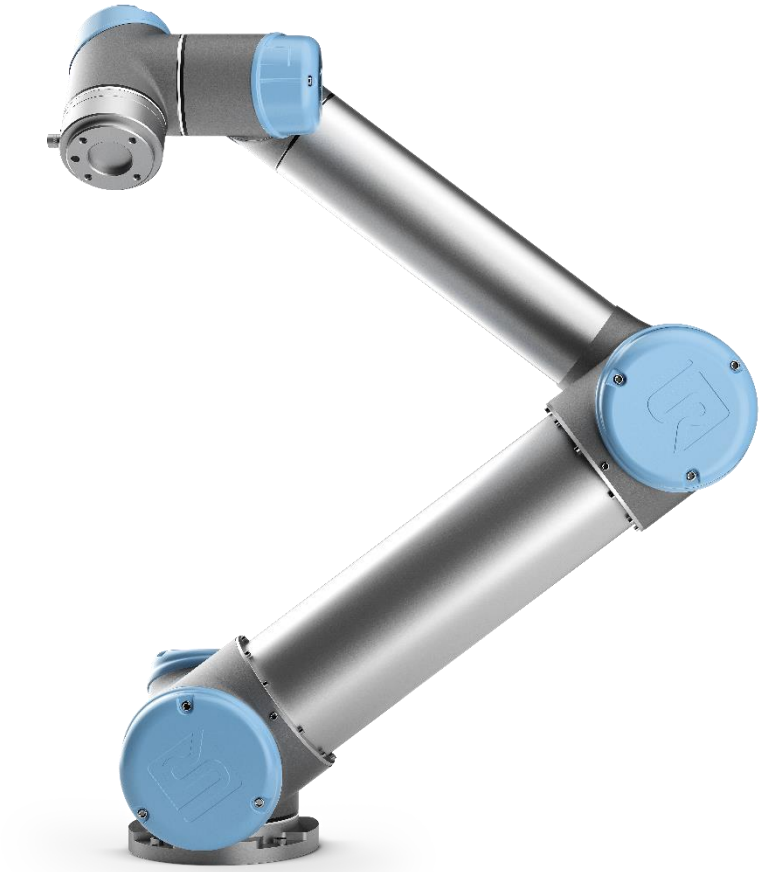
UNIVERSAL ROBOTS



Service Manual

Revision UR5_en_3.2.2

"***Original instructions***"

Robot:

UR5 with CB3.0/CB3.1-controller

CB3.0 valid from robot s/n 2014350001 to 2016351863

CB3.1 valid from robot s/n 2016351864

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 to ensure a long lifetime. However, any improper use of robot can potentially cause failures. If for example, the robot is overloaded, run with a load not recommended by Universal Robots, dropped during relocation, damaged by collision or any other improper usage, the warranty will be void.

Universal Robots recommends that the user does not attempt repair, adjustment or other intervention in the mechanical or electrical systems of the robot without first consulting a UR certified service engineer. Any unauthorized intervention will void the warranty. 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 the main power 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 where the robot was purchased from.
Alternatively, parts can be ordered from the nearest distributor, details of which can be obtained from Universal Robots official website at www.universal-robots.com

1.2 Company details

Universal Robots A/S
Energivej 25
DK-5260 Odense
Denmark
Tel.: +45 89 93 89 89
Fax: +45 38 79 89 89

1.3 Disclaimer

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

1.4 Warning Symbols in this Manual

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

	**DANGER:** These warnings mean a hazardous situation which, if not avoided, **will** result in **death or serious injury.**
	**WARNING:** These warnings mean a hazardous situation which, if not avoided, **could** result in **death or serious injury.**
	**CAUTION:** These warnings mean a hazardous situation which, if not avoided, **could** result in **minor or moderate injury.**
	**NOTICE:** These warnings mean damage to property **may** occur if no precautions are taken.
	This warning sign contain references to safety-relevant information or general safety measures. This warning sign do not refer to individual hazards or individual precautionary measures.

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

	**MANDATORY ACTION:** Procedures marked with this warning **must** be followed exactly.

2. Preventive Maintenance

It is recommended to perform preventive maintenance on the control box and robot at least once per year. In case of use in dirty or dusty environments it is recommended to increase the frequency.

In case dust/dirt/oil is observed on the controller or robot arm, it can be wiped away using a cloth with cleaning agent. Cleaning agent: Water, Isopropyl alcohol, 10% Ethanol alcohol or 10% Naphtha.
In very rare cases, very small amounts of grease can seep from the joint. This does not affect the specified function or lifetime of the joint.

NOTICE:
Never use compressed air to clean the controller or robot arm as it can damage the seals and internal components.

2.1 Controller

2.1.1 Inspection plan

Below inspection plan is a check list that should be performed according to the marked time interval. If the mentioned parts are not in an acceptable state, rectify immediately.

Use the following sections as guide: 2.1.2 Safety Functional 2.1.3 Visual Inspection 3.2 Controller		Monthly	Bi-annually	Annually
Check Emergency stop on Teach Pendant	F	**X**		
Check Backdrive mode	F	**X**		
Check Freedrive mode	F		**X**	
Check safety inputs and outputs (if connected)	F	**X**		
Check Teach Pendant cable	V		**X**	
Check and clean air filters on Control Box	V	**X**		
Check terminals in Control Box	F		**X**	
Check electrical grounding 1< Ω to Control Box	F			**X**
Check main power to Control Box	F			**X**

V = Visual inspection F = Functional inspection ***** = Must also be checked after heavy collision

2.1.2 Safety Functions

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

- Backup data from the storage device - See section 4.4 Backup of data
- 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 on robot again
- Test Freedrive mode:
  - Unmount attachment or set TCP/Payload/CoG according to tool specifications
  - Set the robot in Free drive mode by holding the black *Freedrive* button on the back of the Teach Pendant
  - Move the robot to a position stretched out horizontally to the edge of its workspace
  - Monitor that the robot maintains its position unsupported while the Freedrive button is still pressed.
- Test Backdrive mode:
  If the robot is close to collision, the BACKDRIVE function can be used to move the robot to a safe position before initializing.
  - Press ON to enable power, state will change to *Idle.*
  - Press and hold Freedrive -> status will change to BACKDRIVE
  - Move the robot by hand as in Freedrive.
  - In BACKDRIVE mode brakes will only be released on individual joints when they are moved, and will remain released as long as the Freedrive button is pushed. Robot will be “heavy” to move around compared to Freedrive mode.
  - Be sure to test each joint individually, to ensure the brake release as expected.

- 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.

2.1.3 Visual inspection

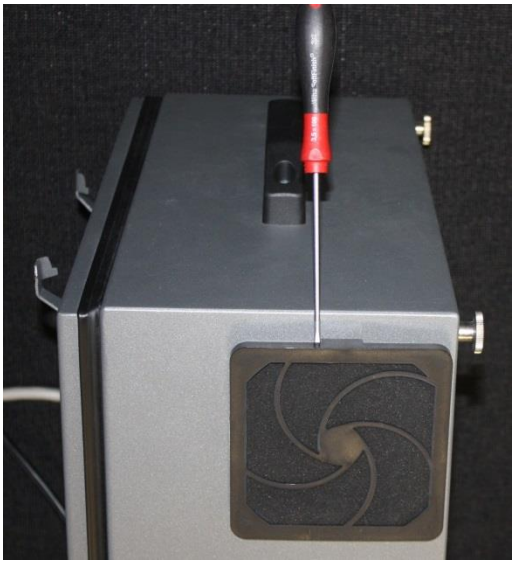
- Disconnect power cable from controller
- Check that the terminals on the Safety Control Board are properly inserted and do not have loose wires
- Check all connections on Motherboard and connection between Safety Control Board and Motherboard
- Check for any dirt/dust inside of controller, clean with ESD vacuum cleaner if needed

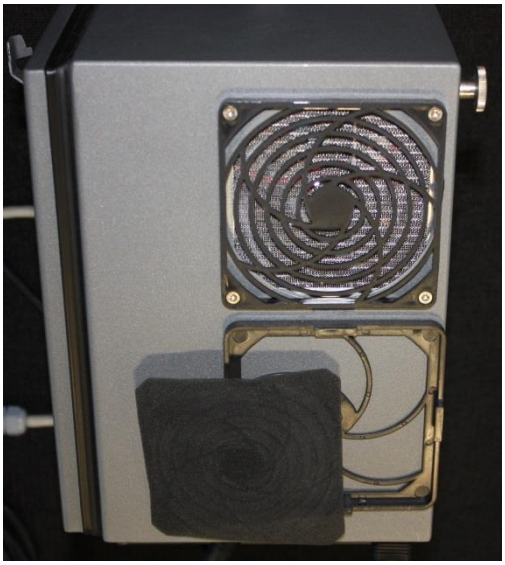
NOTICE:
Never use compressed air to clean inside the controller as it can damage components

2.1.4 Cleaning and replacement of filters

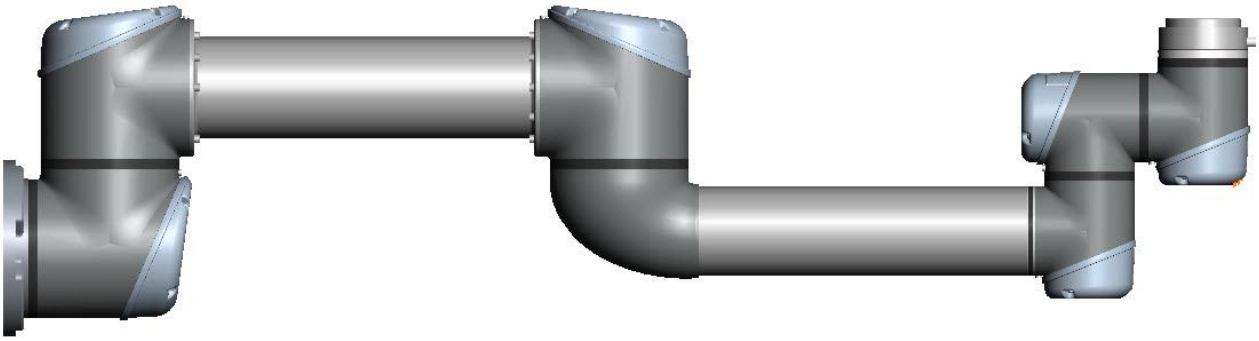
- Controller box has two filters, one mounted on each side of the box

- Remove filters from controller box and clean them thoroughly using low pressure air
    - Replace filters if necessary
    - Gently remove the outer plastic frame and maintain the filter





2.2 Robot arm



2.2.1 Inspection plan

Below inspection plan is a check list that should be performed according to the marked time interval. If the mentioned parts are not in an acceptable state, rectify immediately.

Use the following sections as guide: 2.2.2 Visual Inspection 3.1 Robot Arm		Monthly	Bi-annually	Annually
Check blue lids	V		**X**	
Check blue lid screws	F		**X**	
Check flat rings	V		**X**	
Check robot cable	V		**X**	
Check robot cable connection	V		**X**	
Check Robot Arm mounting bolts*	F	**X**		
Check Tool mounting bolts*	F	**X**		
Check screws/bolts that is connecting joints*	F		**X**	

V = Visual inspection F = Functional inspection ***** = Must also be checked after heavy collision

2.2.2 Visual inspection

NOTICE:
Never use compressed air to clean the robot arm as it can damage the seals and internal components.

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

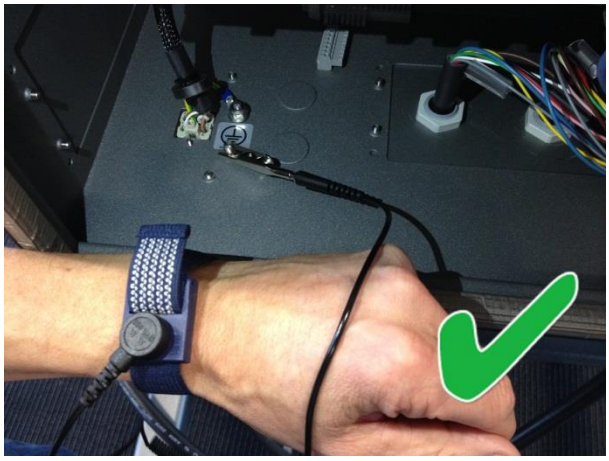
If any damage is observed on a robot within the warranty period, contact the distributor from which the robot has been purchased.

3. Service and Replacement of parts

3.0.0 Handling ESD-sensitive parts

To prevent damage to ESD-sensitive parts, follow the instructions below. These are in addition to standard precautions such as turning off power before removing circuit boards.

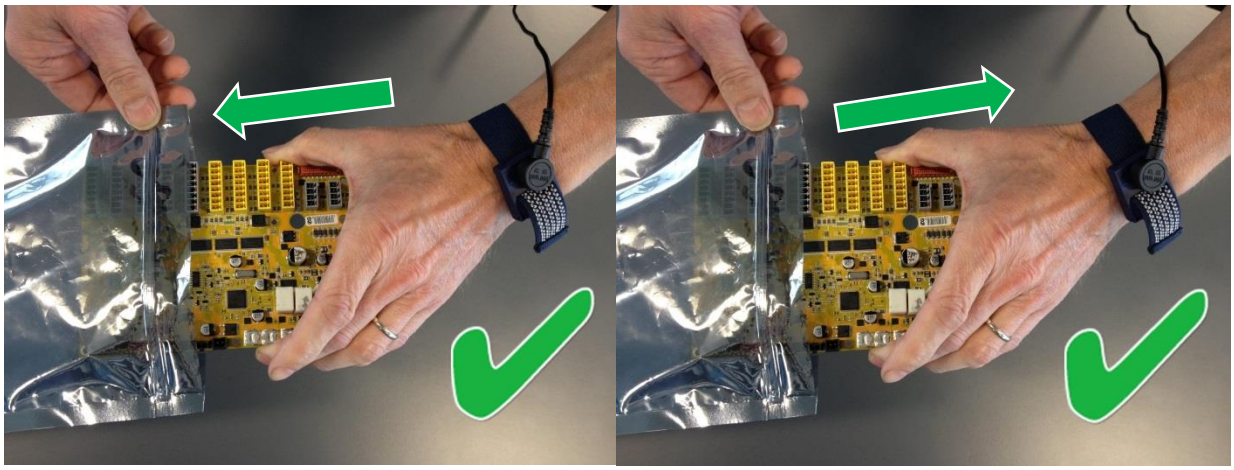
Keep the ESD-sensitive part in its original shipping container.
(a special "ESD bag") until the part is ready to be installed



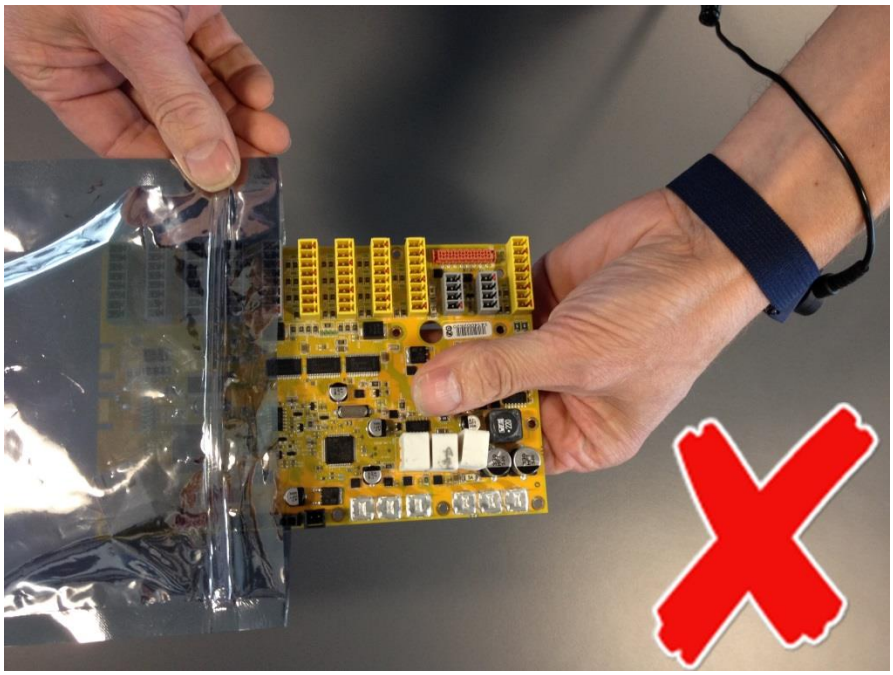
Put the ESD wrist strap on your wrist. Connect the wrist band to the system ground point.
This discharges any static electricity in your body to ground.

Step 1:
Put OLD board into spare ESD bag.

Step 2:
Take NEW board out of ESD bag.

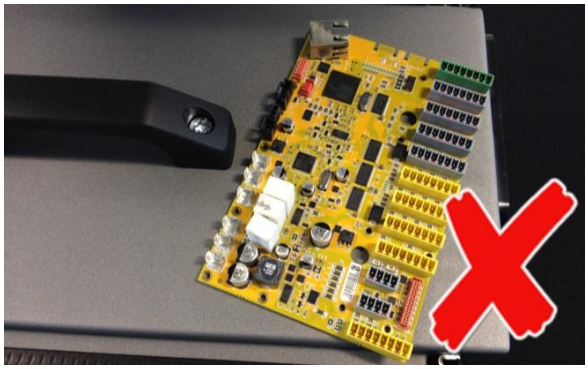


Hold the ESD-sensitive part by its edges;
do not touch its pins.

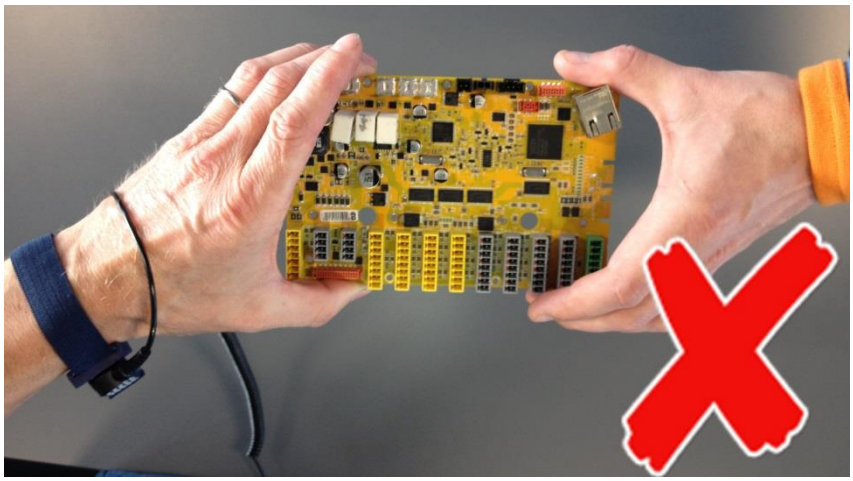


Do not place the ESD-sensitive part on nonconductive material or on a metal table.

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.

3.0.1 Recommended Tools

Robot arm:

- Service kit – part no.: 109010

Control box:

Below tool should be ESD safe tools.

- Slotted screwdriver
  - 0.5 (For terminals on Current Distributor)
- Philips screwdriver
  - PH2 (For terminals on power supplies)
- Torx screwdriver
  - TX10 (For external connections i.e. main power connection)
  - TX20 (For shield in front of PCB's)
  - TX45 (For Control Box handle)
- Hex screwdriver
  - Size 4 (For Safety Control Board and Motherboard)
- Spanner
  - Size 7 (for Energy Eater)
- Socket screwdriver
  - Size 10 (For component bracket and grounding nuts)
  - Bit extinction (To access nuts that are hard to reach)
- Other
  - Flathead Plier (for removing terminals on Safety Control Board and Current Distributor)

3.1 Robot arm

3.1.1 Before returning any part to Universal Robots

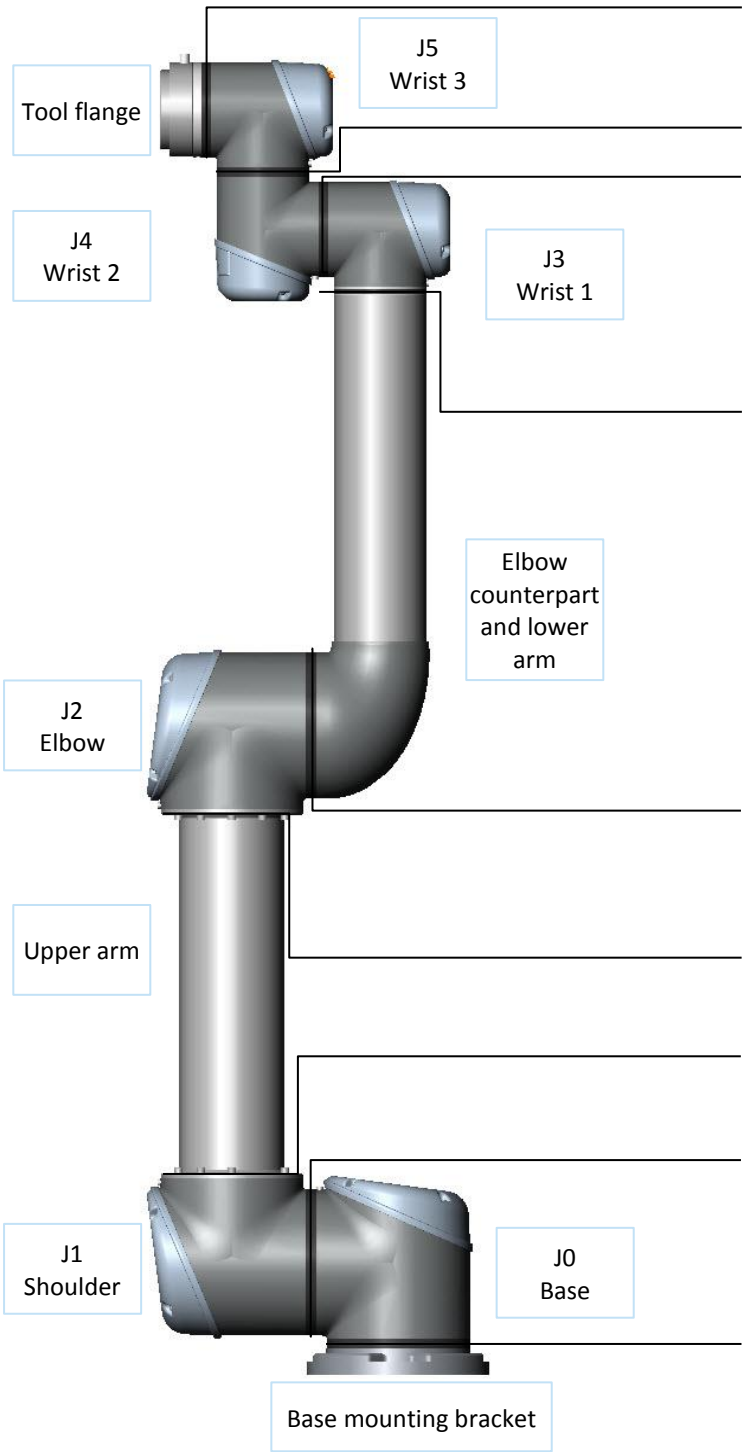
- Remove all external non-UR equipment such as grippers, hoses, cables and so on.
  Universal Robots cannot be held responsible for damage caused to non-UR equipment mounted on the robot.
- Backup all relevant files before sending the robot/part to UR. Universal Robots cannot be held responsible for loss of programs, data or files stored in the robot.

MANDATORY ACTION:
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 customers expense.

Note: Please note that the robot will be updated to newest software/firmware when repaired. New parts will also be updated to newest version (hardware/software). Therefore, updating PolyScope may be necessary when new parts are mounted.

- You will find packing down procedure in section - 7. Packing of robot

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]

[3.1.10 Elbow counterpart – Elbow joint]

[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

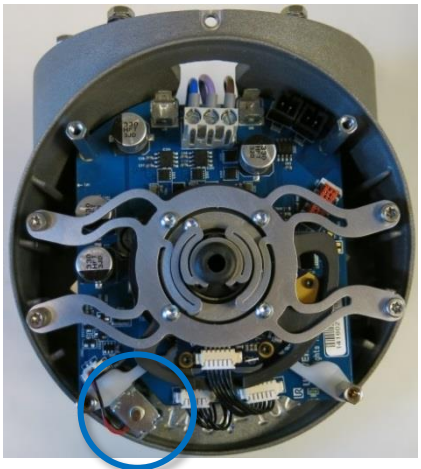
If required, the brake on a joint can be released without power connected.

CAUTION:

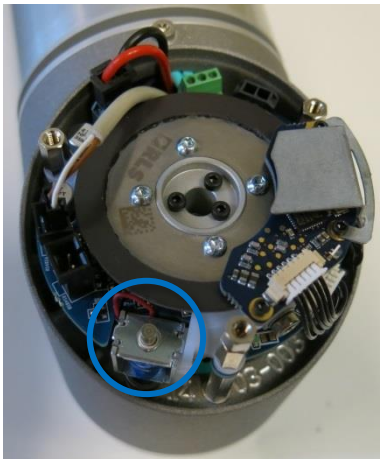
- Before releasing a brake, it is extremely important to dismount any dangerous parts to avoid any hazardous situations.
- If releasing the brake on Base joint, Shoulder joint or Elbow joint, it is important to make proper mechanical support prior to releasing the brake.
- Always make sure personnel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

Procedure for releasing the joint

1. Shut down Controller.
2. Remove blue lid on joint.
3. Push brake pin down to release, joint can then be rotated.



Brake on Base, Shoulder and Elbow joints,



Brake on Wrist joints

4. Make sure to replace blue lid onto joint correctly and fasten screws before turning on Controller.
5. Correct torque value for screws on blue lids are **0.4Nm**

3.1.4 General guidance to separate joint from counterpart

Disassemble:

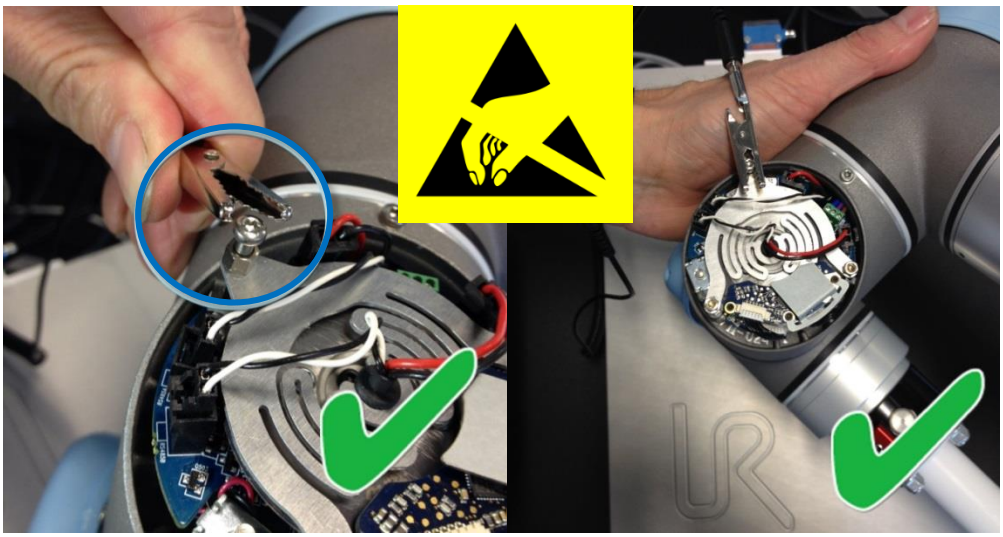
1. Ensure that the necessary tools and documentation are available before starting the repair.
   1.1. Service kit with torque tools, ESD Wristband, etc.
   1.2. Thoroughly read and understand this guide.

2. 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.

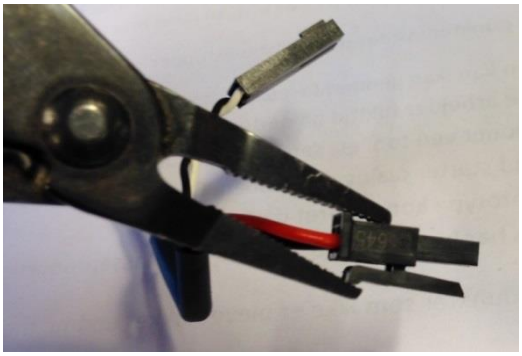
3. Shut down the controller.

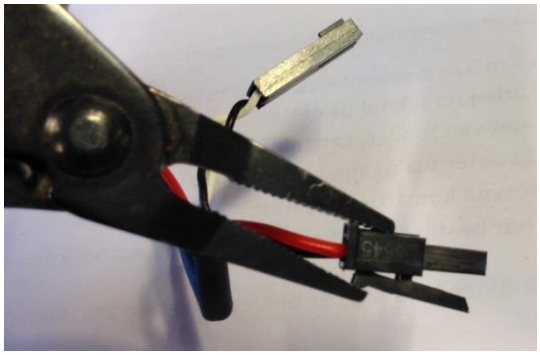
4. Remove blue lid.

5. Reattach one of the screws from the blue lids, and connect the Alligator Clip from the ESD wristband to it, as shown below.



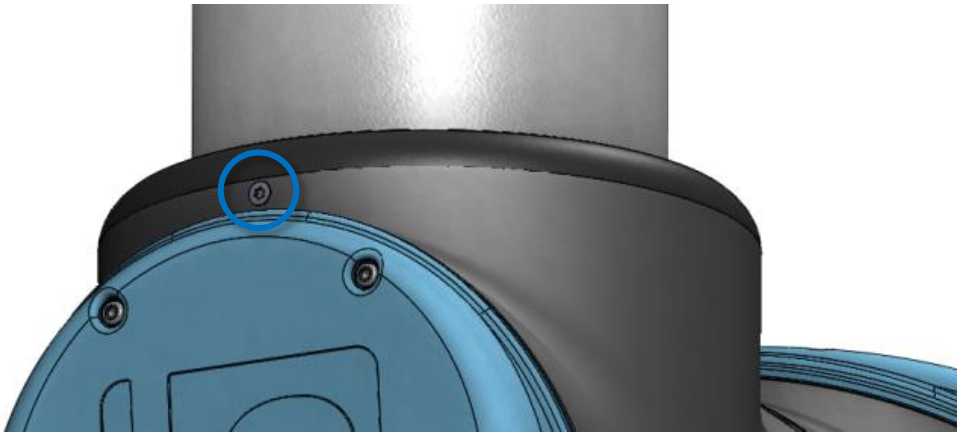
6. **Gently** unplug the cable connectors **without bending the printed circuit board.**
   Some connectors have a lock that must be engaged before it is pulled out of the printed circuit board. Example below.



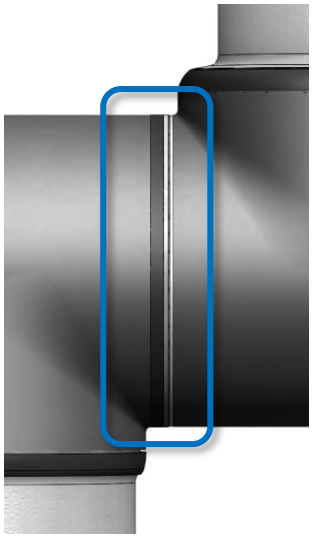


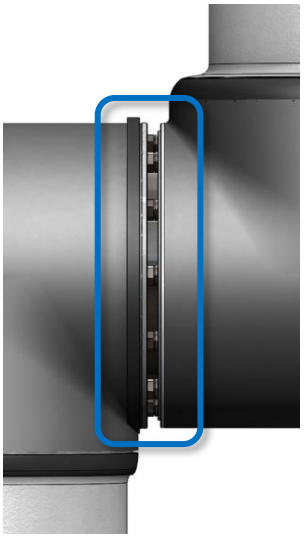
7. Disconnect wires.

8. Remove alignment screw (Not present on newer joint housings).



9. Gently remove black flexible flat ring with a small flathead screwdriver or similar tool and pull it back over joint housing away from its original position.





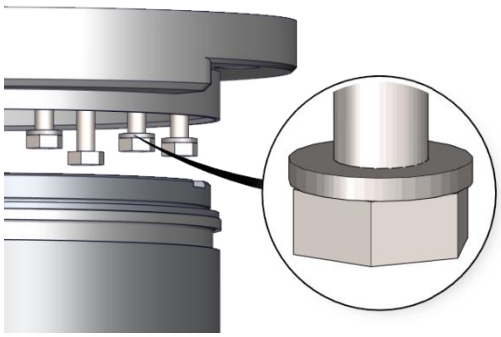
10. Slide the grey Teflon ring back.
    10 screws become visible, 5 on each side of joint.
    Loosen the screws with an open-ended spanner approximately two full turns each.

11. Pull the two parts apart and gently twist them counter-clockwise around 5 degrees, until a mechanical stop is met (holes are keyhole-type). They can then be completely separated.

Assemble:

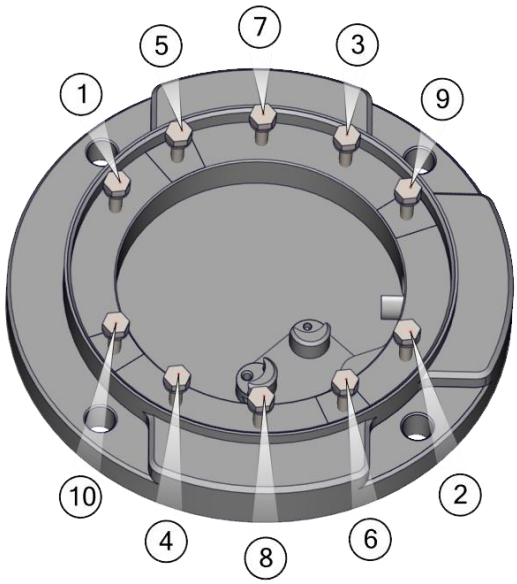
After replacing a joint do as follows to assemble the robot arm.

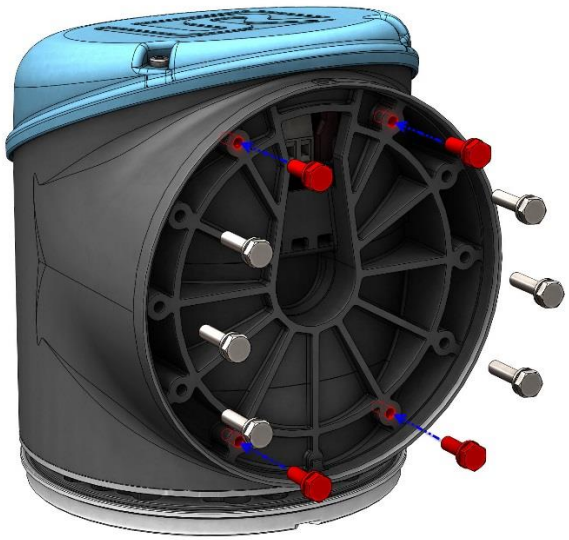
1. Gently insert a screw with washer already on the thread into each of the ten threaded holes in the joint housing (the joint will most likely have these already inserted).



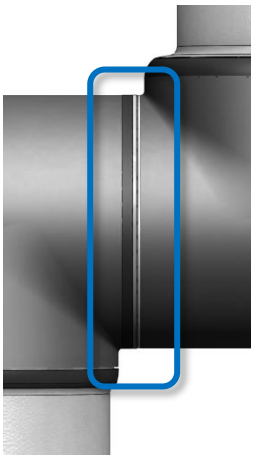
2. Make sure all washers are flush against the head of the bolt (this is important) before gently twisting the parts clockwise roughly 5 degrees until a mechanical stop is met.

3. Gently tighten the screws until they are almost in the correct position, then tighten in cross order (as shown in the numbered diagram below) with the correct torque, to ensure that that the two faces are parallel. When shorter bolts are used (marked with red) drawing on the right shows where they are mounted.
   See 3.1.5 Torque values





4. Slide the grey Teflon ring into place and gently put the flat ring back on top of the Teflon ring.



5. Mount the alignment screw (if present) and tighten with **0.4Nm.**

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

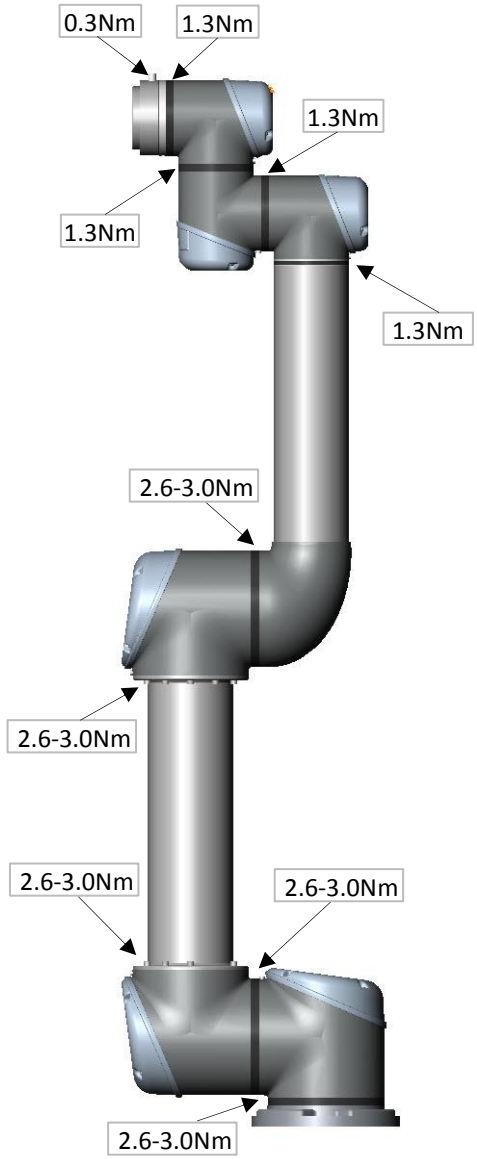
7. Mount the blue lid on the joint and tighten with **0.4Nm.**

8. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

3.1.5 Torque values

UR5 torque values			
CONNECTION		TORQUE	HEAD SIZE
Base mounting bracket	J0 Base	2.6-3.0Nm	7 mm.
[J0] Base	[J1] Shoulder	2.6-3.0Nm	7 mm.
[J1] Shoulder	Upper arm	2.6-3.0Nm	Hex key 3
Upper arm	[J2] Elbow	2.6-3.0Nm	Hex key 3
[J2] Elbow	Lower arm	2.6-3.0Nm	7 mm.
Lower arm	[J3] Wrist 1	1.3Nm	5.5 mm.
[J3] Wrist 1	[J4] Wrist 2	1.3Nm	5.5 mm.
[J4] Wrist 2	[J5] Wrist 3	1.3Nm	5.5 mm.
[J5] Wrist 3	Tool m. bracket	1.3Nm	5.5 mm.
Alignment screw		0.4Nm	Torx T10
Blue lid		0.4Nm	Torx T10
Tool connector		0.3Nm	Finger/hand

Attention**: Click the torque tools 3 times before using** to ensure 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 alignment screw.

3. Gently remove black flexible flat ring with a tiny screwdriver or similar tool and twist it around the joint housing.

4. Slide the grey Teflon ring back. 10 screws become visible, 5 on each side of joint. Loosen the screws with a 7 mm. open-ended spanner about two full turns, approximately 3 mm. for each screw.

5. Pull the base plate and Base joint apart and gently twist the two parts in opposite directions around 10 mm. until a mechanical stop is met (holes are keyhole-type).

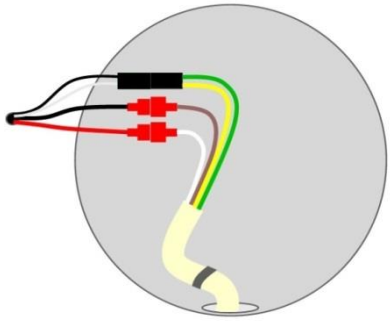
6. Pull away the base plate from Base joint.

7. Disconnect wires between base plate and Base joint.
   1 x red wire = 48V DC
   1 x black wire = GND
   Black connector = bus cable (note connector orientation)

Base joint – Base mounting bracket: Assemble

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

1. Replace base plate and reconnect wires according to illustration:
2. **Twist the communication cable** 1.5 to 2 full rounds before it is connected.
   (To reduce electrical noise in the system)



3. Gently insert base plate with screws and washers into the Base joint.
4. Make sure the washers are fully inserted and flush against the head of the bolt (this is important) before gently twisting the parts in opposite directions until a mechanical stop is met.
5. Gently tighten the 10 screws, and then tighten **in cross order with 2.6-3.0Nm.**
6. Slide the grey Teflon ring into place and gently put the flat ring back on top of the Teflon ring.
7. Mount the alignment screw and tighten with **0.4Nm.**
8. Mount blue lid on Base joint and tighten with **0.4Nm.**
9. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

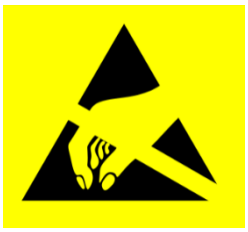
3.1.7 Shoulder joint – Base joint Disassemble

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.

3. Connect ESD wristband



4. Disconnect wires between Base joint and Shoulder joint
   - 1 x red wire = 48V DC
   - 1 x black wire = GND
   - Black connector = bus cable (note connector orientation)

5. Remove alignment screw

6. Gently remove black flexible flat ring between Base and Shoulder with a tiny screwdriver or similar tool and twist it around the joint housing.

7. Slide the grey Teflon ring back. 10 screws become visible, 5 on each side of joint. Loosen the screws with a 7 mm. open-ended spanner about two full turns, approximately 3 mm. for each screw.

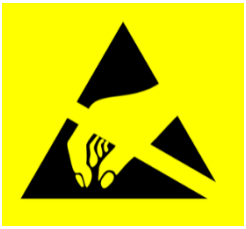
8. Pull the Base joint and Shoulder joint apart and gently twist the two parts in opposite directions around 10 mm. until a mechanical stop is met (holes are keyhole-type).

9. Pull away the Base joint from Shoulder joint.

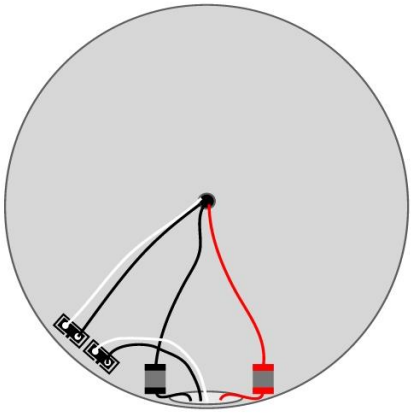
Shoulder joint – Base joint: Assemble

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

1. Gently insert Base joint with screws and washers into the Shoulder joint.
2. Make sure the washers are fully inserted and flush against the head of the bolt (this is important) before gently twisting the parts in opposite directions until a mechanical stop is met.
3. Tighten the 10 screws lightly, and then tighten **in cross order with 2.6-3.0Nm.**
4. Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
5. Mount the alignment screw and tighten with **0.4Nm.**
6. Connect ESD wristband



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



9. Mount blue lid on Base joint and tighten with **0.4Nm.**
10. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

3.1.8 Upper arm – Shoulder joint

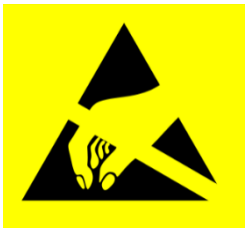
Disassemble

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

1. Shut down the controller.

2. Remove blue lid on Shoulder joint.

3. Connect ESD wristband



4. Disconnect wires between Upper arm and Shoulder joint
   - 1 x red wire = 48V DC
   - 1 x black wire = GND
   - Black connector = bus cable (note connector orientation)

5. Remove alignment screw

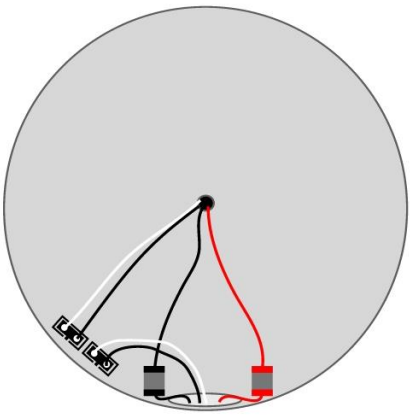
6. Unmount screws around the upper arm as indicated on the illustration:

7. Pull away the Shoulder joint from upper arm.

Upper arm – Shoulder joint: Assemble

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

1. Gently assembly the Shoulder joint with upper arm end mount screws into shoulder joint.
2. Tighten the 10 screws lightly, and then tighten **in cross order with 3.0Nm.**
3. Mount the alignment screw and tighten with **0.4Nm.**
4. Connect ESD wristband
5. Reconnect wires correctly.
6. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)



7. Mount blue lid on Shoulder joint and tighten with **0.4Nm.**
8. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

3.1.9 Elbow joint – Upper arm
Disassemble and assemble

Procedure for separating Elbow joint from Upper arm is similar to separation of Upper arm and Shoulder joint, consult chapter 3.1.8 Upper arm – Shoulder joint

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 alignment screw

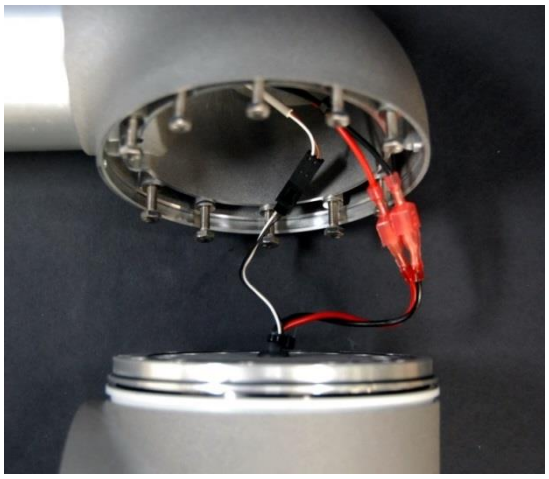
2. Gently remove black flexible flat ring between Elbow and Elbow counterpart with a tiny screwdriver or similar tool and twist it around the joint housing.

