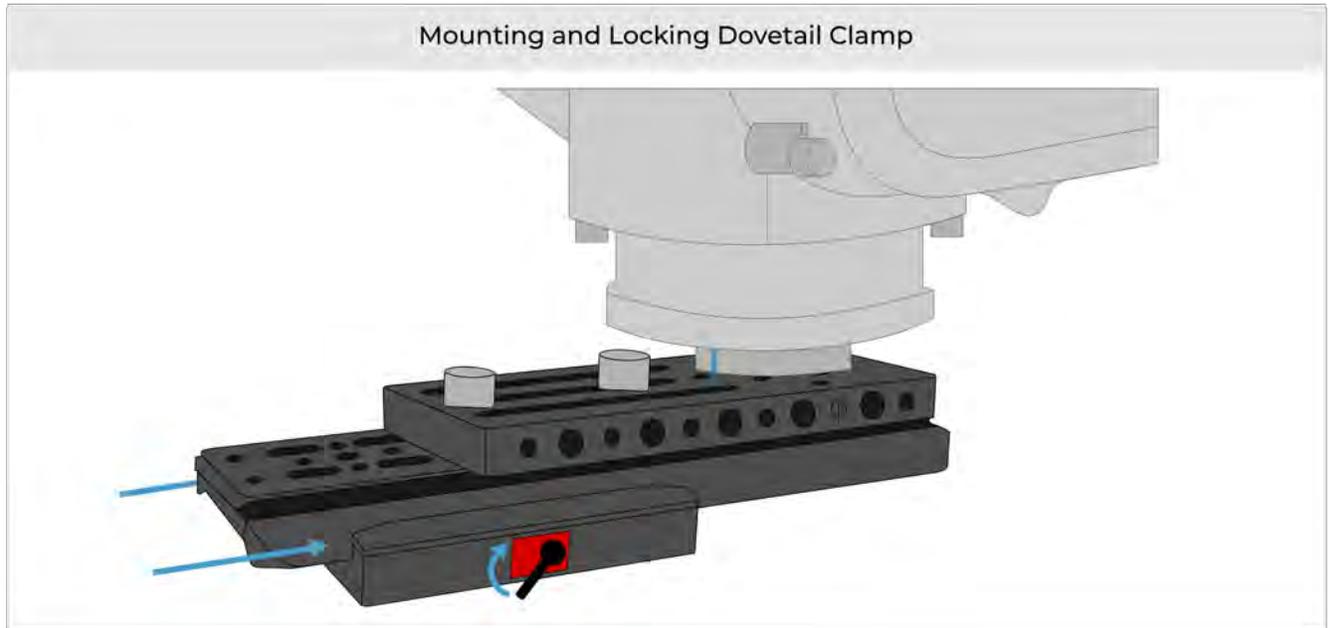


Figure 1: FIZ Cable Hookups

(Numbered instructions continued on next page)

Instructions for setting up the camera, FIZ motors, and FIZ cables:

1. Mount your camera to the dovetail clamp. The dovetail clamp is pictured in step #2.
2. Mount the dovetail clamp to the dovetail by sliding it on and locking it with the lever.



 **SLIDING DOVETAIL CLAMP OFF:** To slide the dovetail clamp off of the dovetail, push the silver tabs on the end of the dovetail in and then slide the dovetail clamp over them.

3. If you have not already done so, mount your FIZ mounting rods to your camera.
4. Mount your cPRO and cforce PLUS FIZ motors onto the FIZ mounting rod in the same order as is shown in Figure 1. If you purchased a 3rd FIZ motor, that will also need to be mounted.
5. Plug the end of the **combo cable** that has only one connector into the bracket at the top of the robot arm.
6. Plug your camera's **video feed** into the bracket at the top of the robot arm next to the medusa cable.
7. Attach the **combo cable** and the **video feed** together into the clamp on the cheese plate. (This clamp is NOT pictured in the image on the previous page, as it is on the opposite side of where the FIZ motors are placed.) **Make sure that the cable is not pulled tightly when you do this. It needs to have room for the robot to move it around.**

(Numbered instructions continued on next page)

8. The **combo cable** splits off into four connections near the camera: camera power, FIZ, bloop light, and I/O.
 - a) Plug the FIZ connector end into the FIZ adapter cable.
 - b) Plug the other end of the FIZ adapter cable into the cPRO motor.
 - c) Plug your personal camera power adapter cable into the camera D-Tap power connector.
 - d) If you have a bloop light, install your bloop light and plug that into the bloop light connector.
9. Plug the other end of the **video feed** into your camera.
10. Connect your **FIZ cable**:
 - a) For a **robot cart set up**, plug one end of the FIZ cable (X22) into X88 on the SIM. Plug the other end into the bracket at the base of the robot pedestal.
 - b) For a **track set up**, plug one end of the FIZ/Track cable (X32) into X21 on the SIM. Plug the other end into the bracket at the base of the robot pedestal.
11. Plug your video feed cable from the bracket at the base of the robot pedestal into your monitor.



MOTOR CALIBRATION: The FIZ motors will calibrate automatically when you start SISU Lab.

3.16 Transporting the Robot



TIP ANGLE: As per OSHA recommendations, the tip angle of the robot while it is being moved should not exceed 10 degrees. Failure to follow these recommendations could result in the robot tipping over and becoming damaged.

3.16.1 Shipping the Robot

Instructions for shipping C31 robots with a PEDESTAL AND WEIGHTS:

1. Detach the camera, dovetail clamp, dovetail, and cheese plate from the end of the robot arm.
2. Unplug all robot connections.
3. Using the tablet, open up the **Home.config** program and run it. This will get the robot into the proper shipping position.
4. Use a pallet jack to remove all weights from the pedestal.
5. You can now move the robot to ship it safely.

Instructions for shipping C31 robots with a BASE PLATE:

1. Detach the camera, dovetail clamp, dovetail, and cheese plate from the end of the robot arm.
2. Unplug all robot connections.
3. Using the tablet, open up the **Home.config** program and run it. This will get the robot into the proper shipping position.
4. If they are not already attached, attach the two forklift wings to the side of the robot (you may need to detach the lower FIZ bracket as the forklift wing on that side uses the same holes and bolts as the lower FIZ bracket).
5. Move the forklift into position using the forklift wings.
6. Unscrew the 8 bolts that are screwed through the base plate into the ground.
7. You can now move the robot to ship it safely.

3.16.2 Moving the Robot to a New Location

Instructions for moving C31 robots (with a PEDESTAL AND WEIGHTS) to a new location:

1. Detach the camera, dovetail clamp, dovetail, and cheese plate from the end of the robot arm.
2. Unplug all robot connections.
3. Using the tablet, open up the **Home.config** program and run it. This will get the robot into the proper shipping position.
4. Use a pallet jack to remove all weights from the pedestal.
5. Use a pallet jack to move the robot to its new location.

Instructions for moving C31 robots (with a BASE PLATE) to a new location:

1. Detach the camera, dovetail clamp, dovetail, and cheese plate from the end of the robot arm.
2. Unplug all robot connections.
3. Using the tablet, open up the **Home.config** program and run it. This will get the robot into the proper shipping position.
4. If they are not already attached, attach the two forklift wings to the side of the robot (you may need to detach the lower FIZ bracket as the forklift wing on that side uses the same holes and bolts as the lower FIZ bracket).
5. Move the forklift into position using the forklift wings.
6. Unscrew the 8 bolts that are screwed through the base plate into the ground.
7. Use the forklift to move the robot to its new location.



SECTION 2

GLOSSARY



4. GLOSSARY

4.1 Chapter Contents

- [Icon Key - 4.2](#)
- [Glossary of Used Terms - 4.3](#)

4.2 Icon Key



4.3 Glossary of Used Terms

A

AUTO MODE: When Auto mode is enabled on the mode key switch the following will occur: The program can be started only from the start button in SISU Lab, robot speed is no longer adjusted by the wand trigger, the stepping functionality is no longer available, and the settings/quick set tray/program tabs are unavailable. Auto is the only mode that lets you run a program without having an operator present. See section [3.13 Testing Robot Motion](#). **Auto mode is not currently available.**

C

CASE: The case is a black box that holds the tablet and the wand. The box itself has a power button and contains connection points to the the SIM and the tablet. See section [2.4 Case](#) and section [3.9 Connecting the Case, Tablet, and Wand](#).

CHEESE PLATE: The cheese plate is the piece of metal that mounts to the robot and camera. It also has a dovetail mounted to it. See section [3.14 Mount Cheese Plate and Dovetail](#).

D

DOVETAIL: The dovetail is attached to the cheese plate and is used to mount the camera to the robot arm. See section [3.14 Mount Cheese Plate and Dovetail](#).

DOVETAIL CLAMP: The dovetail clamp is a plate used to mount the camera to the robot arm. See section [3.14 Mount Cheese Plate and Dovetail](#).

E

E-STOP (emergency stop): E-stop buttons will override other system commands and cause the robot to stop immediately as a safety precaution. There are E-stop buttons on the SIM, tablet, and KUKA pendant. See sections [2.11 SIM](#), [2.12 Tablet](#), and [2.7 KUKA Pendant](#) for illustrations of E-stop buttons.

