UNIVERSAL ROBOTS

Service Manual

Revision UR5_en_3.1.1

Robot:
UR5 with CB3-controller

valid from robot s/n 2014350001

Contents

• General information

1.1 Purpose

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

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

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

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

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

1.2 Company details

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1.3 Disclaimer

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• Preventive Maintenance

2.1 Controller

2.1.1 Inspection plan, Safety Functions

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

- Test that the Emergency Stop button on the Teach Pendant functions:
  - Press the Emergency Stop button on the Teach Pendant
  - Observe that the robot stops and turns off the power to the joints
  - Power the robot again
- Test Teach mode:
  - Set the robot in Teach mode by pressing the *Teach* button on the Teach Pendant
  - Move the robot to a position where it is stretched out horizontally
  - Monitor that the robot maintains its position when not holding the robot and the teach button still pressed
- Verify safety settings:
  - Verify that the safety settings of the robot comply with the Risk Assessment of the robot installation
- Test that additional safety inputs and outputs are still functioning:
  - Check which safety inputs and outputs are active and test that they can be triggered

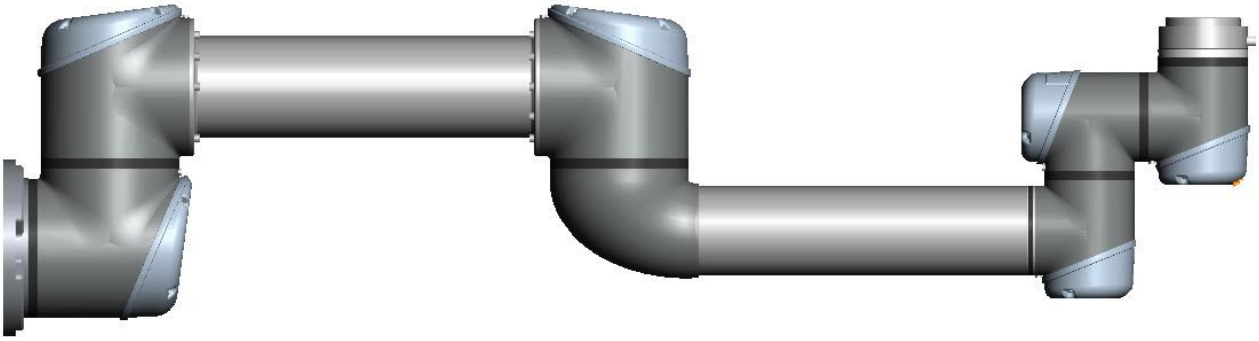
2.1.2 Visual inspection

- Disconnect power cable from controller
- Open cabinet door
- Check connectors are properly inserted on printed circuit boards
- Check for any dirt/dust inside of controller
- If any dirt/dust is present:
  - » gently use a vacuum cleaner to remove particles

2.1.3 Cleaning and replacement of filters

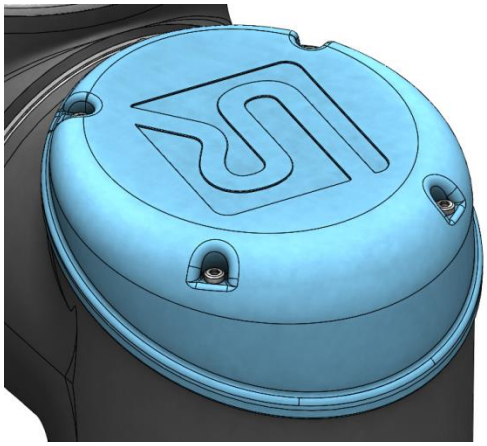
- Controller box contains two filters, one on each side of controller
- Remove filters from controller box and clean them thoroughly using compressed air
  - » Replace filters if necessary