3. Slide the grey Teflon ring back. 10 screws become visible, 5 on each side of joint. Loosen the screws with a 7 mm. open-ended spanner about two full turns, approximately 3 mm. for each screw.

4. Pull Elbow joint and Elbow counterpart apart and gently twist the two parts in opposite directions around 10 mm. until a mechanical stop is met (holes are keyhole-type).

5. Pull away the Elbow joint from Elbow counterpart.

6. Disconnect wires between Elbow joint and Elbow counterpart
   - 1 x red wire = 48V DC
   - 1 x black wire = GND
   - Black connector = bus cable (note connector orientation)



Elbow counterpart – Elbow joint: assemble

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

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

3. Gently insert Elbow joint with screws and washers into the Elbow counterpart.
4. Make sure the washers are fully inserted and flush against the head of the bolt (this is important) before gently twisting the parts in opposite directions until a mechanical stop is met.
5. Tighten the 10 screws lightly, and then tighten **in cross order with 2.6-3.0Nm.**
6. Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
7. Mount the alignment screw and tighten with **0.4Nm.**
8. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

3.1.11 Wrist 1 joint – Lower arm

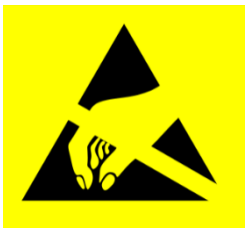
Disassemble

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.

3. Connect ESD wristband



4. Disconnect wires between lower arm and Wrist 1 joint.
   - 1 x red wire = 48V DC
   - 1 x black wire = GND
   - Black connector = bus cable (note connector orientation)

5. Remove alignment screw

6. Gently remove black flexible gasket between lower arm and Wrist 1 joint with a tiny screwdriver or similar tool and twist it around the lower arm.

7. 8 screws become visible, 4 on each side of joint. Loosen the screws with a 5.5 mm. open-ended spanner about two full turns, approximately 3 mm. for each screw.

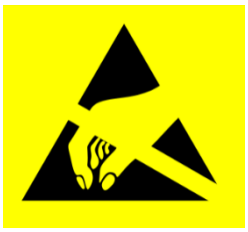
8. Pull the lower arm and Wrist 1 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).

9. Pull away the lower arm from Wrist 1 joint.

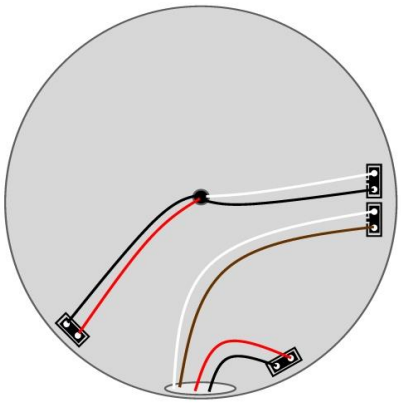
Wrist 1 joint – Lower arm: Assemble

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

1. Gently insert Wrist 1 joint with screws and washers into the lower arm.
2. Make sure the washers are fully inserted and flush against the head of the bolt (this is important) before gently twisting the parts in opposite directions until a mechanical stop is met.
3. Tighten the 8 screws lightly, and then tighten **in cross order with 1.3Nm.**
4. Gently put back the gasket.
5. Mount the alignment screw and tighten with **0.4Nm.**
6. Connect ESD wristband



7. Reconnect wires between lower arm and Wrist 1 joint correctly.
8. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)



9. Mount blue lid on Wrist 1 joint and tighten with **0.4Nm.**
10. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

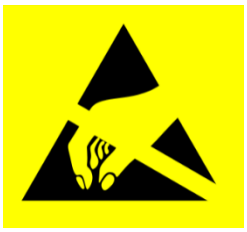
3.1.12 Wrist 2 joint – Wrist 1 joint

Disassemble

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

1. Remove blue lid on Wrist 1 joint.

2. Connect ESD wristband



3. Disconnect wires between Wrist 1 joint and Wrist 2 joint

1 x red wire	= 48V DC
1 x black wire	= GND
Black connector	= bus cable (note connector orientation)

4. Remove alignment screw

5. Gently remove black flexible flat ring between Wrist 1 and Wrist 2 with a tiny screwdriver or similar tool and twist it around the joint housing.

6. Slide the grey Teflon ring back. 8 screws become visible, 4 on each side of joint. Loosen the screws with a 5.5 mm. open-ended spanner about two full turns, approximately 3 mm. for each screw.

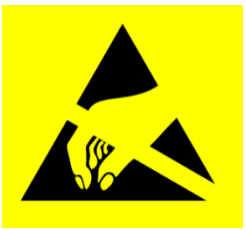
7. Pull Wrist 1 joint and Wrist 2 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).

8. Pull away Wrist 1 joint from Wrist 2 joint.

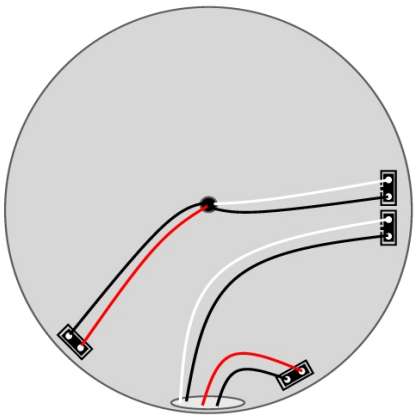
Wrist 2 joint – Wrist 1 joint: Assemble

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

1. Gently insert Wrist 1 joint with screws and washers into Wrist 2 joint.
2. Make sure the washers are fully inserted and flush against the head of the bolt (this is important) before gently twisting the parts in opposite directions until a mechanical stop is met.
3. Tighten the 8 screws lightly, and then tighten **in cross order with 1.3Nm.**
4. Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
5. Mount the alignment screw and tighten with **0.4Nm.**
6. Connect ESD wristband



7. Replace Wrist 1 and reconnect connectors as illustrated into Wrist 2.
   Twist the communication cable 1.5 to 2 full rounds before it is connected.
   (To reduce electrical noise in the system)



8. Mount blue lid on Wrist 1 joint and tighten with **0.4Nm.**
9. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

3.1.13 Wrist 3 joint – Wrist 2 joint
Disassemble and assemble

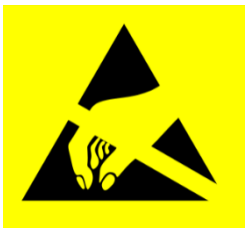
Procedure for separating Wrist 3 joint from Wrist 2 is similar to separation of Wrist 2 joint and Wrist 1 joint, consult chapter 3.1.12 Wrist 2 joint – Wrist 1 joint

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

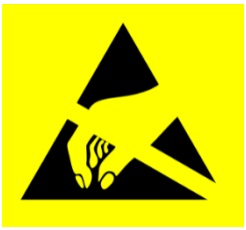
1. Shut down the controller.
2. Remove alignment screw.
3. Gently remove black flexible flat ring with a tiny screwdriver or similar tool and twist it around the joint housing.
4. Slide the grey Teflon ring back. 8 screws become visible, 4 on each side of joint. Loosen the screws with a 5.5 mm. open-ended spanner about two full turns, approximately 3 mm. for each screw.
5. Pull the tool flange and Wrist 3 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).
6. Pull away the tool flange from Wrist 3 joint.
7. Connect ESD wristband
8. Disconnect the two connectors.



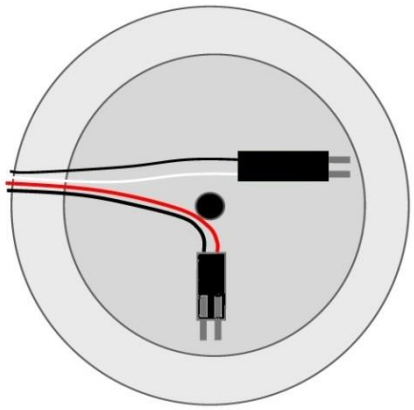
Tool flange – Wrist 3 joint: Assemble

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

1. Connect ESD wristband



2. Replace tool flange and reconnect connectors as illustrated.
3. **Twist the communication cable** 1.5 to 2 full rounds before it is connected. (To reduce electrical noise in the system)



4. Gently insert tool flange with screws and washers into the Wrist 3 joint.
5. Make sure the washers are fully inserted and flush against the head of the bolt (this is important) before gently twisting the parts in opposite directions until a mechanical stop is met.
6. Tighten the 8 screws lightly, and then tighten **in cross order with 1.3Nm.**
7. Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
8. Mount the alignment screw and tighten with **0.4Nm.**
9. Proceed to chapter 3.1.16 Dual Robot Calibration. for calibrating the robot.

3.1.15 Instructions for calibrating a joint

After replacement, calibration of the new joint is required in order to find the correct zero position.
If it is possible (a dual robot calibration kit and second robot of the same model are available) and necessary (highest possible positional accuracy, and minimal deviation from positions taught prior to joint replacement are required), perform the 3.1.16 Dual Robot Calibration. Alternatively perform a simple joint calibration as shown below.

Instructions for calibrating a joint:

1. Jog robot to HOME position

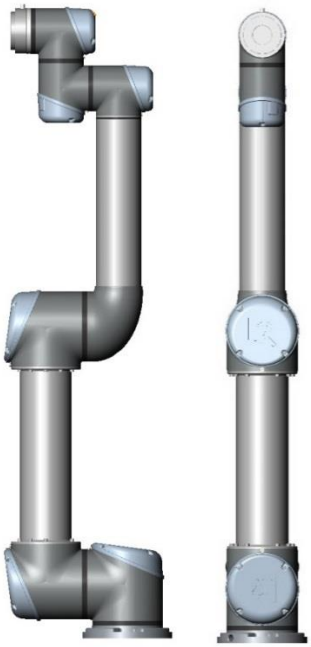
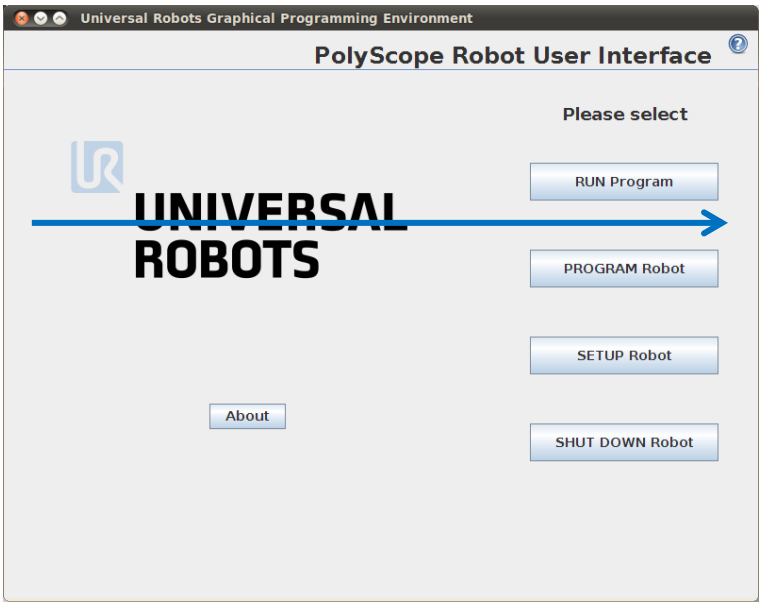
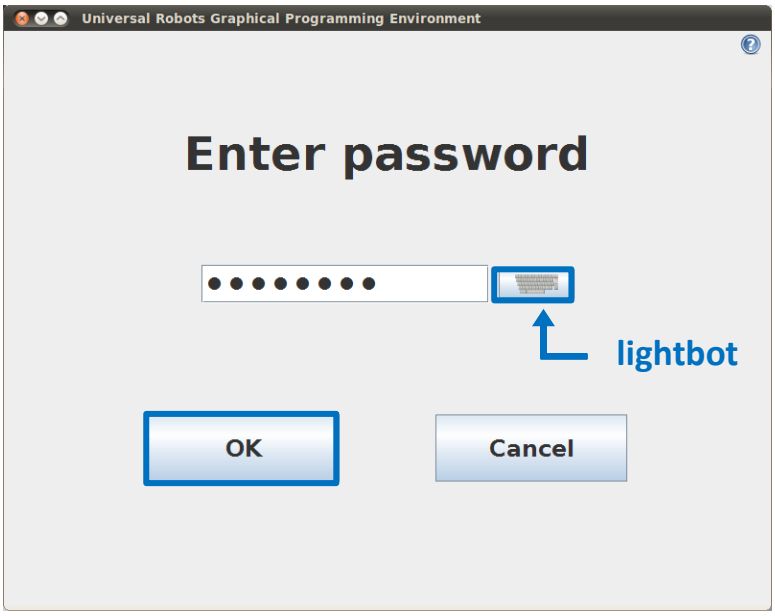


Illustration shows the HOME position, which is defined as zero position of all joints.

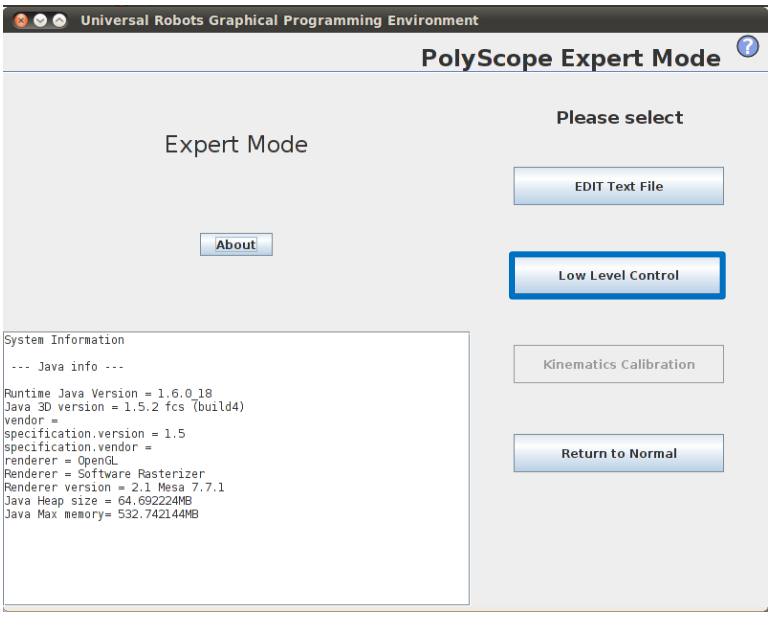
2. Swipe from left to right across the *UNIVERSAL ROBOTS* logo on main screen of PolyScope.



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



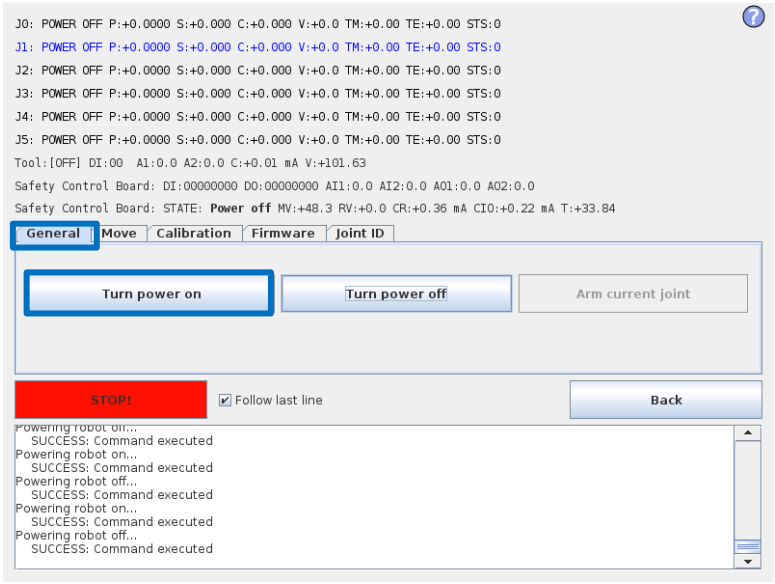
4. You are now in *Expert Mode*, press *Low Level Control*.



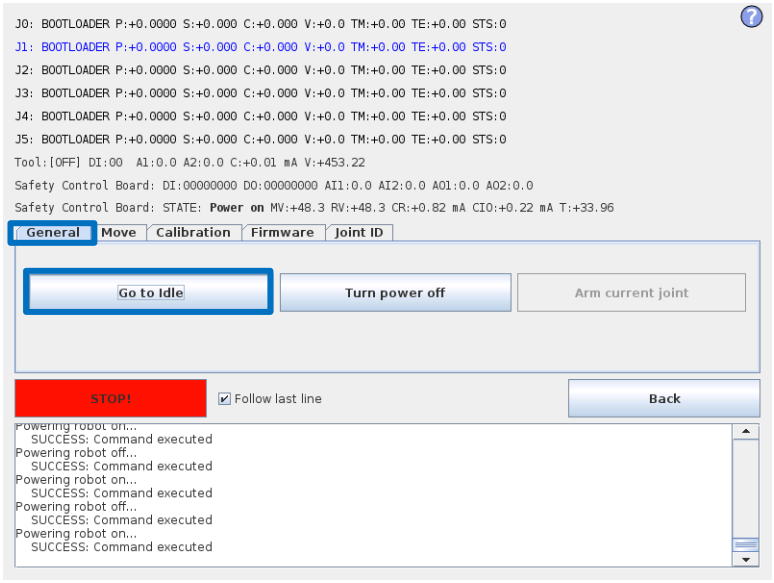
WARNING:
In Low Level Control, only the safety settings in the Polyscope Installation tab are active. **The protective stop is NOT active.**

Set all safety settings to their lowest settings before moving the robot.

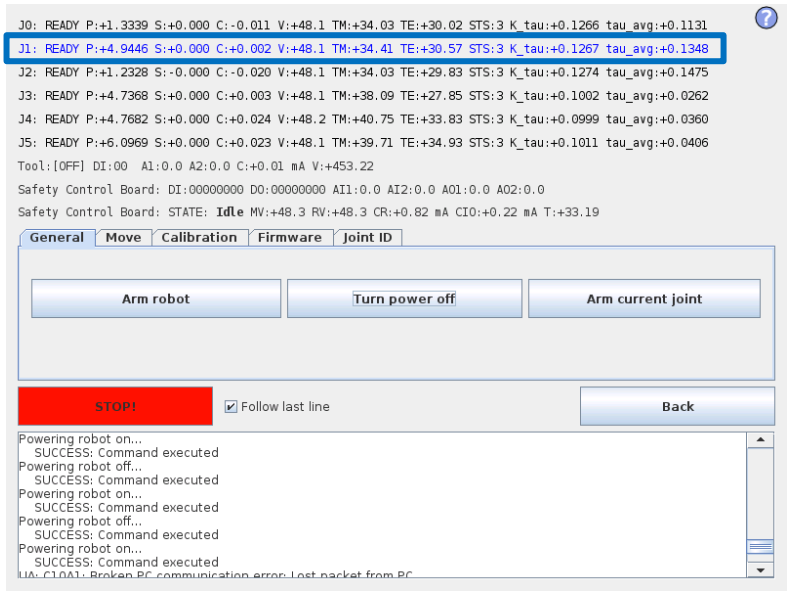
5. Press *Turn power on* to enable power to joints.



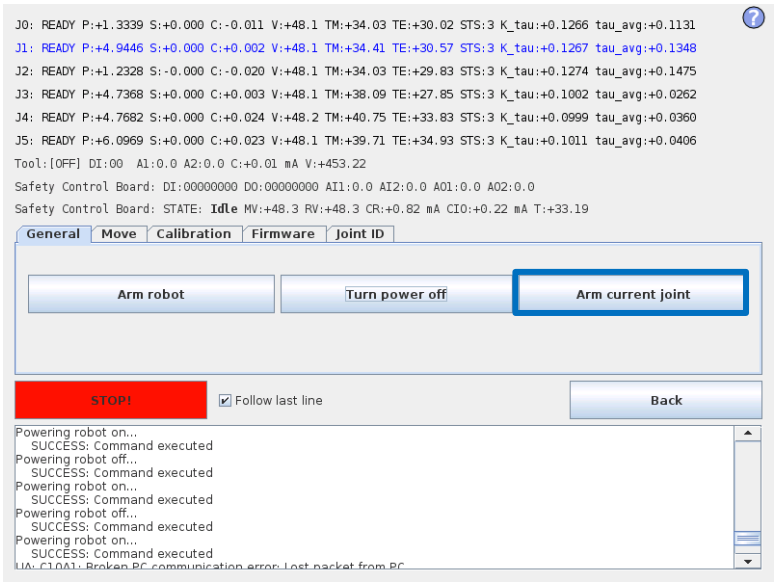
6. Press *Go to Idle* to put joints into ready mode.



7. Select the desired joint by directly clicking the status line for that joint. Currently selected joint is highlighted in blue.

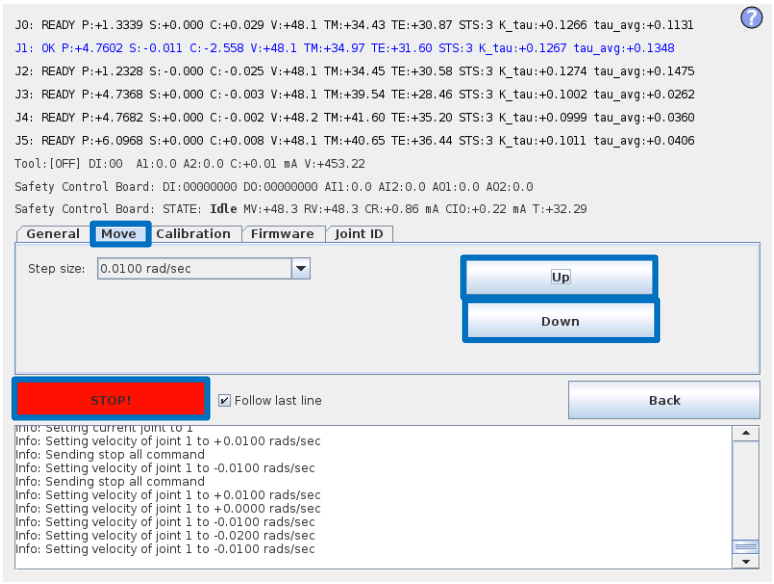


8. Press *Arm current joint* to release the brake on the selected joint.



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

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

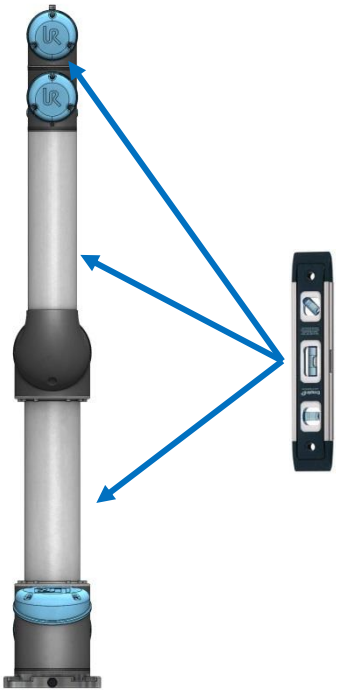


9. Zero position illustrations

Base:

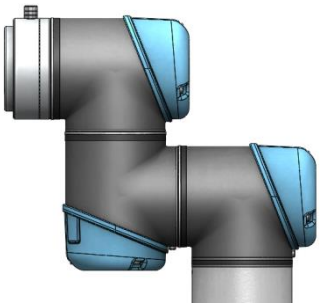
Base zero position is aligned so that the output flange is offset 180 degrees from the cable at the back of the robot base.

Shoulder, Elbow, Wrist 1:



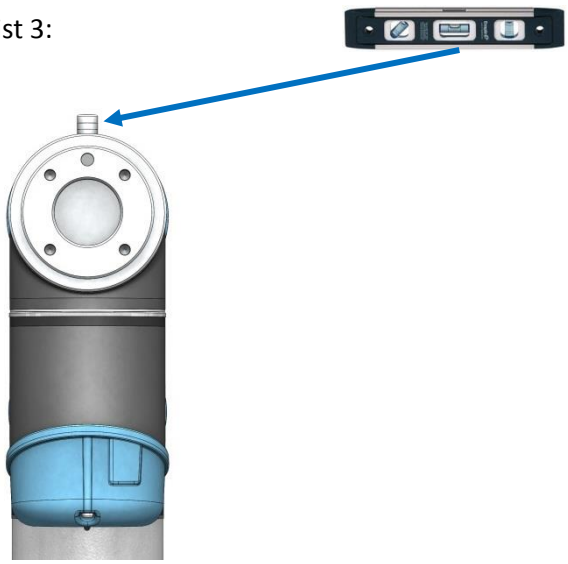
Shoulder, Elbow and Wrist 1 zero output flange vertically aligned (assuming Base is horizontal). Make sure that base of robot is horizontal, use spirit level to align joints.

Wrist 2:



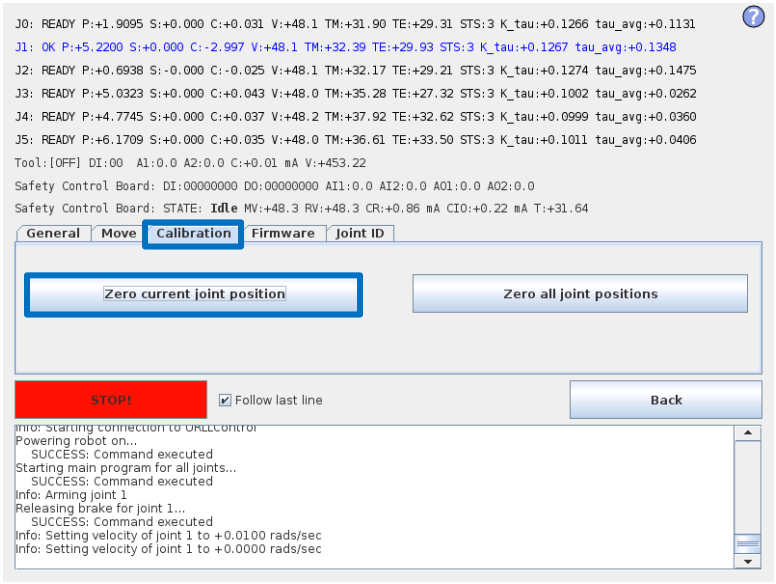
Wrist 2 zero position is aligned similar to Base joint, with tool flange parallel with wrist 1 output flange.

Wrist 3:

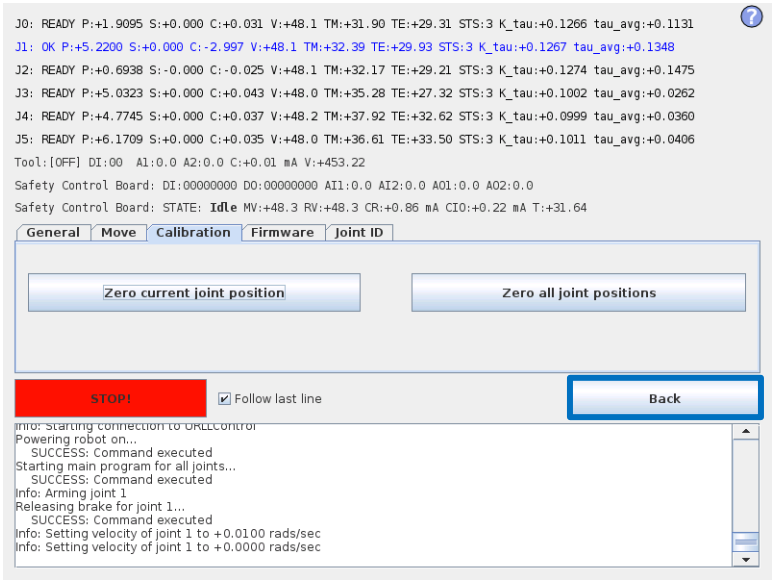


Wrist 3 zero position is aligned so tool connector is pointing upward.
Mount two bolts in tool holes and use spirit level to align joint.

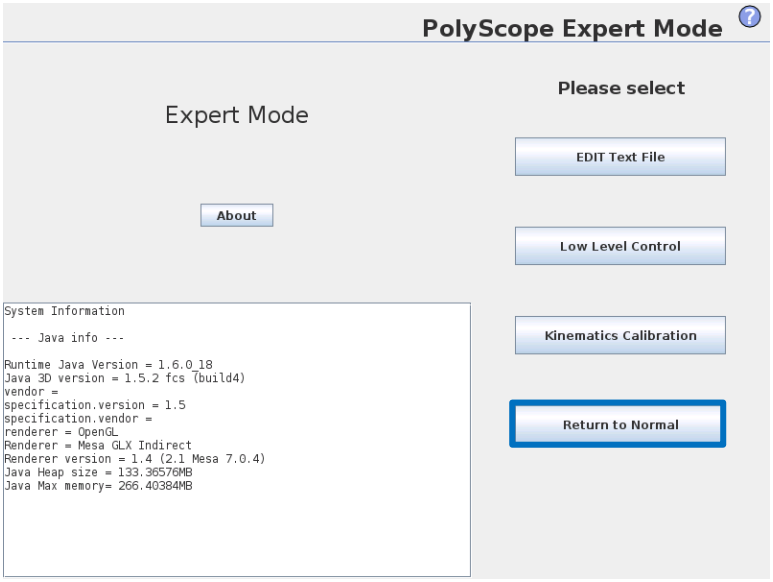
10. Select *Calibration* tab and press *Zero current joint position* to calibrate the joint.



11. Press *Back* to exit Low Level Control.



12. Press *Return to Normal*.



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

3.1.16 Dual Robot Calibration.

Dual Robot Calibration kit (Part no: 185500)

The Dual Robot Calibration process calibrates the robot across its full workspace. All robots are Dual Robot Calibrated before leaving the factory.
If a joint has been replaced, then the factory calibration is no longer valid.

There are 2 options:

- Performing a Dual Robot Calibration after replacement of a joint will allow the robot to 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 www.universal-robots.com/support/ to download the Calibration Manual in PDF format.

- Simple Joint calibration (as described in 3.1.15 Instructions of calibrating a joint). After replacing a joint the zero position of the joint can be adjusted but the quality of calibration will not be as good as that achieved by the Dual Robot Calibration method. Adjustment of program waypoints will likely be required.

3.1.17 Change joint ID

Each joint has a unique ID no. Having two joints with the same ID on a robot will cause communication problems and the robot will not be able to operate.

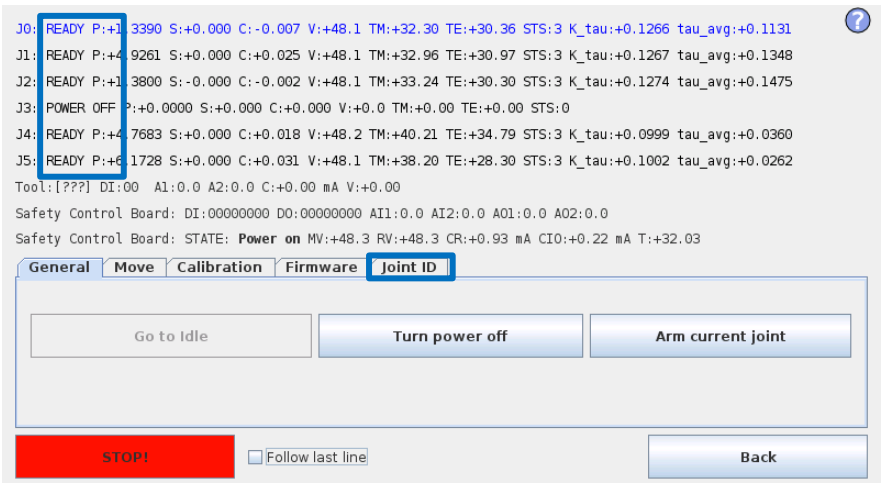
ID	Joint
J0	Base
J1	Shoulder
J2	Elbow
J3	Wrist 1
J4	Wrist 2
J5	Wrist 3

Example:

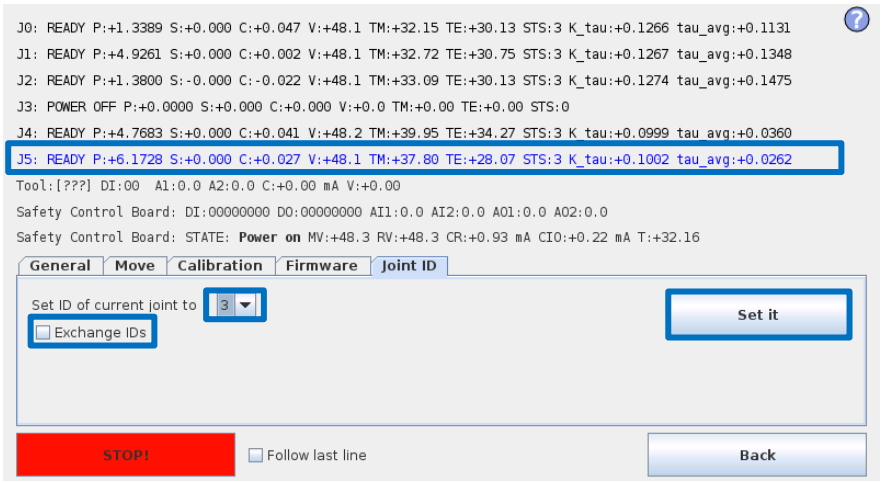
Wrist 1 (J3) has to be replaced. Spare joint is a Wrist 3 (J5)

1. Disconnect the joint with correct ID no.
2. Enter Low Level Control
3. Press *Turn power on* and the connected joints enter BOOTLOADER mode

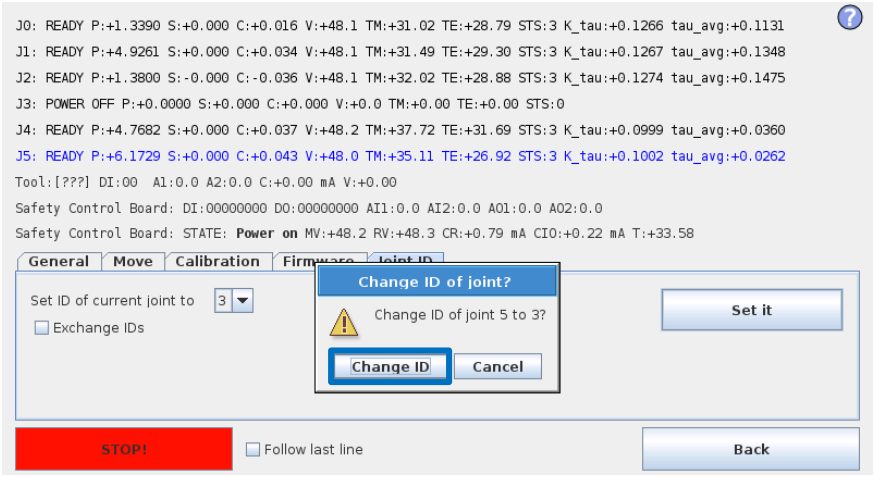
4. Press *Go to Idle* and the connected joints enter READY mode



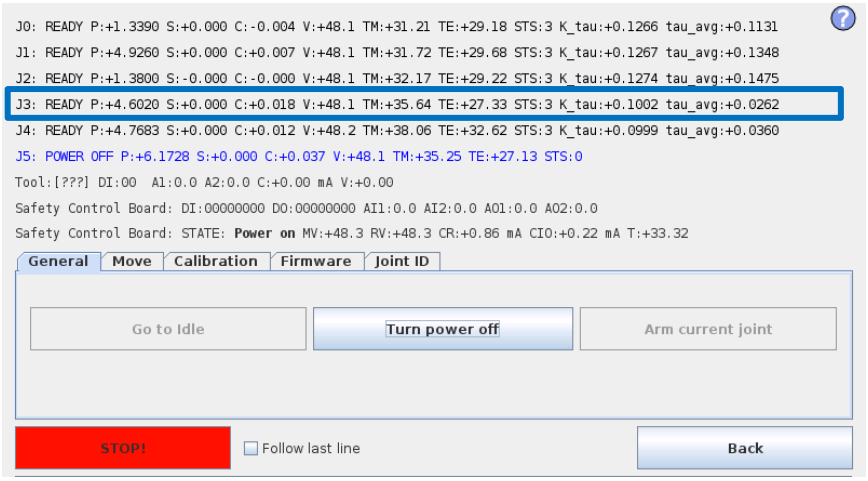
5. Select *Joint ID* tab
6. Select *J5* (The one to be changed)
7. Uncheck “Exchange IDs” box
8. In dropdown box, select ID no. 3
9. Press *Set it*



10. Confirm *Change ID*



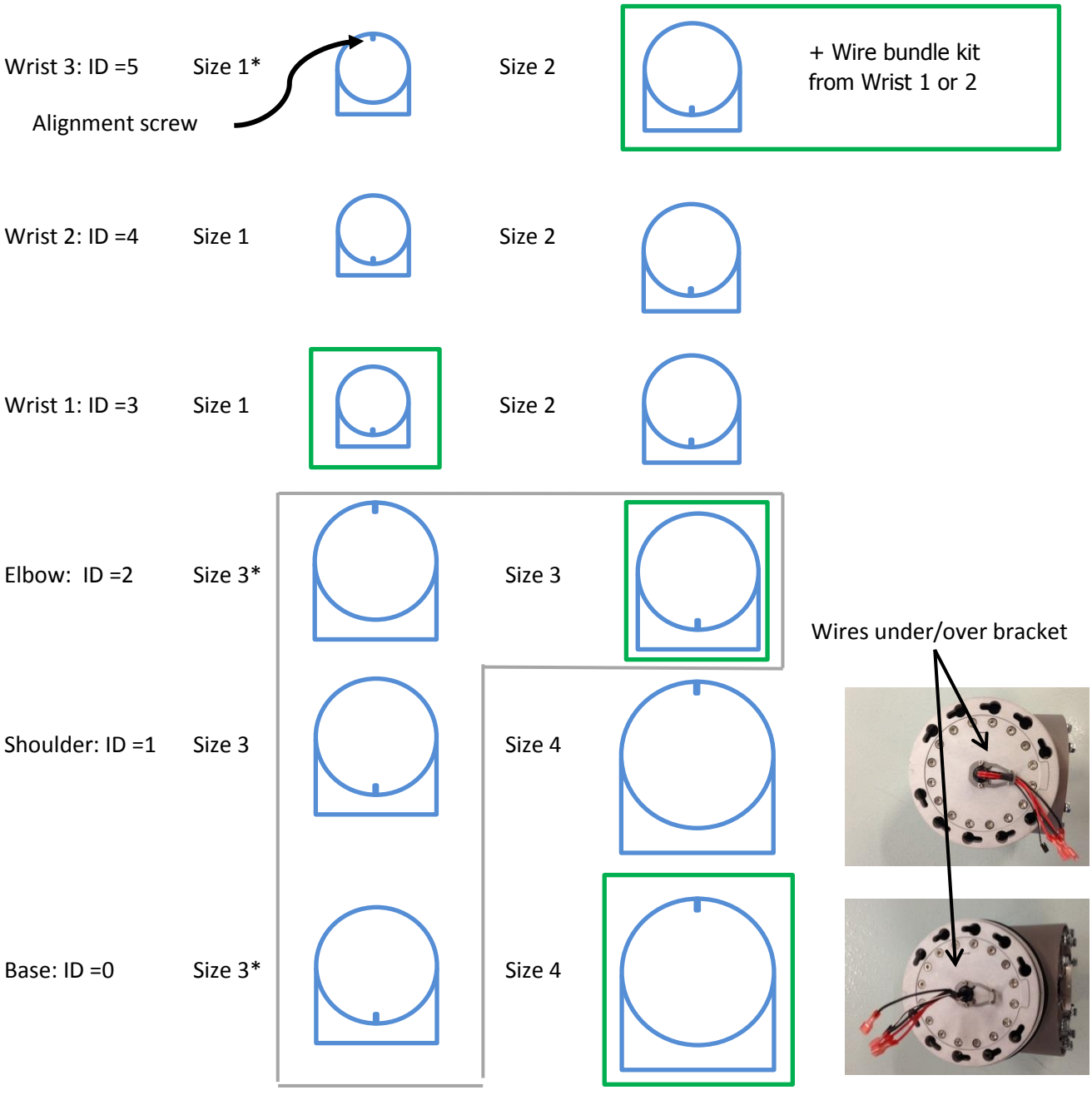
11. When the robot is powered on again, J5 will be displayed as J3.



3.1.18 Joint spare part adaptation

The UR5 and UR10 consist of four different joint sizes, some of which are interchangeable between different positions/robots.

