



UNIVERSAL ROBOTS

Original instructions (EN)

Version: 0.0.1

Robot:

UR3, UR5 and UR10

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1. General information

1.1 Purpose

The purpose of these articles is to help Universal Robots (UR) users and integrators to safely perform service-related operations and troubleshooting.

Universal Robots industrial robots are designed using high quality components to ensure a long lifetime. However, improper use of a robot or robot parts can potentially cause failures. If, for example, the robot is overloaded, dropped during relocation, damaged by collision, or any other improper usage, the warranty will be void.

Universal Robots recommends the user does not attempt repair, adjustment, or make other interventions in the mechanical or electrical systems of the robot without first consulting an UR certified service engineer. Any unauthorized intervention voids the warranty. Service-related operations and troubleshooting should only be performed by qualified personnel.

Before performing service-related operations, stop the robot program and disconnect the main power to any potentially dangerous tool on the robot or in the surroundings.

In the event of a defect, Universal Robots recommends ordering new parts from the Universal Robot distributor where the robot was originally purchased. Alternatively, parts can be ordered from the nearest distributor, details of which can be obtained from Universal Robots official website at www.universal-robots.com

1.2 Company details






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1.3 Disclaimer


Universal Robots continues to improve reliability and performance of its products, and therefore reserves the right to upgrade the product without prior warning. Universal Robots takes every care that the contents of this manual are precise and correct, but takes no responsibility for any errors or missing information.

1.4 Warning symbols

DANGER, WARNING, CAUTION, NOTICE, and SAFETY INSTRUCTION statements are used throughout this manual to emphasize important and critical information. You **MUST** read these statements to ensure safety and to prevent product damage. The symbols are defined below.

	<p>DANGER:</p> <p>These warnings mean it is certain or highly probable that death or severe injuries will occur if no precautions are taken.</p>
	<p>WARNING:</p> <p>These warnings mean death or severe injuries may occur if no precautions are taken.</p>
	<p>CAUTION:</p> <p>These warnings mean minor injuries may occur if no precautions are taken.</p>
	<p>NOTICE:</p> <p>These warnings mean damage to property may occur if no precautions are taken.</p>
	<p>This warning sign contains references to safety-related information or general safety measures. This warning sign does not refer to individual hazards or individual precautionary measures.</p>

This warning draws attention to procedures which serve to prevent or remedy emergencies or malfunctions:

	<p>SAFETY INFORMATION:</p> <p>Procedures marked with this warning must be followed exactly.</p>
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2. Handling ESD-Sensitive Parts

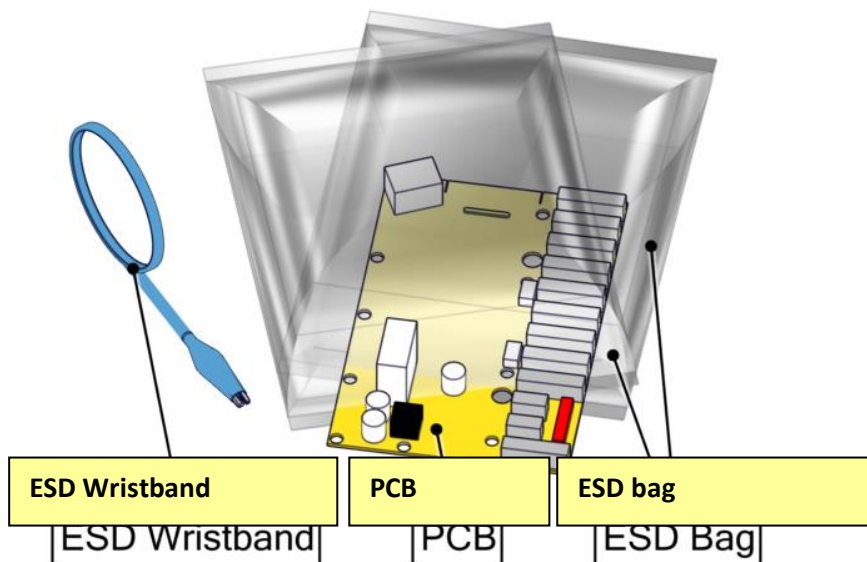


To prevent damage to ESD-sensitive parts i.e. Printed Circuit Board, follow the instructions below in addition to all the usual precautions, such as turning off the power before removing the circuit boards. See section **Error! Reference source not found.**



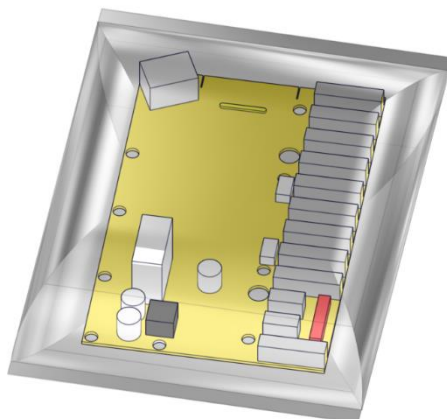
NOTICE:

Be sure you have intact ESD Wristband and a spare ESD bag before replacing any ESD-sensitive parts.

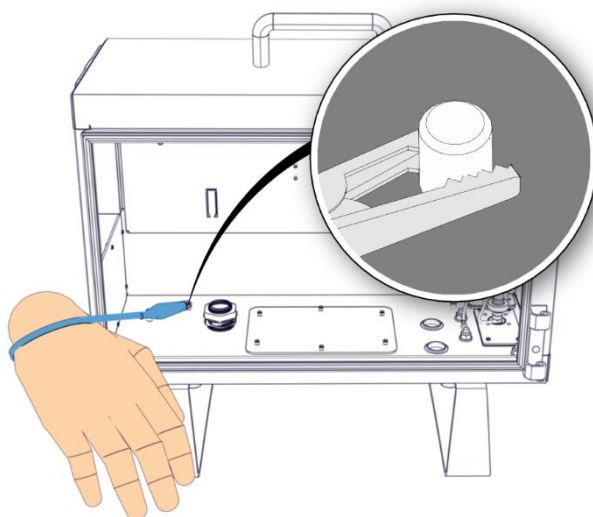




NOTICE:
Keep the ESD-sensitive part in its original shipping container.
 (a special "ESD bag") until the part is ready to be installed.



NOTICE:
Put the ESD wristband on your wrist. Connect the wristband to the system ground point.
 It discharges any static electricity in your body to ground.



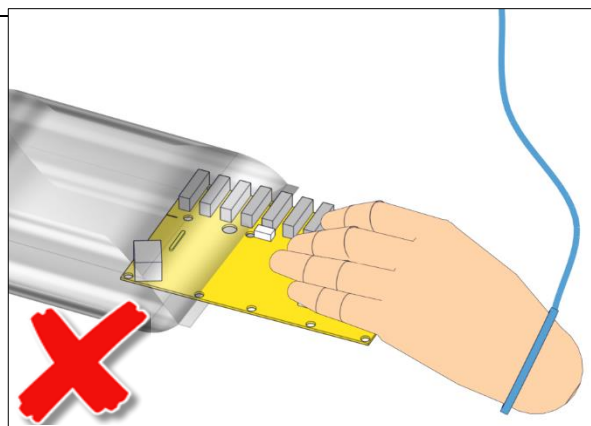
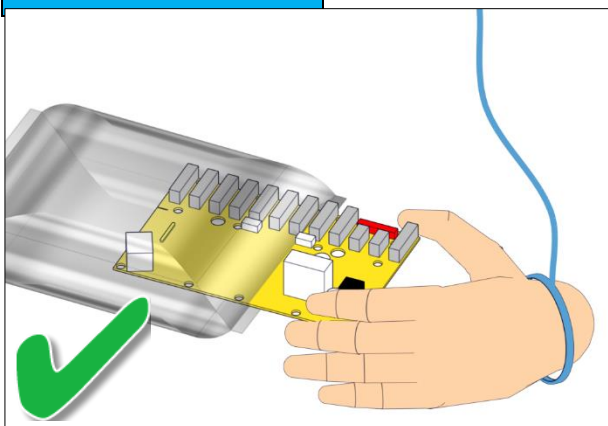
Replacing an ESD-sensitive part in a safe way is important to avoid damage to the part. It is important to take precisions when handling the ESD-sensitive part.