2.2 Robot arm



2.2.1 Visual inspection

- 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



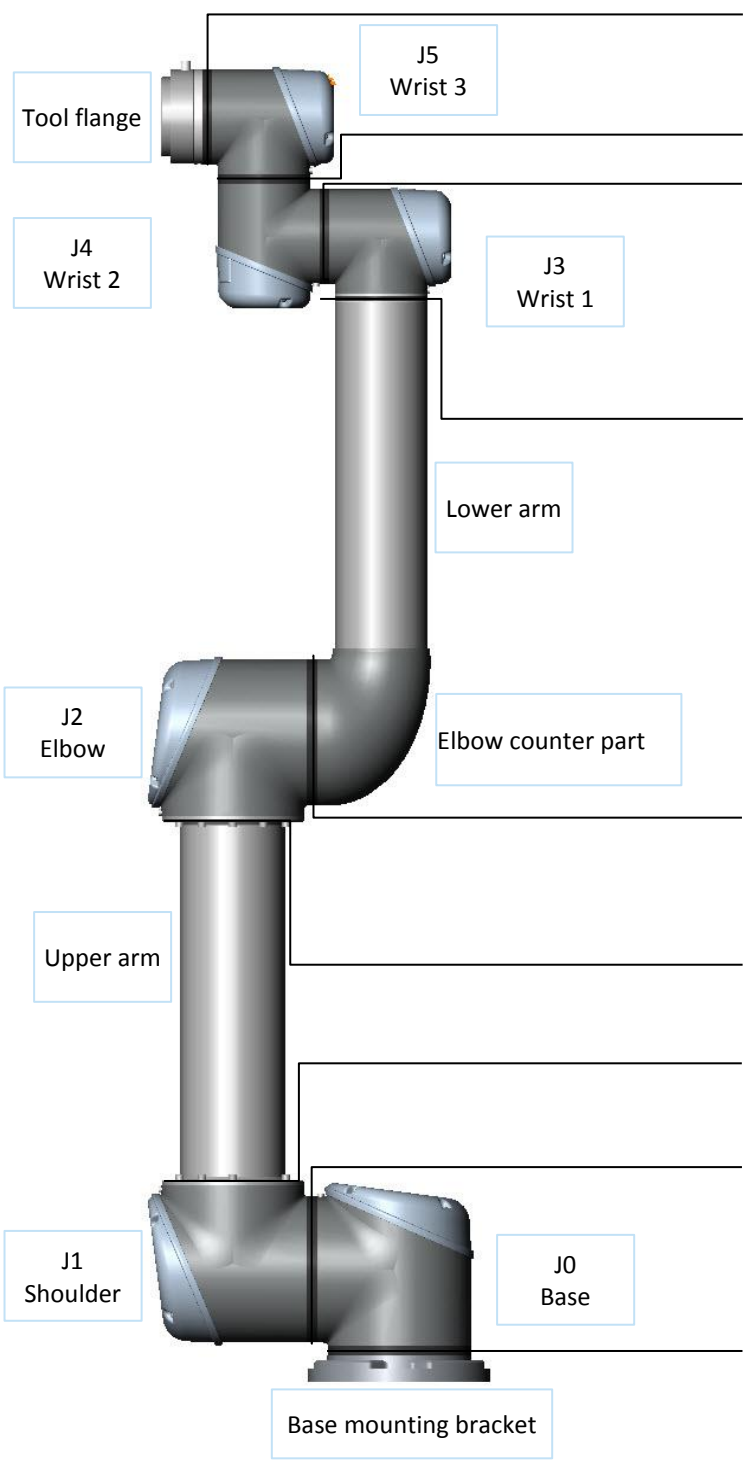
Correct torque value for screws on blue lids are **0.4Nm**

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

• Service and Replacement of parts

3.1 Robot arm

3.1.1 Robot arm configuration



3.1.2 Brake release

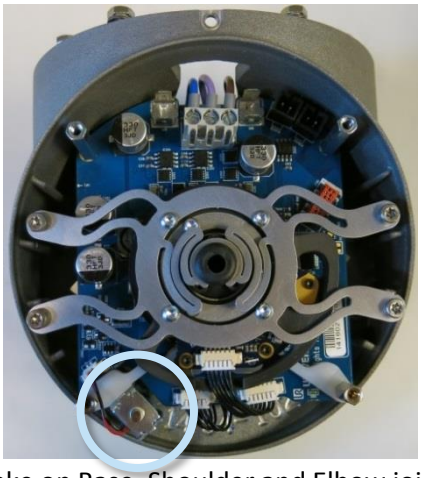
If required, the brake on a joint can be released without power connected.

