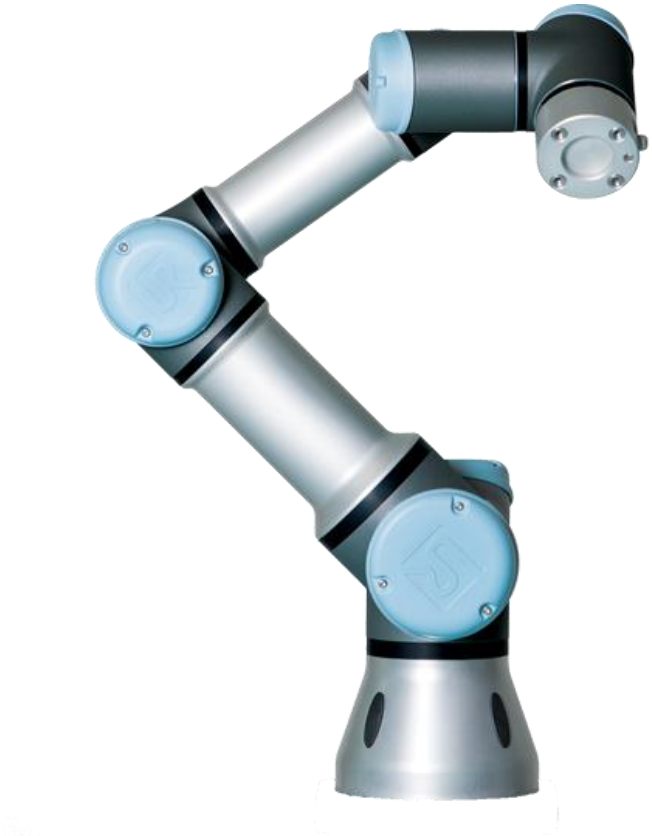
UNIVERSAL ROBOTS



Service Manual

Revision UR3_en_3.1.3

"***Original instructions***"

Robot:

UR3 with CB3-controller

Valid from robot s/n 2014330001

Contents

1. General information

1.1 Purpose

The main purpose of this manual is to help the user safely perform service related operations and troubleshooting.

Universal Robots industrial robots are designed using high quality components designed for long lifetime. However any improper use of robot can potentially cause failures. For example, the robot may have been overloaded or have been dropped on the floor when relocating or have run with a load not recommended by Universal Robots. Any improper use of the robot will invalidate the guarantee.

Universal Robots recommends that you do not attempt repair, adjustment or other intervention in the mechanical or electrical systems of the robot unless a problem has arisen. Any unauthorized intervention will invalidate the guarantee. Service related operations and troubleshooting should only be performed by qualified personnel.

Before performing service related operations, always make sure to stop the robot program and disconnect power supply to any potential dangerous tool on the robot or in the work cell.

In the event of a defect, Universal Robots recommends ordering new parts from the Universal Robot distributor from where the robot has been purchased.
Alternatively, you can order parts from your nearest distributor, whose details you can obtain from Universal Robots official website at www.universal-robots.com

1.2 Company details

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1.3 Disclaimer

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2. Preventive Maintenance

2.1 Controller

2.1.1 Inspection plan, Safety Functions

The safety functions of the robots must be tested at least once a year to ensure correct function. The following tests must be performed.

- Test that the Emergency Stop button on the Teach Pendant functions:
  - Press the Emergency Stop button on the Teach Pendant
  - Observe that the robot stops and turns off the power to the joints
  - Power the robot again
- Test Free drive mode:
  - Set the robot in Free drive mode by pressing the *Free drive* button on the Teach Pendant
  - Move the robot to a position where it is stretched out horizontally
  - Monitor that the robot maintains its position when not holding the robot and the Free drive button still pressed.
- Test Back drive mode:
  - If robot is close to collision, the BACKDRIVE function can be used to move robot arm to safe position before initializing.
  - Press ON to enable power for the joints - *Do NOT release the brakes.*
  - Press and hold Freedrive -> status will change to BACKDRIVE
  - Pull joint away from collision area -> brake is released for only this joint as long as freedrive is pressed.
- Verify safety settings:
  - Verify that the safety settings of the robot comply with the Risk Assessment of the robot installation
- Test that additional safety inputs and outputs are still functioning:
  - Check which safety inputs and outputs are active and test that they can be triggered.

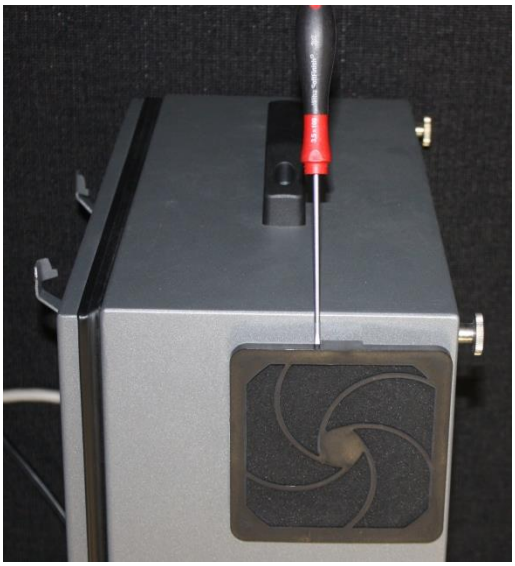
2.1.2 Visual inspection of controller

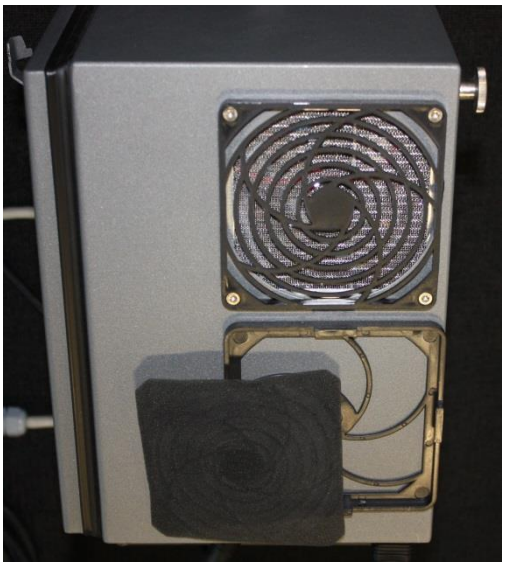
- Disconnect power cable from controller
- Open cabinet door
- Check connectors are properly inserted on printed circuit boards
- Check for any dirt/dust inside of controller
- If any dirt/dust is present:
  - » Gently use a vacuum cleaner to remove particles
  - » Use a soft cloth. You can add: Water, Isopropyl alcohol, 10% Ethanol alcohol or 10% Naphtha

2.1.3 Cleaning and replacement of filters

- Controller box contains two filters, one on each side of controller
- Remove filters from controller box and clean them thoroughly using compressed air
  - Replace filters if necessary

  - Gently remove the outer plastic frame and maintain the filter



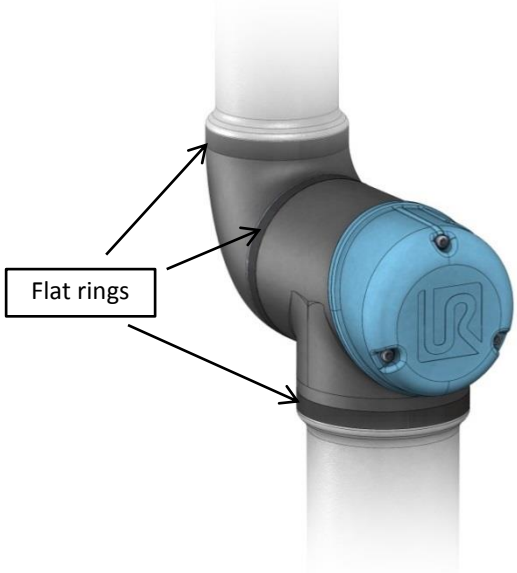


2.2 Robot arm

2.2.1 Visual inspection of robot arm

- Of safety reasons confirm that the 4 rubber covers over the mounting screws are present on the Base mounting bracket.

- If you observe oil on the robot arm you simply clean it with a cloth.
  In very rare cases the grease is from the inside of the joint. There is still enough grease in the gear for life time you just clean the joint with a cloth.
- Move robot arm to HOME position (if possible)
- Turn off and disconnect power cable from controller
- Inspect cable between controller and robot arm for any damage
- Inspect flat rings for wear and damage
  - » Replace flat rings if worn out or damaged
- Inspect blue lids on all joints for any cracks or damage
  - » Replace blue lids if cracked or damaged.
- Inspect that screws for blue lids are in place and properly tightened
  - » Replace screws, tighten properly if necessary



Correct torque value for screws on blue lids are **0.4Nm**

If any damage is observed on a robot within the warranty period, contact the distributor from which the robot has been purchased.

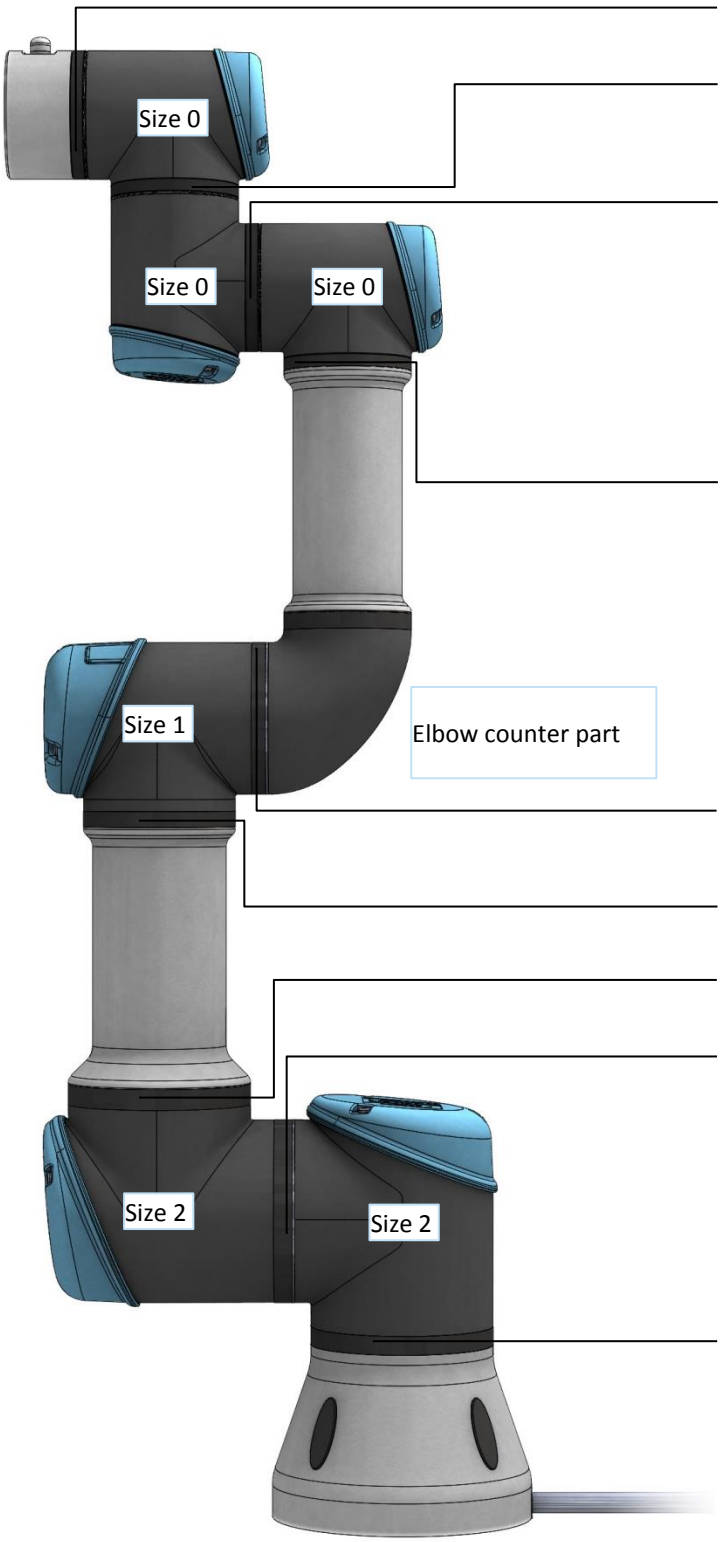
3. Service and Replacement of parts

3.1 Robot arm

3.1.1 Before returning any part to Universal Robots check:

- Remove all external non-UR equipment such as grippers, hoses, cables and so on.
  Universal Robots cannot be held responsible for damage caused to non-UR equipment mounted on the robot.
- Backup all relevant files before sending the robot/part to UR. Universal Robots cannot be held responsible for loss of programs, data or files stored in the robot.
- Safety notice:
  If the robot/part has been in contact with, or working in environments, where dangerous chemicals or materials are present, the robot must be cleaned before shipment.
  If this is not possible, the shipment must be accompanied by an MSDA (Material Safety Data Sheet) in English and instructions for cleaning the chemicals.
  The amount of labor hours needed for cleaning will be billed at the standard rate.
  If UR finds the robot/part unsafe to service, UR reserve the right to get the robot/part cleaned or decline the case and send the part back, at customer's expense.

3.1.2 Robot arm configuration



[3.1.14 Tool flange – Wrist 3 joint]

[3.1.13 Wrist 3 joint – Wrist 2 joint]

[3.1.12 Wrist 2 joint – Wrist 1 joint]

[3.1.11 Wrist 1 joint – Lower arm]

[3.1.9 Elbow joint – Upper arm]

[3.1.8 Upper arm – Shoulder joint]

[3.1.7 Shoulder joint – Base joint]

[3.1.6 Base joint – Base mounting bracket]

3.1.3 Brake release

In a urgent situation the brake on Base, Shoulder and Elbow joints can be released without power connected. It is not possible to release the brakes on Wrist 1, 2 and 3 manually.

IMPORTANT NOTICE:

- Before releasing a brake, it is extremely important to dismount any dangerous parts to avoid any hazardous situations.
- If releasing the brake on Base joint, Shoulder joint or Elbow joint, it is important to make proper mechanical support prior to releasing the brake.
- Always make sure personnel are in no risk when releasing the brake.
- Do not move the joint more than necessary, not more than about 160 degrees in order for the robot to find its original physical position.

Procedure for releasing the joint

- Shut down Controller.
- Remove blue lid on joint.
- Push brake pin down to release, joint can then be rotated.
  On the Wrist 1, 2 and 3 it is not possible to release the brakes manually.

Brake on Base and Shoulder joints,

Brake on Elbow joints

- Make sure to mount blue lid properly on joint before turning on Controller.
- Correct torque value for screws on blue lids are **0.4Nm**

3.1.4 General guidance to separate joint from counterpart

Disassemble:

1. Check if you have the necessary tools before you start to repair the robot.
   1.1. Service kit with torque tools, ESD Wristband, etc.
   1.2. If you have to disassemble the robot arm you need: new flat rings, M3 and M4 tap tool for threads, pre coated screws or Loctite and normal.
   1.3. Check the guide in this manual in details before you continue.

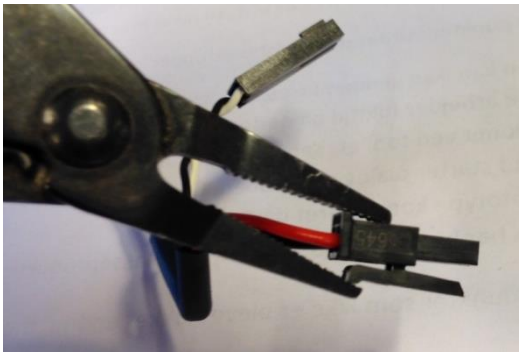
1. Move the robot to a comfortable position for disassembly or if necessary dismount entire robot arm from work cell and place on a solid surface.

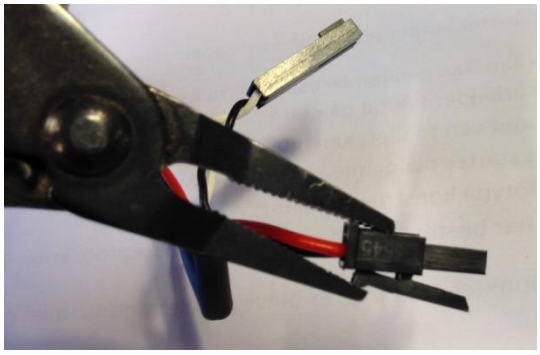
2. Shut down the controller.

3. Remove blue lid.

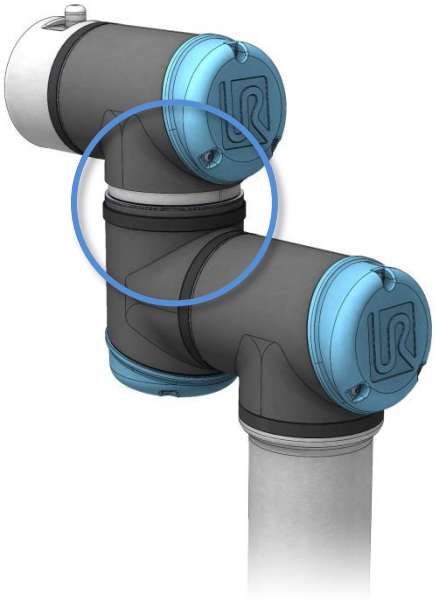
4. Now reattach one of the screws for the blue lids to connect an alligator Clip on your ESD wristband as shown below.

5. **Gently** unplug the cable connectors **without bending the printed circuit board.**
   The power supply connector for the size 0 and the size 1 has a lock that has to be engaged before it is pulled out of the printed circuit board.

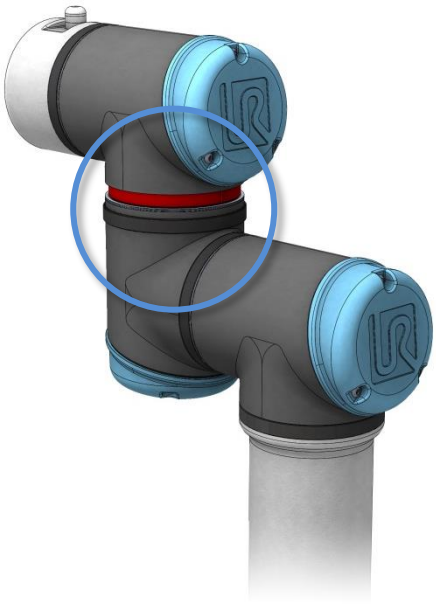


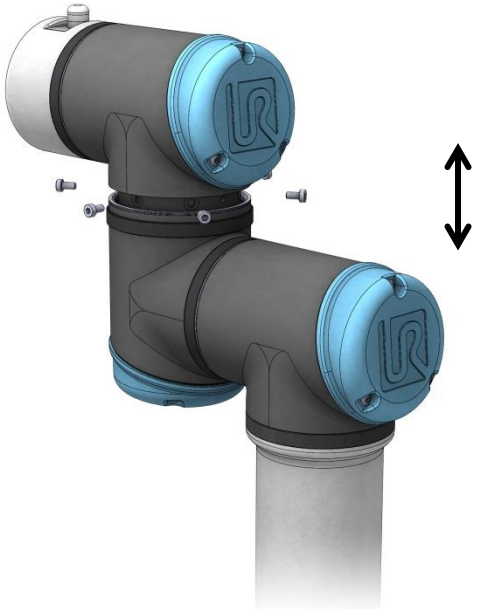


6. After disconnecting the wires gently remove black flexible flat ring with a tiny screwdriver and twist it around the joint housing.



7. Slide back the black Teflon ring. (Marked with red)
   6, 8 or 10 screws become visible
   Loosen the screws.





8. Pull the two parts gently apart.

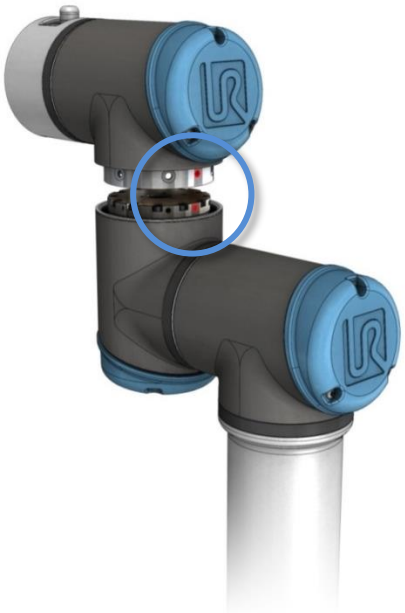
Assemble:

1. **Important note:** remove residues of old Loctite in screw holes with a M3 or M4 tap tool for threads before assembling the joint to get the correct torque on the new screws. 

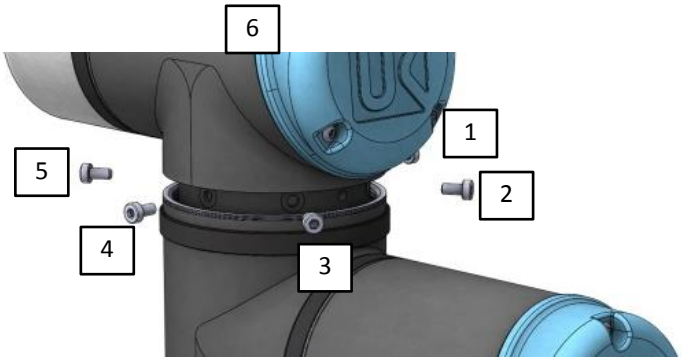
2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.

3. **Important note:** Always replace the black flexible flat ring to maintain the IP classification.

4. Orientate the joints according to the marks and gently push the two joints together. (In the below drawing the marks are indicated with red)

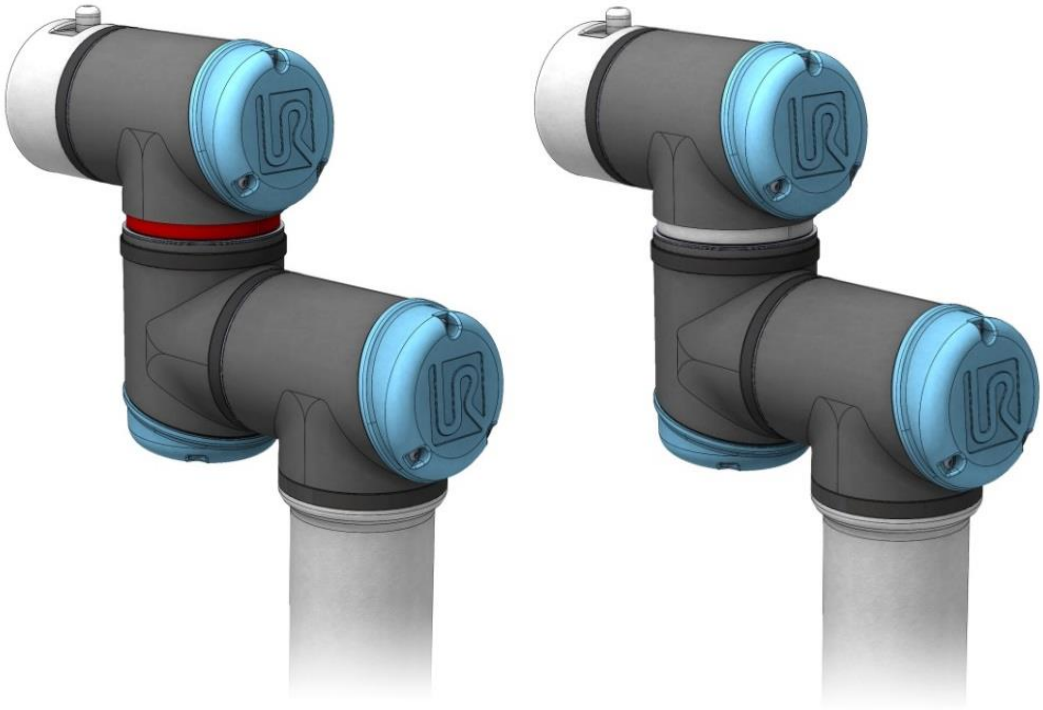


5. Gently tighten the 6, 8 or 10 screws, and then **tighten in cross** order with the correct torque. See 3.1.5 Torque values

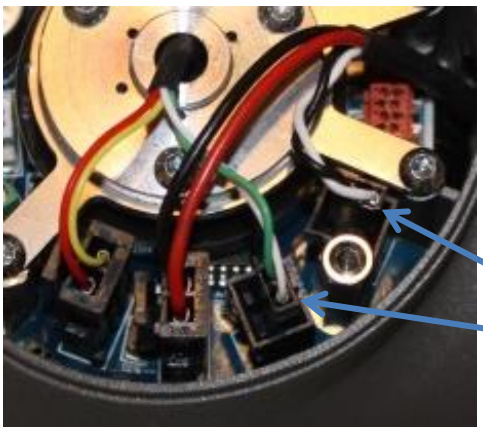


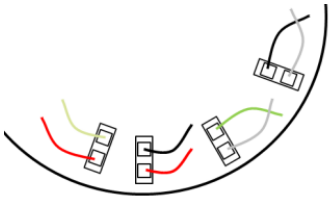
Example: The screws from 1 to 6 should be tightened like this:
1, 4, 2, 5, 3, 6 and again
1, 4, 2, 5, 3 and 6

6. Slide the black Teflon ring (Indicated with red) into place and gently put the new flat ring back on top of the Teflon ring.



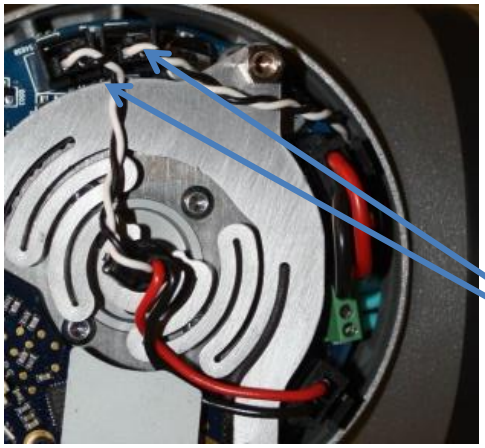
7. Connect the cables:
   Size 0 joint.

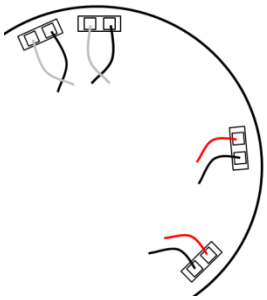




Twist the communication cable 1.5 to 2 full rounds before connection

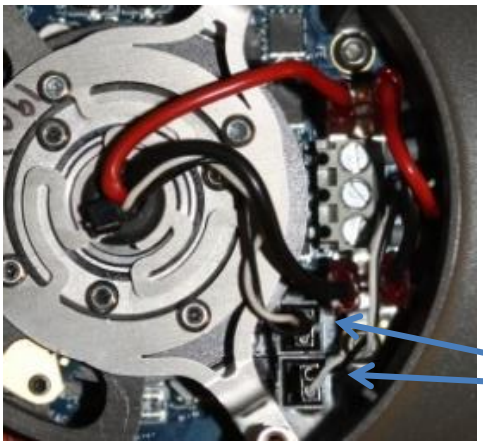
Size 1 joint.

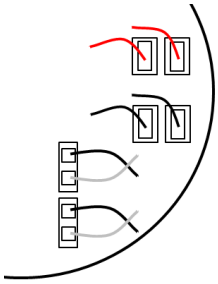




Twist the communication cable 1.5 to 2 full rounds before connection

Size 2 joint.





Twist the communication cable 1.5 to 2 full rounds before connection

8. **Twist the communication cable** 1.5 to 2 full rounds before connection.
   (To reduce electrical noise in the system)

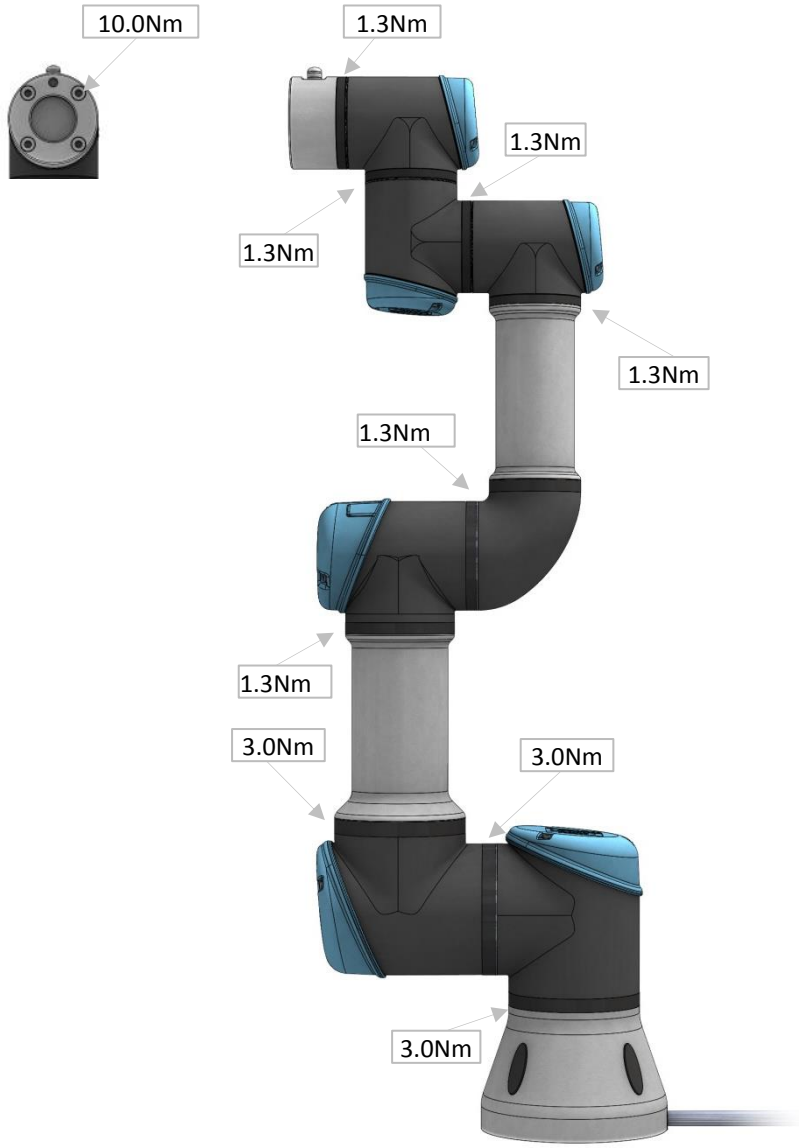
9. Mount the blue lid on the joint and tighten with **0.4Nm.**

10. Proceed to 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the Robot.

3.1.5 Torque values

UR3 torque values			
CONNECTION		TORQUE	HEAD SIZE
Base mounting bracket	J0 Base	3.0Nm	Torx T20
[J0] Base	J[1] Shoulder	3.0Nm	Torx T20
[J1] Shoulder	Upper arm	3.0Nm	Torx T20
Upper arm	[J2] Elbow	1.3Nm	Torx T10
[J2] Elbow	Lower arm	1.3Nm	Torx T10
Lower arm	[J3] Wrist 1	1.3Nm	Torx T10
[J3] Wrist 1	[J4] Wrist 2	1.3Nm	Torx T10
[J4] Wrist 2	[J5] Wrist 3	1.3Nm	Torx T10
[J5] Wrist 3	Tool mounting bracket	1.3Nm	Torx T10
Tool/ Gripper M6		10Nm	
Blue lid: Base, Shoulder and Elbow		0.4Nm	Torx T10
Blue lid: Wrist 1, Wrist 2 and Wrist 3		0.4Nm	Torx T8

Attention**: Click the torque tools 3 times before used** to get the correct calibrated torque.



3.1.6 Base joint – Base mounting bracket Disassemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

1. Shut down the controller.
2. Remove black flexible flat ring with a tiny screwdriver and twist it around the joint housing.
3. Slide back the black Teflon ring. 10 screws become visible. Loosen the screws.
4. Pull the Base mounting bracket and Base joint gently apart.
5. Disconnect wires from the EMC filter in the Base mounting bracket.

Base joint – Base mounting bracket: Assemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

1. **Important note:** remove residues of old Loctite in screw holes with a M4 tap tool for threads before assembling the joint to get the correct torque on the new screws. 

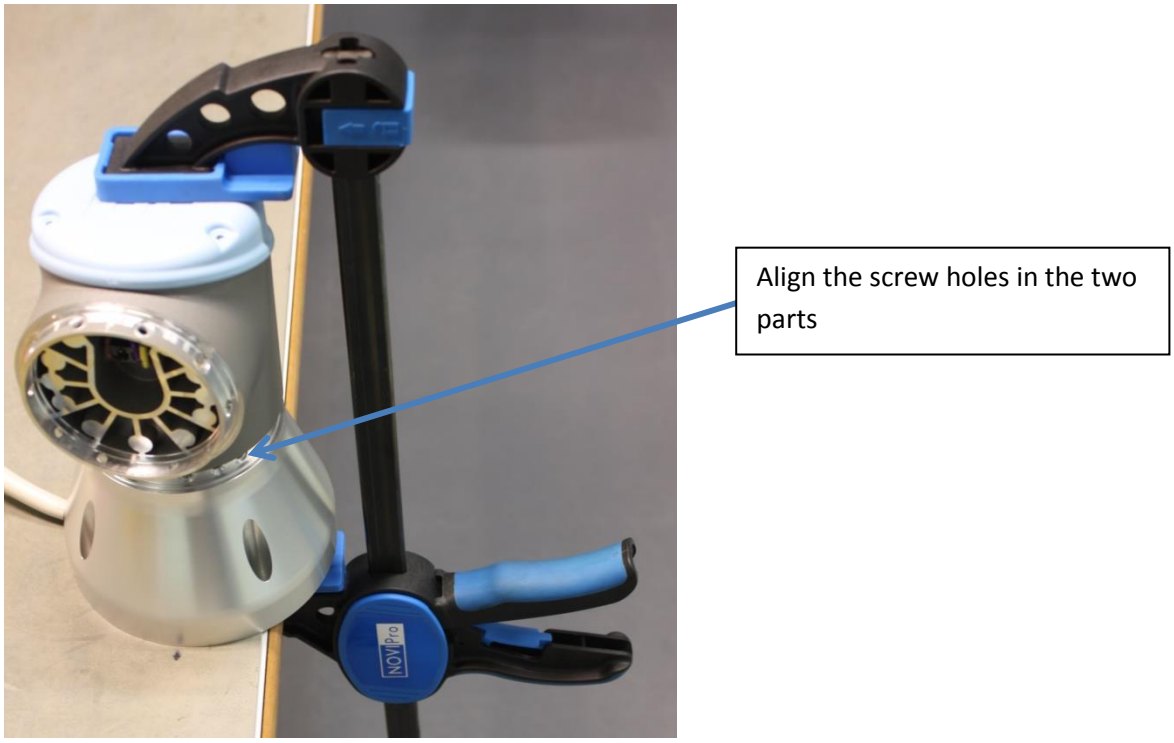
2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.

3. Replace Base mounting bracket and reconnect wires to the EMC filter.
   Twist the communication cable 1.5 to 2 full rounds before it is connected.
   (To reduce electrical noise in the system)

1 x red wire	= 48V DC
1 x black wire	= GND
White and black	= bus connector

4. Orientate the joint and Base mounting bracket according to the marks and gently push them together.

5. Press gently the base and base mounting bracket together to align the screw holes in the two parts before attaching the screws.