NOTICE:

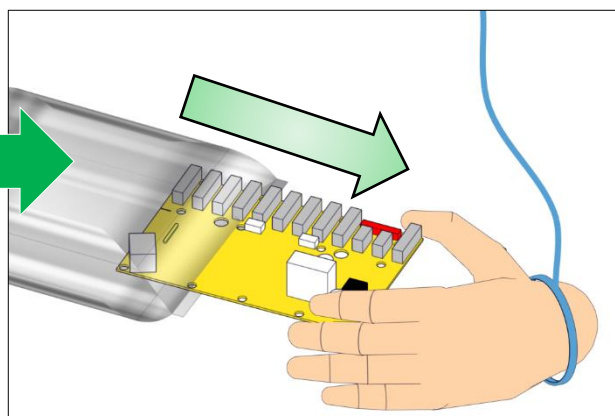
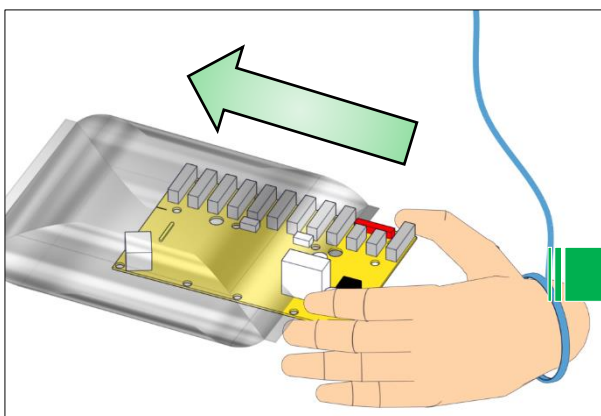
Hold the ESD-sensitive part by its edges.

Do not touch its pins or hold directly on any exposed prints.



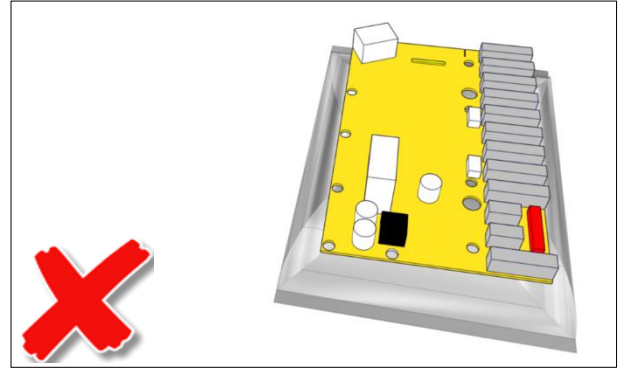
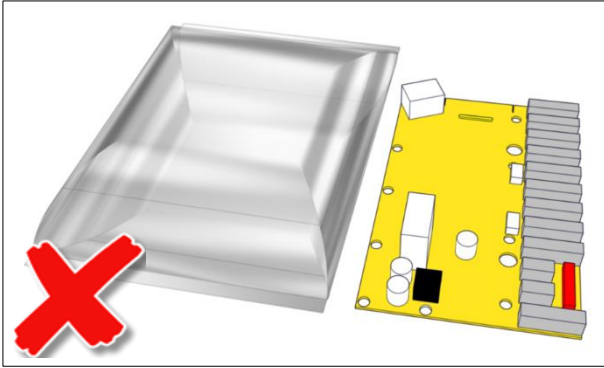
NOTICE:

First place the OLD part in the spare ESD bag, then take out the NEW part of the ESD bag. .

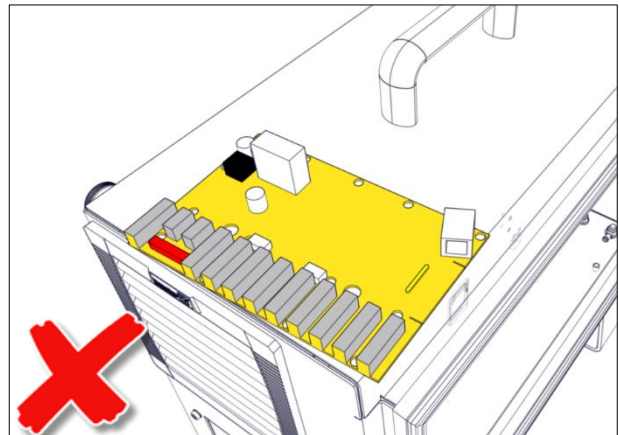
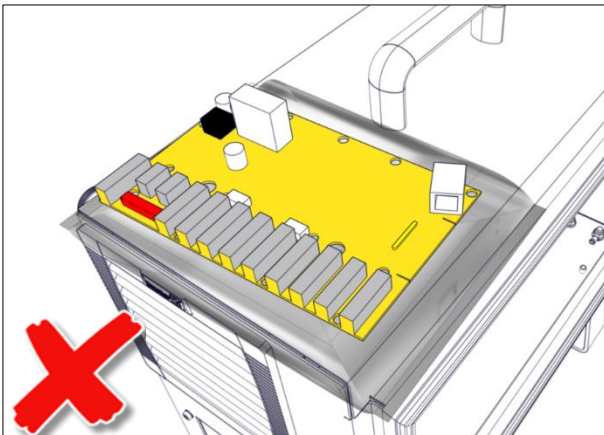



NOTICE:

Do not place the ESD-sensitive part on nonconductive material or on metal tables/surfaces.
If you must put down the ESD-sensitive part for any reason, then first place it into the ESD bag.

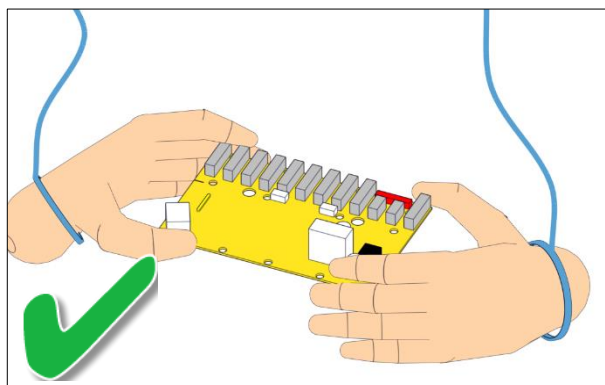
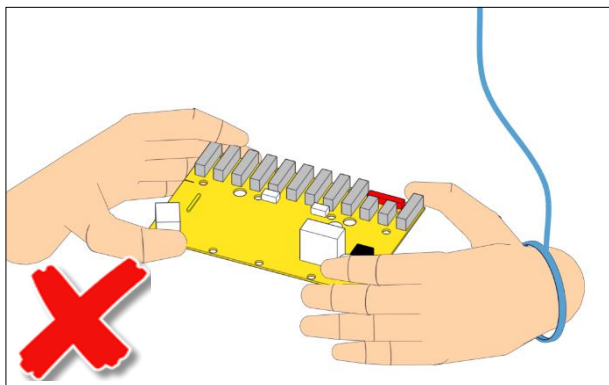

NOTICE:

Machine covers and metal tables/surfaces are electrical grounds.
They increase the **risk of damage** because they make a discharge path from your body through the ESD-sensitive part. (Large metal objects can be discharge paths without being grounded.).




NOTICE:

If passing an ESD-sensitive part to another person, ensure both are wearing ESD wristband and the ESD wristband is attached to the system grounding point.


NOTICE:

Be extra careful in working with ESD-sensitive parts when cold-weather and heating is used, because low humidity increases static electricity.

**WARNING:**

Change of electric shock

Do not try to repair defective parts

3. Controller can't power on

3.1 Most common problems

- Missing AC power
- Faulty power supply
- Faulty component
- Bad connection

3.2 Nothing happens when pressing the power button on Teach Pendant

If you press the power button on the TP and there's no green light nor the controller starts up, a few things can be wrong:

- Missing AC (Current distributor)
- Problem with 12V Power supply
- Problem with Safety control board – SCB

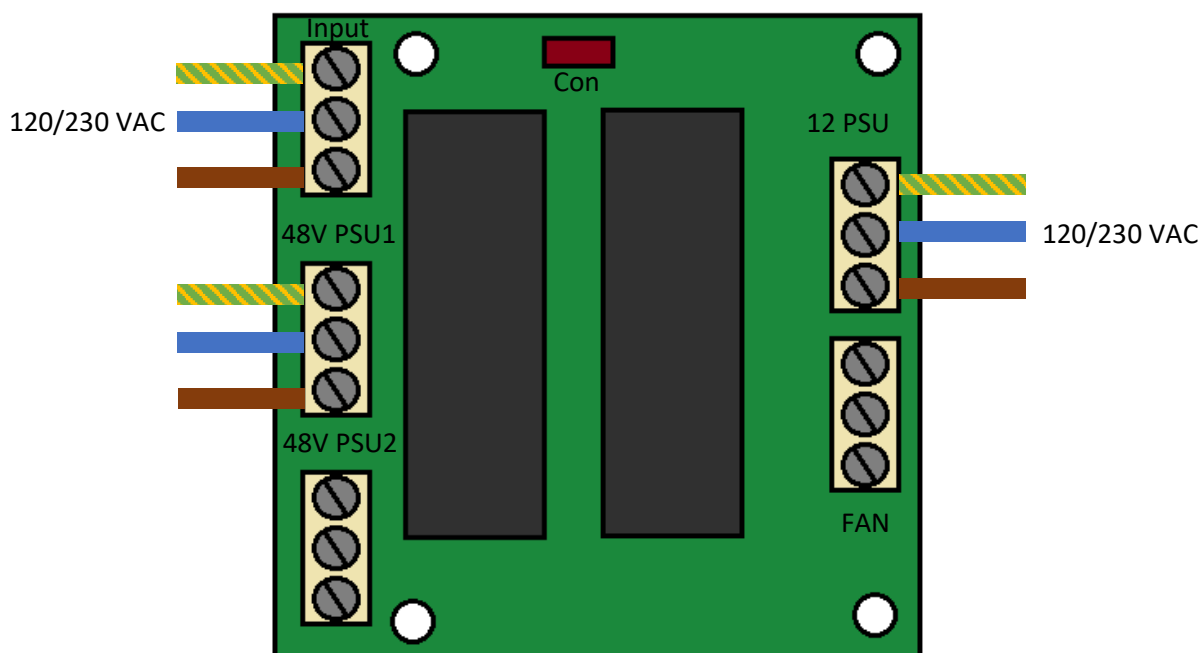
In the next steps we will cover how to check each part.