IMPORTANT NOTICE:

- Before releasing a brake it is extremely important to dismount any dangerous tooling 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 no personnel are located under the arm when releasing the brake.
- Do not move the joint more than necessary, absolute max. is 180 degrees in order for the robot to find its original physical position.

Procedure for releasing the joint

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



Brake on Base, Shoulder and Elbow joints,

Brake on Wrist joints

- Make sure to mount blue lid properly on joint before turning on Controller.

3.1.3 General guidance to separate joint from counterpart

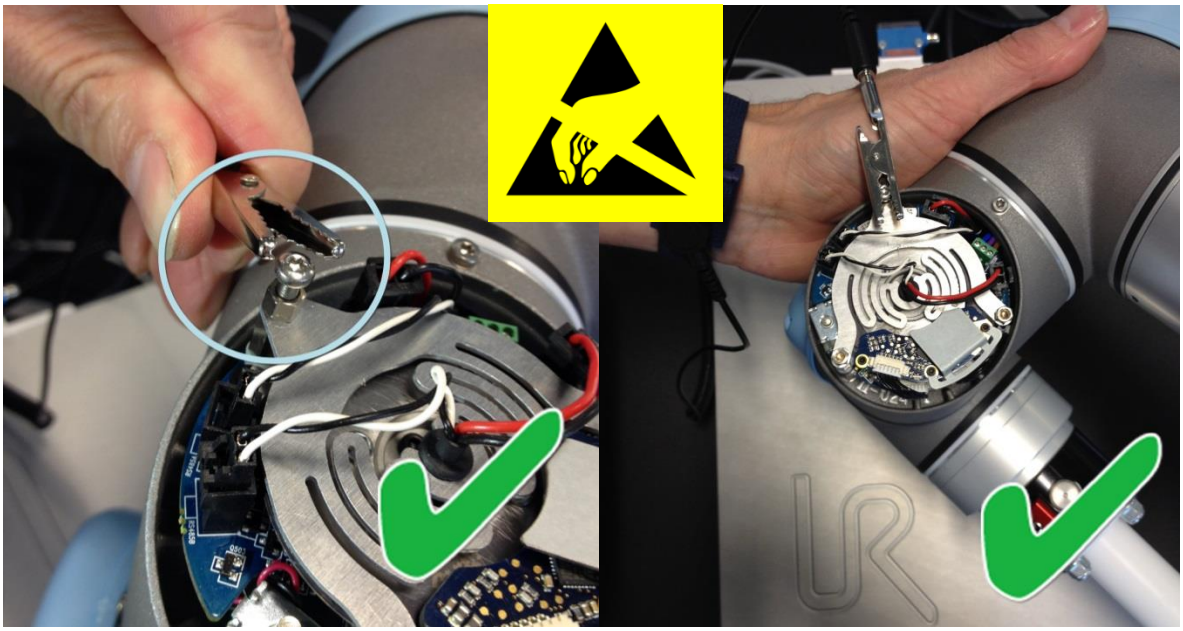
Disassemble:

1. Shut down the controller.

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

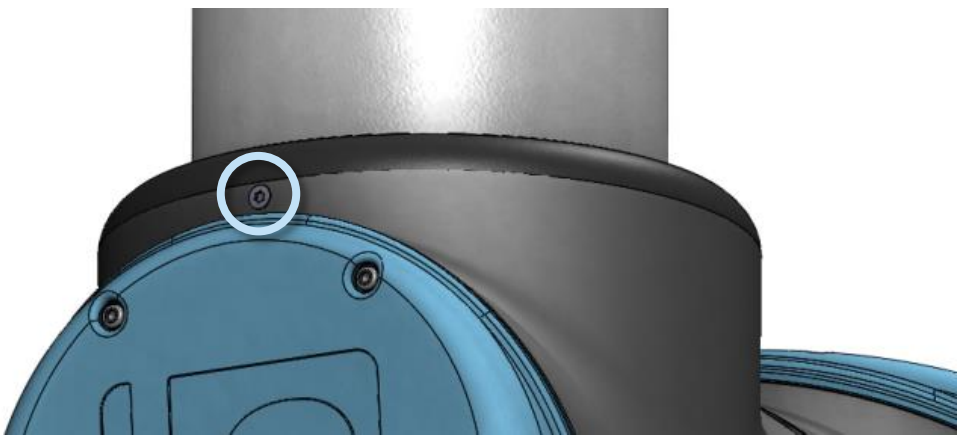
3. Remove blue lid.

