



MARK ROBERTS MOTION CONTROL

# STUDIOBOT XL



## QUICK START GUIDE

QSG Product Code: MRMC-2139-01

Product Covered: MRMC-2011-01

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## Chapter 1 Quick Start

### Overview

Thank you for using Studiobot XL Broadcast Camera Robot from Mark Roberts Motion Control (MRMC). Studiobot XL is designed for reliable day-in, day-out use in professional studio broadcast environments.

Studiobot XL comes as two variants:

- **Studiobot XL on Movable Pedestal** is equipped with a robotic arm mounted on a movable pedestal with the robot controller mounted within the pedestal. For ease of use it can be wheeled to a location of choice and then held down by four feet. The Teleprompter and the noise reduction cover for minimizing noise emission makes it a perfect choice for studio environment.



Studiobot XL on Movable Pedestal



Studiobot XL on Track

- **Studiobot XL on Track** is equipped with a robotic arm mounted on a pedestal base that can move on a precision track. Like the movable pedestal variant, the Studiobot XL on Track also includes a teleprompter and noise reduction cover. It also includes two proximity scanning safety devices.

## Safety procedures for using industrial robots

Note that the words **Robot** and **Rig** are completely interchangeable and identical in meaning, for the purposes of this document.

Motion Control rigs are potentially dangerous. It is important that you and everyone else on the set understand the safety notes on the following pages in order to stay safe.

You should use this document in addition to the normal Safety Manual instructions that are applicable to all motion control rigs, such as Milos.

- It is ultimately the **operator** of the rig who is responsible for the safe use of the equipment so never bypass any of the safety points listed here.
- No one other than a highly trained operator should use the robot, no matter how simple it looks or is.
- This document is for the use of robots for carrying cameras or props, not people.

## Assessing a site

Before setting up Studiobot XL you need to **assess the site**, paying particular attention to the following points:

- Is the ground or floor firm enough and level enough? You might have to use boards or bricks to create a level surface. The surface needs to be strong enough to take the weight of Studiobot XL without flexing.
- Does the site have access? You need to make sure you can either push Studiobot XL into position on its wheels or carry it there using a pallet truck or forklift.
- Does the site have a power source with sufficient capacity for the robot and the correct mains voltage?
  - Studiobot XL gets its power from the Stäubli CS8 unit which runs between **200 and 480 Volt, three-phase power supply (four-wire including Ground)**. The CS8 is set at the factory for the three-phase voltage of the country of use.
  - The Robocam Atelier computer that controls Studiobot XL are auto-switching and can run on 120-240 Volts AC.
- Does the site have unusual environmental attributes that require specialised protection from extreme temperatures, humidity, rain, or dust?

## Installation safety

- Due to the large mass of the rigs and the accelerations they achieve it is important that they are securely mounted, with the recommended plates and bolts to a secure and concrete floor.
- Ensure the floor can support the load and the stresses (see above).
- Ensure the power supply is properly earthed (grounded) and of the correct voltage (see above).
- If the rig is mounted to something other than the floor then the mount should be heavy and strong enough to take the forces and not move or fall over during sudden starts and stops. Use the recommended minimum thickness steel plates.

Check with MRMC if you are unsure of the exact requirements for your robot.

- Check that all cables are securely fixed and are not going to catch during motion.
- Ensure the camera, lens, focus motor, accessories, power supplies/batteries, etc. are all very securely mounted and will not come off during sudden motions, to become lethal missiles.
- Ensure all safety accessories are securely attached and in working order, including emergency stops, safety sensors, etc.
- Keep stands, lights and accessories out of the No Go Zone, if possible. If not possible then try to take as much care with their positioning and the motion of the rig, as if they were a person. Remember a light, accidentally hit at high speed by the robot, can be just as dangerous to someone standing outside the No Go Zone as the robot is to someone standing in the zone.
- Where physical safety barriers are impractical, light guards should be used or similar alternatives such as laser scanners, to stop anyone entering the No Go Zone during motion.
- Ideally have the robot surrounded on all four sides by a safety barrier, but where that is not practical, ensure that the maximum number of sides feasible are closed off, and that any person having to stand within reach of the robot is located as far away as possible for the shot.

## Software setup

- Always ensure you have the right configuration for the robot you are using, such as maximum axis speeds and accelerations.
- Prior to running moves, enter in and keep to a minimum all software axis and Cartesian limits. For example if the main axis only needs to travel +/-40 degrees then reduce the limit to +/-40 degrees even though it could do +/-180 degrees. This keeps the likelihood of operator or software errors to a minimum.
- Also check the Cartesian speed and acceleration limits are set to reasonable values.

## Operational safety

- Do not use around flammable gas. All electrical equipment can generate sparks that can ignite flammable gas.
- Keep the equipment dry. The system has **not** been made weatherproof. Do not use with wet hands.
- Always run moves only when standing within easy reach of the emergency stop.
- Always tell the production company and the crew to keep away from the robot and not approach it when any of its red lights are on which indicates it is powered up. Have them sign the appropriate safety documents and disclaimers to ensure they understand this and are indemnifying MRMC if anything happens.
- Always loudly and clearly indicate to others when the rig is about to move. Shout “Rig Moving!” if no other means exists.
- Always ensure the rig is disabled when someone has to enter the No Go Zone.
- Always run any move or adjusted move slowly at first to check the motion. Even if you have checked the move previously, if you make a minor change to it then you need to recheck it.