Missing AC – Current distributor

If the power supplies don't start up, it could be a defective current distributor.

To check the current distributor, you must disassemble the controller first.

Guide for dissembling can be found in the service manual at <https://www.universal-robots.com/support/>.



If you have power connected to the controller you should always measure about 120/230 VAC on the input side (voltage depends on which region you live in).

With power connected you should always be able to measure about 120/230 VAC on the output for the 12 PSU as well, if you can't the current distributor is defective and needs to be replaced.

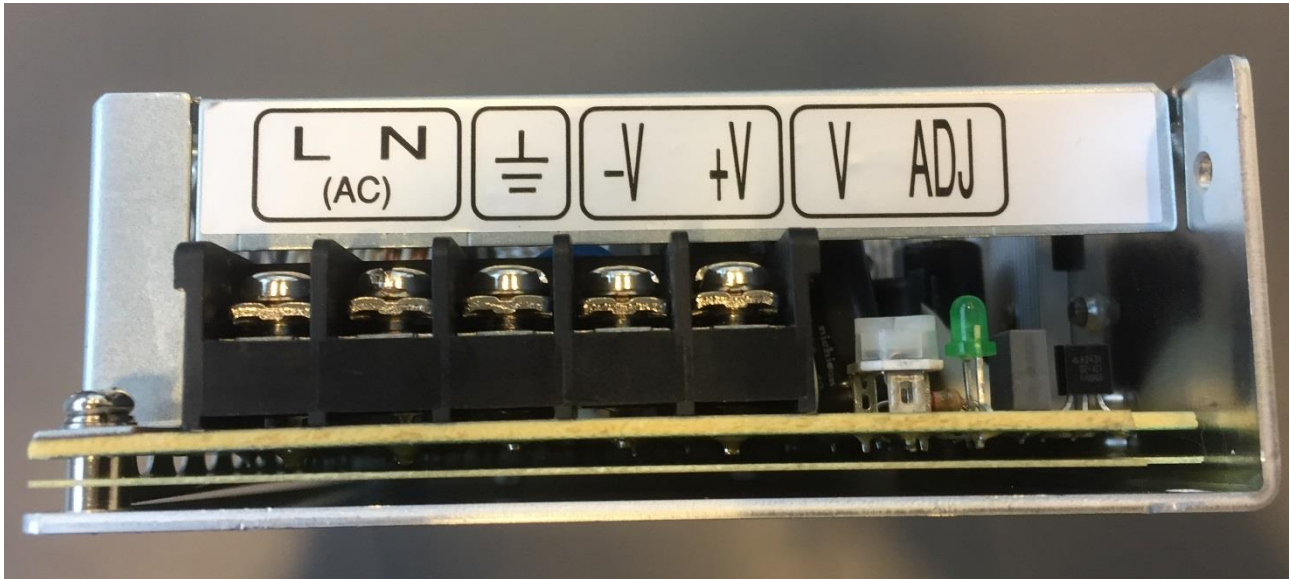
Problem with 12V Power supply

If you can measure 120/230 VAC on the current distributor, you should measure the same thing on the 12V Power supply's input side.

On the power supply there's a green LED that indicates if the PSU is powered on.

On the two terminals label with V+ - V- you should measure around 12V DC

The potentiometer can be used to adjust the output voltage between 10,8V – 13,2V

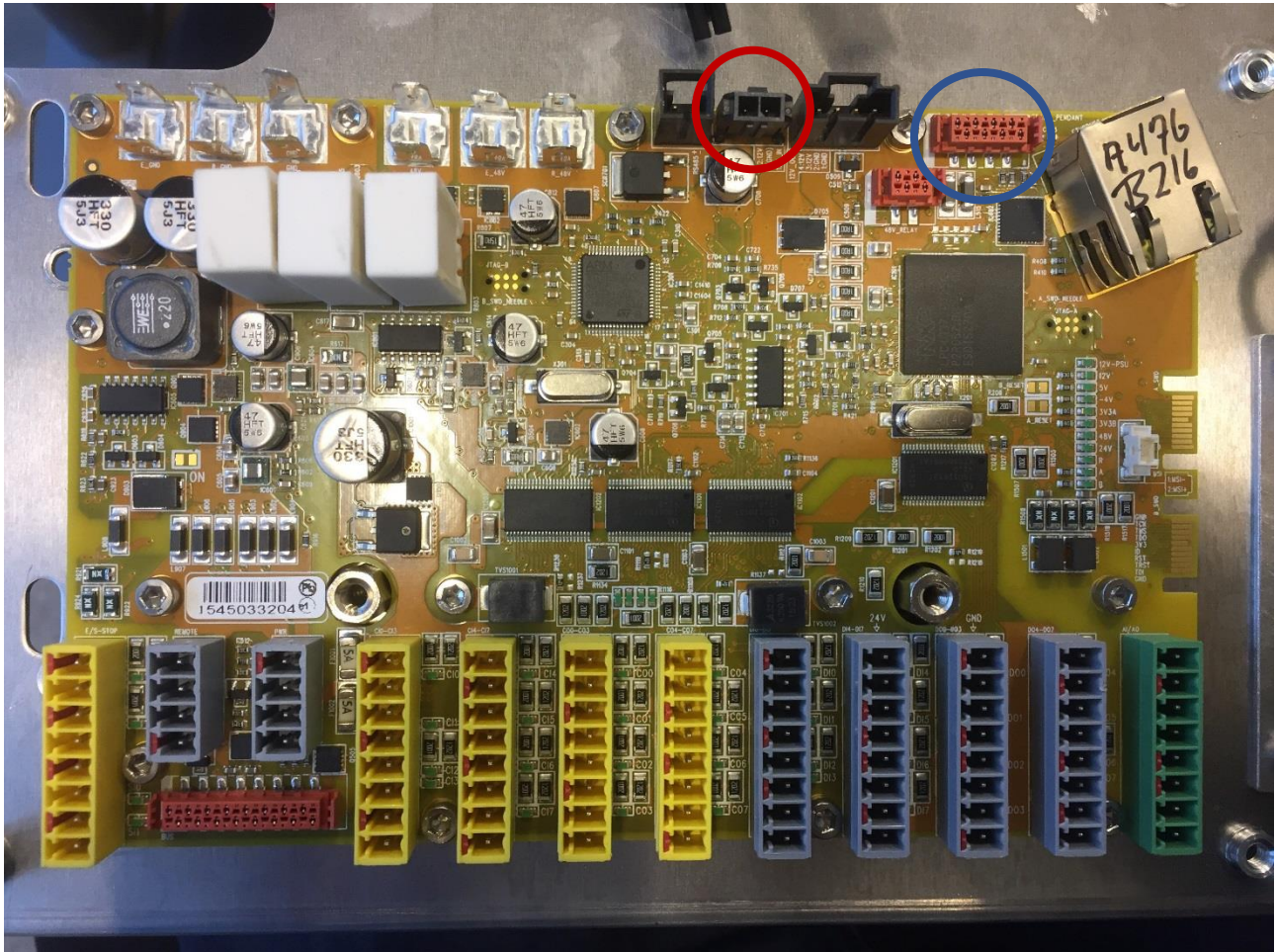


If you can't measure 12V on the output side of the power supply. Then remove the two cables that goes from the PSU's output side to the SCB and then try to measure again.

If you can measure 12V after that, then your SCB is defective and is pulling down the PSU voltage.

If no voltage is presented on the output side, when you have power applied to the input side, your power supply is defective and needs to be replaced.