4. Now screw back one of the lid screws into a pol. Clip on your ESD wristband/alligator clip as shown below.

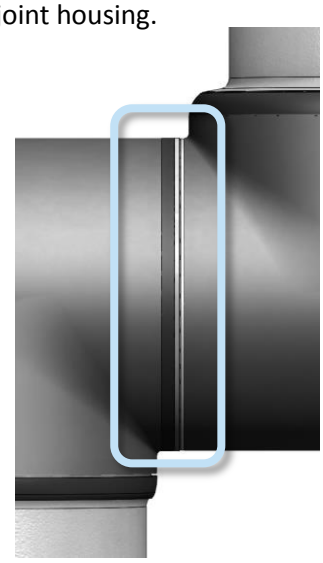


5. Disconnect wires.

6. Remove alignment screw.



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



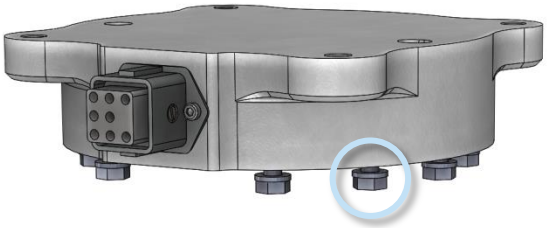
8. Slide the grey Teflon ring back.
   10 screws become visible, 5 on each side of joint.
   Loosen the screws with an open-ended spanner approximately two full turns each.

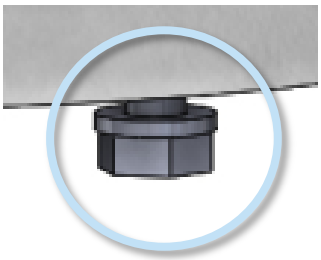
9. Pull the two parts apart and gently twist them in opposite directions around 10 mm, until a mechanical stop is met (holes are keyhole-type). They can then be completely separated.

Assemble:

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

2. Gently insert one part with screws and washers into the other part.

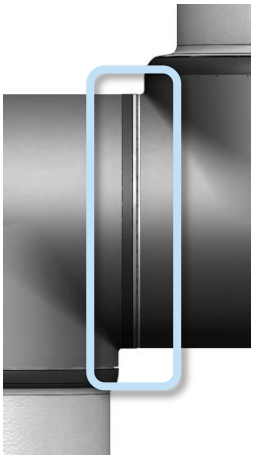




3. Make sure the washers are fully inserted and flush against the head of the bolt (this is important) before gently twisting the parts in opposite directions until a mechanical stop is met.

4. Gently tighten the 10 screws, and then tighten in cross order with the correct torque.
   See Section 3.1.4 Torque value.

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



6. Mount the alignment screw and tighten with **0.4Nm.**

7. **Twist the communication wires** before they are connected.
   (To reduce electrical noise in the system)

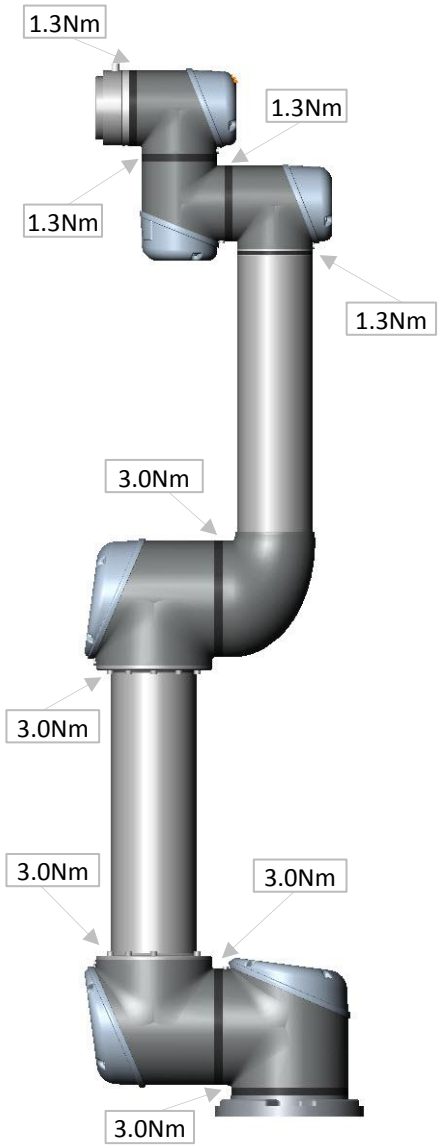
8. Mount the blue lid on the joint and tighten with **0.4Nm.**