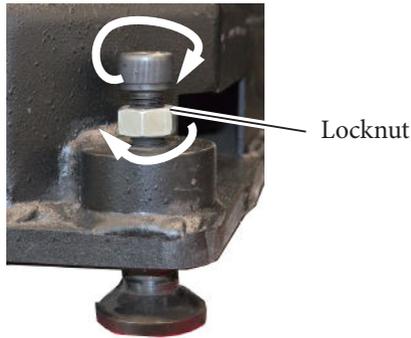
- Keep the software in “slow mode” unless the move has been tested and is now specifically doing a high speed pass.
- In the event that a person or Actor has to be within the no-go zone during a move (hand model etc.) ensure that they fully briefed on the safety requirements and that they know not to change their position or do anything other than the rehearsed moves without fully warning the operator. Any such person is to have a clear escape route to allow them to move safely away from the robot.
- During use, repeatedly check the rig mounting points, cables, camera mount, accessories etc. to ensure nothing has, or is, working its way loose.
- Never bypass any safety hardware or software.

## Mounting the Staubli arm

1. Tie the supplied straps around the Staubli arm and insert the hook from the gantry hoist on to it.
2. Wheel the Studiobot base under the gantry hoist.
3. Use the gantry hoist to gently lift the arm and lower it in position on the base aligning the screw slots.
4. Tighten the four screws to secure the arm on the Studiobot XL base.
5. Remove the gantry hook and the straps from the arm.

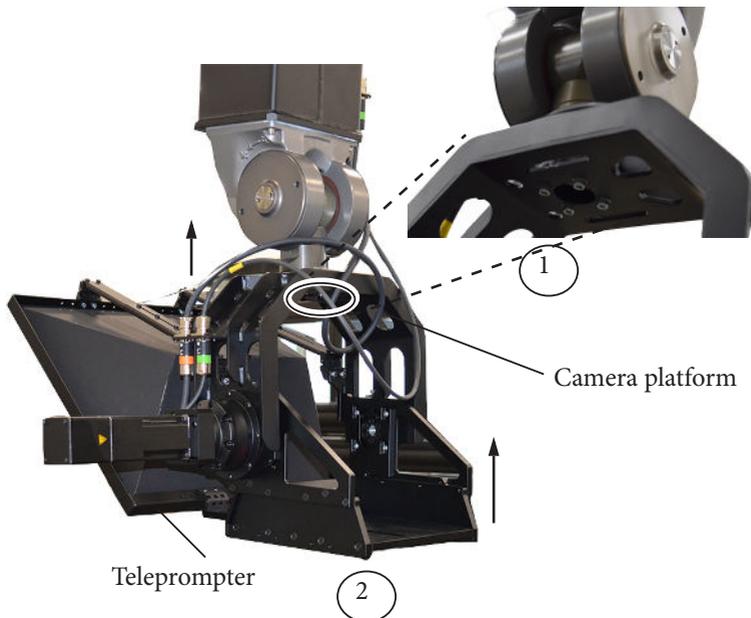


6. Wheel the Studiobot to the location and lower the 4 x feet to secure to the ground.



7. Once in place, ensure that you fully secure the feet by tightening the locknut in the feet.

## Mounting the Camera Platform and Teleprompter



1. Raise the camera platform to the robot arm and tighten 4 x M5 screws in the Studiobot XL arm to mount the camera platform on the arm.
2. Ensure that the top bracket is mounted correctly on the camera platform. Use the following figure for correct placement of screws.



3. Detach the camera plate from the camera platform. Mount the camera on the long side of the camera plate using 2 x thumb screws.
4. Attach the camera plate on the short side to the platform using 2xscrews.



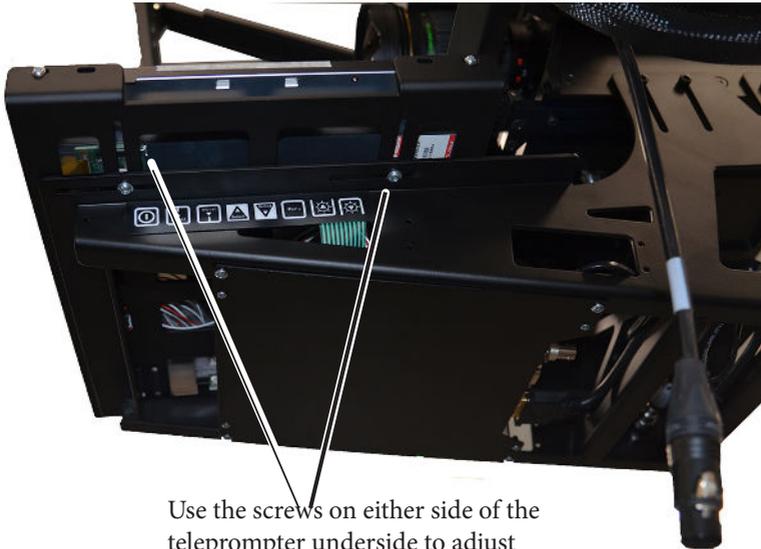
Screw the camera plate to the camera platform

5. Once firmly secure, attach the pan and tilt connections.



6. Add the teleprompter glass close to the camera.

7. Ensure that the image from the teleprompter is properly reflected on the glass. If not, the teleprompter can be adjusted sideways and backwards and forwards using the 4xscrews underneath.