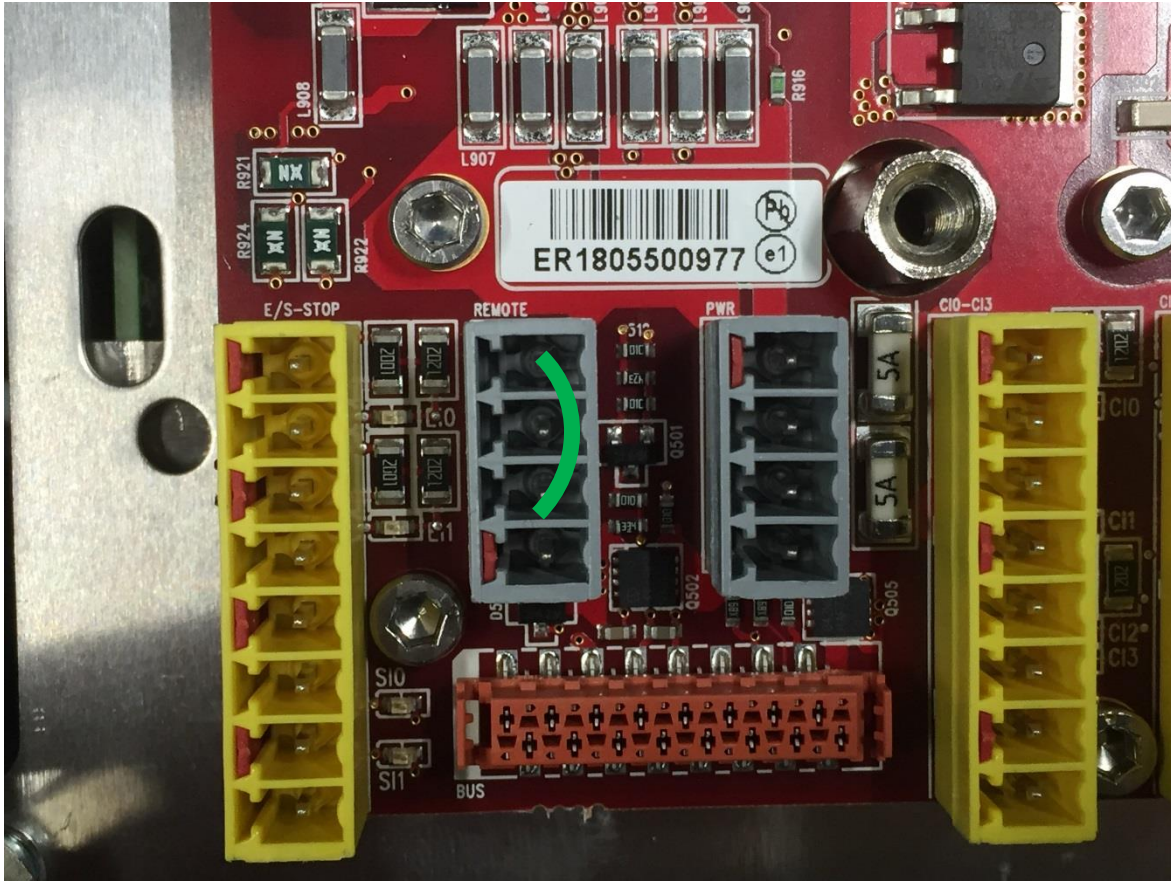
Problem with Safety control board – SCB



The 12V from the PSU is connected to the SCB at the point marked with **red**. It's possible to measure the 12V at the cable without disassembling the controller.

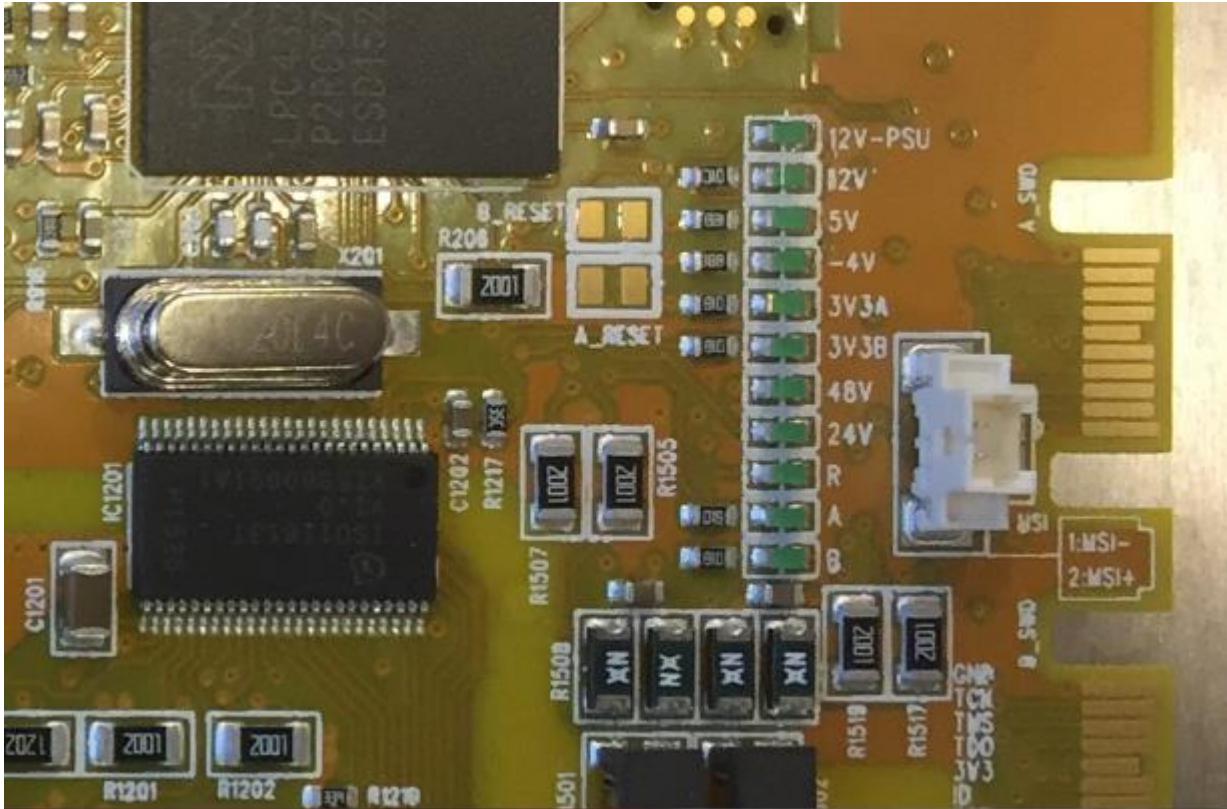
The Teach Pendant is connected to the SCB at the point marked with **blue**. If the connector has been removed or is not connected correct, the signal from the Teach Pendant will not reach the SCB.

If you think the cable from the TP is damaged, you can use the “remote power on terminals” on the SCB to see if the controller starts up.



Short the 12V and ON pin in the remote terminal for a short moment to start the controller. If the controller starts to boot, and when using your Teach Pendant it doesn't, then the Teach Pendant might be defective.

If you can turn on the SCB by using the Teach Pendant or by using the remote terminal, then check the SCB's right side, there is some LED indicators.



The LED indicator for 12V – PSU should always be active when power is connected.

When powering on the controller all the other LED's should turn on except for the 48V, 24V and R LEDs.

The A and B LEDs will blink occasionally.

If nothing happens, and power is applied to the SCB, is most likely defective and needs to be replaced.

3.3 Screen stays black when powering up controller – Teach Pendant

If you turn on the controller and see that the LED on Teach Pendant lights up, that the LED indicators on the SCB is active, your Teach Pendant might be defective.

To see if your controller is starting up, you can connect an external monitor to the motherboard using a DVI cable.

Another indicator that your Teach Pendant might be defective is that a UNIVERSAL ROBOTS logo doesn't show up when powering on the TP.



This logo is generated inside the TP and doesn't need an external signal source, for it to be visible.

3.4 No signal after the logo – Teach Pendant

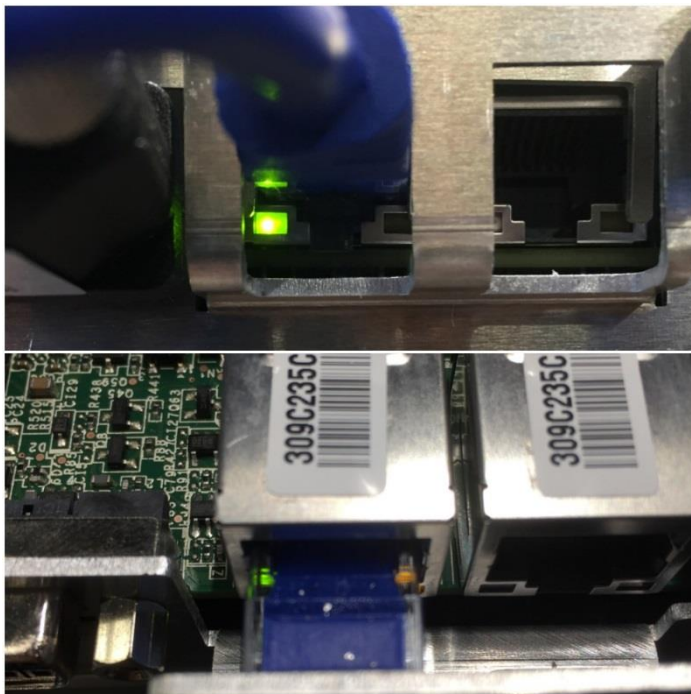
If the Teach Pendant says DVI – NO signal, then starts scanning for a signal source and after that goes black.