9. Proceed to chapter 3.1.14 Joint calibration for calibrating the joint.

3.1.4 Torque values

UR5 torque values			
CONNECTION		TORQUE	HEAD SIZE
BASE PLATE	J0 BASE	3.0Nm	7 mm.
[J0] BASE	J[1] Shoulder	3.0Nm	7 mm.
[J1] SHOULDER	LOWER ARM	3.0Nm	7 mm.
LOWER ARM	[J2] ELBOW	3.0Nm	7 mm.
[J2] ELBOW	HIGHER ARM	3.0Nm	7 mm.
HIGHER 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	1.3Nm	5.5 mm.
Alignment screw		0.4Nm	Torx T10
Blue lid		0.4Nm	Torx T10

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



3.1.5 Base joint – Base mounting bracket Disassemble

For details and photos please see: 3.1.3 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).

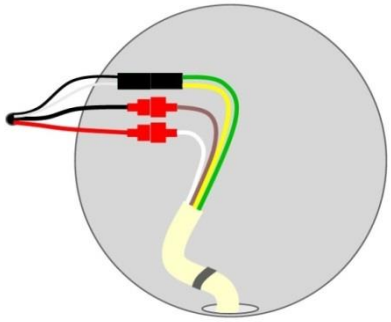
6. Pull away the base plate from Base joint.

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

Base joint – Base mounting bracket: Assemble

For details and photos please see: 3.1.3 General guidance to separate joint from counterpart

1. Replace base plate and reconnect wires according to illustration:
   Twist the communication wires before they are connected.
   (To reduce electrical noise in the system)



2. Gently insert base plate with screws and washers into the Base joint.

3. 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.

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

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

6. Mount the alignment screw and tighten with **0.4Nm.**

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

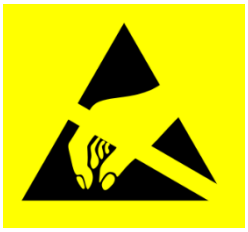
3.1.6 Shoulder joint – Base joint
Disassemble

For details and photos please see: 3.1.3 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 (NB: polarized)

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).

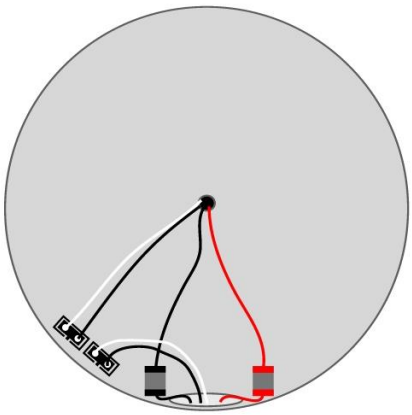
9. Pull away the Base joint from Shoulder joint.

Shoulder joint – Base joint: Assemble

For details and photos please see: 3.1.3 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 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.
   Twist the communication wires before they are connected.
   (To reduce electrical noise in the system)



8. Mount blue lid on Base joint and tighten with **0.4Nm.**
9. Proceed to chapter 3.1.14 Joint calibration for calibrating the joint.

3.1.7 Upper arm – Shoulder joint

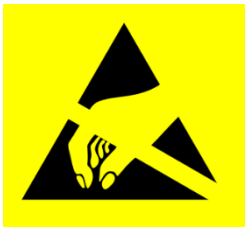
Disassemble

For details and photos please see: 3.1.3 General guidance to separate joint from counterpart