6. Gently tighten the 10 screws, and then tighten **in cross order with 3.0Nm.**

7. Slide the black Teflon ring into place and gently put the flat ring back on top of the Teflon ring.

8. Proceed to chapter 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the robot.

3.1.7 Shoulder joint – Base joint Disassemble

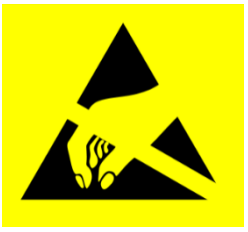
For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

1. Shut down the controller.
2. Remove blue lid on Base joint and **connect ESD wristband.**
3. Disconnect wires between Base joint and Shoulder joint.
   Without bending the printed circuit board.
4. After disconnecting the wires gently remove black flexible flat ring with a tiny screwdriver and twist it around the joint housing.
5. Slide back the black Teflon ring. 10 screws become visible. Loosen the screws.
6. Pull the Base joint and Shoulder joint gently apart.

Shoulder joint – Base joint: Assemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

1. **Important note:** remove residues of old Loctite in screw holes with a M4 tap tool for threads before assembling the joint to get the correct torque on the new screws. 
2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.
3. Orientate the Base joint and Shoulder joint according to the marks and gently push them together.
4. Gently tighten the 10 screws, and then tighten **in cross order with 3.0Nm.**
5. Slide the black Teflon ring into place and gently put the flat ring back on top of the Teflon ring.
6. **Connect ESD wristband.**

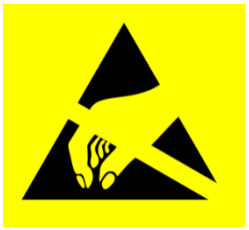


7. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)
   1 x red wire = 48V DC
   1 x black wire = GND
   White and black = bus connector
8. After connection of the wires then mount the blue lid and tighten with **0.4Nm.**
9. Proceed to chapter 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the robot.

3.1.8 Upper arm – Shoulder joint

Disassemble

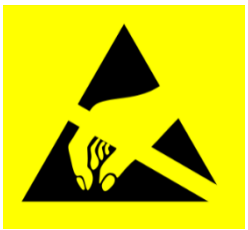
For details and photos please see: 3.1.4 General guidance to separate joint from counterpart Shut down the controller.



1. Remove blue lid on Shoulder joint and **connect ESD wristband.**
2. Disconnect wires between Shoulder joint and Upper arm.
   Without bending the printed circuit board.
3. After disconnecting the wires gently remove black flexible flat ring with a tiny screwdriver and twist it around the Upper arm. Loosen the screws.
4. Pull the Shoulder joint and Upper arm gently apart.

Upper arm – Shoulder joint: Assemble

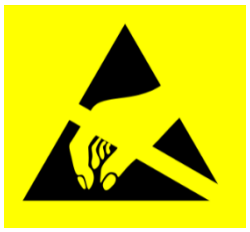
1. **Important note:** remove residues of old Loctite in screw holes with a M4 tap tool for threads before assembling the joint to get the correct torque on the new screws. 
2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.
3. Orientate the Shoulder joint and Upper arm according to the marks and gently push them together.
4. Gently tighten the 10 screws, and then tighten **in cross order with 3.0Nm.**
5. **Connect ESD wristband.**



6. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)
   1 x red wire = 48V DC
   1 x black wire = GND
   White and black = bus connector
7. After connection of the wires then mount the blue lid and tighten with **0.4Nm.**
8. Proceed to chapter 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the robot.

3.1.9 Elbow joint – Upper arm
Disassemble and assemble

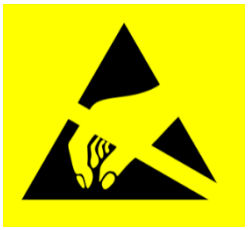
For details and photos please see: 3.1.4 General guidance to separate joint from counterpart Shut down the controller.



1. Remove blue lid on Elbow joint and **connect ESD wristband.**
2. Disconnect wires between Elbow joint and Upper arm.
   Without bending the printed circuit board.
3. After disconnecting the wires gently remove black flexible flat ring with a tiny screwdriver and twist it around the Upper arm. Loosen the screws.
4. Pull the Elbow joint and Upper arm gently apart.

Elbow joint – Upper arm: Assemble

1. **Important note:** remove residues of old Loctite in screw holes with a M3 tap tool for threads before assembling the joint to get the correct torque on the new screws. 
2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.
3. Orientate the Elbow joint and Upper arm according to the marks and gently push them together.
4. Gently tighten the 8 screws, and then tighten **in cross order with 1.3Nm.**
5. **Connect ESD wristband.**



6. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)
   1 x red wire = 48V DC
   1 x black wire = GND
   White and black = bus connector
7. After connection of the wires then mount the blue lid and tighten with **0.4Nm.**
8. Proceed to chapter 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the robot.

3.1.10 Elbow counterpart – Elbow joint Disassemble

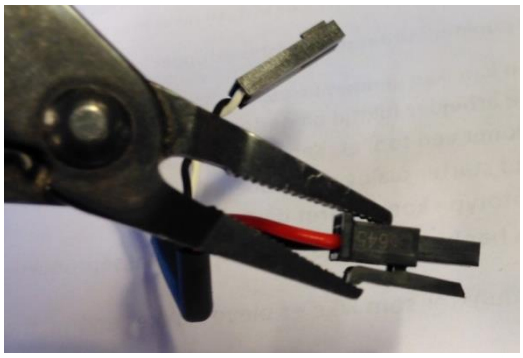
For details and photos please see: 3.1.4 General guidance to separate joint from counterpart Shut down the controller.

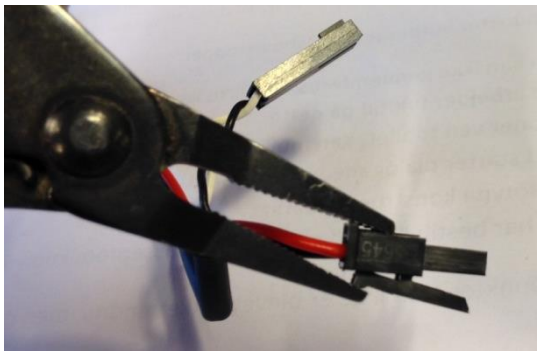
1. Remove black flexible flat ring with a tiny screwdriver and twist it around the joint housing.

2. 8 screws become visible. Loosen the screws.

3. Pull the Elbow joint and Elbow counterpart gently apart.

4. Disconnect wires.
   Without bending the printed circuit board.
   The power supply connector has a lock that has to be engaged before it is pulled out of the printed circuit board.





Elbow counterpart – Elbow joint: assemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

1. **Important note:** remove residues of old Loctite in screw holes with a M3 tap tool for threads before assembling the joint to get the correct torque on the new screws. 

2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.

3. Reconnect connectors.
   Twist the communication cable 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)
   1 x red wire = 48V DC
   1 x black wire = GND
   White and black = bus connector

4. Orientate the joint and Elbow counterpart according to the marks and gently push them together.

5. Gently tighten the 8 screws, and then tighten **in cross order with 1.3Nm.**

6. Put the flat ring back on top of the screws.

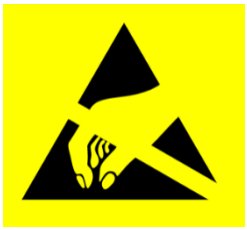
7. Proceed to chapter 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the robot.

3.1.11 Wrist 1 joint – Lower arm

Disassemble

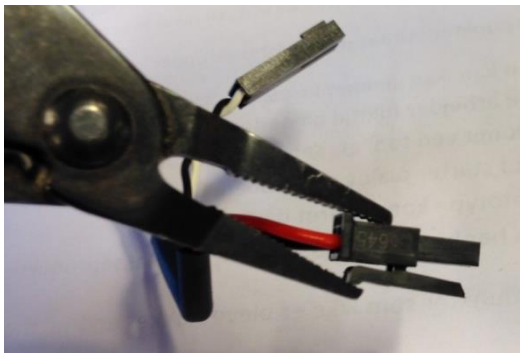
For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

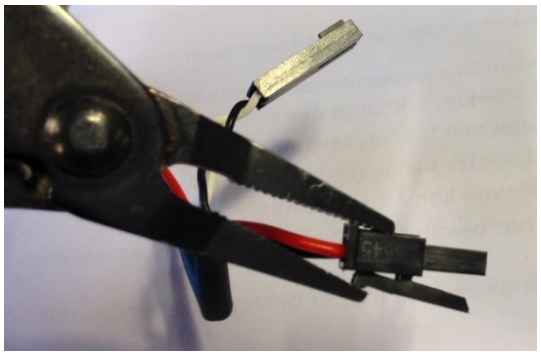
1. Shut down the controller.



2. Remove blue lid on Wrist 1 joint and **connect ESD wristband.**

3. Disconnect wires between Wrist 1 joint and Lower arm.
   Without bending the printed circuit board.
   The power supply connector has a lock that has to be engaged before it is pulled out of the printed circuit board.





4. After disconnecting the wires, gently remove black flexible flat ring with a tiny screwdriver and twist it around the Lower arm.

5. Remove the plastic cover ring. 6 screws become visible. Loosen the screws.

6. Pull the Wrist 1 joint and Lower arm gently apart.

Wrist 1 joint – Lower arm Assemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

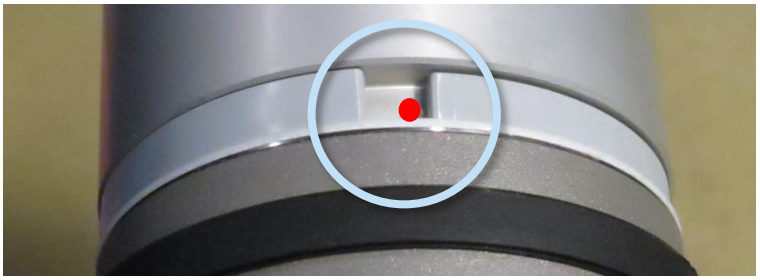
1. **Important note:** remove residues of old Loctite in screw holes with a M3 tap tool for threads before assembling the joint to get the correct torque on the new screws. 

2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.

3. Orientate the Wrist 1 joint and Lower arm according to the marks and gently push them together.

4. Gently tighten the 6 screws, and then tighten **in cross order with 1.3Nm.**

5. Place the plastic cover ring according to the mark on the flange. (On the photo the mark is indicated in red)



6. Gently put the flat ring back on top of the plastic cover ring.

7. **Connect ESD wristband.**

8. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)
   1 x red wire = 48V DC
   1 x black wire = GND
   White and black = bus connector

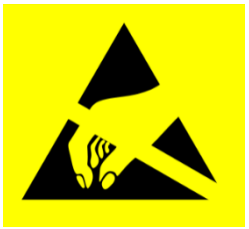
9. After connection of the wires then mount the blue lid and tighten with **0.4Nm.**

10. Proceed to chapter **3.1.15 Dual Robot Calibration and Joint calibration.** for calibrating the robot.

3.1.12 Wrist 2 joint – Wrist 1 joint Disassemble

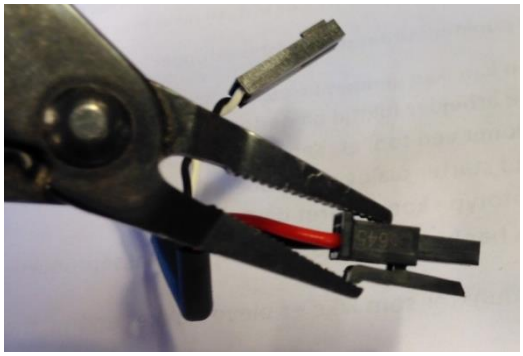
For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

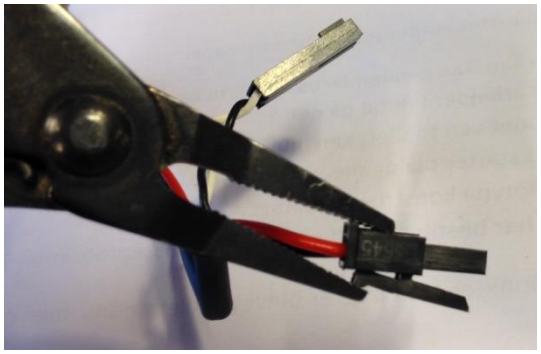
1. Shut down the controller.



2. Remove blue lid on Wrist 2 and **connect ESD wristband.**

3. Disconnect wires between Wrist 1 joint and Wrist2 joint
   without bending the printed circuit board.
   The power supply connector has a lock that has to be engaged before it is pulled out of the printed circuit board.





4. After disconnecting the wires gently remove black flexible flat ring with a tiny screwdriver and twist it around the joint housing.

5. Remove the plastic cover ring. 6 screws become visible. Loosen the screws.

6. Pull the Wrist 2 joint and Wrist 1 joint gently apart.

Wrist 2 joint – Wrist 1 joint: Assemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

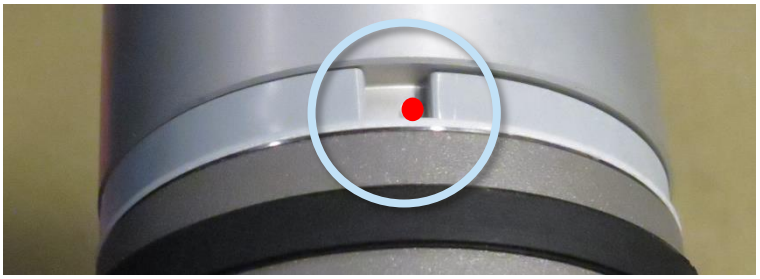
1. **Important note:** remove residues of old Loctite in screw holes with a M3 tap tool for threads before assembling the joint to get the correct torque on the new screws. 

2. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.

3. Orientate the Wrist 2 joint and Wrist 1 joint according to the marks and gently push them together.

4. Gently tighten the 6 screws, and then tighten **in cross order with 1.3Nm.**

5. Place the plastic cover ring according to the mark on the flange.



6. Gently put the flat ring back on top of the teflon ring.

7. **Connect ESD wristband.**

8. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)

1 x red wire	= 48V DC
1 x black wire	= GND
White and black	= bus connector

9. After connection of the wires then mount the blue lid and tighten with **0.4Nm.**

10. Proceed to chapter 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the robot.

3.1.13 Wrist 3 joint – Wrist 2 joint
Disassemble and assemble

Procedure for separating Wrist 3 joint from Wrist 2 is similar to separation of Wrist 2 joint and Wrist 1 joint, consult chapter 3.1.12 Wrist 2 joint – Wrist 1 joint

3.1.14 Tool flange – Wrist 3 joint

Disassemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

1. Shut down the controller.

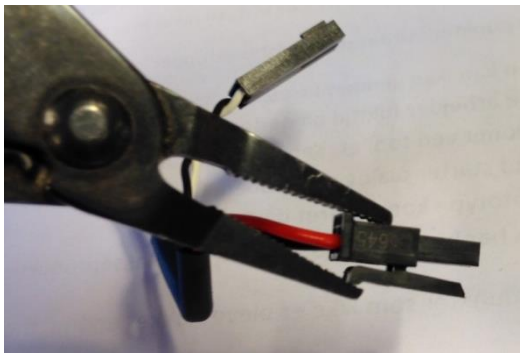
2. Remove black flexible flat ring with a tiny screwdriver and twist it around the joint housing.

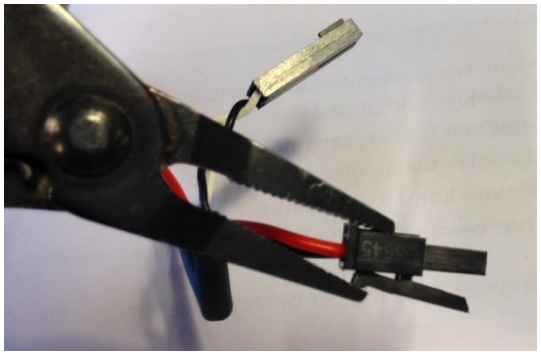
3. Remove the plastic cover ring. 6 screws become visible. Loosen the screws.

4. **Connect ESD wristband.**

5. Pull the Tool flange and Wrist 3 joint gently apart.

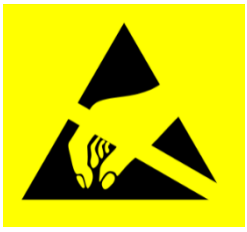
6. Disconnect wires.
   Without bending the printed circuit board.
   The power supply connector has a lock that has to be engaged before it is pulled out of the printed circuit board.





Tool flange – Wrist 3 joint: Assemble

For details and photos please see: 3.1.4 General guidance to separate joint from counterpart

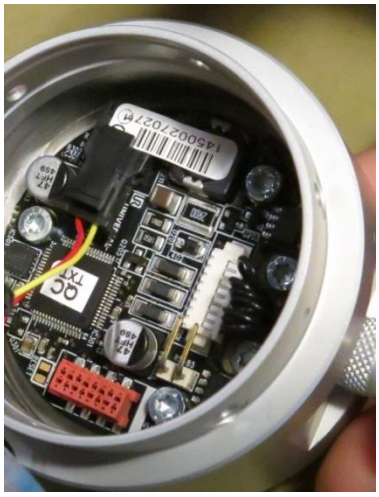


1. **Connect ESD wristband.**
2. **Important note:** remove residues of old Loctite in screw holes with a M3 tap tool for threads before assembling the joint to get the correct torque on the new screws.

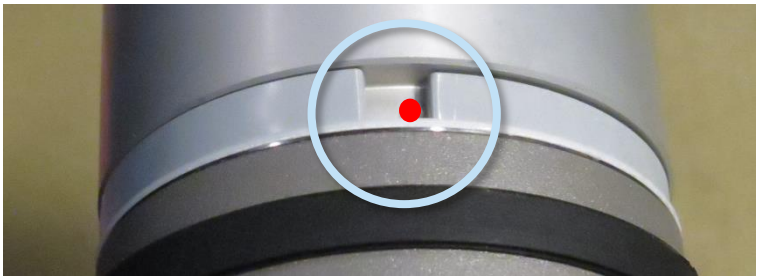
3. **Important note:** Always use new **pre-coated screws** when it is possible. If you have to assemble with old screws carefully clean the screws and attach Loctite 243 on the screws before assembly.
4. Reconnect connectors.

   Twist the communication cable 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)

   1 x red wire = 48V DC
   1 x yellow wire = GND
   White and green = bus connector



5. Orientate the Tool flange and Wrist 3 joint according to the marks and gently push them together.
6. Place the plastic cover ring according to the mark on the flange.



7. Gently tighten the 6 screws, and then tighten **in cross order with 1.3Nm.**
8. Slide the black Teflon ring into place and gently put the flat ring back on top of the Teflon ring.
9. Proceed to chapter 3.1.15 Dual Robot Calibration and Joint calibration. for calibrating the robot.

3.1.15 Dual Robot Calibration and Joint calibration.

Dual Robot Calibration kit (Part no: 185500)

Dual Robot Calibration is a calibration that calibrates the robot in the full work space. All robots are Dual Robot Calibrated when they are produced.
If a joint has been replaced on a calibrated robot the calibration is not correct anymore.

There are 2 options:

- Performing a Dual Robot Calibration after replacement of a joint will let the robot continue in the production line without modifying waypoints in the robot program. To perform a Dual Robot Calibration, you need: 2 robots (same size and same generation), calibration Horse and calibration tool connector.
  Go to http://www.universal-robots.com/support/ for downloading CalibrationManual.pdf.

- Joint calibration described in this section: After replacing a joint a zero position of the joint can be adjusted but the calibration level form the Dual Robot Calibration cannot be achieved. Adjustments of waypoints in the program should be expected.

3.1.16 Instructions for calibrating a joint

If it is not possible to make a dual robot calibration you can make a calibration of joints. After this you must expect to adjust the most important waypoints.

- Make sure that the base of the robot is horizontal.
- Jog robot to HOME position

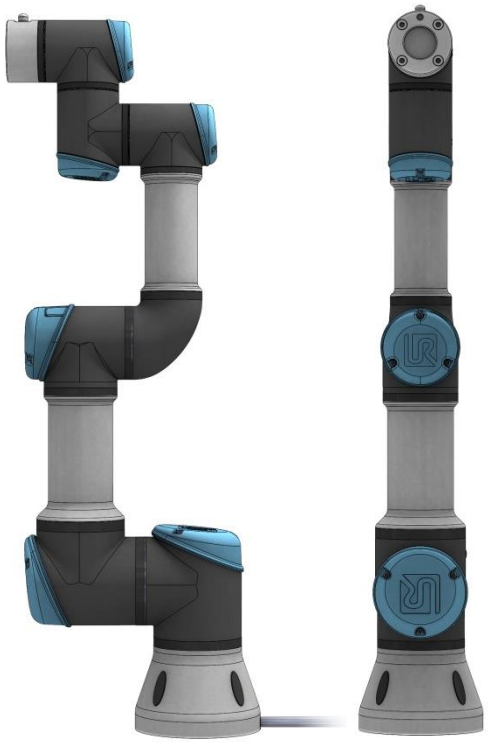
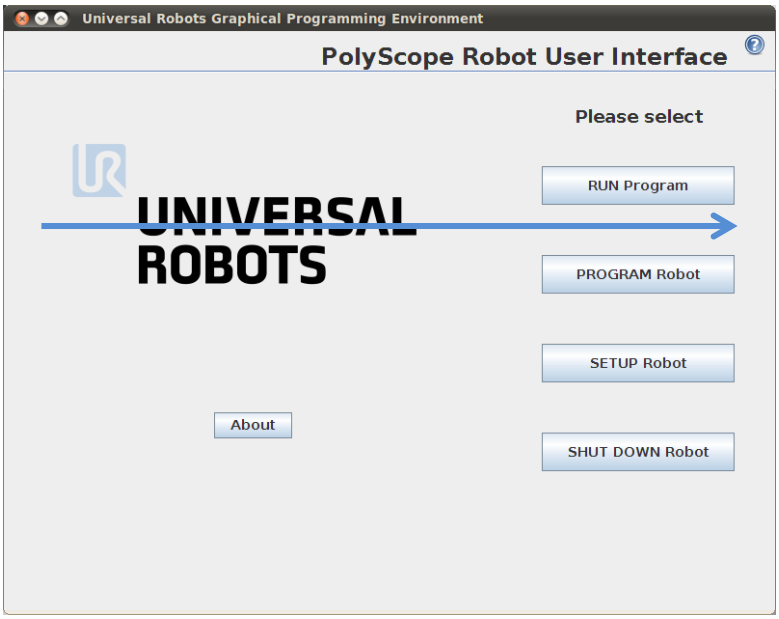
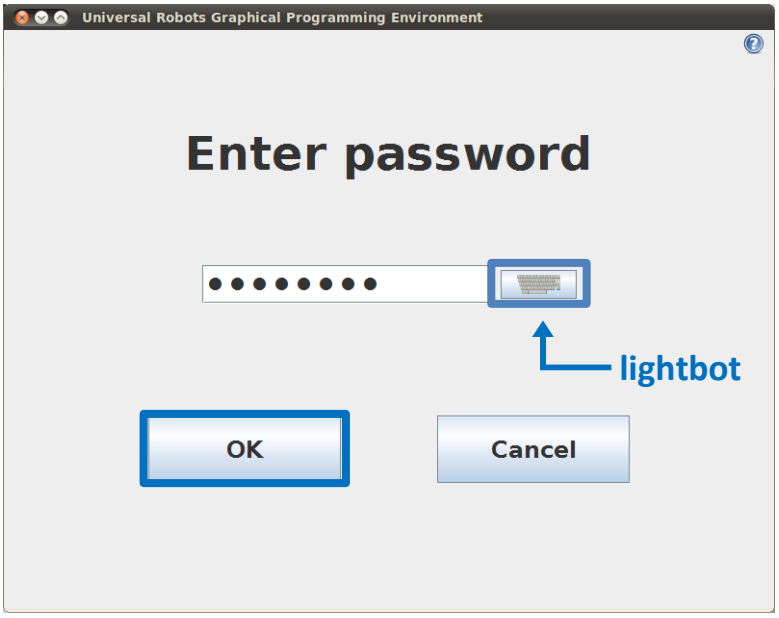


Illustration shows the HOME position, which is defined as zero position of all joints.

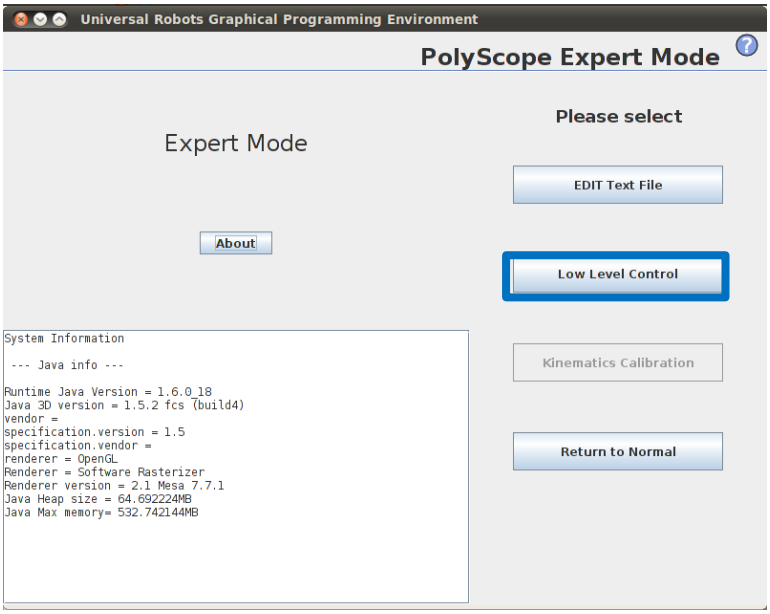
- Drag a finger from left to right across the *UNIVERSAL*-sign on main screen of PolyScope.



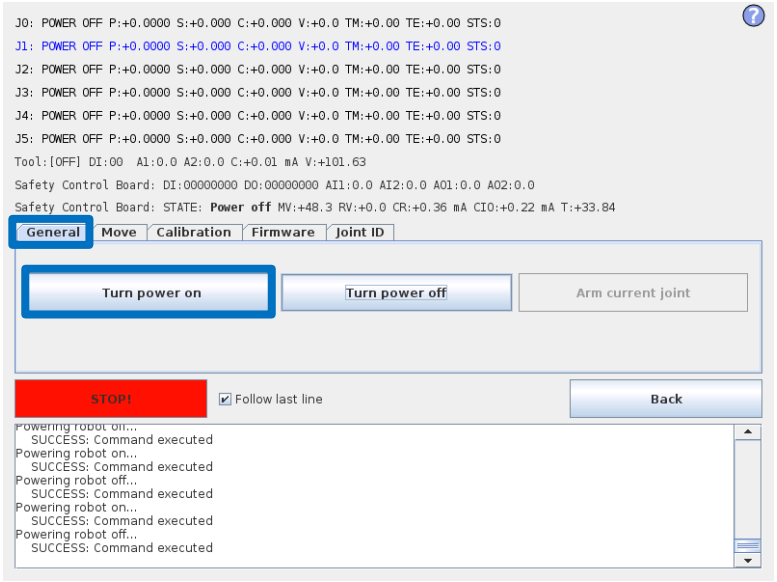
- Enter password *lightbot* and press *OK*.



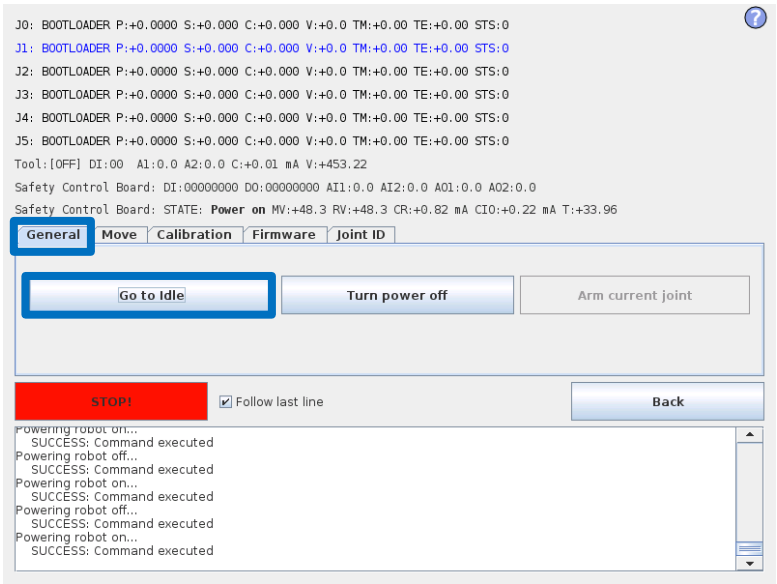
- You are now in *Expert Mode*, press *Low Level Control*.



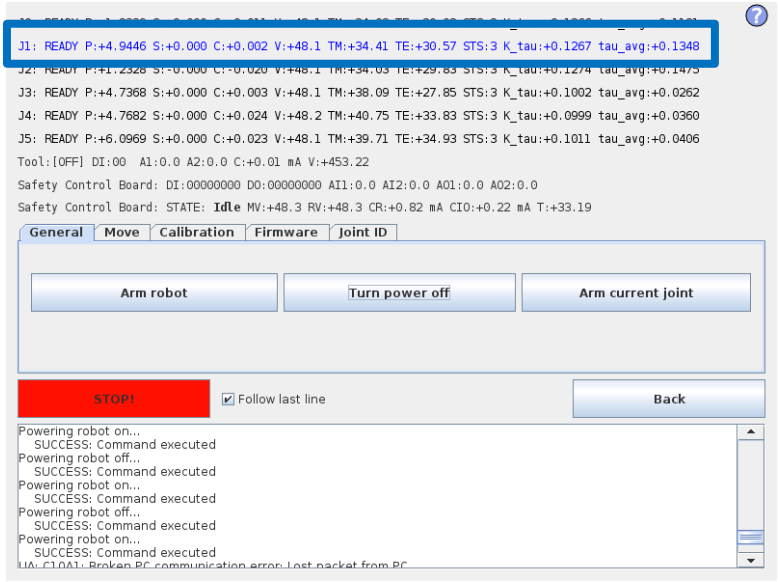
- Press *Turn power on* for enabling power to joints.



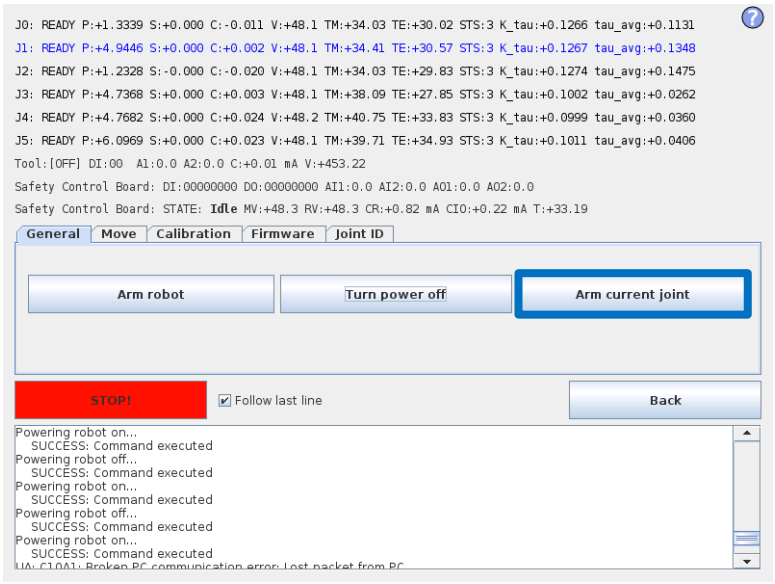
- Press *Go to Idle* for enabling the joints ready mode.



- Select the desired joint by directly clicking the status line for that joint.

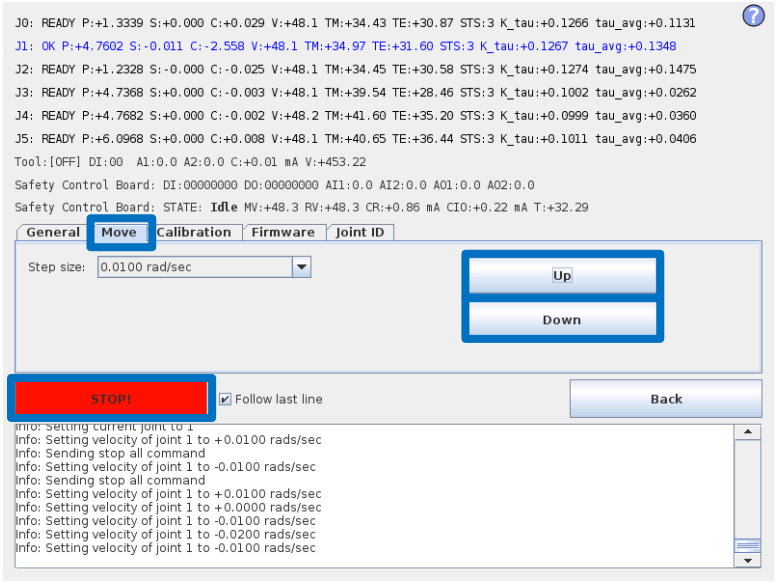


- Press *Arm current joint* to release the brake on the selected joint.



Use the *Up* and *Down* buttons in the *Move* window to navigate the joint to the correct zero position according to the following illustrations.

Press *STOP* when the joint is in the correct position.

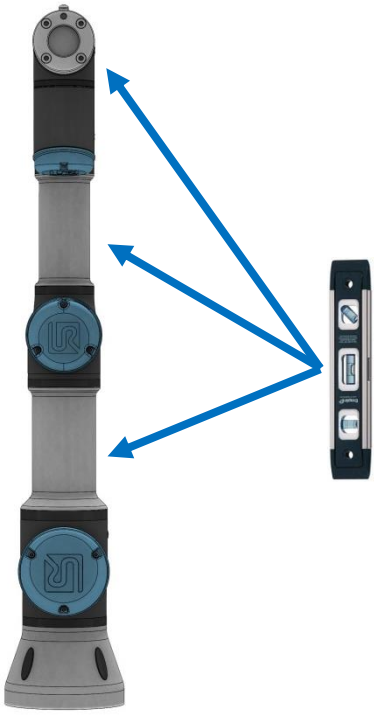


- Zero position illustrations

Base:

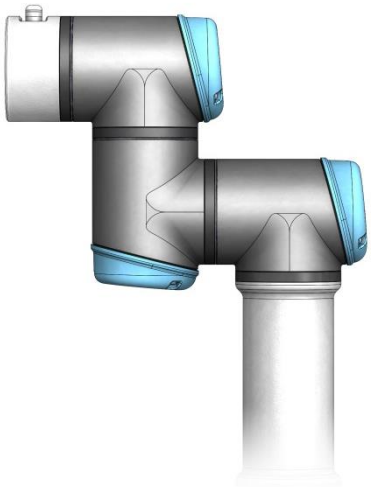
Base zero position is aligned so that the output flange is offset 180 degrees from the slot for cable in back of robot base.

Shoulder, Elbow, Wrist 1:



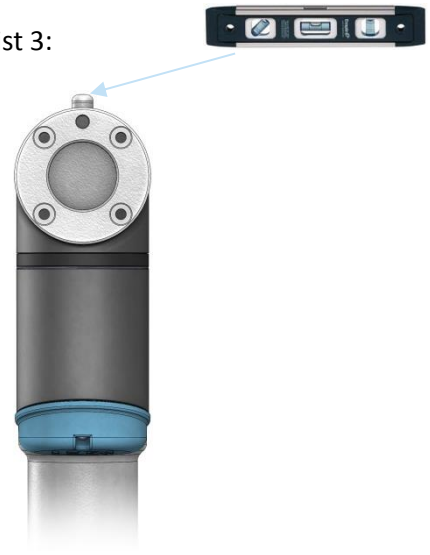
Shoulder, Elbow and Wrist 1 zero output flange is vertical aligned (if Base if horizontal).
Make sure that base of robot is horizontal, use spirit level to align joints.