Then the Teach Pendant is not getting a video signal from the motherboard.

It could be that the motherboard is defective, or motherboard is not getting power from the SCB or the cable that goes from the motherboard to the Teach Pendant.

Defective motherboard, Safety control board or Teach Pendant?

When powering on, check if there's any indication LED's that lights up on the Ethernet port that's connected to the SCB.



If there's no light, check that the motherboard is receiving 12V from the SCB. Use a multimeter to measure the voltage on either the cable that goes from the SCB to the motherboard or measure the voltage directly on the SCB. If the SCB is not putting out 12V see last section **Problem with Safety control board – SCB**.

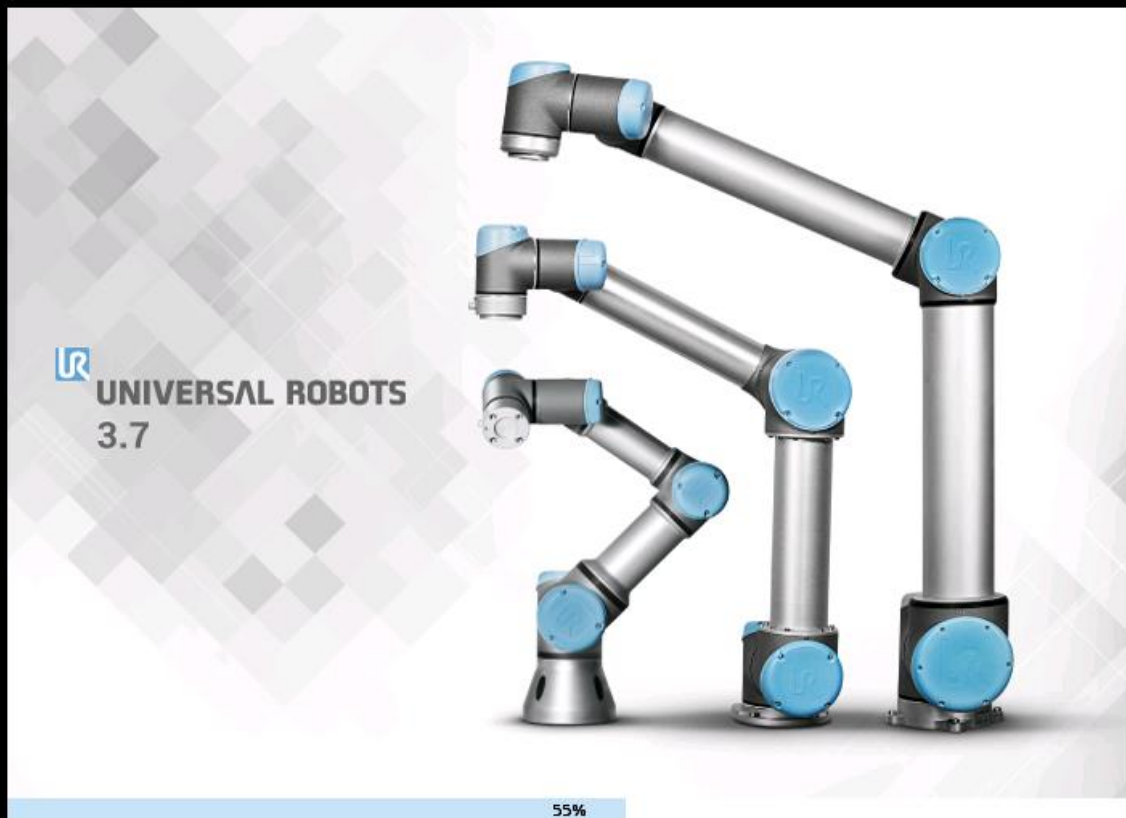
If there's power to the motherboard but no picture on the Teach Pendant. Try to connect an external screen or another Teach Pendant to the motherboard to see if there's coming a signal from it. If there's still no picture the motherboard is most likely defective. If there's a picture the problem is the DVI cable/Teach Pendant.

4 Controller starts up, but won't boot into Polyscope

4.1 Video signal presented but Polyscope won't boot

After the Teach Pendant has shown the UNIVERSAL ROBOTS logo, the system will start up.

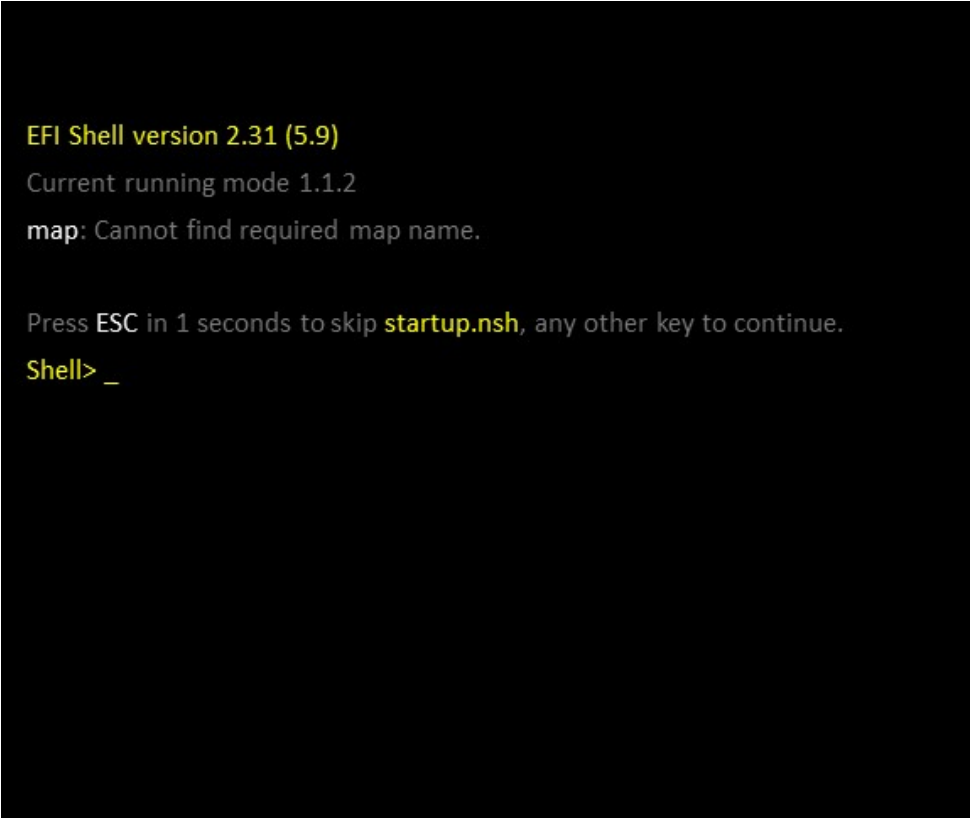
Operating system can't start up



You will see a loading screen and the Operating system will start to load.

If Polyscope fails to start up at this point, try to replace the USB or write a new image to it. **See article on how to**

No bootable device – “EFI Shell version”



```
EFI Shell version 2.31 (5.9)
Current running mode 1.1.2
map: Cannot find required map name.

Press ESC in 1 seconds to skip startup.nsh, any other key to continue.
Shell> _
```

If you get this screen, the motherboard does not have a valid media to boot from.

Try this in the following order:

Check if the USB/flashcard is not inserted in the motherboard port.

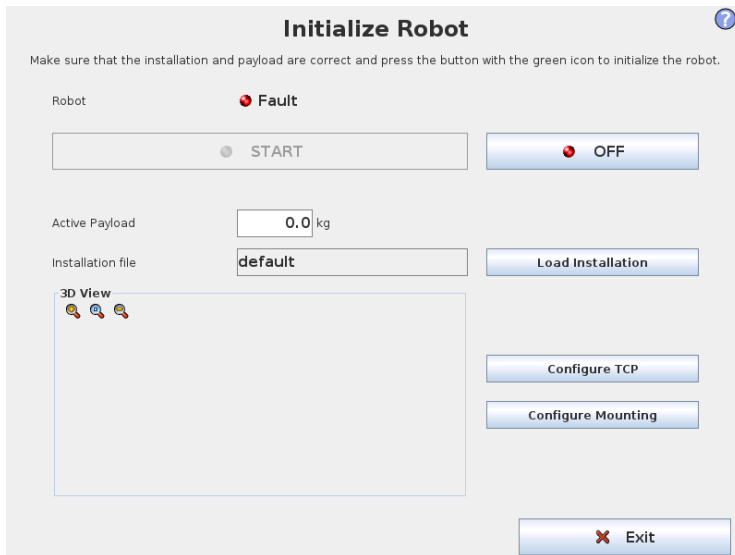
Maybe the USB is corrupted or damaged, write a new image to it or try with a new USB.

The motherboard could be defective.