Recommended spare joints for UR5 and UR10 are marked with: 



* When using a joint in a different location i.e. UR5 base as UR5 Elbow, it may be necessary to change ID, connect all joints electrically, turn the joint 180 degrees in low level control by using the Move Tab Up/Down function, before mechanically assembling the robot. The robot then needs to be zero positioned or dual robot calibrated - 3.1.15 Instructions for calibrating a joint

3.1.19 Wire bundle installation guide

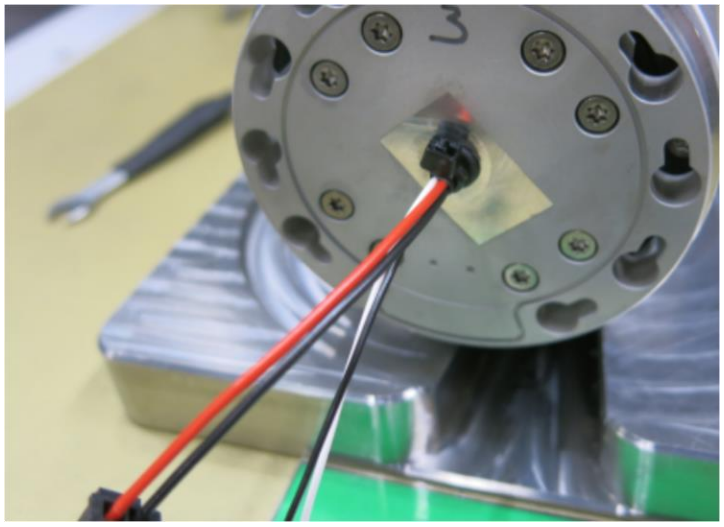
General

As well as the Wire bundle kit for the correct joint size, the Following ESD approved tools are recommended for this replacement:

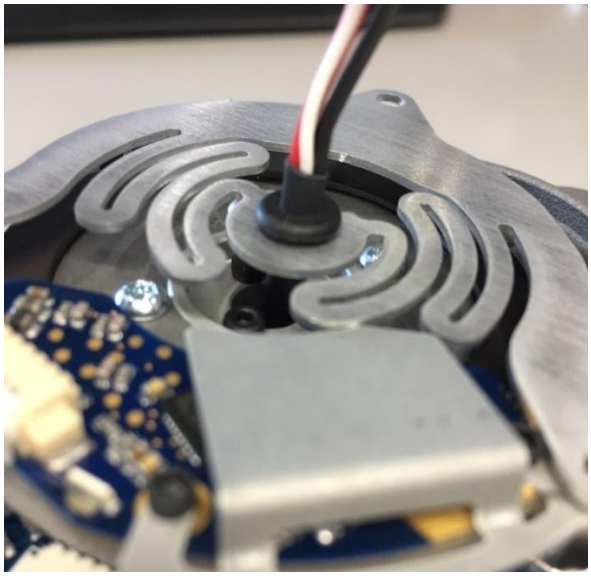
- Tool for pressing in the pins
- Small flat nose plier
- Cable tie tension and cutting tool
- Small flathead screwdriver
- Tweezers
- Crimping tool for cable shoes

Time expected: 20min (joint disassembly time not included)

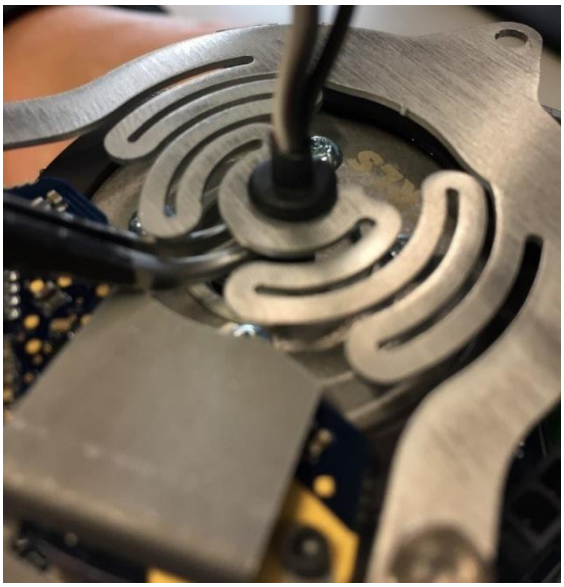
Size 1 – part number: 103501



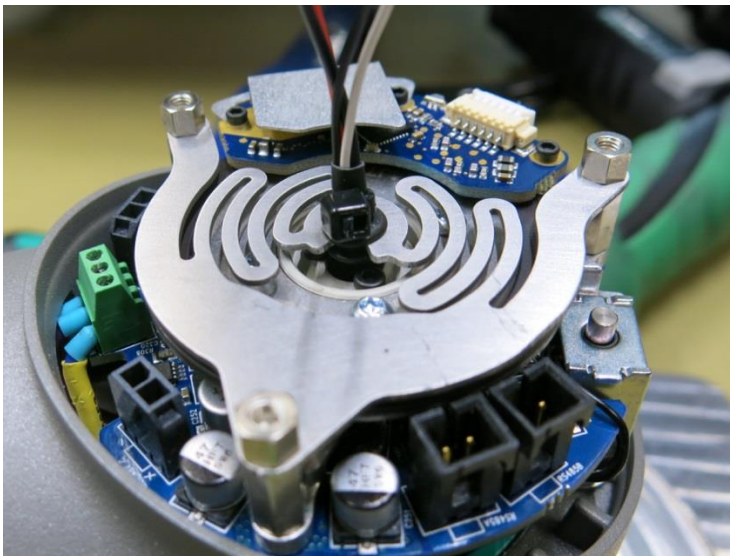
- Insert wire bundle through joint as shown on photo, with the cable tie flush against the tool flange.



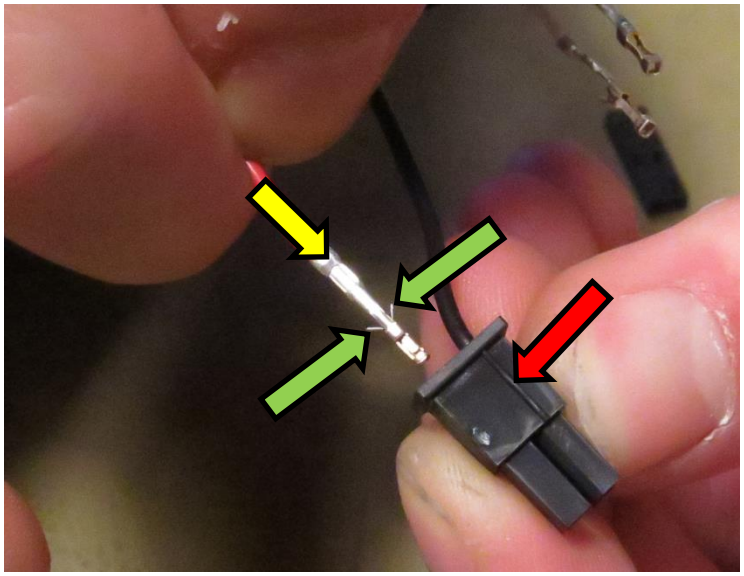
- Mount the grommet into the flex plate with the tweezers or the small flat nose screwdriver.



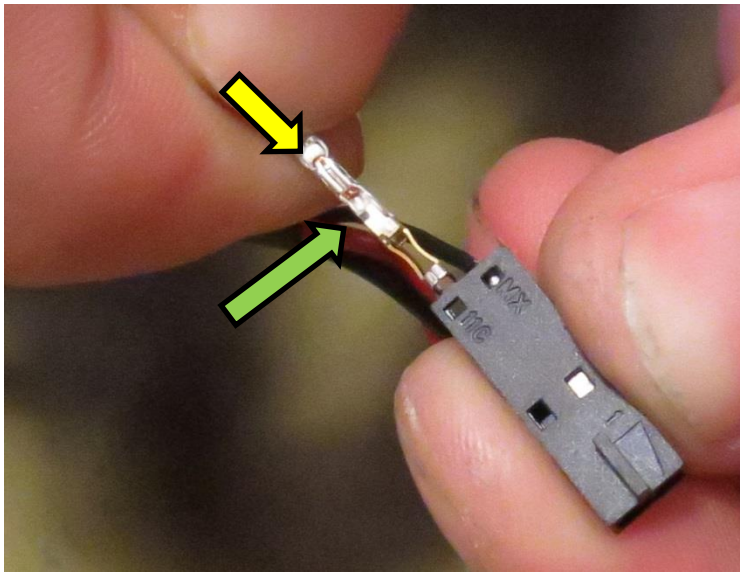
- Hold the heat shrink with tweezers, while sliding down the grommet.



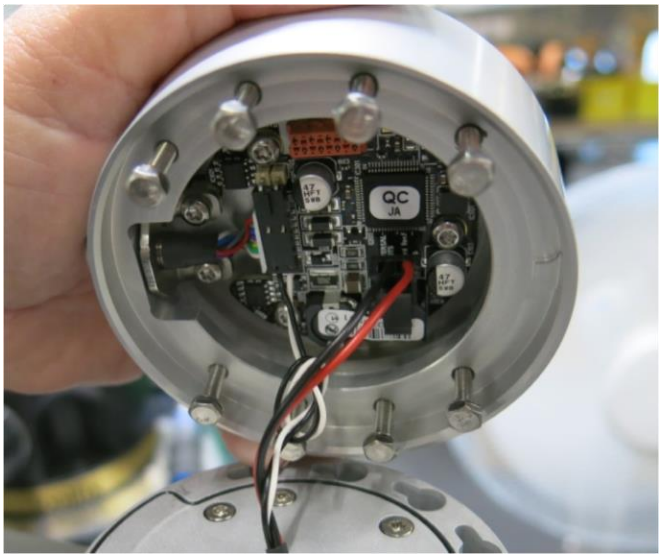
- Mount a cable tie on top of the grommet.
- Tighten and cut it off with the cable tie tool.



- Take the power connector:
- When inserting the connector pins, make sure the barbs, shown with green arrows, are located as shown on the photo. If not, they will not hook inside the connector and will fall out.
- Insert the black connector pin into the plug hole marked with a line – also shown with red arrow. Remember to orientate the barbs as described above.
- Insert the red into the other plug hole.
- When done, check that the connector pins are firmly hooked inside the plug by pulling gently in the wires.
- If not, check that the orientation of the barbs is correct. If they are correctly inserted, use a tool to press on the pins to ensure they are pushed all the way in.

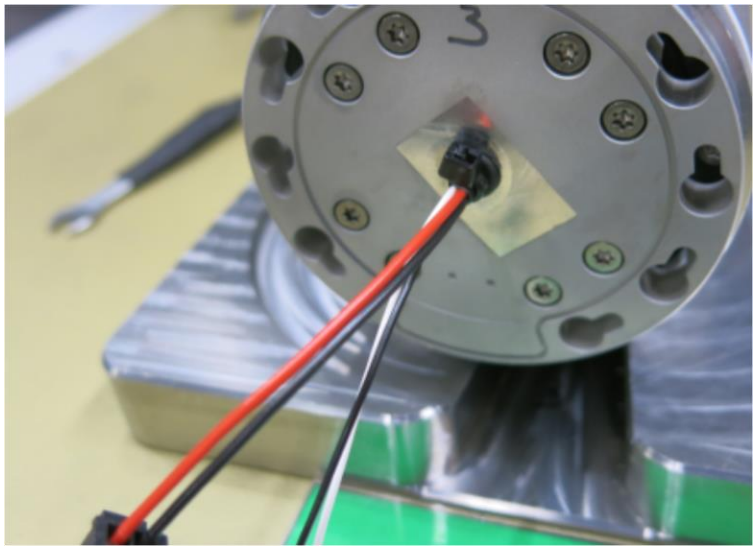


- Take the communication connector:
- When inserting the connector pins, make sure the barbs, shown with green arrows, are located as shown on the photo. If not, they will not hook inside the connector and will fall out.
- Inset the black connector pin into the plug hole marked “MX”. Remember to orientate the barbs as described above. A “click” will be heard when inserted correctly.
- Inset the white pin in the other plug hole.
- When done, check that the connector pins are firmly hooked inside the plug by pulling gently in the wires.
- If not, check that the orientation of the barbs is correct. If inserted correctly, use a tool to press on the pins to ensure they are pushed all the way in.

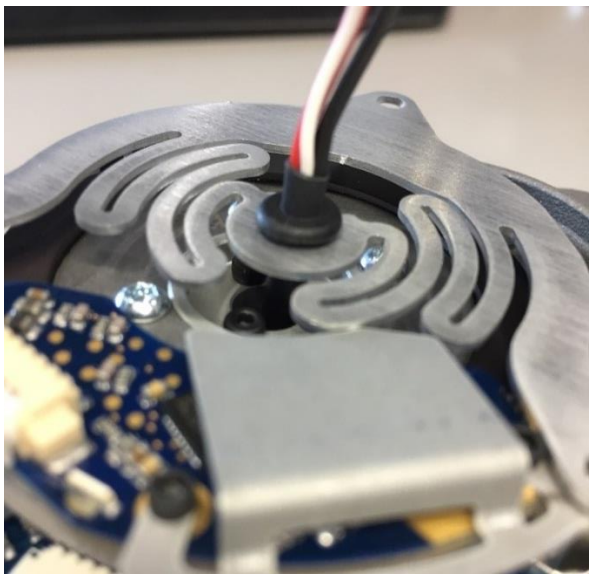


- When connecting to the tool flange, tie a loose knot in the communication wire in order to shorten it and minimize the risk of trapping the wire and damaging it when reattaching the tool flange.

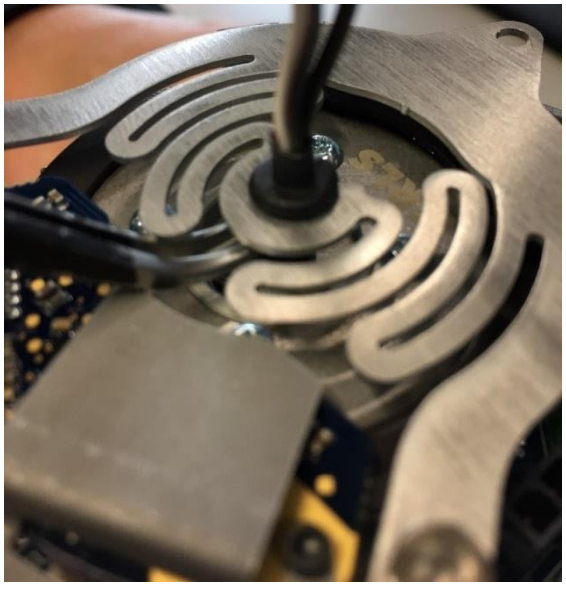
Size 3 – part number: 103503



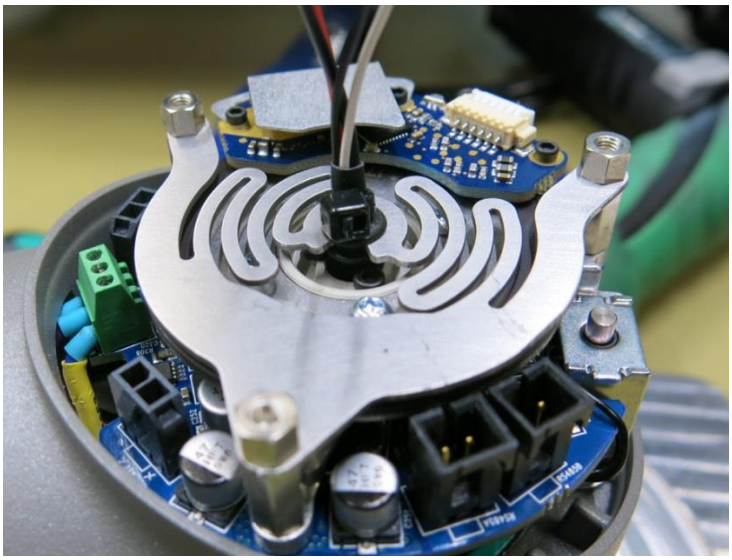
- Inset wire bundle as shown on photo example, with the cable tie towards the flange.



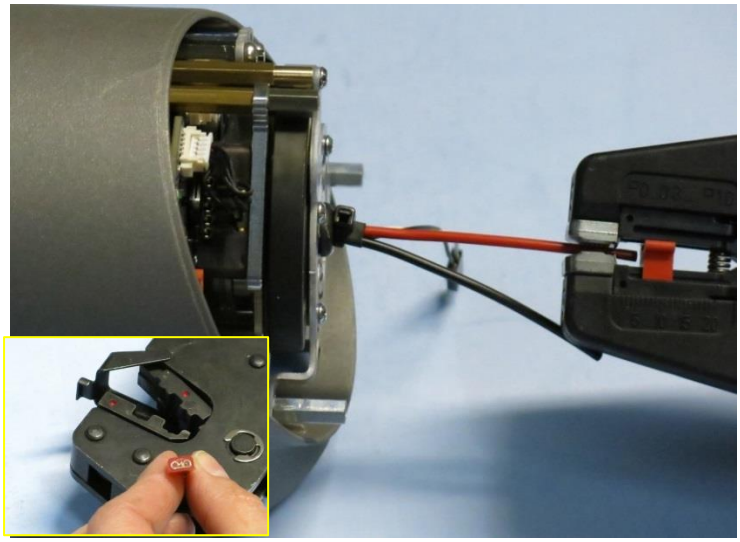
- Mount the grommet into the flex plate with the tweezers or the small flat nose screwdriver.



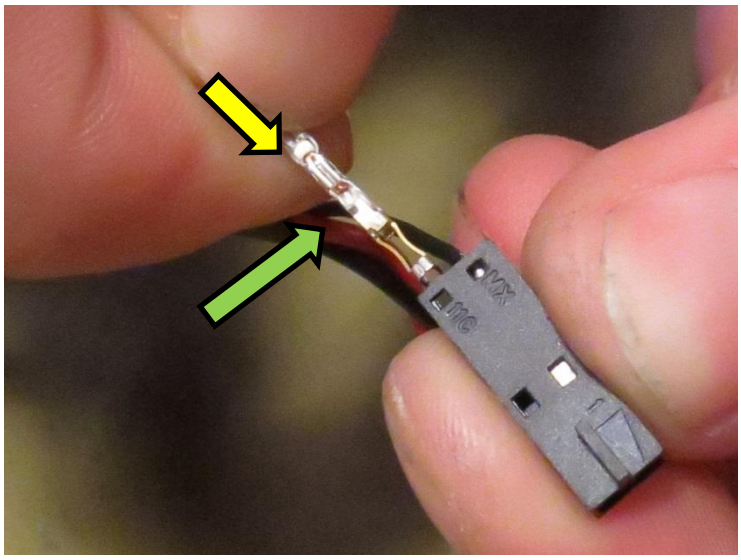
- Hold the heat shrink with tweezers while sliding down the grommet into position.



- Mount a cable tie on top of the grommet.
- Tighten and cut it off with the cable tie tool.



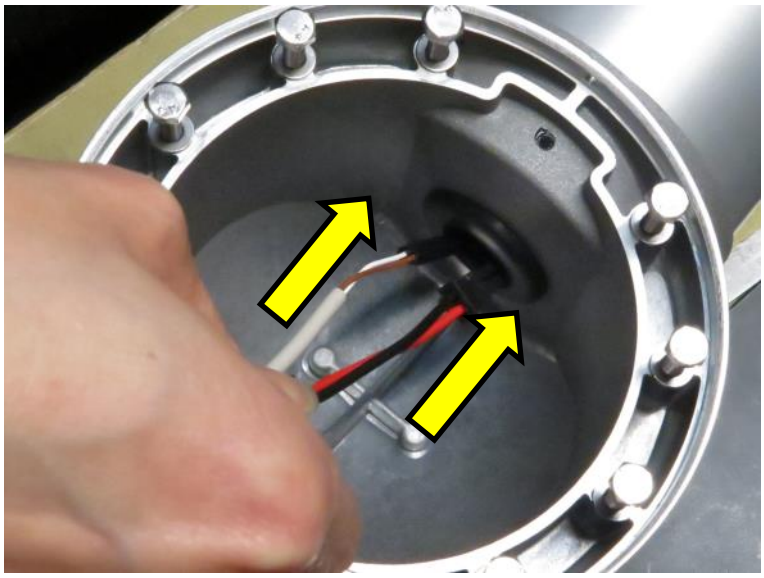
- The two power cables (two thicker, red and black wires) needs to be stripped (approx. 5mm).
- Mount the cable shoes
- Use the clamping tool as described by the manufacture.
- Check that the wire is secure in the cable shoes.



- Take the communication connector:
- When inserting the connector pins, make sure the barbs, shown with green arrows, are located as shown on the photo. If not, they will not hook inside the connector and will fall out.
- Inset the black connector pin into the plug hole marked “MX”. Remember to orientate the barbs as described above. A “click” will be heard when inserted correctly.
- Inset the white pin in the other plug hole.
- When done, check that the connector pins are firmly hooked inside the plug by pulling gently in the wires.
- If not, check that the orientation of the barbs is correct. If inserted correctly, use a tool to press on the pins to ensure they are pushed all the way in.

Lower arm – part number: 103508

Note: The lower arm wire bundle kit contains wire bundle for multiple robot types. Please be sure use the correct length.

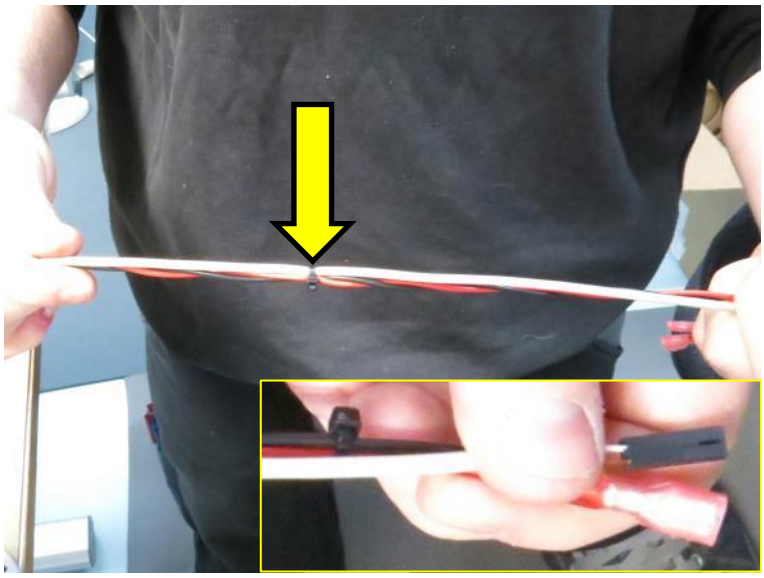


- Slide the end with the two black connectors through the hole from the elbow end – see photo example.

- When it is pulled all the way through, it should look like the photo.

Upper arm – part number: 103509

Note: The lower arm wire bundle kit contains wire bundle for multiple robot types. Please be sure use the correct length.



- Both ends of this wire bundle are identical so inserting in either direction is acceptable.

3.2 Controller

3.2.1 Replacement of Motherboard 3.0

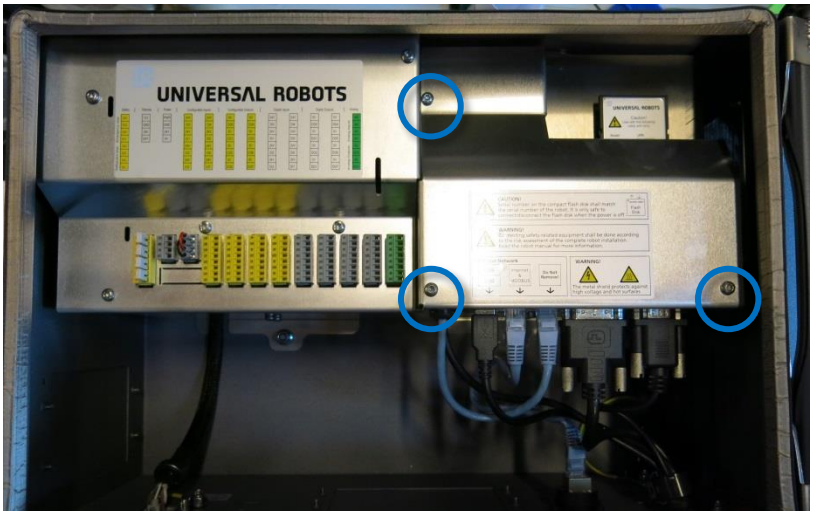
WARNING:
Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown.
Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.

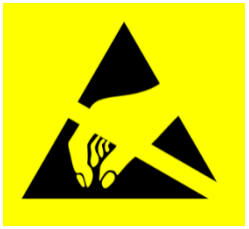
When completing the following replacement, please follow the guidelines laid out in section 3.0 Handling ESD-sensitive parts

NOTICE:

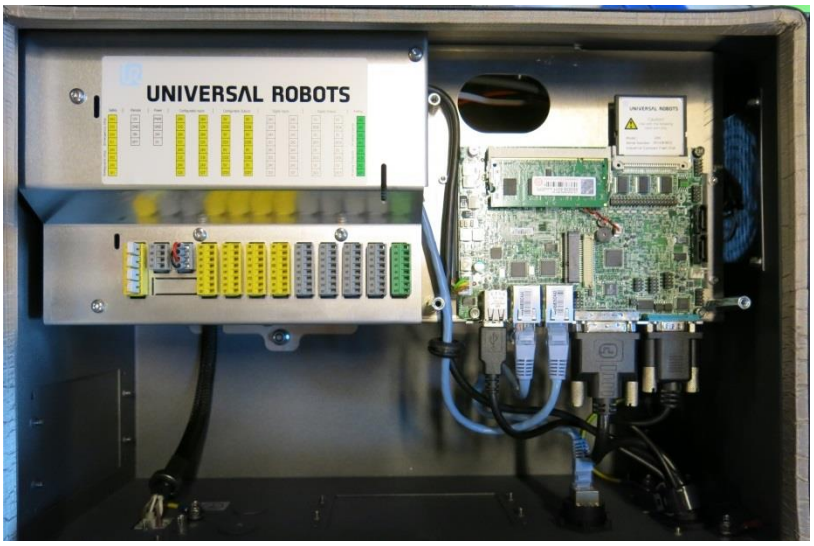
- Motherboard 3.0 uses compact flash memory card.
- Motherboard 3.1 uses USB memory stick.

1. Shut down the controller and disconnect the power cable, open the controller cabinet and remove the 3 torx screws

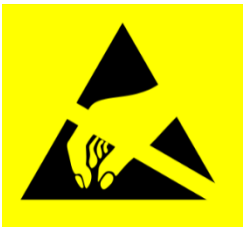


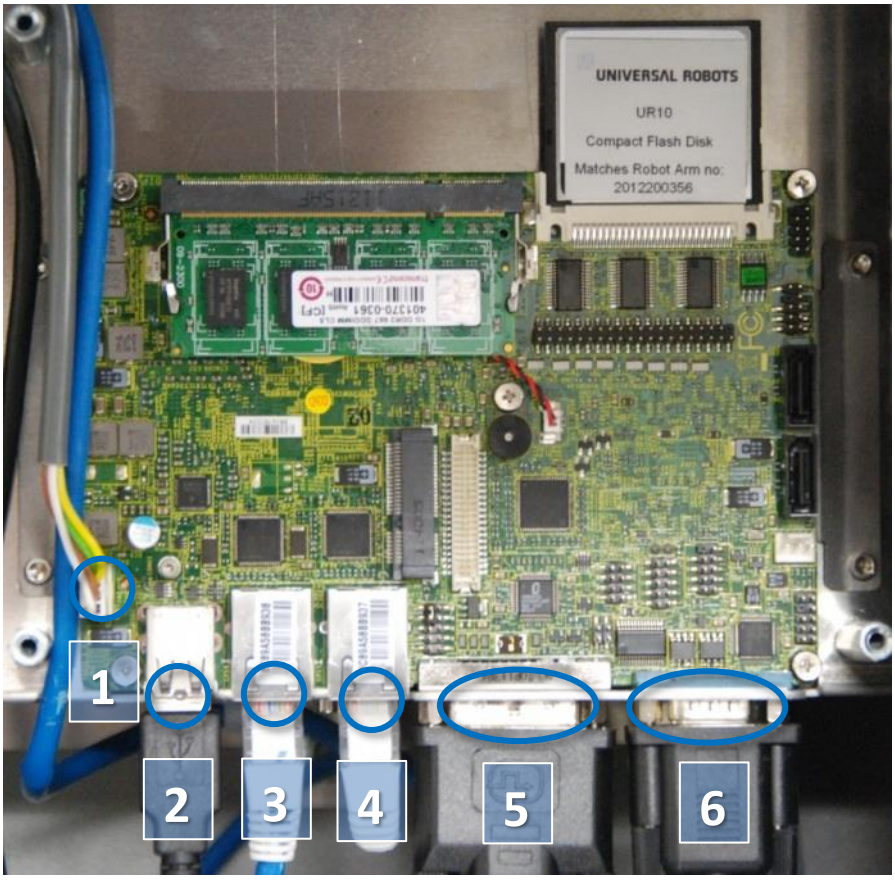


2. Remove the aluminum cover plate

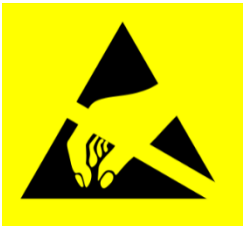


3. Disconnect cable connections from motherboard:
    1. White plug with white, brown, yellow and green wires, 12 V Power
    2. Black USB cable for Teach Pendant USB connector
    3. Ethernet cable to external connector
    4. Ethernet cable to Safety Control Board SCB
    5. DVI-cable for Teach Pendant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





4. Remove the 4 screws from the 2 holding brackets



NOTE! Ethernet cable to Safety Control Board

5. If controller is equipped with long-hole brackets, make sure to replace them with circular-hole brackets

6. Replace Motherboard and tighten the 4 screws gently

7. Insert the 6 cables in correct positions. Special attention on the **Ethernet cable to the Safety Control Board. It must be connected to the right connector on the mother board**

8. Re-install flash card and RAM block

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

10. Connect power and verify that teach pendant functions correctly.

3.2.2 Replacement of Motherboard 3.1

WARNING:
Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown.
Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.

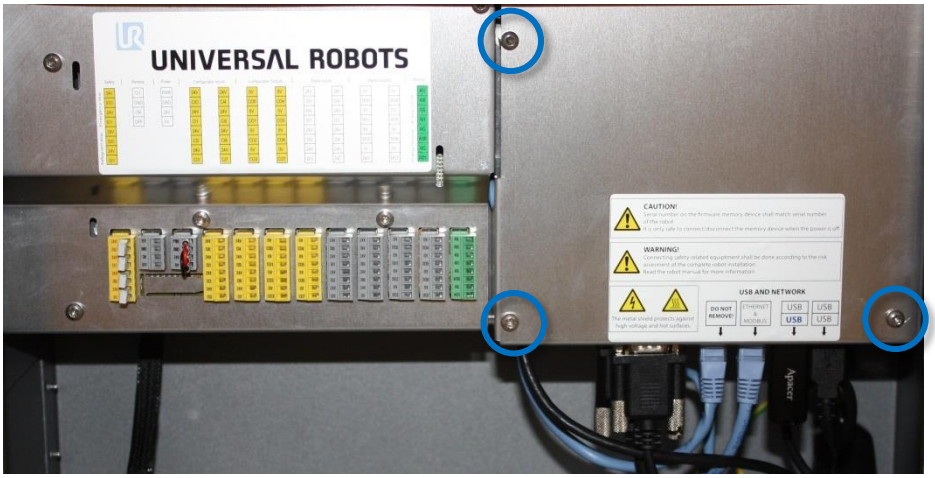
When completing the following replacement, please follow the guidelines laid out in section 3.0 Handling ESD-sensitive parts

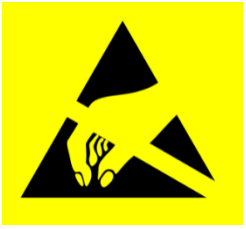
NOTICE:

- Motherboard 3.0 uses compact flash memory card.
- Motherboard 3.1 uses USB memory stick.

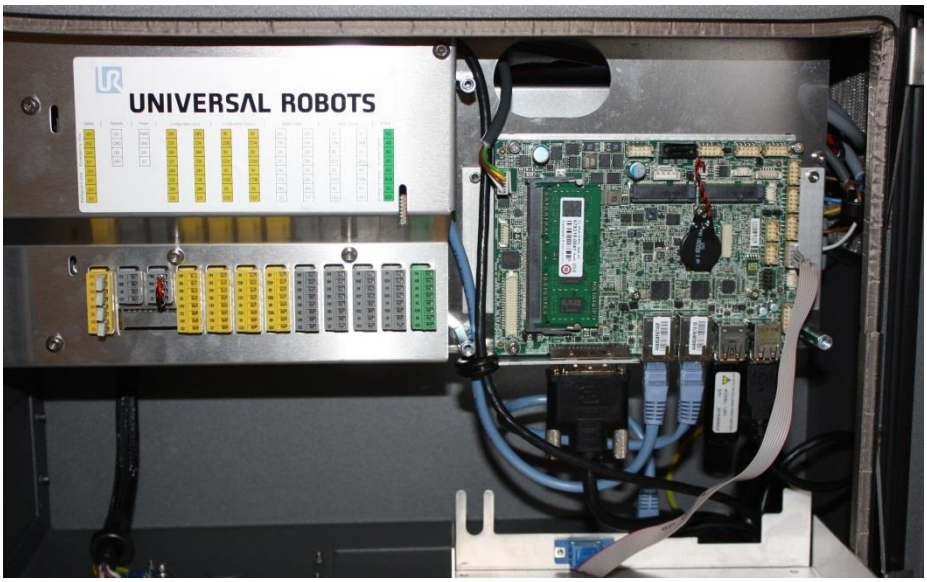
Motherboard 3.1 is from serial number: 2016351864

1. Shut down the controller and disconnect the power cable, open the controller cabinet, and remove the 3 torx screws

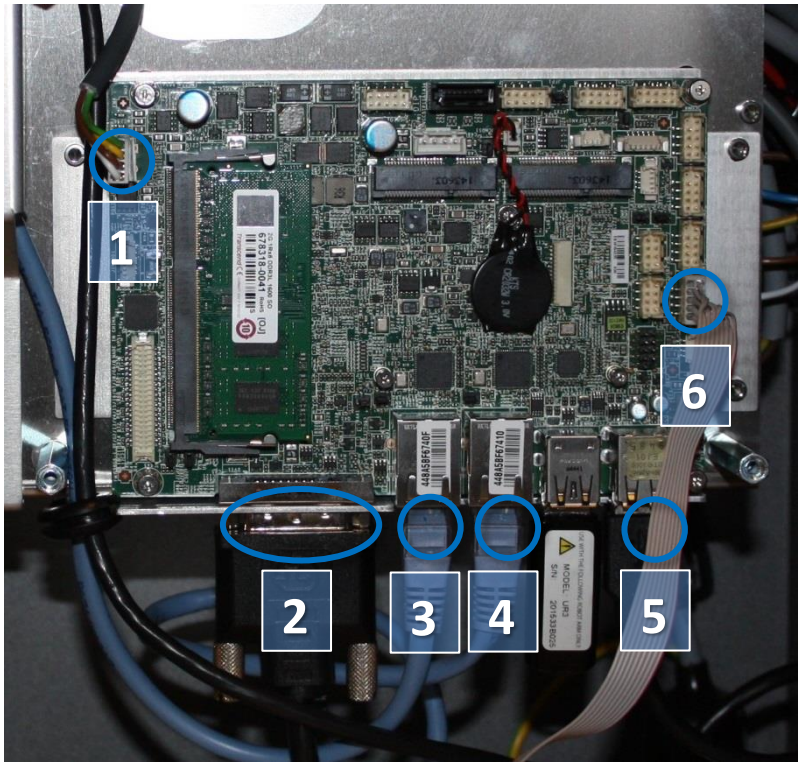




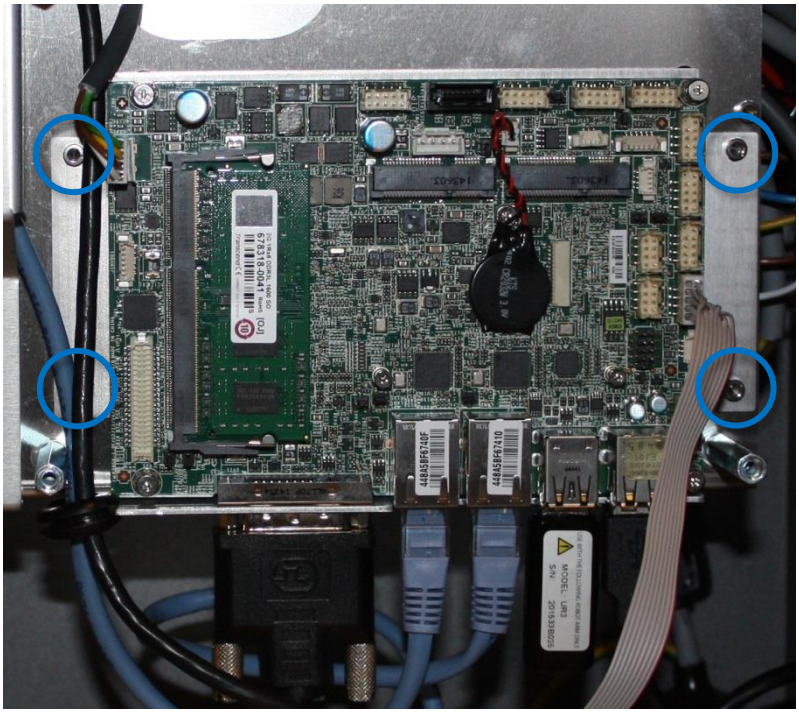
2. Remove the aluminum cover plate



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



4. Remove the 4 screws from the 2 holding brackets



5. Replace Motherboard.

6. Insert the 6 cables in correct connectors. Pay special attention to the Ethernet cable to the Safety Control Board. It must be connected to the right connector on the mother board

7. Re-install USB stick for UR system software

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

3.2.3 Upgrading of Motherboard 3.0 to 3.1

WARNING:
Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown.
Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.

Introduction

- This section provides guidelines for exchanging an existing CB3 motherboard with a new CB3.1 motherboard.
- It is solely intended for advanced integrators of UR robots.

Parts and check list

The kit includes the below parts. Please check that all parts are present before starting the replacement.

		QNT.
122430	CB3.0 to CB3.1 Upgrade kit	
	Standoff for mounting cover M4x35 – hex 7	3
	Screws for cover mounting M4x8 torx T20	3
	Standoff for mounting Motherboard M3x6x25mm – hex 5	4
	Screws for mounting Motherboard M3x6 torx T10	4
	Grommet	1
	USB drive with image	1
	Disposable ESD-wrist strap	1
	Safety Control Board cover assembly	1
	Improved motherboard power cable for CB3	1

Tools needed (not incl. in the kit):

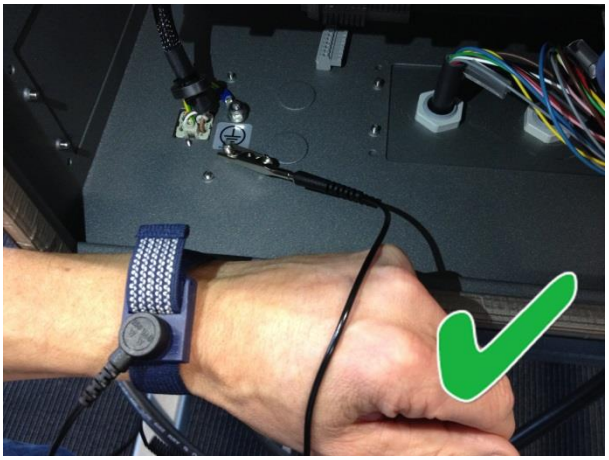
- ESD-wrist strap
- Hex 7 key
- Hex 5 key
- T20 torx
- T10 torx
- 2.5 Allen key
- Compact flash card reader
- Laptop with USB port, running Windows (7 or higher) or Linux (10 or higher) operating system

Time needed:

- Approx. 1 hour

3.2.3.1 Hardware

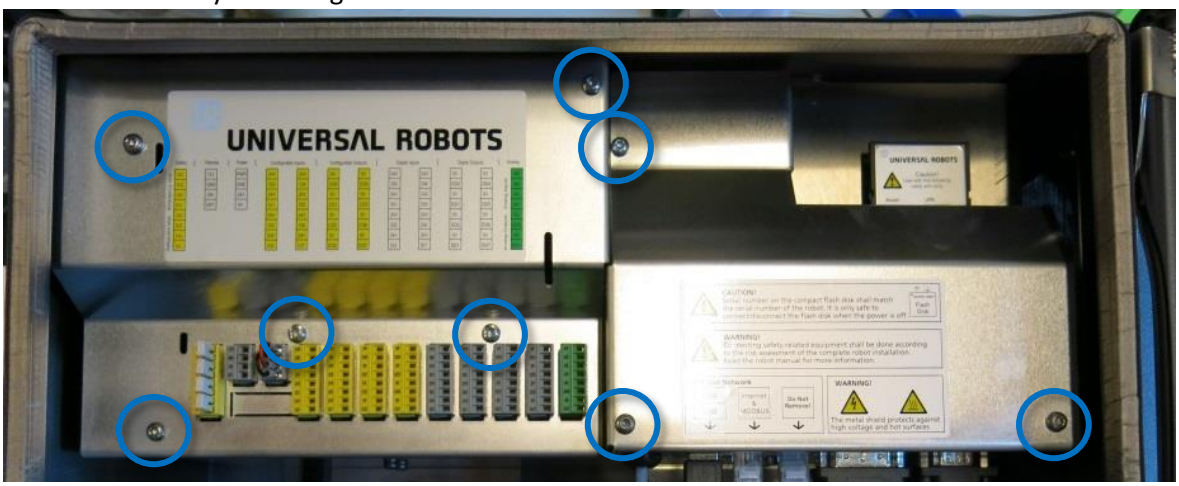
- Always use an ESD wristband when working on the controller.



Put the ESD wrist strap on your wrist. Connect the wrist band to the system ground point.

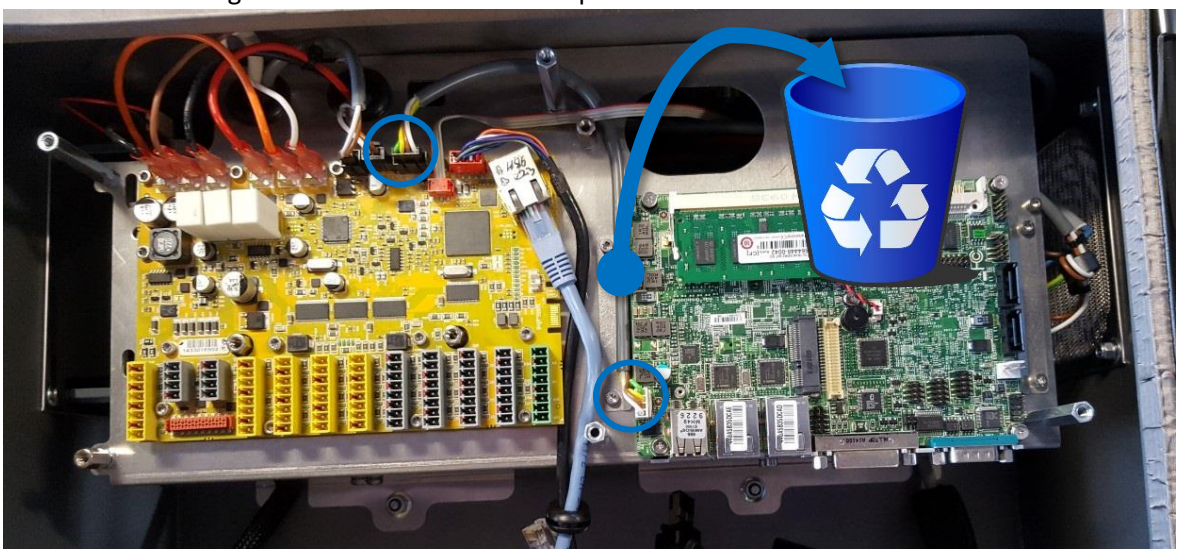
This discharges any static electricity in your body to ground.