1. Shut down the controller.

2. Remove blue lid on Shoulder joint.

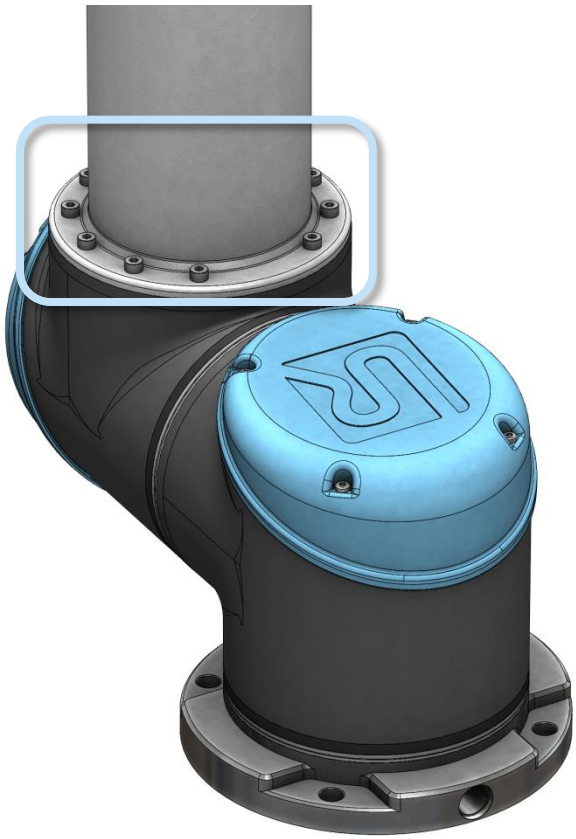
3. Connect ESD wristband



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

5. Remove alignment screw

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

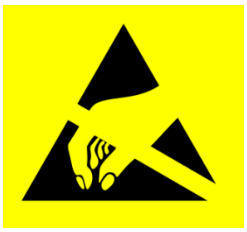


7. Pull away the Shoulder joint from upper arm.

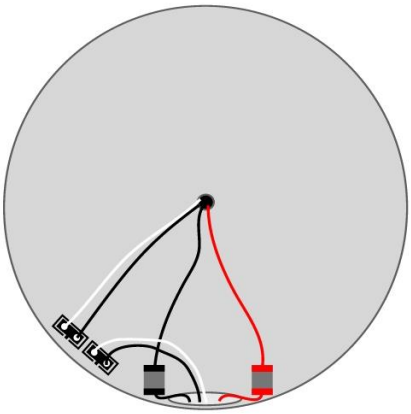
Upper arm – Shoulder joint: Assemble

For details and photos please see: 3.1.3 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.
   Twist the communication wires before they are connected.
   (To reduce electrical noise in the system)



6. Mount blue lid on Shoulder joint and tighten with **0.4Nm.**
7. Proceed to chapter 3.1.14 Joint calibration for calibrating the joint.

3.1.8 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 3.1.7 Upper arm - Shoulder joint.

3.1.9 Elbow counterpart – Elbow joint
Disassemble

For details and photos please see: 3.1.3 General guidance to separate joint from counterpart

1. Shut down the controller.

2. Remove alignment screw

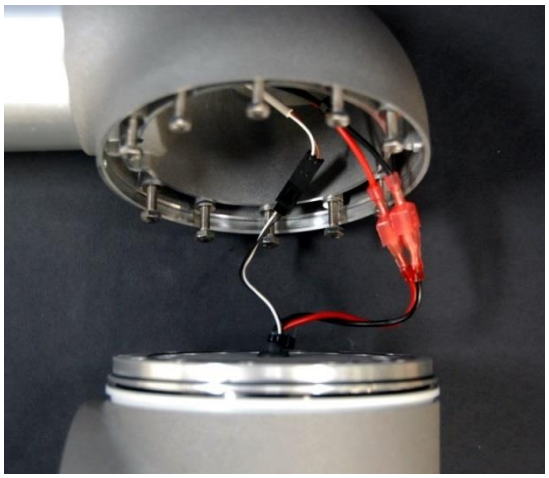
3. Gently remove black flexible flat ring between Elbow and Elbow counterpart with a tiny screwdriver or similar tool and twist it around the joint housing.

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 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).