ENABLE BUTTON: The enable button on the tablet enables robot motion (i.e. running programs and live motion) in modes T1 and T2. See section [2.12 Tablet](#). For instructions on how to use the enable button, see step #3 in section [3.13 Testing Robot Motion](#).

F

FIZ MOTORS: The FIZ motors are the Focus, Iris, and Zoom motors that attach to your camera and allow you to control the focus, iris, and zoom on your camera remotely by using your wand (in joint mode) or the tablet. See section [2.5 FIZ Motors](#) and section [3.15 Mounting Camera and Setting Up FIZ Motors](#).

FIZ MOUNTING CLAMPS: The FIZ mounting clamps are used to mount the FIZ motors to the FIZ mounting rod. See section [2.2.2 Hardware Map - Not Included with System](#) and section [3.15 Mounting Camera and Setting Up FIZ Motors](#).

FIZ 15 mm MOUNTING ROD: The FIZ mounting rod is used to mount the FIZ motors to the camera. See section [2.2.2 Hardware Map - Not Included with System](#) and section [3.15 Mounting Camera and Setting Up FIZ Motors](#).

H

HARDWARE MAPS: See section [2.2.1 Hardware Map - Included with System](#) for a hardware map featuring all SISU Cinema Robotics hardware components. See section [2.2.2 Hardware Map - Not Included with System](#) for a hardware map featuring all hardware components that you will need to provide.

J

JOYSTICK: The joystick is located on the wand and is used to move the robot and FIZ motors. See section [2.13 Wand](#).

K

KUKA ROBOT CONTROLLER (KRC4): The KRC4 is the KUKA Robot Controller and comes with the C20 and C31 robots (the KRC4 compact comes with the C11 and C14 robots). See section [2.6.1 KRC4](#) and section [3.7 Connecting the SIM and KUKA Robot Controller](#).

KUKA PENDANT: The KUKA pendant is used to reconfigure the mastering position when needed. It can also be used to control the robot and write programs independent of SISU Lab. See section [2.7 KUKA Pendant](#).

L

LEFT WAND BUTTON (C2): The left wand button (or C2) allows you to capture robot program points, or add keyframes to your program. See section [2.13 Wand](#).

LIVE CONTROL: Live Control is the general term for moving the robot in any way using the wand. (Live Control is not when you move the robot via the Joint Page or when the robot is moving during a run.)

R

READY INDICATOR LIGHTS (RIL): The ready indicator lights (or RIL) are lights on the wand that show when the robot is engaged and ready to move. See section [2.13 Wand](#).

REFERENCE SWITCH: The reference switch is a sensor that verifies the robot has reached its mastering position when running mastering checks. See section [2.8 Reference Switch](#), and section [3.7 Connecting the SIM and KUKA Robot Controller](#).

RIGHT WAND BUTTON (C3): The right wand button (or C3) takes you in and out of joint mode. See section [2.13 Wand](#).

ROBOT ARM: The robot arm is the mechanism to which your camera will be attached. The robot arm's movements are controlled with the wand. See section [2.9 Robot Arms and Joints](#) and section [3.13 Testing Robot Motion](#).

S

SINGULARITY: A robot singularity is a condition when the alignment of two or more joints results in an unpredictable robot motion; often the robot will become stuck. See #4 in section [3.13 Testing Robot Motion](#).

SISU CINEMA ROBOTICS system: The SISU Cinema Robotics system is the combination of the wand, tablet, case, KUKA KRC4 (or KRC4 compact), SIM, and robot controlling software (SISU Lab). See section [2.2.1 Hardware Map - Included with System](#).

SISU INTERFACE MODULE (SIM): The SISU Interface Module (SIM) has a connection point to the reference switch. See section [2.11 SIM](#) and section [3.7 Connecting the SIM and KUKA Robot Controller](#). It also has a key switch to flip between T1, T2, and Auto mode (the mode switch is located on the controls cart if you have a C11 or C14 robot). It is also used to run the program autonomously in Auto mode, and indicates errors (which can be reset using the SIM). It also contains an E-stop button. See section [2.11 SIM](#), and section [3.7 Connecting the SIM and KUKA Robot Controller](#).

T

T1 MODE: When T1 mode is enabled on the mode switch the following occur: Trigger mode is enabled, the enable switch on the tablet is required to perform moves, SISU Lab code will limit velocities to stay within safe limits, programs will run at a reduced speed, and the program is run from the tablet. See section [3.13 Testing Robot Motion](#).

T2 MODE: When T2 mode is enabled on the mode switch the following occur: you can no longer control the robot in Trigger mode, the program can run at full speed, the enable switch on the tablet is still required to perform moves, and the program is run from the tablet. See section [3.13 Testing Robot Motion](#).

TABLET: The tablet has connection points to the case and wand and has a screen that allows you to interface with the software, write robot programs, access settings, and run the robot in T1 and T2 mode. See section [2.12 Tablet](#) and section [3.9 Connecting the Case, Tablet, and Wand](#).

TRIGGER - on wand: The trigger is on the wand and is used to control the robot speed. See section [2.13 Wand](#).

W

WAND: The wand allows you to move the robot using several different modes. It also allows you to capture program points and can take you in and out of joint mode. See section [2.13 Wand](#) and section [3.9 Connecting the Case, Tablet, and Wand](#).



SECTION 3

APPENDICES



A. APPENDIX A - TROUBLESHOOTING KNOWN ISSUES

A.1 Chapter Contents

- **Robot issues** - [A.2](#)

- ISSUE: The robot's movements are erratic or halting / The robot randomly starts plunging while using trigger control - [A.2.1](#)
- ISSUE: The robot's movements are shaky - [A.2.2](#)
- ISSUE: The robot bumps or jerks AT the keyframe - [A.2.3](#)
- ISSUE: Wave-like pattern in camera roll speed - [A.2.4](#)
- ISSUE: Target tracking does not work (or goes wild) when running your program - [A.2.5](#)
- ISSUE: The robot is stuck in position - SISU Lab case does NOT power on - [A.2.6](#)
- ISSUE: The robot is stuck in position - SISU Lab case powers on - [A.2.7](#)
 - * Reset button on SIM is flashing - [A.2.7](#)
 - * Reset button on SIM is not flashing - [A.2.7](#)
- ISSUE: Robot dips or stops suddenly when you are running a program - [A.2.8](#)
- ISSUE: Mastering check failure - [A.2.9](#)
- ISSUE: Interference Detected Message Pops Up Constantly - [A.2.10](#)

- **FIZ and focus issues** - [A.3](#)

- ISSUE: The FIZ motor lights are blinking - [A.3.1](#)
- ISSUE: Focus marks are off when running a program - [A.3.2](#)
- ISSUE: FIZ motors have power but appear as disconnected in SISU Lab - [A.3.3](#)
- ISSUE: FIZ motor movement not smooth in joint mode - [A.3.4](#)
- ISSUE: Items in the foreground and background are not staying lined up when you pan the camera - [A.3.5](#)

A.2 Robot issues

A.2.1 ISSUE: The robot's movements are erratic or halting / The robot randomly starts plunging while using trigger control

PROBLEM: ERRATIC MOVEMENT: When the signal from the wand gets distorted the robot's motions can become erratic (e.g. it moves on its own or in a halting manner). **ROBOT PLUNGING:** While moving the robot using trigger control, the robot will start moving in a set direction no matter how you move the wand or joystick.

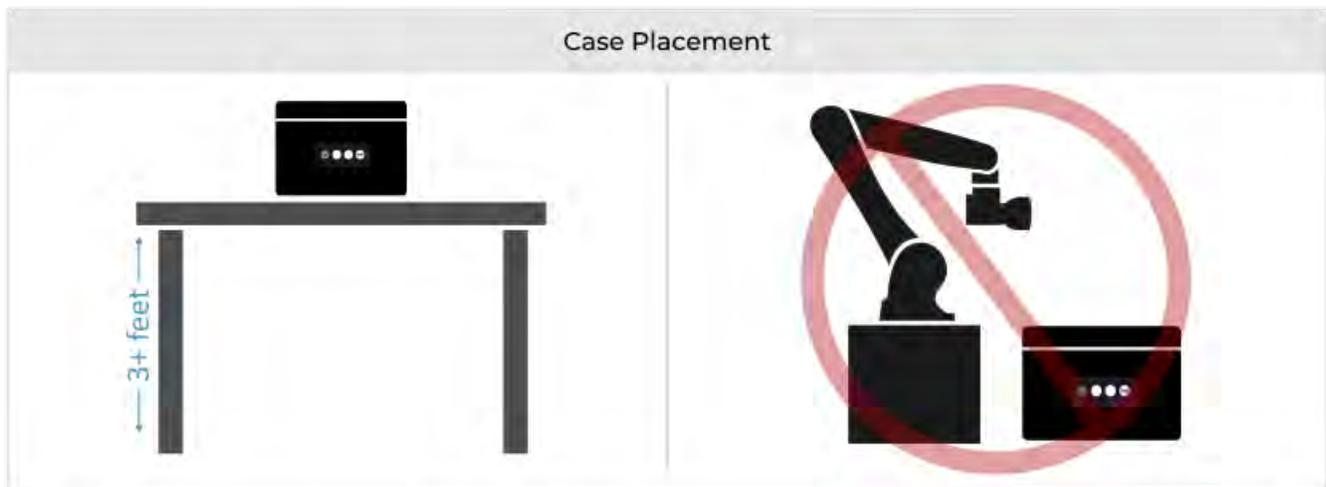
SOLUTION #1: Try turning down your distortion tolerance. When your distortion tolerance is low, you will receive notifications for wand signal interference which can confirm that the signal is becoming distorted. If your signal **is** becoming distorted, steps from solutions 2-4 may improve the signal.