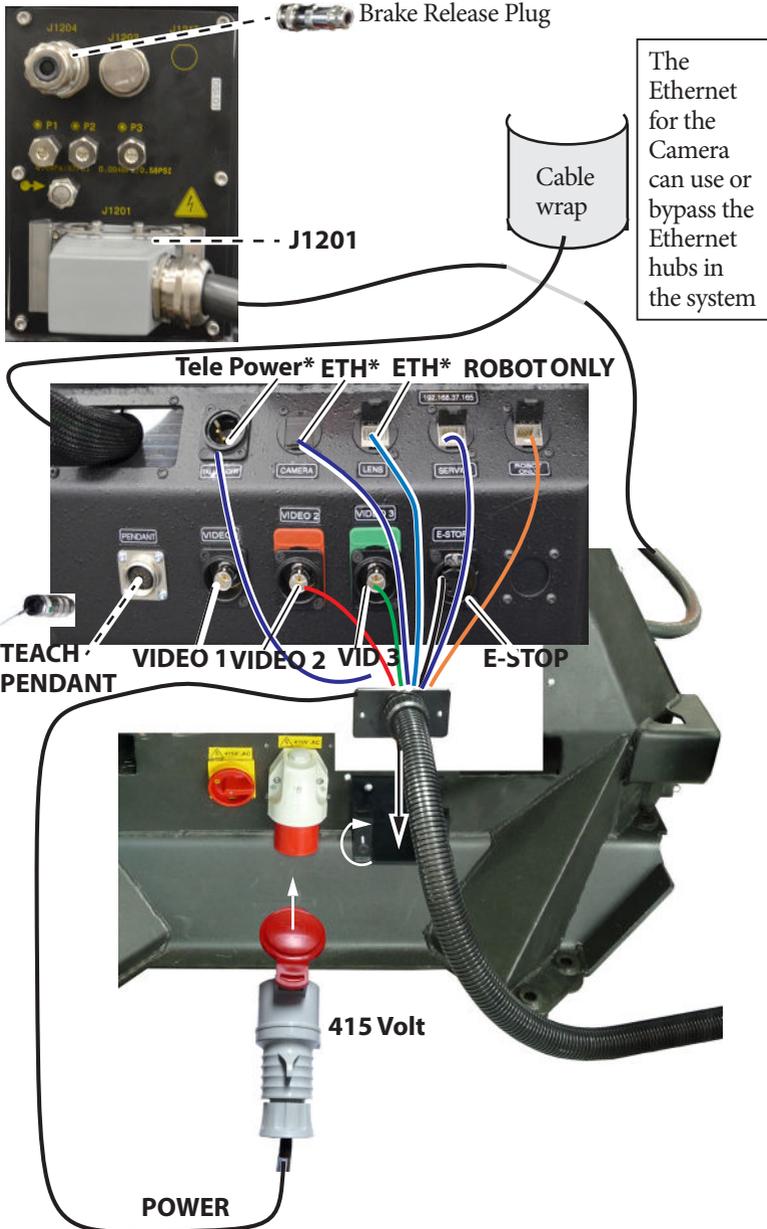


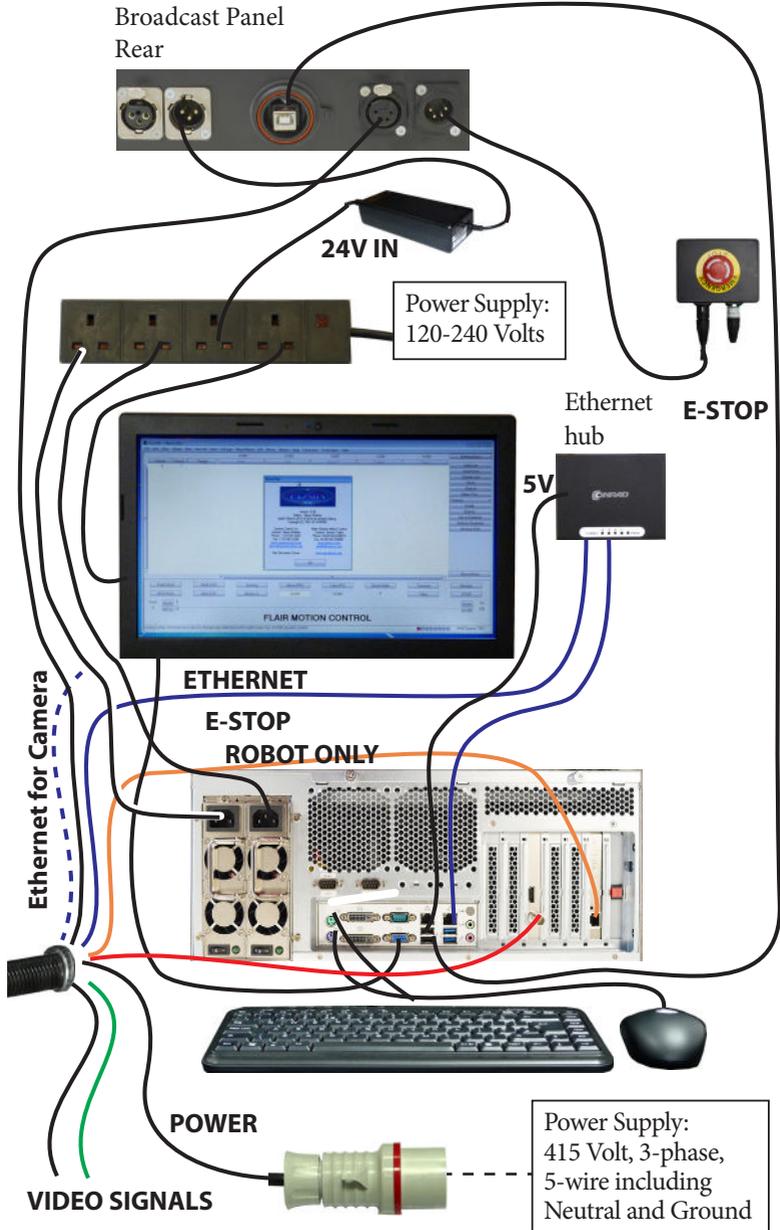
Use the screws on either side of the teleprompter underside to adjust its position.

- 8.