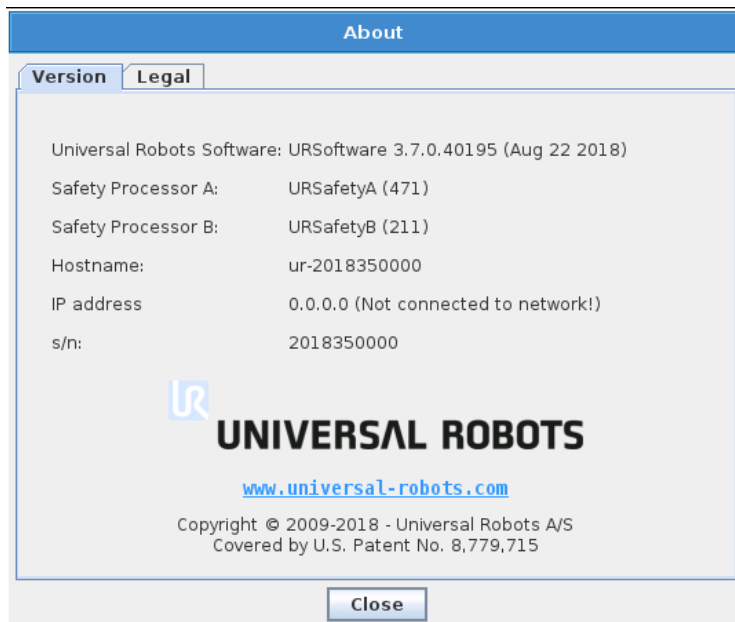
See article on how to make a new USB

5 Errors when Polyscope starts up

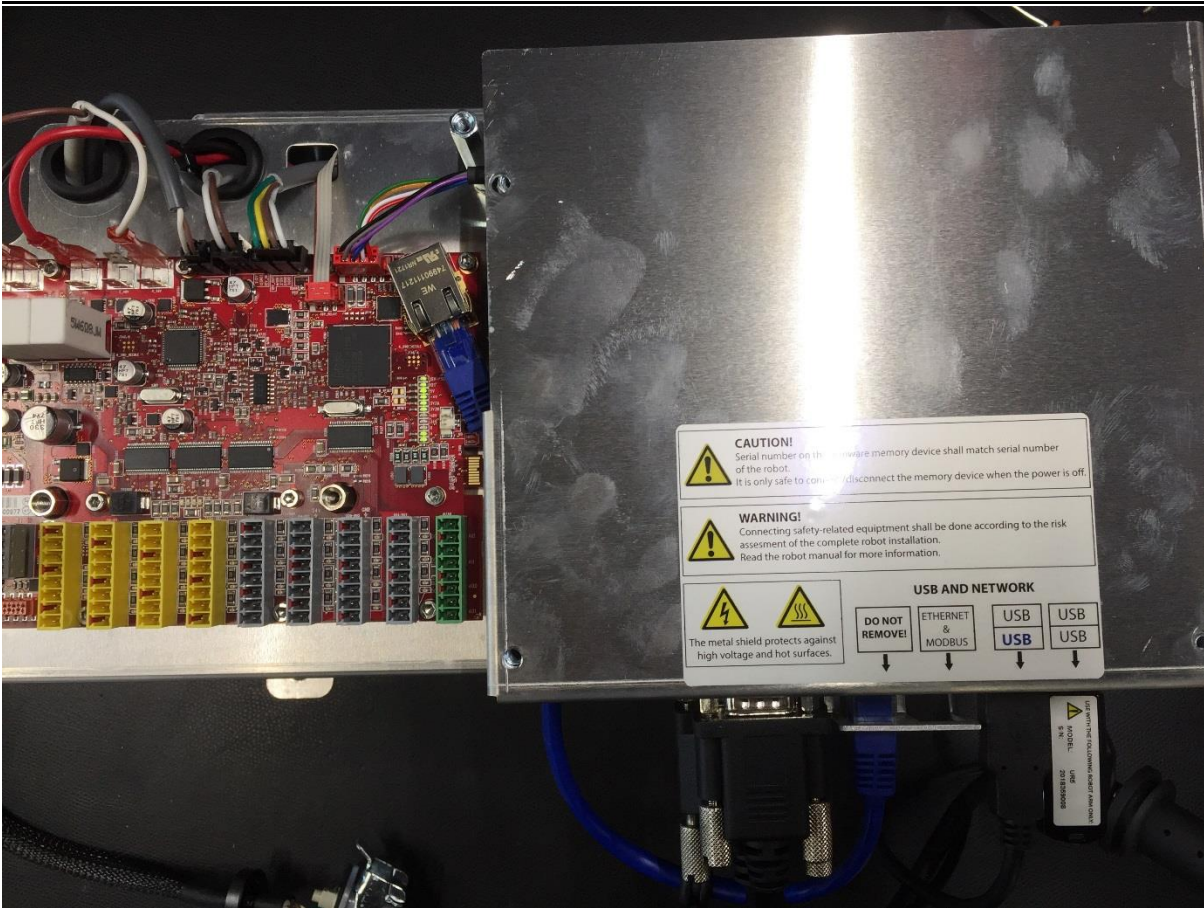
5.1 Polyscope show error C201A0: Safety board failed, or robot just says fault when trying to power on



If this fault shows up when Polyscope starts up and you can't press anything else. The motherboard doesn't communicate with the SCB.



If you open the About menu, you can see that it says the Safety A and B processor is 471 and 211. It should have been 3.5.2 and 3.5.1, another sign that the motherboard is not communicates with SCB.



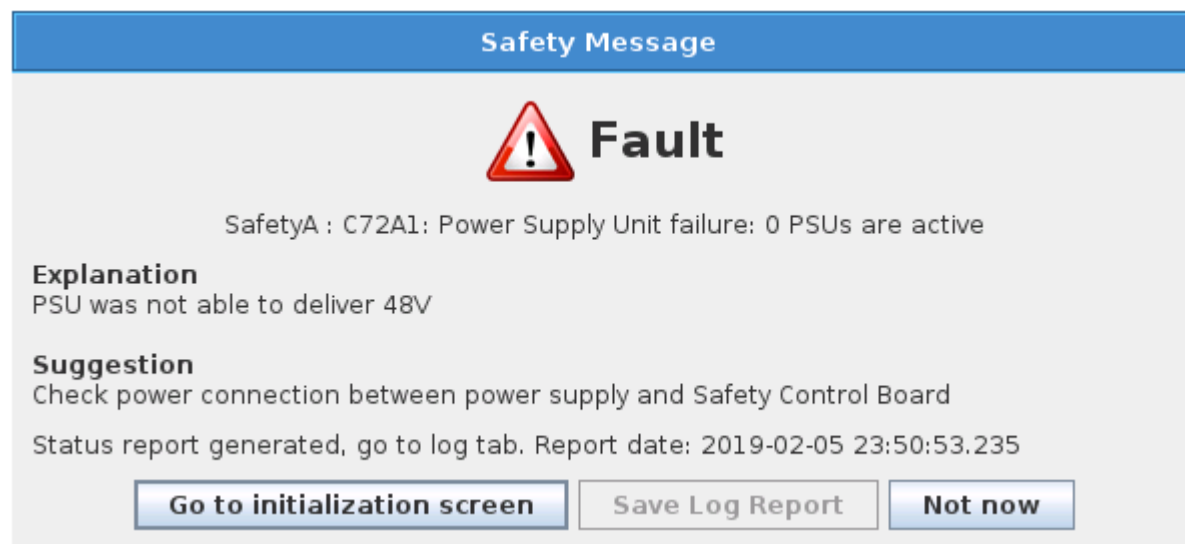
Check if the ethernet cable between the SCB and motherboard is connected corrected. On the motherboard, the cable should be connected to the port with (do not remove) sticker on top.

If everything is connected, try to replace the cable between the two components. You will have to reboot the controller afterwards.

If none of this is working, either the motherboard or most likely the SCB defective. See section **Problem with Safety control board – SCB**.

5.2 Polyscope show error C72 Power Supply Unit failure – 48V

C72A1: 0 Power supplies are active



You will get this message if the 48V Power supply/supplies can't be activated. This could be a faulty current distributor, 48V PSU or the SCB. The wiring between the current distributor and the SCB could be the problem as well or a bad connection.

Current distributor - Check

When the error pops up, click on the "Go to initialization screen and then press restart".

If you hear the current distributors relays click, the SCB is doing what it supposed to do. Note that error will show up on screen again.