JUMP TO: See section **Distortion Tolerance** in your **SISU Cinema Robotics Manual** for instructions.

SOLUTION #2: Move your case to a new location.

SOLUTION #3: Make sure your case is at least 3 feet off of the ground.



SOLUTION #4: Make sure your case is not near any large metal objects that could interfere with the signal - including the transformer and/or controls cart.

SOLUTION #5: Try unplugging the wand from the tablet and then plugging it back in.

SOLUTION #6: If none of the above instructions fix the problem, please contact SISU customer support.

A.2.2 ISSUE: The robot's movements are shaky

PROBLEM: The robot appears to have a measure of shakiness to it when it is moving. It's important to note that all robots have some degree of shakiness due to mechanical constraints, but steps can be taken to minimize the degree of shakiness appearing in the footage.

SOLUTION #1: Avoid large movements using joint 6 and joint 4.



SOLUTION #2: Keep in mind that the shakiness can get worse when you are moving the robot away/out, and the shakiness can lessen if the robot is moving across. The more extended the robot arm is, the worse the shakiness will get due to more force about the base of the robot. Modify the program to reduce any long reaches of the robot arm.

SOLUTION #3: Shakiness can be even more present in both macro lenses and lenses with a focal length longer than 35mm.

SOLUTION #4: Place the 2 bolts on the dovetail and cheeseplate as **far apart** as possible.



JUMP TO: See section [3.14 Mount Cheese Plate and Dovetail](#) for an illustration on where to place the 2 bolts.

A.2.3 ISSUE: The Robot bumps or jerks AT the keyframe

PROBLEM: The robot/camera bumps or jerks right at a keyframe.

SOLUTION #1: If you have two simultaneous moves - one with a lot of roll and one with a small amount of roll - you may get a bump at the keyframe **between** those moves where there is a large change in roll speed. In this case, you can try turning **Sync Roll off** at the keyframe where the bump occurs, at the keyframe immediately following where the bump occurs, or both.

 **JUMP TO:** See section **Settings Options For Camera Channel Keyframes** in your **SISU Cinema Robotics Manual** for instructions.

A.2.4 ISSUE: Wave-like pattern in camera roll speed

PROBLEM: There is a wave-like pattern in your camera's roll speed across a set of moves.

SOLUTION #1: If you have several unsynced roll moves **in a row** you can end up with an unwanted wave-like pattern in roll speed across these moves. Try turning **Sync Roll** on for one or more of these moves.

 **JUMP TO:** See section **Settings Options For Camera Channel Keyframes** in your **SISU Cinema Robotics Manual** for instructions.

A.2.5 ISSUE: Target tracking does not work (or goes wild) when running your program

PROBLEM: When you go to run your program, target tracking either goes wild or does not appear to be following the target correctly.

SOLUTION #1: Your camera tool could be set incorrectly. To double check this, do the following steps:

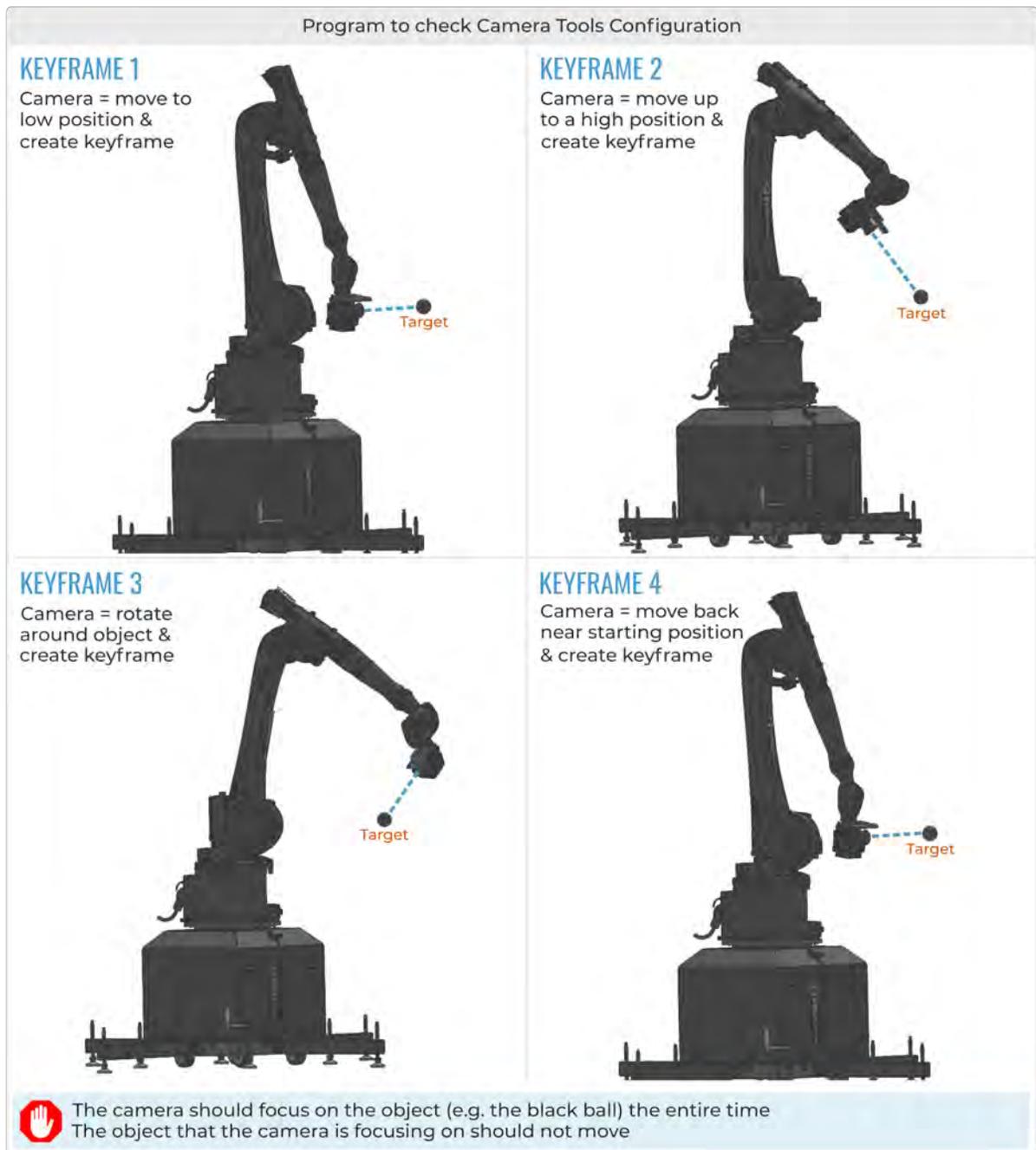
1. Move the robot with the joystick, and switch between camera and crane reference. If the camera appears to be moving in the wrong direction, check your robot orientation. If your robot orientation is correct, move on to step 2.

 **CAMERA TOOL TABS / PAGES:** You only need to fill out **ONE** camera tool tab / page per camera configuration.

 **JUMP TO:** See section **Robot Orientation** in your **SISU Cinema Robotics Manual** for instructions.

(Continued on next page)

2. Write a 4 point camera channel program with 1 target keyframe.
- Load the **Camera Tool** test from the SISU Cinema Robotics download page to start your program.
 - Add 1 keyframe in the **target channel**.
 - Add your 4 keyframe points in the **camera channel**. These 4 points should correspond with the following positions:



(Continued on next page)

3. Turn on **horizon lock** and rotate / translate.
 - a) Turn **horizon lock** ON in the quick set tray at the top of the screen.
 - b) Move the camera around with trigger control. With horizon lock turned ON you should NOT be able to roll around the lens. **If you ARE able to roll around the lens with horizon lock turned ON, your camera tool may be set incorrectly.**



JUMP TO: See section **Setting The Camera Tools** in your **SISU Cinema Robotics Manual** for instructions on how to set your camera tool.

SOLUTION #2: Your lens configuration settings could be incorrect. Go to the lens configuration settings page and double check all values and settings.