- Remove shields by removing the 7 x T20 torx screws

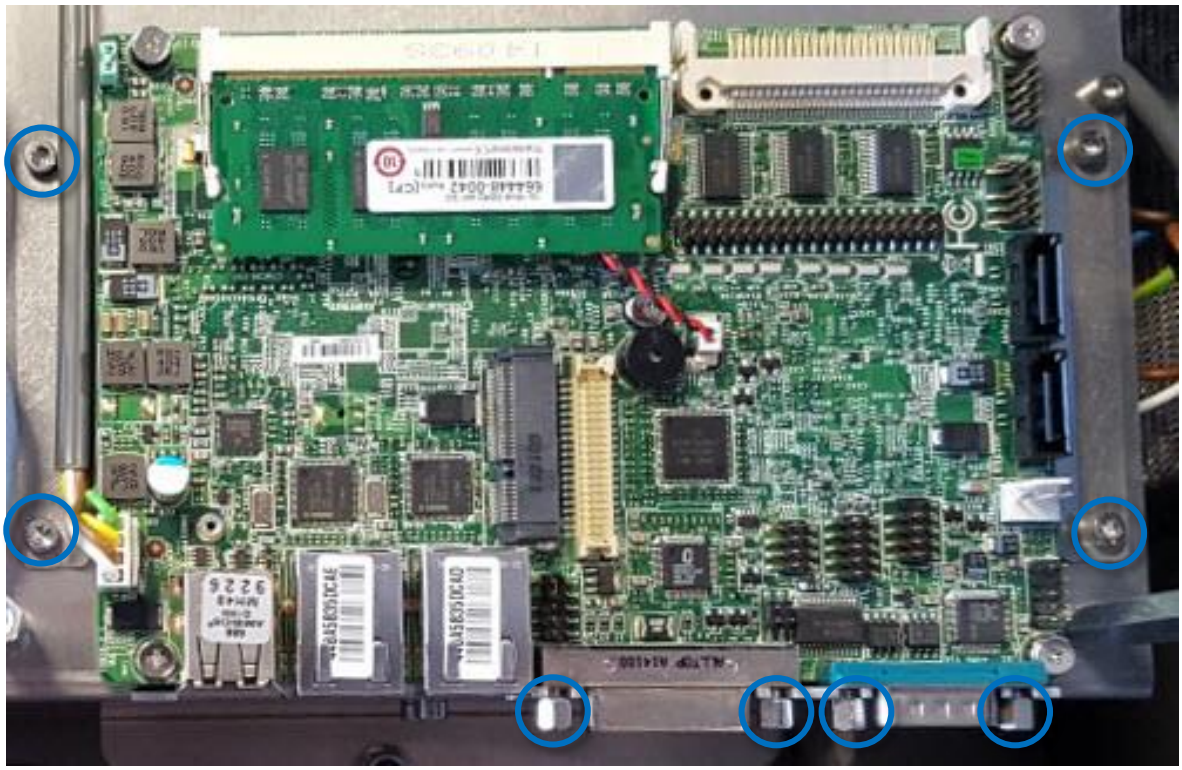


- Remove all cables attached to the motherboard and the compact flash card

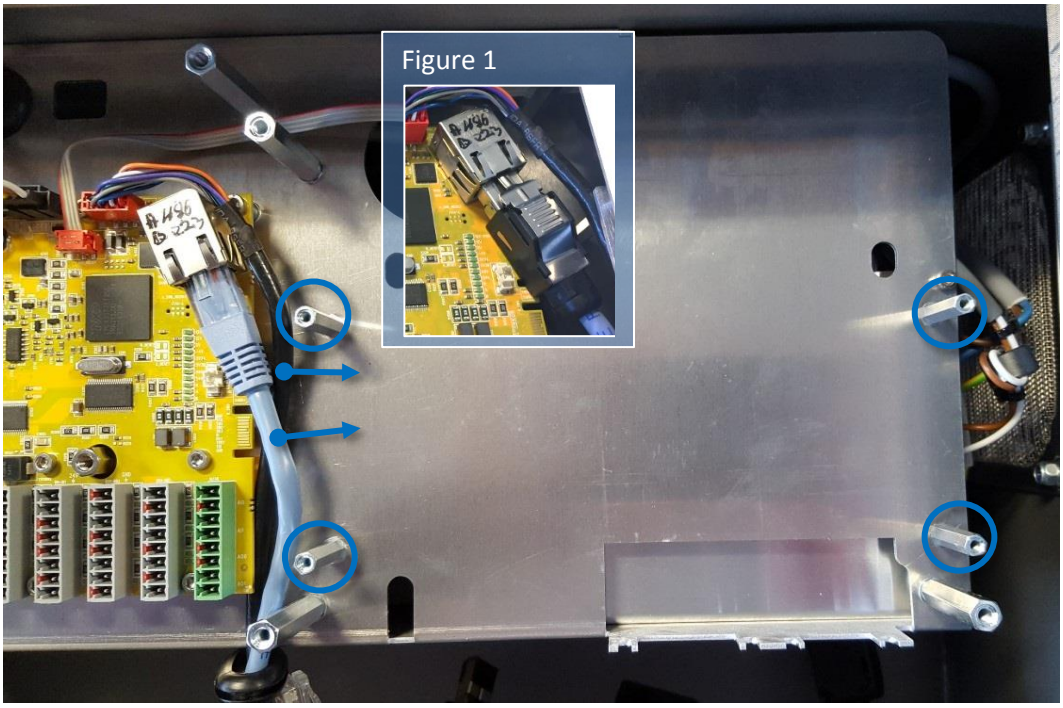
- Remove the cable that connects the motherboard and Safety Control Board.
  This cable is no longer needed and should be disposed of.



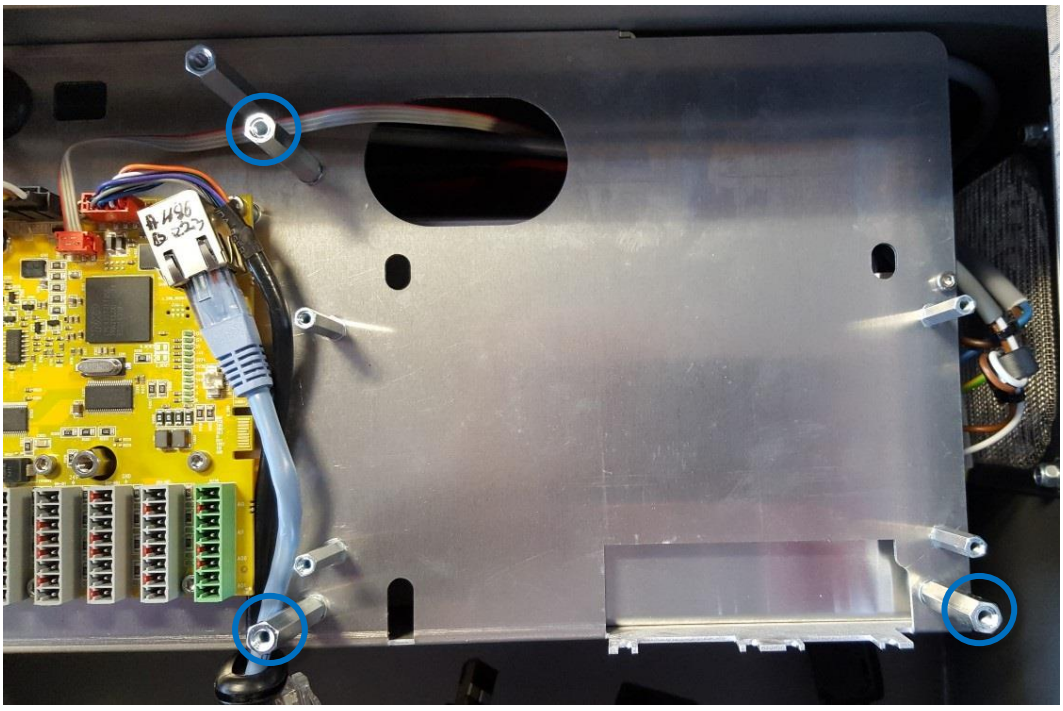
- Unscrew the motherboard by loosening the 4 x 2.5mm hex screws and the 4 x 5,5 hex standoffs that hold the RS232 and DVI connectors



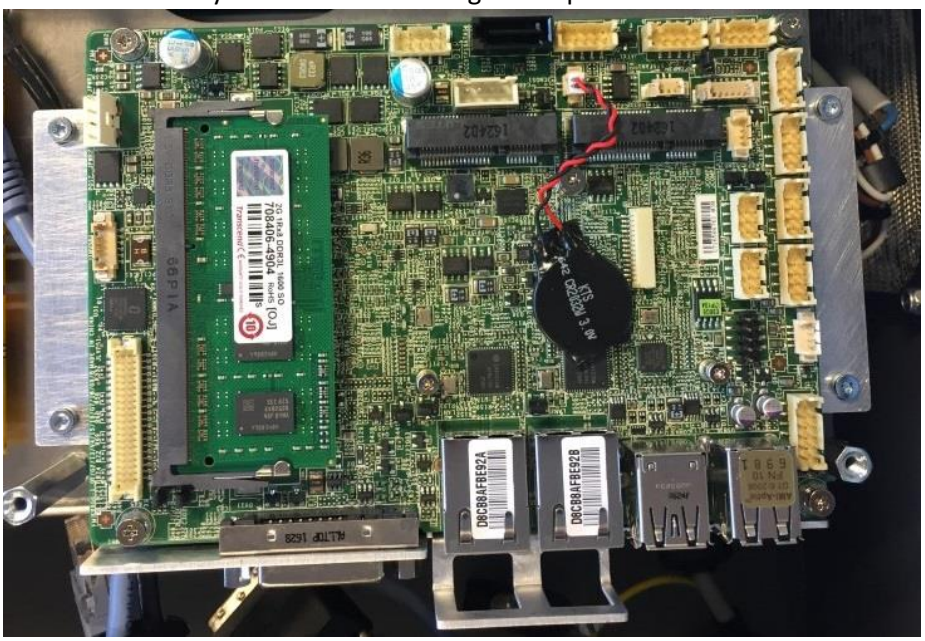
- Mount the smaller standoffs where the motherboard screws were before.
  Place the black cable from the Teach Pendant and the Ethernet cable on the left side of the Standoff as shown on the photo.
  Note: If your Ethernet cable has a black plug (Figure 1) at one end, then this end must be connected to the Safety Control Board.



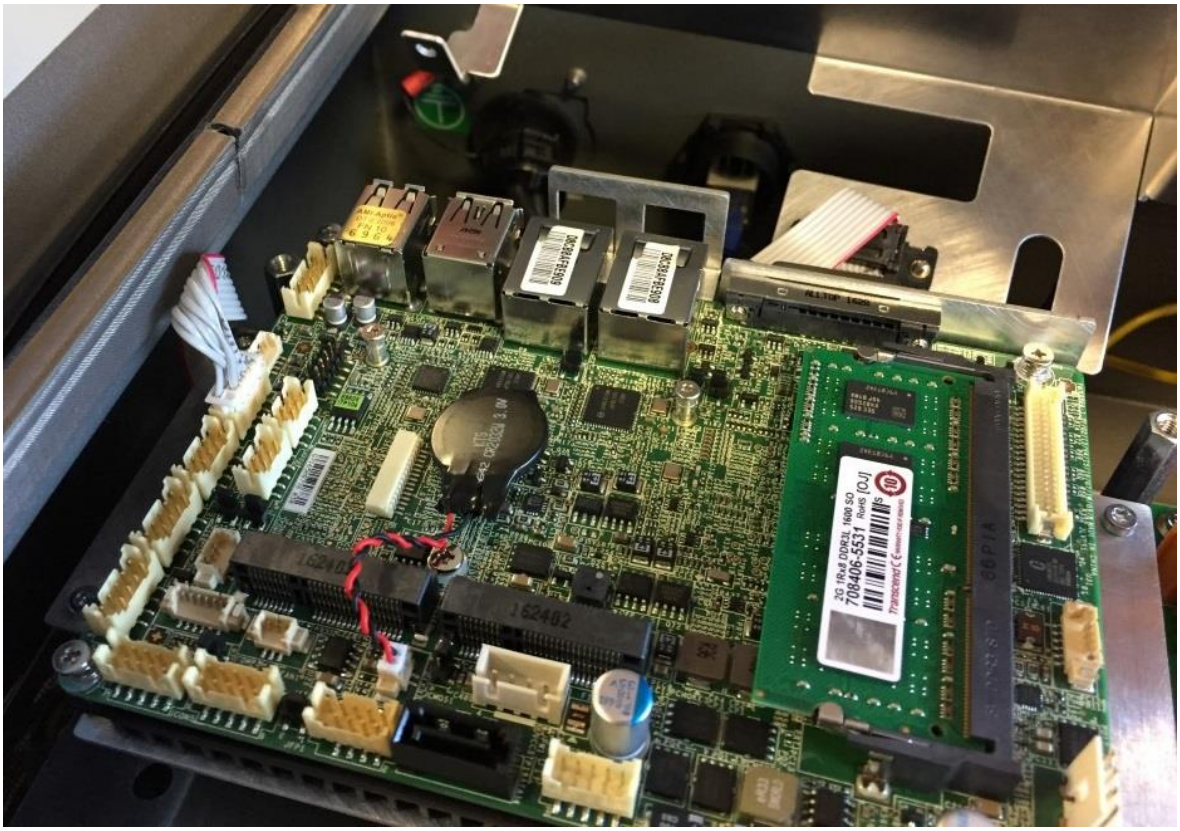
- Unscrew the 3 standoffs that hold the cover for the motherboard and mount the new larger standoffs.



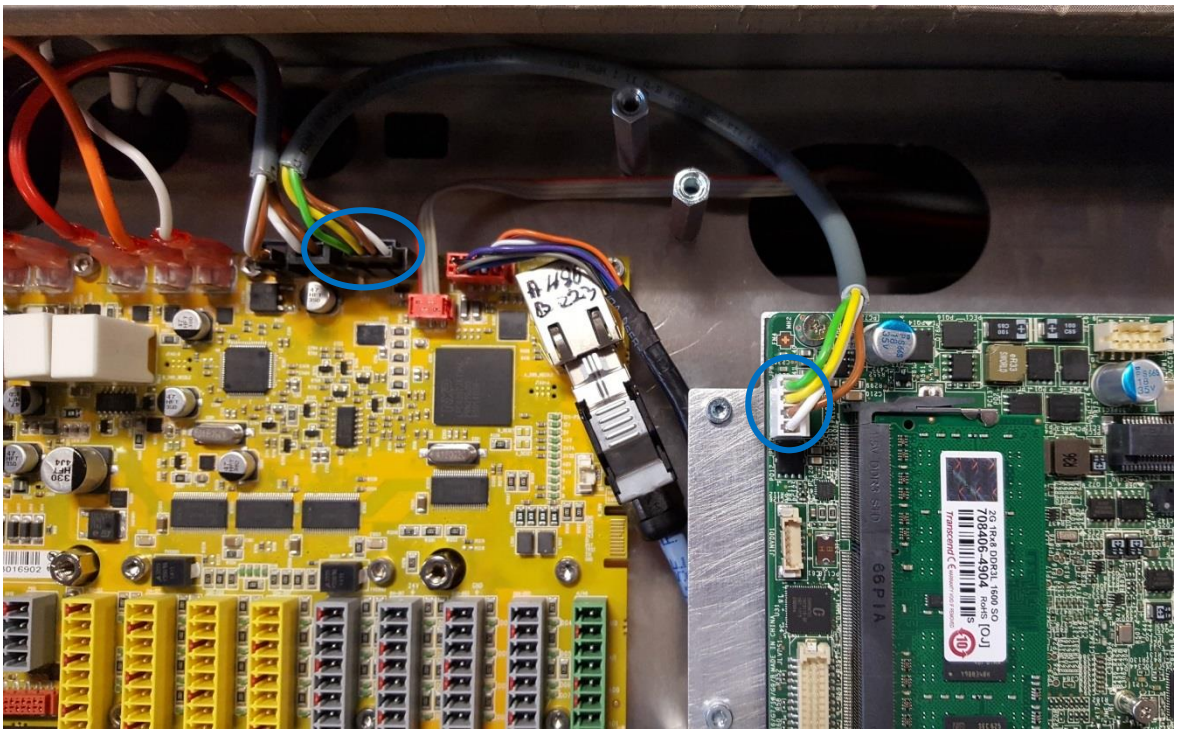
- Mount the motherboard onto the standoffs. Please note that the two screws toward the outside of the controller may be more difficult to get into position.



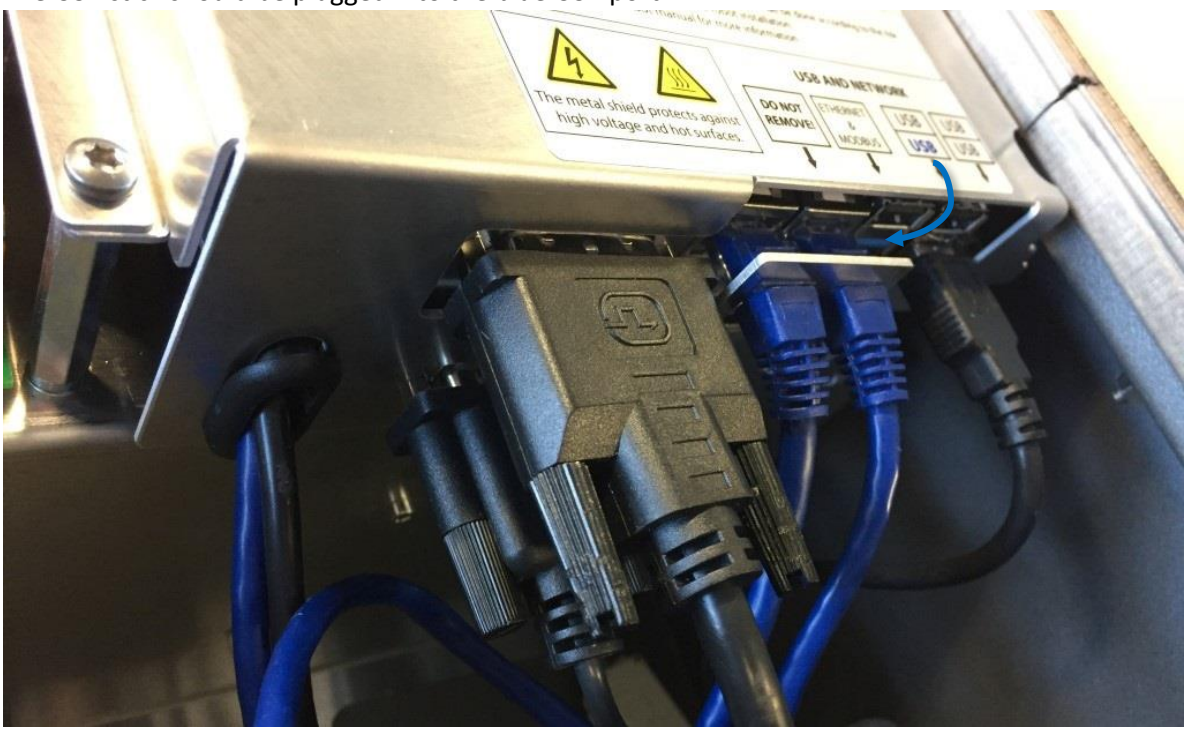
- Now take the new cover for the motherboard and navigate the flat cable under the motherboard and to the connector as shown in the photo below



- Plug the new power cable from the SCB to the CB 3.1 motherboard as shown.



- Screw on the new cover. Please note that the screw toward the outside of the controller may be difficult to get into position.
- Mount the new cover for the Safety Control Board.
- Mount all the connectors again according to the sticker on the cover and photo below.
  The USB stick should be plugged into the blue USB port.



3.2.3.2 Software

NOTICE:

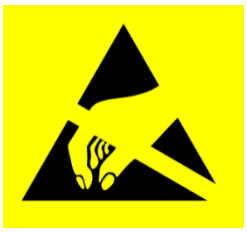
1. Do not downgrade a robot with a CB3.1 motherboard, to a Software version below 3.1.1.7336. Doing so may cause unexpected behavior of the robot.
2. Universal Robots assumes no responsibility for the outcome of this process.
3. The instructions in this document shall be considered as general guidelines. It is assumed that the integrator has a high level of technical knowledge

- The following files need to be copied from the existing compact flash card, onto the new USB.
  - root/ur-serial
  - root/log_history.txt
  - root/histogram.properties
  - root/.urcontrol/urcontrol.conf
  - root/.urcontrol/calibration.conf
  - root/.urcontrol/calibration.log
  - root/.urcontrol/robot_calibration_summary.txt
  - programs/ [all of the following files: .urp, .txt, .script, .installation, .variable, .old]

- Detailed description on backup of data can be found in 4.4 backup of data
- If the old CB 3.0 motherboard is defective, use a flash card reader and install a Linux partition reader for Windows to read the Linux partition on the flash card.
- Polyscope must be minimum software version 3.1.1.7336

3.2.4 Replacement of Safety Control Board

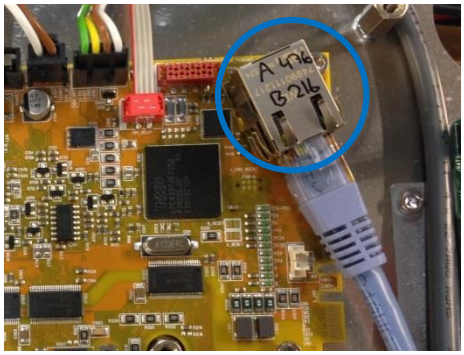
WARNING:
Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown.
Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.



When completing the following replacement, please follow the guidelines laid out in section 3.0 Handling ESD-sensitive parts

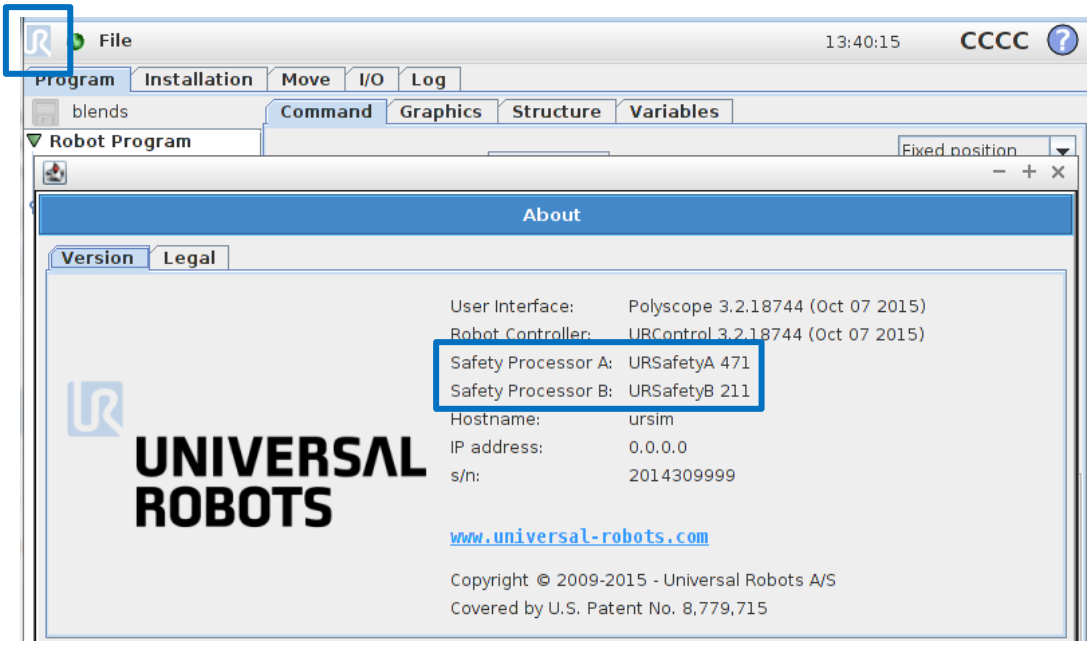
To replace Safety Control Board in controller box:

1. Check that the software on the robot is not older than the firmware version on the SCB.
   If the software on the robot is older, error C203A0 will be displayed.
   The SCB firmware version can be found on the Ethernet connector.

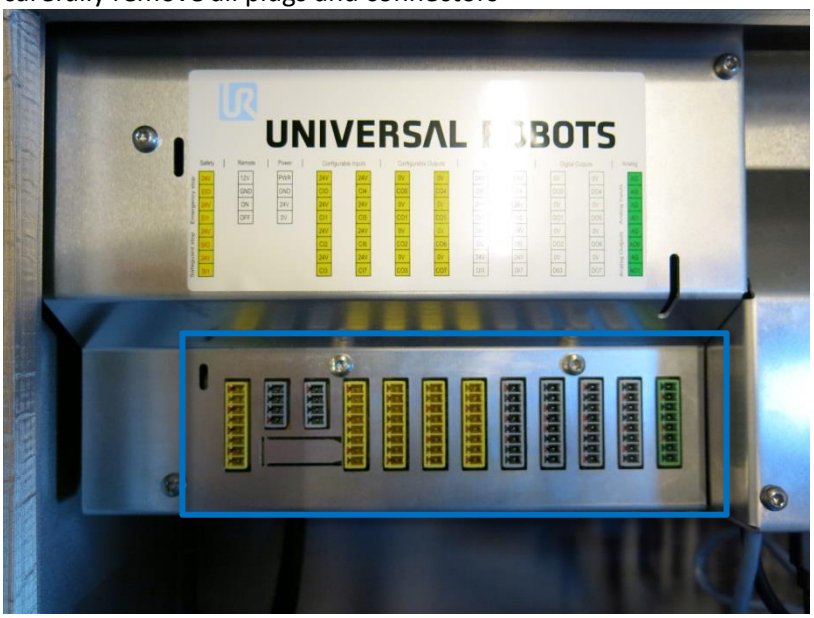


   This can also be found in the “About” menu.

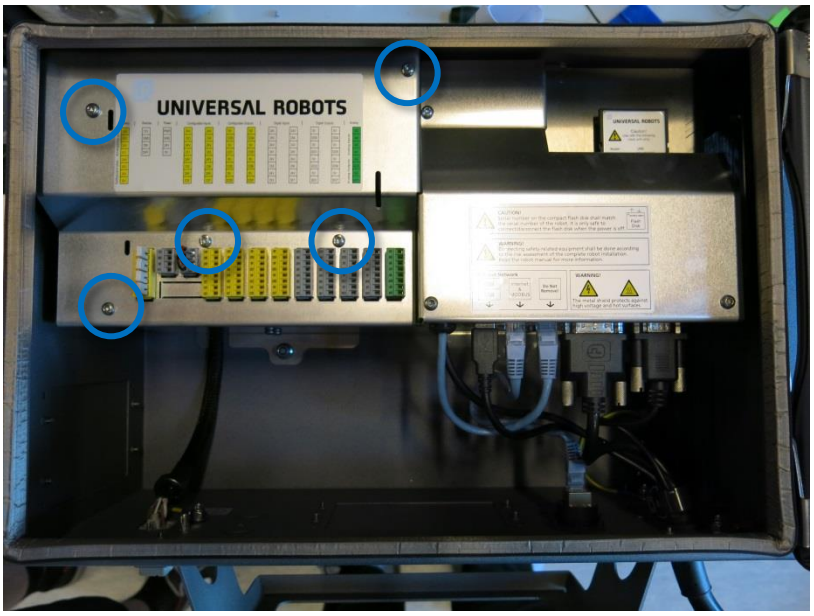
   Shortcut to “About”, by clicking on the UR logo in the top right corner of the screen is available from software version 3.2.18642



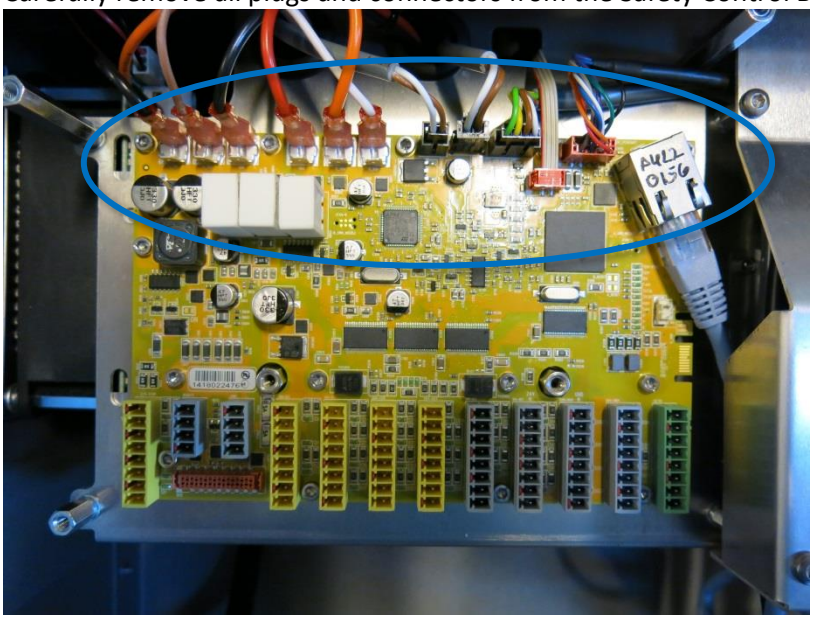
2. Shut down the controller and disconnect the power cable, open the controller cabinet then carefully remove all plugs and connectors

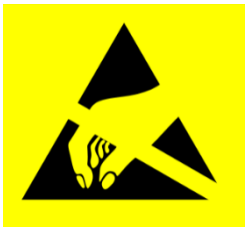


3. remove the 5 torx screws and followed by the aluminum cover.

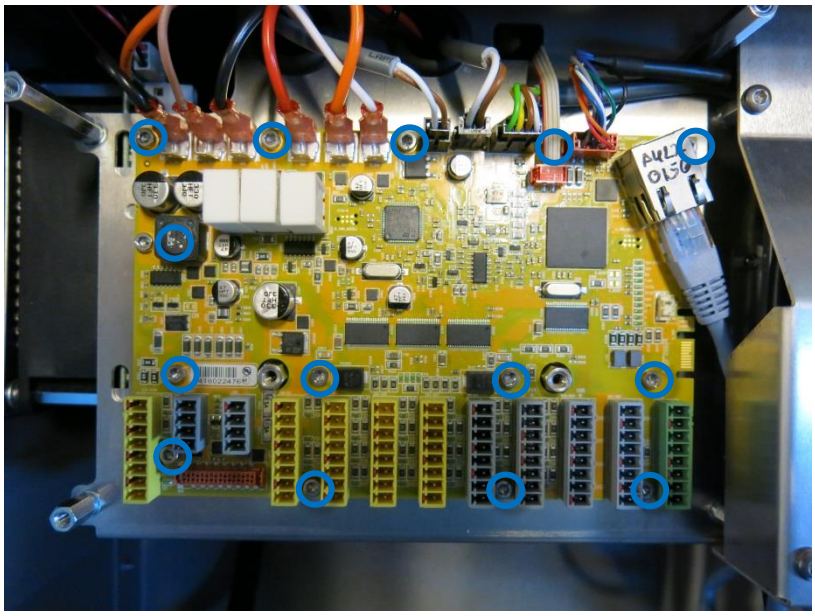


4. Carefully remove all plugs and connectors from the Safety Control Board.





5. Remove the 14 screws holding the board in place.



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

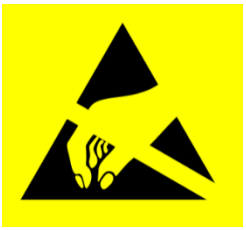
7. Insert all connectors and plugs back into their correct positions. If unsure of the correct positions consult 5.4.1 Schematic overview

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

3.2.5 Replacement of Teach Pendant

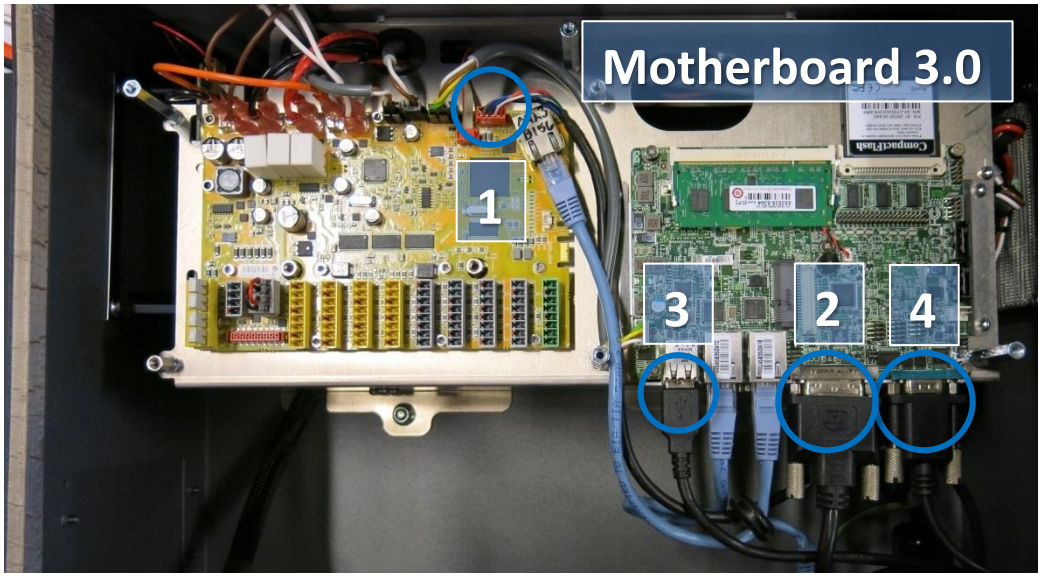
	**WARNING:** Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown. Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.

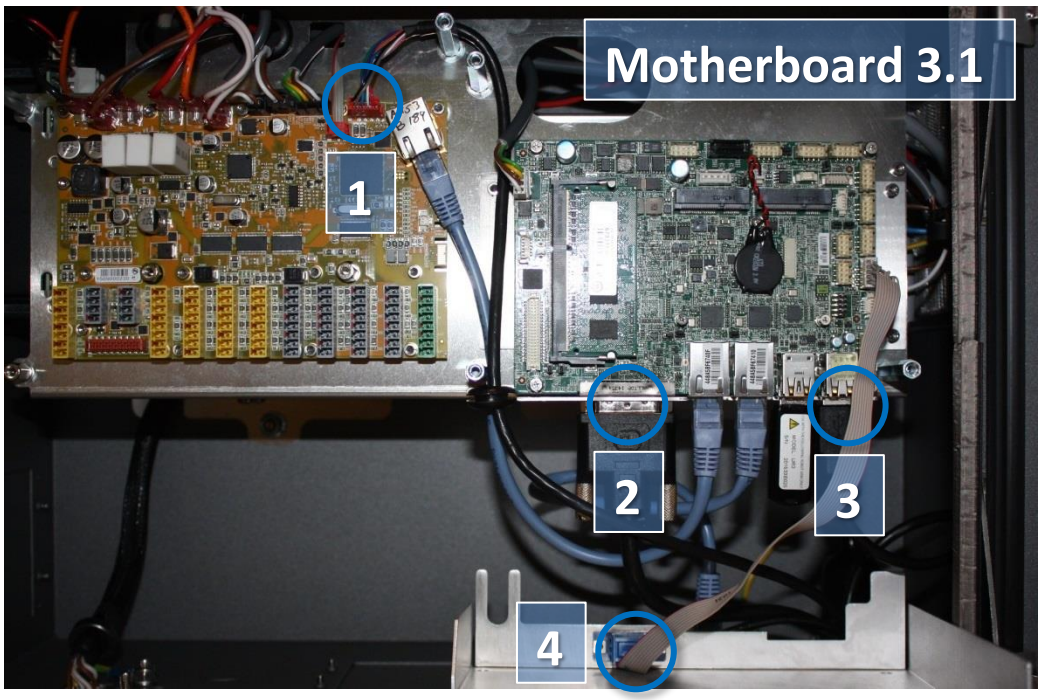
When completing the following replacement, please follow the guidelines laid out in section 3.0 Handling ESD-sensitive parts



Note: use the same procedure for power down and removing the aluminum cover plates as in chapter 3.2.1 Replacement of Motherboard 3.0, 3.2.2 Replacement of Motherboard 3.1 *or* 3.2.4 Replacement of Safety Control Board

1. Disconnect 4 cables:
    1. Red plug with black cable
    2. Black DVI cable
    3. Black USB cable
    4. Black cable for RS232-connection to 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. To install new teach pendant, thread cables through inlet, plug connectors into correct positions, then mount aluminum cover into place.

4. Connect power and verify that teach pendant functions correctly.
   See diagram: 5.4.1 Schematic overview

3.2.6 Replacement of 48V power supply

	**WARNING:** Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown. Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.

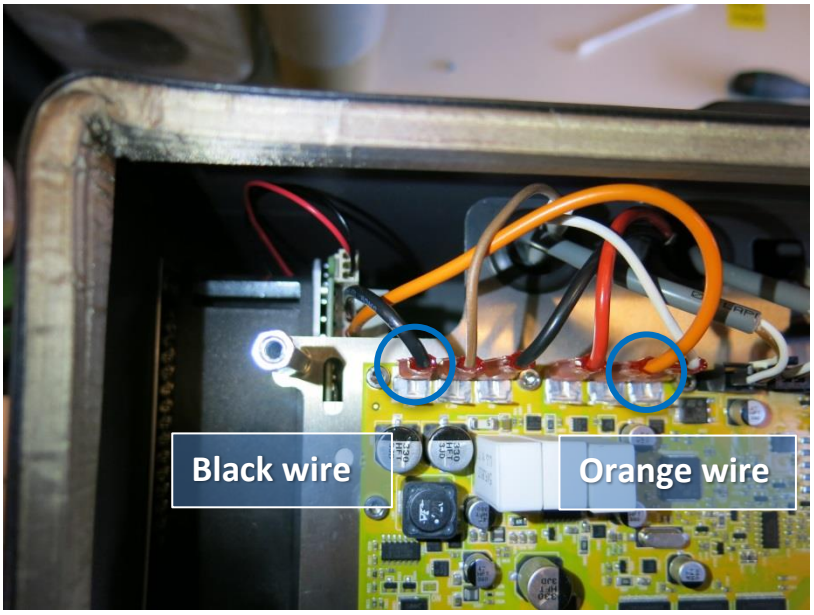
When completing the following replacement, please follow the guidelines laid out in section 3.0 Handling ESD-sensitive parts

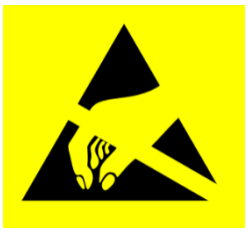
To replace 48V power supply in controller box:

Note: use the same procedure for power down and removing the aluminum cover plates as in chapter 3.2.1 Replacement of Motherboard 3.0, 3.2.2 Replacement of Motherboard 3.1 *or* 3.2.4 Replacement of Safety Control Board

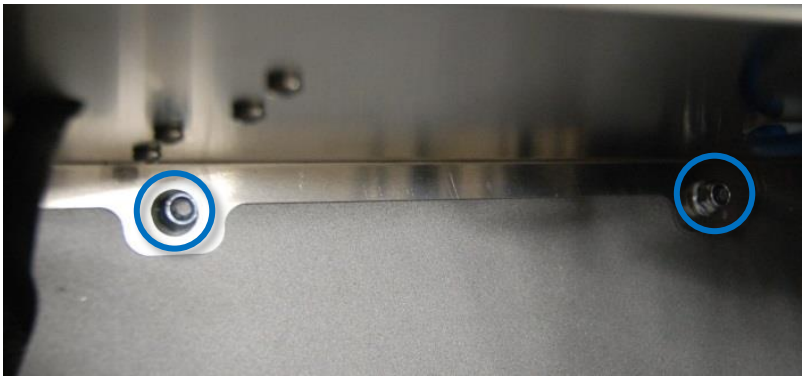
1. Remove teach pendent cable – see previous section.
2. Detach the controller box handle by removing the 2 screws holding it in place.

3. Disconnect the 2 wires for the energy eater and fan.

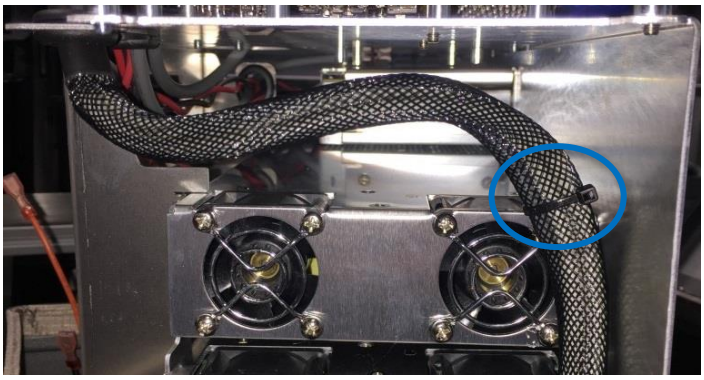




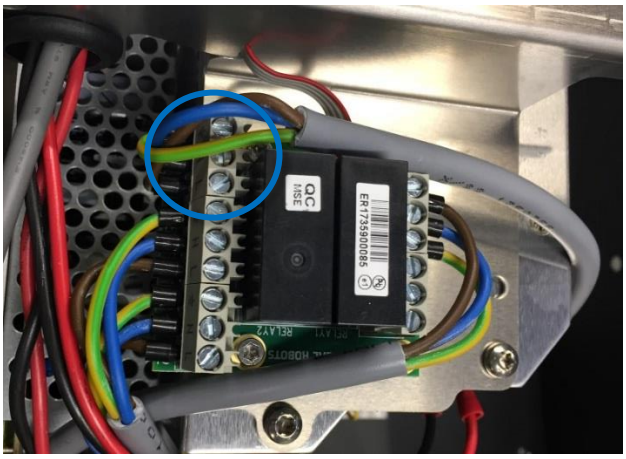
4. Remove the 2 nuts (M6) in the bottom of controller module.



5. Gently take out the controller module from the controller box.
6. Turn the module 90° counterclockwise and place it on the controller edge.
7. Cut the cable tie that ties the robot cable, unplug the connectors from the Safety Control Board and remove the cable.

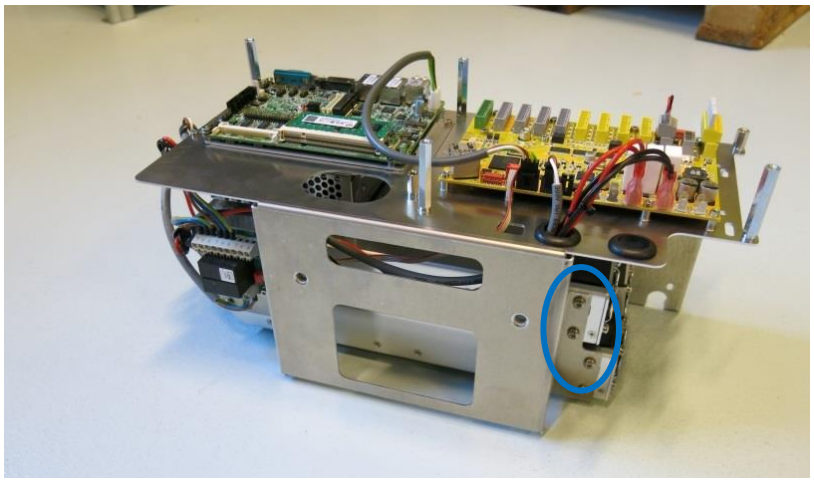


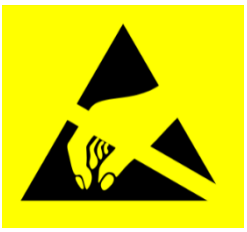
8. Turn the module 180° clockwise and place it on the controller edge.
9. Remove the power connection on the current distributor.
   The module is now loose from the controller.

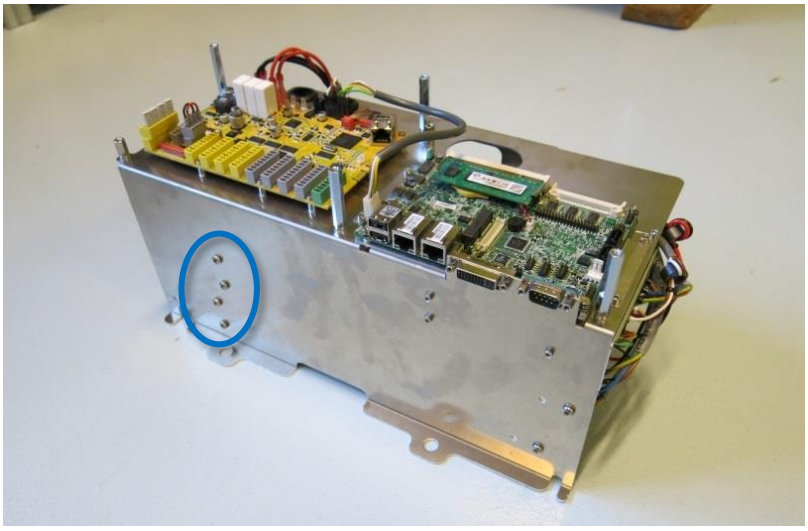


10. Power supplies are located in the rack under the controller module, the two 48V power supplies are the lower ones in the rack (UR3 and UR5 has one and UR10 has two 48V power supplies). Before removing the 48V power supply, label the wires then disconnect them from that supply.

11. Remove the screws keeping the defective 48V power supply in place from the side of the rack.







12. Replace the defect 48V power supply with the new one.

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

14. Reinstall controller module in reverse order and reconnect the 2 wires for the fan and cables for the teach pendant.

15. Carefully put back the aluminum cover plate, making sure to mount it correctly and fix into place with the screws.

16. Connect the power cable and verify that teach pendant functions correctly.

3.2.7 Replacement of 12V power supply

WARNING:
Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown.
Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.