Wrist 2:



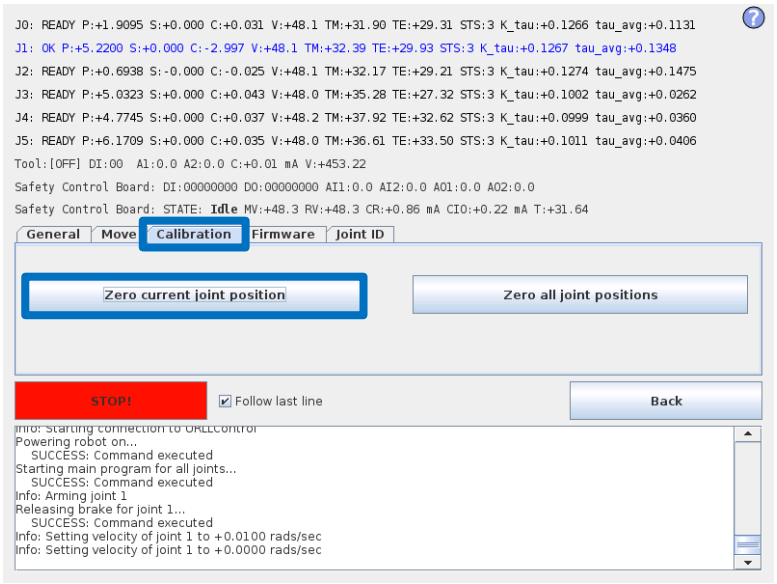
Wrist 2 zero position is aligned similar to Base joint, with tool flange parallel with wrist

Wrist 3:

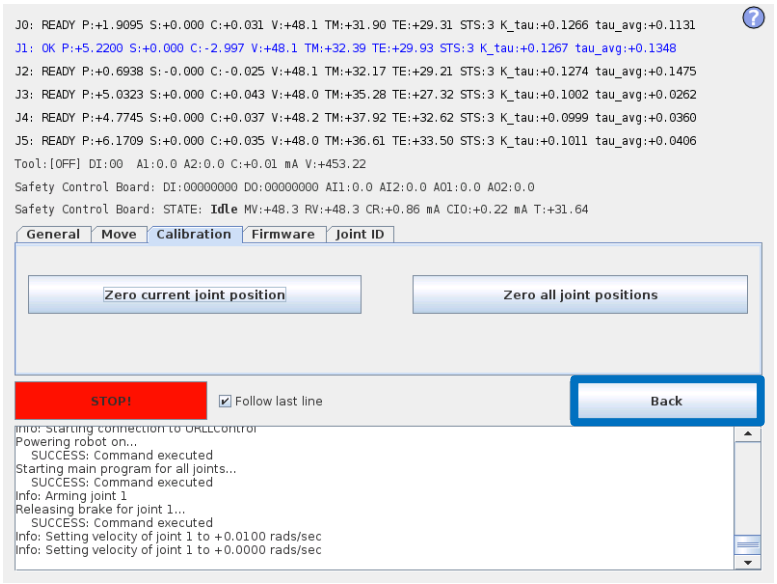


Wrist 3 zero position is aligned so tool connector is pointing upward.
Mount two bolts in tool holes and use spirit level to align joint.

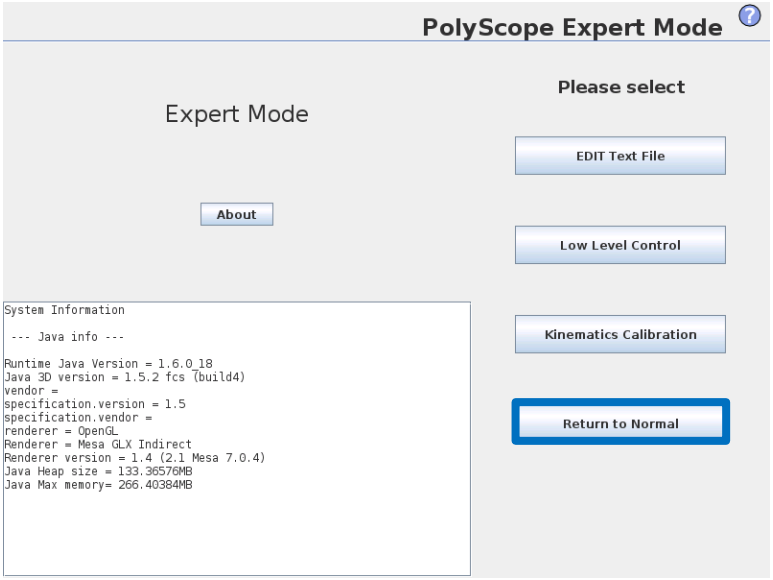
- Select *Calibration* tab and press *Zero current joint position* to calibrate the joint.



- Press *Back* to exit Low Level Control.



- Press *Return to Normal*.



- Verify zero position by moving the robot to HOME.
  If not satisfied with the zero position, perform the procedure once again.

3.1.17 Change joint ID

Each joint has a unique ID no. It is NOT possible to have two joints with the same ID no. on the same robot.

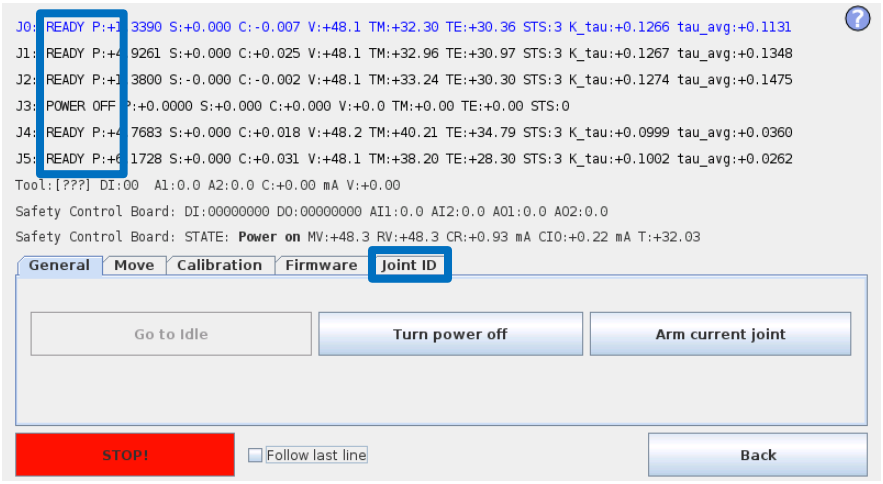
ID	Joint
J0	Base
J1	Shoulder
J2	Elbow
J3	Wrist 1
J4	Wrist 2
J5	Wrist 3

Example:

Wrist 1 (J3) has to be replaced. Spare joint is a Wrist 3 (J5)

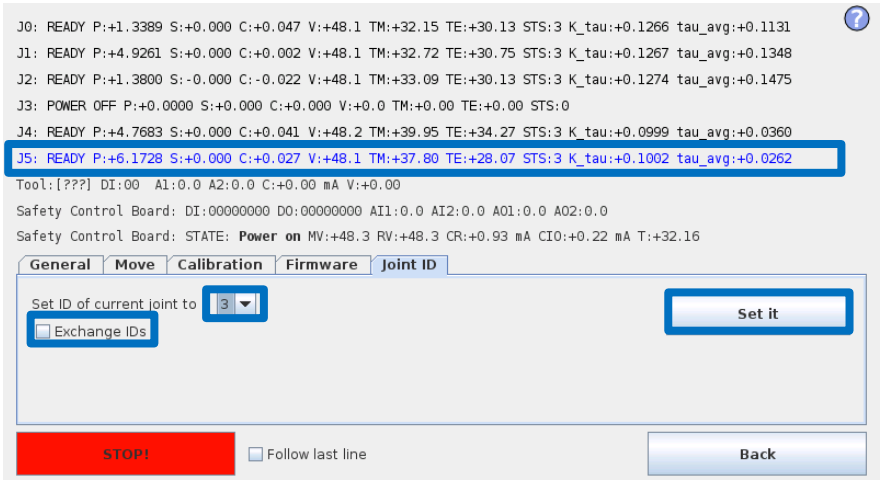
- Disconnect the joint with correct ID no.
- Enter Low Level Control
- Press *Turn power on* and the connected joints turn into BOOTLOADER

- Press *Go to Idle* and the connected joints turn into READY

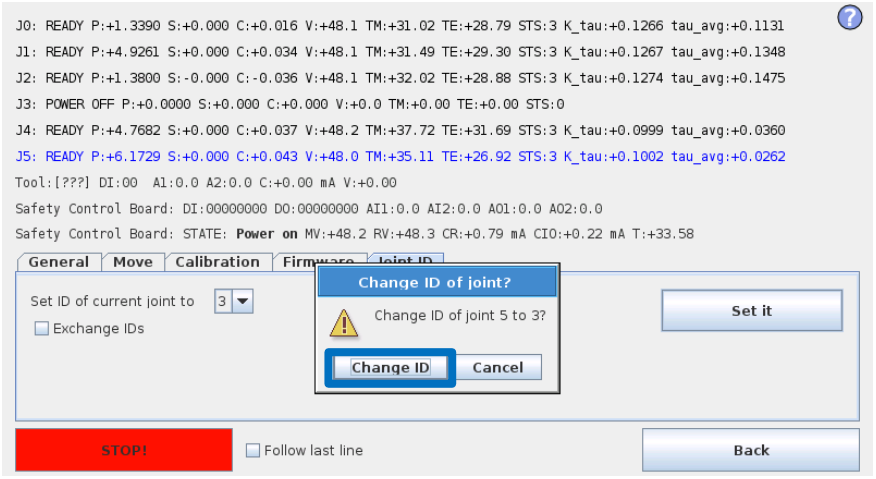


- Select *Joint ID*

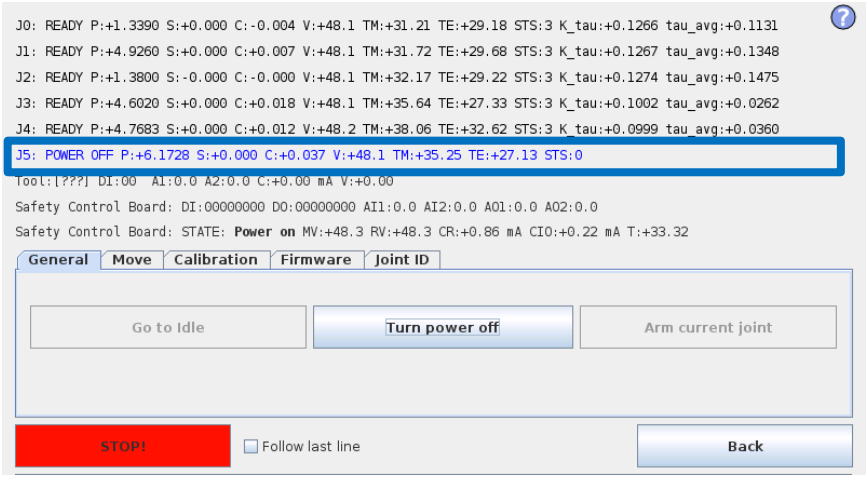
- Select *J5* (The one to be changed)
- Uncheck “Exchange IDs” box
- In dropdown box, select ID no. 3
- Press *Set it*



- Confirm *Change ID*



- After you have turned power on you can see the joint J5 has changed to J3.



3.1.18 Joint spare part adaptation

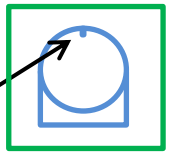
The UR3 constructed of 3 joint sizes and have to be setup on the robot:

Recommended spare joints for UR3 are marked with: 

Robot: UR3

Wrist 3: ID =5 Size 0

Alignment mark

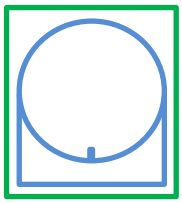


To use a wrist 3 joint as wrist 1 or wrist 2 it is necessary to modify the joint.
See 3.1.19 Modify wrist 3 to wrist 1 or wrist2

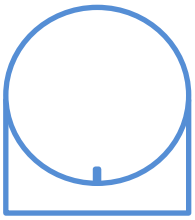
Wrist 2: ID =4 Size 0

Wrist 1: ID =3 Size 0

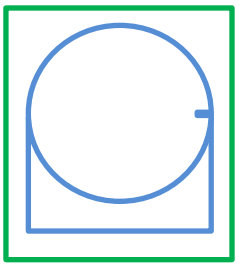
Elbow: ID =2 Size 1



Shoulder: ID =1 Size 2



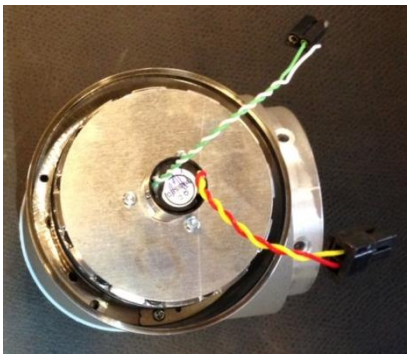
Base: ID =0 Size 2



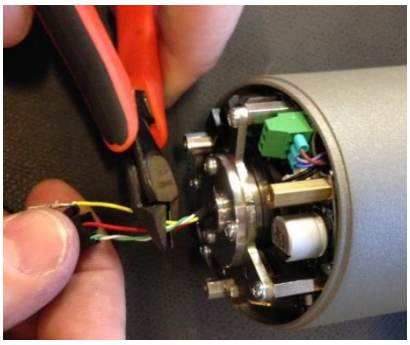
3.1.19 Modify wrist 3 to wrist 1 or wrist2

- Mechanical parts have to be replaced.
- The orientation of the output flange has to be changed
- The joint ID has to be modified.

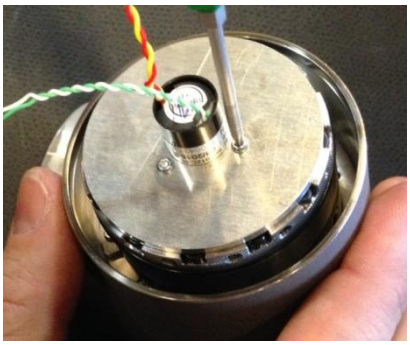
Use the ESD guidelines for the modification of the wrist see: 3.2.1 Handling ESD-sensitive parts



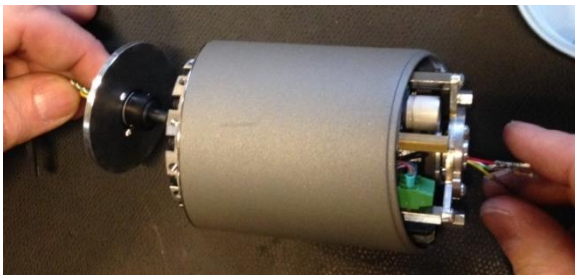
The Wrist 3 has the slipring for infinite turning of the tool mounting bracket.



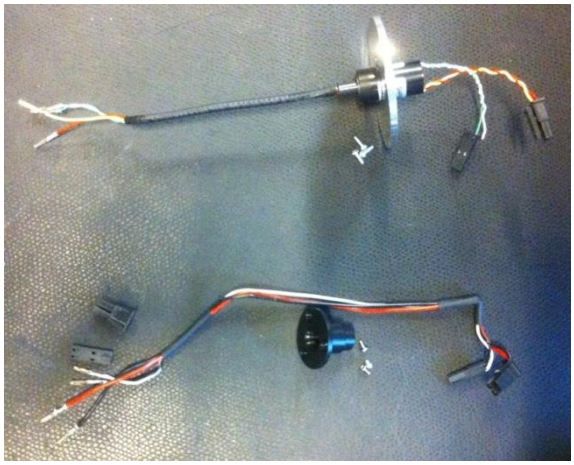
Cut the wires for the slipring



Unscrew the Slipring



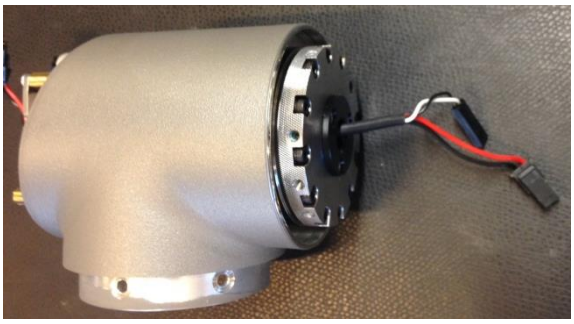
Remove the Slipring gently



The removed slipring with screws

Parts for wrist 1 and wrist 2

Attach the plastic protection.



Put the wires through the joint and attach and assemble the connectors for the communication and power.
There is no cable tie for this joint.

NB! Pull gently in each wire to be sure the connector is attached correct in the plastic part of the connector.

Adjust the joint orientation. See: **3.1.16 Instructions for calibrating a joint**

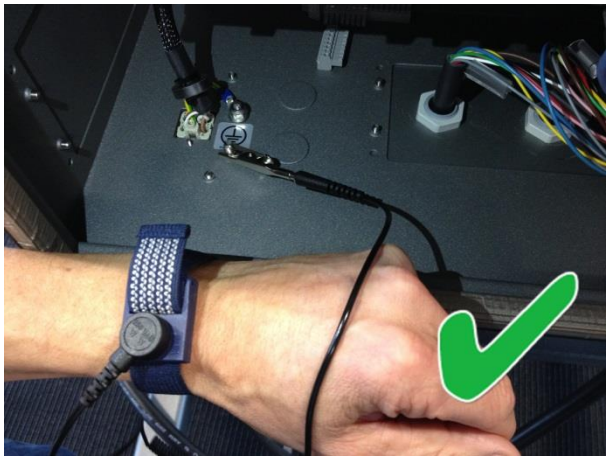
Changing the joint ID See **3.1.17 Change joint ID**

3.2 Controller

3.2.1 Handling ESD-sensitive parts

To prevent damage to ESD-sensitive parts, follow the instructions below in addition to all the usual precautions, such as turning off power before removing logic cards:

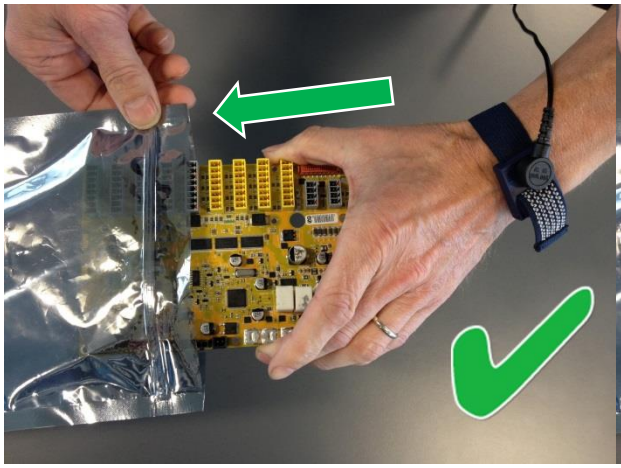
Keep the ESD-sensitive part in its original shipping container.
(a special "ESD bag") until the part is ready to be installed



Put the ESD wrist strap on your wrist. Connect the wrist band to the system ground point.
This discharges any static electricity in your body to ground.

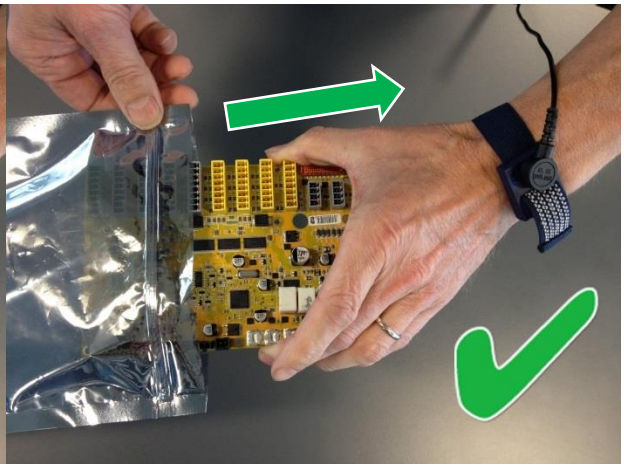
Step 1:

Put OLD board into spare ESD bag.



Step 2:

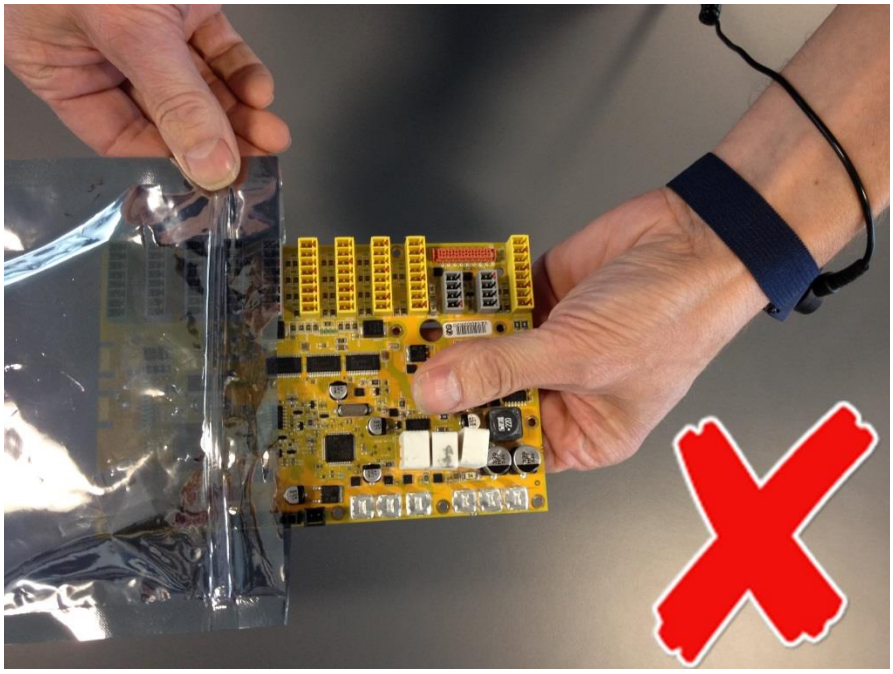
Take NEW board out of ESD bag.



Hold the ESD-sensitive part by its edges.

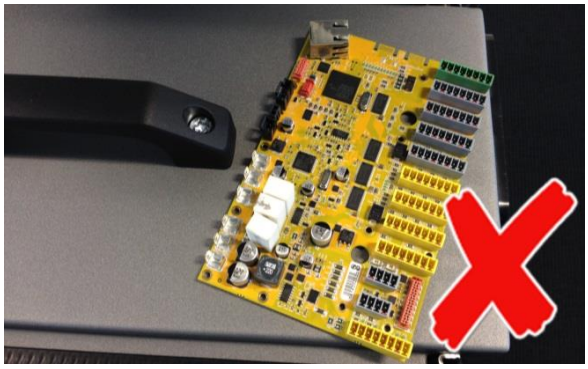
Do not touch its pins.

If a pluggable module is being removed, then use the correct tool.

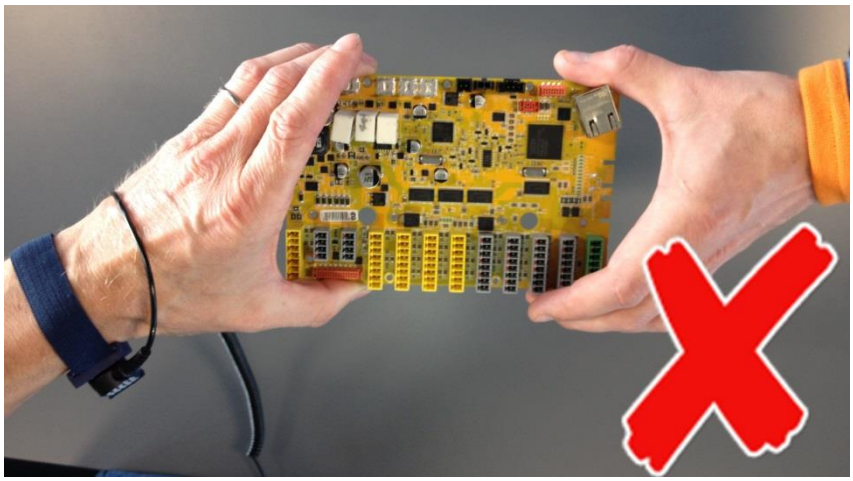


Do not place the ESD-sensitive part on nonconductive material or on a metal table.

If the ESD-sensitive part needs to be put down for any reason, then first put it **into** its special ESD bag



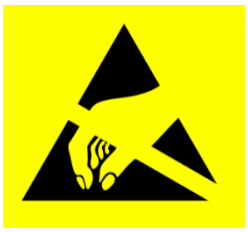
Machine covers and metal tables are electrical grounds. They increase the risk of damage because they make a discharge path from your body through the ESD-sensitive part. (Large metal objects can be discharge paths without being grounded.)



Prevent ESD-sensitive parts from being accidentally touched by other personnel and do not put unprotected ESD-sensitive parts on a table.

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

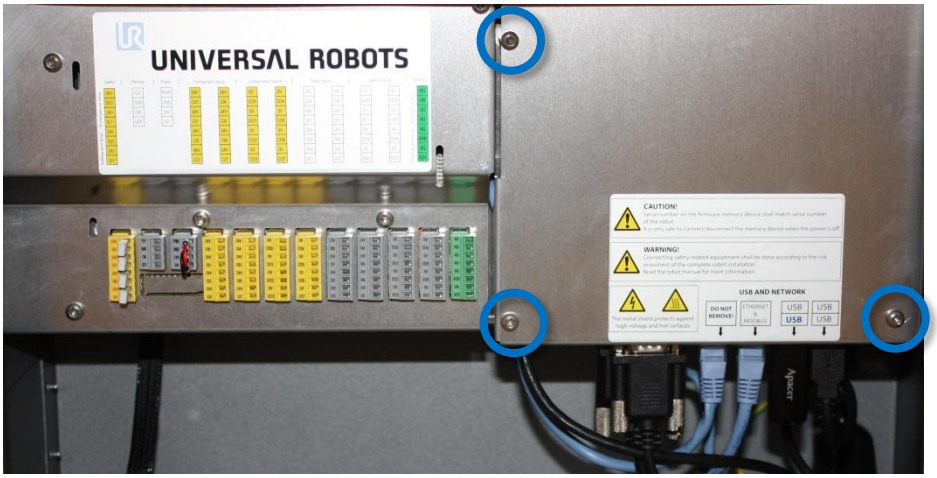
3.2.2 Replacement of motherboard 3.1



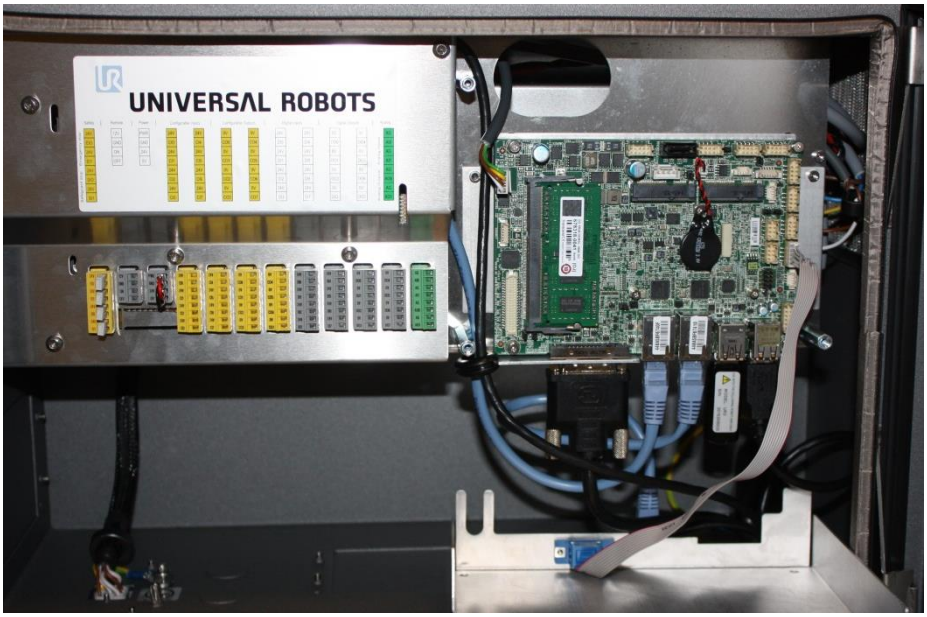
Take care of ESD handling **3.2.1 Handling ESD-sensitive parts**

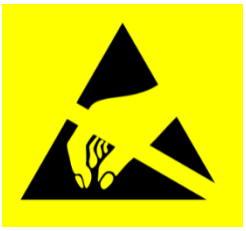
How to replace motherboard 3.1

1. Shut down the controller and disconnect the power cable, open the controller cabinet and loosen the 3 Torx screws

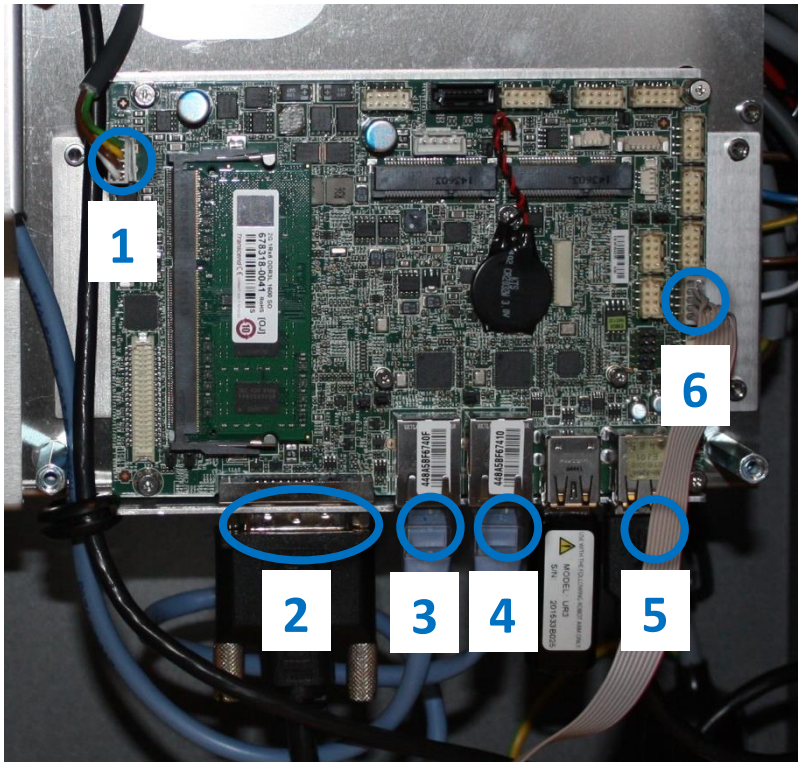


2. Remove the aluminum cover plate

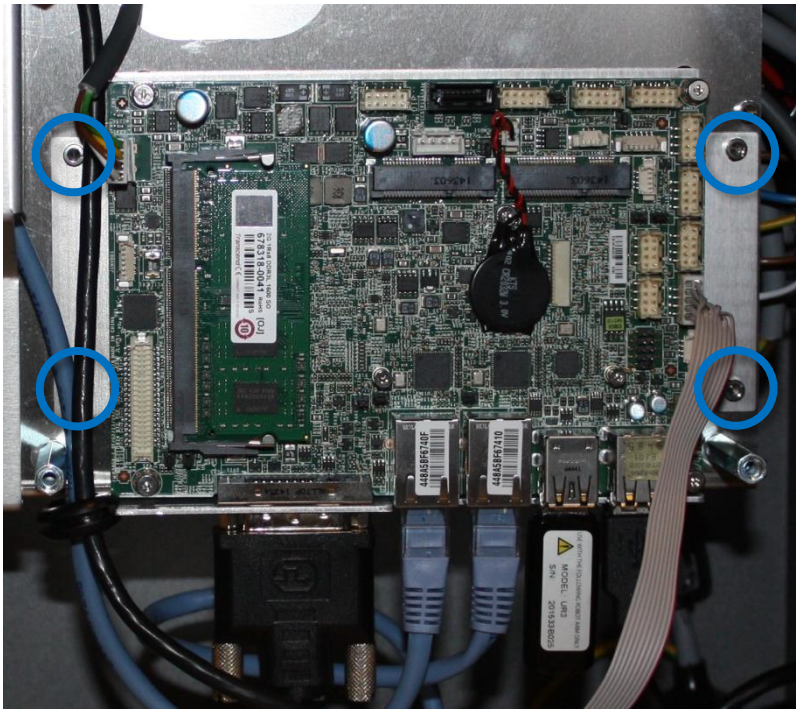




3. Disconnect cable connections from motherboard:
    1. White plug with white, brown, yellow and green wires. 12 V Power
    2. DVI-cable for TP screen
    3. Ethernet cable to Safety control board SCB
    4. Ethernet cable to external connector
    5. Black USB cable for TP USB connector
    6. Grey flat cable for RS232-connection for TP touch

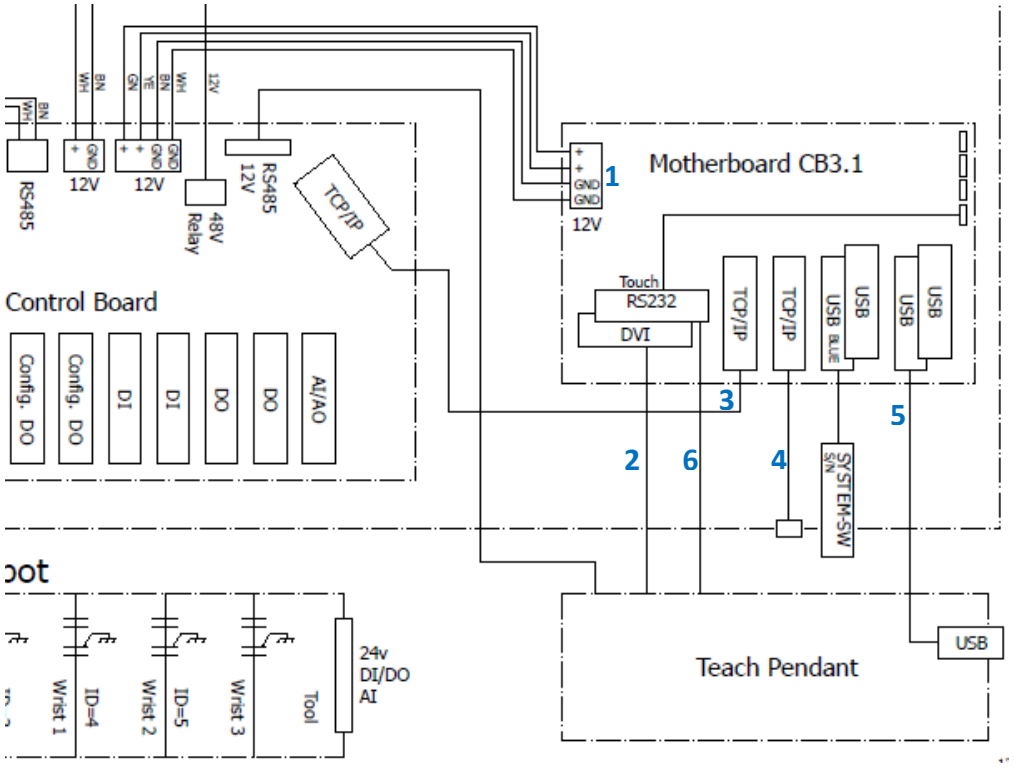


7. Remove the 4 screws from the 2 holding brackets



8. Replace Motherboard.

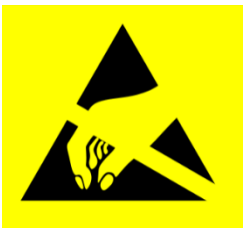
9. Insert the 6 cables in correct connectors.