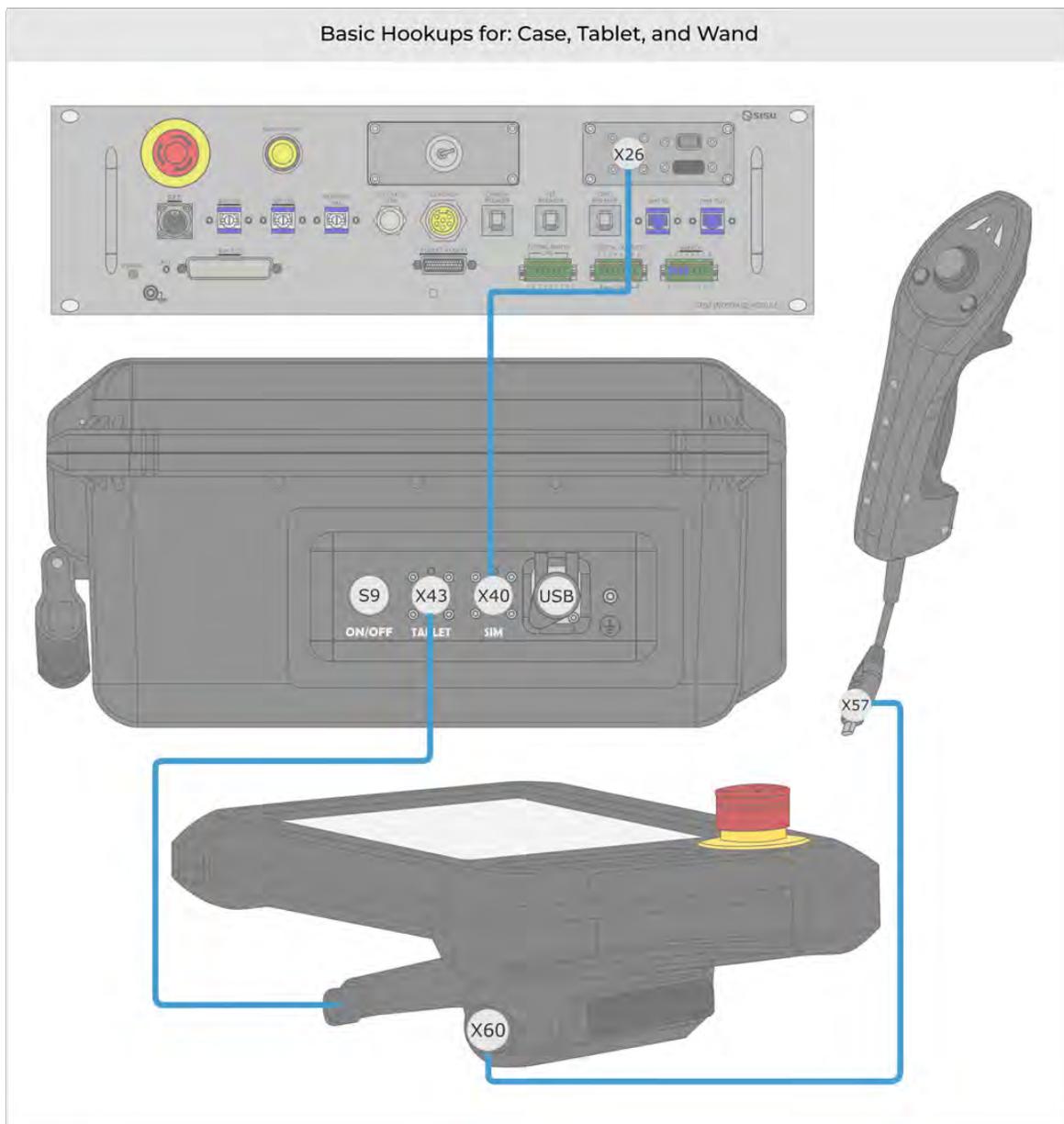
SOLUTION #3: Make sure that you are accurately measuring the distance between the camera sensor and the target **at every keyframe**.

A.2.6 ISSUE: The robot is stuck in position - SISU Lab case does NOT power on

 **JUMP TO:** If the SISU Lab case **DOES** power on see section [A.2.7 ISSUE: The robot is stuck in position - SISU Lab case powers on](#) for instructions.

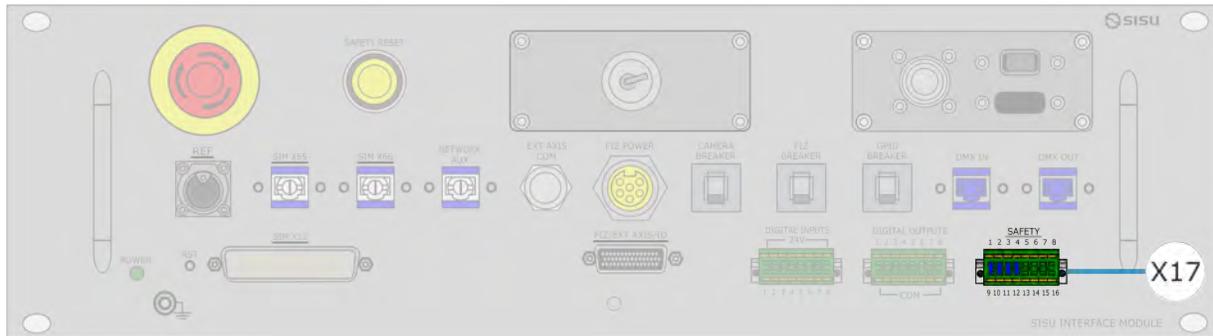
SOLUTION #1: Make sure your robot is turned on. (If the KUKA pendant can turn on, the robot is on.)

SOLUTION #2: Make sure all of your connections are plugged in correctly.



(Continued on next page)

SOLUTION #3: Make sure that the SIM safety cable is plugged in.



SOLUTION #4: After applying power to the case, check to see if the wand lights and/or the case light (located on the side of the case) is on. If no lights appear on the wand or case please contact SISU customer support.

Case Power Button

POWER BUTTON DELAY

After plugging in the case it may take a few seconds before the power button is ready to respond.

BLINKING vs. SOLID LIGHT

The power button light on the case will blink when it is powering on, and will remain solid once it is completely powered on.

QUICK BLINK vs. SLOW BLINK

The power button light on the case will blink quickly when it is powering on, and will blink slowly when it is powering off.

A.2.7 ISSUE: The robot is stuck in position - SISU Lab case powers on

 **JUMP TO:** If the SISU Lab case does **NOT** power on see section [A.2.6 ISSUE: The robot is stuck in position - SISU Lab case does NOT power on](#) for instructions.

PROBLEM: The robot is stuck and you are no longer able to move it with the wand (but you CAN power the SISU Lab case on).

If the yellow reset button the SIM **IS** flashing, follow the steps in section [A.2.7 Reset Button On SIM Is Flashing](#).

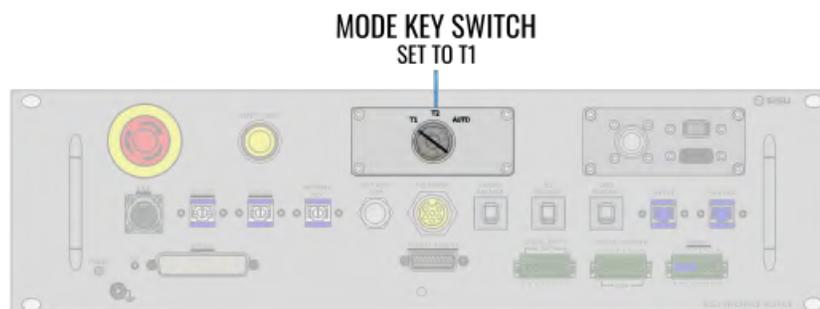
If the yellow reset button the SIM is **NOT** flashing, follow the steps in section [A.2.7 Reset Button On SIM Is Not Flashing](#).

Reset Button On SIM Is Flashing

If your robot is stuck and the yellow **Safety Reset** button on the SIM **IS** flashing, press it. If you press it and it does **NOT** stop flashing, follow these steps:

SOLUTION #1: Clear all depressed red E-stops (by turning them counter clockwise) and press the yellow **Safety Reset** button on the SIM again. You also need to make sure that the mode key switch is set to **T1**, and the KUKA pendant is set to **Ext.**.

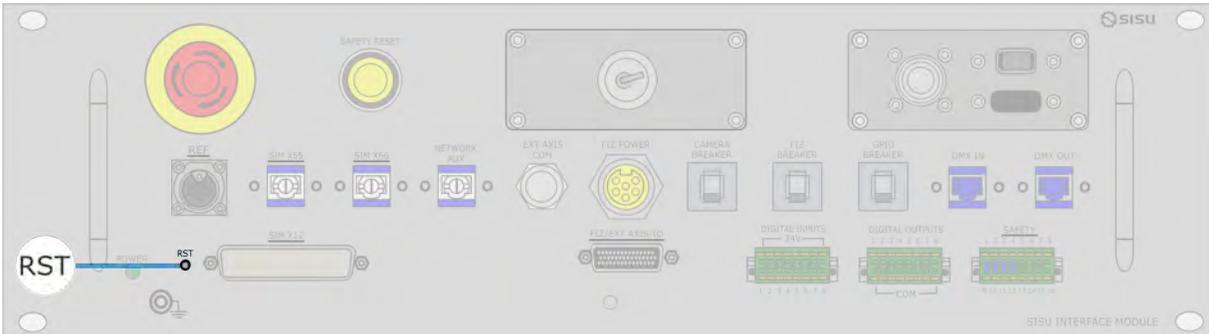
 **EXT. INSTRUCTIONS:** If your KUKA pendant says T1, T2, or Aut, you will need to turn the switch on top of the KUKA pendant, select **Ext.**, and then turn the key switch back.



(Continued on next page)

SOLUTION #2: Shut down SISU Lab from the tablet screen, power cycle the robot, and then press the small **RST** button on the SIM **after the KUKA pendant has powered back on**.

! **CASE POWER BUTTON:** You should **always try to avoid** powering down the case using the case power button.