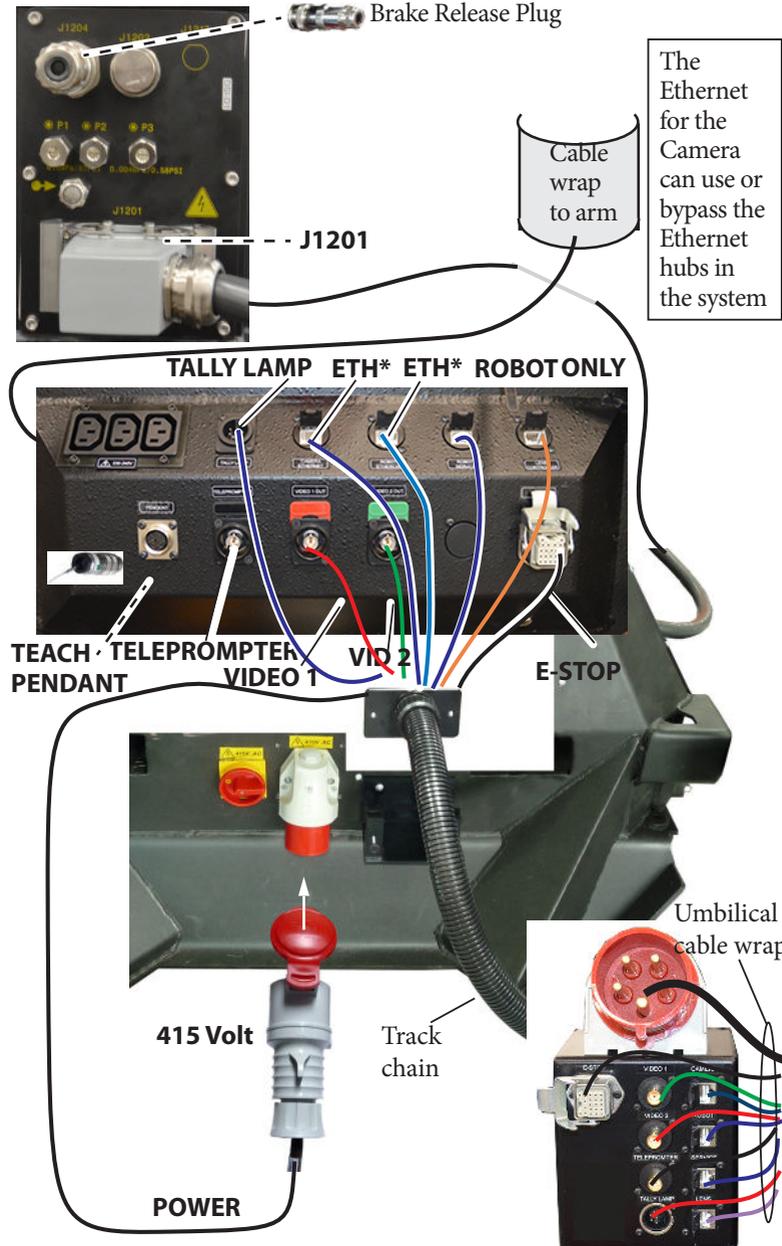
Notes

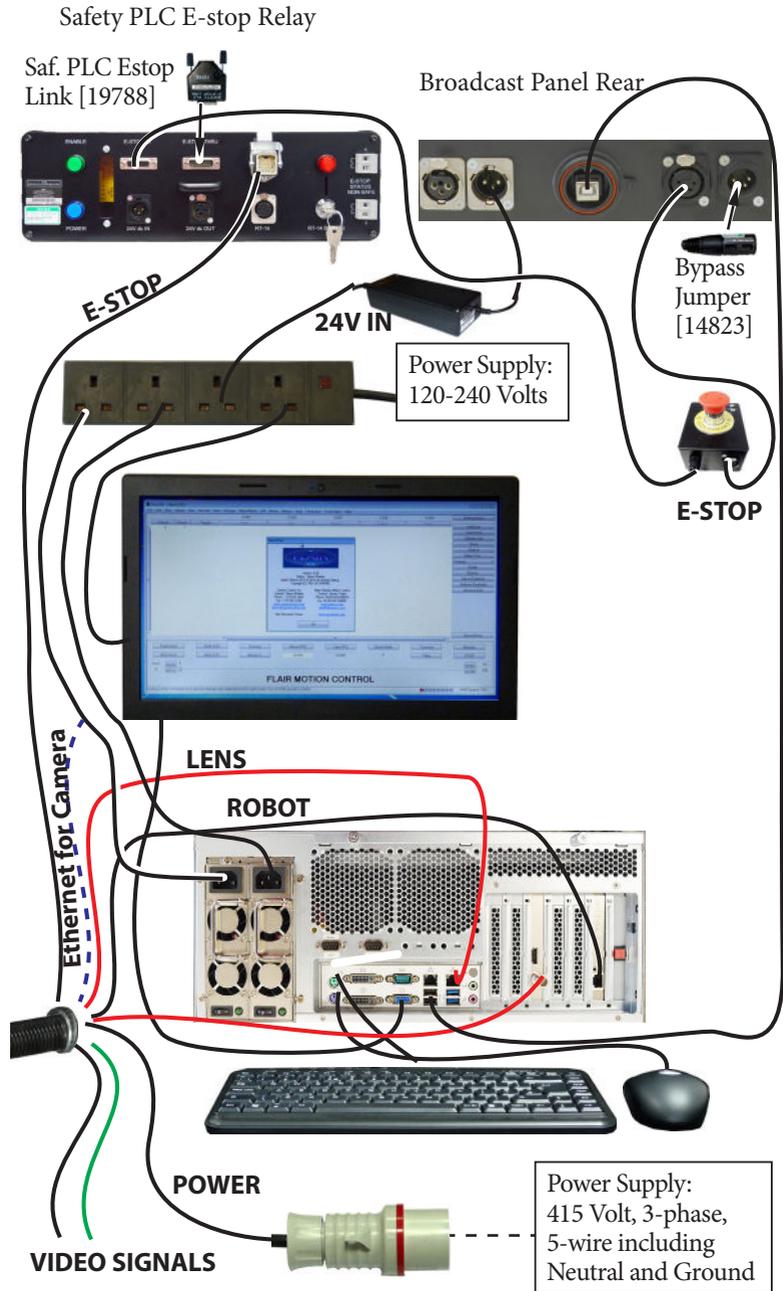
## Connecting the cables - Studiobot on Pedestal