6. Pull away the Elbow joint from Elbow counterpart.

7. Disconnect wires between Elbow joint and Elbow counterpart
   1 x red wire = 48V DC
   1 x black wire = GND
   Black connector = bus cable (NB: polarized)



Elbow counterpart – Elbow joint: assemble

For details and photos please see: 3.1.3 General guidance to separate joint from counterpart

1. Reconnect connectors.
   Twist the communication wires before they are connected.
   (To reduce electrical noise in the system)

2. Gently insert Elbow joint with screws and washers into the Elbow counterpart.

3. 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.

4. Tighten the 10 screws lightly, and then tighten **in cross order with 3.0Nm.**

5. Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.

6. Mount the alignment screw and tighten with **0.4Nm.**

7. Proceed to chapter 3.1.14 Joint calibration for calibrating the joint.

3.1.10 Wrist 1 joint – Lower arm

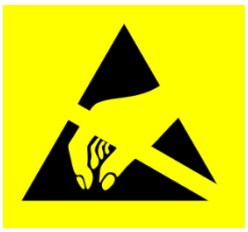
Disassemble

For details and photos please see: 3.1.3 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 (NB: polarized)

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.

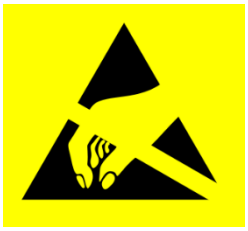
8. Pull the lower arm and Wrist 1 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).

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

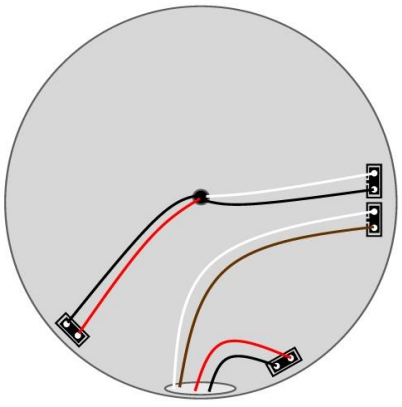
Wrist 1 joint – Lower arm: Assemble

For details and photos please see: 3.1.3 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.
   Twist the communication wires before they are 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 3.1.14 Joint calibration for calibrating the joint.

3.1.11 Wrist 2 joint – Wrist 1 joint

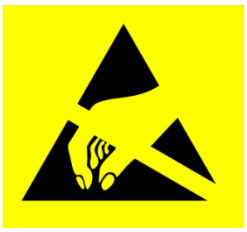
Disassemble

For details and photos please see: 3.1.3 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 Wrist 1 joint and Wrist 2 joint

1 x red wire	= 48V DC
1 x black wire	= GND
Black connector	= bus cable (NB: polarized)

5. Remove alignment screw

6. 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.

7. 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.

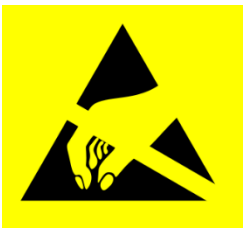
8. Pull Wrist 1 joint and Wrist 2 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).

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

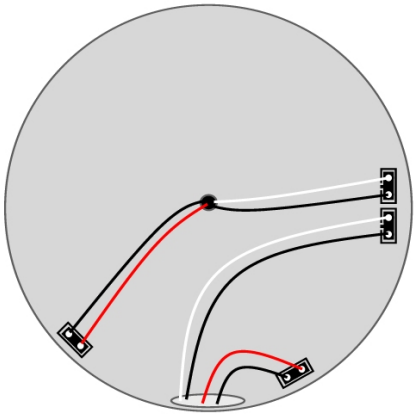
Wrist 2 joint – Wrist 1 joint: Assemble

For details and photos please see: 3.1.3 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 wires before they are 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 3.1.14 Joint calibration for calibrating the joint.

3.1.12 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 3.1.11 Wrist 2 joint – Wrist 1 joint.

3.1.13 Tool flange – Wrist 3 joint

Disassemble

For details and photos please see: 3.1.3 General guidance to separate joint from counterpart

1. Shut down the controller.

2. Remove alignment screw.

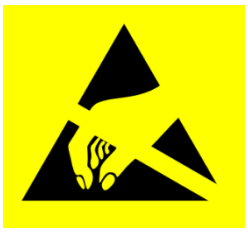
3. Gently remove black flexible flat ring with a tiny screwdriver or similar tool and twist it around the joint housing.

10. 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.

4. 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).