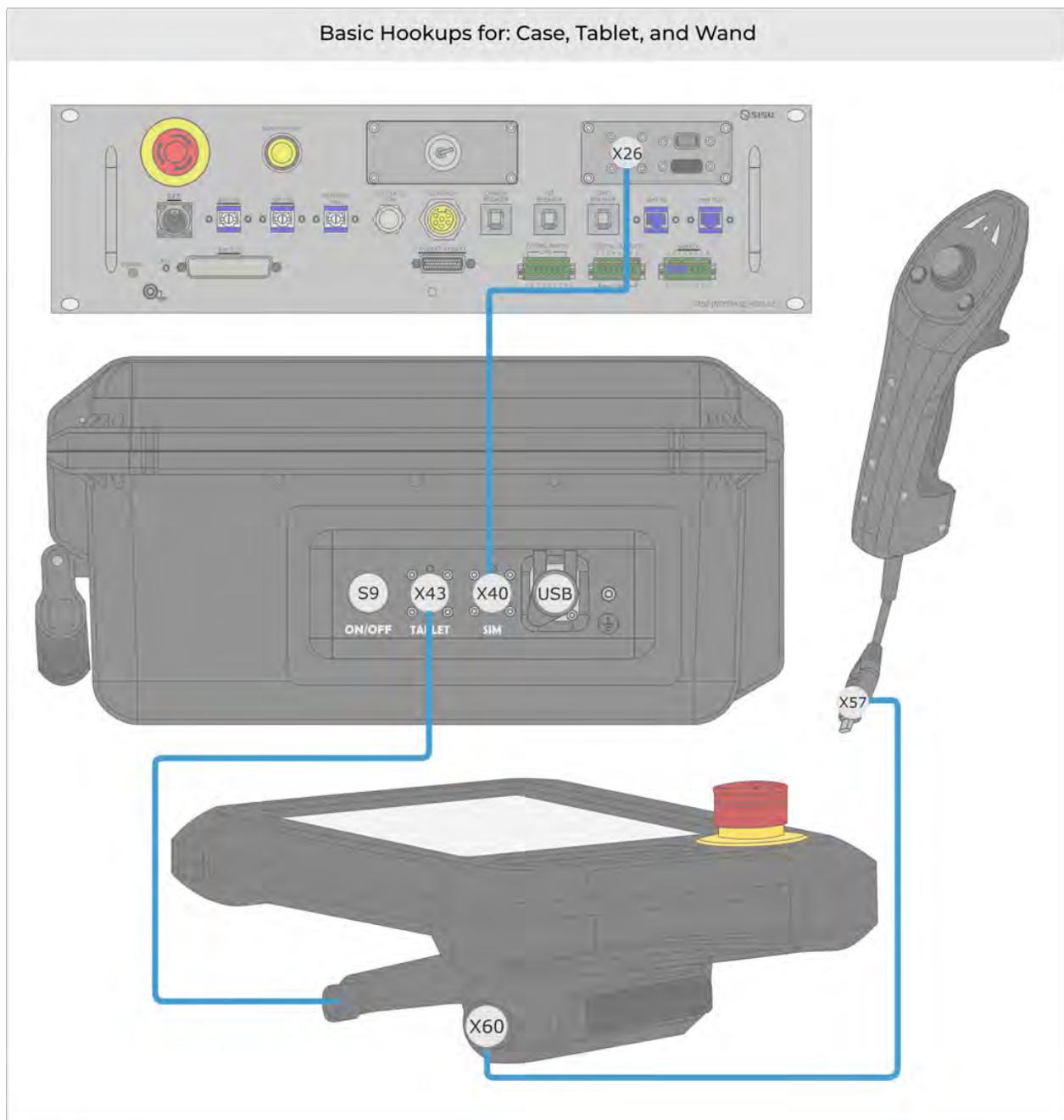
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Reset Button On SIM Is Not Flashing

If your robot is stuck and the yellow **Safety Reset** button on the SIM is **NOT** flashing, follow these steps:

SOLUTION #1: Make sure your robot is turned on. (If the KUKA pendant can turn on, the robot is on.)

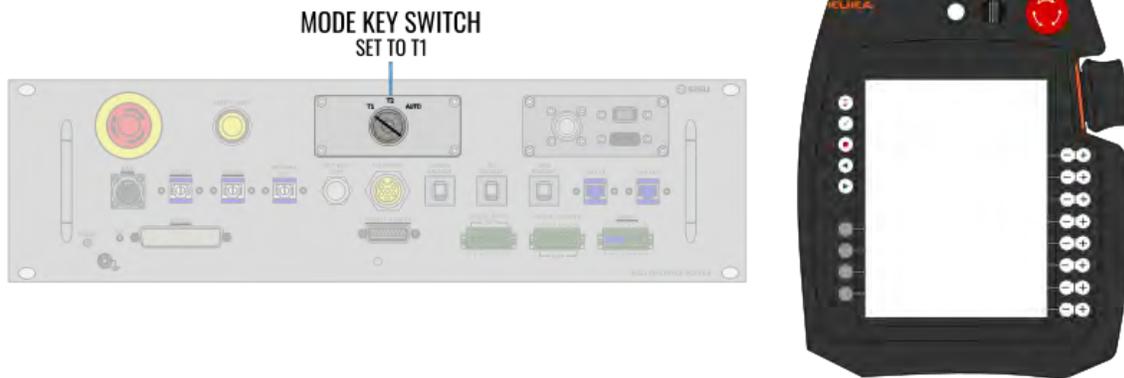
SOLUTION #2: Make sure all of your connections are plugged in correctly.



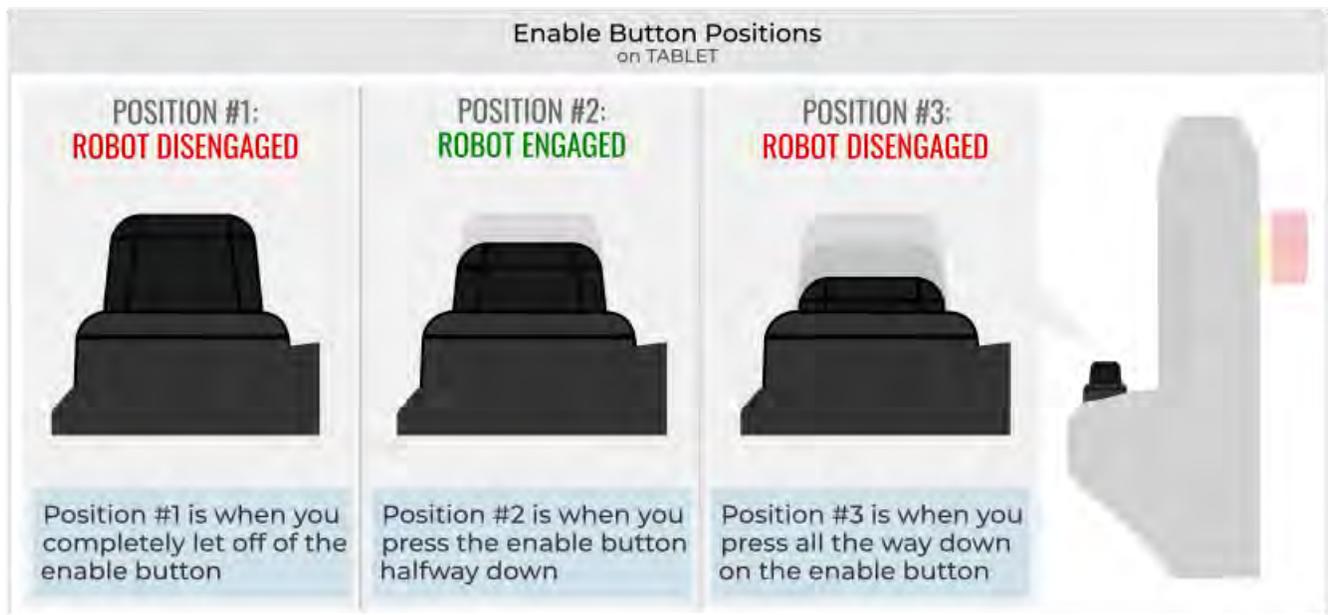
(Continued on next page)

SOLUTION #3: Make sure your mode key switch is set to **T1** mode and your KUKA pendant is set to **Ext.**

! EXT. INSTRUCTIONS: If your KUKA pendant says T1, T2, or Aut, you will need to turn the switch on top of the KUKA pendant, select **Ext.**, and then turn the key switch back.



SOLUTION #5: If you do not hear a clicking sound when you hold down the motion enable button follow these steps:



1. View the above image to ensure that you are using the motion enable button correctly. If everything is working properly, the robot notifier at the bottom left of your tablet should appear green.