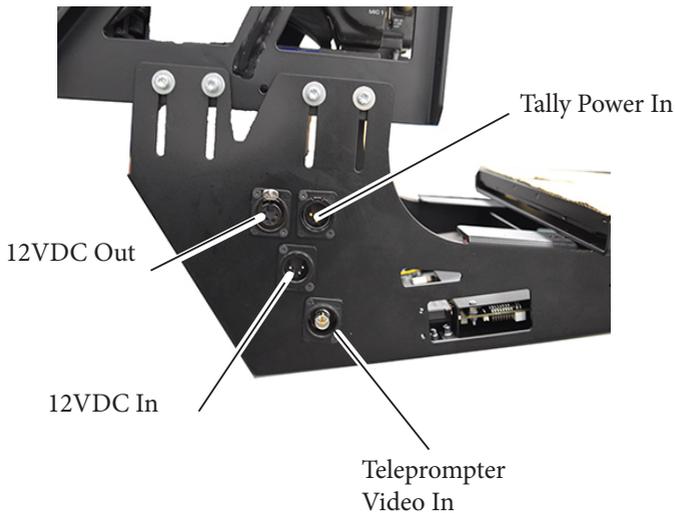


## Connecting the cables - Studiobot on Track





## Teleprompter connections



## Starting up the Studiobot XL system

Once you have attached all the cables, you power up the rig by switching on the components in the order described below.

1. Make sure you have secured the area around Studiobot XL.
2. Release the E-stop on the **Studiobot XL base** by turning the red button clockwise until the button pops up. Also make sure the key is in the clockwise position. **Do not release the other E-stop by the computer stack yet.**
3. Power up Studiobot XL itself as follows:



Turn on the power switch on the side of the Studiobot Base.



The Studiobot XL power-up sequence takes about three minutes. When it has completed, the Stäubli CS8 shows an “A” on its display.



**Hint**

The Stäubli CS8 is inside the Studiobot XL base and you can see the CS8 display and lights by looking through the window.



4. Power up the Robocam Atelier computer system and all of its components, including the RT-14 interface box. You can do this while the Studiobot XL is powering up (step 3). **Do not start the Robocam Atelier application yet.**

5. After Studiobot has finished powering up (step 3) and the Stäubli CS8 is displaying an “A”, check that the cifX boards in both the Stäubli CS8 and the Robocam Atelier PC display two steady lights and one blinking light (see previous diagram). Look through the window in the Studiobot base to check the lights. This pattern indicates that the dedicated Ethernet connection running over the **ROBOT ONLY** cable is now working.
6. On the Robocam Atelier PC, start the Robocam Atelier application. Robocam Atelier automatically loads the relevant firmware into all attached axis boards, including any additional interface boxes that are attached to the computer stack
7. Release the E-stop that is plugged into the computer stack, by turning the button clockwise until the red button pops up.  


Once all E-stop buttons on the system are up, the Stäubli CS8 display shows “U”.
8. Zero the axes as required in Robocam Atelier. The Studiobot arm itself does not require zeroing but you need to zero other axes.
9. Engage the robot in Robocam Atelier.
10. In Robocam Atelier, move the Studiobot arm to its home position (rotated straight forward and tucked under).

Hint

If the Studiobot arm is in a backward or reversed starting position, the arm might swing overhead or around the side to reach the home position, possibly striking the walls, ceiling, or other rigging! If the rig is in an enclosed space or near other equipment, it is recommended that you do the following:



- Manually move the arm close to its home position before Homing it.
- When you home the rig, have one hand ready on the E-stop in case you need to stop the rig quickly.

11. Set the soft limits for the rig axes in Robocam Atelier as required:
  - Arm position limits
  - Lens Control Motor limits (if using external LCMs)

## Shutting down the Studiobot system

1. Move Studiobot XL to its Home position.

or...

If you are going to transport the robot to a new location, put the Studiobot arm into its transport position. You can do this either by using Robocam Atelier (although you might have to reset the soft limits to reach the transport position) or by moving the arm manually. For details see page 22.

2. In the Robocam Atelier software, disengage the robot.
3. Press down all E-stop buttons:
  - On the computer stack
  - On the Studiobot base
4. Close the Robocam Atelier software.
5. Shut down Windows on the Robocam Atelier PC.
6. Turn off Studiobot XL as follows:

Turn off the power switch on the side of the Studiobot Base.



## Moving the Studiobot arm by hand

In some circumstance you need to move the Studiobot arm manually with your own hands. For example:

- Recovering from a **software lock-up**. For example if momentum has carried the arm outside the soft limits, the software might refuse to move the arm to get back inside the limits.
- Recovering from a **hardware lock-up**. If momentum or a programming error moves the arm against its internal hard limits or if the camera platform gets stuck against another part of the arm, the motors might not be able to back off from this position without tripping out.
- Putting the arm into **transport position**, to make the Studiobot volume as small as possible so it will fit into a truck. You can do this with Robocam Atelier software (although you will probably need to change the soft limits) but if you forget to do so before shutting down the Robocam Atelier computer then you can do it by hand.