10. Re-install USB stick for UR system SW.

11. Carefully put back the aluminum cover plate, make sure to mount it correct and fix it with the 3 screws

3.2.3 Replacement of Safety Control Board (SCB)

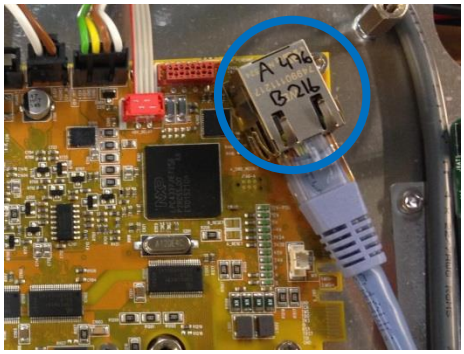


Take care of ESD handling **3.2.1 Handling ESD-sensitive parts**

How to replace Safety Control Board in Controller box

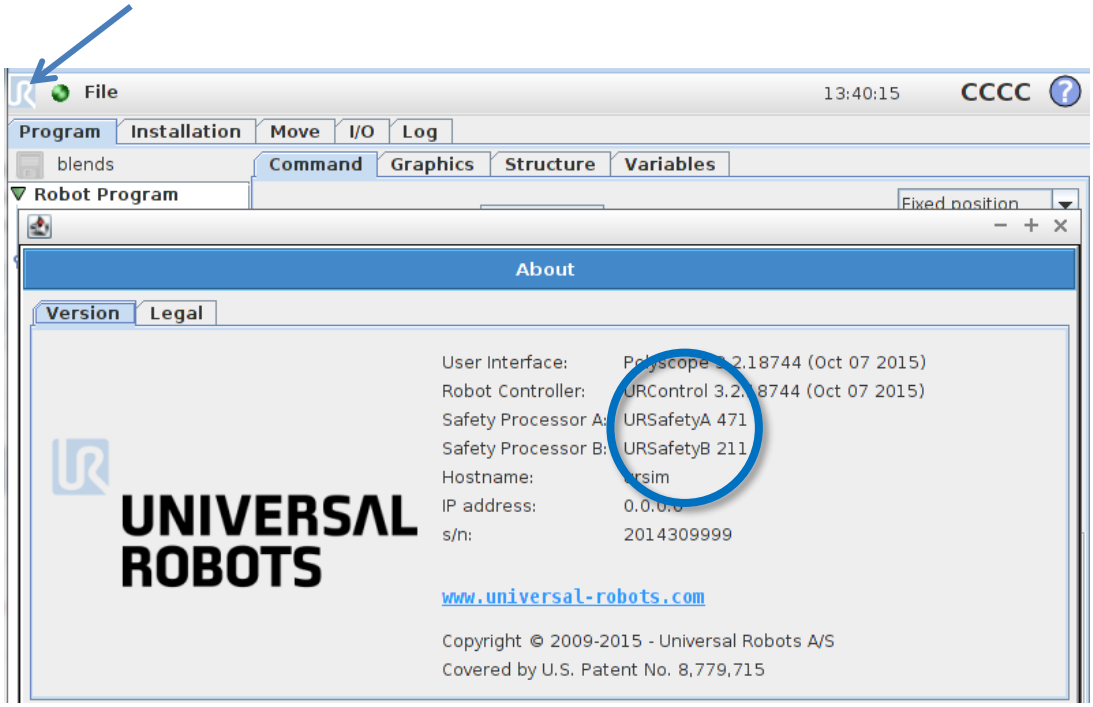
1. Check that the software on the robot is as new as the firmware version on the SCB.
   If the software on the robot is too old, then you get an error C203A0.

   Find the SCB firmware ver. on the Ethernet connector.

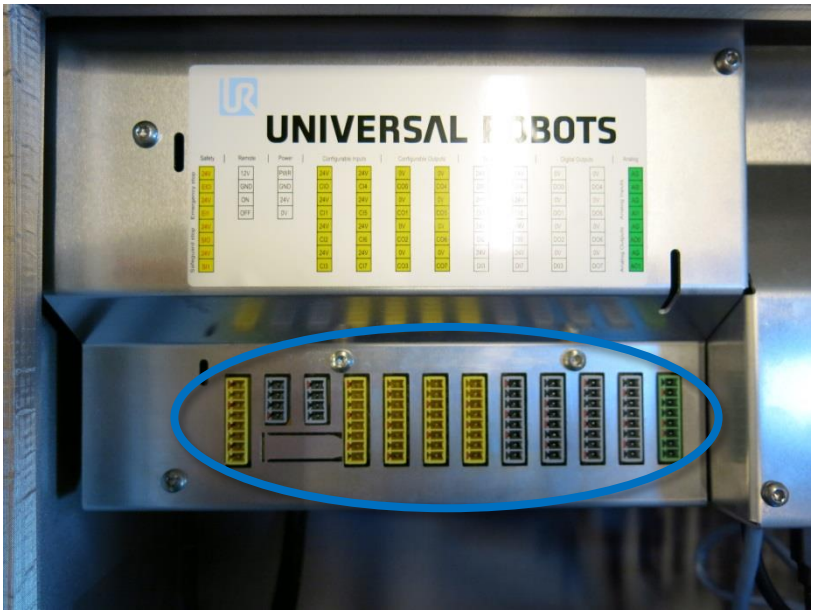


   Find the firmware versions in the “About” menu.

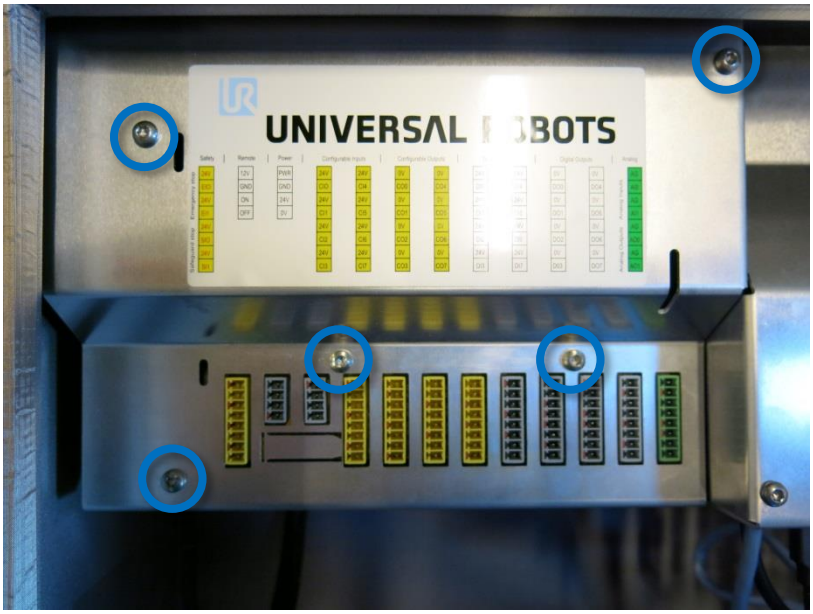
   Shortcut to “About” is available from software version 3.2.18642



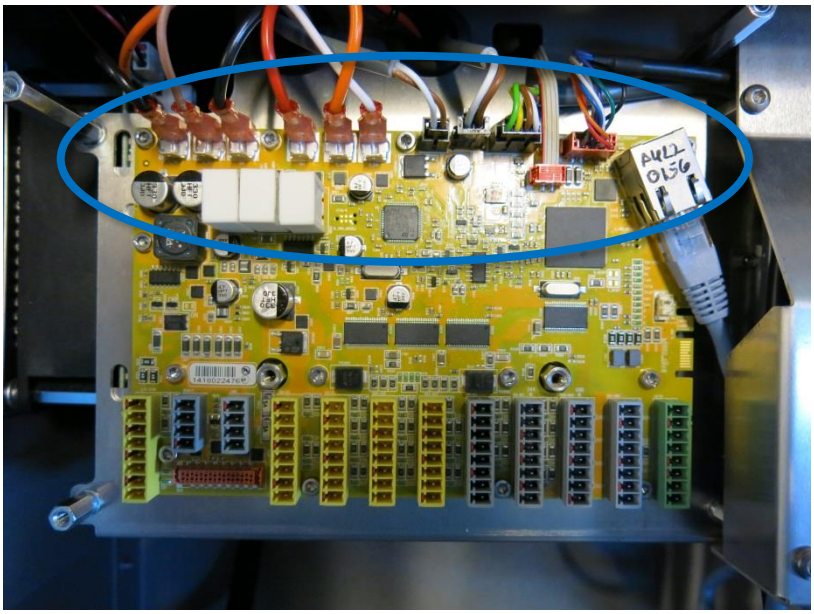
2. Shut down the controller and disconnect the power cable, open the controller cabinet. Carefully remove all plugs and connectors

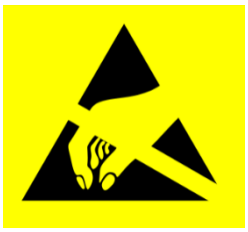


3. Loosen the 5 Torx screws and remove the aluminum cover**.**

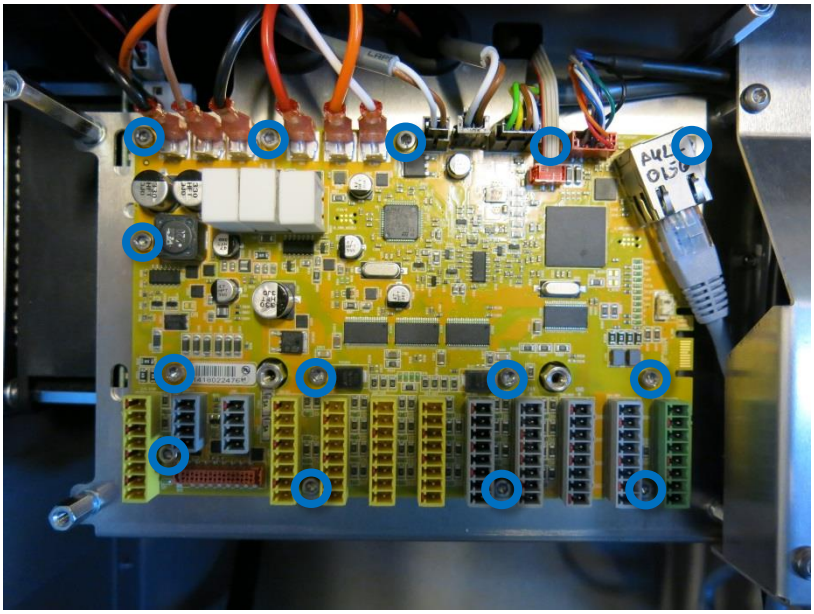


4. Carefully remove all plugs and connectors.





5. Remove 14 screws holding the Safety Control Board.

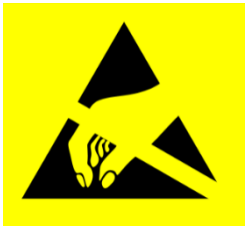


6. Replace Safety Control Board with new one and tighten the 14 screws to hold the board

7. Insert all connectors and plugs in correct positions. Eventually see section 5.4.1 Schematic overview

8. Carefully attach the aluminum cover, make sure to mount it correct and fix it with the 5 screws.

3.2.4 Replacement of teach pendant

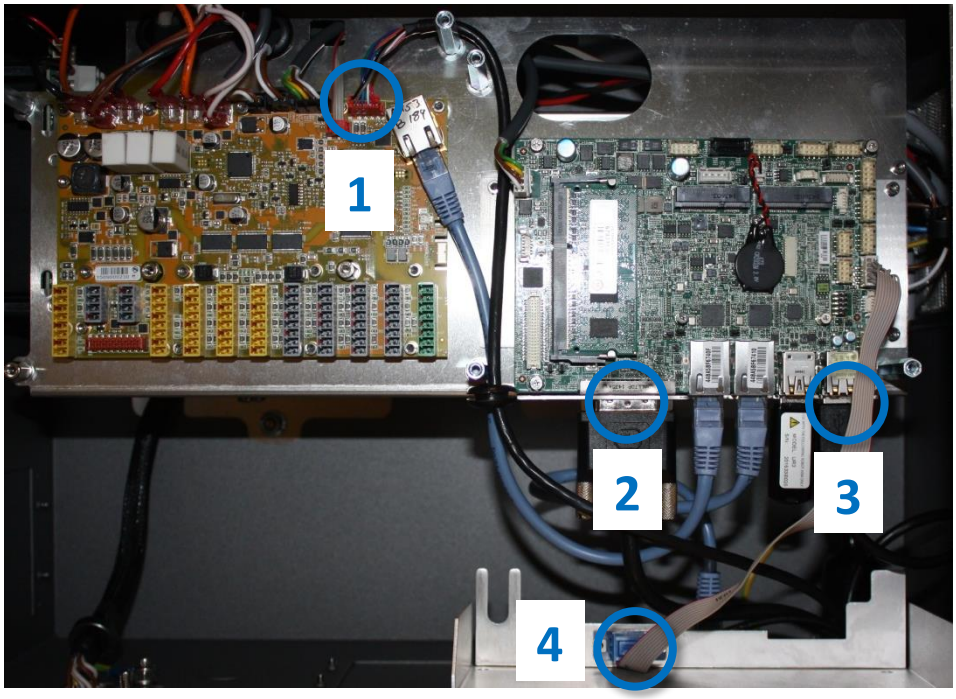


Take care of ESD handling **3.2.1 Handling ESD-sensitive parts**

How to replace Teach Pendant on Controller

Note: use the same procedure for power down and removing the aluminum cover plates as in chapter **3.2.2 Replacement of motherboard 3.1** and **3.2.3 Replacement of Safety Control Board (SCB)**

1. Disconnect 4 cables:
    1. Red plug with black cable 12 V Power
    2. Black DVI cable for the TP screen
    3. Black USB cable for the TP USB connector
    4. Black cable for RS232-connection for the TP touchscreen

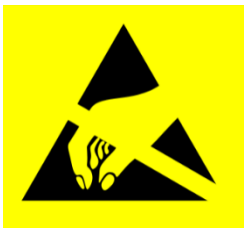


2. Remove the bracket (foot of the controller box) that holds the cable inlet and pull out the cables and plugs through this hole.

3. Replace teach pendant with new, insert cable in cable inlet and perform reconnection of all plugs and mounting of aluminum cover in reverse order to the above description.

4. Connect power and verify that teach pendant works properly. See diagram: 5.4.1 Schematic overview

3.2.5 Replacement of 48V power supply



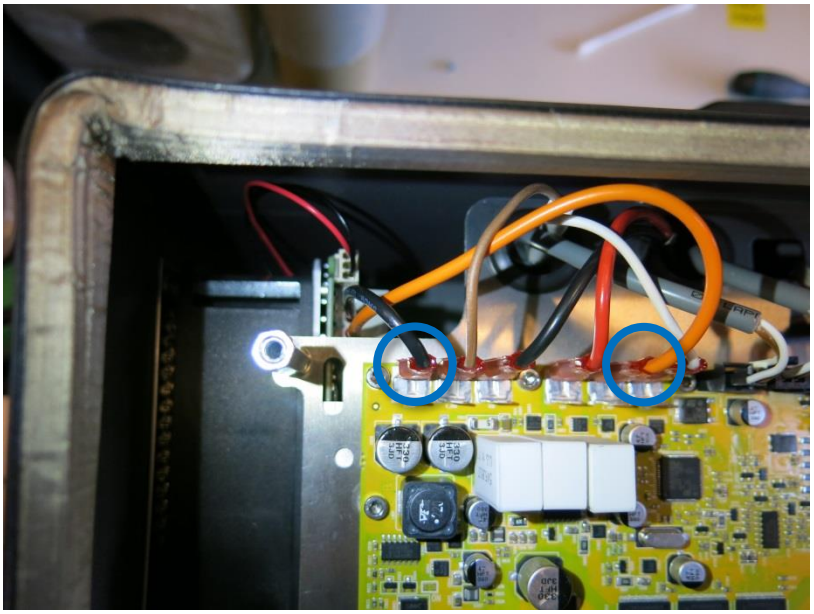
Take care of ESD handling **3.2.1 Handling ESD-sensitive parts**

How to replace 48V power supply in Controller box

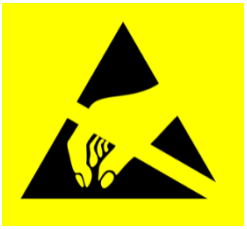
Note: use the same procedure for power down and removing the aluminum covers as in Chapter **3.2.2 Replacement of motherboard 3.1** *and* **3.2.3 Replacement of Safety Control Board (SCB)**

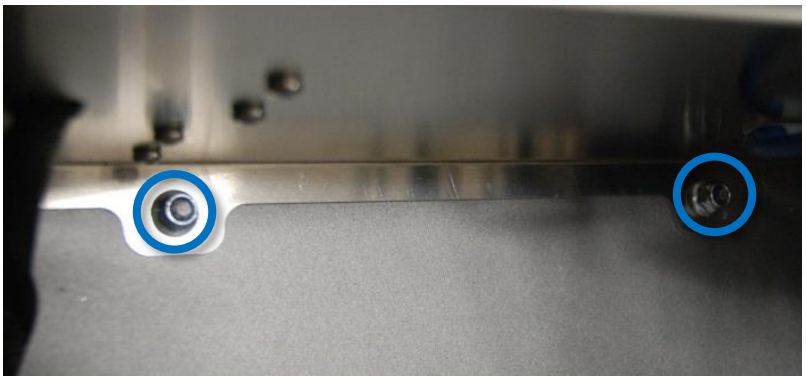
1. Remove the handle on Controller box by loosen the 2 screws holding it.

2. Removes the black and orange wires for the energy eater/fan.



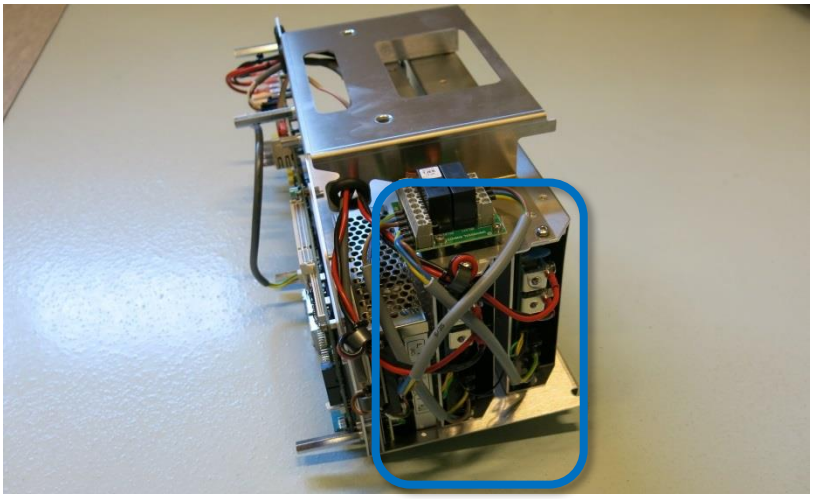
3. Remove the 2 nuts (M6) in the bottom of Controller module.



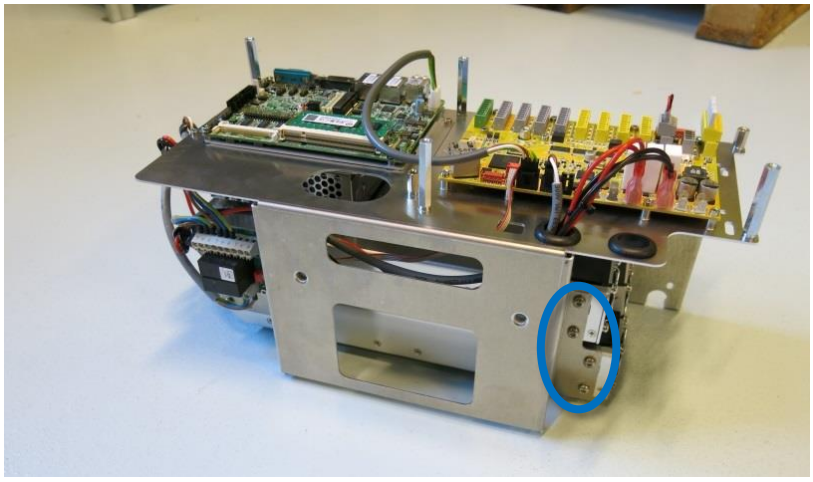


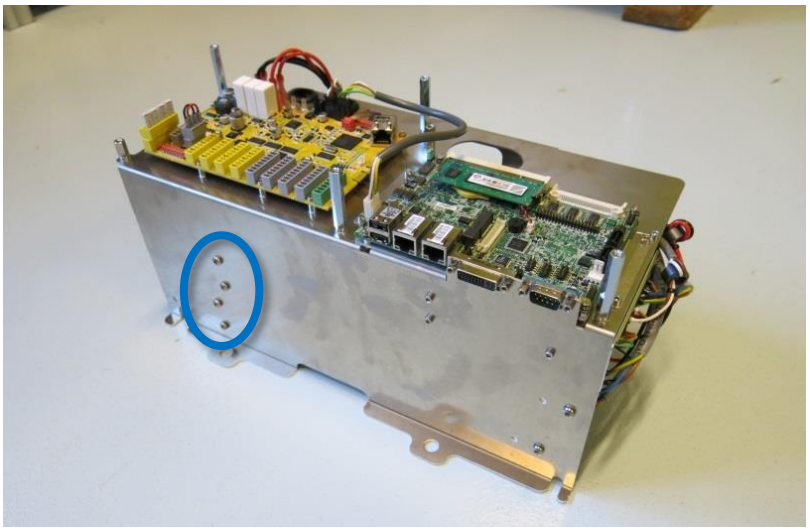
4. Gently take out the controller module from the Controller box

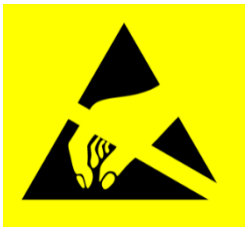
5. Power supplies are located in the rack under the controller module, the two 48V power supplies are the lower ones in the rack. (UR3 and UR5 have one and the UR10 have two 48V power supplies) Before dismounting the 48V power supply, mark and disconnect the cables from that supply.



6. Remove the screws respectively of the defective 48V power supply from the side of the rack.







7. Replace 48V power supply with new one.

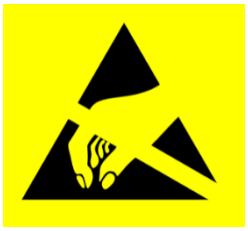
8. Reconnect the wires for the 48V power supply.

9. Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.

10. Carefully put back the aluminum cover, make sure to mount it correct and fix it with the screws.

11. Connect power and verify that teach pendant works properly.

3.2.6 Replacement of 12V power supply



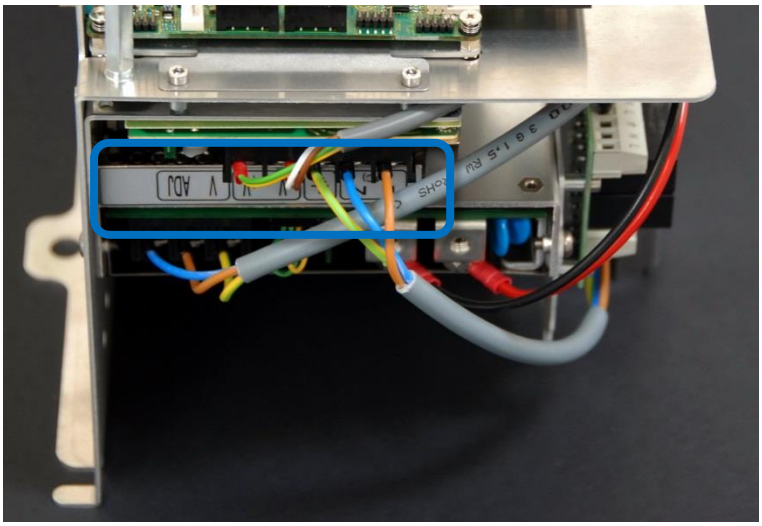
Take care of ESD handling **3.2.1 Handling ESD-sensitive parts**

How to replace 12V power supply in Controller box

Note: use the same procedure for power down and removing the aluminum cover and cables for teach pendant as in chapter **3.2.4 Replacement of teach pendant**

To replace the 12V power supply follow exactly the same steps as for the procedure in chapter **3.2.5 Replacement of 48V power supply**

1. The 12V power supply is placed in top of rack. The screws holding it in the frame are placed on the sides.



2. Replace 12V power supply with new one.

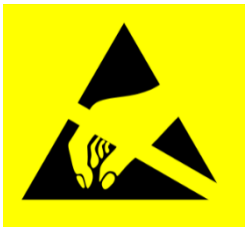
3. Reconnect the wires for the 12V power supply.

4. Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.

5. Carefully attach the grey aluminum cover, make sure to mount it correct and fix it with the screws.

6. Connect power and verify that teach pendant works properly.

3.2.7 Replacement of current distributor

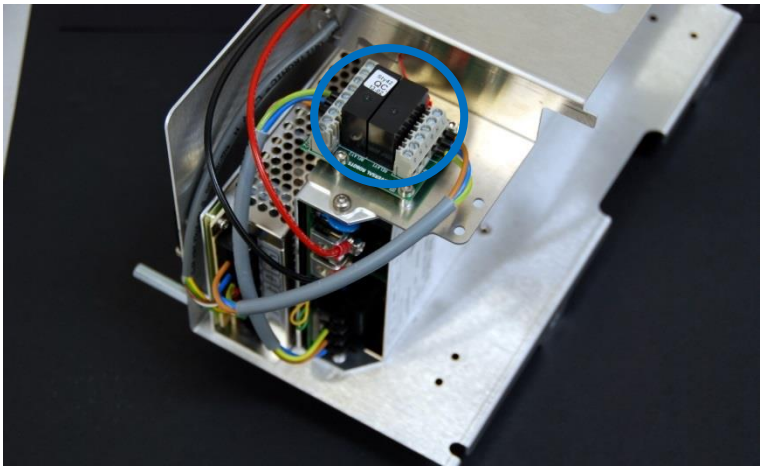


Take care of ESD handling **3.2.1 Handling ESD-sensitive parts**

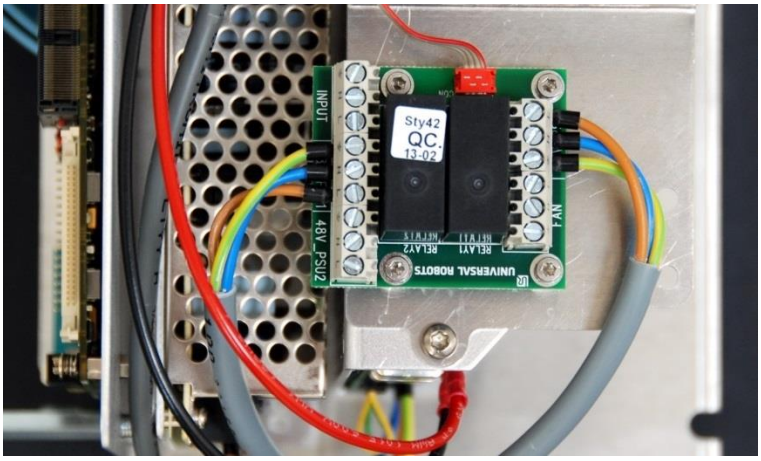
How to replace current distributor in Controller box

Note: use the same procedure for power down and removing the aluminum cover and cables for teach pendant as in chapter **3.2.4 Replacement of teach pendant**

1. Current distributor is placed on top of rack.



2. Before dismounting the current distributor, mark and disconnect the cables from the circuit board.



3. Replace current distributor with new one.

4. Reconnect the wires for the current distributor.

5. Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.

6. Carefully put back the grey aluminum cover, make sure to mount it correct and fix it with the screws.

7. Connect power and verify that teach pendant works properly.

4. Software

4.1 Update software

Universal Robots software is named PolyScope.

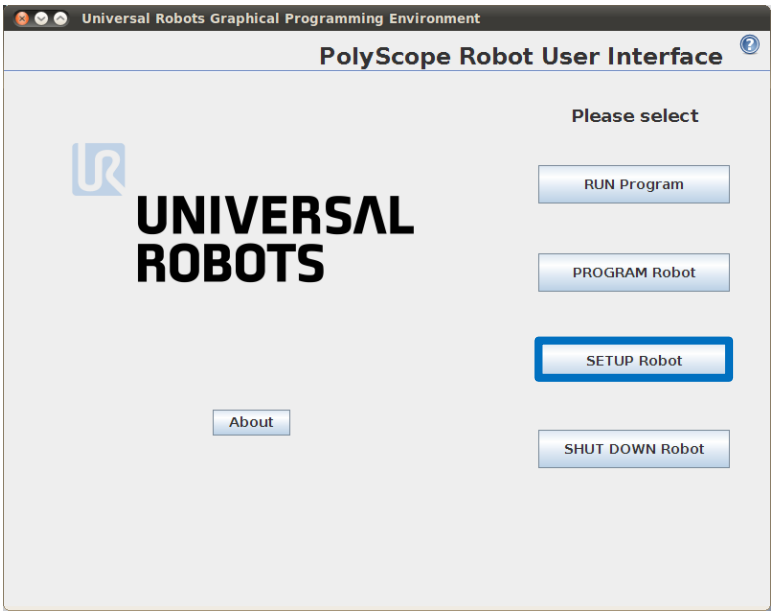
Read This Prior to Updating Your Software:

Updating the software may cause changes or restrictions to functionality.

- Do not downgrade the software to earlier version than the version the robot was produced with.
- We advise you only to update, if you can benefit from the new features or the fixed issues.
- We advise you to thoroughly read the release notes before doing an update, in order to avoid surprises, caused by changed or added functionality.
- In case of concerns related to your actual or planned applications, please contact your supplier for advice and assistance.
- Follow the instructions in the guide in the download section of the support web site.
  Find it under universal-robots.com/support

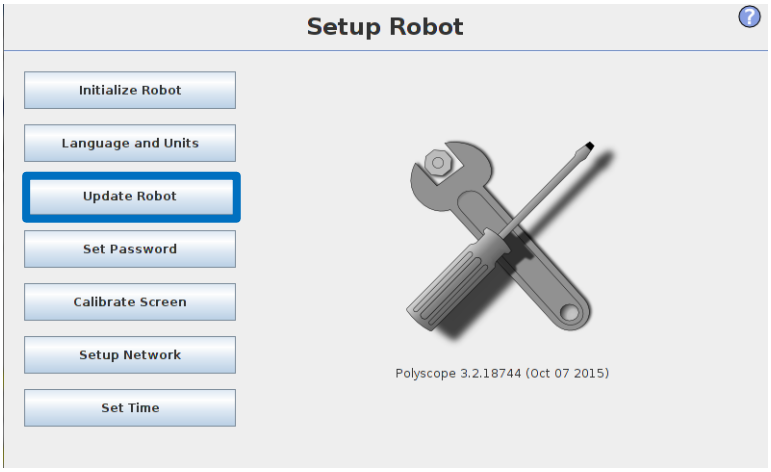
Instructions to update software:

1. Download software update. Carefully read requirements on support site relating to which software must be installed on robot prior to updating to the downloaded version.
2. Save it in the root folder on a USB-stick.
3. Insert USB-stick into USB-connector on right-hand side of teach pendant.
4. Go to main screen of PolyScope.

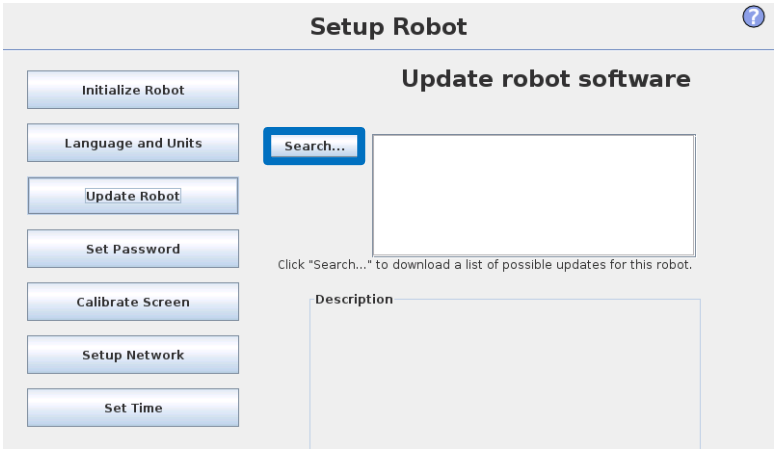


5. Press button *SETUP Robot*.

6. In left side menu, select *Update Robot*.



7. Press button *Search* for searching after software update on USB-stick.



8. Select the found software update and press *UPDATE*.
9. Press YES to update the software.
10. Wait for update to complete, after successful update controller will automatically reboot.
11. Remove USB-stick and power on.

4.2 Update joint firmware

Each joint on the robot contains firmware to control the joint.

When the software is updated on a UR3 robot the firmware is **automatically** updated.
After replacement of a joint on a UR3 the firmware is **automatically** updated.

4.3 Using Magic files

For easy backup, Universal Robots provides Magic files to automatically copy data from controller to USB-stick.

These files are available:	Function:
• URmagic log file	copies the entire log history file to USB-stick
• URmagic backup programs	copies all programs and installation files to USB-stick
• URmagic configuration files	copies all configuration files to USB-stick
• URmagic upload programs	copies all programs and installation files *from* USB-stick
• URmagic screenshot	generates a screenshot of GUI when USB-stick is inserted

Go to http://www.universal-robots.com/support/ to download Magic files.

Instruction for using Magic files.

1. Download Magic file.
2. Save it in the root folder on a USB-stick.
   If more than one Magic file is on USB-stick, they will be run in sequence; the warnings will then appear for each file. Do not remove the USB-stick until after the last file has been run. Multiple folders will be created and named with serial number plus a sequential no, like 201430xxxx_0, 201430xxxx_1etc.
3. Insert USB-stick into USB-connector on right-hand side of teach pendant.
4. After a few seconds a red **! USB !** -sign will appear on the screen, this is a warning not to remove the USB-stick, while the file will do its magic.
5. Await a green **<- USB** -sign appears on the screen, if there is more than one Magic file on the USB-stick then go to 4.
6. After the last Magic file is completed the USB-stick can be safely removed.
7. Remove USB-stick and the process is complete.

The Magic file creates a folder on USB-stick named with the serial number of the robot.