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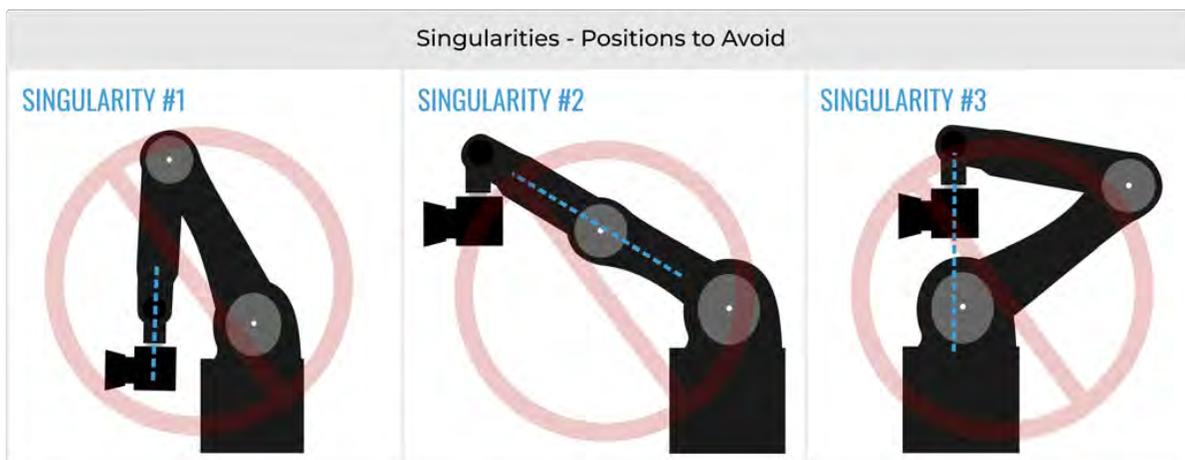
2. Make sure that the top of the KUKA pendant says **Ext.**. If it says T1, T2, or Aut you will need to turn the switch on top of the KUKA pendant, select **Ext.**, and then turn the key switch back.
3. If the wand and case lights are on, you are holding the enable button down in the correct position, and you still cannot move the robot please contact SISU customer support as there may be something wrong with your tablet. **Please let customer support know if it has been recently dropped.**

SOLUTION #6: Make sure the wand is calibrated and the correct wand lights are on.



Unplug your wand from the tablet and plug it back in, then calibrate your wand. If you still do not see the lights on the wand (but you do see the power light on the side of the case) contact SISU customer support as there may be something wrong with your wand. **Please let customer support know if the wand has been recently dropped, crushed, etc.**

SOLUTION #7: Make sure you haven't encountered a singularity.



If you **have** encountered a singularity, use joint mode to jog the robot out of the singularity position.
(Continued on next page)

IF NONE OF THE ABOVE SOLUTIONS WORKED, TRY THE FOLLOWING:

SOLUTION #1: Make sure that the **S** (located in the leftmost display button at the top of the KUKA pendant) is green. If it is gray, contact SISU customer support.

SOLUTION #2: Can you move the robot using the KUKA pendant? To test this, do the following:

1. Switch to **AUTO** mode on the SIM.
2. Switch to **T1** on the KUKA pendant, hold the motion enable button on the KUKA pendant, and hit **confirm** in the error bar. Axes 1-6 (on the right side of the pendant) should turn green. If they are, you should be able to move the robot one joint at a time with the buttons on the left side of the pendant.



T1 INSTRUCTIONS - KUKA PENDANT: To change your KUKA pendant to **T1** mode, you will need to turn the switch on top of the KUKA pendant, select **T1**, and then turn the key switch back.

If axes 1-6 are not green, contact SISU customer support.

SOLUTION #3: Check for errors on your KUKA pendant: first press **Confirm All** to clear old errors, then look at the remaining errors.

1. Look at the error messages on the KUKA pendant to see if you have a “Mastering Test Required” error message: **Upper left Robot icon/Diagnosis/Logbook/Display** (will show a history of all errors encountered). **This is not the same as a “Perform Mastering” error message.**

If you **DO** have a “Mastering Test Required” error message, you will need to perform the mastering test using the link below.



JUMP TO: See section **Running The MasteringCheck** in your **SISU Cinema Robotics Manual** for instructions.

(Continued on next page)

2. Look at the error messages on the KUKA pendant to see if you have a “Perform Mastering” error message: **Upper left Robot icon/Diagnosis/Logbook/Display** (will show a history of all errors encountered). **This is not the same as a “Mastering Test Required” error message.**

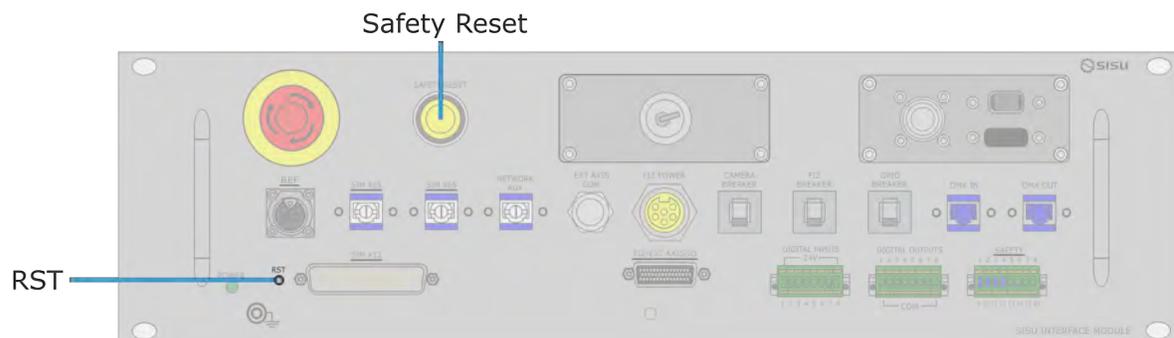
If you **DO** have a “Perform Mastering” error message, you will need to manually master the robot using the link below. If not, keep reading.

 **JUMP TO:** See appendix **Manual Mastering For KUKA Robots** in your **SISU Cinema Robotics Manual** for instructions.

3. If any other errors remain active on the KUKA pendant, take a photo and contact SISU customer support.

SOLUTION #4: If you have a red error bar on the KUKA pendant, do the following:

1. Push the yellow **Safety Reset** button on the SIM, and reset the SIM by pushing on the small SIM **RST** button. If you still cannot move the robot, keep reading.



2. Power cycle the whole system by doing the following:

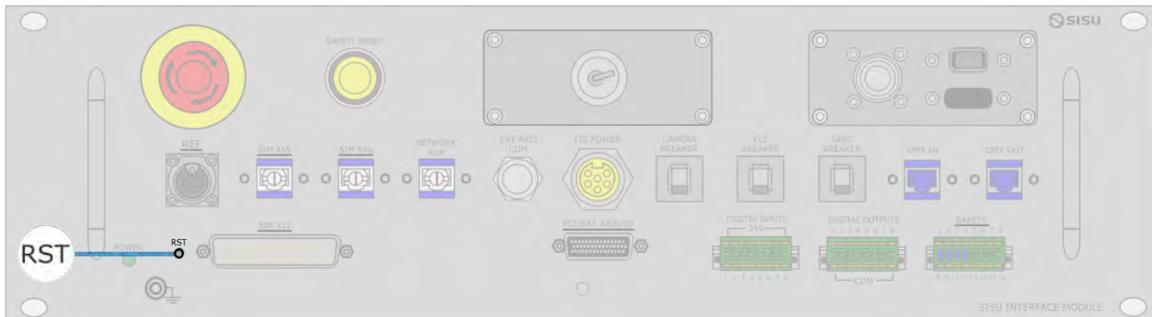
- a) Shut down the SISU Lab case from the tablet screen.

 **CASE POWER BUTTON:** You should **always try to avoid** powering down the case using the case power button.

- b) Power down the KUKA robot.
- c) Check the SIM and the KRC4 connections per the installation guide.
- d) Power everything back on.

(Continued on next page)

e) Press the small **RST** button on the SIM.



SOLUTION #5: If you have gone through all possible solutions above and still cannot move the robot, please contact SISU customer support.

A.2.8 ISSUE: Robot dips or stops suddenly when you are running a program

PROBLEM: Your C14 robot dips or stops suddenly while you are running a program.

SOLUTION #1: If the robot stops suddenly check for the following notification messages at the top of the KUKA pendant.