Transport position:

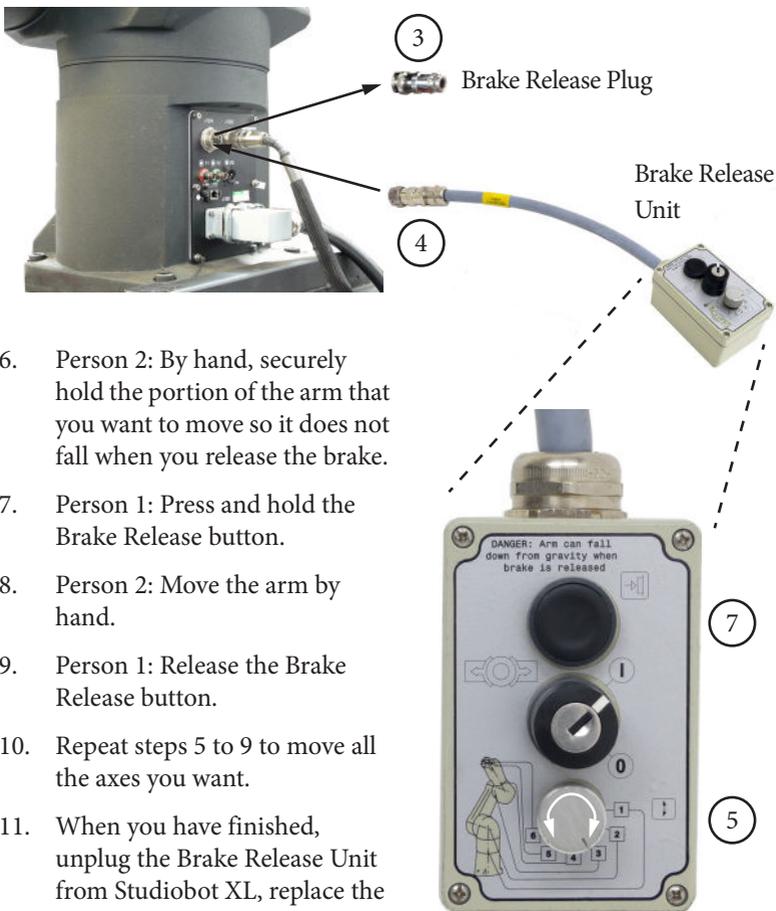
- Arm rotated forward and tucked under.
- Camera platform perpendicular to base slope, above the wheel unit, with about 3 cm clearance between it and the base.

### Hint

Moving the Studiobot arm by hand is usually a two-person job — one to operate the Brake Release Unit and one to move the arm.

To move the Studiobot arm by hand:

1. Make sure that Studiobot itself has power and is switched on. The brakes are **on** when the unit is switched **off**, so if you want to move the arm by hand, Studiobot must have power and be switched on.
2. If Studiobot is connected to a running Robocam Atelier PC, disengage the robot in the software.
3. Remove the Brake Release Plug from socket J1204 on the arm base.
4. Plug the Brake Release Unit into socket J1204 on the arm base.
5. Person 1: On the Brake Release Unit, use the lower dial to select which Studiobot axis you want to move.



6. Person 2: By hand, securely hold the portion of the arm that you want to move so it does not fall when you release the brake.
7. Person 1: Press and hold the Brake Release button.
8. Person 2: Move the arm by hand.
9. Person 1: Release the Brake Release button.
10. Repeat steps 5 to 9 to move all the axes you want.
11. When you have finished, unplug the Brake Release Unit from Studiobot XL, replace the plug in socket J1204, and power

Notes

Notes

## Appendix 1 Troubleshooting

### Typical symptoms, causes, and actions

Note

The Stäubli teach pendant should only be used for troubleshooting purposes and should not be used for normal operation of the rig. The teach pendant is not related to Robocam Atelier in any way and is not an interlace to MRMC Studiobot system.

Symptoms	Cause and/or action
Robocam Atelier fails to establish a network connection to the Studiobot controller (the Stäubli CS8) over the <b>ROBOT ONLY</b> cable.	<p>Try a different cable. The cable between the cifX boards in the Robocam Atelier PC and Stäubli CS8 needs to be a high quality, fault-free, straight-through (that is, not cross-over) Ethernet cable.</p> <p>Check that all cables are connected correctly (page 13) and that all devices, including the Ethernet hubs, have power.</p> <p>Check the order in which you are powering up the devices (page 17).</p> <p>Make sure you have allowed enough time for the Studiobot/Stäubli CS8 unit to completely power up (with the Stäubli CS8 panel displaying an “A” and the cifX board lights displaying the correct pattern) before you engage the robot in the software.</p>

Symptoms	Cause and/or action
Studiobot won't move	<p>Make sure you have enabled Studiobot in Robocam Atelier.</p> <p>The Staubli arm has its own hard limits for rotate, lift and arm. If any of the axes in the arm have hit the internal limits then the arm will 'lock up' and will not engage at all. You will need to move the arm by hand. For more details, refer to <i>Moving the Studiobot arm by hand</i> on page 22.</p> <p>Make sure all of your E-stop buttons are up, and that you have pressed the Reset button on each E-stop (if it has one). When they are all up, the Stäubli CS8 panel displays a "U".</p> <p>If you have moved the Studiobot arm by hand with the Brake Release Unit, make sure you have replaced the Brake Release Plug in the socket when you have finished. For details see <i>Moving the Studiobot arm by hand</i> on page 22.</p>

## Moving the axes when the Stäubli arm hard and soft limits are hit

The rotate, lift and arm axes in the Stäubli arm have the hard limit switches. The other three axes, pan, tilt, and roll, only have the soft limits. Moving the arm by hand is required when you hit the hardware limits. For more detail on how to move the arm by hand, refer to *Moving the Studiobot arm by hand* on page 22.

When the arm hits the software limits, use the teach pendant to move the axis. To do this:

1. Plug the teach pendant in Stäubli CS8.
2. Release the e-stop.
3. Switch the Stäubli e-stop to manul (hand) position. The LED on the 'hand' symbol will go green.
4. Clear any options in teach pendant by clicking OK.
5. Put the dead man's handle to the middle position.

6. Press the Power (green) button. You should hear the robot engage and the light on the arm should come on.
7. Select **Joint in the Move** mode. The light on it comes on.
8. Press the button, + or -, to take the axis back to the required position. This will only let you move the axis that has crossed the limits and only in the direction that brings it back to a position within the soft limits.