5. Troubleshooting

In the error codes different words have been used for the same thing:

- On the Safety Control Board: Processor A = A uP = SafetySys1
- On the Safety Control Board: Processor B = B uP = SafetySys2

PSU = Power Supply
PC = Controller

Open log files with Support Log Reader.
Go to http://www.universal-robots.com/support/ to download Support Log Reader

5.1 Error codes

Code	Error description	Explanation	How to fix
C0	No error		
C1	Outbuffer overflow error		
C1A1	Buffer of stored warnings overflowed		
C1A2	Outbuffer to RS485 overflowed (problem with PCs message)		
C2	Inbuffer overflow error		
C3	Processor overloaded error	Processor in any part could give this error.	
C4	Broken communication		
C4A1	Communication with PC lost.	Between Safety Control Board and Motherboard	
C4A2	Communication with Safety Control Board A uP lost	If either processor A or processer B is communicating, the Safety Control Board or cable between the Motherboard and Safety Control Board is defect	a) Check TCP/IP connection between Motherboard and Safety Control Board. B) Exchange Safety Control Board
C4A3	Communication with Safety Control Board B uP lost	If either processor A or processer B is communicating, the Safety Control Board or cable between the Motherboard and Safety Control Board is defect	a) Check TCP/IP connection between Motherboard and Safety Control Board. B) Exchange Safety Control Board
C4A4	Communication with primary Teach Pendant uP lost	If either processor A or processer B is communicating, the Teach Pendant or cable between the Motherboard and Teach Pendant is defect	a) Check RS485-12V connection between Motherboard and Teach Pendant. B) Exchange Teach Pendant
C4A5	Communication with secondary Teach Pendant uP lost	If either processor A or processer B is communicating, the Teach Pendant or cable between the Motherboard and Teach Pendant is defect	a) Check RS485-12V connection between Motherboard and Teach Pendant. B) Exchange Teach Pendant

C4A6	Communication with primary EUROMAP67 uP lost	If either processor A or processer B is communicating, Euromap67 or cable between the Motherboard and Euromap is defect	a) Check Euromap67 connection between Motherboard and Euromap67. B) Exchange Euromap67
C4A7	Communication with secondary EUROMAP67 uP lost	If either processor A or processer B is communicating, Euromap67 or cable between the Motherboard and Euromap is defect	a) Check Euromap67 connection between Motherboard and Euromap67. B) Exchange Euromap67
C4A8	Primary EUROMAP67 uP present, but euromap67 is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
C4A9	Secondary EUROMAP67 uP present, but euromap67 is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
C4A10	Primary Teach Pendant present, but Teach Pendant safety is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
C4A11	Secondary Teach Pendant uP present, Teach Pendant safety is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
C4A12	Communication with joint 0 lost	More than 1 package lost	
C4A13	Communication with joint 1 lost	More than 1 package lost	
C4A14	Communication with joint 2 lost	More than 1 package lost	
C4A15	Communication with joint 3 lost	More than 1 package lost	
C4A16	Communication with joint 4 lost	More than 1 package lost	
C4A17	Communication with joint 5 lost	More than 1 package lost	
C4A18	Communication with tool lost	More than 1 package lost	
C4A65	Lost package from Primary Teach Pendant	1 package lost – warning	
C4A66	Lost package from Secondary Teach Pendant	1 package lost – warning	
C4A67	Lost package from Primary Euromap67	1 package lost – warning	
C4A68	Lost package from Secondary Euromap67	1 package lost – warning	
C4A69	Lost package from Secondary Masterboard	1 package lost – warning	
C4A70	Lost package from joint 0	1 package lost – warning	
C4A71	Lost package from joint 1	1 package lost – warning	
C4A72	Lost package from joint 2	1 package lost – warning	
C4A73	Lost package from joint 3	1 package lost – warning	
C4A74	Lost package from joint 4	1 package lost – warning	
C4A75	Lost package from joint 5	1 package lost – warning	
C4A76	Lost package from tool	1 package lost – warning	

C4A77	Lost package from uPA to joints	1 package lost – warning	
C4A78	Lost package from uPA to teach pendant	1 package lost – warning	
C4A79	Lost package from uPA to uPB	1 package lost – warning	
C4A80	Lost package from uPB	1 package lost – warning	
C4A81	Packet counter disagreement in packet from Primary Screen	Safety processor 1 in Teach pendant has a packet disagreement	
C4A82	Packet counter disagreement in packet from Secondary Screen	Safety processor 2 in Teach pendant has a packet disagreement	
C4A83	Packet counter disagreement in packet from Primary Euromap67		
C4A84	Packet counter disagreement in packet from Secondary Euromap67		
C4A85	Packet counter disagreement in packet from Safety Control Board B		
C4A86	Packet counter disagreement in packet from joint 0		
C4A87	Packet counter disagreement in packet from joint 1		
C4A88	Packet counter disagreement in packet from joint 2		
C4A89	Packet counter disagreement in packet from joint 3		
C4A90	Packet counter disagreement in packet from joint 4		
C4A91	Packet counter disagreement in packet from joint 5		
C4A92	Packet counter disagreement in packet from tool		
C4A93	Packet counter disagreement in packet from processor A to joints		
C4A94	Packet counter disagreement in packet from processor A to B		
C4A95	Packet counter disagreement in packet from processor A to Teach Pendant and EUROMAP		
C5	Heavy processor load warning		
C5A1	Heavy processor load warning:1		
C5A2	Heavy processor load warning:2		
C10	Broken PC communication error		Eventually update the software

C10A1	Lost packet from PC		Eventually update the software
C10A101	PC packet received too early		Eventually update the software
C10A102	Packet counter does not match		Eventually update the software
C10A103	PC is sending packets too often		Eventually update the software
C11	Bad CRC error	Serial communication problem with joint	Check black 2-wire connectors and wires in joints. Eventually 2 joints with the same ID.
C12	Unknown message error		
C14	Debug message		
C14A1	{float}	Should not occur in the field	Do you see this error on a robot report it to Universal Robots.
C14A2	{signed}	Should not occur in the field	Do you see this error on a robot report it to Universal Robots.
C14A3	{unsigned}	Should not occur in the field	Do you see this error on a robot report it to Universal Robots.
C17	Inbuffer overflow in package from PC	Communication error between Safety Control Board and Motherboard	Check Ethernet connection between circuit boards. Eventually update the software
C26	Motor Encoder index drift detected	Joint mechanical problem	Replace joint
C27	Calibration data is invalid or does not exist, selftest is needed!		
C29	Online Calibration data checksum failed	Calibration data is not in the joint	a) Power OFF and Power ON. B) replace joint
C30	Master received data from too many joints		
C31	Caught wrong message (not from master)	Serial communication problem with joint	Check black 2-wire connectors and wires in joints
C32	Flash write verify failed	Debug message	Ignor
C33	Calibration flash checksum failed		
C34	Program flash checksum failed		Update Firmware
C34A0	Program flash checksum failed during bootloading		Update Firmware
C34A1	Program flash checksum failed at runtime		Update Firmware
C35	Joint ID is undefined		
C36	Illegal bootloader command	Debug message	Ignore
C37	Inbuffer parse error	Serial communication problem with joint	Check black 2-wire connectors and wires in joints

C38	Online RAM test failed		Replace Item
C38A1	Data-bus test failed		Replace Item
C38A2	Address-bus stuck-high test failed		Replace Item
C38A3	Address-bus stuck-low test failed		Replace Item
C38A4	Address-bus shorted test failed		Replace Item
C38A5	Memory-cell test failed		Replace Item
C39	Logic and Temporal Monitoring Fault		
C39A1	Max current deviation failure		The joint is broken; it must be replaced
C39A2	Max joint-encoder speed exceeded		The joint is broken; it must be replaced
C39A3	Max motor-encoder speed exceeded		The joint is broken; it must be replaced
C39A4	Illegal state change in joint detected		If this error occurs several times, report it as a bug
C39A5	Too fast state change in joint detected		If this error occurs several times, report it as a bug
C39A6	5V regulator voltage too low		Replace joint
C39A7	5V regulator voltage too high		Replace joint
C39A100	Watchpoint fault: ADC task timeout		
C39A101	Watchpoint fault: Motor-Control task timeout		
C39A102	Watchpoint fault: Motor-encoder task timeout		
C39A103	Watchpoint fault: Joint-encoder task timeout		
C39A104	Watchpoint fault: Communication task timeout		
C39A105	Watchpoint fault: RAM-test task timeout		
C39A106	Watchpoint fault: CalVal-test task timeout		
C39A107	Watchpoint fault: ROM-test task timeout		
C40	AD-Converter hit high limit joint	EMC issue external or electronics internal	Check grounding and shielding for EMC problems
C44	CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Check black 2-wire connectors and wires in joints
C44A0	Joint 0 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Replace joint 0
C44A1	Joint 1 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Replace joint 1
C44A2	Joint 2 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Replace joint 2

C44A3	Joint 3 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Replace joint 3
C44A4	Joint 4 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Replace joint 4
C44A5	Joint 5 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Replace joint 5
C44A6	Tool CRC check failure on primary bus	Serial communication problem with tool or secondary bus node	Replace Tool mounting bracket
C44A80	CRC Check failure on primary bus	Most likely an interference on the communication bus	a) Check green 2-wire connectors and wires in joints, b) If the error reappears contact your local service provider for assistance.
C45	AD-Converter error		Replace Item
C46	Loose gearbox or bad encoder mounting	Mechanical problem in gear related to encoder mounting	Replace joint
C47	AD-Converter hit low limit	EMC issue external or electronics internal	a) Check grounding and shielding for EMC problems. B) Replace Item
C48	Powerbus voltage drop detected.	Error on 48V powerbus to robot arm	Check 48V output from PSU. Check current-distributor PCB. Replacement of 48V PSU or current-distributor is necessary
C49	RS485 receive warning		
C49A200	Secondary RS485 bus is down	Bus for: Teach Pendant, Processor A and Processor B on the Safety Control Board.	Check TCP/IP-12V cable to Teach Pendant
C50	Robot powerup failure	Electrical error control box	Remove all external connections to I/O-interface of Safety Control Board. Check for short circuit. Argument of error code specifies in detail what causes the error.
C50A1	Voltage detected at 24V rail before startup		
C50A2	Voltage present at unpowered robot		
C50A5	Powersupply voltage too low		
C50A6	Powersupply voltage too high		
C50A11	Voltage not detected at 24V rail after startup	24 V to the I/O interface in the controller	
C50A15	Warning, waiting for SafetySYS2	SafetySYS2 = Processor B on Safety Control Board	

C50A16	The Teach Pendant does not respond	Loose wire or incorrect safety configuration. Message comes from Safety Control Board	Check the cable or change in the Safety Configuration of the Installation the miscellaneous settings
C50A17	The Euromap67 interface does not respond	Loose wire or incorrect safety configuration	Check the cable or change in the Safety Configuration of the Installation the miscellaneous settings
C50A18	Warning, waiting for SafetySYS1	SafetySYS1 = Processor A on Safety Control Board	
C50A20	5V, 3V3 or ADC error (5V too high)		
C50A21	5V, 3V3 or ADC error (5V too low)		
C50A22	Robot current sensor reading too high		
C50A23	Robot current sensor reading too low		
C50A24	48V not present (Check internal connection)		
	This error can have several root causes and you have to measure the voltage some places. There are 3 different components that could be the root cause and you have to measure the voltage to determine which one of them that is the faulty one. - 48 V power supply - Current distributor - Safety Control Board. Find the schematic drawing in this service manual		
C50A25	Robot voltage present at 48V PSU powereup		
C50A26	Voltage present on unpowered 48V power supply		
C50A27	12V, 3V3 or ADC error (12V too high)		
C50A28	12V, 3V3 or ADC error (12V too low)		
C50A29	Analog I/O error (-12V too high)		
C50A30	Analog I/O error (-12V too low)		
C50A31	The other safetySYS do not initialize		
C50A40	Wrong voltage from PSU1		
C50A41	Wrong voltage from PSU2		
C50A42	Voltage will not disappear from PSU		
C50A43	Warning, waiting for CB2 type answer from primary processor		
C50A50	Processor A 3.3V supply voltage out of bounds		
C50A51	Robot voltage below threshold		
C50A52	Robot voltage above threshold		

C50A53	58V generator deviation error		
C50A54	5V regulator too low		
C50A55	5V regulator too high		
C50A56	-4V generator too low		
C50A57	-4V generator too high		
C50A80	Last CPU reset caused by Low-Power-Reset		
C50A81	Last CPU reset caused by Window-Watchdog-Reset		
C50A82	Last CPU reset caused by Independent-Watchdog-Reset		
C50A83	Last CPU reset caused by Software-Reset		
C50A84	Last CPU reset caused by External-Pin-Reset		
C50A85	Last CPU reset caused by Brown-Out-Reset		
C50A99	Wrong software on PCB		
C50A100	Cable not connected	Robot Problem: Robot Cable is not detected	
C50A101	Short circuit in robot detected or wrong robot connected to control box	Robot Problem: 48V or wrong robot type	Check robot type. Look for short circuit in cable and in robot arm.
C50A102	Voltage rising too slowly	Robot Problem: 48V	
C50A103	Voltage failed to reach acceptable level	Robot Problem: 48V	
C51	CRC check failure on secondary bus		
C51A0	Processor B		
C51A1	Primary screen processor	CRC check failure on Safety processor 1 in Teach pendant	
C51A2	Secondary screen processor	CRC check failure on Safety processor 2 in Teach pendant	
C51A3	Primary E67		
C51A4	Secondary E67		
C53	IO overcurrent detected	Safety Control Board error	Remove all external connections to I/O-interface of Safety Control Board. Check for short circuit
C53A1	IO overcurrent detected, max is 800mA	Safety Control Board error	Remove all external connections to I/O-interface of Safety Control Board. Check for short circuit
C53A2	IO overcurrent detected, max is 600mA	Tool error	Remove tool connector. Check for short circuit
C55	Safety system error	Safety system malfunction	Check Motherboard, Safety Control Board, Screenboard, Current distributor (Euromap, if installed). Bypass safety

			connections to I/O-interface of Safety Control Board
C55A23	Safety relay error (minus connection)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
C55A24	Safety relay error (plus connection)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
C55A33	Safety relay error (a relay is stuck)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
C55A34	Safety relay error (relays are not on)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
C55A50	Voltage present at unpowered robot	SCB hardware fault	Replace Safety Control Board (SCB)
C55A51	Voltage will not disappear from robot	SCB hardware fault	Replace Safety Control Board (SCB)
C55A52	5V, 3V3 or ADC error (5V too low)	SCB hardware fault	Replace Safety Control Board (SCB)
C55A53	5V, 3V3 or ADC error (5V too high)	SCB hardware fault	Replace Safety Control Board (SCB)
C55A90	Bootloader error, robot voltage too low or current too high		
C55A91	Bootloader error, robot voltage too high		
C55A100	Safety violation		
C55A101	Safety Channel Error In Safety Control Board		
C55A102	Safety Channel Error In Screen		
C55A103	Safety Channel Error In Euromap67 Interface		
C55A109	Received fault message from PC		
C55A110	Safety State is changing too often		
C55A111	On/Off State is changing too often		
C55A112	Robot current sensors readings differ		
C55A120	Robot current is too high while emergency stopped		
C55A121	Robot current is too high while safeguard stopped		

C56	Overvoltage shutdown	Voltage exceeded 55V	Check Energy Eater. Cable to Energy eater, Replace Energy Eater
C57	Brake release failure		Check Brake, solenoid, Payload, TCP and Mount
C57A1	Joint did not move or motor encoder is not functioning		Check Brake, solenoid, Payload, TCP and Mount
C57A2	Large movement detected during brake release		Check Brake, solenoid, Payload, TCP and Mount
C57A3	Robot was not able to brake release, see log for details		Check Brake, solenoid, Payload, TCP and Mount
C58	Motor encoder not calibrated		Calibrate joint
C59	Overcurrent shutdown	Overcurrent in joint. Argument = Current in Amps.	Check for short circuit. Check program for singularity issues. Replace joint if necessary
C62	Joint temperature		
C62A1	High (80 C)	Warning	
C62A3	Static load too high warning	Warning	
C62A11	Shut down (85 C)	Stop	
C62A13	Static load too high	Stop	Check Payload
C63	Selftest failed		
C68	SPI error	Joint: Absolut encoder on joint communication error	Replace joint
C70	Close to gearbox shear limit	Acceleration / deceleration to high. Mechanical problem in gear related to encoder mounting	Reduce acceleration in user program. Replace joint if necessary
C71	Startup check error	Fault: Firmware in joint	
C71A1	Hardware is size1, software is not	Fault: Firmware in joint	
C71A2	Hardware is size2, software is not	Fault: Firmware in joint	
C71A3	Hardware is size3, software is not	Fault: Firmware in joint	
C71A4	Hardware is size4, software is not	Fault: Firmware in joint	
C71A5	Invalid hardware size read		
C71A6	Motor indication signal not working		
C71A7	Phase 1 and phase 2 not working	The motor wires are damaged, bad connection in screw terminals or defect PCB	Replace joint (Replace PCB)
C71A8	Phase 2 not working	The motor wires are damaged, bad connection in screw terminals or defect PCB	Replace joint (Replace PCB)
C71A9	Phase 1 not working	The motor wires are damaged, bad connection in screw terminals or defect PCB	Replace joint (Replace PCB)
C71A10	Invalid motor test result		
C71A11	ADC calibration failed	Only in joint	

C71A12	Phase 3 not working in joint failed	The wire is (1) damaged or (2) has been disconnected from the PCB (not likely) or (3) defect PCB	Replace the joint
C71A50	Current sensor test failed	Sensor reported wrong current when probed	Replace the joint. Defect Printed circuit board
C71A51	Current sensor test failed	Sensor reported wrong current when probed	Replace the joint. Defect Printed circuit board
C71A52	Current sensor test failed	Sensors reported different currents when probed	Replace the joint. Defect Printed circuit board
C72	Power Supply Unit failure	48 V Power problem	
C72A1	0 PSUs are active	PSU was not able to deliver 48V (In UR10: No 48V)	Check power connection between power supply and Safety Control Board
C72A2	1 PSU active, but we expect 2 (UR10)	PSU was not able to deliver 48V or UR10 flash card in UR5 robot	Check power connection between power supply and Safety Control Board and check that the flash card and robot match
C72A3	2 PSUs active, but we expect 1 (UR5)	UR5 flash card in UR10 robot	Check that the flash card and robot match
C73	Brake test failed during selftest, check brakepin		
C74	Joint encoder warning	Magnetic encoder error (Absolut encoder)	
C74A1	Invalid decode: Readhead misalignment, ring damaged or external magnetic field present.	Warning: The argument is the sum of C74 errors	
C74A2	Speed reading is not valid	Warning: The argument is the sum of C74 errors	
C74A4	System error=malfunction or inconsistent calibration detected	Warning: The argument is the sum of C74 errors	
C74A8	Supply voltage is out of range	Warning: The argument is the sum of C74 errors	
C74A16	Temperature is out of range	Warning: The argument is the sum of C74 errors	
C74A64	Signal low =Too far from magnetic ring	Warning: The argument is the sum of C74 errors	
C74A128	Signal saturation =Too close to magnetic ring	Warning: The argument is the sum of C74 errors	
C74A207	Joint encoder error	Example: Argument 207 is the sum of 128,64,8,4,2,1 which means that all the errors in connection to argument 1, 2, 4, 8, 64 and 128 have been reported.	Example.
C75	Joint encoder error	Magnetic encoder error (Absolut encoder)	
C75A1	Invalid decode: Readhead misalignment, ring damaged	Error: The argument is the sum of C75 errors	Replace joint

	or external magnetic field present.		
C75A2	Speed reading is not valid	Error: The argument is the sum of C75 errors	Replace joint
C75A4	System error=malfunction or inconsistent calibration detected	Error: The argument is the sum of C75 errors	Replace joint
C75A8	Supply voltage is out of range	Error: The argument is the sum of C75 errors	Check previous error
C75A16	Temperature is out of range	Error: The argument is the sum of C75 errors	Check previous error
C75A32	Signal lost =Misaligned readhead or damaged ring	Error: The argument is the sum of C75 errors	Replace joint
C75A64	Signal low =Too far from magnetic ring	Error: The argument is the sum of C75 errors	Replace joint
C75A128	Signal saturation =Too close to magnetic ring	Error: The argument is the sum of C75 errors	Replace joint
C75A207	Joint encoder error	Example: Argument 207 is the sum of 128,64,8,4,2,1 which means that all the errors in connection to argument 1, 2, 4, 8, 64 and 128 have been reported.	Example
C76	Joint encoder communication CRC error	Error between sensor and joint circuit	Check connections or very heavy electrical noise
C77	Sudden position change detected on the joint-encoder	The position reading from the encoder was different than expected	
C78	Large sudden position change detected on the joint-encoder	The position reading from the encoder was severely different than expected, the latest measurement was discarded	Contact your local service provider for assistance
C78A255	Large sudden position change detected on the joint-encoder	The argument 255 is a number that relates to the size of the position change. In other words this can be treated as a C78 error.	Example.
C80A51	Window watchdog reset		
C100	Robot changed mode	Status warning, general modus change	Check preceding errors in log history
C101	Real Robot Connected		
C102	Real Robot not connected – Simulating Robot		
C103	UR Ethernet Error	Comm. Prob. Between Mother Board and Safety Control Board	Check cable
C103A1	Connection to Safety Control Board lost	PC did not receive 3 packets in a row	Check that the Ethernet cable between PC board and Safety Control Board is connected and restart system

C103A2	Package lost from Safety Control Board		
C104	Error=Empty command sent to robot		
C111	Something is pulling the robot		Check Payload setting
C115	Unknown robot type	The robot type specified in the configuration is unknown	
C116	Realtime part warning	Possible CPU-overload due to structure of user program	Restructure user program
C117	Restart SCB failed	The Safety Control Board couldn't be rebooted from the controller.	Reboot the robot
C150	Protective Stop: Position close to joint limits		
C151	Protective Stop: Tool orientation close to limits		
C152	Protective Stop: Position close to safety plane limits		
C153	Protective Stop: Position deviates from path		
C154	Protective Stop: Position in singularity	Robot cannot move linear in a singularity	Use jointspace movement or change the motion
C155	Protective Stop: Robot cannot maintain its position, check if payload is correct		
C156	Protective Stop: Wrong payload or mounting detected, or something is pushing the robot when entering Freedrive mode	The robot may move unexpected due to wrong settings	Verify that the TCP configuration and mounting in the used installation is correct
C160	Protective stop: The robot was powered off last time due to a joint position disagreement	1. Verify that the robot position in the 3D graphics matches the real robot, to ensure that the encoders function before releasing the brakes. Stand back and monitor the robot performing its first program cycle as expected. 2. If the position is not correct, the robot must be repaired. In this case, click "Power Off Robot". 3. If the position is correct, please tick the check box below the 3D graphics and click "Robot Position Verified"	
C161	Protective stop: Large movement of the robot detected while it was powered off. The joints were moved	1. Verify that the robot position in the 3D graphics matches the real robot, to ensure that the encoders function before releasing the	

	while it was powered off, or the encoders do not function.	brakes. Stand back and monitor the robot performing its first program cycle as expected. 2. If the position is not correct, the robot must be repaired. In this case, click “Power Off Robot”. 3. If the position is correct, please tick the check box below the 3D graphics and click “Robot Position Verified”	
C171	Issue with blends		
C171A0	A MoveC-waypoint were skipped due to a blend.	The value for the blend radius is too large compared to the distance between the waypoints.	Decrease the blend radius or choose waypoints that are further apart.
C171A1	Blend radius too small in a MoveC		
C171A3	A ServoC-waypoint were skipped due to a blend.	The value for the blend radius is too large compared to the distance between the waypoints.	Decrease the blend radius or choose waypoints that are further apart.
C171A4	Overlapping Blends in a MoveJ, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.
C171A5	Overlapping Blends in a MoveJ, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.
C171A6	Overlapping Blends in a MoveJ, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.
C171A7	Overlapping Blends in a MoveJ, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.
C171A9	A MoveP-waypoint were skipped due to a blend.	The value for the blend radius is too large compared to the distance between the waypoints.	Decrease the blend radius or choose waypoints that are further apart.
C171A10	Blend radius too small error in a MoveP		
C171A11	Overlapping Blends in a MoveL, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.
C171A12	Overlapping Blends in a MoveL, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.
C171A13	Overlapping Blends in a MoveL, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.

C171A14	Overlapping Blends in a MoveL, a waypoint was skipped		Decrease the blend radius or choose waypoints that are further apart.
C172	Illegal control mode		
C184	Joint self test not received by controller		
C185A1	START_NORMAL_OPERATION is not allowed on selftest firmware		
C185A2	GOTO_BACKDRIVE_COMMAND is not allowed on selftest firmware		
C186A1	joint_mode == JOINT_RUNNING_MODE is not allowed on selftest firmware		
C191	Safety system violation		
C191A1	Joint position limit violated		
C191A2	Joint speed limit violated		Reduce acceleration or speed for joint
C191A3	TCP speed limit violated		Reduce acceleration or speed for joint
C191A4	TCP position limit violated		
C191A5	TCP orientation limit violated		
C191A6	Power limit violated		Reduce acceleration or speed for joint
C191A7	Joint torque window violated		
C191A8	Joint torque window too large		
C191A9	Reduced mode output violation		
C191A10	Safeguard stop output violation		
C191A11	Emergency stop output violation		
C191A12	Momentum limit violation		
C191A13	Robot moving output violation		
C191A14	Robot is not braking in stop mode	During the braking process, the safety system monitors if the robot brakes as expected. If this is not the case, this error is generated	Check payload settings and mounting
C191A15	Robot is moving in stop mode	When the robot is stopped due to a safety violation or a safeguard stop, the safety system generates this error, if the robot moves while in this mode	Is the robot physically pushed while safeguard stopped?
C191A16	Robot did not stop in time		
C191A17	Received a null vector for TCP orientation	Fault in config file, when no GUI is used	
C191A18	Robot not stopping output violation		

C191A19	Invalid safety IO configuration	Fault in config file, when no GUI is used	
C191A20	Configuration information or limit sets not received		
C191A21	The other safety processor detected a violation		
C191A22	Received unknown command from Controller		Check Firmware
C191A23	Invalid setup of safety limits		Check Firmware
C191A24	Reduced Mode Output set, while it should not be		Check Firmware
C191A25	Reduced Mode Output not set, while it should be		Check Firmware
C191A26	Not Reduced Mode Output set, while it should not be		Check Firmware
C191A27	Not Reduced Mode Output not set, while it should be		Check Firmware
C191A28	Robot Emergency Stop exceeded maximum stop time	Too high payload	
C191A29	System Emergency Stop exceeded maximum stop time	Too high payload	
C191A30	Safeguard Stop exceeded maximum stop time	Too high payload	
C191A31	Operation mode switch is present while the three position switch is missing		
C192	Safety system fault		
C192A1	Robot still powered in emergency stop	When emergency stop is active, the robot arm powers off. The controller is responsible for sending the power off command. This error is generated, if the safety system detects that the robot arm still has power.	
C192A2	Robot emergency stop disagreement	E-stop in teach pendant or in Robot E-stop circuit problem	Check cables or replace Safety Control Board (SCB)
C192A3	System emergency stop disagreement	System E-stop circuit problem	Check cables or replace Safety Control Board (SCB)
C192A4	Safeguard stop disagreement	Safeguard circuit problem	Check cables or replace Safety Control Board (SCB)
C192A5	Euromap safeguard stop disagreement	Euromap circuit problem	Check cables from Safety Control Board to Euromap to external machine
C192A6	Joint position disagreement		Reduce payload, check for encoder problems
C192A7	Joint speed disagreement		Reduce payload, check for encoder problems
C192A8	Joint torque disagreement		Reduce payload, check for encoder problems

C192A9	TCP speed disagreement		Reduce payload, check for encoder problems
C192A10	TCP position disagreement		Reduce payload, check for encoder problems
C192A11	TCP orientation disagreement		Reduce payload, check for encoder problems
C192A12	Power disagreement	Power calculation: uP-A and uP-B disagreement	Joint error: Check previous error codes from the same joint and evaluate
C192A13	Joint torque window disagreement		
C192A14	Reduced mode input disagreement	Safety I/O uP-A and uP-B disagreement	Check cables
C192A15	Reduced mode output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A16	Safety output failed		
C192A17	Safeguard stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A18	The other safety processor is in fault		
C192A19	Emergency stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A20	SPI output error detected	Safety Control Board	Check 24 V supply
C192A21	Momentum disagreement		
C192A22	Robot moving output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A23	Wrong processor ID		
C192A24	Wrong processor revision		
C192A25	Potential brownout detected	Voltage drop on Safety Control Board(SCB) or defect SCB	
C192A26	Emergency stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A27	Safeguard stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A28	Robot not stopping output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A29	Safeguard reset input disagreement	Safety I/O uP-A and uP-B disagreement	Check cables
C192A30	Safety processor booted up in fault mode		
C192A31	Reduced Mode Output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A32	Not Reduced Mode Output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
C192A33	Checksum disagreement between uA and uB		
C192A34	User safety config checksum disagreement between uA and GUI		
C192A35	Robot config checksum disagreement between uA and GUI		

C192A36	Online RAM test failed		
C192A37	Not all safety related functionalities are running		
C192A38	Package too short for CRC calculation		
C192A39	Three position switch input disagreement		
C192A40	Operation mode switch input disagreement		
C193	One of the nodes is in fault mode	SCB has detected an error	See previous error or update the firmware on the joint or reboot system
C193A0	Joint 0 is in fault mode	SCB has detected an error	See previous error or update the firmware on the joint or reboot system
C193A1	Joint 1 is in fault mode	SCB has detected an error	See previous error or update the firmware on the joint or reboot system
C193A2	Joint 2 is in fault mode	SCB has detected an error	See previous error or update the firmware on the joint or reboot system
C193A3	Joint 3 is in fault mode	SCB has detected an error	See previous error or update the firmware on the joint or reboot system
C193A4	Joint 4 is in fault mode	SCB has detected an error	See previous error or update the firmware on the joint or reboot system
C193A5	Joint 5 is in fault mode	SCB has detected an error	See previous error or update the firmware on the joint or reboot system
C193A6	Tool is in fault mode	SCB has detected an error	See previous error or reboot system
C193A7	Screen 1 is in fault mode	SCB has detected an error on Safety processor 1 in Teach pendant	See previous error or reboot system
C193A8	Screen 2 is in fault mode	SCB has detected an error on Safety processor 2 in Teach pendant	See previous error or reboot system
C193A9	Euromap 1 is in fault mode	SCB has detected an error	See previous error or reboot system
C193A10	Euromap 2 is in fault mode	SCB has detected an error	See previous error or reboot system
C194	One of the nodes is not booted or not present		
C194A0	Joint 0 is not booted or not present	SCB has detected an error	
C194A1	Joint 1 is not booted or not present	SCB has detected an error	
C194A2	Joint 2 is not booted or not present	SCB has detected an error	
C194A3	Joint 3 is not booted or not present	SCB has detected an error	

C194A4	Joint 4 is not booted or not present	SCB has detected an error	
C194A5	Joint 5 is not booted or not present	SCB has detected an error	
C194A6	Tool is not booted or not present	SCB has detected an error	
C194A7	Screen 1 is not booted or not present	SCB has detected an error on Safety processor 1 in Teach pendant	
C194A8	Screen 2 is not booted or not present	SCB has detected an error on Safety processor 2 in Teach pendant	
C194A9	Euromap 1 is not booted or not present	SCB has detected an error	
C194A10	Euromap 2 is not booted or not present	SCB has detected an error	
C194A128	Joint 0 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	1. Check for loose communication cable. 2. Replace base
C194A129	Joint 1 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	1. Check for loose communication cable. 2. Replace shoulder
C194A130	Joint 2 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	1. Check for loose communication cable. 2. Replace elbow
C194A131	Joint 3 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	1. Check for loose communication cable. 2. Replace Wrist 1
C194A132	Joint 4 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	1. Check for loose communication cable. 2. Replace Wrist 2
C194A133	Joint 5 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	1. Check for loose communication cable. 2. Replace Wrist 3
C194A134	Tool not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	1. Check for loose communication cable. 2. Replace Tool
C195	Conveyor speed too high	Conveyor speed higher than robot is able to run	Make sure that conveyor tracking is set correct up
C195A1	Conveyor speed too high for joint speed safety limit		Make sure that conveyor tracking is set correct up
C195A2	Conveyor speed too high for TCP speed safety limit		Make sure that conveyor tracking is set correct up
C195A3	Conveyor speed too high for momentum safety limit		Make sure that conveyor tracking is set correct up
C196	MoveP speed too high	Too high speed in relation to blend radius	Reduce speed or increase blend radius in user program

C197	Blend overlap warning		
C200	Safety Control Board hardware error	SCB: uP-A has detected an error	
C200A1	Hardware ID is wrong	SCB: uP-A has detected an error: Wrong SCB	
C200A2	MCU type is wrong	SCB: uP-A has detected an error	
C200A3	Part ID is wrong	SCB: uP-A has detected an error	
C200A4	RAM test failed	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
C200A5	Register test failed	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
C200A6	pRom Crc test failed	SCB: uP-A has detected an error: firmware error	Replace Safety Control Board (SCB)
C200A7	Watchdog reset the processor	SCB: uP-A has detected an error	
C200A8	OVG signal test not passed	SCB: uP-A has detected an error: over voltage generator	Replace Safety Control Board (SCB)
C200A9	3V3A power good pin is low	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
C200A10	3V3B power good pin is low	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
C200A11	5V power good is low	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
C200A12	3V3 voltage too low	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
C200A13	3v3 voltage too high	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
C200A14	48V input is too low		Check: 48 V power supply, current distributer energy eater or replace SCB
C200A15	48V input is too high		Check: 48 V power supply, current distributer energy eater or replace SCB
C200A16	24V IO short circuited	Too high current	Disconnect external connections
C200A17	PC current is too high	Motherboard takes too high current	
C200A18	Robot voltage is too low		Check: Short circuit in robot arm, 48 V power supply, current distributer energy eater or replace SCB
C200A19	Robot voltage is too high		Check: 48 V power supply, current distributer energy eater or replace SCB
C200A20	24V IO voltage is too low		Disconnect I/O or replace SCB
C200A21	12V voltage is too high		Check 12 V power supply, cables or replace SCB
C200A22	12V voltage is too low		Check 12 V power supply, cables or replace SCB

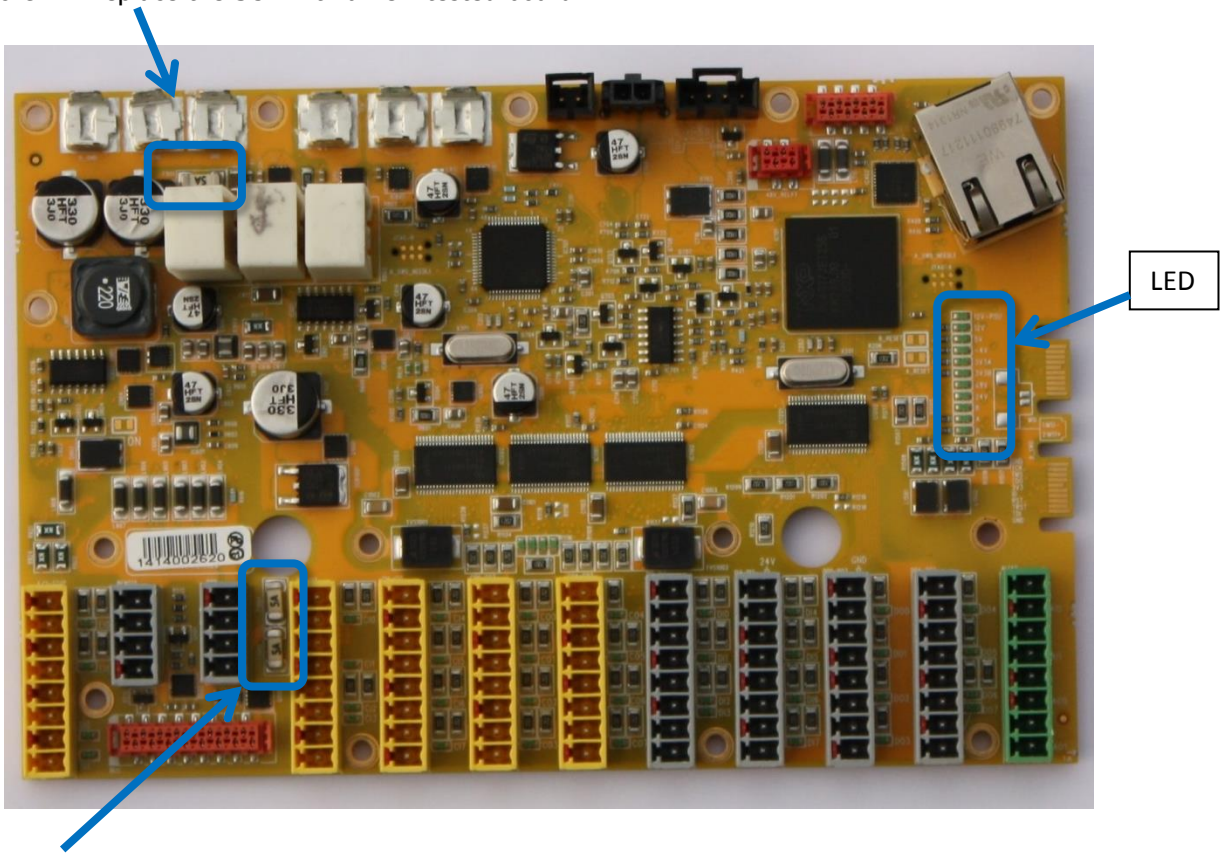
C200A23	It took too long to stabilize 24V	Safety Control Board error(SCB)	External 24 V problem or replace SCB
C200A24	It took too long to stabilize 24V IO	Safety Control Board error(SCB)	External 24 V problem or replace SCB
C200A25	24V voltage is too high	Safety Control Board error(SCB)	Replace Safety Control Board (SCB)
C200A26	24V IO voltage is too high		Disconnect I/O or replace SCB
C201	Setup of safety board failed	Invalid safety parameters have been received	Verify that the setup of the Safety Configuration is valid. Check the Ethernet connection between Motherboard and Safety Control Board.
C202	SCE configuration was illegal, after applying tolerances		
C203A0	PolyScope detected a mismatch between the shown and (to be) applied safety parameters	The PolyScope continuously verifies that the shown safety parameters are equal to the running parameters	Check that the software version is the same or newer than the firmware on the safety control board. Reload the installation and re boot the robot
C204A0	Protective Stop: Invalid setpoint		
C204A1	Sudden change in target position		
C204A2	Inconsistency between target position and speed		
C204A3	Sudden stop	The program contains motions that are not ramped correctly down	To abort a motion, use “stopj(a)” or “stopl(a)” script commands to generate a smooth deceleration.”
C204A4	Robot is not braking in stop or pause mode		If this happens, report it as a bug
C204A5	Robot program resulted in invalid setpoint		
C204A6	Blending failed and resulted in an invalid setpoint		Try changing the blend radius or contact technical support
C205	Target speed does not match target position		
C205A0	Inconsistency between target position and speed		
C206	Sanity check failed		The software version on the robot must be the same or later than the version the robot had from the factory.