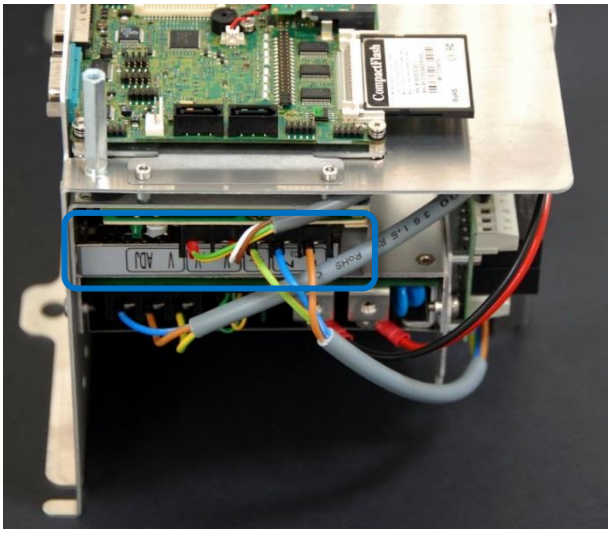
When completing the following replacement, please follow the guidelines laid out in section 3.0 Handling ESD-sensitive parts

To replace 12V power supply in controller box

Note: use the same procedure for power down and removing the aluminum cover plate and cables for teach pendant as in chapter 3.2.5 Replacement of Teach Pendant

To replace the 12V power supply follow the same steps as for the procedure in chapter 3.2.6 Replacement of 48V power supply

1. The 12V power supply is placed in the top of the rack. The screws holding it in the frame are at 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 put back the aluminum cover plate, make sure to mount it correctly and fix it in place with the 5 screws.

6. Connect power and verify that teach pendant functions correctly.

3.2.8 Replacement of Current distributor

WARNING:
Before replacing ANY components inside the control box, it is IMPORTANT to do a complete shutdown.
Follow the first 3 steps in section 5.3.7 Complete rebooting sequence.

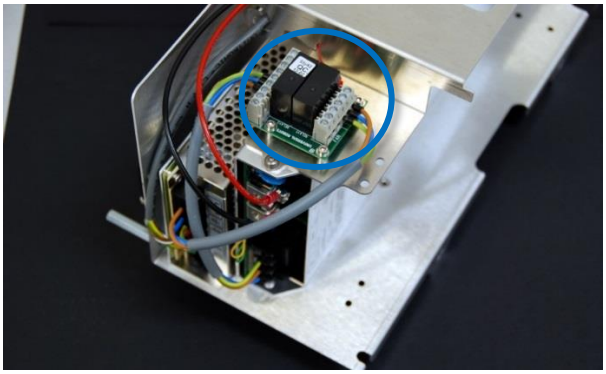
When completing the following replacement, please follow the guidelines laid out in section 3.0 Handling ESD-sensitive parts

To replace current distributor in controller box:

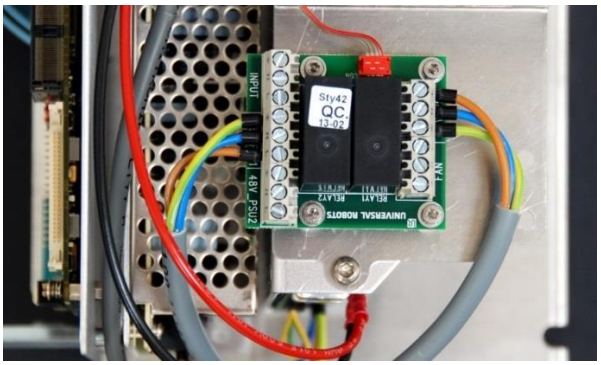
Note: use the same procedure for power down and removing the aluminum cover plate and cables for teach pendant as in chapter 3.2.5 Replacement of Teach Pendant

To replace the current distributor, follow the same steps as for the procedure in chapter 3.2.6 Replacement of 48V power supply

1. Current distributor is placed on top of the 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 aluminum cover plate, make sure to mount it correctly and fix it in place with the 5 screws.

7. Connect power and verify that teach pendant functions correctly.

4. Software

4.1 Update software

Universal Robots software is named PolyScope.

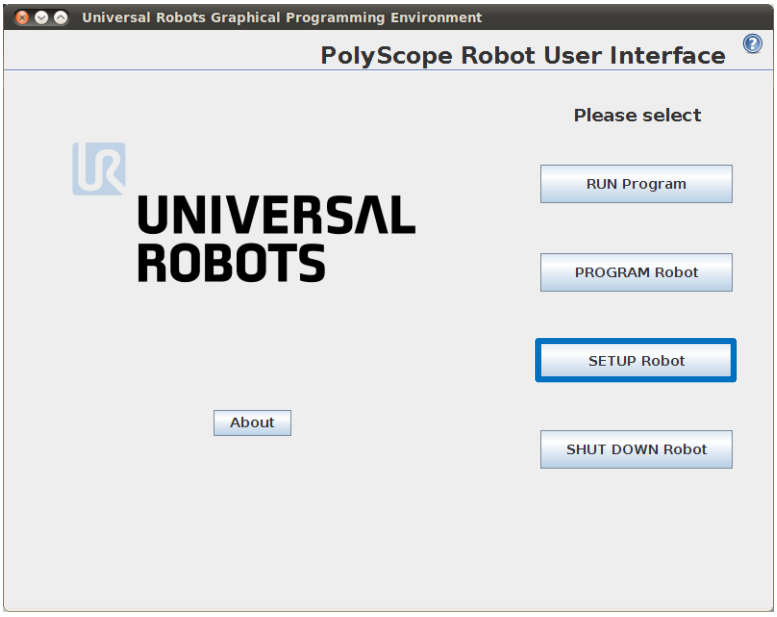
NOTICE:
Read the complete section prior to updating your software.
Controller power MUST NOT be turned off during software update process.
Universal Robots assume no responsibility for any failed update caused by improper operation.

Updating the software may cause changes to some functionality. Always check with the release notes on the Universal Robots support site. www.universal-robots.com/support/

1. Do not downgrade the software to earlier version than the version the robot was produced with.
2. We advise you only to update, if you can benefit from the new features or the fixed issues.
3. We advise you to thoroughly read the release notes before performing an update, to avoid unexpected behavior, caused by changed or added functionality.
4. In case of concerns related to your actual or planned applications, please contact your supplier for advice and assistance.

Instructions to update software:

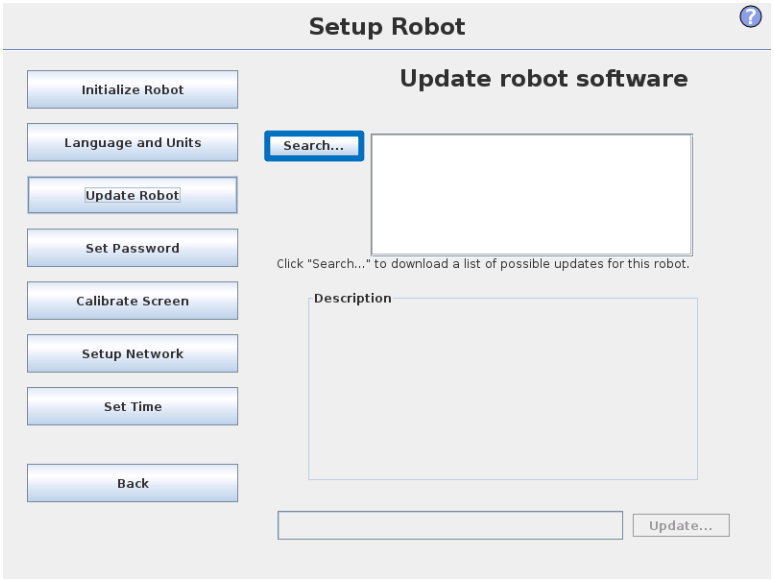
1. Download software update. When updating, it must be done in steps i.e. from 3.3 to 3.4 to 3.5.
2. Save it in the root folder on a USB-stick.
3. Insert USB-stick into USB-connector on right-hand side of teach pendant.
4. Go to main screen of PolyScope.



5. Press button *SETUP Robot*.

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

7. Press button *Search* to search for software update files on USB-stick.



8. Select the desired 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 initialize the robot.

4.2 Update joint firmware

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

NOTICE:
Read the complete section prior to updating your firmware.
Controller power MUST NOT be turned off during firmware update process.
Universal Robots assume no responsibility for any failed update caused by improper operation.

Software version 3.1.16828 and newer:

When the software is updated on a robot the firmware is **automatically** updated.

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

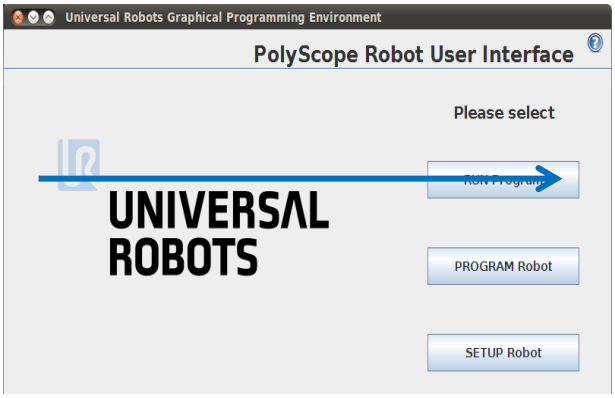
Software version before 3.1.16828:

Instructions for updating firmware:

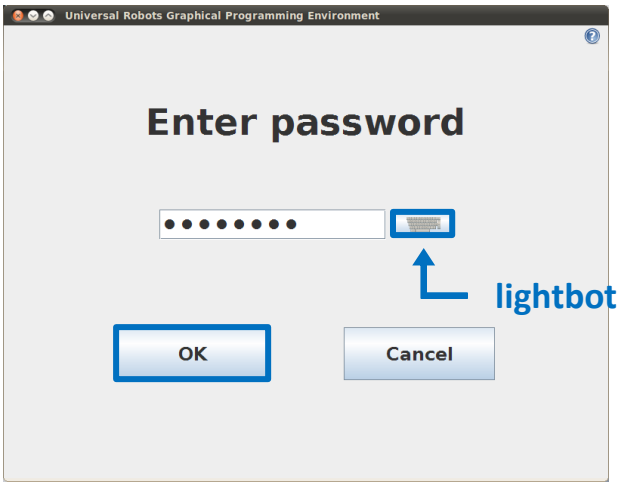
Prior to updating firmware, robot software must be updated.

Please refer to chapter 4.1 Update software . When updating robot software, the firmware will automatically be copied to a folder on the controller.

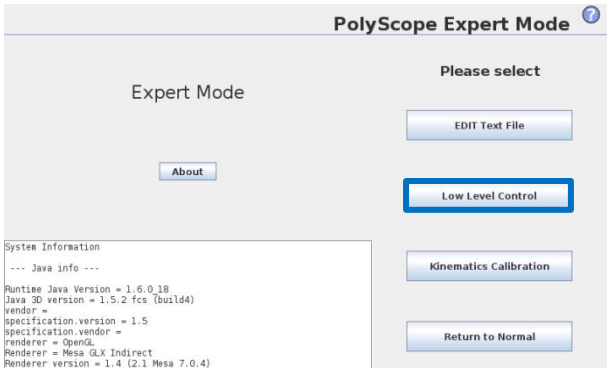
1. Swipe from left to right across the *UNIVERSAL* ROBOTS logo on main screen of PolyScope.



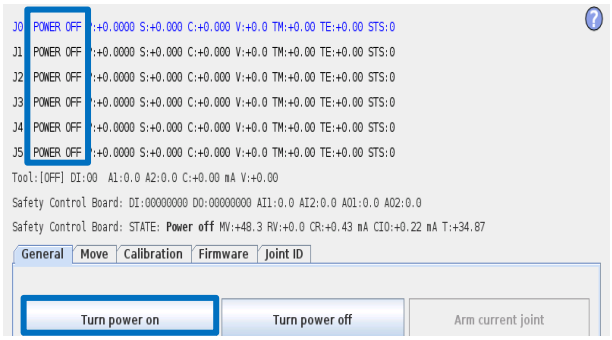
2. Enter password *lightbot* and press *OK*.



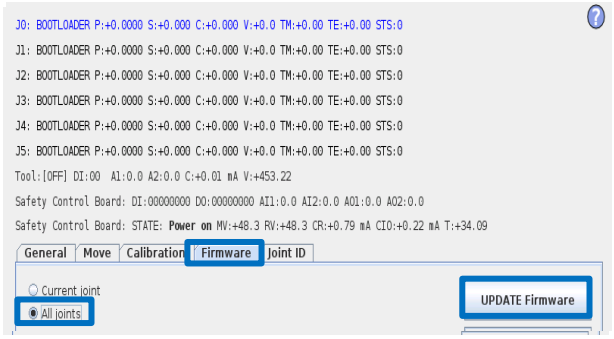
3. You are now in *Expert Mode*, press *Low Level Control*.



4. Press *Turn power on* to go into BOOTLOADER



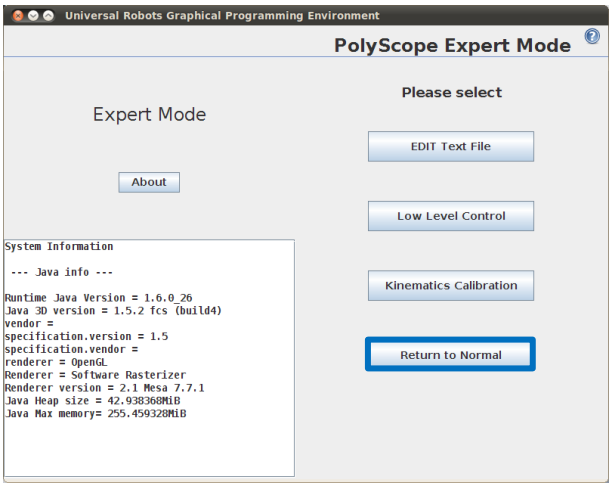
5. Select the *Firmware* tab, mark All joints and press UPDATE Firmware.



6. Firmware update is being processed, await message that *robot firmware updated successfully*. Controller MUST NOT be powered off during this update.

7. After successful update, press *Back*.

8. Back in Expert Mode, press *Return to Normal*.



Firmware has now been 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 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, e.g. 201430xxxx_0, 201430xxxx_1 etc.
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 step 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.

4.4 Backup of data

NOTICE:
When copying/moving files and folders, incorrect action might corrupt the file system.

This section explains the process of moving required files when upgrading from motherboard with compact flashcard to motherboard with USB.

4.4.1 Hardware requirements

The following hardware is needed:

Compact flash card from the old motherboard

A standard flash card reader that can read the CF-card (not included in motherboard upgrade kit).

The USB stick from the motherboard upgrade kit

Part no. 122430 (CB3.0 to CB3.1 upgrade kit)

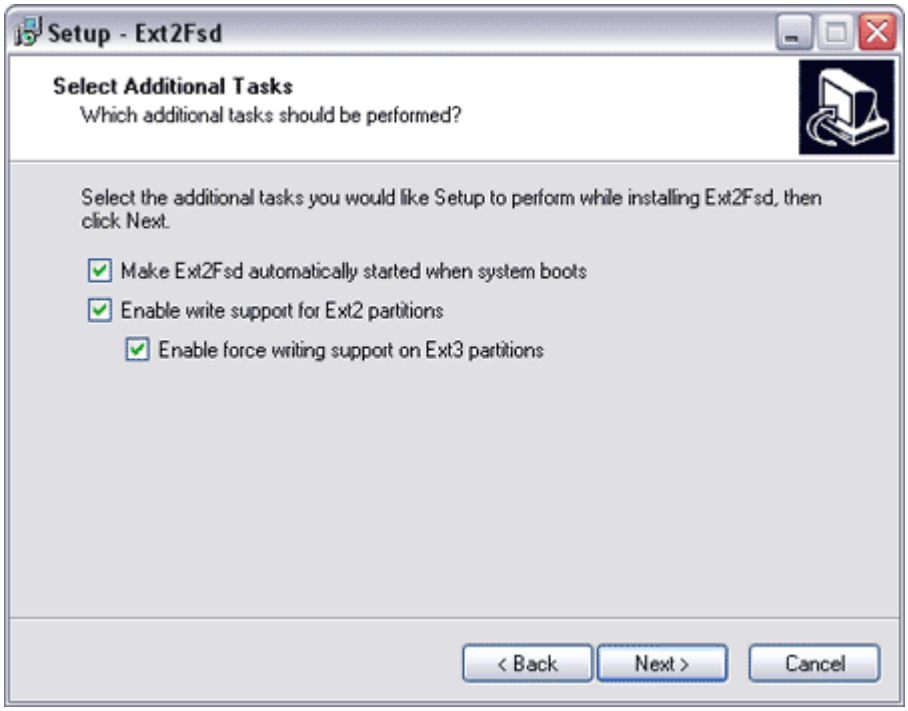
4.4.2 Software requirements

A Linux software file system driver is required; Universal robots recommend the free Linux-partition driver **Ext2Fsd** but other windows Linux reader can be used as well (these are however not tested by Universal Robots).

4.4.3 How to access Linux partition from Windows

Download and install **Ext2Fsd**.

Ensure to enable Read and Write Support for Ext2 and Ext3.



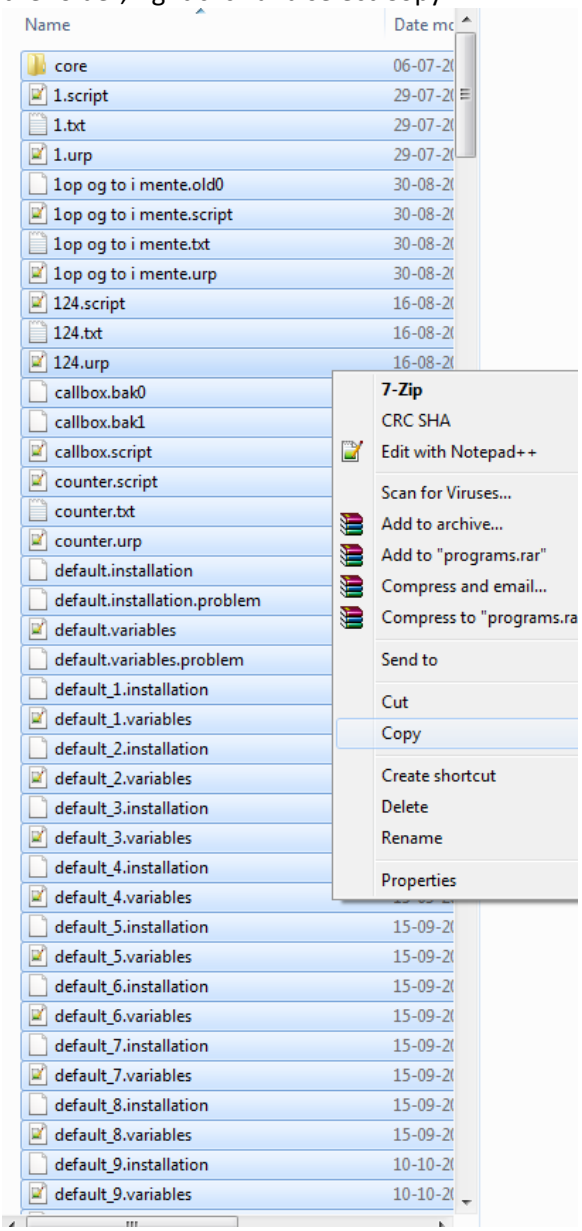
Reboot the computer to allow the changes to take effect.

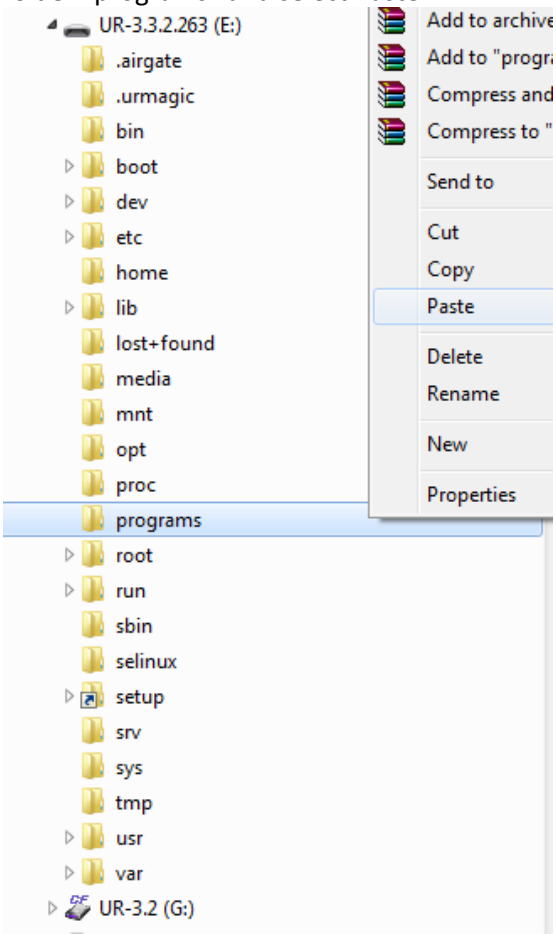
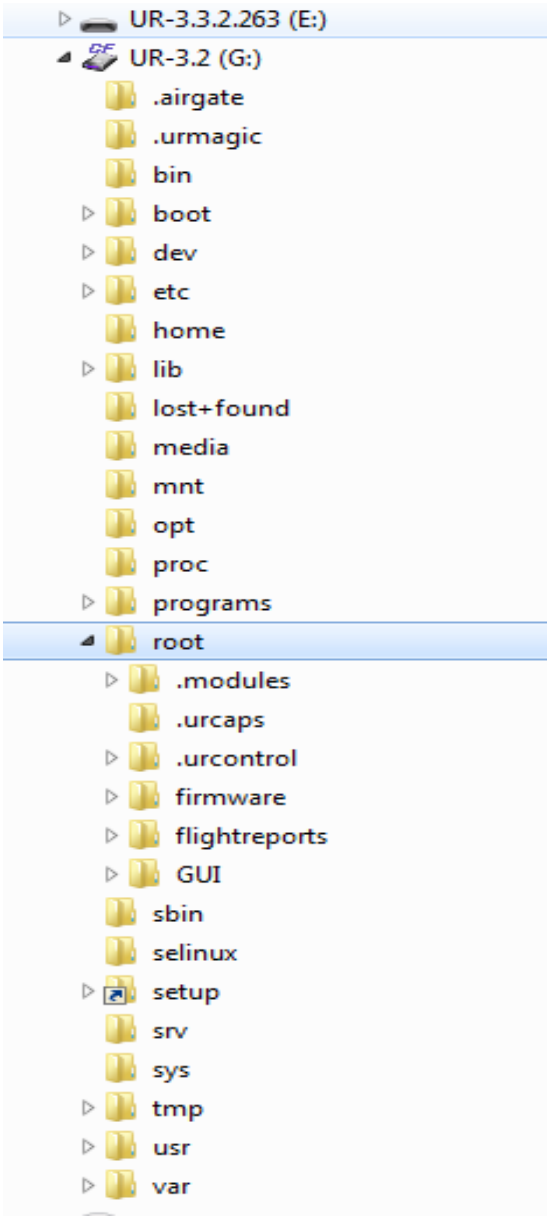
4.4.4 Copy the data from CF-card to UR-USB

1. Take CF-card from control box and insert the CF-card in card reader and the UR-USB in one of the computers USB ports.

CB3

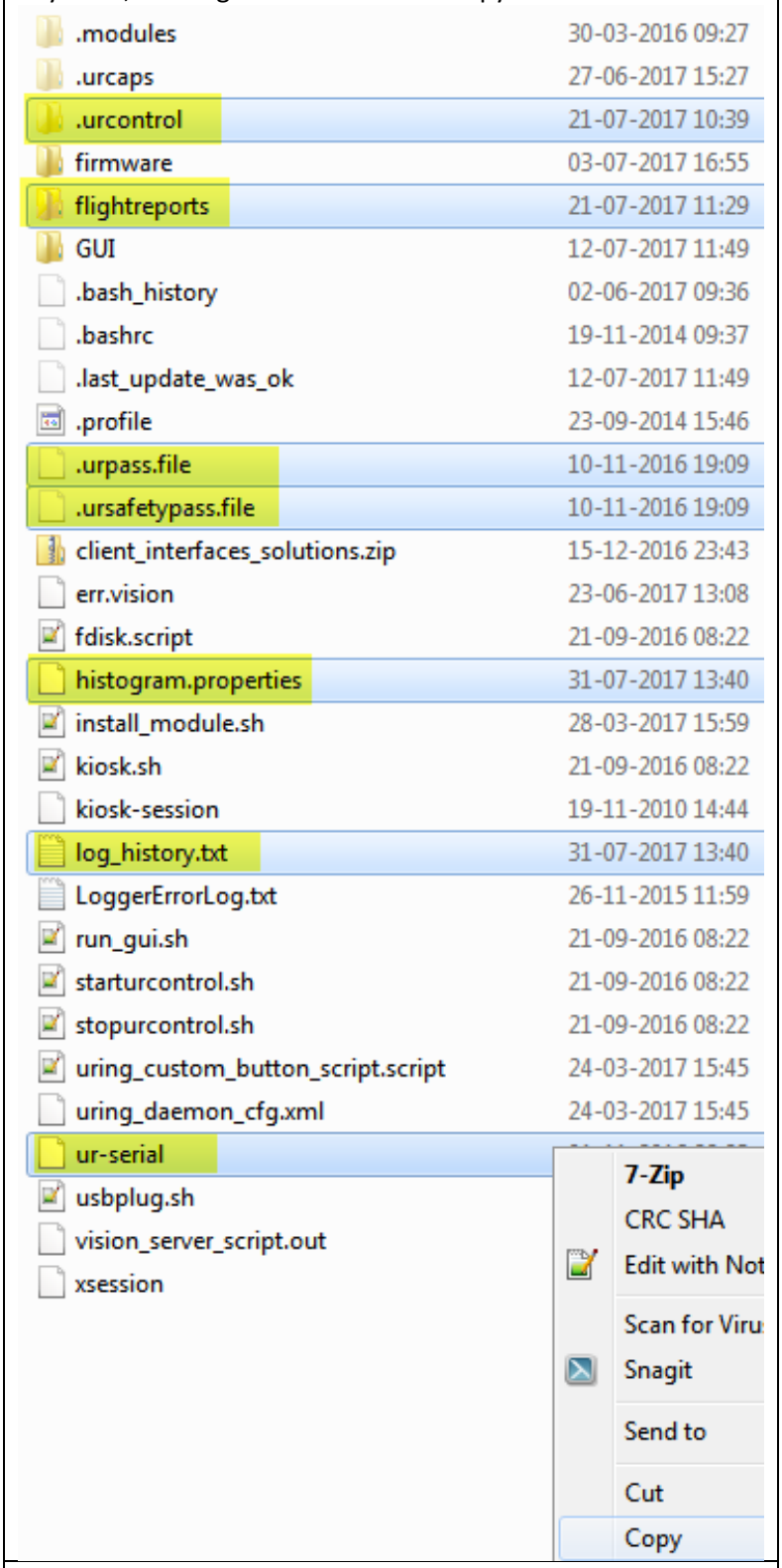
Open **windows explorer** navigate to the CF-card open the folder “programs”, select all the files in the folder, right click and select Copy.



CB3	
Navigate to the UR-USB right-click on the folder “programs” and select Paste. 	Navigate to the root folder on the CF-Card 

CB3

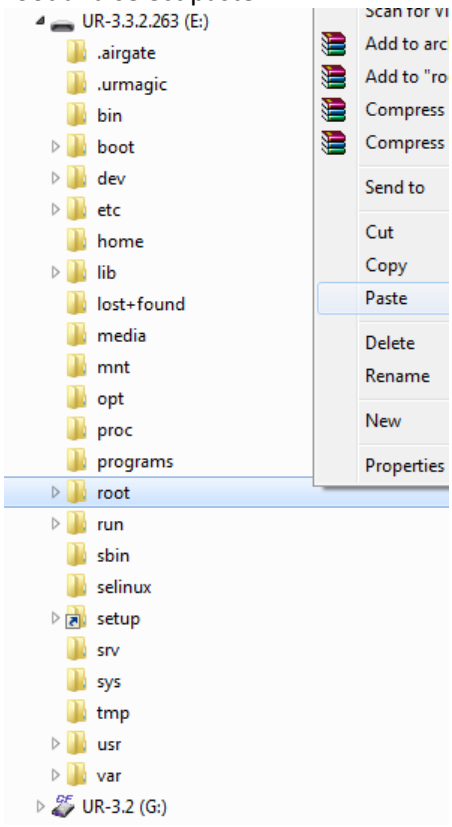
In the root folder view select the folders and files highlighted in yellow, then right-click and select Copy.



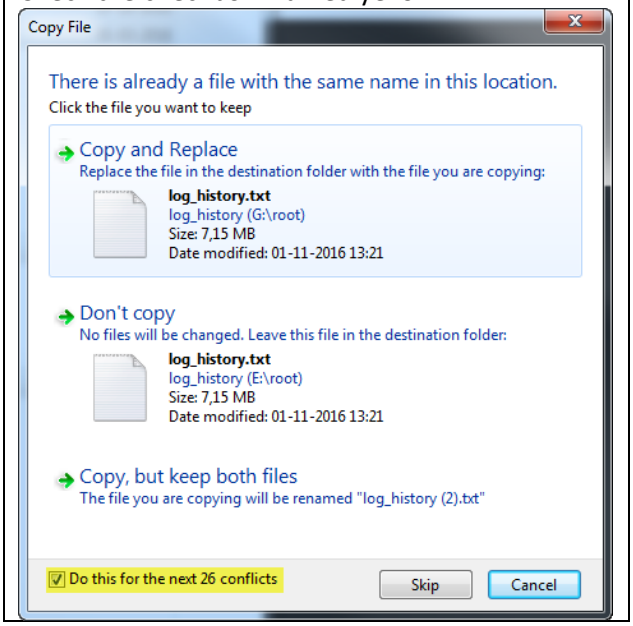
If the .urpass.file or .ursafetypass.file is not visible on the CF-card, then the files don't need to be saved

CB3

Navigate to the UR-USB right-click on the folder root and select paste.



A prompt will popup when the files are being copied, in the prompt choose Copy and replace. Check the checkbox marked yellow.



2. All required files are copied. UR-USB can now be inserted in new motherboard and booted

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

Abbreviations in the troubleshooting chapter

PSU = Power Supply

PC = Controller

Open log files with Support Log Reader(SLR).

Go to 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		a) Check Ethernet cable between Safety Control Board and Motherboard, check that a script or UR+ software is not overloading the communication between the Safety Control Board and Motherboard. b) Do a Complete rebooting sequence as per section 5.3.7 c) Update the software
C4A1	Communication with PC lost.	Between Safety Control Board and Motherboard	a) Check Ethernet cable between Safety Control Board and Motherboard, check that a script or UR+ software is not

			overloading the communication between the Safety Control Board and Motherboard. b) Do a Complete rebooting sequence as per section 5.3.7 c) Update the software
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) Do a Complete rebooting sequence as per section 5.3.7 c) 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) Do a Complete rebooting sequence as per section 5.3.7 c) 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) Do a Complete rebooting sequence as per section 5.3.7 c) 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) Do a Complete rebooting sequence as per section 5.3.7 c) 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) Do a Complete rebooting sequence as per section 5.3.7 c) 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) Do a Complete rebooting sequence as per section 5.3.7 c) Exchange Euromap67
C4A8	Primary EUROMAP67 uP present, but euromap67 is disabled	Incorrect safety configuration	a) Update the miscellaneous settings in the Safety Configuration b) Do a Complete rebooting sequence as per section 5.3.7
C4A9	Secondary EUROMAP67 uP present, but euromap67 is disabled	Incorrect safety configuration	a) Update the miscellaneous settings in the Safety Configuration b) Do a Complete rebooting sequence as per section 5.3.7

C4A10	Primary Teach Pendant present, but Teach Pendant safety is disabled	Incorrect safety configuration	a) Update the miscellaneous settings in the Safety Configuration b) Do a Complete rebooting sequence as per section 5.3.7
C4A11	Secondary Teach Pendant uP present, Teach Pendant safety is disabled	Incorrect safety configuration	a) Update the miscellaneous settings in the Safety Configuration b) Do a Complete rebooting sequence as per section 5.3.7
C4A12	Communication with joint 0 lost	More than 1 package lost	a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A13	Communication with joint 1 lost	More than 1 package lost	a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A14	Communication with joint 2 lost	More than 1 package lost	a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A15	Communication with joint 3 lost	More than 1 package lost	a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A16	Communication with joint 4 lost	More than 1 package lost	a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A17	Communication with joint 5 lost	More than 1 package lost	a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A18	Communication with tool lost	More than 1 package lost	a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A65	Lost package from Primary Teach Pendant	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A66	Lost package from Secondary Teach Pendant	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A67	Lost package from Primary Euromap67	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A68	Lost package from Secondary Euromap67	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7

C4A69	Lost package from Secondary Masterboard	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A70	Lost package from joint 0	Serial communication problem with one or more joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A71	Lost package from joint 1	Serial communication problem with one or more joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A72	Lost package from joint 2	Serial communication problem with one or more joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A73	Lost package from joint 3	Serial communication problem with one or more joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A74	Lost package from joint 4	Serial communication problem with one or more joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A75	Lost package from joint 5	Serial communication problem with one or more joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A76	Lost package from tool	Serial communication problem with one or more joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A77	Lost package from uPA to joints	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A78	Lost package from uPA to Teach pendant	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A79	Lost package from uPA to uPB	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7

C4A80	Lost package from uPB	1 package lost – warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A81	Packet counter disagreement in packet from Primary Screen	Safety processor 1 in Teach pendant has a packet disagreement	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A82	Packet counter disagreement in packet from Secondary Screen	Safety processor 2 in Teach pendant has a packet disagreement	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A83	Packet counter disagreement in packet from Primary Euromap67		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A84	Packet counter disagreement in packet from Secondary Euromap67		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A85	Packet counter disagreement in packet from Safety Control Board B		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A86	Packet counter disagreement in packet from joint 0		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A87	Packet counter disagreement in packet from joint 1		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A88	Packet counter disagreement in packet from joint 2		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A89	Packet counter disagreement in packet from joint 3		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A90	Packet counter disagreement in packet from joint 4		If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7

C4A91	Packet counter disagreement in packet from joint 5	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A92	Packet counter disagreement in packet from tool	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A93	Packet counter disagreement in packet from processor A to joints	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A94	Packet counter disagreement in packet from processor A to B	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A95	Packet counter disagreement in packet from processor A to Teach Pendant and EUROMAP	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C4A100	Communication lost due to Packet counter disagreements	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C5	Heavy processor load warning	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C5A1	Heavy processor load warning:1	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C5A2	Heavy processor load warning:2	If this appears often in the log, then: a) Verify that the communication cables are connected properly b) Do a Complete rebooting sequence as per section 5.3.7
C10	Broken PC communication error	a) Do a Complete rebooting sequence as per section 5.3.7 b) Update the software
C10A1	Lost packet from PC	a) Do a Complete rebooting sequence as per section 5.3.7 b) Update the software
C10A101	PC packet received too early	a) Do a Complete rebooting sequence as per section 5.3.7 b) Update the software

C10A102	Packet counter does not match		a) Do a Complete rebooting sequence as per section 5.3.7 b) Update the software
C10A103	PC is sending packets too often		a) Do a Complete rebooting sequence as per section 5.3.7 b) 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	If you see this error on a robot, report it to Universal Robots.
C14A2	{signed}	Should not occur in the field	If you see this error on a robot, report it to Universal Robots.
C14A3	{unsigned}	Should not occur in the field	If 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	a) Check Ethernet connection between circuit boards. b) Do a Complete rebooting sequence as per section 5.3.7 c) Update the software
C26	Motor Encoder index drift detected	Joint mechanical problem	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C27	Calibration data is invalid or does not exist, selftest is needed!		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C29	Online Calibration data checksum failed	Calibration data is not in the joint	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, 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	Ignore
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		Check the log file for what item is reporting this error. Replace the reporting item
C38A1	Data-bus test failed		Check the log file for what item is reporting this error. Replace the reporting item
C38A2	Address-bus stuck-high test failed		Check the log file for what item is reporting this error. Replace the reporting item
C38A3	Address-bus stuck-low test failed		Check the log file for what item is reporting this error. Replace the reporting item
C38A4	Address-bus shorted test failed		Check the log file for what item is reporting this error. Replace the reporting item
C38A5	Memory-cell test failed		Check the log file for what item is reporting this error. Replace the reporting item
C39	Logic and Temporal Monitoring Fault		
C39A1	Max current deviation failure		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C39A2	Max joint-encoder speed exceeded		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C39A3	Max motor-encoder speed exceeded		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C39A4	Illegal state change in joint detected		
C39A5	A timing issue occurred during startup. Please restart to proceed	Too fast state change in joint detected	Do a Complete rebooting sequence as per section 5.3.7
C39A6	5V regulator voltage too low		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C39A7	5V regulator voltage too high		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, 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
C41A0	RC Oscillator Trim register hit high limit		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C42A0	RC Oscillator Trim register hit low limit		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C43A0	Change in invariant memory detected		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C43A1	Change in invariant memory detected : Current sensor gain		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C44	CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance
C44A0	Joint 0 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance

C44A1	Joint 1 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance
C44A2	Joint 2 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance
C44A3	Joint 3 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance
C44A4	Joint 4 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance
C44A5	Joint 5 CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance
C44A6	Tool CRC check failure on primary bus	Serial communication problem with tool or secondary bus node	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance
C44A80	CRC Check failure on primary bus	Most likely an interference on the communication bus	a) Check black 2-wire connectors and wires in joints b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, contact your local service provider for assistance.
C45	AD-Converter error		
C46	Loose gearbox or bad encoder mounting	Mechanical problem in gear related to encoder mounting	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C47	AD-Converter hit low limit	EMC issue external or electronics internal	Check grounding and shielding for EMC problems.

C48	Powerbus voltage drop detected.	Error on 48V powerbus to robot arm	Check 48V output from Power supply. Check current-distributor PCB. Replacement of 48V Power supply 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 on the Safety Control Board. Check for short circuit.
C50A1	Voltage detected at 24V rail before startup		
C50A2	Voltage present at unpowered robot		
C50A5	Power supply voltage too low	voltage is below 40V	Check 48 V cable between Power supply and Safety Control Board.
C50A6	Power supply voltage too high	Voltage is above 56V	
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.	a) Check the Teach Pendant cable and connections. b) Check the settings in the miscellaneous tab in the Safety menu.
C50A17	The Euromap67 interface does not respond	Loose wire or incorrect safety configuration	a) Check the Euromap 67 cable and connections. b) Check the settings in the miscellaneous tab in the Safety menu.
C50A18	Warning, waiting for SafetySYS1	SafetySYS1 = Processor A on Safety Control Board	
C50A19	Warning, Waiting for a valid "euromap67 activated" status bit from secondary 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 Power supply powerup	
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 Power supply1	
C50A41	Wrong voltage from Power supply2	
C50A42	Voltage will not disappear from Power supply	
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	The Safety Control Board was reset on explicit request.	
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	Check cable and connections between robot and control box
C50A101	Short circuit in robot detected or wrong robot connected to control box	Robot Problem: 48V power supply 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 power supply	
C50A103	Voltage failed to reach acceptable level	Robot Problem: 48V power supply	
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’s. Check for short circuit
C53A1	IO overcurrent detected, max is 800mA	Safety Control Board error	Remove all external connections to I/O’s. Check for short circuit

C53A2	IO overcurrent detected, max is 600mA	Tool error	Remove all external connections to I/O's. Check for short circuit
C55	Safety system error	Safety system malfunction	a) Check Motherboard, Safety Control Board, Screenboard, Current distributor (Euromap, if installed). b) Check safety devices and cables/connections to these devices. c) Do a Complete rebooting sequence as per section 5.3.7
C55A23	Safety relay error (minus connection)	Current distributor error	a) Check cable from Safety Control Board to Current distributor or 48V Power supply and Current distributor for issues b) Do a Complete rebooting sequence as per section 5.3.7
C55A24	Safety relay error (plus connection)	Current distributor error	a) Check cable from Safety Control Board to Current distributor or 48V Power supply and Current distributor for issues b) Do a Complete rebooting sequence as per section 5.3.7
C55A33	Safety relay error (a relay is stuck)	Current distributor error	a) Check cable from Safety Control Board to Current distributor or 48V Power supply and Current distributor for issues b) Do a Complete rebooting sequence as per section 5.3.7
C55A34	Safety relay error (relays are not on)	Current distributor error	a) Check cable from Safety Control Board to Current distributor or 48V Power supply and Current distributor for issues b) Do a Complete rebooting sequence as per section 5.3.7
C55A50	Voltage present at unpowered robot	Safety Control Board hardware fault	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C55A51	Voltage will not disappear from robot	Safety Control Board hardware fault	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C55A52	5V, 3V3 or ADC error (5V too low)	Safety Control Board hardware fault	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C55A53	5V, 3V3 or ADC error (5V too high)	Safety Control Board hardware fault	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
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	a) Check Energy Eaters cable and connections. b) Check Energy c) Replace Energy Eater
C57	Brake release failure		a) Check Brake, solenoid b) Check TCP configuration, payload and mounting settings
C57A1	Joint did not move or motor encoder is not functioning		a) Check Brake, solenoid b) Check TCP configuration, payload and mounting settings
C57A2	Large movement detected during brake release		a) Check Brake, solenoid b) Check TCP configuration, payload and mounting settings
C57A3	Robot was not able to brake release, see log for details		a) Check Brake, solenoid b) Check TCP configuration, payload and mounting settings
C58	Motor encoder not calibrated		
C59	Overcurrent shutdown	Overcurrent in joint. Argument = Current in Amps.	a) Check for short circuit. b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than two times in a row, replace joint
C62A1	Thermal issue: Joint temperature: High (80 C)"	Warning	a) Check nothing is hindering free movement of the joints b) Check TCP configuration, payload and mounting settings

C62A3	Thermal issue: Warning: Static load to high	Warning	a) Check nothing is hindering free movement of the joints b) Check TCP configuration, payload and mounting settings
C62A11	Thermal issue: Joint temperature: Shut down (85 C)"	Stop	a) Check nothing is hindering free movement of the joints b) Check TCP configuration, payload and mounting settings
C62A13	Thermal issue: Shutdown: Static load to high	Stop	a) Check nothing is hindering free movement of the joints b) Check TCP configuration, payload and mounting settings
C63	Motor test failed in step {unsigned}.		
C68	SPI error	Joint: Absolut encoder on joint communication error	a) Check for short circuit. b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than several times in a row, replace joint
C70	Close to gearbox shear limit	Acceleration / deceleration too high. Mechanical problem in gear related to encoder mounting	a) Reduce acceleration in user program. b) Do a Complete rebooting sequence as per section 5.3.7 c) If this happens more than several times in a row, replace joint
C71	Startup check error	Fault: Firmware in joint	Update firmware
C71A0	Hardware is size0, wrong firmware at the joint	Fault: Firmware in joint	Update firmware
C71A1	Hardware is size1, wrong firmware at the joint	Fault: Firmware in joint	Update firmware
C71A2	Hardware is size2, wrong firmware at the joint	Fault: Firmware in joint	Update firmware
C71A3	Hardware is size3, wrong firmware at the joint	Fault: Firmware in joint	Update firmware
C71A4	Hardware is size4, wrong firmware at the joint	Fault: Firmware in joint	Update firmware
C71A5	Invalid hardware size read		
C71A6	ADC calibration failed	Only in joint	
C71A7	Unknown error result	The motor wires are damaged, bad connection in screw terminals or defect PCB	a) Check joint for damaged or loose connections b) Replace the joint
C71A8	Motor short circuit to ground or H-bridge problems	The motor wires are damaged, bad connection in screw terminals or defect PCB	a) Check joint for damaged or loose connections b) Replace the joint

C71A9	Motor indication signal does not work	The motor wires are damaged, bad connection in screw terminals or defect PCB	a) Check joint for damaged or loose connections b) Replace the joint
C71A10	Phase 1 is unconnected or not working	The motor wires are damaged, bad connection in screw terminals or defect PCB	a) Check joint for damaged or loose connections b) Replace the joint
C71A11	Phase 2 is unconnected or not working	The motor wires are damaged, bad connection in screw terminals or defect PCB	a) Check joint for damaged or loose connections b) Replace the joint
C71A12	Phase 3 or multiple phases is unconnected or not working	The wire is (1) damaged or (2) has been disconnected from the PCB (not likely) or (3) defect PCB	a) Check joint for damaged or loose connections b) Replace the joint
C71A50	Current sensor test failed	Sensor reported wrong current when probed	a) Check joint for damaged or loose connections b) Replace the joint
C71A51	Current sensor test failed	Sensor reported wrong current when probed	a) Check joint for damaged or loose connections b) Replace the joint
C71A52	Current sensor test failed	Sensors reported different currents when probed	a) Check joint for damaged or loose connections b) Replace the joint
C72	Power Supply Unit failure	48 V Power problem	
C72A1	0 Power supplies are active	Power supply was not able to deliver 48V	Check power connection between Power supply and Safety Control Board
C72A2	1 Power supply active, but we expect 2 (UR10)	Power supply 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 flashcard/USB and robot match
C72A3	2 Power supplys active, but we expect 1 (UR5)	UR5 flash card in UR10 robot	Check that the flashcard/USB 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.		Check grounding and shielding for EMC problems
C74A2	Speed reading is not valid		

C74A4	System error=malfunction or inconsistent calibration detected		
C74A8	Supply voltage is out of range		
C74A16	Temperature is out of range		
C74A64	Signal low =Too far from magnetic ring		
C74A128	Signal saturation =Too close to magnetic ring		
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.	
C75	Joint encoder error	Magnetic encoder error (Absolut encoder)	
C75A1	Invalid decode: Readhead misalignment, ring damaged or external magnetic field present.		a) Do a Complete rebooting sequence as per section 5.3.7 b) Check grounding and shielding for EMC problems c) If this happens more than two times in a row, replace joint
C75A2	Speed reading is not valid		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C75A4	System error=malfunction or inconsistent calibration detected		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C75A8	Supply voltage is out of range		Check previous error
C75A16	Temperature is out of range		Check previous error
C75A32	Signal lost =Misaligned readhead or damaged ring		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C75A64	Signal low =Too far from magnetic ring		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace joint
C75A128	Signal saturation =Too close to magnetic ring		a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, 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.	
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	
C78A255	Large sudden position change detected on the joint-encoder	Example: 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.	
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	Communication problem between Motherboard and Safety Control Board	a) Check that the Ethernet cable between Motherboard and Safety Control Board is connected b) Do a Complete rebooting sequence as per section 5.3.7
C103A1	Connection to Safety Control Board lost	Motherboard did not receive 3 packets in a row	a) Check that the Ethernet cable between Motherboard and Safety Control Board is connected b) Do a Complete rebooting sequence as per section 5.3.7
C103A2	Package lost from Safety Control Board		
C103A3	Ethernet connection initialization with Safety Control Board failed		
C104	Error=Empty command sent to robot		
C111	Something is pulling the robot		Check TCP configuration, payload and mounting settings
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 Safety Control Board failed	The Safety Control Board couldn't be rebooted from the controller.	Do a Complete rebooting sequence as per section 5.3.7
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		Check TCP configuration, payload and mounting settings
C154	Protective Stop: Position in singularity	Robot cannot move linear near a singularity	Use MoveJ 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
C157	Protective Stop: Collision detected by joint		Make sure no objects are in the path of the robot and resume the program
C160	Protective stop: The robot was powered off last time due to a joint position disagreement	a) 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. b) If the position is not correct, the robot must be repaired. In this case, click “Power Off Robot”. c) 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 while it was powered off, or the encoders do not function.	a) 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. b) If the position is not correct, the robot must be repaired. In this case, click “Power Off Robot”. c) 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		Increase blend in 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		
C190	Joint failed during selftest		
C190A0	Motor encoder index mark not found		

C190A1	Phases not mounted correctly		
C190A2	Motor encoder counting the wrong way		
C190A3	Joint encoder counting the wrong way		
C190A4	No movement detected while trying to move the motor		
C190A11	Temperature alignment did not warm up to 45 degrees C within 30 minutes		
C190A12	Temperature alignment did not cool down to 45 degrees C within 60 minutes		
C191	Safety system violation		
C191A1	Joint position limit violated		
C191A2	Joint speed limit violated		
C191A3	TCP speed limit violated		
C191A4	TCP position limit violated		
C191A5	TCP orientation limit violated		
C191A6	Power limit violated		
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 TCP configuration, payload and mounting settings

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	a) Check if the robot is physically pushed while safeguard stopped b) Check TCP configuration, payload and mounting settings
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		
C191A23	Invalid setup of safety limits		a) Check Firmware/update firmware b) Do a Complete rebooting sequence as per section 5.3.7
C191A24	Reduced Mode Output set, while it should not be		a) Check Firmware/update firmware b) Do a Complete rebooting sequence as per section 5.3.7
C191A25	Reduced Mode Output not set, while it should be		a) Check Firmware/update firmware b) Do a Complete rebooting sequence as per section 5.3.7
C191A26	Not Reduced Mode Output set, while it should not be		a) Check Firmware/update firmware b) Do a Complete rebooting sequence as per section 5.3.7
C191A27	Not Reduced Mode Output not set, while it should be		a) Check Firmware/update firmware b) Do a Complete rebooting sequence as per section 5.3.7
C191A28	Robot Emergency Stop exceeded maximum stop time	Too high payload	a) Check that max payload of the robot has not been exceeded. b) Check TCP configuration, payload and mounting settings
C191A29	System Emergency Stop exceeded maximum stop time	Too high payload	a) Check that max. payload of the robot has not been exceeded. b) Check TCP configuration, payload and mounting settings
C191A30	Safeguard Stop exceeded maximum stop time	Too high payload	a) Check that max. payload of the robot has not been exceeded. b) Check TCP configuration, payload and mounting settings

C191A31	Operation mode switch is present while the three position switch is missing		
C191A32	Joint speed limit violated - Joint 0 (Base)		
C191A33	Joint speed limit violated - Joint 1 (Shoulder)		
C191A34	Joint speed limit violated - Joint 2 (Elbow)		
C191A35	Joint speed limit violated - Joint 3 (Wrist 1)		
C191A36	Joint speed limit violated - Joint 4 (Wrist 2)		
C191A37	Joint speed limit violated - Joint 5 (Wrist 3)		
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 safety devices and cables/connections to these devices.
C192A3	System emergency stop disagreement	System E-stop circuit problem	Check safety devices and cables/connections to these devices.
C192A4	Safeguard stop disagreement	Safeguard circuit problem	Check safety devices and cables/connections to these devices.
C192A5	Euromap safeguard stop disagreement	Euromap circuit problem	Check cables from Safety Control Board to Euromap and to external machine
C192A6	Joint position disagreement		a) Check TCP configuration, payload and mounting settings b) Check that safety settings respected.
C192A7	Joint speed disagreement		a) Check TCP configuration, payload and mounting settings b) Check that safety settings respected.