Note

Always carry the Break Release cable with a Studiobot system. Once the Stäubli hard limits are hit, there's no way to bring the axes back into a position within the hard limits without using the break release cable!

## Checking robot temperature using the pendant

The robots efficiency might suffer if the temperature inside the cabinet is too high. To check the temperature:

1. Replace the bypass jumper from the Pendant connector in the Bolt base with the Pendant connector on the teach pendant.



2. Select **Main Menu > Control Panel**. Press Enter.



3. Select **Controller Status** and press '→'.



- The Cabinet Temperature is shown on the pendant screen.



- Remember to replace the Teach Pendant with the bypass plug after you have completed the procedure.

## Modifying the Range of Motion for Roll Axis

1. Replace the bypass jumper from the Pendant connector in the Bolt base with the Pendant connector on the teach pendant.



2. Power on the teach pendant and the main menu appears.
3. Press  +  on the pendant to display the user menu.
4. Press  to display the Profile Selection screen.

5. Press  to scroll to the **Maintenance** profile and press .



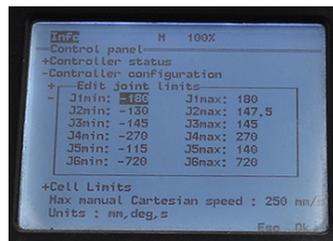
6. Enter the password '**spec\_cal**' and press OK (F8). (To enter '**\_**', press  + M.)
7. The screen would return to Main Menu. Scroll and select **Control Panel** and press . Scroll to **Controller configuration** and press . Press  to expand the menu.
8. Scroll to **Arm Limits** and press .



13. Delete the existing number using the  key. For minus symbol, press  and 'F'. Keep  illuminated so, it selects numeric functions on letter keys.
14. Press  when finished.
15. Scroll to the next number to be edited. Repeat steps 11-14.



16. In the following example, the Roll limits have been modified to -720 to +720.



17. When all the new limits are added, press F8 to return the screen to Main Menu.

## Staubli CS8 Controller Critical Fault Reset

The CS8C has two Ethernet ports, J204 and J205. On delivery, J204 is configured with the address 192.168.0.254 (mask 255.255.255.0) and J205 with the address 172.31.0.1 (mask 255.255.0.0).

When an E-Stop fault has occurred, you may get a message such as: “Cannot settle arm power: fault on signal UESAI needs to be corrected and tested”.

This problem arises when the CS8 has detected a difference in the two E-Stop signal chains, and this is a critical safety error.

Once the wiring problem has been resolved, the error needs to be cleared.

To do this you will need to:

1. Connect to the controller via FTP.
2. Delete **usr/configs/sfty.dat**.
3. Delete **usr/temp/pdrv.dat files**.
4. Restart the controller.

Accessing robot file system:

1. Connect network cable to J204 Ethernet port on robot controller. Use FTP Surfer which can be downloaded for free.
2. Set laptop to an IP address on same subnet as J204 IP address (this can be found on the robot teach pendant in **Control Panel** → **Controller Configuration** → **Network**).

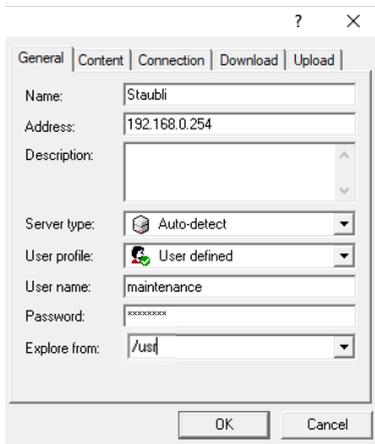
Name: Staubli

Address: J204 IP address

User name: maintenance

Password: spec\_cal

Explore from: /usr



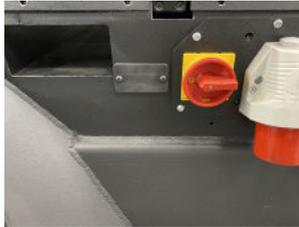
## Reseating the PCBs

### Bolt on Pedestal

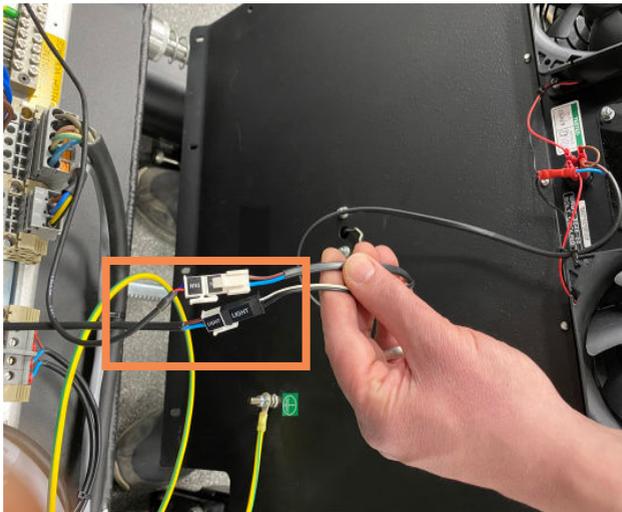
Switch the controller off using the main black switch on the CS8 and disconnect from power.

### Bolt on Track

1. First switch off the robot using the main red switch on the base and disconnect the 3-phase power supply cable from the track base.



2. Remove 14xscrews from the side panel and carefully swing it to one side. There is an earth connection, but that has enough slack to allow you to place the panel on the floor next to the base
3. Unplug the Light and Fan mate'n'lock connections from the side panel. (This step is only required if your Bolt on Track has a Fan unit in the Track base.)