C206A0	Target joint speed does not match target joint position – Joint 0 (Base)	
C206A1	Target joint speed does not match target joint position – Joint 1 (Shoulder)	
C206A2	Target joint speed does not match target joint position – Joint 2 (Elbow)	
C206A3	Target joint speed does not match target joint position – Joint 3 (Wrist 1)	
C206A4	Target joint speed does not match target joint position – Joint 4 (Wrist 2)	
C206A5	Target joint speed does not match target joint position – Joint 5 (Wrist 3)	
C207	Fieldbus input disconnected	Check fieldbus connections or disable the fieldbus in the installation

5.2 LED indicators and Fuses on Safety Control Board

Safety Control Board (SCB)

Fuse 48 V:
The 5 A fuse "48 V" protects all 48 V for over current in the system inclusive Euromap.
This information is only for troubleshooting. Do NOT replace the fuse on any circumstances.
Do ONLY replace the SCB with a new tested board.



Fuse 24 V:
2 fuses 5 Amp in parallel for the DI/DO 24 V supply on the safety control board no matter if the 24 V is from the controller or external power supply. Do NOT replace the fuse on any circumstances. Do ONLY replace the SCB with a new tested board.

LED indicators:

12V-PSU	On when the power plug is connected.
12V	System: On when the power on has been activated
5V	On when "12 V System" is on and indicate that 5 V is ok.
-4V	On when "12 V System" is on and indicate that - 4 V to analog I/O is ok.
3V3A	On when 5V is on and indicate 3.3 V for logic Safety circuit A
3V3B	On when 5V is on and indicate 3.3 V for logic Safety circuit B
48V	48 V is present on the safety control board
24V	48 V is detected and ok, indicate that internal 24 V is present for I/O's
R	48 V on robot arm
A	Status for Logic A: a blink sequence
B	Status for Logic B: a blink sequence

Normal startup sequence on a CB3.x UR3:

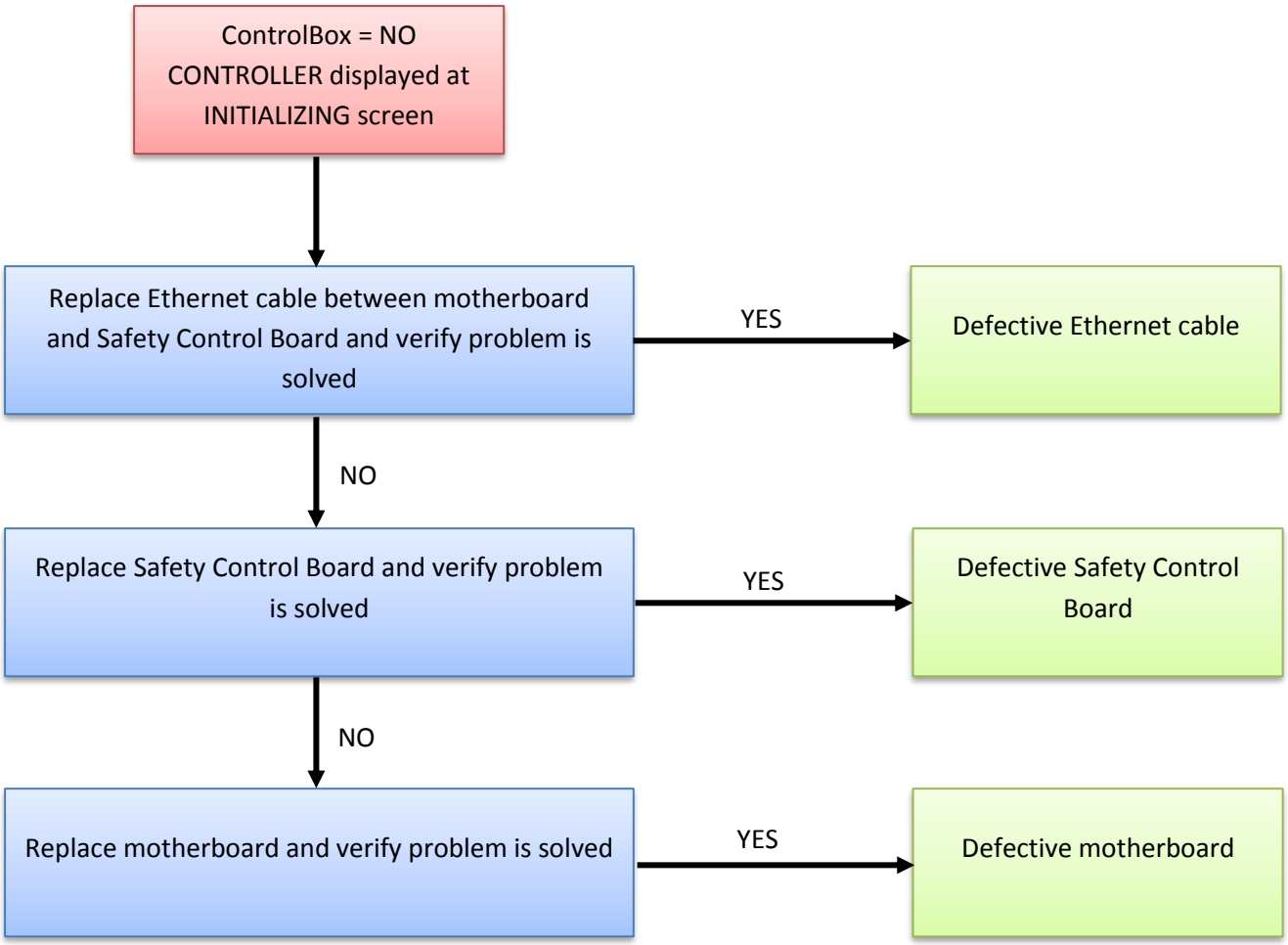
1. The 12V-PSU LED is on when the power plug is connected to a working power supply.
2. When the power button on the teach pendant is pressed, all LED indicators are turned on except for the 48V, 24V and R LEDs. The A and B LEDs also exhibit a special behavior by intermittently turning off and on ("blinking") once triggered.
3. The final phase of the startup sequence occurs (immediately) after the Polyscope software is done loading. At this stage, the 48V and 24V LED indicators become active (are switched on).

   If the 48V LED indicator is off all the time in the startup sequence you should measure the voltage:
   See the E-Plan diagram: **5.4.1 Schematic overview**

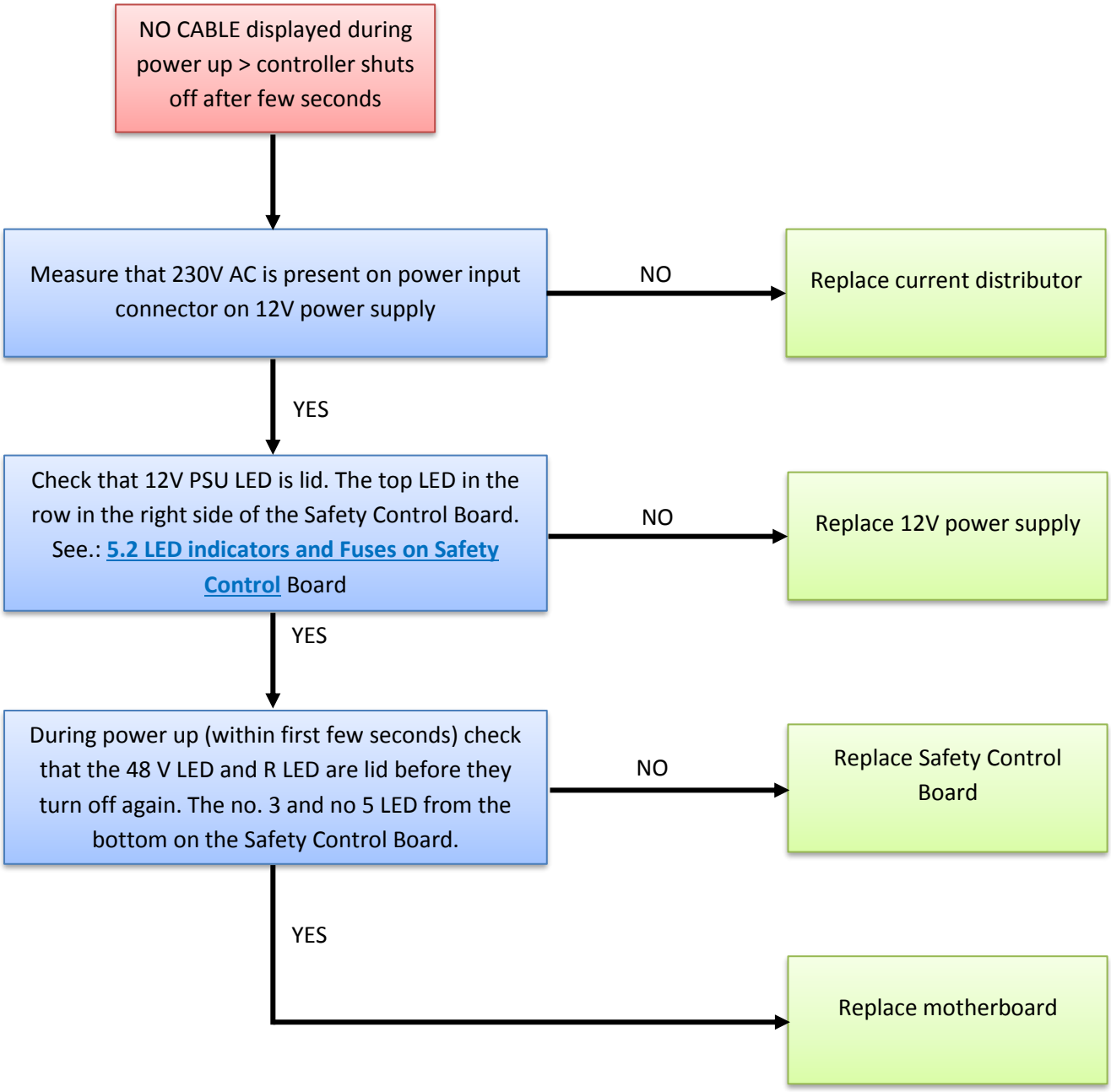
   3.1. Measure the 48V on the Safety Control Board (SCB) where the 48V comes from the Current distributor. And check this 1 second pulse.
   - 3.1.1. The voltage is measured on the Safety Control Board. That means the Safety Control Board is defect.
   - 3.1.2. No voltage is measured on the Safety Control Board. Then measure the 230 V on the input side of the 48V power supply. If the voltage pulse of 1 second is present, the Power supply is defect.
   - 3.1.3. No voltage is measured on the input of the power supply. Then measure the 230 V on the input side of the Current distributor. If the voltage is present, the current distributor is defect.

5.3 Error phenomena

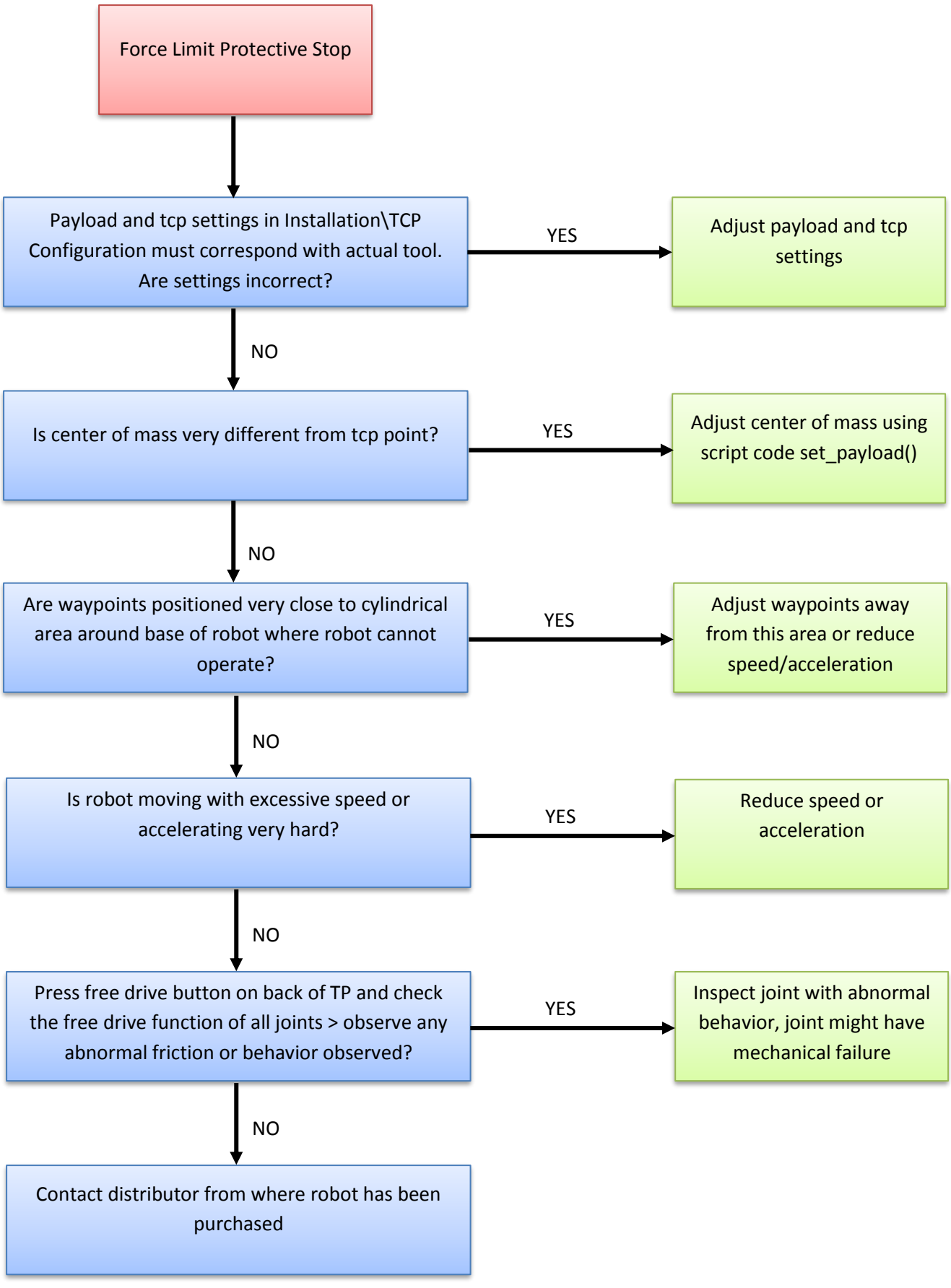
5.3.1 ControlBox: NO CONTROLLER displayed in Initializing



5.3.2 NO CABLE displayed during power up



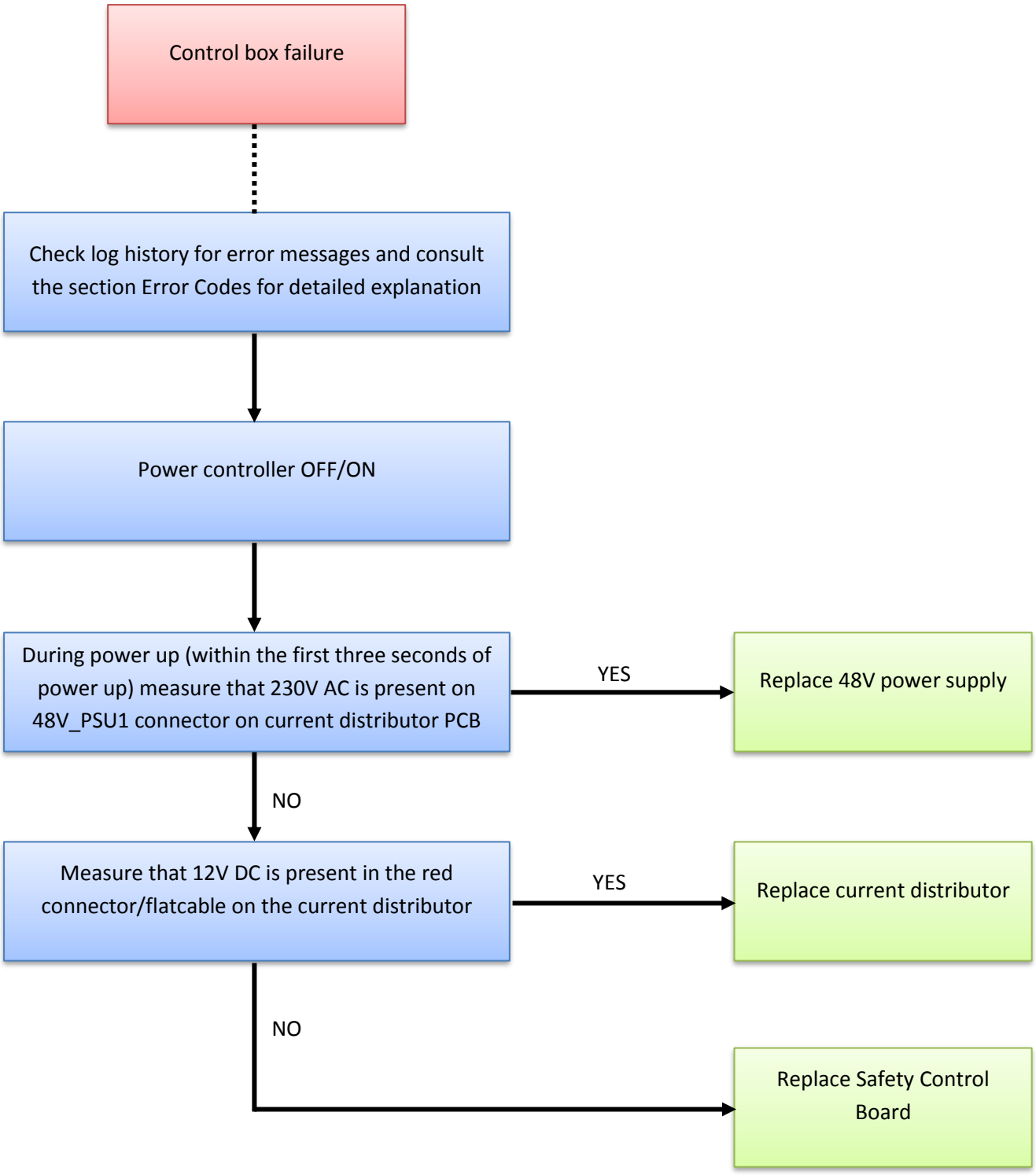
5.3.3 Force limit protective stop

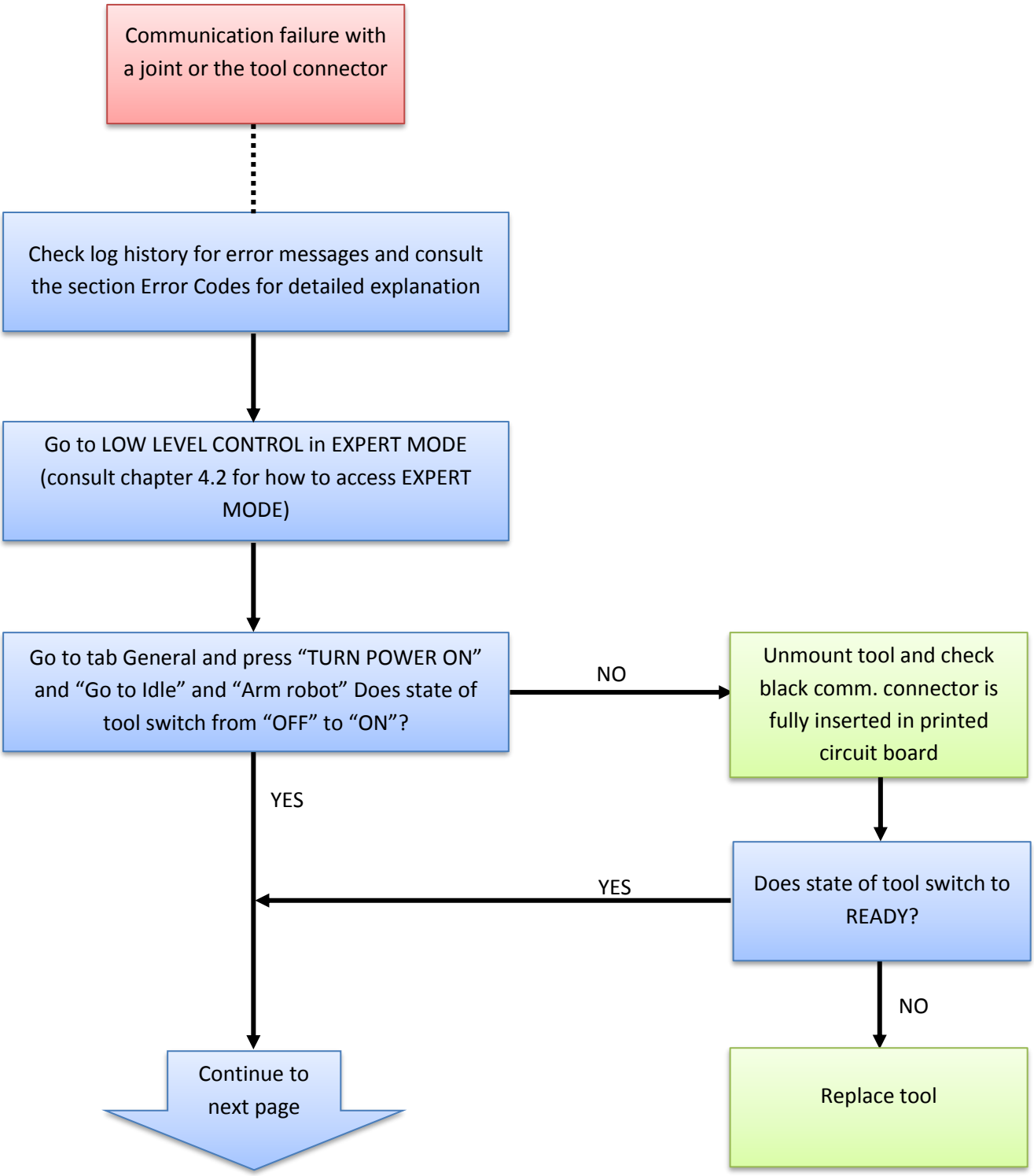


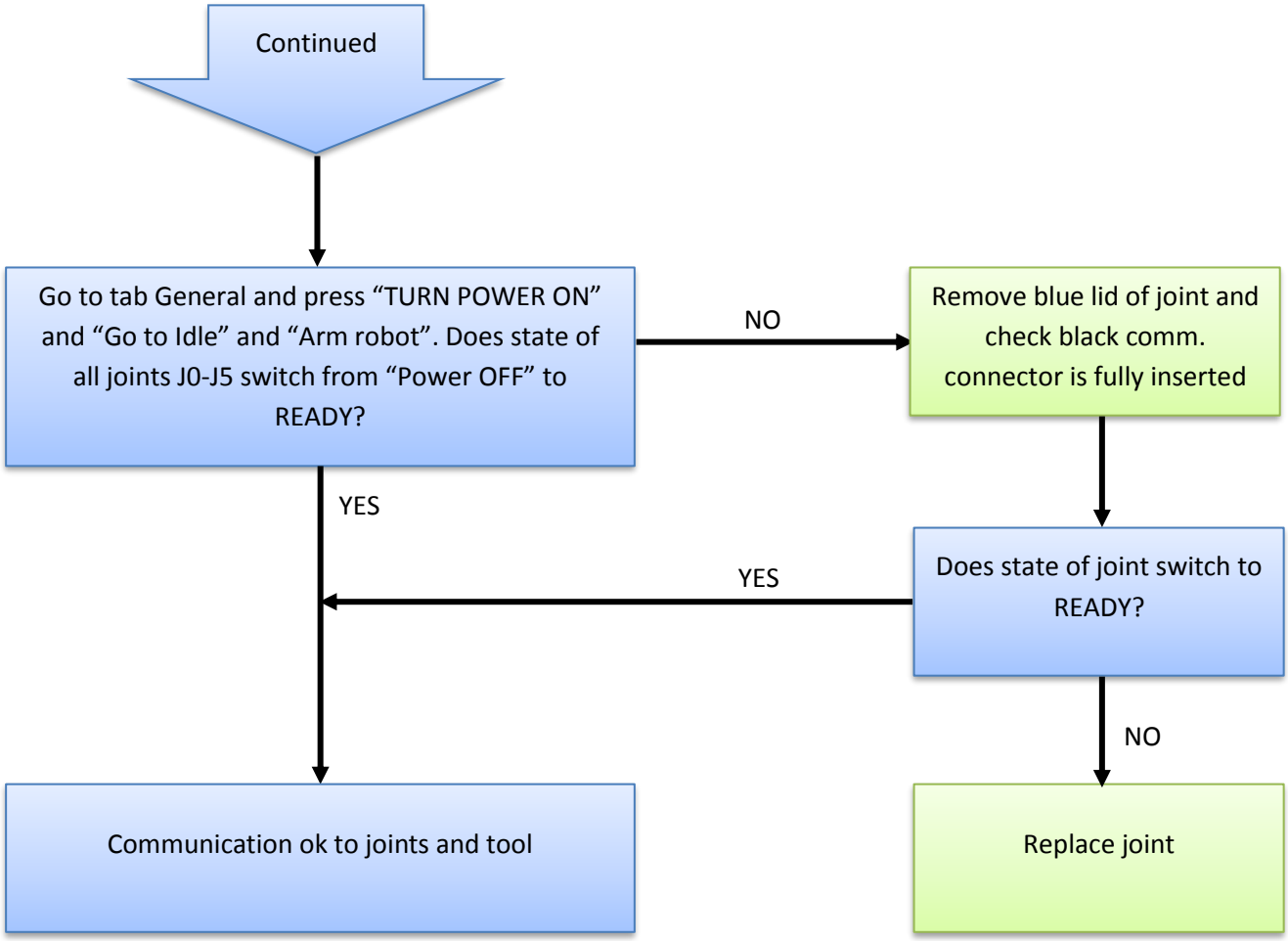
5.3.4 Power on failure in Initializing

If power turns off a few seconds after Robot Power is turned On in the Initializing window, there are many possible causes for this phenomenon.

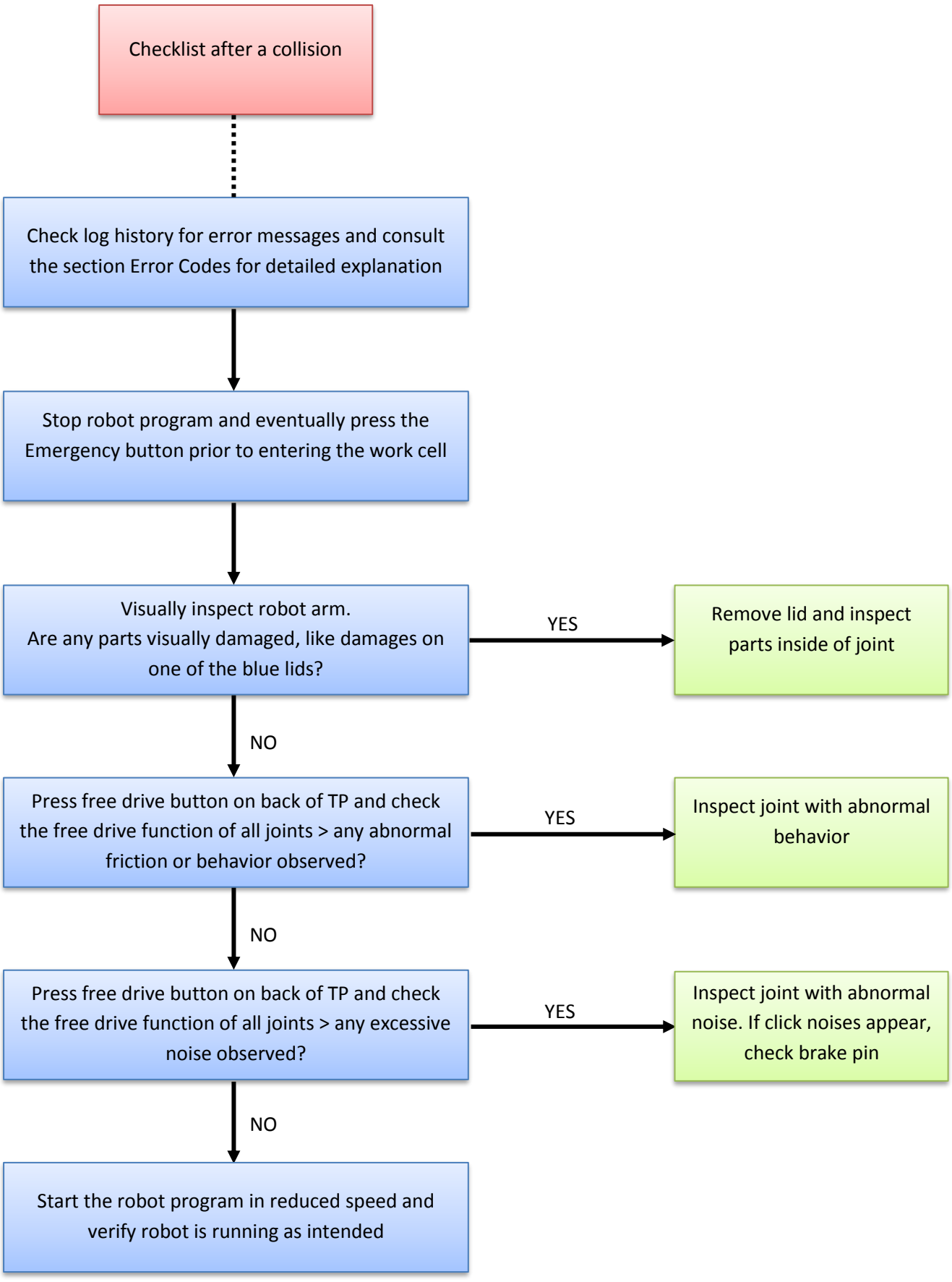
Most likely it is a control box failure or a communication failure with a joint or the tool.