1. Error: Charging of intermediate circuit failed
2. Error: General power supply error

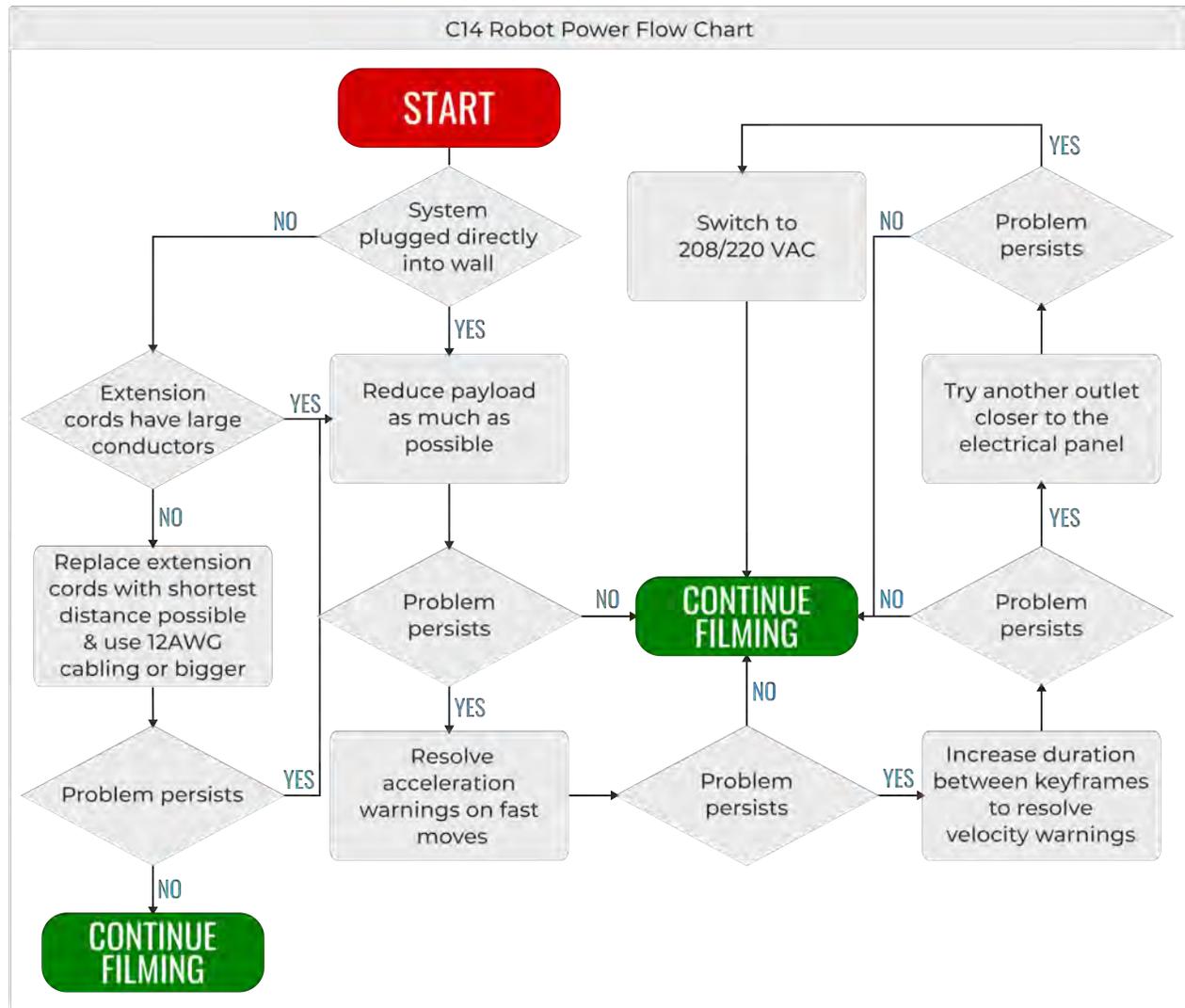
If any of these notifications are present, jump to [solution #2](#).

If none of these notifications are present, jump to [solution #3](#).

SOLUTION #2: If the robot stops suddenly, check for acceleration or velocity **warnings** in the Activity Logs for your program at the time of the issue. On the KUKA pendant, check for **Max Torque** or **High Acceleration** errors. Increase duration between keyframes or ease in/out where the robot stopped to remove the warning. Try to run the program again.

(Continued on next page)

SOLUTION #3: If the robot motion unexpectedly dipped or dropped and you do not have errors on the KUKA pendant, you could be running into power limitations on a C14. Follow the troubleshooting flowchart to try to resolve the issue.



A.2.9 ISSUE: Mastering check failure

For a list of possible mastering check failures, see section **Mastering Check Failures** in your **SISU Cinema Robotics Manual**.

A.2.10 ISSUE: Interference Detected message pops up constantly

PROBLEM: You keep seeing the message **Interference Detected**. Release the wand trigger, and make sure no objects are too close to the wand. If this message continues to pop up repeatedly, recalibrate the wand. If recalibrating the wand does not solve the problem, go through the following solutions:

SOLUTION #1: Ensure that your case is not placed on or near large metal objects, and that the case is not sitting on the ground.

SOLUTION #2: Update your distortion tolerance to a higher value and test robot motion with the trigger to confirm that it is smooth.

SOLUTION #3: Calibrate the wand to a different frequency. (If you have multiple SISU Cinema Robots on set, each should be calibrated to a different frequency).



JUMP TO: See section **4.5 Calibrating the Wand** in your **SISU Cinema Robotics Manual** for more information on calibrating the wand to different frequencies.

A.3 FIZ and focus issues

A.3.1 ISSUE: The FIZ motor lights are blinking

PROBLEM: If the FIZ motors stop moving it could be that they have torqued out: meaning they have tried to switch directions too quickly or they receive a signal that interferes with their normal motion control.

SOLUTION #1: Look in your FIZ users manual to adjust the torque and artistry settings.

A.3.2 ISSUE: Focus marks are off when running a program

PROBLEM: After writing a program, you run the program and the focus seems to be a little off at the saved robot positions.

SOLUTION #1: Depending on the lens and the FIZ motor combination, you may experience an offset from your saved FIZ keyframes when running a program. This can be due to gaps in the gearing between the FIZ motors and the lens ring gears: this gap is known as backlash. To fix, calibrate and set the backlash values for the focus, iris, and zoom.



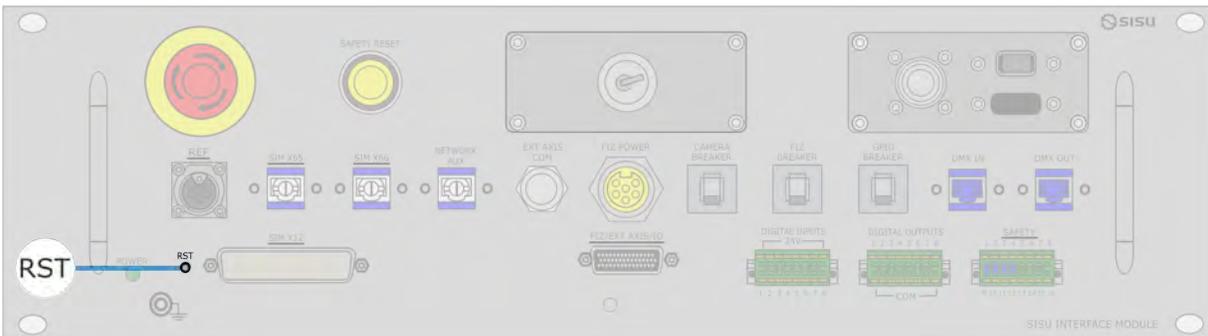
JUMP TO: See section **Calculating Backlash Compensation Factors** in your **SISU Cinema Robotics Manual** for instructions.

SOLUTION #2: Always use cine lenses with hard stops and cinegears. Continuously rotating lenses may slip while running a program, causing the programmed focus marks to be offset.

A.3.3 ISSUE: FIZ motors have power but appear as disconnected in SISU Lab

PROBLEM: Your FIZ motors appear to be powered on (e.g. lights are blinking), but they are showing as being disconnected in SISU Lab.

SOLUTION #1: Press the small **RST** button on the SIM and wait for the system to reboot (this could take several minutes).



A.3.4 ISSUE: FIZ motor movement not smooth in Joint Mode

PROBLEM: Moving your FIZ motor on the **Joint Mode** page is not smooth. After switching to another motor, it jerks the last moved motor position.

SOLUTION #1: Do NOT press the **Enable** button (robot disengaged) when changing the FIZ motor position.

A.3.5 ISSUE: Items in the foreground and background are not staying lined up when you pan the camera

PROBLEM: When you use your camera to pan across your set the items in your foreground and background are not staying lined up properly.

SOLUTION #1: Measure and set a **Nodal Offset** point in your **Lens Configuration** page. For more details on how to do this, see section **LensConfiguration** in your **SISU Cinema Robotics Manual**.

B. APPENDIX B - ROBOT SPECS AND REPLACEMENT PARTS

B.1 Chapter Contents:

- Environmental Conditions - [B.2](#)
- Ventilation Requirements - [B.3](#)
- General Robot Specs - [B.4](#)
- SISU Smart Transformer 2.0 Specs - [B.5](#)
- Replacement Parts - [B.6](#)

B.2 Environmental Conditions

- **Operating Ambient Temperature:** Min 0C - Max 45C
- **Storage Temperature:** Min 0C - Max 45C
- **Humidity:** 90% non-condensing

 **IMPORTANT:** For indoor use **only**.

 **IMPORTANT:** Do **not** use near liquids.

B.3 Ventilation Requirements

- Keep the side vents of the SISU Interface Module (SIM) clear (a minimum of 2 inches).
- **The case must sit flat on a table that is at least 3 feet off of the ground.** Keep a space of 3 inches between the case heat sink and another object to allow for adequate airflow.

 **JUMP TO:** See section [3.9 Connecting the Case, Tablet, and Wand](#) for a case placement graphic and more information.