C192A8	Joint torque disagreement		a) Check TCP configuration, payload and mounting settings b) Check that safety settings respected.
C192A9	TCP speed disagreement		a) Check TCP configuration, payload and mounting settings b) Check that safety settings respected.
C192A10	TCP position disagreement		a) Check TCP configuration, payload and mounting settings b) Check that safety settings respected.
C192A11	TCP orientation disagreement		a) Check TCP configuration, payload and mounting settings b) Check that safety settings respected.
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 safety devices and cables/connections to these devices.
C192A15	Reduced mode output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A16	Safety output failed	The safety output did not reach the correct value in the expected time	Check for short circuit on I/O or for wrong connection to output.
C192A17	Safeguard stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A18	The other safety processor is in fault		
C192A19	Emergency stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A20	SPI output error detected	Power supply for the I/O is not detected	Check if the connection to the internal Power supply is correct. If an external power supply is being used, check if it is powered on and correct voltage.
C192A21	Momentum disagreement		
C192A22	Robot moving output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A23	Wrong processor ID		
C192A24	Wrong processor revision		
C192A25	Potential brownout detected	Voltage drop on Safety Control Board or defect Safety Control Board	
C192A26	Emergency stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A27	Safeguard stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A28	Robot not stopping output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.

C192A29	Safeguard reset input disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A30	Safety processor booted up in fault mode		
C192A31	Reduced Mode Output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A32	Not Reduced Mode Output disagreement	Safety I/O uP-A and uP-B disagreement	Check safety devices and cables/connections to these devices.
C192A33	A timing issue occurred during startup. Please restart to proceed	Checksum disagreement between safety processors 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	Safety Control Board has detected an error	a) See previous error b) Do a Complete rebooting sequence as per section 5.3.7
C193A0	Joint 0 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Update the firmware on the joint c) Do a Complete rebooting sequence as per section 5.3.7
C193A1	Joint 1 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Update the firmware on the joint c) Do a Complete rebooting sequence as per section 5.3.7
C193A2	Joint 2 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Update the firmware on the joint c) Do a Complete rebooting sequence as per section 5.3.7

C193A3	Joint 3 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Update the firmware on the joint c) Do a Complete rebooting sequence as per section 5.3.7
C193A4	Joint 4 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Update the firmware on the joint c) Do a Complete rebooting sequence as per section 5.3.7
C193A5	Joint 5 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Update the firmware on the joint c) Do a Complete rebooting sequence as per section 5.3.7
C193A6	Tool is in fault mode	Safety Control Board has detected an error	a) See previous error b) Do a Complete rebooting sequence as per section 5.3.7
C193A7	Screen 1 is in fault mode	Safety Control Board has detected an error on Safety processor 1 in Teach pendant	a) See previous error b) Do a Complete rebooting sequence as per section 5.3.7
C193A8	Screen 2 is in fault mode	Safety Control Board has detected an error on Safety processor 2 in Teach pendant	a) See previous error b) Do a Complete rebooting sequence as per section 5.3.7
C193A9	Euromap 1 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Do a Complete rebooting sequence as per section 5.3.7
C193A10	Euromap 2 is in fault mode	Safety Control Board has detected an error	a) See previous error b) Do a Complete rebooting sequence as per section 5.3.7
C194	One of the nodes is not booted or not present		
C194A0	Joint 0 is not booted or not present	Safety Control Board has detected an error	
C194A1	Joint 1 is not booted or not present	Safety Control Board has detected an error	
C194A2	Joint 2 is not booted or not present	Safety Control Board has detected an error	
C194A3	Joint 3 is not booted or not present	Safety Control Board has detected an error	
C194A4	Joint 4 is not booted or not present	Safety Control Board has detected an error	
C194A5	Joint 5 is not booted or not present	Safety Control Board has detected an error	
C194A6	Tool is not booted or not present	Safety Control Board has detected an error	
C194A7	Screen 1 is not booted or not present	Safety Control Board has detected an error on Safety processor 1 in Teach pendant	
C194A8	Screen 2 is not booted or not present	Safety Control Board has detected an error on Safety processor 2 in Teach pendant	

C194A9	Euromap 1 is not booted or not present	Safety Control Board has detected an error	
C194A10	Euromap 2 is not booted or not present	Safety Control Board 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	Check for loose communication cable.
C194A129	Joint 1 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	Check for loose communication cable.
C194A130	Joint 2 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	Check for loose communication cable.
C194A131	Joint 3 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	Check for loose communication cable.
C194A132	Joint 4 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	Check for loose communication cable.
C194A133	Joint 5 not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	Check for loose communication cable.
C194A134	Tool not ready while brake release requested	Must be at least in IDLE mode when the brake release is requested	Check for loose communication cable.
C195	Conveyor speed too high	Conveyor speed higher than robot is able to run	Make sure that conveyor tracking is set correctly
C195A1	Conveyor speed too high for joint speed safety limit		Make sure that conveyor tracking is set correctly
C195A2	Conveyor speed too high for TCP speed safety limit		Make sure that conveyor tracking is set correctly
C195A3	Conveyor speed too high for momentum safety limit		Make sure that conveyor tracking is set correctly
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	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board

C200A1	Hardware ID is wrong	Safety Control Board: uP-A has detected an error: Wrong Safety Control Board	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A2	MCU type is wrong	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A3	Part ID is wrong	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A4	RAM test failed	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A5	Register test failed	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A6	pRom Crc test failed	Safety Control Board: uP-A has detected an error: firmware error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A7	Watchdog reset the processor	Safety Control Board: uP-A has detected an error	
C200A8	OVG signal test not passed	Safety Control Board: uP-A has detected an error: over voltage generator	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A9	3V3A power good pin is low	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A10	3V3B power good pin is low	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A11	5V power good is low	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board

C200A12	3V3 voltage too low	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A13	3v3 voltage too high	Safety Control Board: uP-A has detected an error	a) Do a Complete rebooting sequence as per section 5.3.7 b) If this happens more than two times in a row, replace Safety Control Board
C200A14	48V input is too low		a) Do a Complete rebooting sequence as per section 5.3.7 b) Check 48 V Power supply, current distributer, energy eater and Safety Control Board for issues
C200A15	48V input is too high		a) Do a Complete rebooting sequence as per section 5.3.7 b) Check 48 V Power supply, current distributer, energy eater and Safety Control Board for issues
C200A16	24V IO short circuited	Too high current	a) Do a Complete rebooting sequence as per section 5.3.7 b) Disconnect external I/O connections and check external power supply if connected
C200A17	PC current is too high	Motherboard takes too high current	a) Do a Complete rebooting sequence as per section 5.3.7 b) Check cable between Safety Control Board and Motherboard and check all connections to Motherboard. Also check for short circuit.
C200A18	Robot voltage is too low		a) Do a Complete rebooting sequence as per section 5.3.7 b) Check for short circuit in robot arm. c) Check 48 V Power supply, current distributer, energy eater and Safety Control Board for issues
C200A19	Robot voltage is too high		a) Do a Complete rebooting sequence as per section 5.3.7 b) Check 48 V Power supply, current distributer, energy eater and Safety Control Board for issues
C200A20	24V IO voltage is too low		a) Do a Complete rebooting sequence as per section 5.3.7 b) Disconnect I/O, check external power supply if connected and check Safety Control Board for issues
C200A21	12V voltage is too high		a) Do a Complete rebooting sequence as per section 5.3.7 b) Check 12 V Power supply, cables and Safety Control Board for issues

C200A22	12V voltage is too low		a) Do a Complete rebooting sequence as per section 5.3.7 b) Check 12 V Power supply, cables and Safety Control Board for issues
C200A23	It took too long to stabilize 24V	Safety Control Board error	a) Do a Complete rebooting sequence as per section 5.3.7 b) Check external 24 V and Safety Control Board for issues
C200A24	It took too long to stabilize 24V IO	Safety Control Board error	a) Do a Complete rebooting sequence as per section 5.3.7 b) Check external 24 V and Safety Control Board for issues
C200A25	24V voltage is too high	Safety Control Board error	a) Check external 24 V and Safety Control Board for issues b) Do a Complete rebooting sequence as per section 5.3.7 C) If this happens more than two times in a row, replace Safety Control Board
C200A26	24V IO voltage is too high		a) Disconnect I/O's b) Do a Complete rebooting sequence as per section 5.3.7 c) Check external 24 V and Safety Control Board for issues
C201A0	Setup of safety board failed	No data was received from the Safety Control Board at initialization or invalid safety parameters have been received.	a) Do a Complete rebooting sequence as per section 5.3.7 b) Check that the ethernet cable between Motherboard and Safety Control Board is connected and verify that the setup of the Safety Configuration is valid.
C201A1	SCB uA is not responding	No data or invalid data was received from the Safety Control Board uA at initialization.	a) Do a Complete rebooting sequence. b) Check that the ethernet cable between Motherboard and Safety Control Board is connected and verify that the setup of the Safety Configuration is valid.
C201A2	SCB uB is not responding	No data or invalid data was received from the Safety Control Board uB at initialization.	Do a Complete rebooting sequence.
C201A3	SCB is not responding	No data or invalid was received from Safety Control Board when requested for configuration parameters.	Do a Complete rebooting sequence.
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	a) Check that the software version is the same or newer than the firmware on the Safety Control Board.

			b) Reload the installation c) Do a Complete rebooting sequence as per section 5.3.7
C204A0	Protective Stop: Path sanity check failed		
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" or "stopl" script commands to generate a smooth deceleration before using "wait". Avoid aborting motions between waypoints with blend
C204A4	Robot has not stopped in the allowed reaction and braking time		
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 (RTDE, ModBus, EtherNet/IP and Profinet) or disable the fieldbus in the installation. Check RTDE “watch dog” feature. Check if a URCaps is using this feature as well.
C212A0	Name conflict in loaded program		
C212A1	Name conflict(s) occurred between feature names and program variables	Some feature names and program variables share the same name, which may cause confusion.	Rename the program variables.
C213A0	No Kinematic Calibration found (calibration.conf file is either corrupt or missing)	Calibration.conf file is either corrupt or missing	A new kinematics calibration may be needed if the robot needs to improve its kinematics, otherwise, ignore this message.
C214A0	Kinematic Calibration for the robot does not match the joint(s)	The calibration checksum stored in the calibration.conf does not match the values from the joint(s)	If moving a program from a different robot to this one, re-kinematic calibrate the second robot to improve kinematics, otherwise ignore this message.
C214A1	The Kinematic Calibration checksum does not match the Base checksum	The calibration checksum stored in the calibration.conf does not match the values from the joint	If moving a program from a different robot to this one, re-kinematic calibrate the second robot to improve kinematics, otherwise ignore this message.
C214A2	The Kinematic Calibration checksum does not match the Shoulder checksum	The calibration checksum stored in the calibration.conf does not match the values from the joint	If moving a program from a different robot to this one, re-kinematics calibrating the second robot to improve kinematics, otherwise ignore this message.
C214A3	The Kinematic Calibration checksum does not match the Elbow checksum	The calibration checksum stored in the calibration.conf does not match the values from the joint	If moving a program from a different robot to this one, re-kinematic calibrate the second robot to improve kinematics, otherwise ignore this message.
C214A4	The Kinematic Calibration checksum does not match the Wrist 1 checksum	The calibration checksum stored in the calibration.conf does not match the values from the joint	If moving a program from a different robot to this one, re-kinematic calibrate the second robot to improve kinematics, otherwise ignore this message.

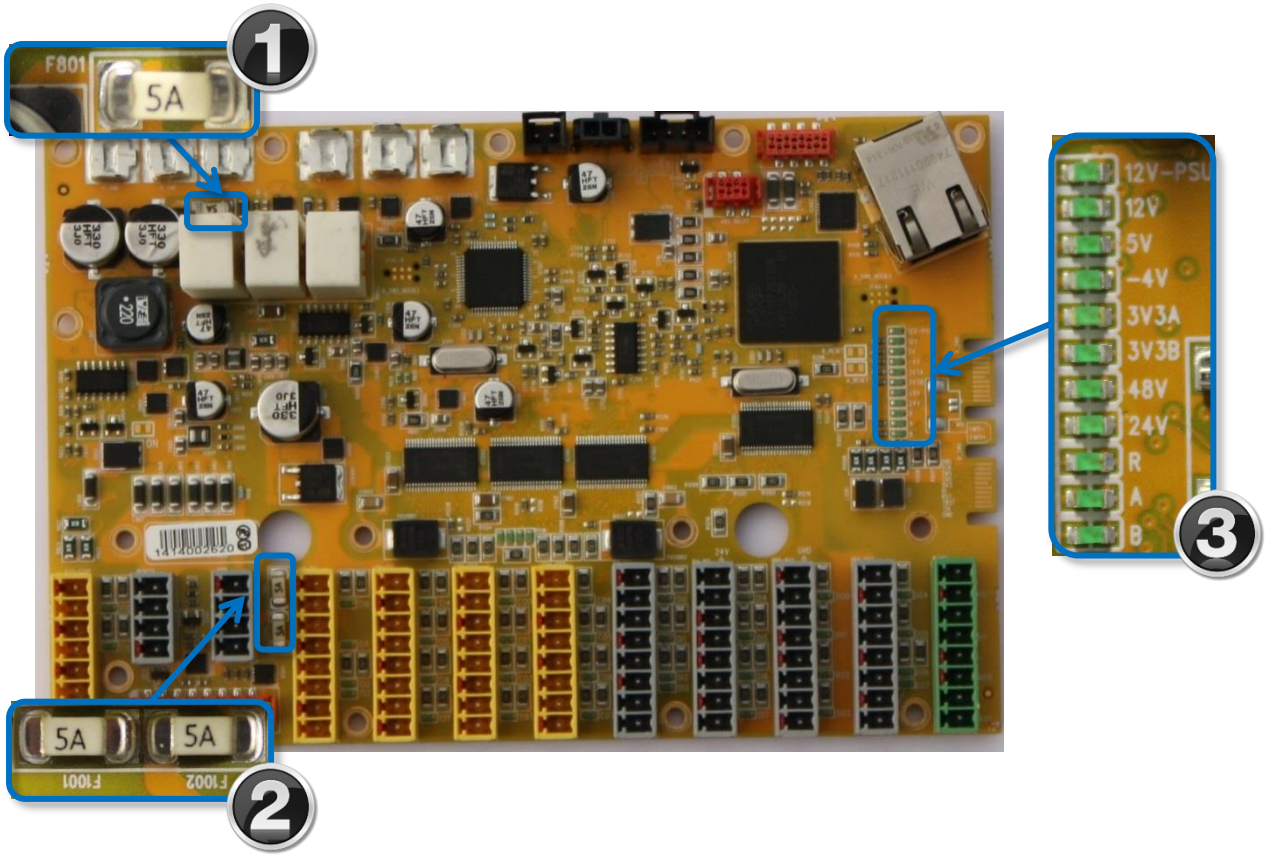
C214A5	The Kinematic Calibration checksum does not match the Wrist 2 checksum	The calibration checksum stored in the calibration.conf does not match the values from the joint	If moving a program from a different robot to this one, re-kinematic calibrate the second robot to improve kinematics, otherwise ignore this message.
C214A6	The Kinematic Calibration checksum does not match the Wrist 3 checksum	The calibration checksum stored in the calibration.conf does not match the values from the joint	If moving a program from a different robot to this one, re-kinematic calibrate the second robot to improve kinematics, otherwise ignore this message.
C215A0	Kinematic Calibration does not match the robot	The calibration checksum stored in the calibration.conf does not match the values from the joints	Check if the serial number of the robot arm matches the Control Box.
C216A0	The offset of the joint has changed		The joint has been zeroed by the user. Perform a kinematic calibration to improve kinematics if needed.
C216A1	The offset of the Base joint has changed		The joint has been zeroed by the user. Perform a kinematic calibration to improve kinematics if needed.
C216A2	The offset of the Shoulder joint has changed		The joint has been zeroed by the user. Perform a kinematic calibration to improve kinematics if needed.
C216A3	The offset of the Elbow joint has changed		The joint has been zeroed by the user. Perform a kinematic calibration to improve kinematics if needed.
C216A4	The offset of the Wrist 1 joint has changed		The joint has been zeroed by the user. Perform a kinematic calibration to improve kinematics if needed.
C216A5	The offset of the Wrist 2 joint has changed		The joint has been zeroed by the user. Perform a kinematic calibration to improve kinematics if needed.
C216A6	The offset of the Wrist 3 joint has changed		The joint has been zeroed by the user. Perform a kinematic calibration to improve kinematics if needed.

5.2 LED indicators and Fuses on Safety Control Board

Safety Control Board (SCB)

1) Fuse 48 V:
   The 5A fuse (F801) "48V" protects all 48V in the system inclusive of Euromap from over current.
   This information is only for troubleshooting. Do NOT replace the fuse under any circumstances.
   In case of failure, ONLY replace the SCB with a new tested board.
2) Fuse 24 V:
   2 x 5A fuses (F1001 and F1002) in parallel protect the DI/DO 24 V supply on the Safety Control Board, whether the 24 V is from the controller or external power supply. Do NOT replace the fuses under any circumstances. In case of failure ONLY replace the SCB with a new tested board.
3) LED indicators:

12V-PSU	On when the power plug is connected.
12V	System: On when the main controller power has been activated.
5V	On when "12V System" is on and indicates that 5V is present.
-4V	On when "12V System" is on and indicates that – 4V to analog I/O is present.
3V3A	On when 5V is on and indicates 3.3V for logic Safety circuit A is present.
3V3B	On when 5V is on and indicates 3.3V for logic Safety circuit B is present.
48V	Indicates 48 V is present on the Safety Control Board
24V	48V is detected and ok, indicates that internal 24 V is present for I/Os
R	48 V present on robot arm
A	Indicates Status for Logic A: a blink sequence
B	Indicates status for Logic B: a blink sequence



5.2.1 Normal startup sequence for a CB3.x UR5

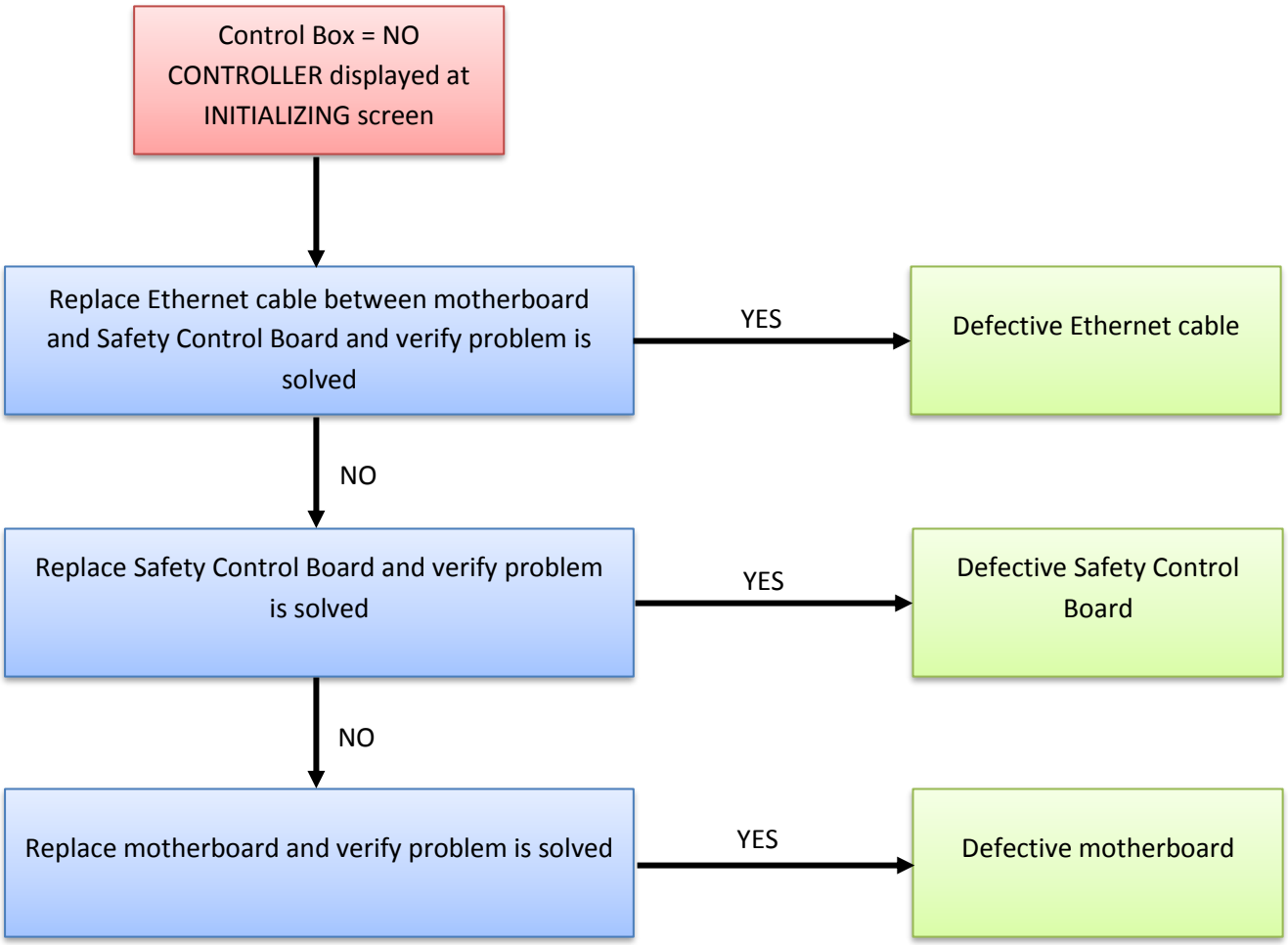
1) The 12V-Power supply LED is on when the power plug is connected to a working power supply.
2) When the power button on the teach pendant is pressed, all LED indicators are turned on except for the 48V, 24V and R LEDs. The A and B LEDs also exhibit a special behavior by intermittently turning off and 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, measure the voltage as described below:
See the E-Plan diagram: 5.4.1 Schematic overview

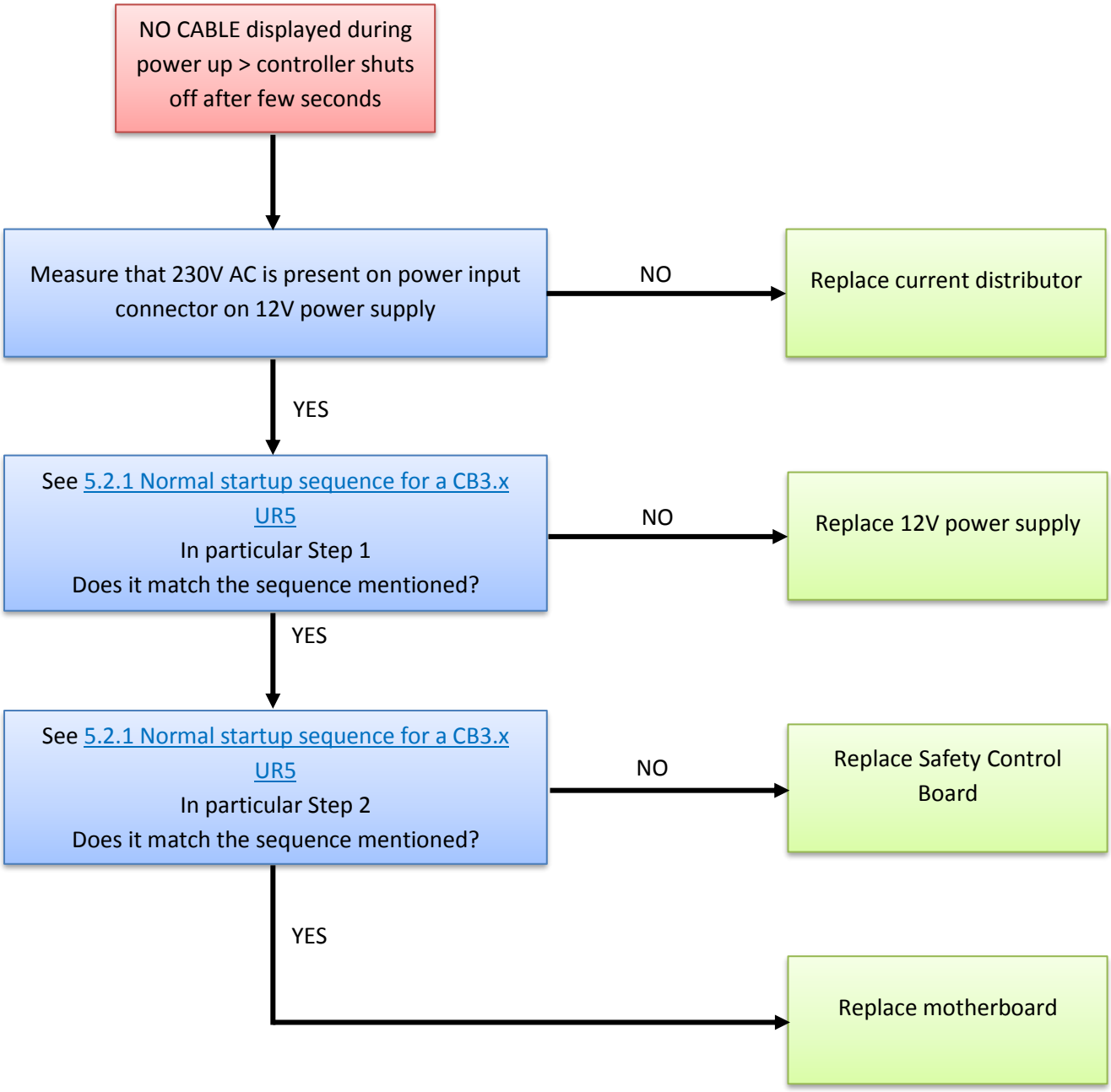
a) Measure the 48V on the Safety Control Board (SCB) where the 48V comes from the 48V power supply. And check this 1 second pulse.
   i) The voltage is measured on the Safety Control Board.
   That means the Safety Control Board is defect.
   ii) No voltage is measured on the Safety Control Board. Then 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.
   iii) 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

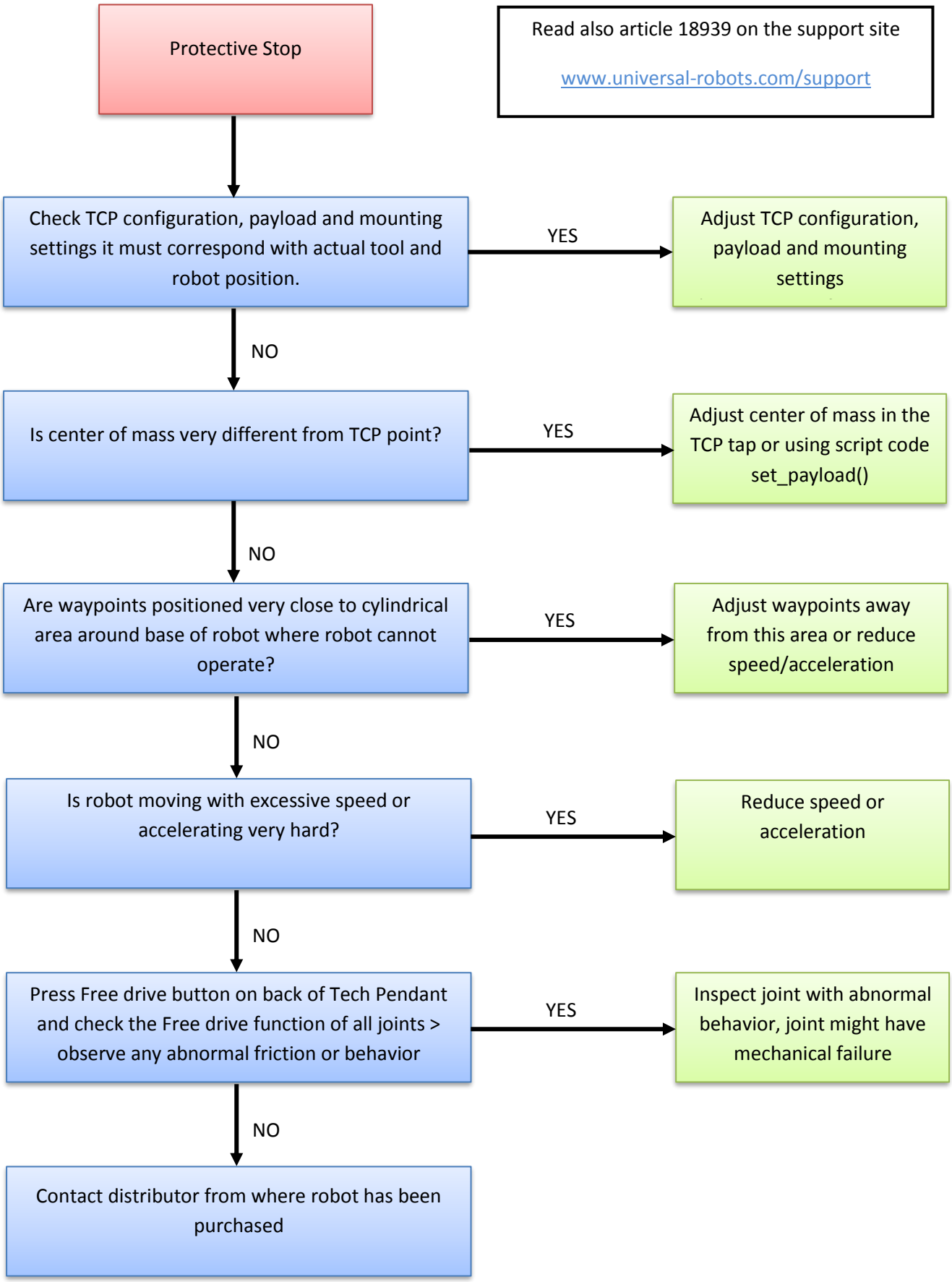
5.3.1 Control Box: NO CONTROLLER displayed in Initializing



5.3.2 NO CABLE displayed during power up



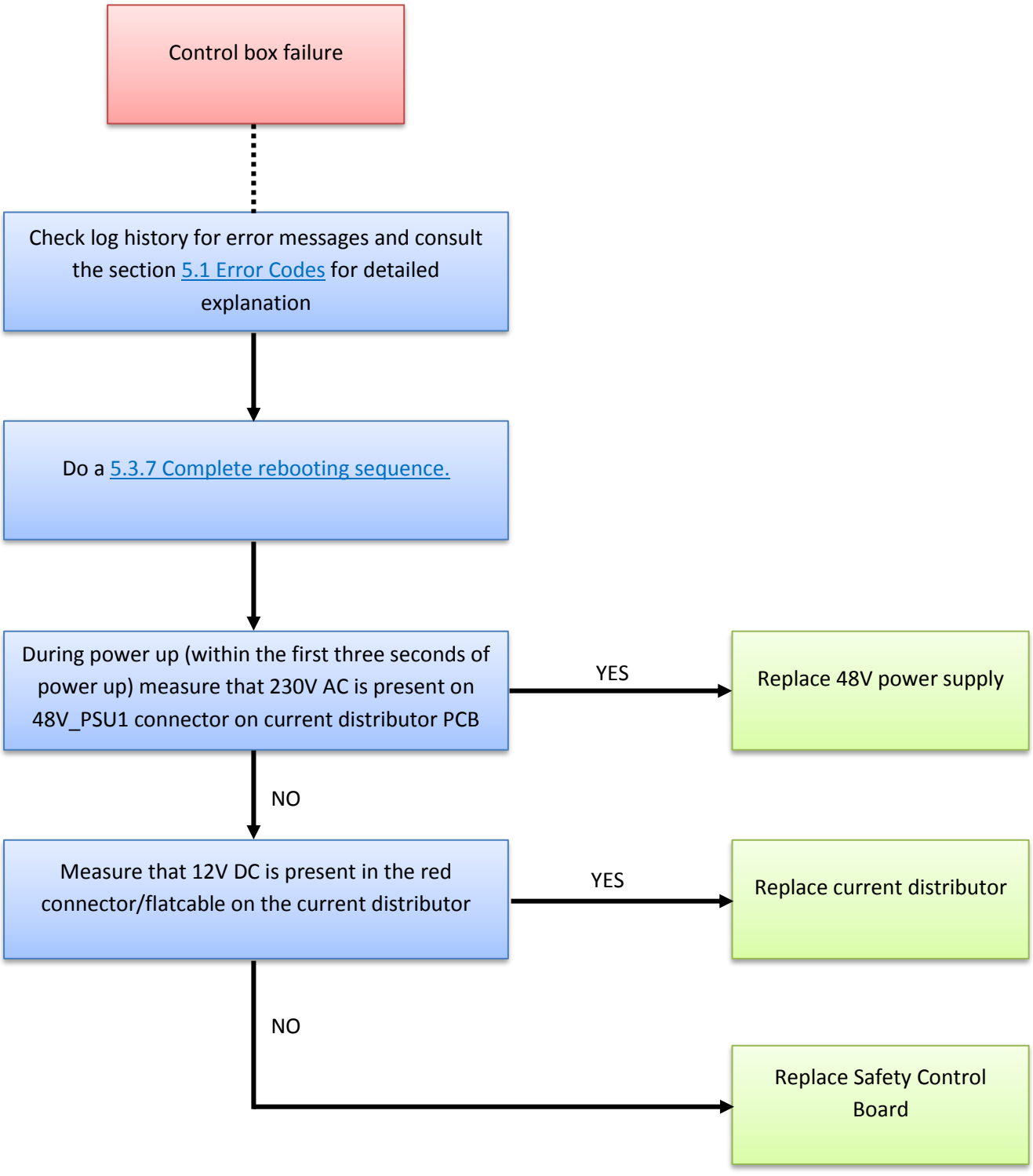
5.3.3 Protective stop



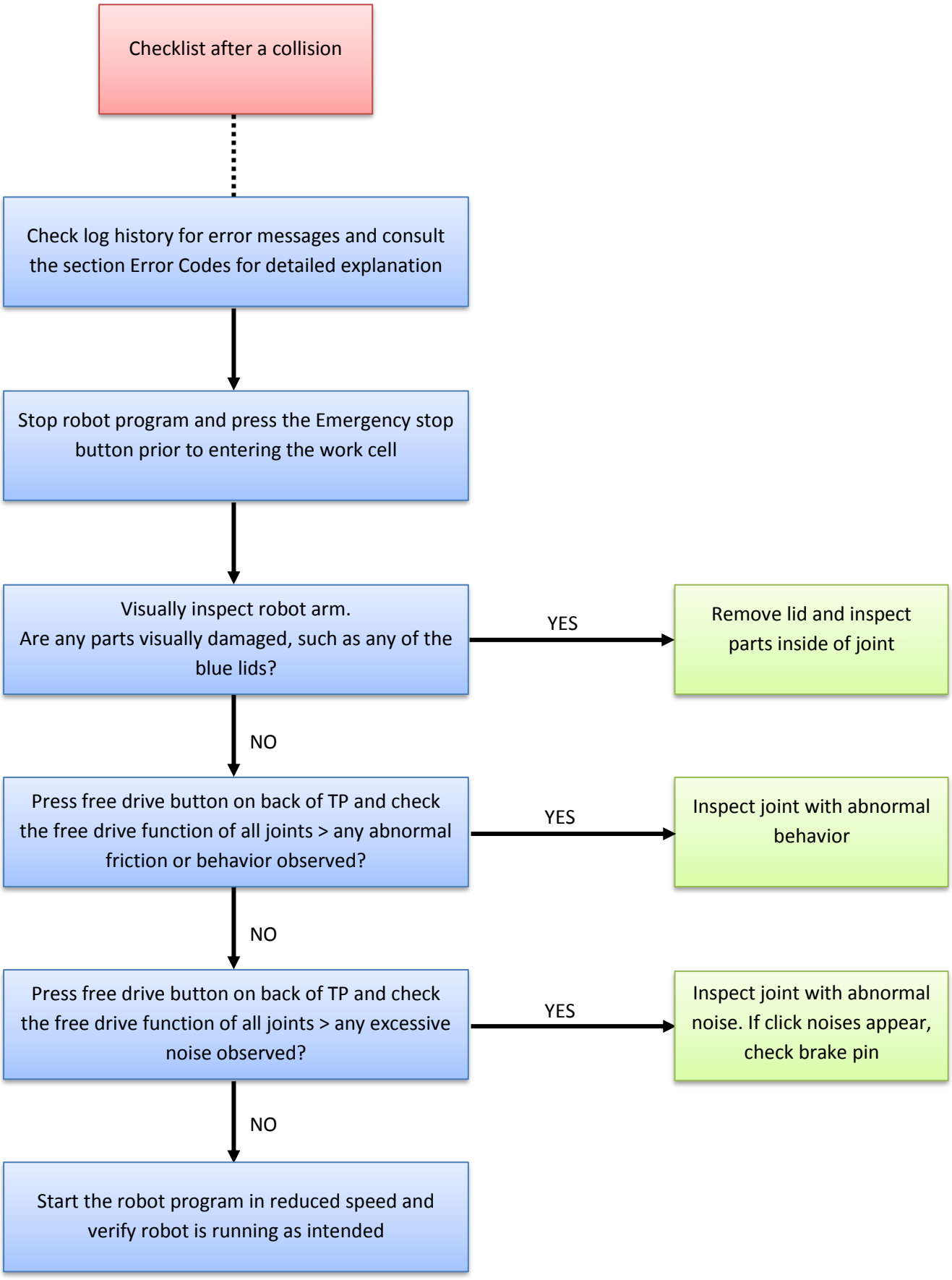
5.3.4 Power on failure in Initializing

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.