Communication failure with a joint or the tool connector
Check log history for error messages and consult the section Error Codes for detailed explanation
Go to LOW LEVEL CONTROL in EXPERT MODE (consult chapter 4.2 for how to access EXPERT MODE)
Go to tab General and press “TURN POWER ON” and “Go to Idle” and “Arm robot” Does state of tool switch from “OFF” to “ON”?
NO
Unmount tool and check black comm. connector is fully inserted in printed circuit board
YES
Does state of tool switch to READY?
YES
NO
Continue to next page
Replace tool


Continued
Go to tab General and press “TURN POWER ON” and “Go to Idle” and “Arm robot”. Does state of all joints J0-J5 switch from “Power OFF” to READY?
NO
Remove blue lid of joint and check black comm. connector is fully inserted
YES
Does state of joint switch to READY?
YES
NO
Communication ok to joints and tool
Replace joint

5.3.5 Checklist after a collision



5.4 Electrical drawing

5.4.1 Schematic overview

Diagrams in pdf or in E-plan format, can be found on the support site
http://www.universal-robots.com/support/

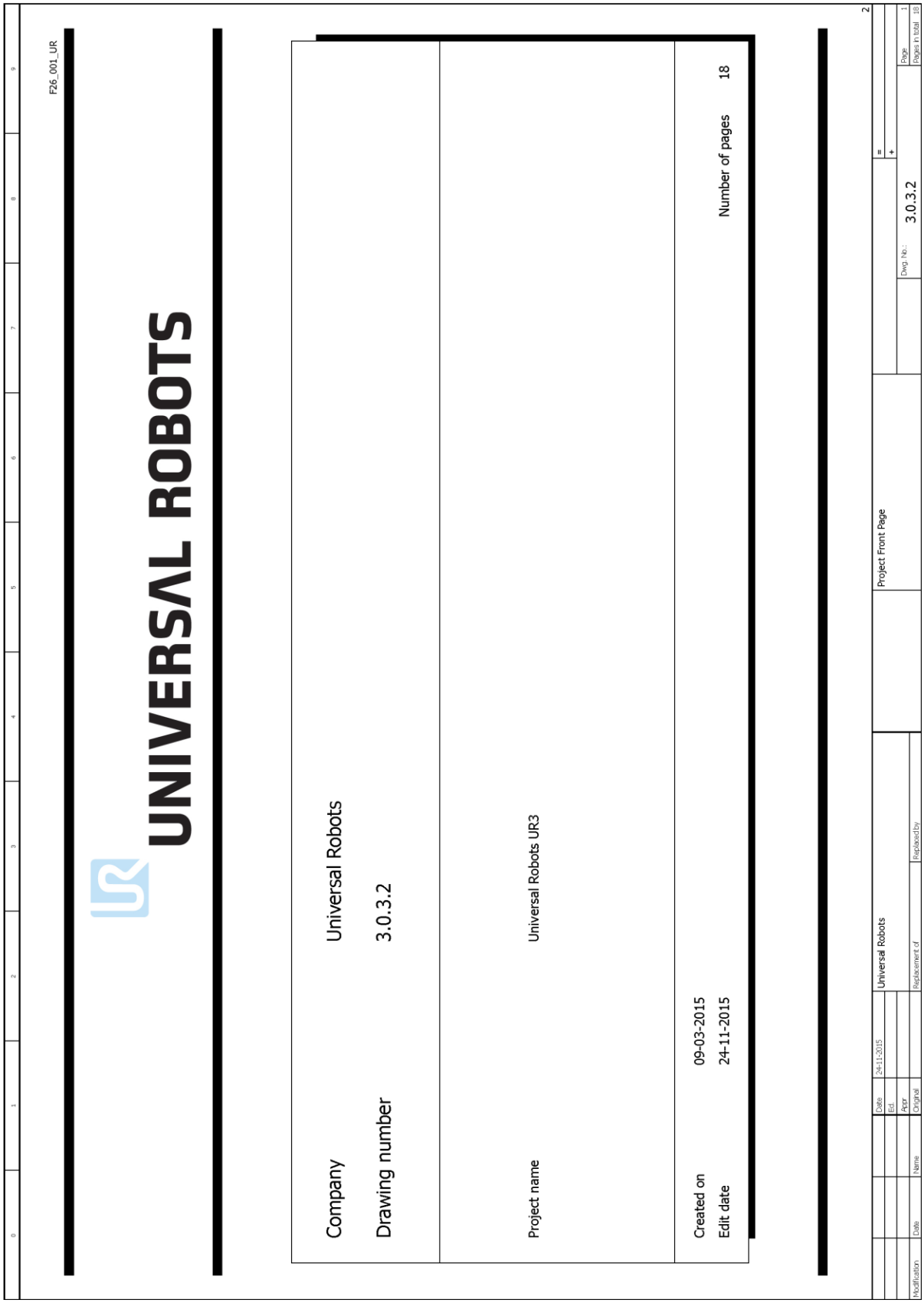


Table of contents

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1

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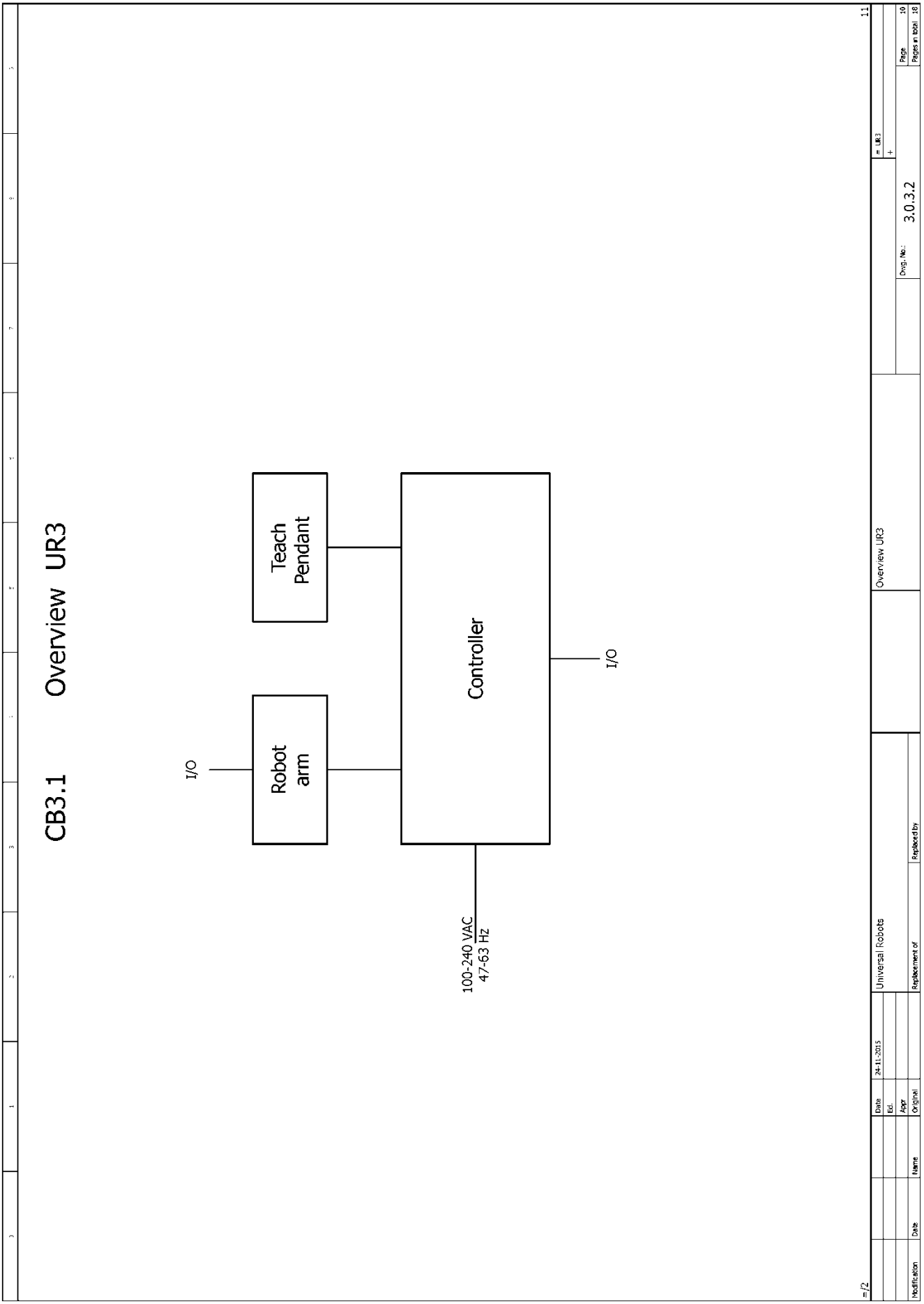
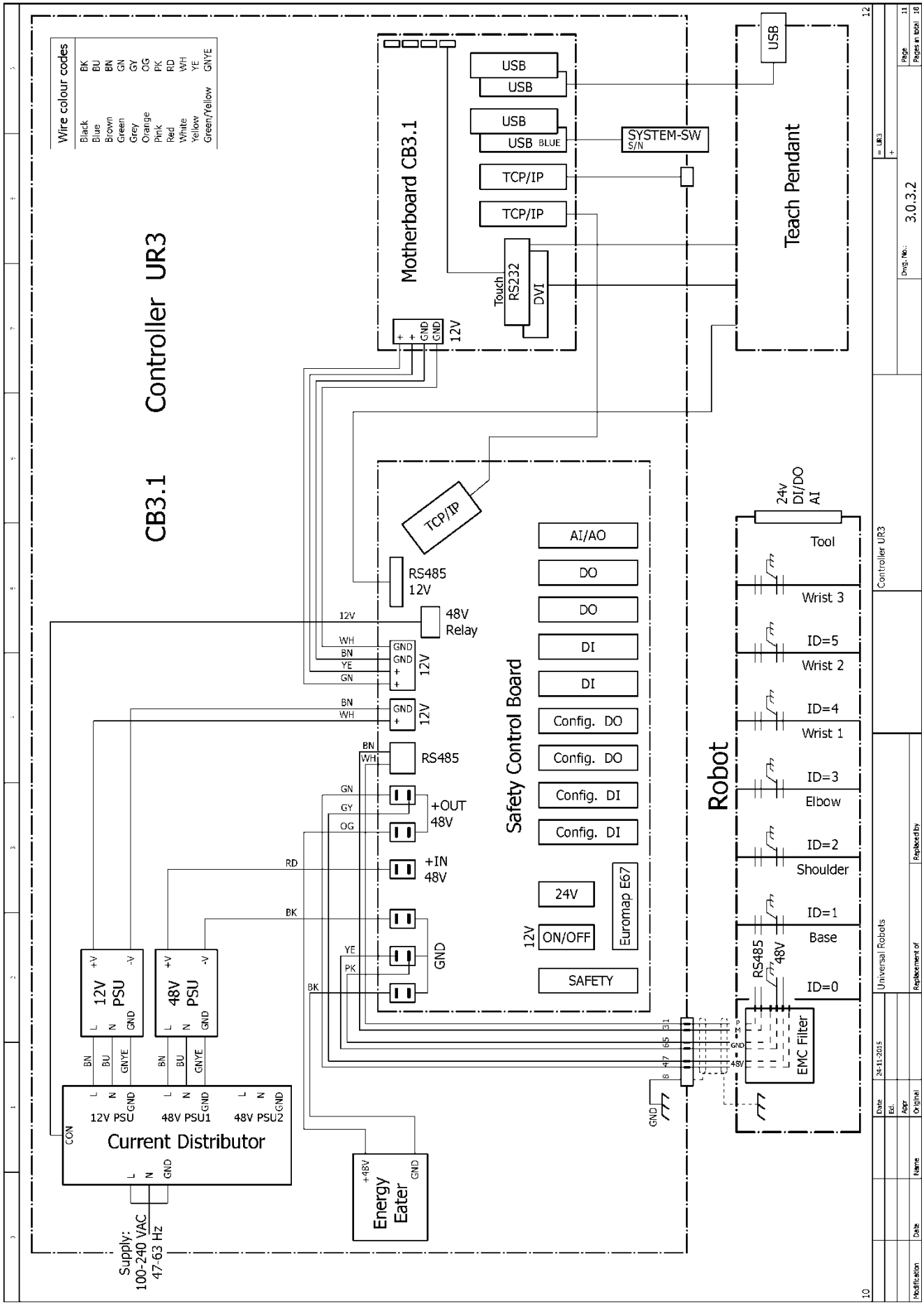
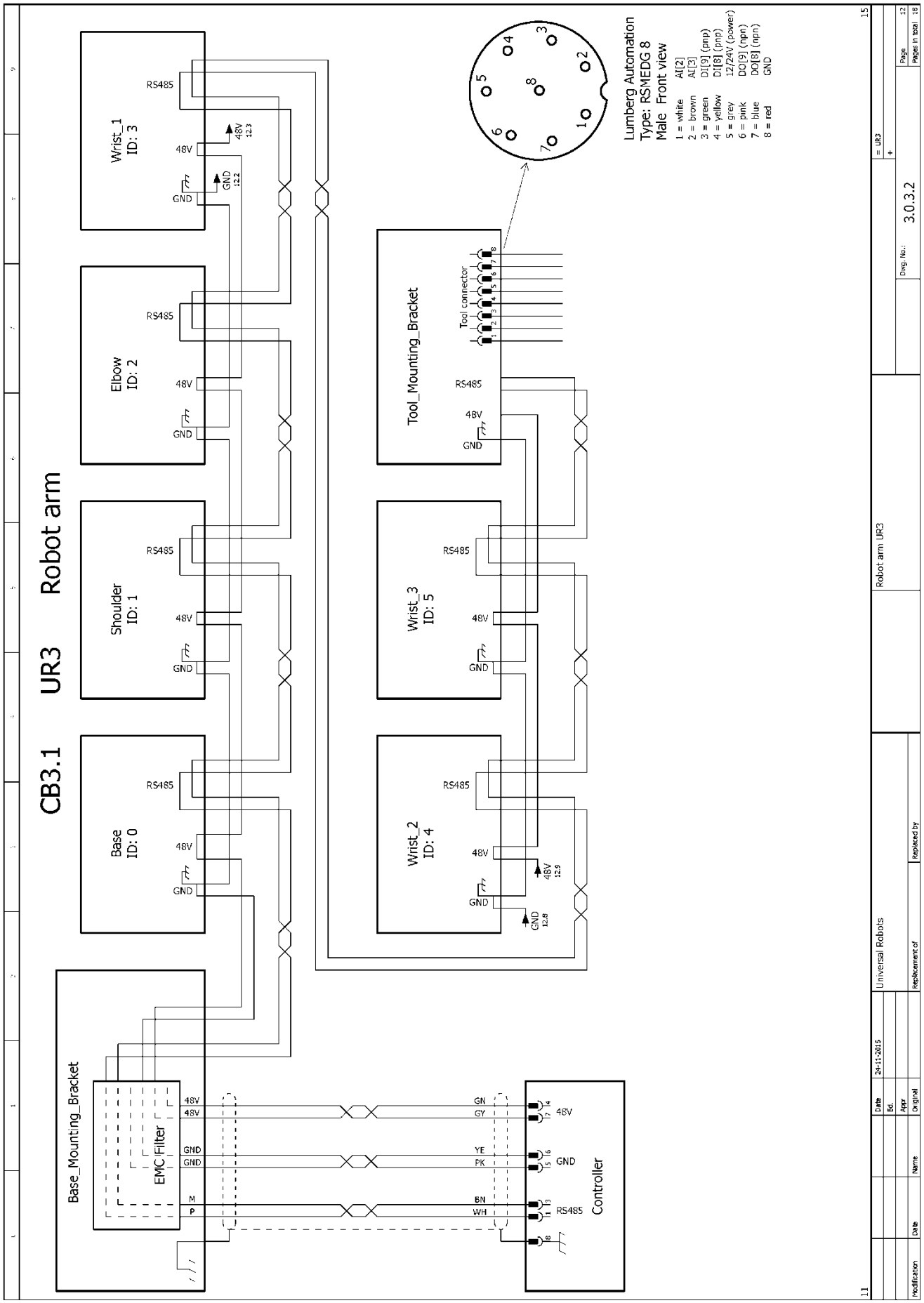
			Date	24-11-2015	Universal Robots		Table of Contents (index)	=	
			Ed.					+	
			Appr				Dwg. No.: 3.0.3.2	Page	2
Modification	Date	Name	Original		Replacement of	Replaced by		Pages in total	18

UNIVERSAL ROBOTS


CB3.1 Overview UR3
Teach Pendant
Robot arm
Controller
I/O
I/O
100-240 VAC
47-63 Hz
Overview UR3
Universal Robots
3.0.3.2

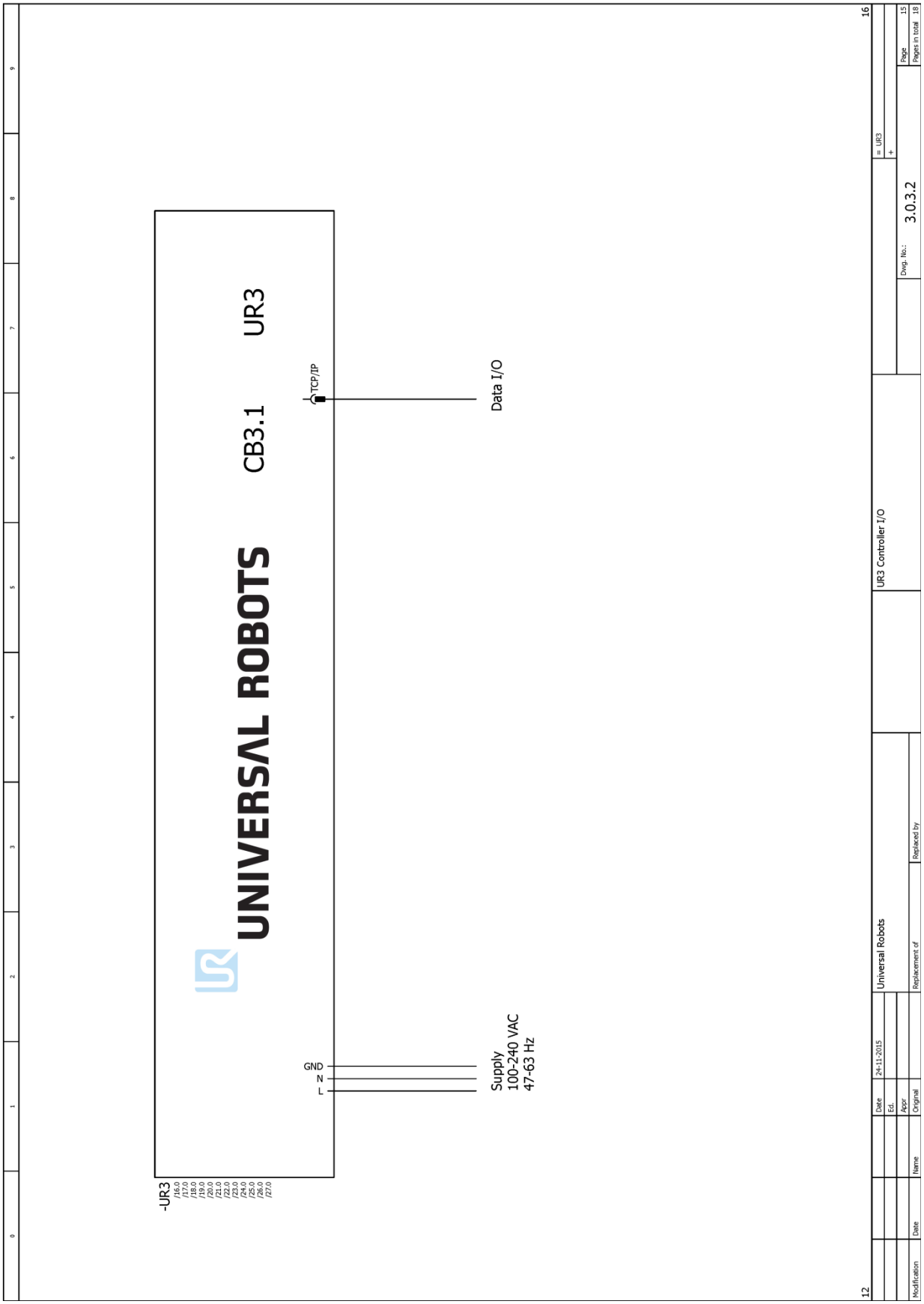

Controller UR3
CB3.1
Wire colour codes
Black BK
Blue BU
Brown BN
Green GN
Grey GY
Orange OG
Pink PK
Red RD
White WH
Yellow YE
Green/Yellow GNYE
Motherboard CB3.1
USB
USB
USB
USB BLUE
TCP/IP
TCP/IP
SYSTEM-SW S/N
Touch
RS232
DVI
12V
GND
GND
+
+
Teach Pendant
USB
TCP/IP
RS485 12V
48V Relay
12V
WH
BN
YE
GN
BN
WH
BN
WH
RS485
GN
GY
OG
+OUT 48V
RD
+IN 48V
BK
YE
PK
BK
GND
Safety Control Board
AI/AO
DO
DO
DI
DI
Config. DO
Config. DO
Config. DI
Config. DI
24V
12V
ON/OFF
Euromap E67
SAFETY
24V DI/DO AI
Robot
Tool
Wrist 3
ID=5
Wrist 2
ID=4
Wrist 1
ID=3
Elbow
ID=2
Shoulder
ID=1
Base
ID=0
RS485
48V
EMC Filter
GND
48V
12V PSU
48V PSU
L
N
GND
+V
-V
BN
BU
GNYE
12V PSU
48V PSU1
48V PSU2
CON
Current Distributor
Supply:
100-240 VAC
47-63 Hz
Energy Eater
+48V
GND
Controller UR3
Universal Robots
3.0.3.2
24-11-2015

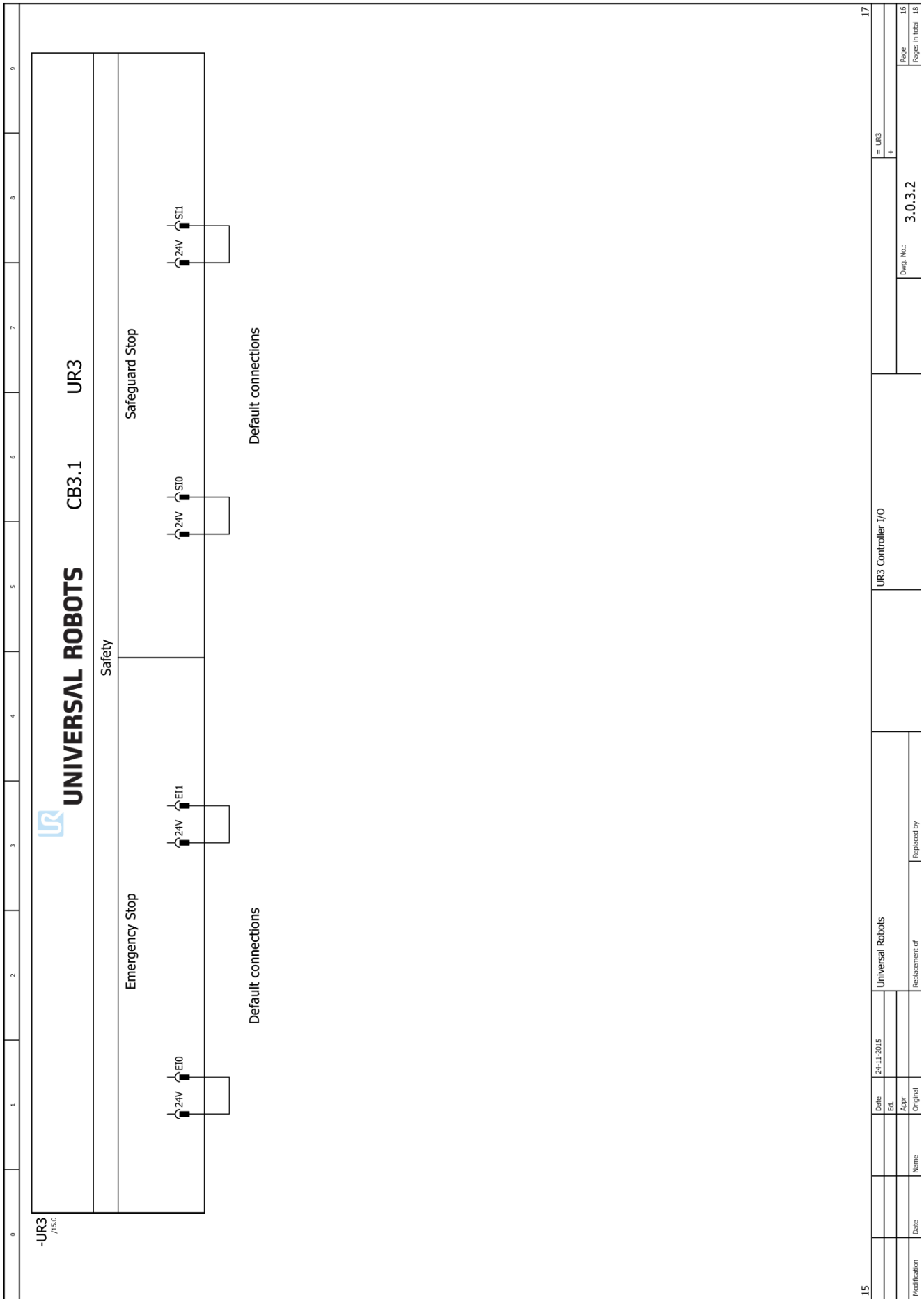

CB3.1 UR3 Robot arm
Base
ID: 0
Shoulder
ID: 1
Elbow
ID: 2
Wrist_1
ID: 3
Wrist_2
ID: 4
Wrist_3
ID: 5
Tool_Mounting_Bracket
Tool connector
Base_Mounting_Bracket
EMC Filter
Controller
RS485
48V
GND
Lumberg Automation
Type: RSMEDG 8
Male Front view
1 = white AI[2]
2 = brown AI[3]
3 = green DI[9] (pnp)
4 = yellow DI[8] (pnp)
5 = grey 12/24V (power)
6 = pink DO[9] (npn)
7 = blue DO[8] (npn)
8 = red GND
Universal Robots
Robot arm UR3
3.0.3.2

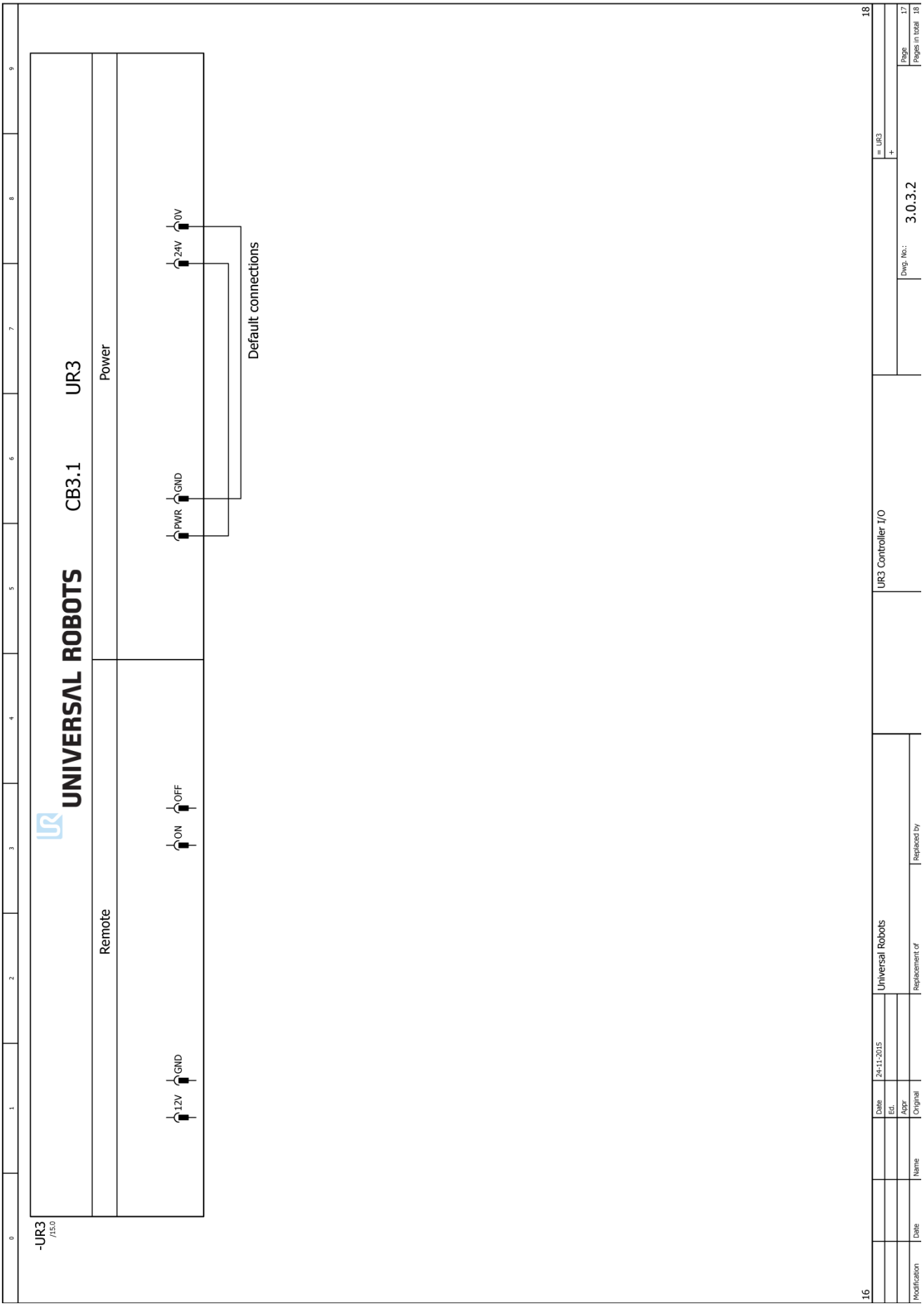
5.4.2 E-Plan diagrams

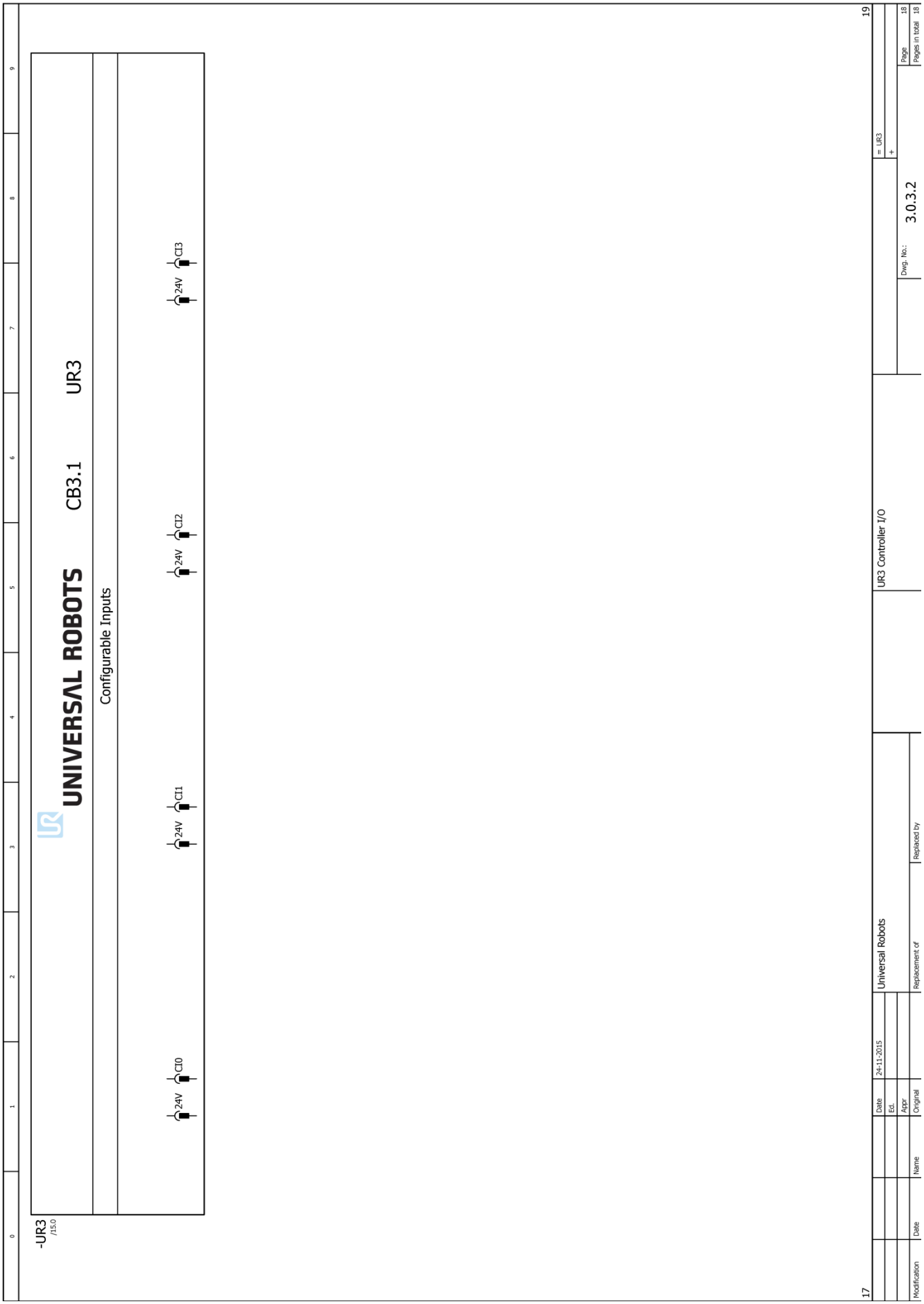
Diagrams in pdf or in E-plan format, can be found on the support site.