B.4 General Robot Specs

METRIC VERSION:

SISU CINEMA ROBOTS - ROBOT COMPARISON				
	C11	C14	C20	C31
				
DIMENSIONS				
Max Height	2.3 m	2.5 m	3.4 m	3.6 m
Lowest Position	0.3 m	0 m	-0.75 m	-2.1 m
Wingspan	2.4 m	2.8 m	4 m	6.2 m
REPEATABILITY				
Repeatability	0.02 mm	0.04 mm	0.04 mm	0.05 mm
WEIGHT				
Robot	57 kg	160 kg	255 kg	549 kg
Max Payload	10 kg	10 kg	19 kg	20 kg
TEMPERATURE				
Min	0C	5C	5C	0C
Max	45C	45C	45C	55C
REQUIRED POWER				
Power	Standard Outlet	Standard Outlet	480V 3-Phase	480V 3-Phase
FITS THROUGH STANDARD DOORWAY				
Standard Door	Yes	Yes	Yes	No
TRANSPORTABILITY				
Recommended	Truck/Trailer	Truck/Trailer	Truck w/lift gate	Mobile in studio

(Imperial version on next page)

IMPERIAL VERSION:

 SISU CINEMA ROBOTS - ROBOT COMPARISON				
	C11	C14	C20	C31
				
DIMENSIONS				
Max Height	7' 6.5"	8' 2"	11' 2"	12' 0"
Lowest Position	12"	0'	-2' 5"	-7' 0"
Wingspan	7' 10"	9' 2"	13' 2"	20' 4"
REPEATABILITY				
Repeatability	0.0008 in.	0.0016 in.	0.0016 in.	0.0020 in.
WEIGHT				
Robot	126 lbs.	353 lbs.	562 lbs.	1210 lbs.
Max Payload	22 lbs.	22 lbs.	42 lbs.	44 lbs.
TEMPERATURE				
Min	32F	40F	40F	32F
Max	113F	113F	113F	131F
REQUIRED POWER				
Power	Standard Outlet	Standard Outlet	480V 3-Phase	480V 3-Phase
FITS THROUGH STANDARD DOORWAY				
Standard Door	Yes	Yes	Yes	No
TRANSPORTABILITY				
Recommended	Truck/Trailer	Truck/Trailer	Truck w/lift gate	Mobile in studio

B.5 SISU Smart Transformer 2.0 Specs

Contact the SISU sales team at: sales@sisucinemarobotics.com, 512-377-6075 for more information on the SISU Smart Transformer 2.0.

METRIC VERSION:

v1.0m

SISU SMART TRANSFORMER 2.0



POWER		INPUT / OUTPUT	
PWR INPUT RECEPTACLE ●	250V 60A (male) IEC 60309 60A 3P 4W	INPUT	OUTPUT
ROBOT PWR OUTPUT RECEPTACLE ●	480V 20A (female) IEC 60309 20A 3P 4W (x2)	208 VAC, 1Φ, 63A	480 VAC, 3Φ, 15.6A
SHORT CIRCUIT CURRENT RATING	5kA	208 VAC, 3Φ, 46A	480 VAC, 3Φ, 20A
MAX POWER	15kVA	240 VAC, 1Φ, 63A	480 VAC, 3Φ, 18A
FREQUENCY (HZ)	60	240 VAC, 3Φ, 40A	480 VAC, 3Φ, 20A
OTHER SPECS		DIMENSIONS	
CART POWER PLUG TYPE	 NEMA 14-50P	CART POWER CABLE	3m
ENVIRONMENTAL CONDITIONS		ROBOT POWER CABLE for C20/C31	7m or 15m <i>(Not included with smart transformer)</i>
OPERATING AMBIENT TEMPERATURE	max 43.3C	CART DIMENSIONS	1.3m x 1.2m x 0.7m
HUMIDITY	non-condensing	WEIGHT	306.2 kg



ONLY QUALIFIED ELECTRICIANS AND PERSONNEL SHOULD SERVICE THIS DEVICE
 ARC FLASH EXPLOSION HAZARD
 RISK OF ELECTRIC SHOCK
 THE SMART TRANSFORMER IS FOR INDOOR USE ONLY
 DO NOT TRY TO LIFT THE SMART TRANSFORMER BY THE HANDLES



(Imperial version on next page)

IMPERIAL VERSION:

v1.0i

SISU SMART TRANSFORMER 2.0



POWER

PWR INPUT RECEPTACLE ●	250V 60A (male) IEC 60309 60A 3P 4W
ROBOT PWR OUTPUT RECEPTACLE ●	480V 20A (female) IEC 60309 20A 3P 4W (x2)
SHORT CIRCUIT CURRENT RATING	5kA
MAX POWER	15kVA
FREQUENCY (HZ)	60

OTHER SPECS

CART POWER PLUG TYPE	 NEMA 14-50P
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INPUT / OUTPUT

INPUT	OUTPUT
208 VAC, 1Φ, 63A	480 VAC, 3Φ, 15.6A
208 VAC, 3Φ, 46A	480 VAC, 3Φ, 20A
240 VAC, 1Φ, 63A	480 VAC, 3Φ, 18A
240 VAC, 3Φ, 40A	480 VAC, 3Φ, 20A

DIMENSIONS

CART POWER CABLE	9' 10"
ROBOT POWER CABLE (C20/C31) <i>(Not included with smart transformer)</i>	22' 11" or 49' 2"
CART DIMENSIONS	51.5" x 50" x 29"
WEIGHT	675 lb



ONLY QUALIFIED ELECTRICIANS AND PERSONNEL SHOULD SERVICE THIS DEVICE
 ARC FLASH EXPLOSION HAZARD
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B.6 Replacement Parts

Individual Spare Parts	Spare Parts Kits
Case	Camera Mounting Assembly
Individual Cables	Complete Cable Kit
Tablet	Complete Electrical Cabinet
SIM	FIZ Control Kit
Wand	FIZ Wireless Control Kit
Weight Plates	Reference Switch Assembly
	SIM Cables



JUMP TO: To inquire about purchasing, please contact support listed in section [1.8 Contact Information](#).

C. APPENDIX B - SISU CINEMA ROBOTICS COMPLIANCE

C.1 Chapter Contents

The SISU Cinema Robotics system conforms to the following compliances and standards:

- CE Certification - [C.2](#)
- Industrial EMC Standards - [C.3](#)
- Electrical Safety - [C.4](#)
- Emergency Stop Buttons - [C.5](#)
- Standards Applied to Design - [C.6](#)
- Risk Assessment - [C.7](#)

C.2 CE Certification

SISU Cinema Robotics systems are CE certified.



C.3 Industrial EMC Standards

SISU Cinema Robotics systems are tested to industrial EMC standards per IEC 61326-1:2012:

1. Radiated Emissions, 30MHz - 1GHz, CISPR 11:2009 / A1:2010, Group 1, Class A
2. AC Power, Conducted Emissions, 230VAC / 50Hz, CISPR 11:2009 / A1:2010, Group 1, Class A

(Continued on next page)

3. ESD on Enclosure, 4kV/8kV IEC 61000-4-2:2008 Criteria B
4. Radiated Immunity, 80MHz - 1GHz, 10V/m, IEC 61000-4-3:2006 / A1:2007 / A2:2010, Criteria C*
5. Radiated Immunity, 1.4GHz - 2GHz, 3V/m, IEC 61000-4-3:2006 / A1:2007 / A2:2010, Criteria A
6. Radiated Immunity, 2GHz - 2.7GHz, 1V/m, IEC 61000-4-3:2006 / A1:2007 / A2:2010, Criteria A
7. AC Power, Burst: 2kV, 5/50ns, 5kHz, IEC 61000-4-4:2004 / Corr:2007 / A1:2010, Criteria B
8. I/O Line, Burst: 1kV, 5/50ns, 5kHz, IEC 61000-4-4:2004 / Corr:2007 / A1:2010, Criteria B
9. AC Power, Surge: 1kV line-to-line / 2kV line-to-earth, IEC 61000-4-5:2005 / Corr:2009, Criteria B
10. AC Line, Conducted Immunity: 150kHz - 80MHz, 3Vrms, IEC 61000-4-6:2008, Criteria A
11. I/O Line, Conducted Immunity: 150kHz - 80MHz, 3Vrms, IEC 61000-4-6:2008, Criteria A
12. Radiated Magnetic Field, 30A/m, IEC 61000-4-8:2009, Criteria A
13. AC Power, Voltage Dips: 0% for 1 cycle, 40% for 10/12 cycles, 70% for 25/30 cycles, IEC 61000-4-11:2004, Criteria A
14. AC Power, Short Interruptions: 0% for 250/300 cycles, IEC 61000-4-11:2004, Criteria C

*Exception to IEC 61326-1:2012 - Industrial Requirements: System is rated to criteria C and not A for Radiated Immunity, 80MHz - 1GHz, 10V/m. High peaks of electromagnetic noise may cause loss of signal from the control tablet and require a user recalibration in the case.

C.4 Electrical Safety

The SISU Cinema Robotics system is tested to Electrical Safety per UL/EN 61010-1:2010.

C.5 Emergency Stop Buttons

Emergency stop buttons are compliant to IEC60947-5-5 following EN ISO 13850:2015 Safety of machinery.

(Continued on next page)

C.6 Standards Applied to Design

Principles of the following standards are applied to design:

1. EN ISO 10218-1:2011 Robots and robotic devices – Safety requirements for industrial robots – Part 1: Robots (equivalent to ANSI/RIA R.15.06-2012, Part 1)
2. EN ISO 10218-2:2011 Robots and robotic devices – Safety requirements for industrial robots – Part 2: Robot systems and integration (equivalent to ANSI/RIA R.15.06-2012, Part 2)
3. EN ISO 12100:2010 Safety of machinery – General principles for design – Risk assessment and risk reduction and RIA TR R15.306-2016 Task-based Risk Assessment Methodology

C.7 Risk Assessment

A risk assessment must be performed by the final integrator following EN ISO 12100:2010 or RIA TR R15.306-2016 to be compliant with general safety standards.