Perform the following steps to access the CPT unit that houses the network cards in CS8 and then reset them:

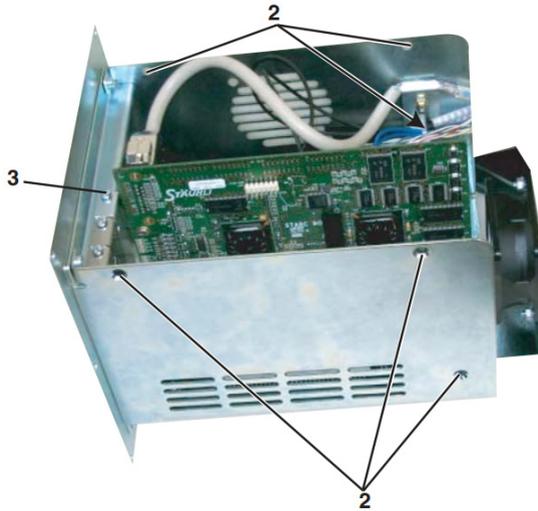
1. Undo the 6 x screws shown as “1” in the picture to slide the CPT unit out and tilt downwards slightly as permitted by the cables at the rear.

Note

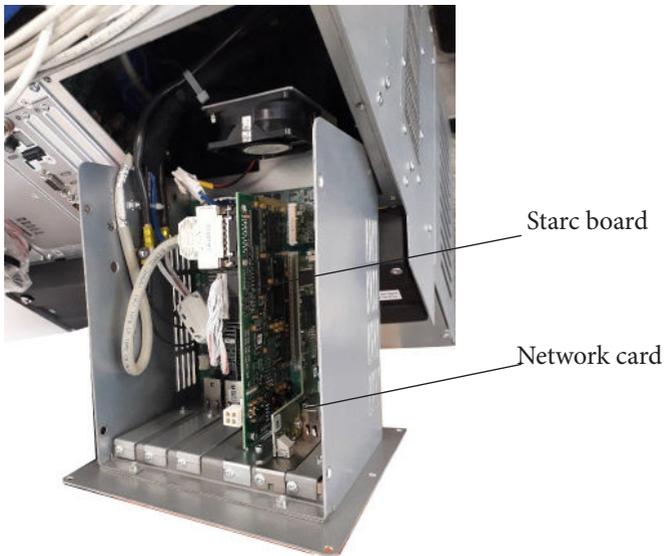
The CPT contains ESD sensitive devices, therefore the use ESD protection devices is recommended.



2. Unscrew 6 x screws (3 on each side) shown as “2” in the picture to remove the top cover of the CPT box.



3. Now you can access the 2 x PCBs inside: the Starc board and the Network card.



4. Undo the screws on the front bracket of each card (number 3), remove the card from the slot, clean the contacts and put them back.
5. Replace the top cover. If there is any holding bracket, make sure that they push the cards firmly in place.
6. Fit the CPT unit back and screw it in place.
7. Power up the robot and check that the booting sequence completes successfully.

Notes

## Appendix 2 Studiobot XL panels

### Studiobot base panel connector summary



1. **TALLY LIGHT** connector is the power in connector for teleprompter.
- 2-4. **ETHERNET** connectors. The **CAMERA** connector provides Ethernet communication with the camera and the **LENS** connector is to communicate with the lens. **SERVICE** connector is an additional port to be used by MRMC support and has the IP 192.168.37.165. **CAMERA** port is rated at 100 Mbits/sec.
5. **ROBOT ONLY** Ethercat connector. You use this to connect the cifX board in the Stäubli CS8 unit (inside the Studiobot base) to the cifX board in the Robocam Atelier PC, via the umbilical cable. The cifX Ethernet network is an industrial grade high speed network used to control the Studiobot motion, and is completely separate from the Ethernet network that runs the camera and lens.
6. **PENDANT** connector, for attaching a Teach Pendant to the rig. This is required for the rig to operate, and should only be removed under advice from MRMC support staff.
- 7,8,9. **VIDEO 1-3** connectors for the video signal from the camera or to the Teleprompter.
10. **E STOP** connector. You connect this to the E-stop button or Broadcast Panel beside the computer stack, via the umbilical cable.

Notes

## Appendix 3 Specifications

Dimensions	Measurement
Weight	630kg
Height - maximum lens height	2.7 m
Height - maximum mechanical clearance needed	3.6 m
Length/width - maximum lens reach from centre	1.9 m
Length/width - maximum clearance needed	2.4 m
Height - arm in transport position	2.2 m
Length - arm in transport position	1.2 m
Width	1.105 m

Temperature range: 0-45 °C (32-113 °F)

Humidity tolerance: 0% to 85% relative humidity, non-condensing

Camera payload: 14kg

Power requirements: 415 Volt, three-phase, 8 Amps, 50-60 Hz with Earth (Ground) connection.

Studiobot XL requires three phase but NO NEUTRAL. The power cable is wired directly to the robot's controller (CS8). It can be configured to run on different voltages without affecting performance. Change the CS8 PSU input to match the available three phase voltage (50/60 Hz) as shown in the table.

Allowed three phase input voltages:

200 V	208 V	230 V	400 V	440 V	480 V
7F 8F 9F	7E 8E 9E	7D 8D 9D	7C 8C 9C	7B 8B 9B	7A 8A 9A

### Cable Colours

Brown            Phase 1

Black            Phase 2

Grey            Phase 3  
Green/Yellow   Ground

Note: No NEUTRAL is used

Optional power generator requirements: 3 kVA

Performance:

Axis	Range of travel	Maximum speed
Rotate	$\pm 160^\circ$	35°/sec
Lift	$\pm 136.5^\circ$	35°/sec
Arm	$-30^\circ$ to $+150^\circ$	35°/sec
Cam Tilt/Tilt2	$\pm 70^\circ$	35°/sec
Tilt	$\pm 90^\circ$	35°/sec
Roll	$\pm 180^\circ$	35°/sec

Notes

Notes



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