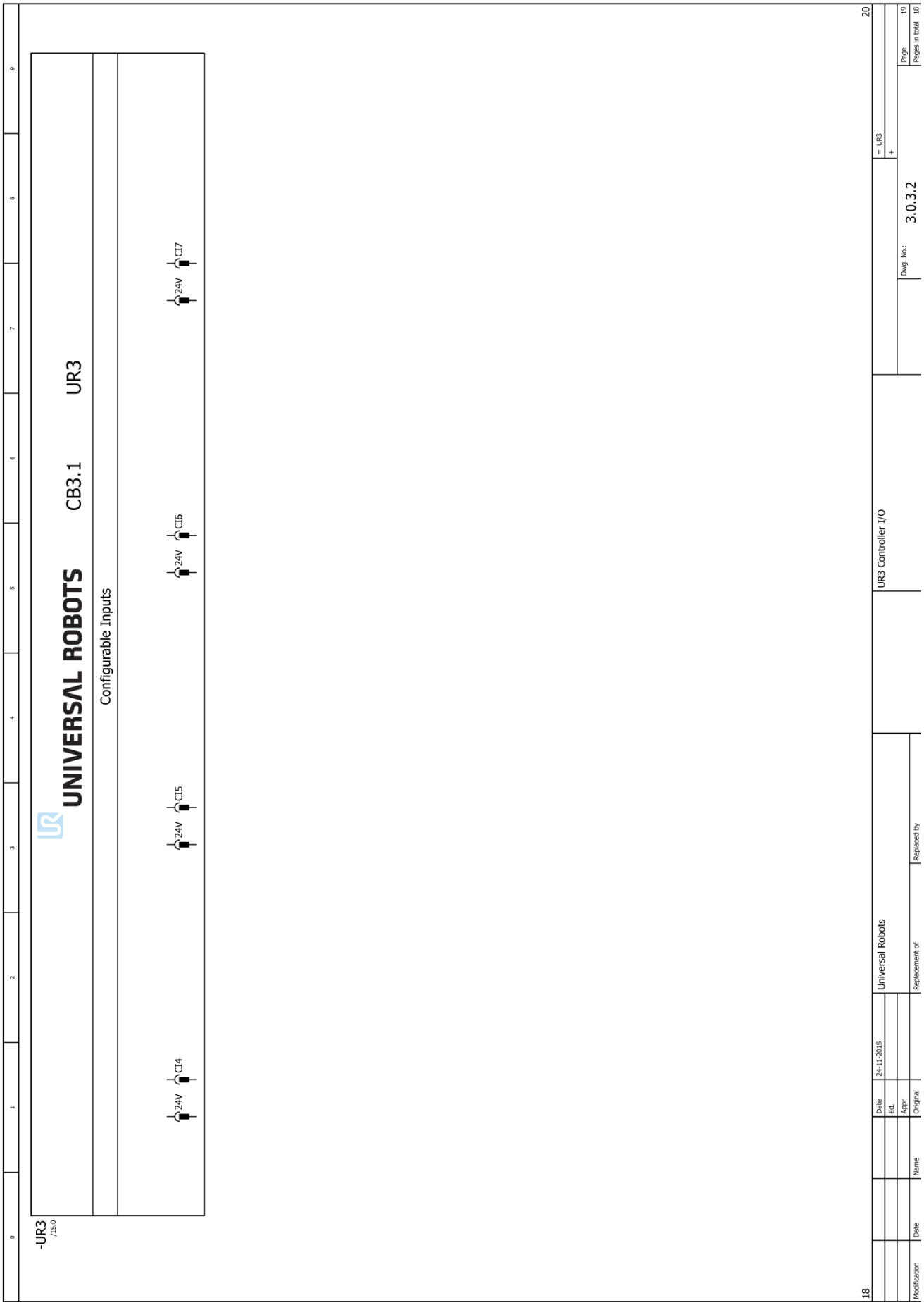
http://www.universal-robots.com/support/

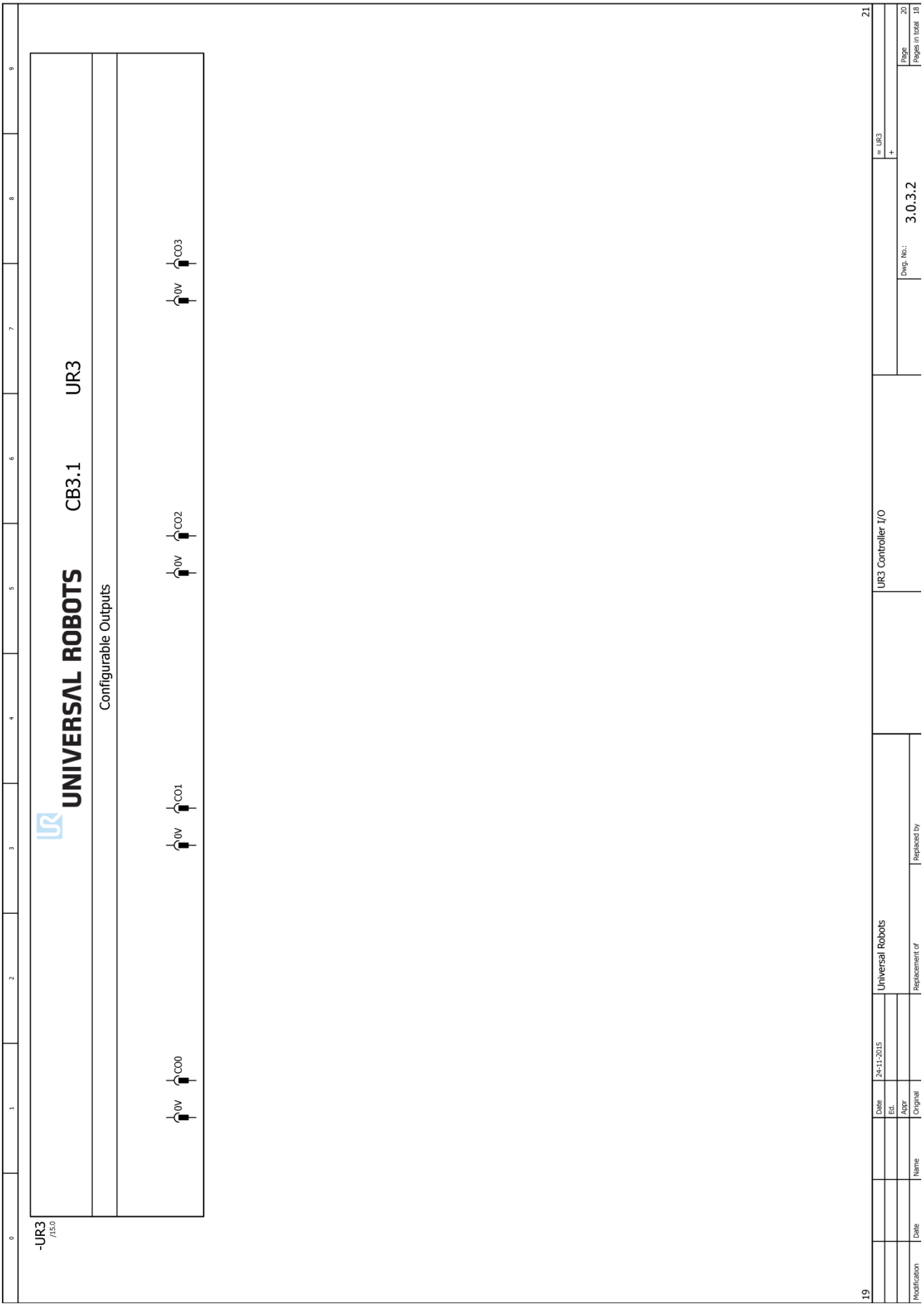


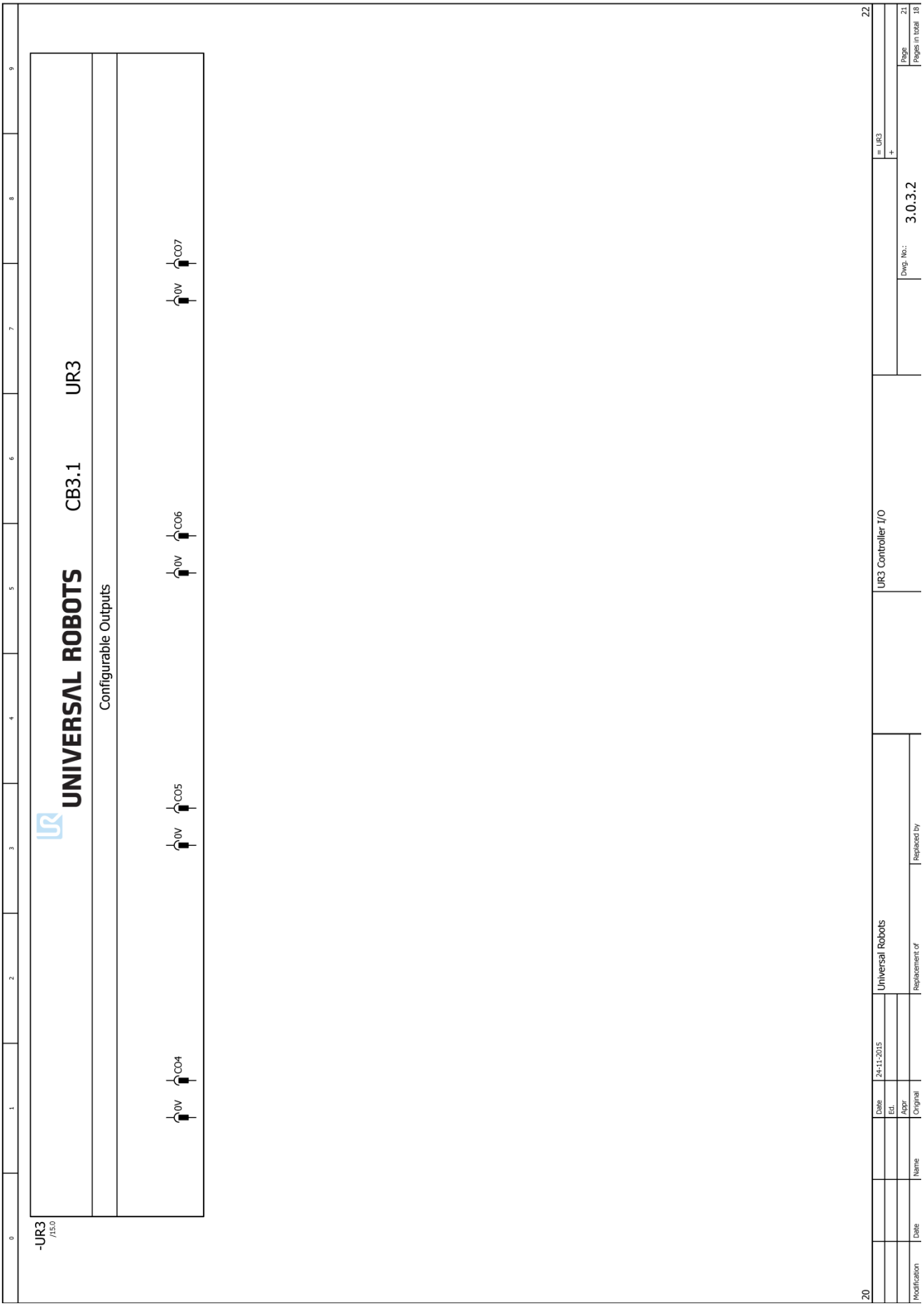

UNIVERSAL ROBOTS
CB3.1
UR3
Safety
Emergency Stop
Safeguard Stop
24V
EI0
24V
EI1
24V
SI0
24V
SI1
Default connections
Default connections
-UR3
/15.0
UR3 Controller I/O
Universal Robots
3.0.3.2
Dwg. No.:
Page
Pages in total
Date
Name
Original
Replacement of
Replaced by
Modification

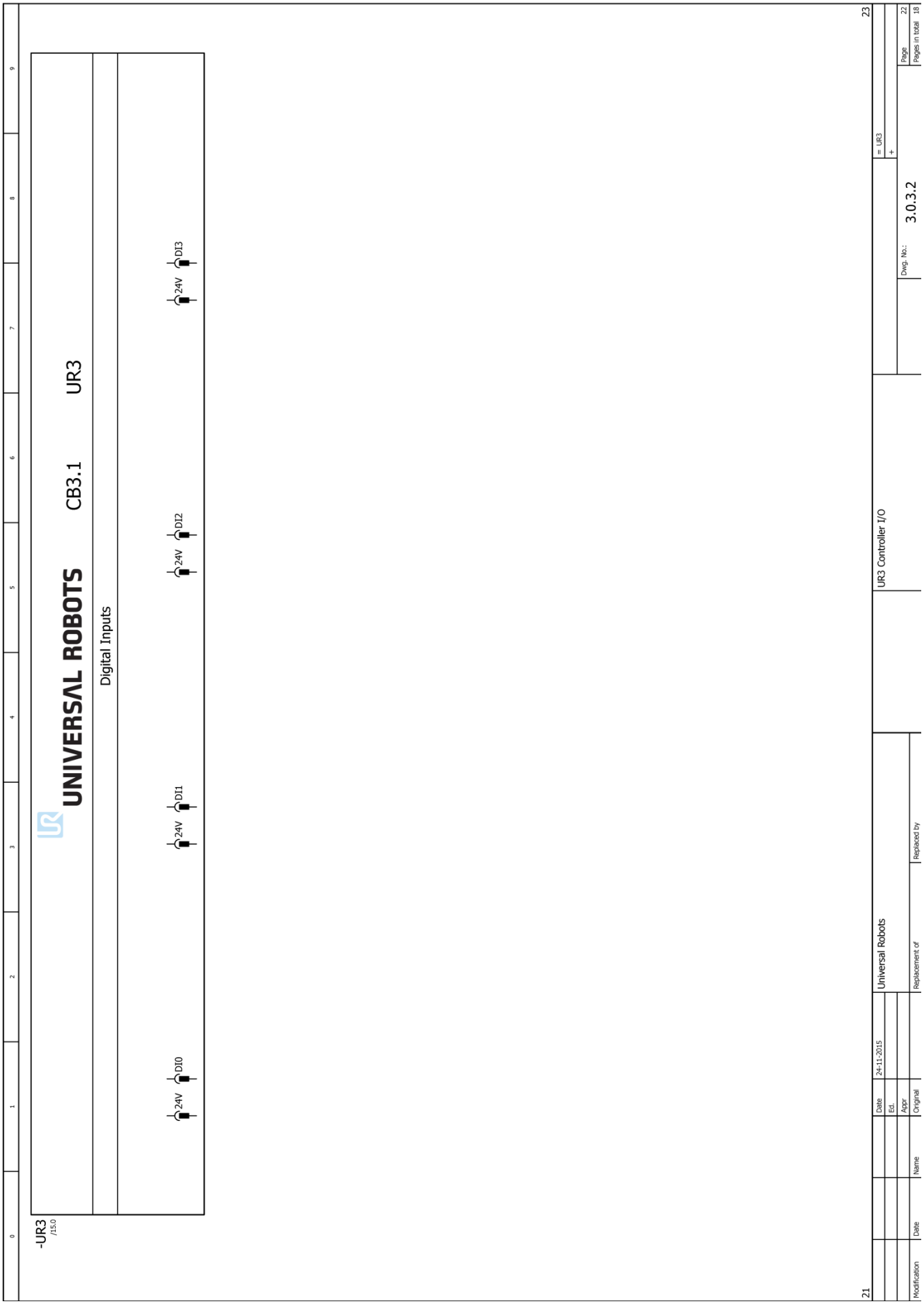

UNIVERSAL ROBOTS
CB3.1
UR3
Power
Remote
0V
24V
PWR
GND
ON
OFF
12V
GND
Default connections
-UR3
/15.0
UR3 Controller I/O
Universal Robots
3.0.3.2
Dwg. No.:
Page
Pages in total
Date
Name
Original
Replacement of
Replaced by
Modification

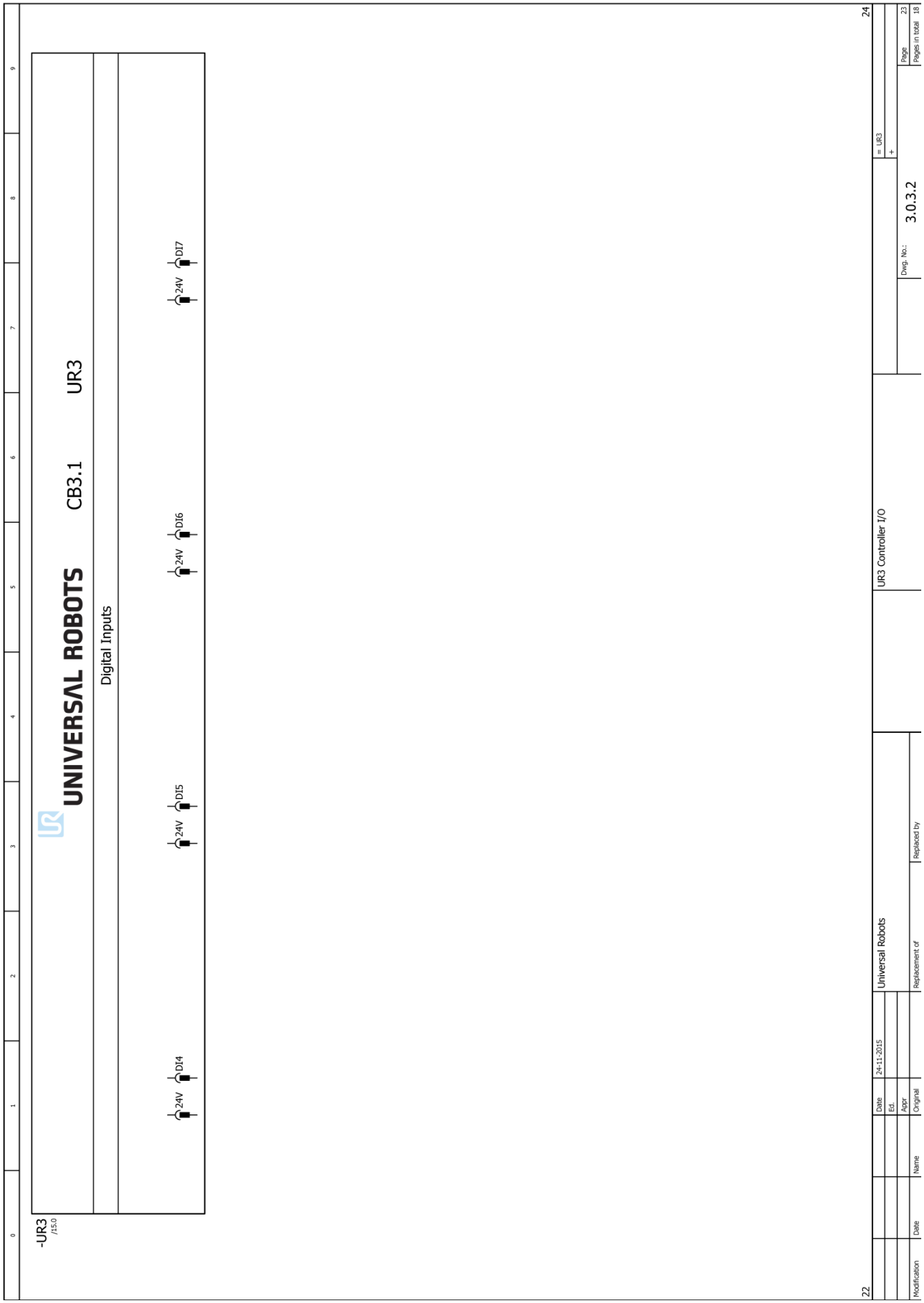

-UR3
/15:0
UNIVERSAL ROBOTS
CB3.1
UR3
Configurable Inputs
24V
CI0
24V
CI1
24V
CI2
24V
CI3
17
19
Universal Robots
UR3 Controller I/O
= UR3
+
Dwg. No.:
3.0.3.2
Page
18
Pages in total
18
Modification
Date
Name
Date
Ed.
Appr
Original
24-11-2015
Replacement of
Replaced by

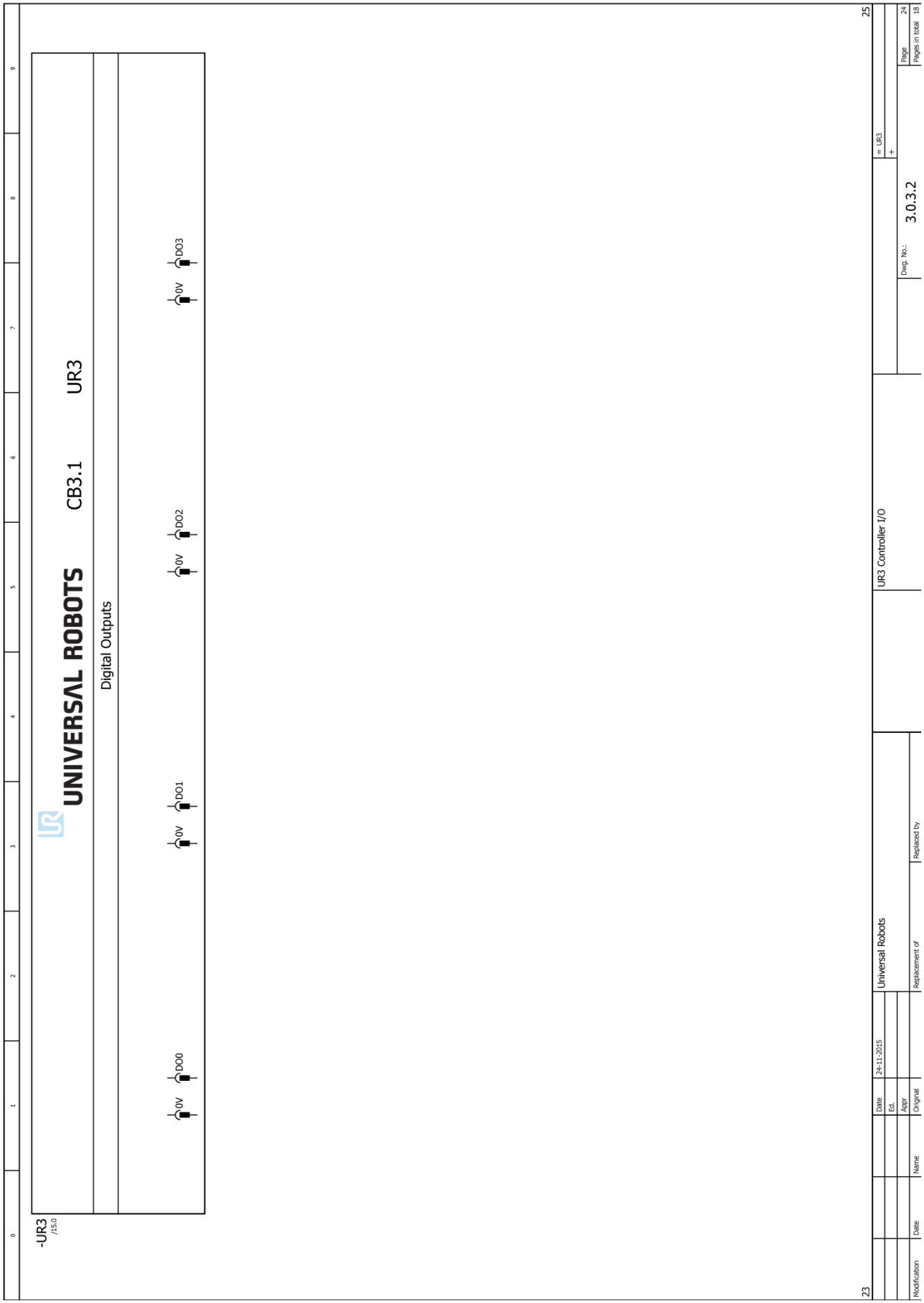

-UR3
/15.0
UNIVERSAL ROBOTS
CB3.1
UR3
Configurable Inputs
24V
CI4
24V
CI5
24V
CI6
24V
CI7
18
20
UR3 Controller I/O
= UR3
+
Dwg. No.:
3.0.3.2
Page
19
Pages in total
18
Universal Robots
Date
24-11-2015
Edi
Appr
Original
Name
Date
Modification
Replacement of
Replaced by

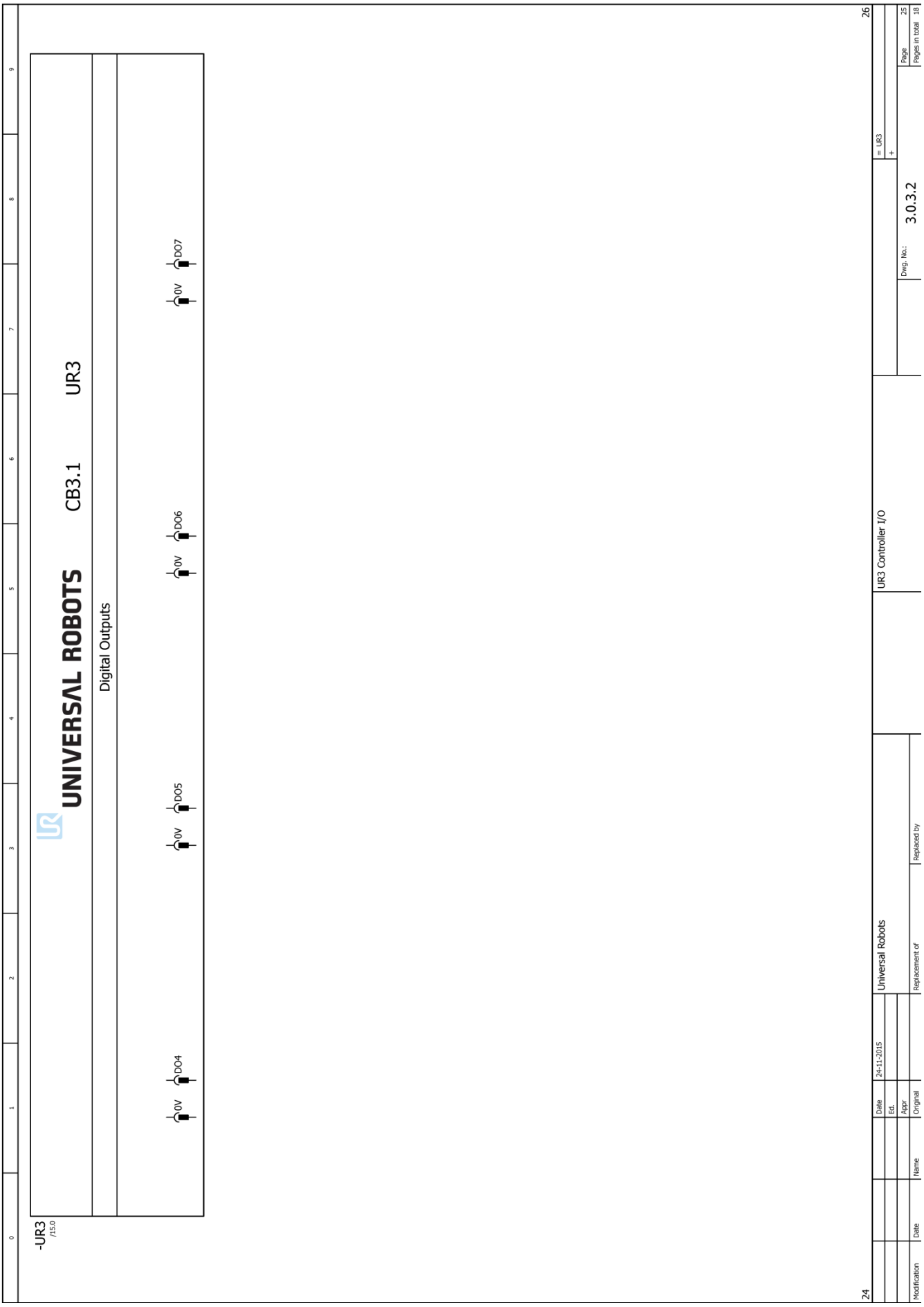

-UR3
/15.0
UNIVERSAL ROBOTS
CB3.1
UR3
Configurable Outputs
0V
CO0
0V
CO1
0V
CO2
0V
CO3
19
21
Date
Name
Modification
Date
Ed.
Appr
Original
24-11-2015
Universal Robots
Replacement of
Replaced by
UR3 Controller I/O
= UR3
+
Dwg. No.:
3.0.3.2
Page
20
Pages in total
18

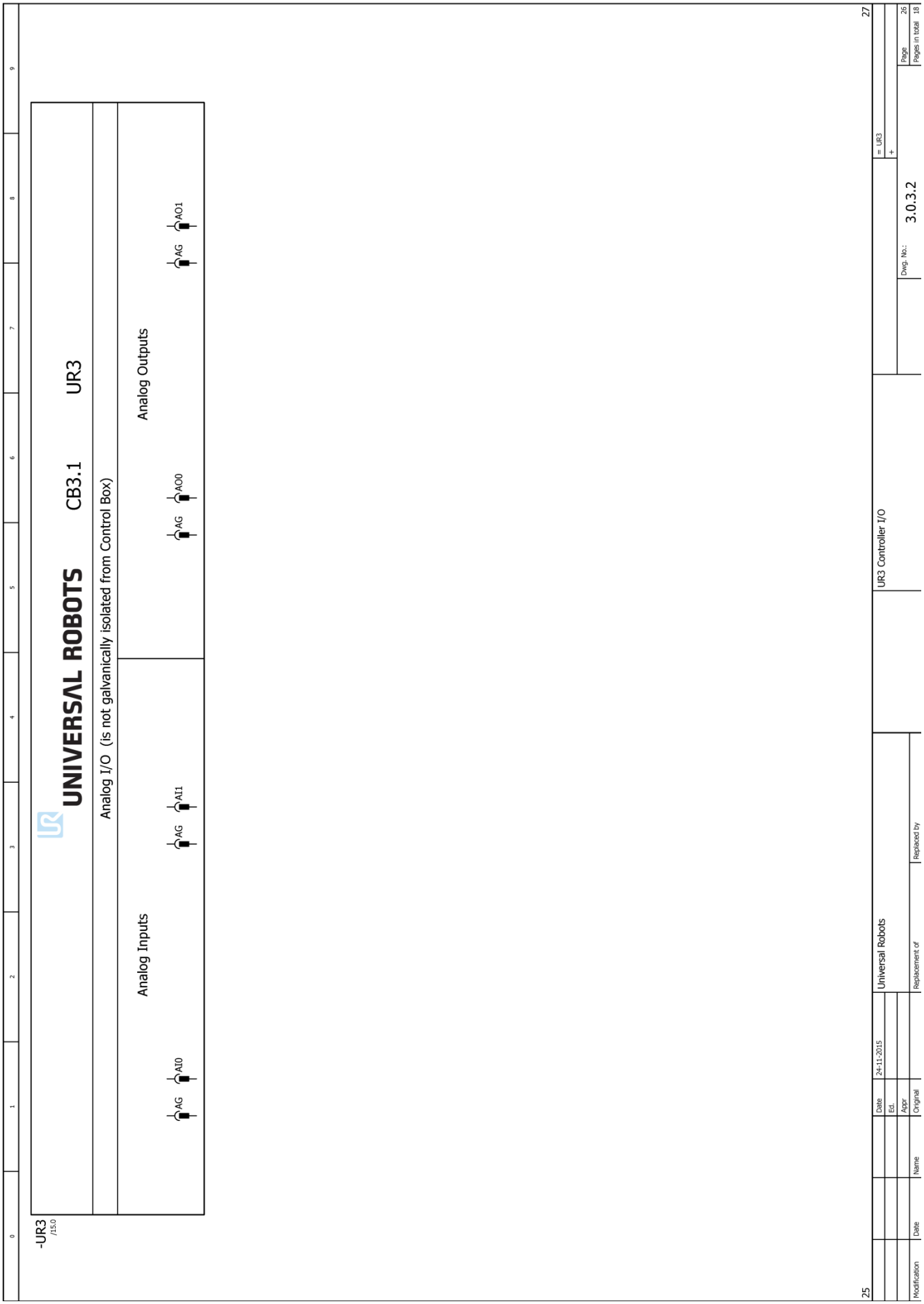

-UR3
/15.0
UNIVERSAL ROBOTS
CB3.1
UR3
Configurable Outputs
0V
CO4
0V
CO5
0V
CO6
0V
CO7
UR3 Controller I/O
Universal Robots
Date
24-11-2015
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by
Dwg. No.:
3.0.3.2
= UR3
+
Page
21
Pages in total
18


UNIVERSAL ROBOTS
CB3.1
UR3
Digital Inputs
-UR3
/15.0
24V
DI0
24V
DI1
24V
DI2
24V
DI3
23
21
Universal Robots
UR3 Controller I/O
= UR3
+
Dwg. No.:
3.0.3.2
Page
22
Pages in total
18
Date
24-11-2015
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by


UNIVERSAL ROBOTS
CB3.1
UR3
Digital Inputs
-UR3
/15.0
24V
DI4
24V
DI5
24V
DI6
24V
DI7
UR3 Controller I/O
Universal Robots
3.0.3.2
Dwg. No.:
Page
Pages in total
Modification
Date
Name
Original
Appr
Ed.
Date
24-11-2015
Replacement of
Replaced by


UNIVERSAL ROBOTS
CB3.1
UR3
Digital Outputs
-UR3
/15.0
0V
DO0
0V
DO1
0V
DO2
0V
DO3
25
23
Universal Robots
UR3 Controller I/O
Date
Ed.
Appr
Original
24-11-2015
Name
Date
Modification
Replacement of
Replaced by
= UR3
+
Dwg. No.:
3.0.3.2
Page
24
Pages in total
18


UNIVERSAL ROBOTS
CB3.1
UR3
Digital Outputs
-UR3
/15.0
0V
DO4
0V
DO5
0V
DO6
0V
DO7
26
24
Universal Robots
UR3 Controller I/O
= UR3
+
Dwg. No.:
3.0.3.2
Page
25
Pages in total
18
Date
24-11-2015
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by


-UR3
/15.0
UNIVERSAL ROBOTS
CB3.1
UR3
Analog I/O (is not galvanically isolated from Control Box)
Analog Inputs
AG
AI0
AG
AI1
Analog Outputs
AG
AO0
AG
AO1
25
27
Date
Ed.
Appr
Original
24-11-2015
Universal Robots
Name
Date
Modification
Replacement of
Replaced by
UR3 Controller I/O
= UR3
+
Dwg. No.:
3.0.3.2
Page
26
Pages in total
18

-UR3
/15.0

UNIVERSAL ROBOTS CB3.1 UR3

Tools connector Inputs/Outputs

26

			Date	24-11-2015	Universal Robots		UR3 Tools I/O	= UR3
			Ed.					+
			Appr				Dwg. No.: 3.0.3.2	Page 27
Modification	Date	Name	Original		Replacement of	Replaced by		Pages in total 18

UNIVERSAL ROBOTS

6 Spare parts

6.1 Spare part list

Item no.	Item designation
Controller:	
122973	Controller excl. Teach Pendant CB3.1 UR3 (With cabinet)
124903	Controller OEM CB3.1 UR3 (Without Teach Pendant and cabinet)
122091	Teach Pendant Incl. Touch Screen & power cable UR3, UR5 & UR10
180001	Stylus Pen
171010	USB Flash 2 GB for UR system SW CB3.1
122650	Motherboard kit CB3.1
172290	Safety Control board kit
177002	Power Supply Unit 12V
177003	Power Supply Unit 48V
172080	Current Distributor PCB
122745	Energy-eater incl. fan
164228	Connector Epic w. cable UR3 (Controller output connector to robot arm)
171031	RAM module DDR3L
177503	Filter kit for controller
106800	Euromap E67 kit CB3
122671	Euromap E67 Bypass Plug
122673	Euromap E67 module CB3
123670	Euromap E67 cable 6 m
Robot arm:	
122030	Base Mounting Bracket Incl. Cable 6 m UR3
124122	Joint Size 2 Base UR3
124222	Joint Size 2 Shoulder UR3
124321	Joint Size 1 Elbow UR3
104003	Elbow counterpart and Lower arm kit UR3
124120	Joint Size 0 Wrist 1 UR3
124220	Joint Size 0 Wrist 2 UR3
124320	Joint Size 0 Wrist 3 UR3
122020	Tool Mounting Bracket UR3
103303	Sealing set UR3, external. Visible flat rings between joints
103413	Lid set complete UR3 incl. seal in the lids

Item no.	Item designation
Accessories:	
173101	Cable for tool, angle: external
131095	Lid Tool protective cap Alu. For tool connector
139033	Bracket for Mounting Teach Pendant
103203	Cover plug kit for UR3 base: 4 x covering screw holes + 1 x cover for cable hole
132407	Bracket for Mounting Controller
107000	Safety Control board Terminal kit
131503	Bracket for mounting robot arm UR3 (Item and Bosch profiles)

6.2 Service kit

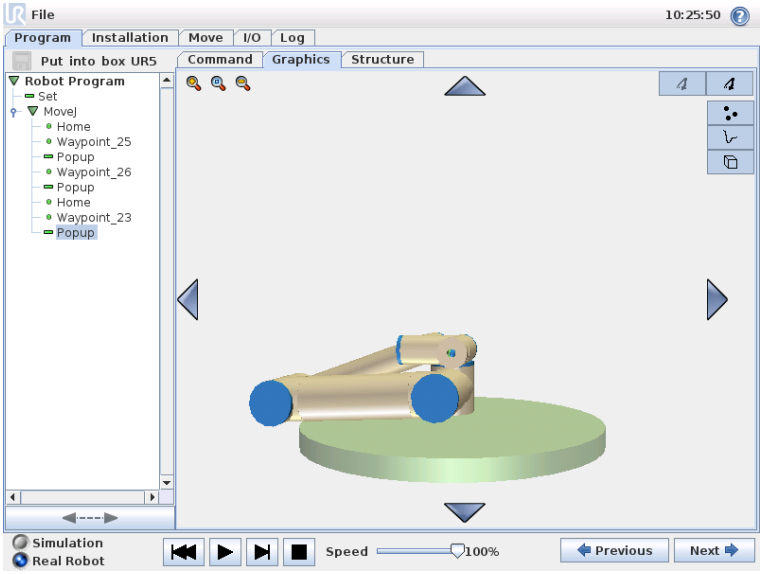
Item no.	Item designation	
109010	Service kit UR3/UR5/UR10 (kit includes all of the below part no.'s)	
109101	Spanner Hex 5.5mm	UR5 & UR10
109102	Spanner Hex 7.0mm	UR5 & UR10
109110	Spanner Hex 10.0mm	UR10 only
	Screwdriver Flat 2.5	UR3 & UR5 & UR10
109103	Screwdriver torx T10	UR5 & UR10
109105	Torque wrench Hex 5.5mm Size 1 and Size 2 (1.3 Nm)	UR5 & UR10
109106	Torque wrench Hex 7.0mm Size 3 (3.0 Nm)	UR5 & UR10
109107	Torque wrench Hex 10.0mm Size 4 (8.0 Nm)	UR10 only
109104	Torque screwdriver torx T8 + T10 (0.4 Nm)	UR3 & UR5 & UR10
109111	Torque screwdriver torx T10 (1.3 Nm)	UR3
109112	Torque screwdriver torx T20 (3.0 Nm)	UR3
164084	Bypass cable (for setting joint-ID)	UR3 & UR5 & UR10
109180	ESD wrist strap	UR3 & UR5 & UR10
	Service kit box	UR3 & UR5 & UR10

7 Packing of robot

Packing of robot and controller box for shipment

- Remove any external tooling and external electrical connections.
- Download the Put_Into_Box program to a USB stick. Download it from: http://www.universal-robots.com/support/

- Load program *Put_into_box_ur3.urp* on the robot and follow instructions while removing mounting bolts.



While robot folds together, hold a piece of bubble wrap between Shoulder joint and wrists.

Note: If robot cannot run or power is not available, it is possible to manually release the brakes for each joint individually and pack the robot accordingly. For brake release, see **3.1.3 Brake release**

- Power down, disconnect power and disconnect robot arm from controller.

- Pack robot arm and Controller box in designated boxes. Make sure the orientation of the robot arm is correct in the box.

8 Changelog

8.1 Changelog

Date	Revision	Action	Changes
20. Marts 2015	UR3_en_3.1.1	Added	Revision 3.1.1 released
December 2015	UR3_en_3.1.2	Added	More details for replacements of parts, additional error codes, Updated Electrical drawings, Torque value for elbow changed,
December 2016	UR3_en_3.2.0	Added	Error code C71A12
		Corrected	5.2 LED startup sequence