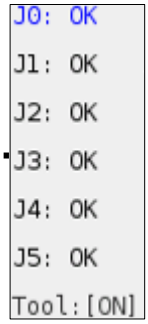
5.3.5 Checklist after a collision



5.3.6 Communication to joints and tool

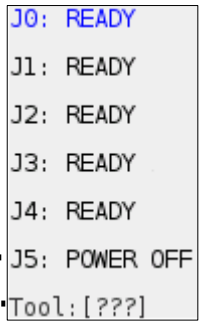
Check if there is communication to joints and tool

Go to Expert mode and start up the robot arm. Check whether all joints/tool are communicating

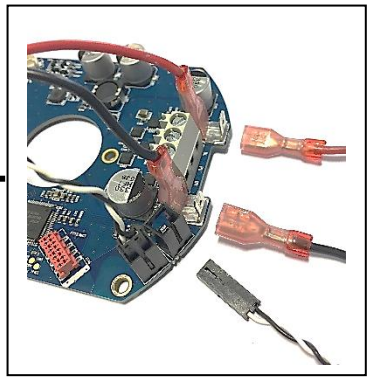


No communication to joint will show “Power off”

No communication to tool will show [???]



If there are communication issues, check connection terminals and wires on the joint with communication issue and the joint before.

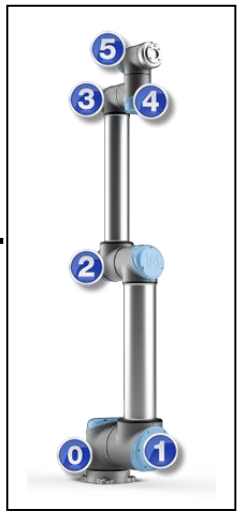


Remove all power and communication connections except to the base joint (J0). Check if there is connection to this joint.

No communication to base joint (J0)

Check cable from control box and the control box connections.

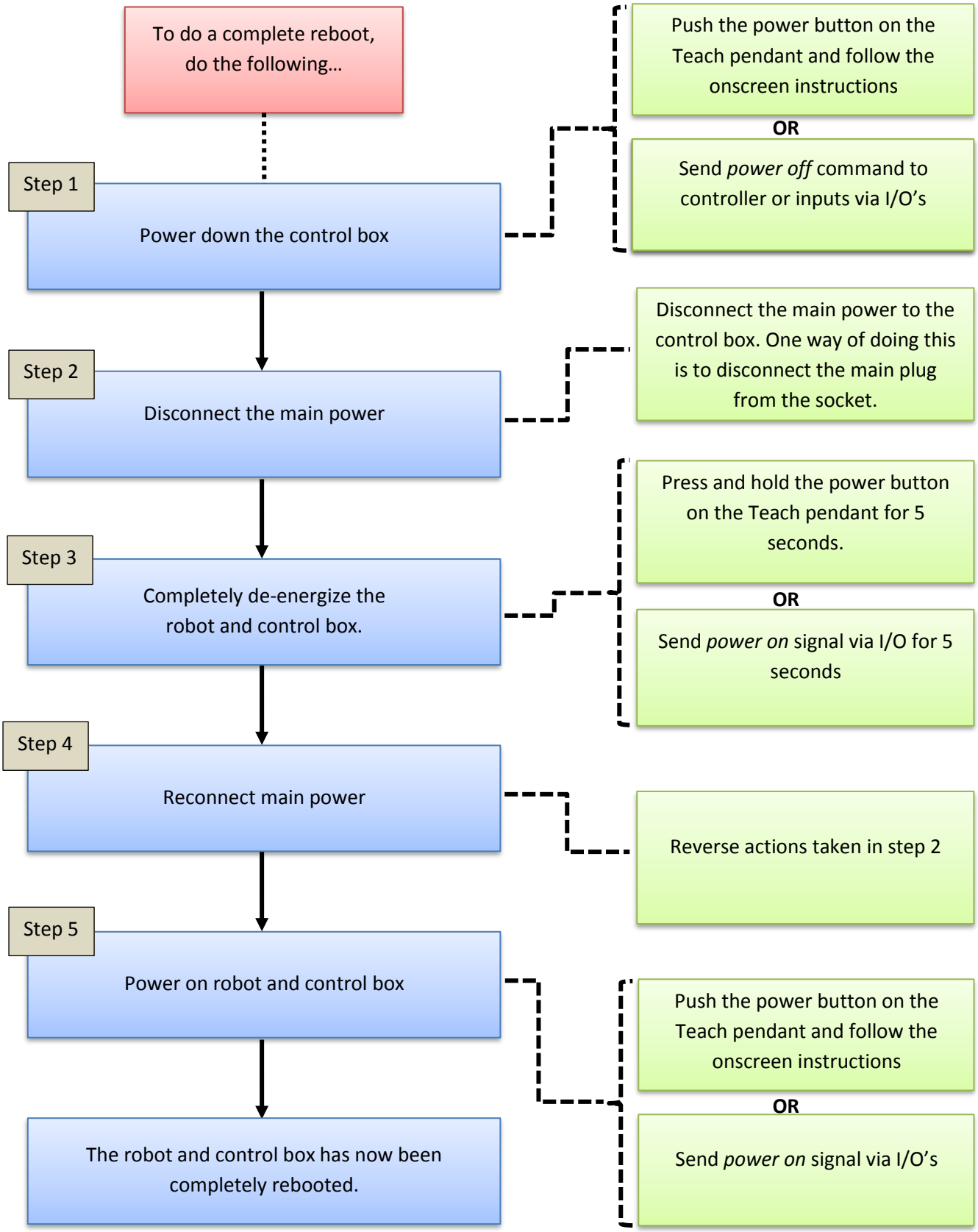
Progress by connecting the next joint and check whether this also communicates.



If none of the above steps resolves the issue, please contact your Universal Robots representative.

5.3.7 Complete rebooting sequence.

To do a complete reboot of the robot system follow these 5 steps:

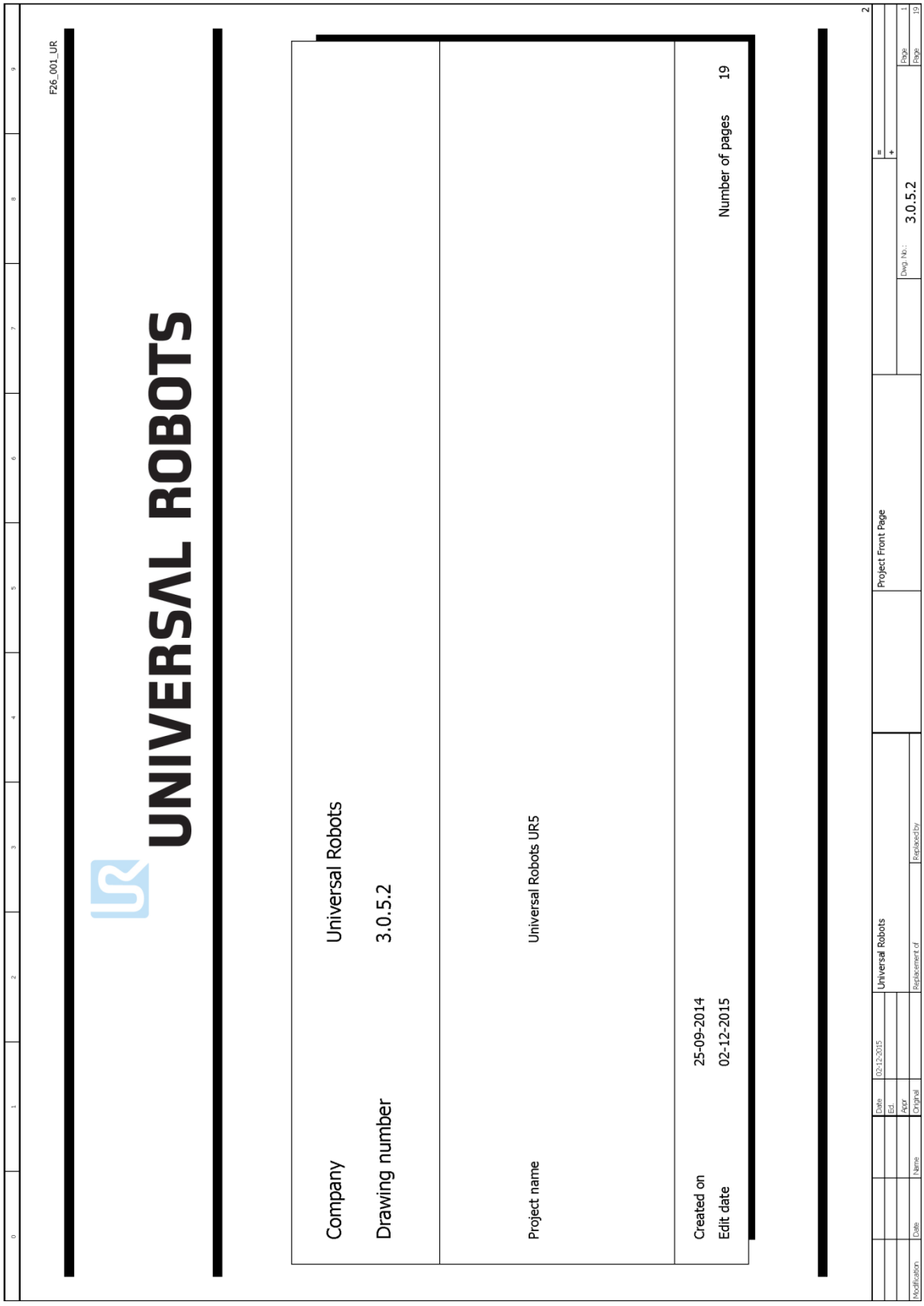


5.4 Electrical drawing

5.4.1 Schematic overview

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

www.universal-robots.com/support/



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=UR5 / 12	Controller UR5 - CB3.1		02-12-2015	VKV	
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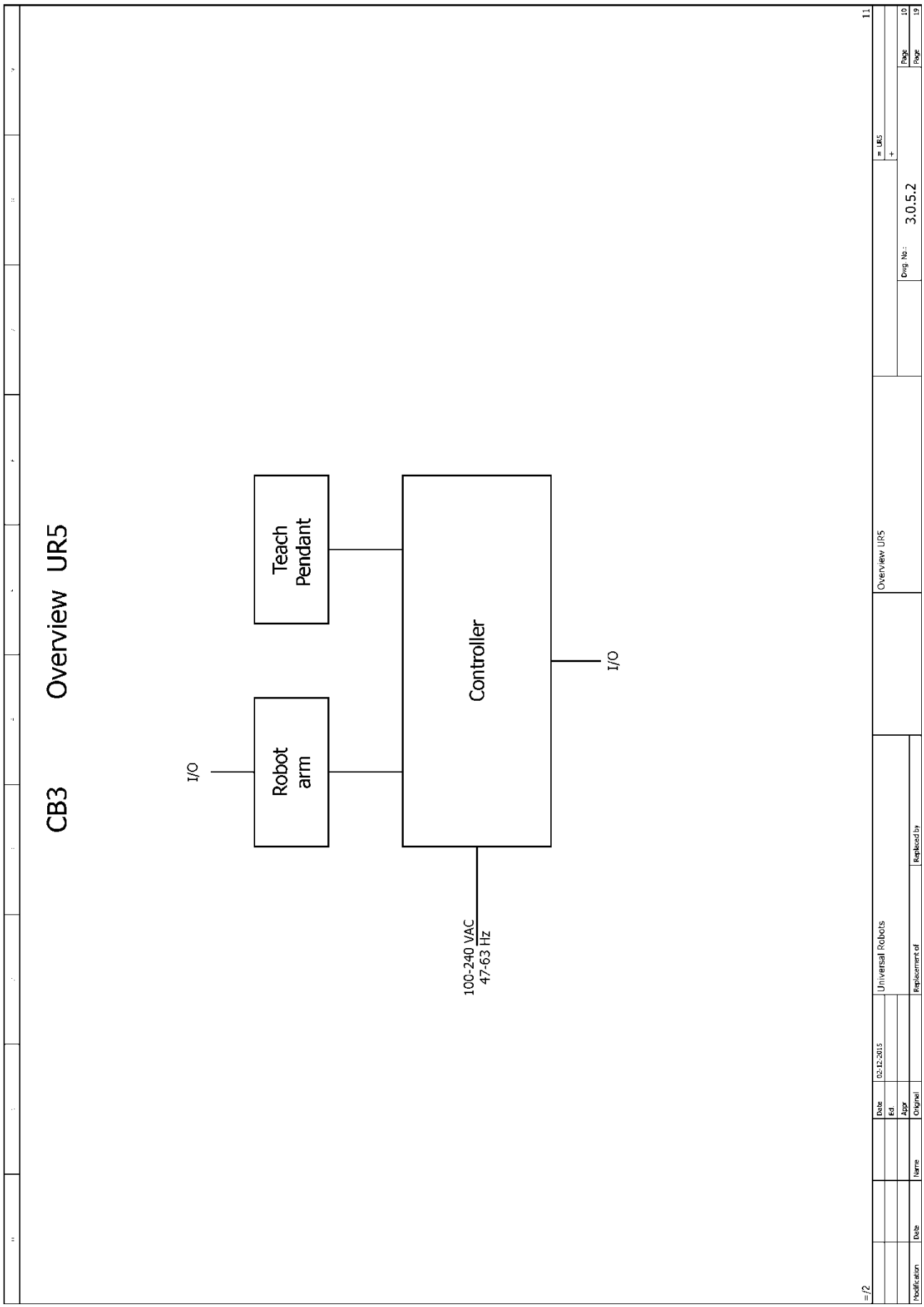
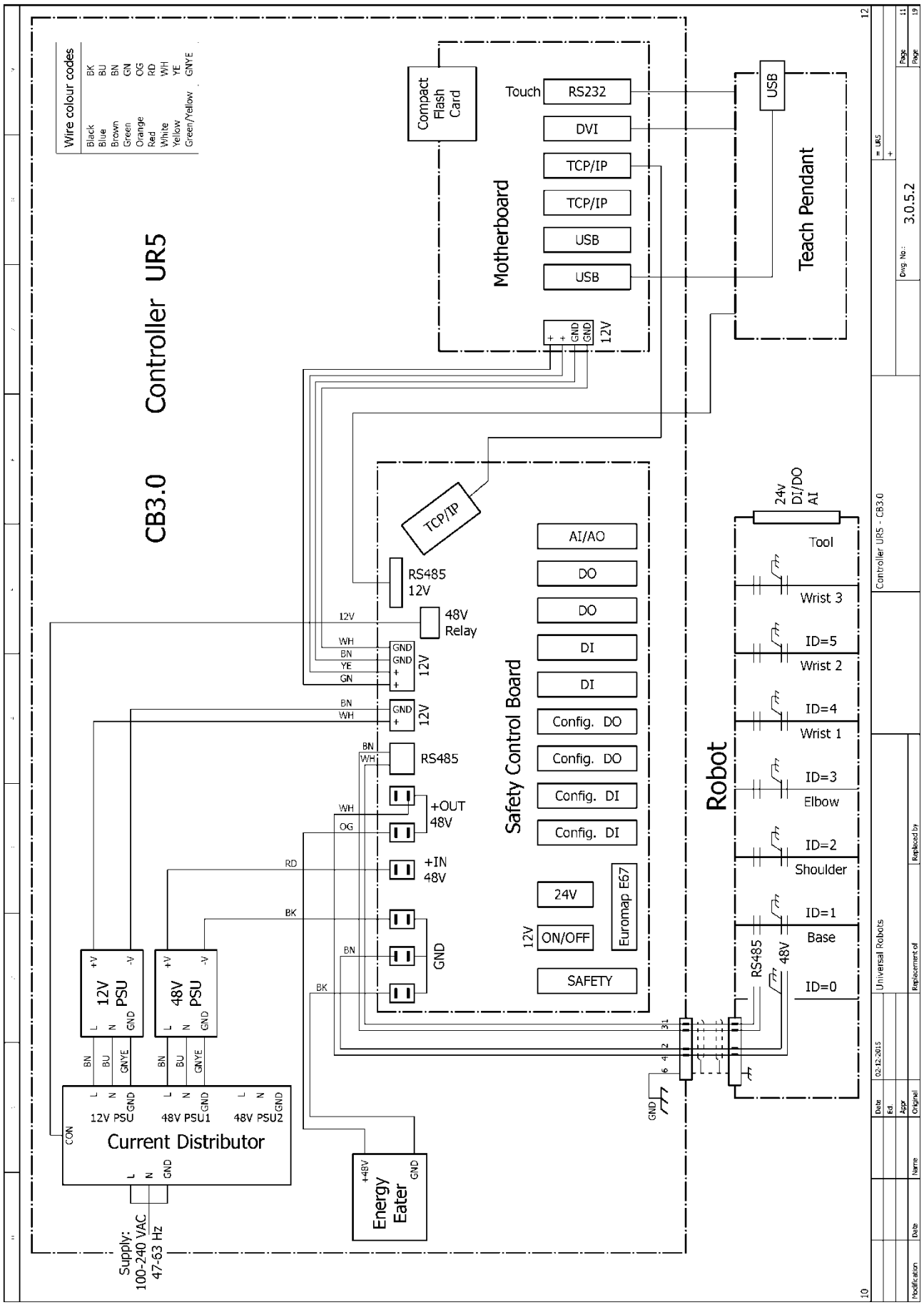
UNIVERSAL ROBOTS


CB3
Overview UR5
Teach Pendant
Robot arm
Controller
I/O
I/O
100-240 VAC
47-63 Hz
Overview UR5
Universal Robots
3.0.5.2


Controller UR5
CB3.0
Wire colour codes
Black BK
Blue BU
Brown BN
Green GN
Orange OG
Red RD
White WH
Yellow YE
Green/Yellow GNYE
Compact Flash Card
Motherboard
Touch
RS232
DVI
TCP/IP
TCP/IP
USB
USB
USB
Teach Pendant
12V
GND
GND
TCP/IP
RS485
12V
48V Relay
Safety Control Board
AI/AO
DO
DO
DI
DI
Config. DO
Config. DO
Config. DI
Config. DI
24V
ON/OFF
Euromap E67
SAFETY
+OUT 48V
+IN 48V
GND
RS485
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
12V PSU
48V PSU
Current Distributor
12V PSU
48V PSU1
48V PSU2
Energy Eater
Supply:
100-240 VAC
47-63 Hz
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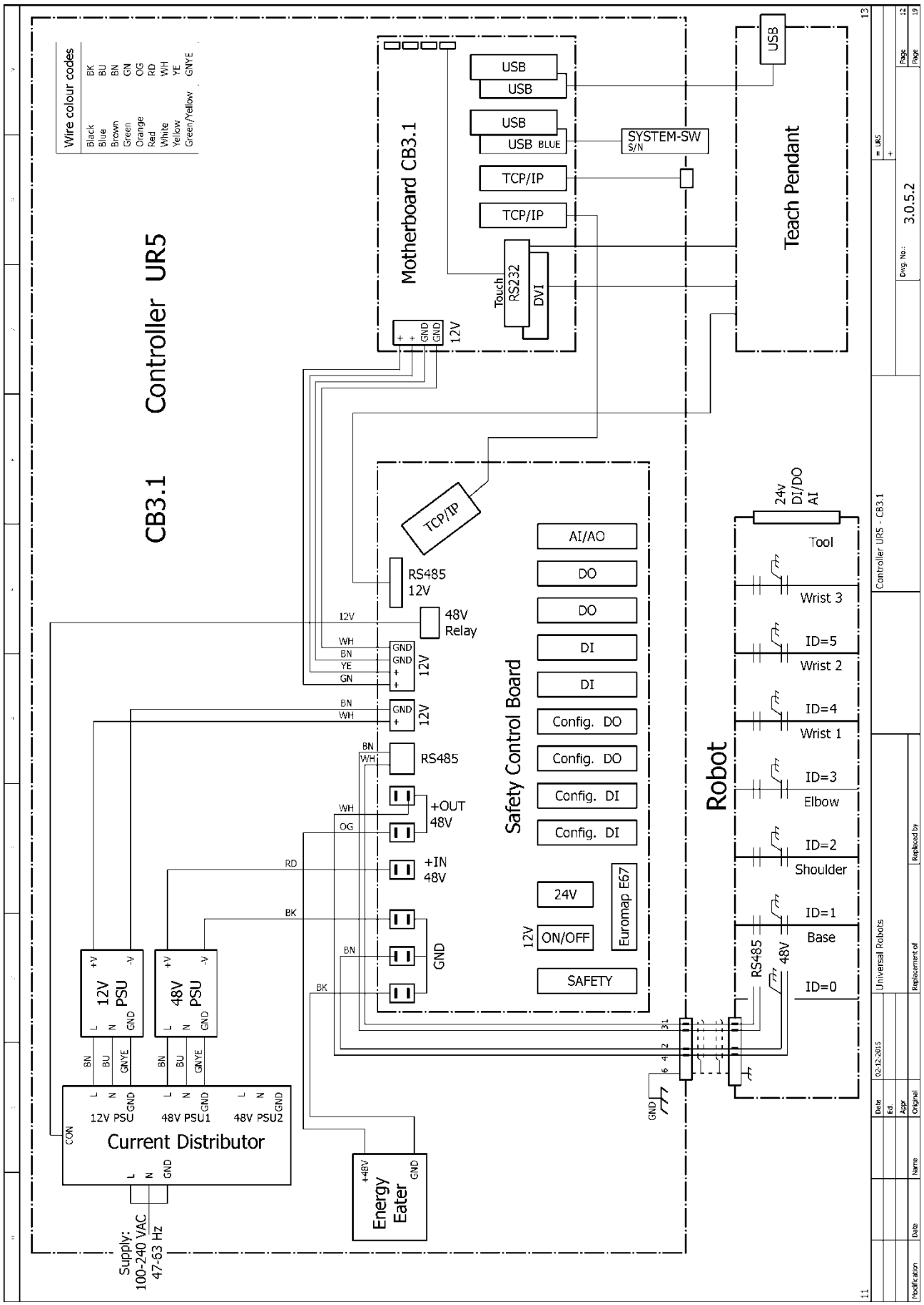
Controller UR5
CB3.1
Wire colour codes
Black BK
Blue BU
Brown BN
Green GN
Orange OG
Red RD
White WH
Yellow YE
Green/Yellow GNYE
Motherboard CB3.1
USB
USB
USB
USB BLUE
TCP/IP
TCP/IP
Touch
RS232
DVI
SYSTEM-SW
S/N
Teach Pendant
USB
GND
GND
12V
TCP/IP
RS485
12V
48V
Relay
12V
WH
BN
YE
GN
GND
GND
+
+
12V
BN
WH
GND
+
12V
BN
WH
RS485
WH
+OUT
48V
OG
RD
+IN
48V
BK
GND
BN
BK
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
GND
12V PSU
48V PSU
+V
-V
L
N
GND
BN
BU
GNYE
12V PSU
48V PSU1
48V PSU2
CON
Current Distributor
Supply:
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+48V
Energy
Eater
GND
Controller UR5 - CB3.1
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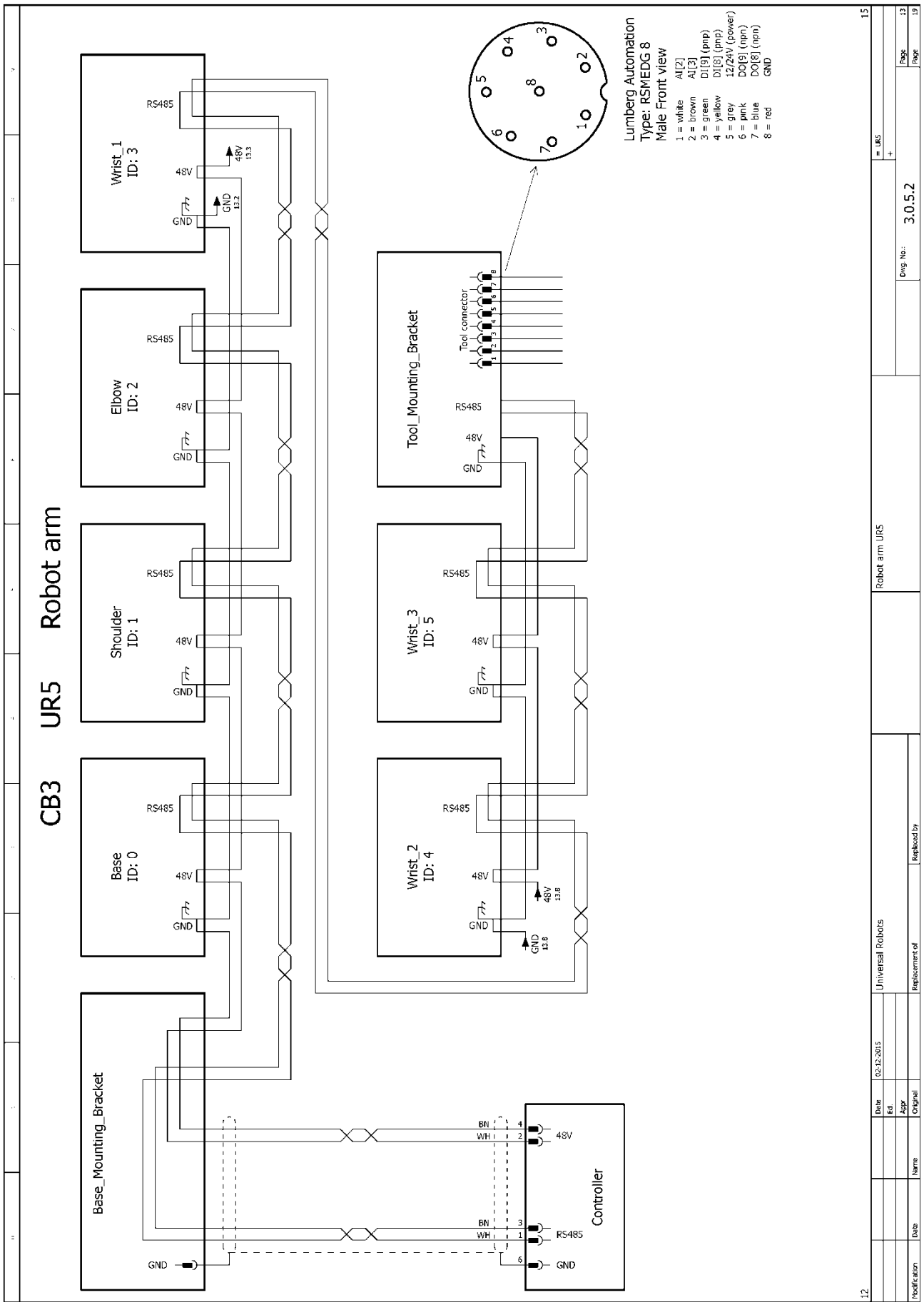
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Base
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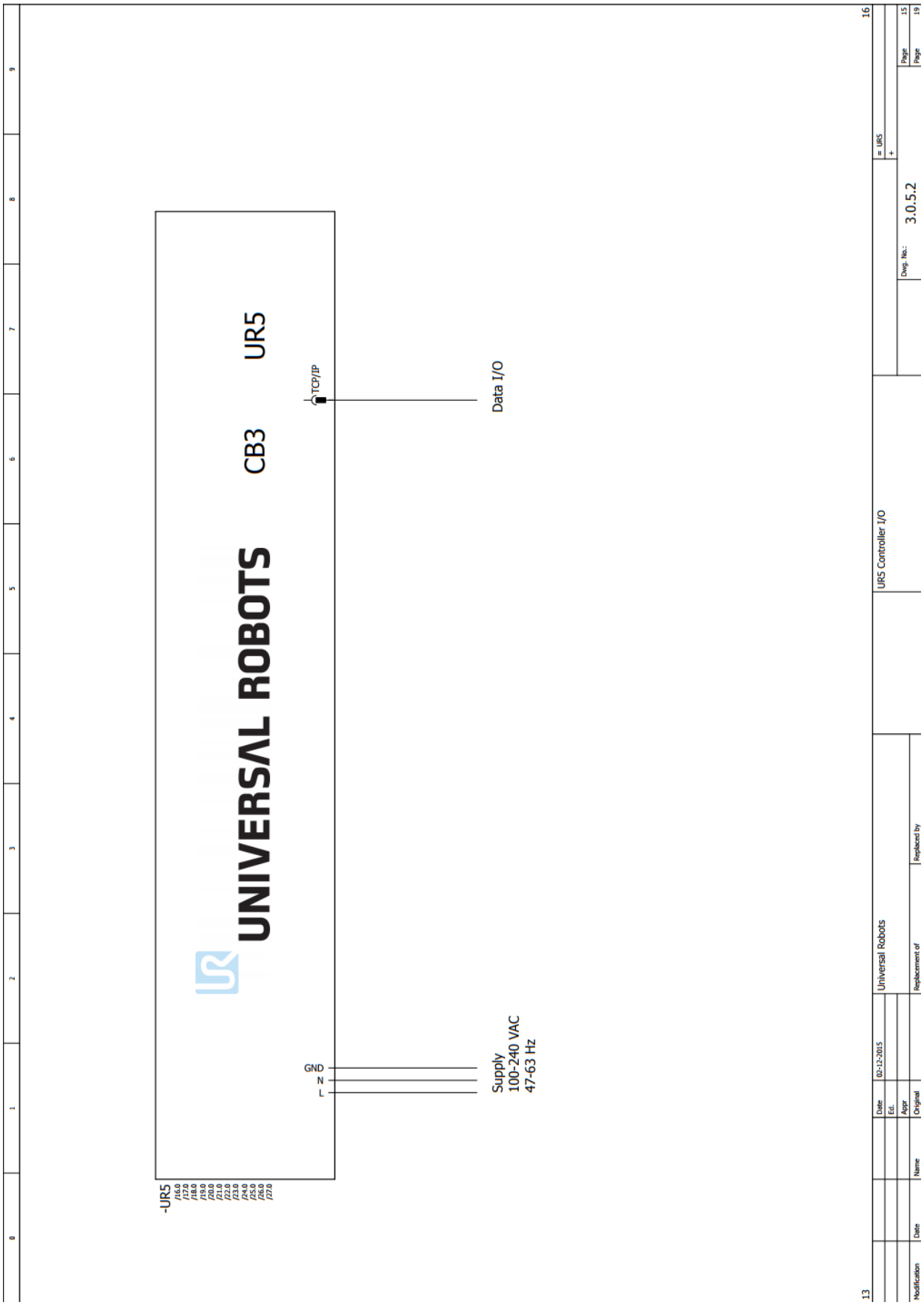
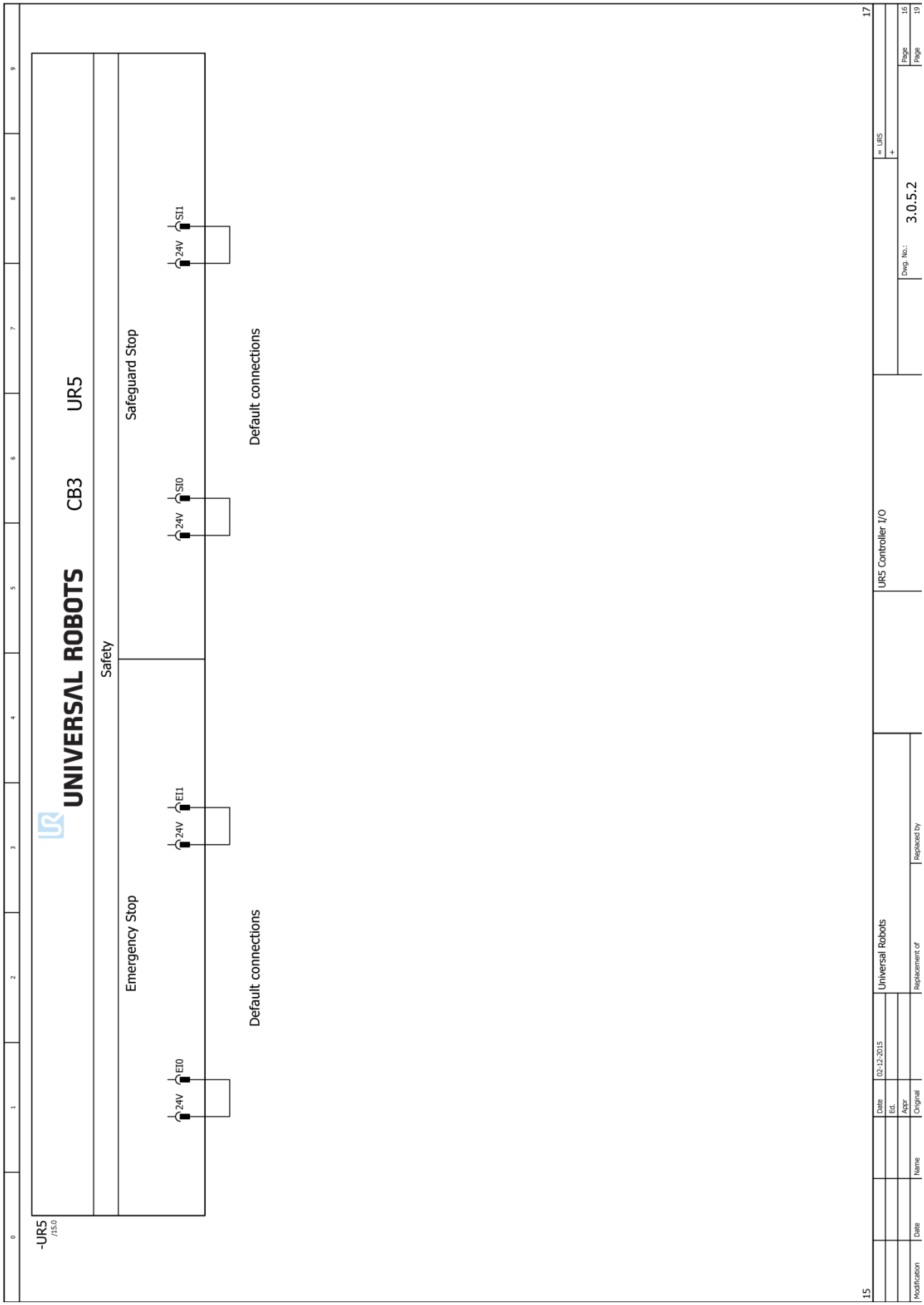
Shoulder
ID: 1
Elbow
ID: 2
Wrist_1
ID: 3
Wrist_2
ID: 4
Wrist_3
ID: 5
Tool_Mounting_Bracket
Base_Mounting_Bracket
Controller
RS485
48V
GND
Tool connector
Lumberg Automation
Type: RSMEDG 8
Male Front view
1 = white AI[2]
2 = brown AI[3]
3 = green DI[9] (pnp)
4 = yellow DI[8] (pnp)
5 = grey 12/24V (power)
6 = pink DO[9] (npn)
7 = blue DO[8] (npn)
8 = red GND
Universal Robots
Robot arm UR5
3.0.5.2

5.4.2 E-Plan diagrams

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

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UNIVERSAL ROBOTS
CB3
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Safeguard Stop
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EI0
24V
EI1
24V
SI0
24V
SI1
Default connections
Default connections
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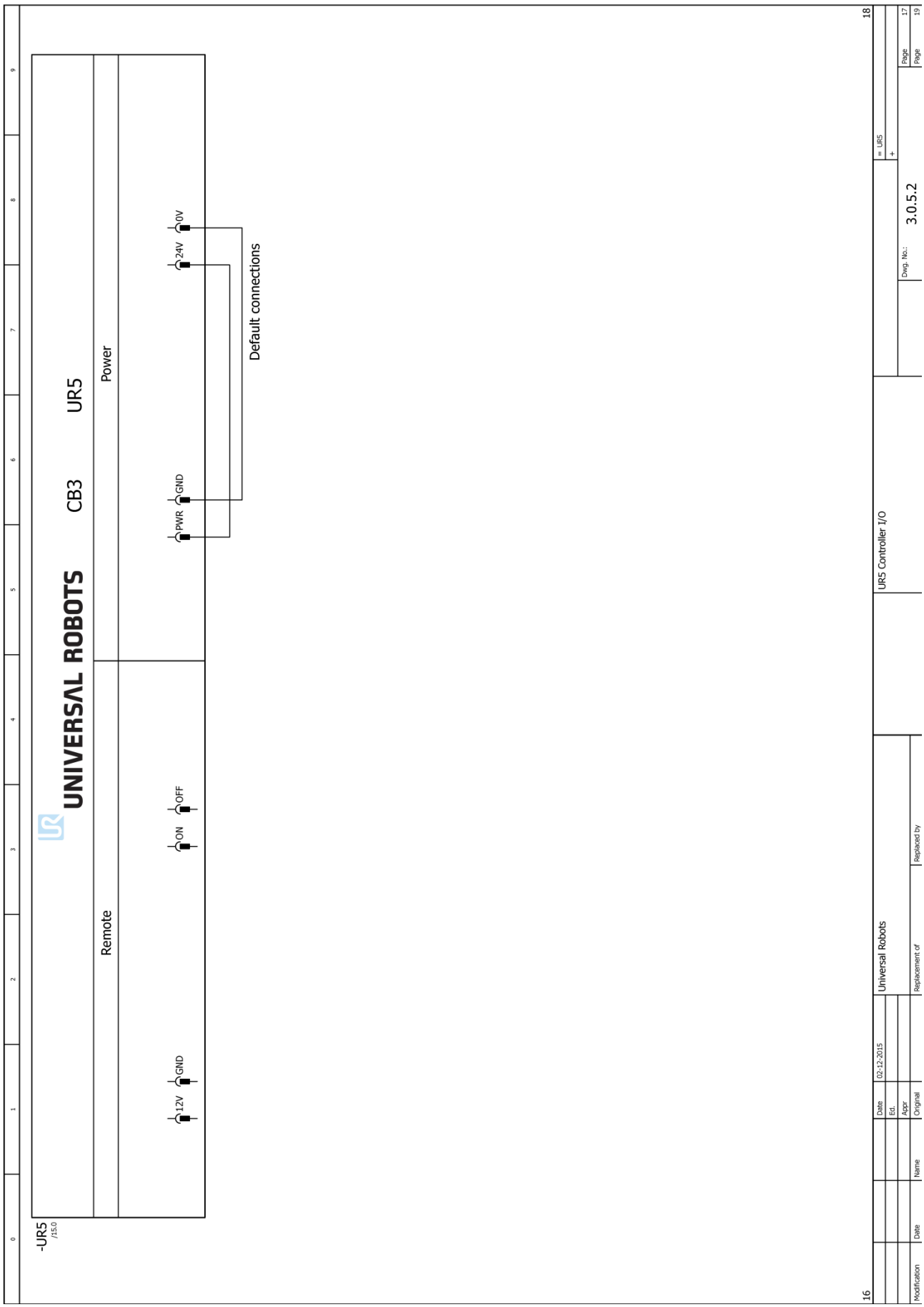
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UNIVERSAL ROBOTS
CB3
UR5
Power
Remote
0V
24V
GND
PWR
OFF
ON
GND
12V
Default connections
UR5 Controller I/O
Universal Robots
Dwg. No.: 3.0.5.2
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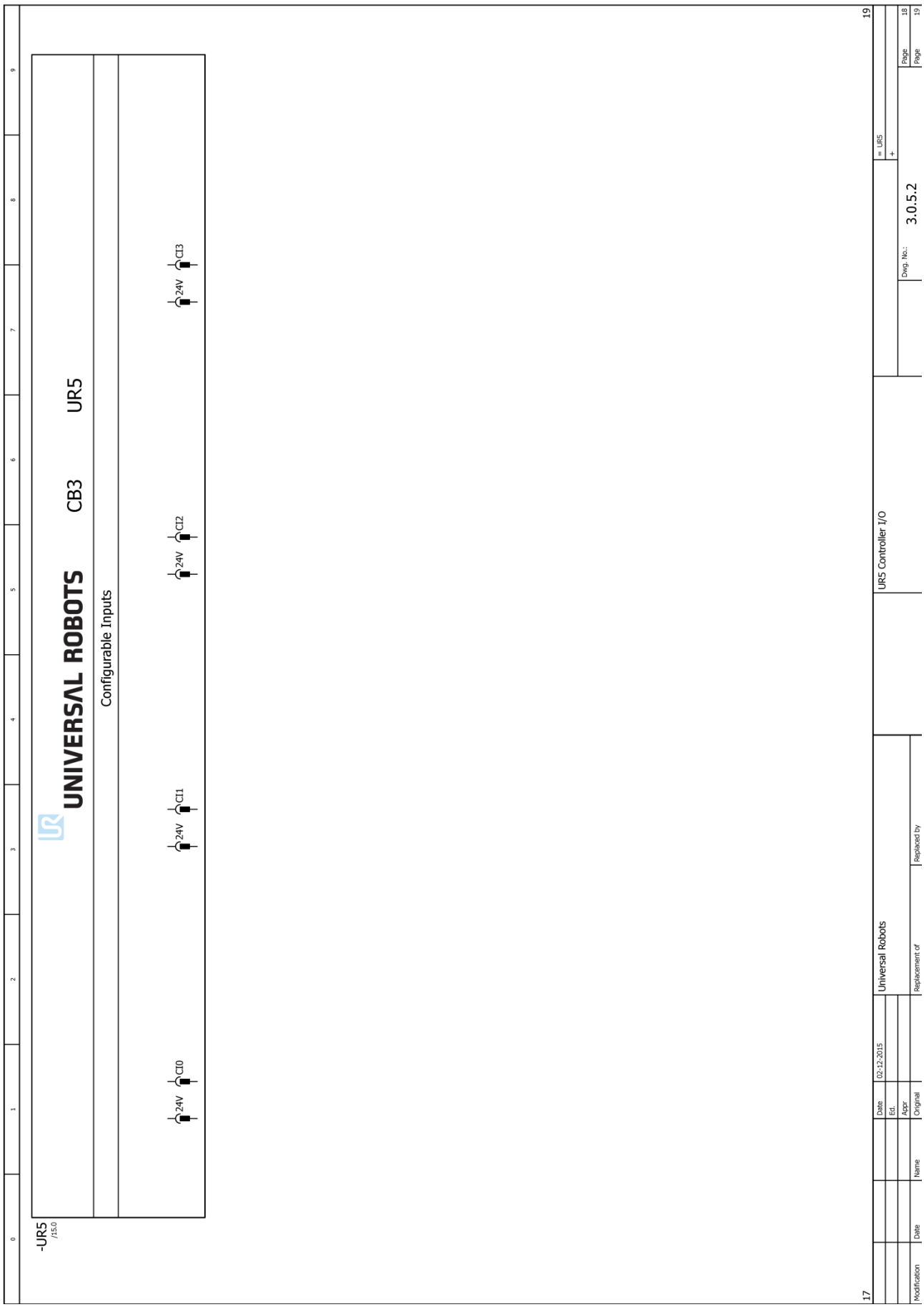
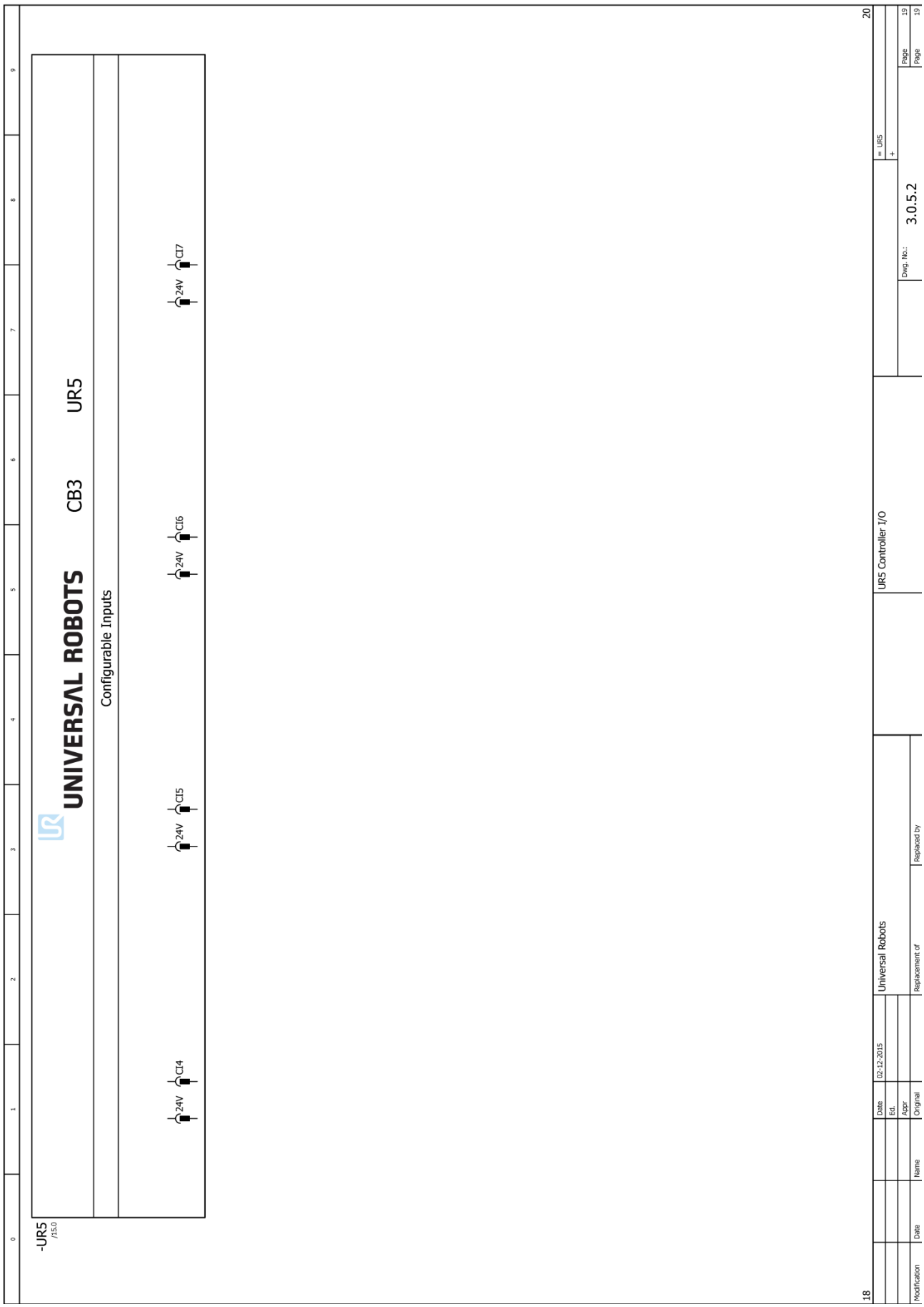
Modification
Date
Name
Original
Appr
Ed.
Date
02-12-2015
Replacement of
Replaced by