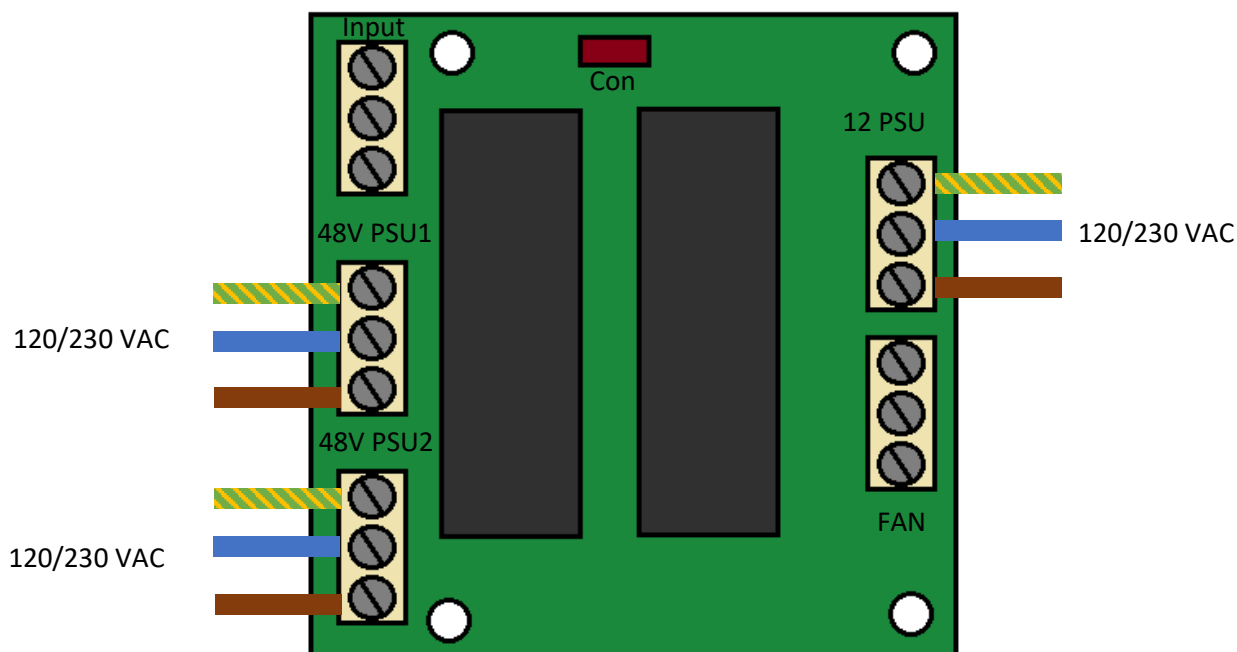
If you are having trouble with hearing the relays, you can use this trick:

You can use a screwdriver to hear the click by using it as a stethoscope. You can wedge the handle of a long screwdriver into your ear, and touch the screwdriver point to the relay

If the relays don't activate, the ribbon cable from the SCB or the SCB itself could be defective. **See next section.**

If the SCB is fine, but the relays still don't click the current distributor is defective.

If the controller is for an UR3 or UR5, only one of the current distributors 48V outputs is being used. So, if only one of the current distributors relay is defective, you can move the wire from one output to the other. We only recommend doing it at a temporary solution. This don't apply to a UR10 as it used both outputs replays.



Current distributor – Measuring

When the relays are active, you should be able to measure around 120/230 VAC on the two 48V outputs.

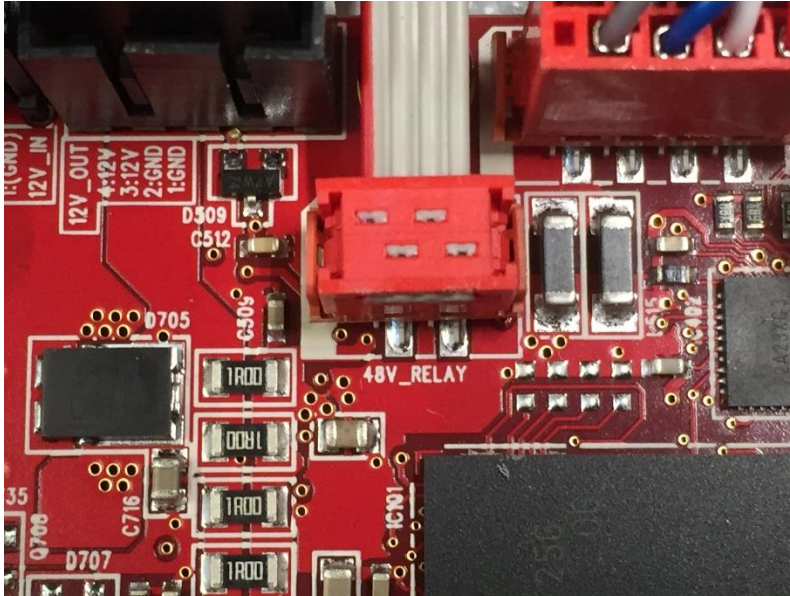
To activate the relays, you will have to go to the initialization screen and then press restart”.

The relays will only be active/pulse a few times before the failure shows up again and you will have to repeat the first step again.

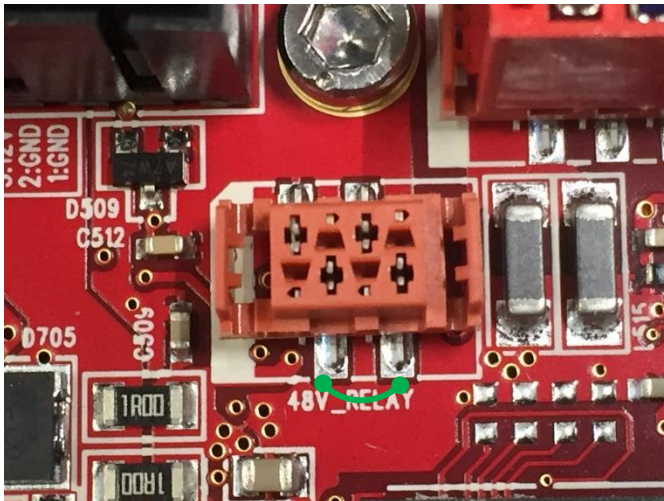
Safety control board – Check

On the SCB, find the connector that the 4 pin ribbon cables go into. On the PCB it's labeled with 48V_RELAY.

Its job is to send pulses to control the current distributors relays.



Safety control board – Measuring



You can measure the 12V-DC pulses between these two pins, when restarting the controller like before, when the current distributor was tested.

If you don't get any pulses from the SCB it defective.

48V – Power supply check

UR3 and UR5 only have one 48V power supply but the UR10 has two. The measuring method is the same for both cases.

Make sure that the jumper (remote sense) is inserted in the PSU and be sure that the screw terminals is tighten enough. It has been seen before that a problem has been solved, by removing the 48V wires and reattached them again. MANGLER MOMENT tal

48v – Power supply measuring



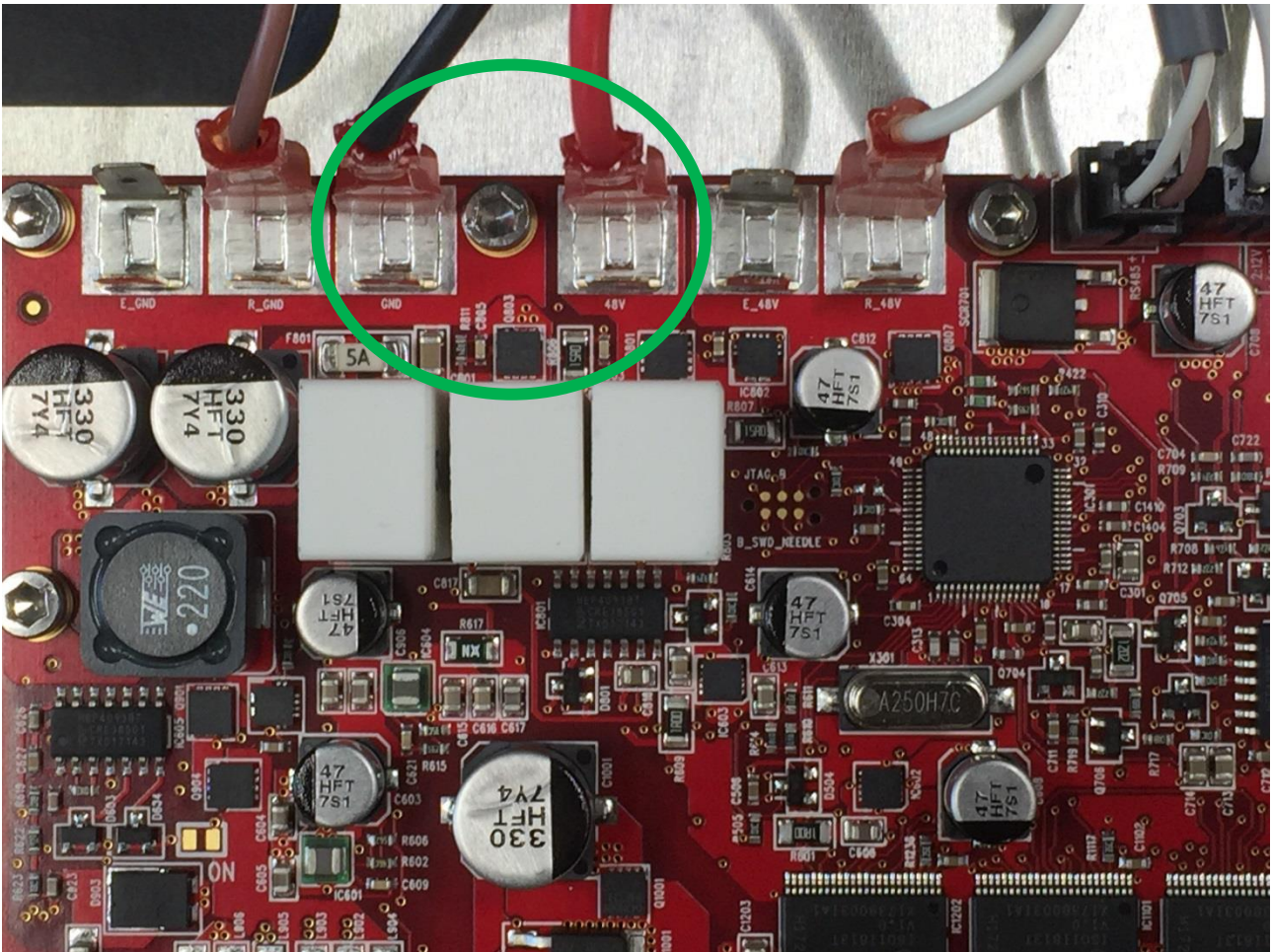
On the input side you should measure around 120-230VAC (note that the relays must be active, or else you won't measure anything).

The potentiometer can be used to adjust the output voltage between 43V – 55V.

On the output side you should measure around 48V DC.

If you can't measure 48V on the output side, when there is power applied on the input side, the PSU is defective.

The 48V from the PSU can be measured on the SCB as well.



C72A2: 1 Power supply active, but we expect 2 (UR10)

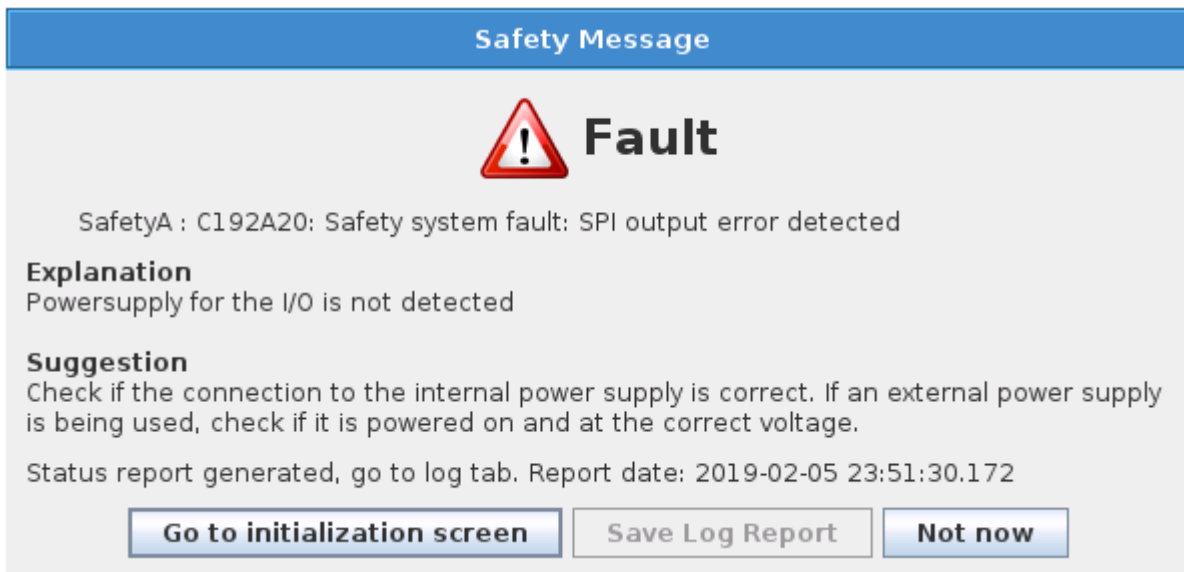
If you get this error, check power supply like in the last section and check the connection between the PSU and SCB.

This error will occur as well if you insert a UR3 or UR5 USB in a UR10 controller.

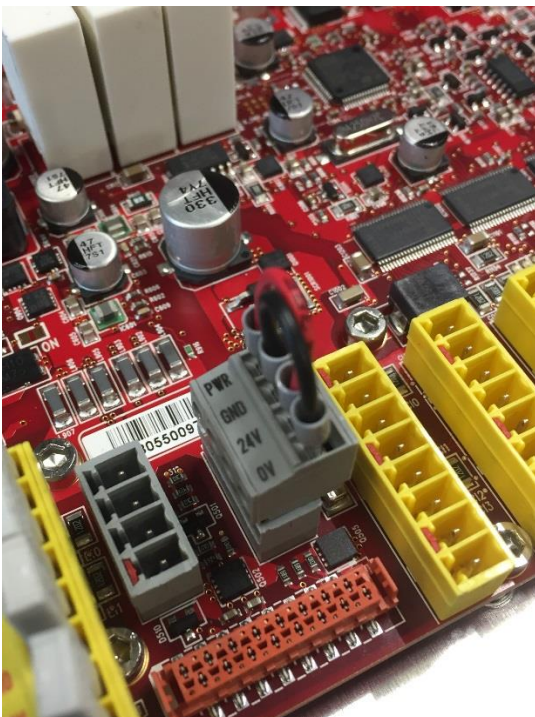
C72A2: 1 Power supply active, but we expect 1 (UR5)

This error will occur if you insert a UR10 USB in a UR5 controller.

5.2 Polyscope show error C192A20: SPI output error detected



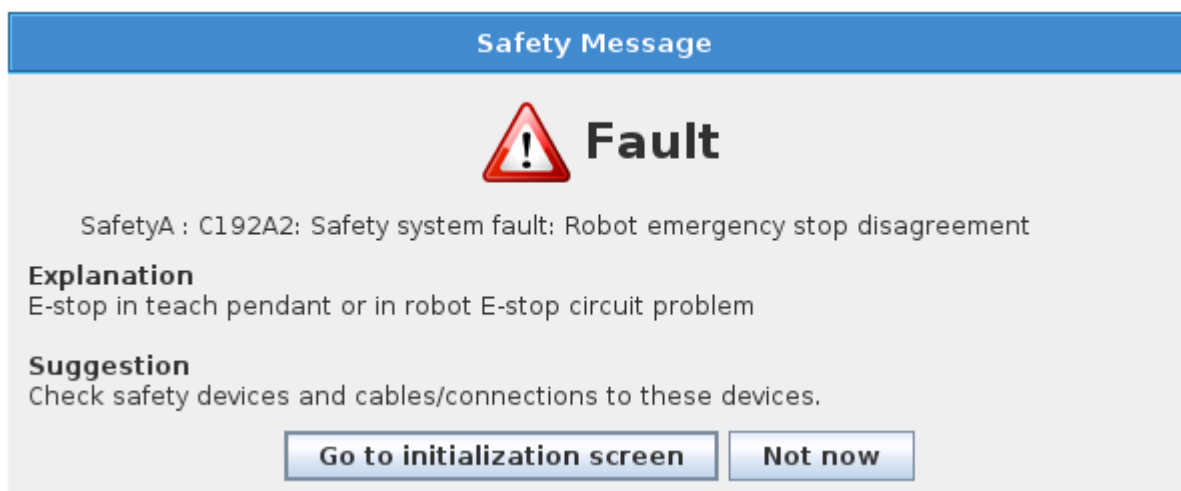
Error indicates that the SCB is missing 24V, check that the jumpers on the SCB is not missing or that the external power supply that are attached is connected and is working.



If jumper/PSU is presented and the error still shows up, in rare cases the SCB can be defective.

5.3 Polyscope show error C192A2 and C192A4

C192A2 indicates there is an issue with the emergency stop. If you are using an external e-stop or a PCL signal. Make sure that it's all connected right.



If you are using the standard terminal, check that all the jumpers are present and there's a good contact, if the error is still presented your Teach pendants e-stop might be defective.

C192A4 indicates there is an issue with the safeguards stop input. If you have external equipment connected, make sure it's setup correct.

If you suspect that the SCB defective, try using the standard terminal without external equipment attached to see if it still fails.



If you are using the standard terminal, check that all the jumpers are present and there's a good contact.

6 Errors when powering on robot

6.1 C4A1: Communication with controller lost

Indicates that communication between the motherboard and SCB has been lost. **See section 5.1**

6.2 C50A100: Robot powerup issue: Cable not connected

Indicates that the robot is not connected to the controller, try the following below:

- 1: Check that robot cable is connected correct to the controller.
- 2: Check if the pins inside the cable's connector is damaged.
- 3: Check that the cables inside the base joint is connected.
- 4: Check that the internal wiring inside the control box, that goes from the SCB to the robot EPIC connector is correct.

6.3 Lost communications to joint

If the controller can't communicate with any of the joints, it could be the SCB that is defective or the wiring from the SCB to the epic plug. But is rare and the communication problem is most likely with the robot. **See broken com article**