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Inputs
24V
CI0
24V
CI1
24V
CI2
24V
CI3
17
19
Date
Ed.
Appr
Original
02-12-2015
Universal Robots
Replacement of
Replaced by
Modification
Date
Name
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.2
Page
18
Page
19


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Inputs
24V
CI4
24V
CI5
24V
CI6
24V
CI7
18
20
Date
Ed.
Appr
Original
02-12-2015
Universal Robots
Replacement of
Replaced by
Modification
Date
Name
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.2
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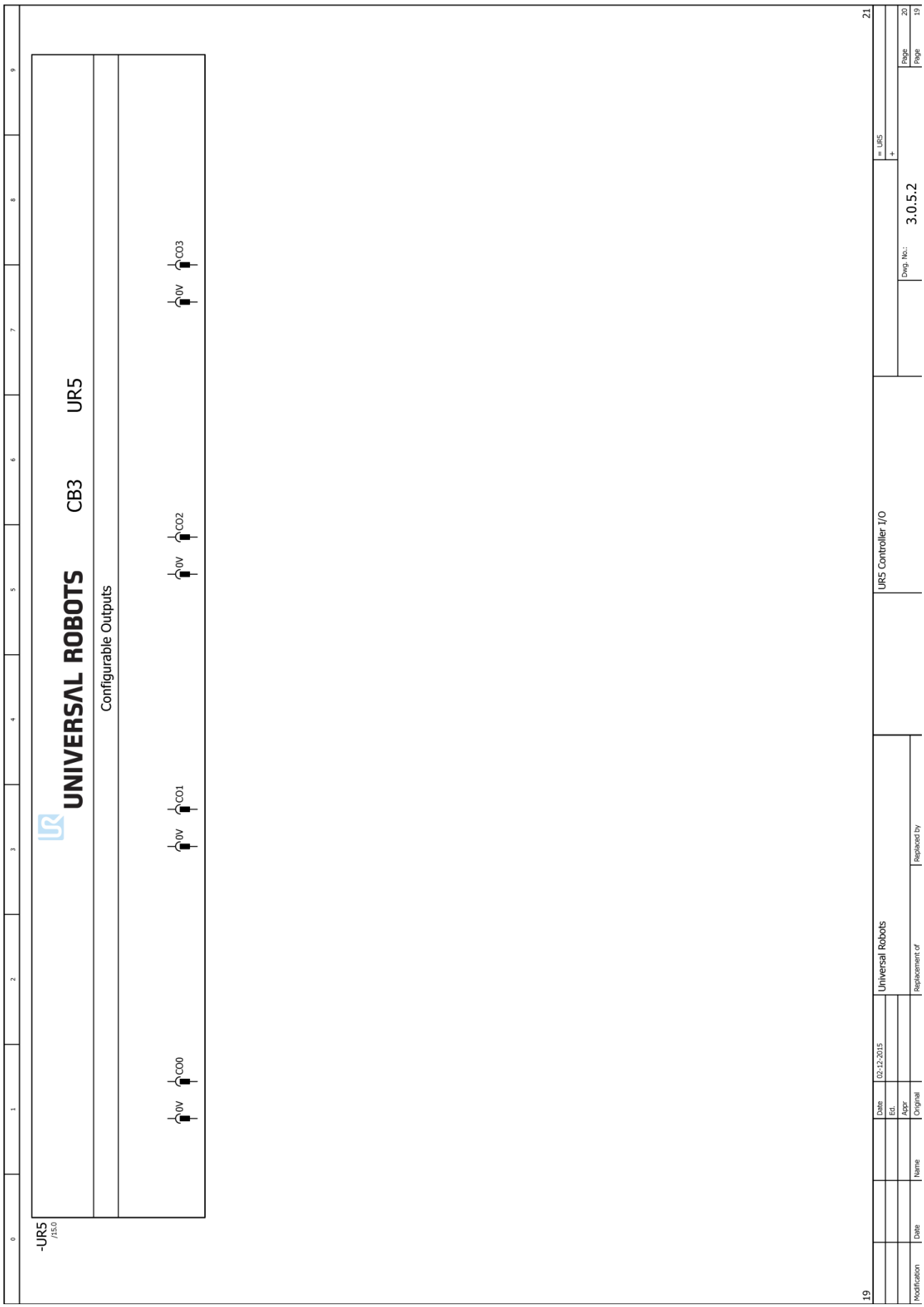
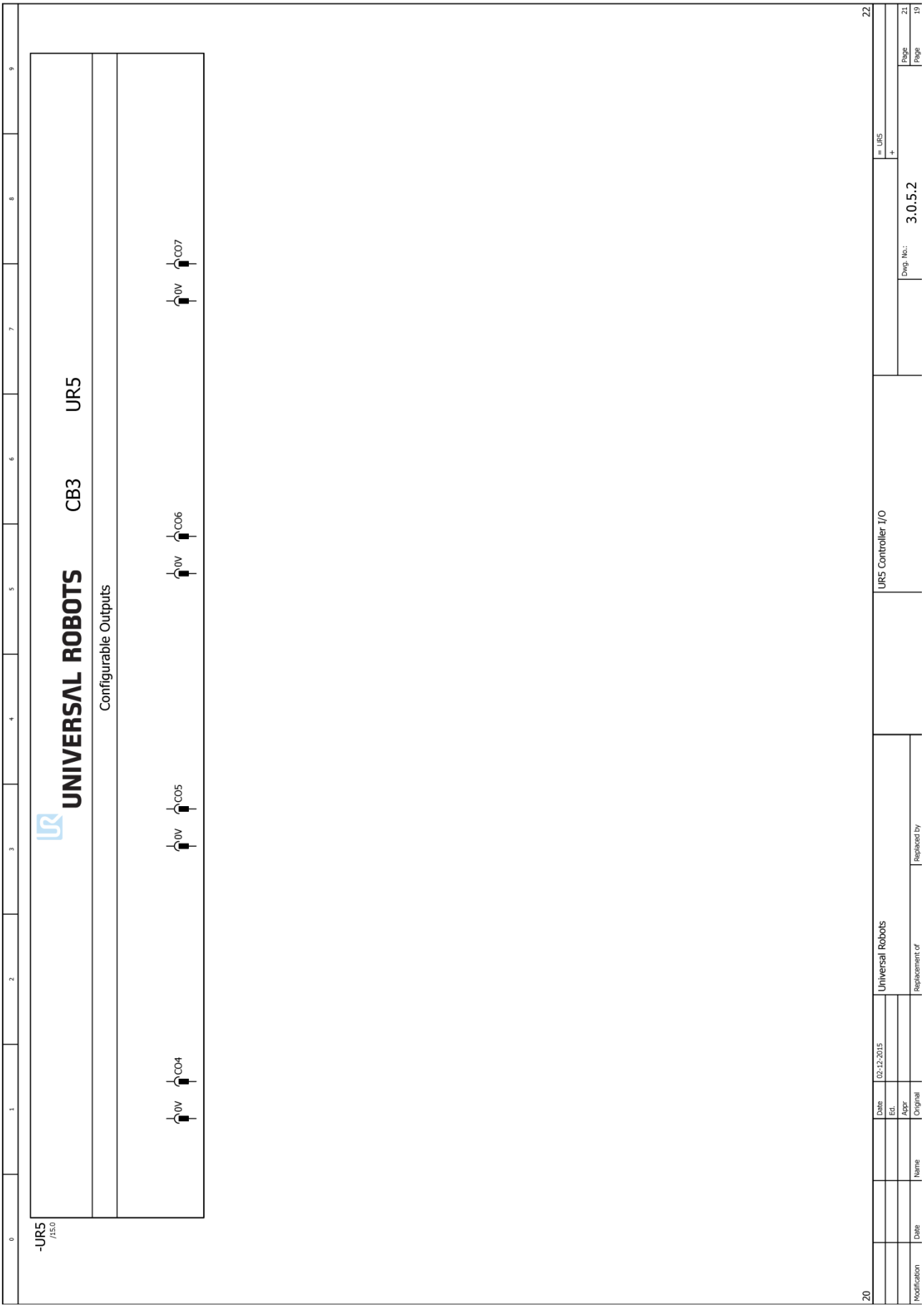
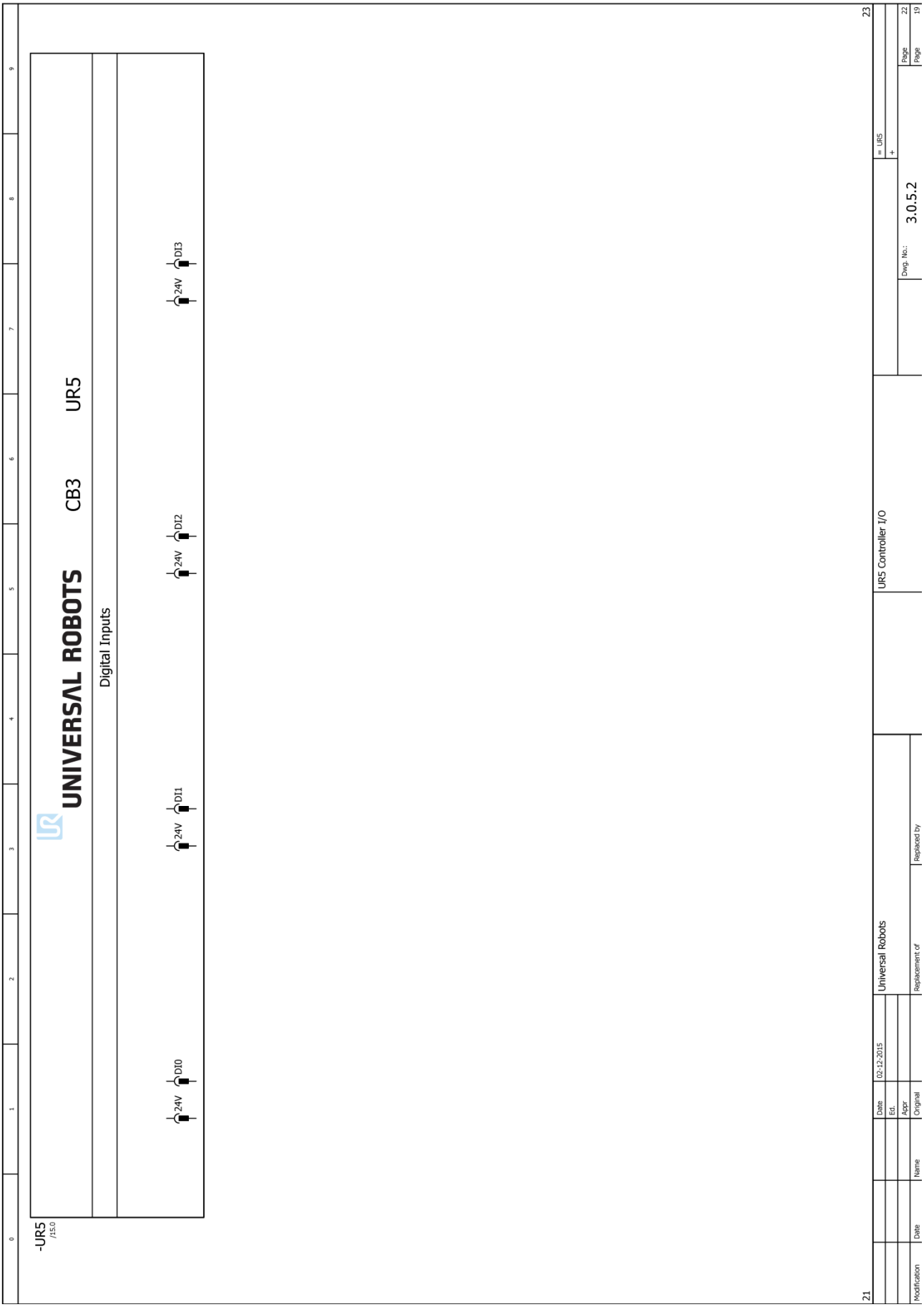
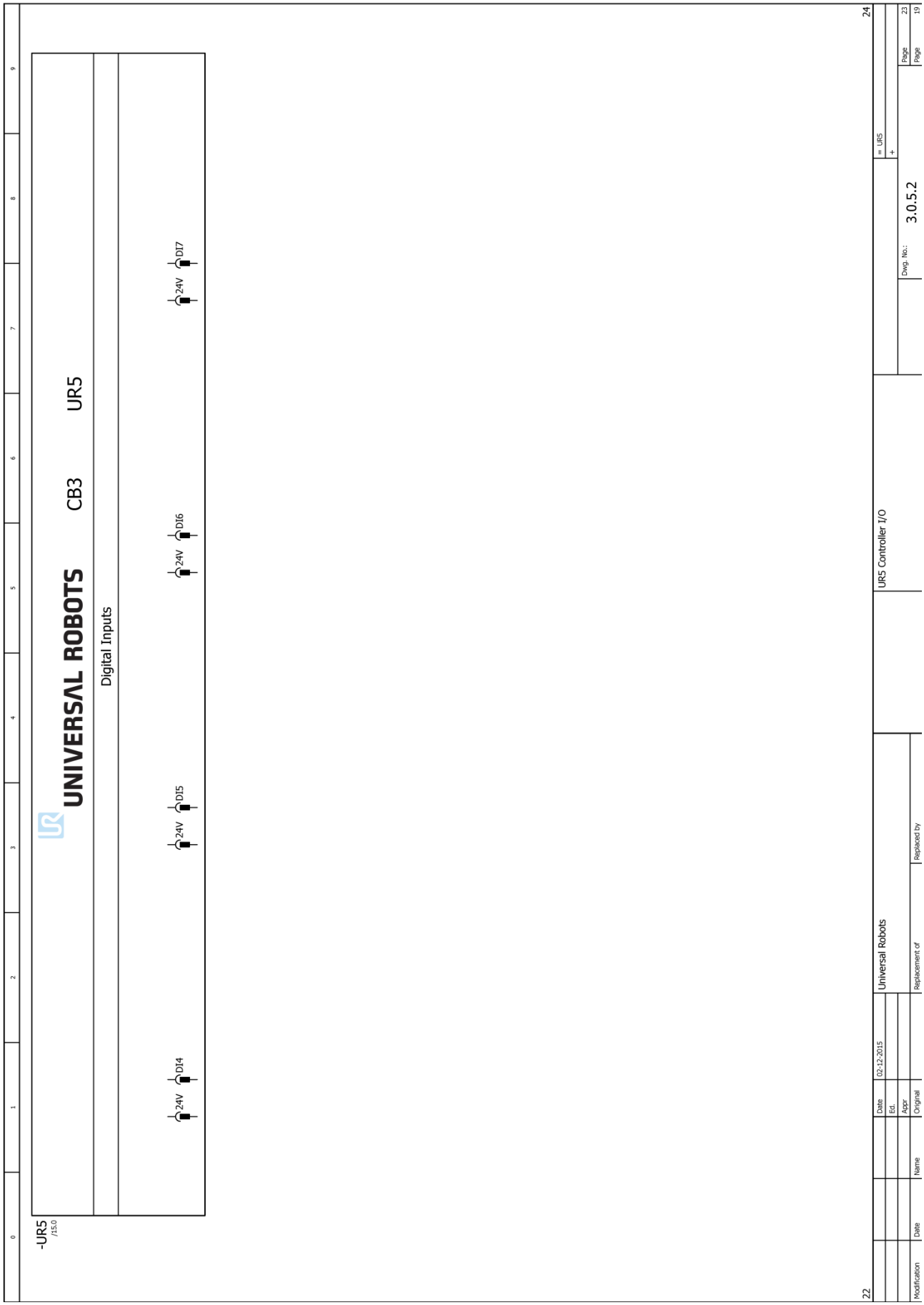
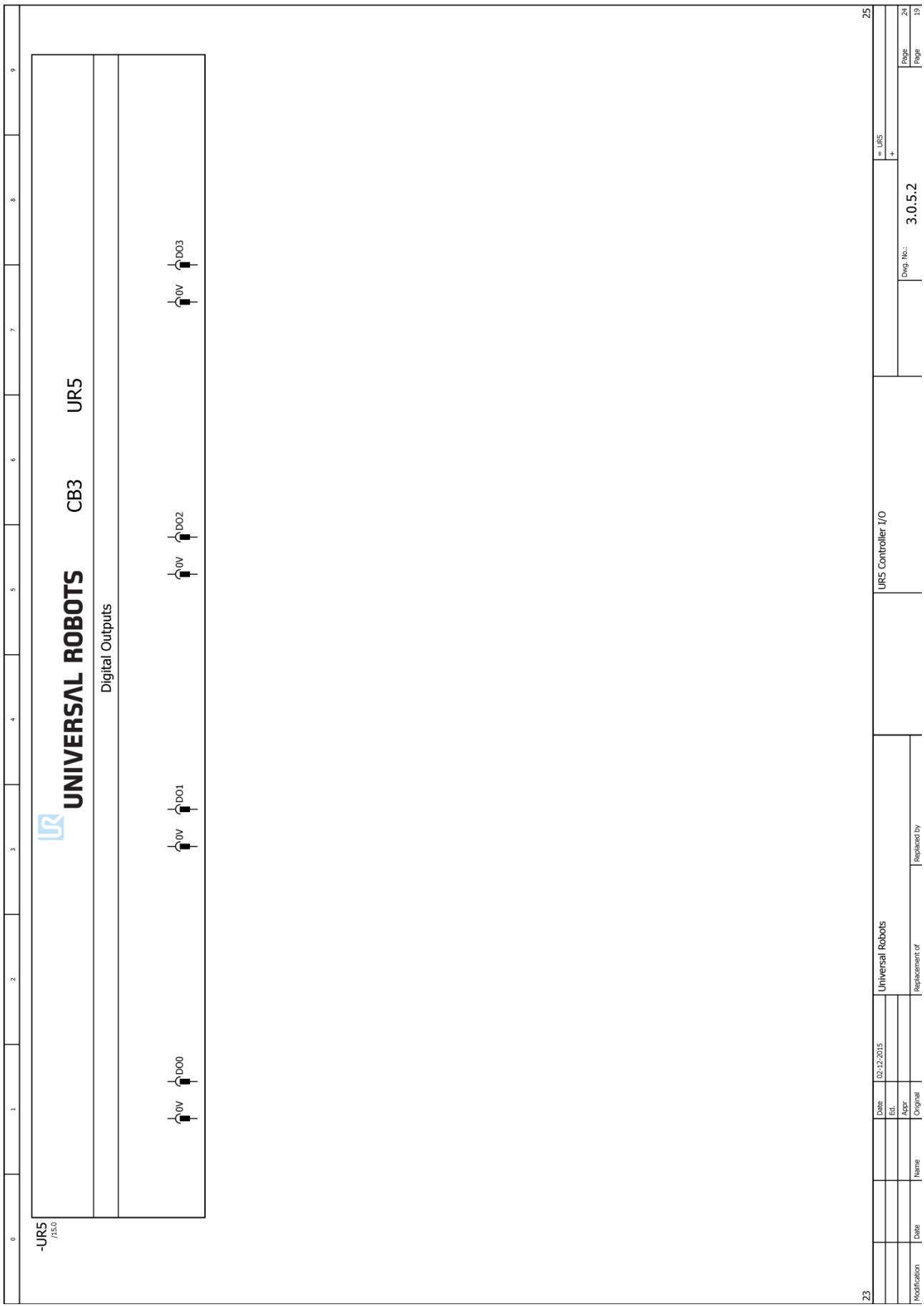
19
Page
19

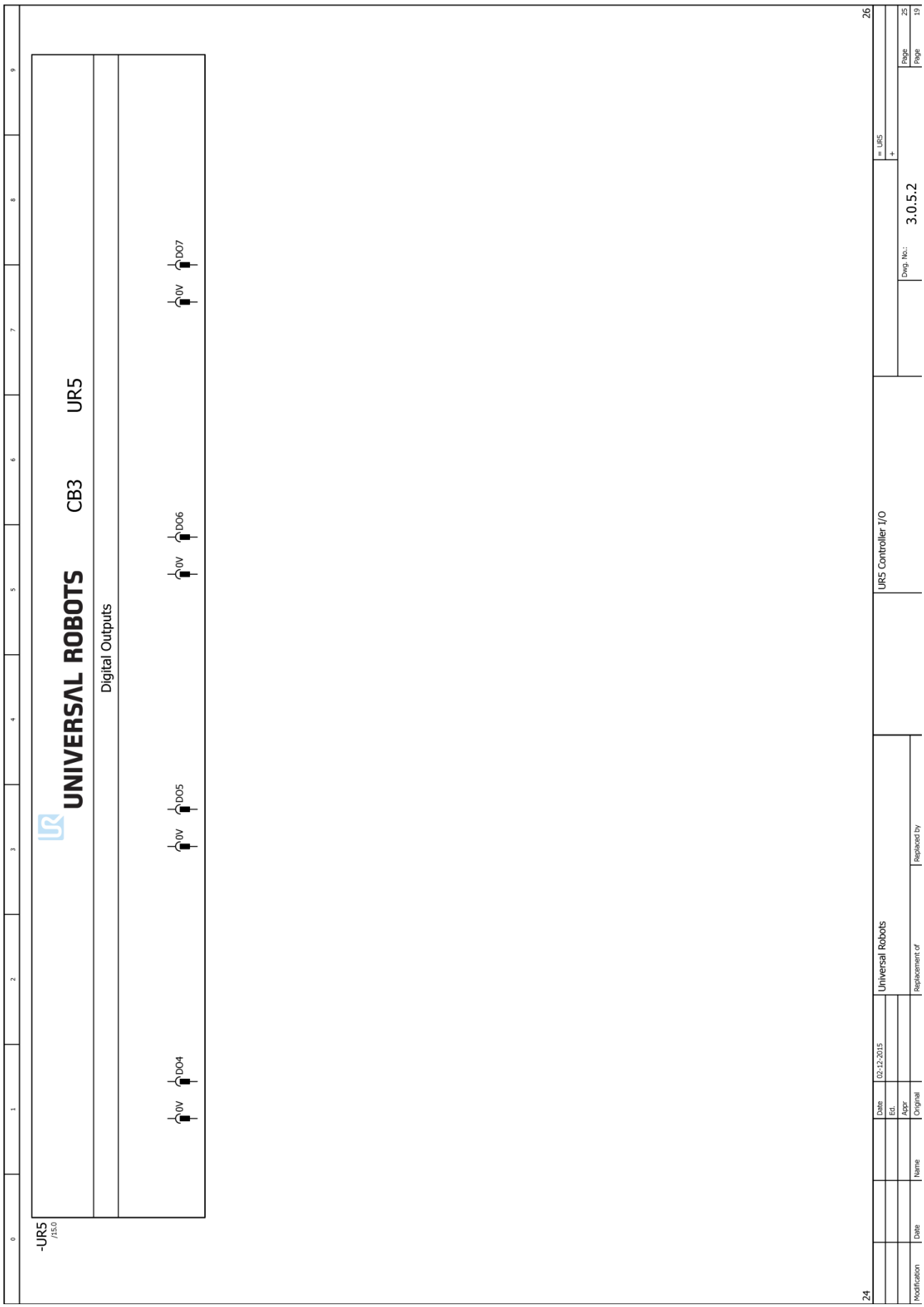

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Outputs
0V
CO0
0V
CO1
0V
CO2
0V
CO3
19
21
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.2
Page
20
Page
19
Universal Robots
Date
02-12-2015
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by

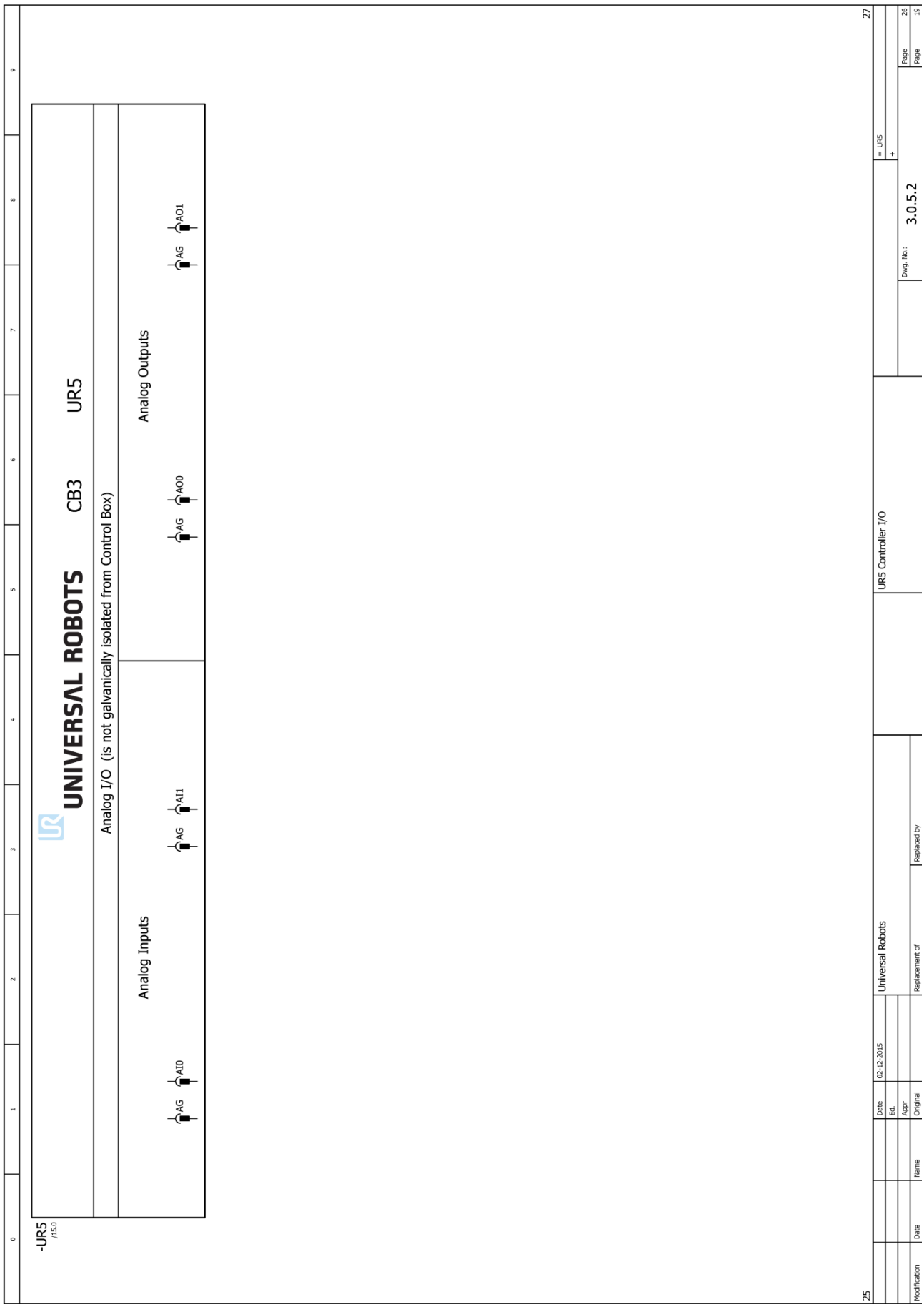

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Outputs
0V
CO4
0V
CO5
0V
CO6
0V
CO7
20
22
Universal Robots
UR5 Controller I/O
= UR5
+
3.0.5.2
Dwg. No.:
Page
21
Page
19
Date
Name
Modification
Date
Ed.
Appr
Original
02-12-2015
Replacement of
Replaced by


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Digital Inputs
24V
DI0
24V
DI1
24V
DI2
24V
DI3
23
21
UR5 Controller I/O
Universal Robots
Date
02-12-2015
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by
= UR5
+
Dwg. No.:
3.0.5.2
Page
22
Page
19


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Digital Inputs
24V
DI4
24V
DI5
24V
DI6
24V
DI7
22
24
UR5 Controller I/O
Universal Robots
Date
02-12-2015
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by
= UR5
+
Dwg. No.:
3.0.5.2
Page
23
Page
19


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Digital Outputs
0V
DO0
0V
DO1
0V
DO2
0V
DO3
23
25
Modification
Date
Name
Original
Appr
Ed.
Date
02-12-2015
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.2
Page
24
Page
19


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Digital Outputs
0V
DO4
0V
DO5
0V
DO6
0V
DO7
24
26
Modification
Date
Name
Original
Appr
Ed.
Date
02-12-2015
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.2
Page
25
Page
19


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Analog I/O (is not galvanically isolated from Control Box)
Analog Inputs
AG
AI0
AG
AI1
Analog Outputs
AG
AO0
AG
AO1
25
27
Modification
Date
Name
Date
02-12-2015
Ed.
Appr
Original
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.2
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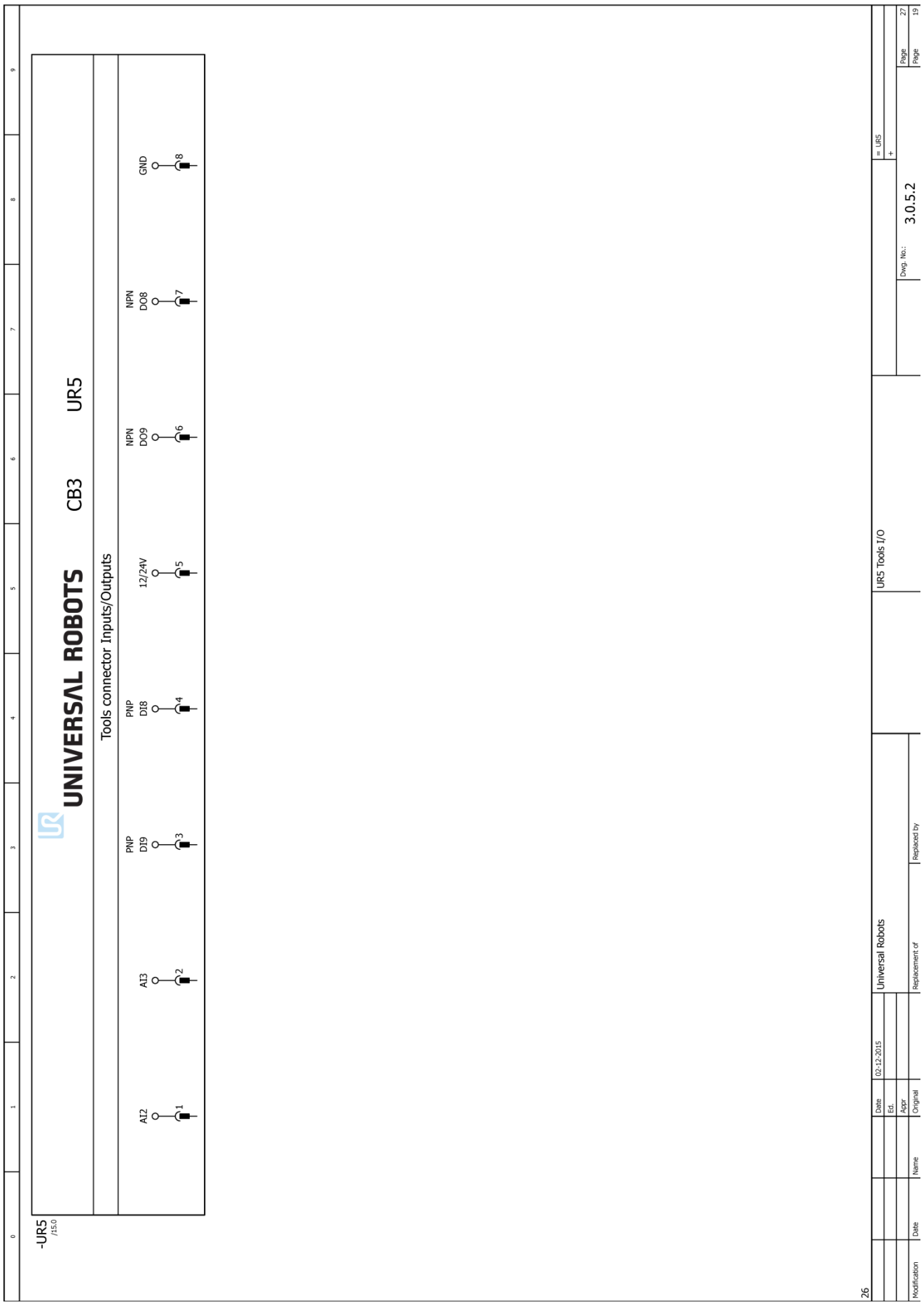
-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Tools connector Inputs/Outputs
AI2
1
AI3
2
PNP
DI9
3
PNP
DI8
4
12/24V
5
NPN
DO9
6
NPN
DO8
7
GND
8
26
Modification
Date
Name
Date
02-12-2015
Ed.
Appr
Original
Universal Robots
Replacement of
Replaced by
UR5 Tools I/O
= UR5
+
Dwg. No.:
3.0.5.2
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19

6. Spare parts

NOTICE:
The Spare Parts list incl. parts for other types of Robots. Please take extra notice when looking up part numbers and descriptions.

Robot arm

CB3 part no.	CB2 Part no.	Product Name	UR3	UR5	UR10	All
103303		Flat-ring sealing set UR3, external	*			
103413		Lid set complete UR3 incl. seal	*			
122020		Tool Mounting Bracket UR3	*			
122030		Base Mounting Bracket Incl. Cable 6m UR3	*			
124120		Joint Size 0 Wrist 1 UR3	*			
124220		Joint Size 0 Wrist 2 UR3	*			
124320		Joint Size 0 Wrist 3 UR3	*			
124321		Joint Size 1 Elbow UR3	*			
124122		Joint Size 2 Base UR3	*			
124222		Joint Size 2 Shoulder UR3	*			
104003		Elbow counterpart and lower arm kit UR3	*			
103305	103305	Flat-ring sealing set UR5, external		*		
103405	103405	Lid set complete UR5 incl. seal		*		
122041		Tool Mounting Bracket UR5 CB3		*		
	122039	Tool Mounting Bracket UR5 CB2+		*		
122050	122050	Base Mounting Bracket Incl. Cable 6m UR5		*		
122121		Joint Size 1 Wrist 1 UR5 CB3		*		
	122011	Joint Size 1 Wrist 1 UR5 +CB2		*		
122221		Joint Size 1 Wrist 2 UR5 CB3		*		
	122012	Joint Size 1 Wrist 2 UR5 +CB2		*		
122321		Joint Size 1 Wrist 3 UR5 CB3		*		
	122013	Joint Size 1 Wrist 3 UR5 CB2+		*		
122123		Joint Size 3 Base UR5 CB3		*		
	122031	Joint Size 3 Base UR5 +CB2		*		
122223		Joint Size 3 Shoulder UR5 CB3		*		
	122032	Joint Size 3 Shoulder UR5 CB2+		*		
122323		Joint Size 3 Elbow UR5 CB3		*		
	122033	Joint Size 3 Elbow UR5 CB2+		*		
123100	123100	Elbow counterpart and lower arm UR5		*		
103310	103310	Flat-ring sealing set UR10, external			*	
103410	103410	Lid set complete UR10 incl. seal			*	

122061		Tool Mounting Bracket UR10 CB3			*	
	122059	Tool Mounting Bracket UR10 CB2+			*	
122071	122071	Base Mounting Bracket UR10			*	
106424	106424	UR10 Base plug w/wire			*	
122122		Joint Size 2 Wrist 1 UR10 CB3			*	
	122021	Joint Size 2 Wrist 1 UR10 CB2+			*	
122222		Joint Size 2 Wrist 2 UR10 CB3			*	
	122022	Joint Size 2 Wrist 2 UR10 CB2+			*	
122322		Joint Size 2 Wrist 3 UR10 CB3			*	
	122023	Joint Size 2 Wrist 3 UR10 CB2+			*	
122324		Joint Size 3 Elbow UR10 CB3			*	
	122034	Joint Size 3 Elbow UR10 CB2+			*	
122124		Joint Size 4 Base UR10 CB3			*	
	122042	Joint Size 4 Base UR10 CB2+			*	
122224		Joint Size 4 Shoulder UR10 CB3			*	
	122043	Joint Size 4 Shoulder UR10 CB2+			*	
104001	104001	Elbow counterpart and lower arm kit UR10			*	
103500		Wire bundle kit for size 0	*			
103501		Wire bundle kit for size 1	*	*		
103502		Wire bundle kit for size 2	*		*	
103503		Wire bundle kit for size 3		*	*	
103504		Wire bundle kit for size 4			*	
103508		Wire bundle kit for lower arm				*
103509		Wire bundle kit for upper arm				*

Controller

CB3 part no	CB2 Part no	Product Name	UR3	UR5	UR10	All
122973		Controller excl. Teach Pendant UR3	*			
122900		Controller excl. Teach Pendant UR5 CB3.1		*		
122950		Controller excl. Teach Pendant UR10 CB3.1			*	
122091		Teach Pendant complete CB3/CB3.1				*
	122092	Teach Pendant complete CB2/CB2.1		*	*	
122673		Euromap E67 module	*			
	106700	Euromap E67 kit CB2 (incl. Bypass plug and cable)		*	*	
106800		Euromap E67 kit CB3 (incl. Bypass plug and cable)				*
123670	123670	Euromap E67 cable 6m				*
122671	122671	Euromap E67 Bypass Plug				*
122650		Motherboard kit CB2.1 and CB3.1 (incl. RAM)				*
	122700	Masterboard kit CB2		*	*	
	122420	CB2.0 to CB2.1 Motherboard Upgrade Kit		*	*	
122430		CB3.0 to CB3.1 Motherboard Upgrade Kit		*	*	

171030	171030	RAM module CB2.0 and CB3.0		*	*	
171031		RAM module CB2.1 and CB3.1				*
171022	171022	Compact flash card CB2 and CB3		*	*	
122421	122421	Compact flashcard for robot incl. SW and Serial no. CB2 and CB3		*	*	
177002	177002	Power Supply Unit 12V				*
177003	177003	Power Supply Unit 48V				*
122431	122431	USB for Robot incl. SW and Serial no. CB2.1 and CB3.1				*
172080	172080	Current Distributor PCB				*
172290		Safety Control Board				*
107000		Safety Control Board Terminal Kit (12 terminals and jumper)				*
122745	122745	Energy-eater incl. fan				*
177503	177503	Filter kit for controller (incl. two filters)				*
139033	139033	Bracket for Mounting Teach Pendant				*
132407	132407	Bracket for Mounting Controller				*
164231	164231	Cable Base to Controller UR10			*	

Tools

CB3 part no	CB2 Part no	Product Name	UR3	UR5	UR10	All
109010	109010	Tool kit UR3/5/10 (kit includes all below marked with *)				*
109101	109101	* Spanner hex 5,5mm				*
109102	109102	* Spanner hex 7,0mm				*
109110	109110	* Spanner hex 10,0mm			*	
109103	109103	* Screwdriver torx T10				*
109104	109104	* Torque screwdriver torx T8 + T10				*
109111		* Torque screwdriver torx T10	*			
109112		* Torque screwdriver torx T20	*			
109105	109105	* Torque wrench hex 5,5mm Size 1 and Size 2				
109106	109106	* Torque wrench hex 7,0mm Size 3				*
109107	109107	* Torque wrench hex 10,0mm Size 4			*	
109180	109180	* ESD Wrist strap				*
164084	164084	* Bypass cable (for setting joint-ID)				*
185500		Dual calibration tool				*
131501	131501	Bracket for mounting robotarm UR5 (Item profile)		*		
131502	131502	Bracket for mounting robotarm UR5 (BOSCH profile)		*		
131503		Bracket for mounting robotarm UR3 (Item & BOSCH profile)	*			
131510	131510	Bracket for mounting robotarm UR10 (Item & BOSCH profile)			*	
131099		Lid tool protective cap alu. for tool connector	*			
173100	173100	Cable for tool external with angle connector				*

7. Packing of robot

Packing of robot and controller box for shipment

NOTICE:

- Remove any external tooling and external electrical connections before shipment.
- Universal Robots may reject the shipment if 3rd party products cannot be unmounted safely or they prohibit to the execution of required post repair tests.
- Universal Robots assume no responsibility for 3rd party goods return shipment.
- Please ensure the robot, controller and teach pendant is packed responsibly.
- Universal Robots will always return Universal Robots products in original Universal Robots packaging.

- Download correct put_in_box program regarding robot type and packing material from www.universal-robots.com/support/
- Upload the program to the robot. See 4.3 Using Magic files on how this can be done.
- Load the program and follow instructions given when running the program.
  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 robot arm from controller.
- Pack robot arm and controller box in designated boxes. Make sure the robot arm is correctly orientated within the box.


8. Change log

Date	Revision	Action	Changes
3. May 2014	UR5_en_3.0	Added	Revision 3.0 released
19. June 2014	UR5_en_3.0.1	Changed	Pictures and illustrations changed to match 3. gen. robot
29. July 2014	UR5_en_3.0.2	Changed	Error codes, Spareparts changed to match 3. Gen robot and ESD handling added
20. Oct. 2014	UR5_en_3.1.1	Changed	Electrical doc., E-plan, Spare parts update and error code update. New structure for disassemble/assemble guide. ESD handling modified.
January 2016	UR5_en_3.1.2	Changed	Update of electrical drawings, Joint spare part adaption, error codes. Dual robot calibration. Added Motherboard 3.1
October 2016	UR5_en_3.2.0	Added	3.1.19 Wire bundle installation guide
December 2016		Added	3.1.4 Bolt length for joints
		Added	Error code C71A12
		Added	3.1.5 Added tolerance to Size 3 torque
		Corrected	5.2 LED startup sequence
		Added	3.2.4 Motherboard 3.1 upgrade instructions
		Added	4.4 Backup of data
		Corrected	Various spellings, word, setup
February 2017		Changed	7. Packing robot
		Added	1.4 Warning signs
		Added	Tolerance description to C50A5 and C50A6
October 2017		Added	Troubleshooting 5.3.6
		Added	Error code C103A3
		Corrected	Error code C20A1 description
		Added	Steps when replacing 48V power supply
January 2018		Added	Troubleshooting 5.3.7
		Corrected	“how to fix” text corrected on many error codes
September 2018	UR5_en_3.2.1	Added	Inspection plan to chapter 2
May 2019	UR5_en_3.2.2	Updated	Inspection plan to chapter 2
		Updated	1.4 Warning signs