5. Pull away the tool flange from Wrist 3 joint.

6. Connect ESD wristband



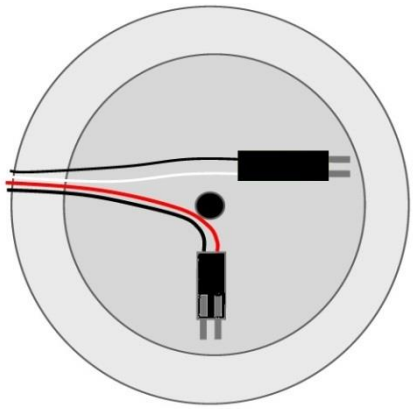
7. Disconnect the two connectors.

Tool flange – Wrist 3 joint: Assemble

For details and photos please see: 3.1.3 General guidance to separate joint from counterpart

1. Connect ESD wristband

2. Replace tool flange and reconnect connectors as illustrated.
   Twist the communication wires before they are connected.
   (To reduce electrical noise in the system)



3. Gently insert tool flange with screws and washers into the Wrist 3 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. Tighten the 8 screws lightly, and then tighten **in cross order with 1.3Nm.**

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.**

3.1.14 Joint calibration

After replacement calibration of the new joint is required in order to find the correct zero position.

Instructions for calibrating a joint:

- Jog robot to HOME position

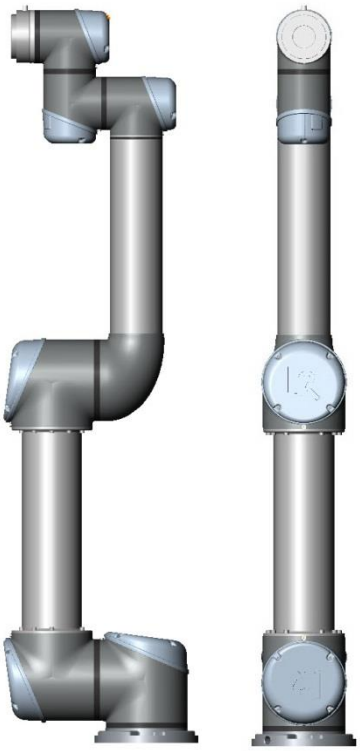
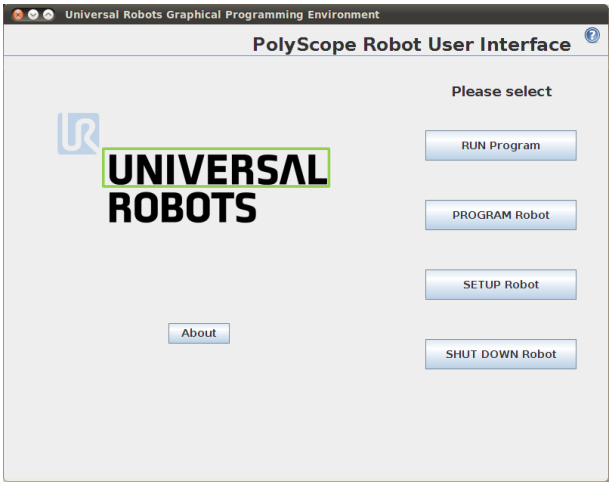
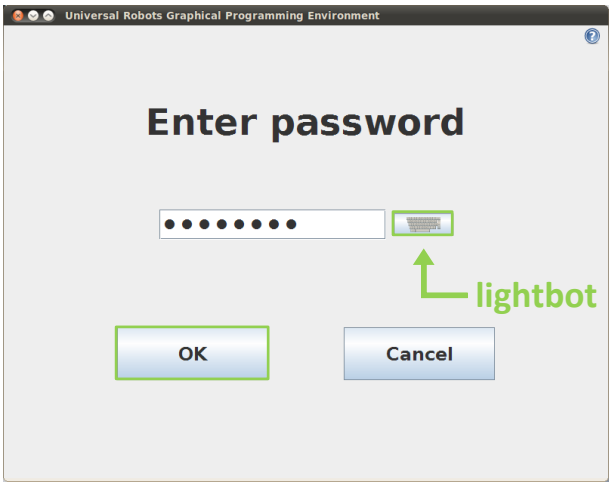


Illustration shows the HOME position, which is defined as zero position of all joints.

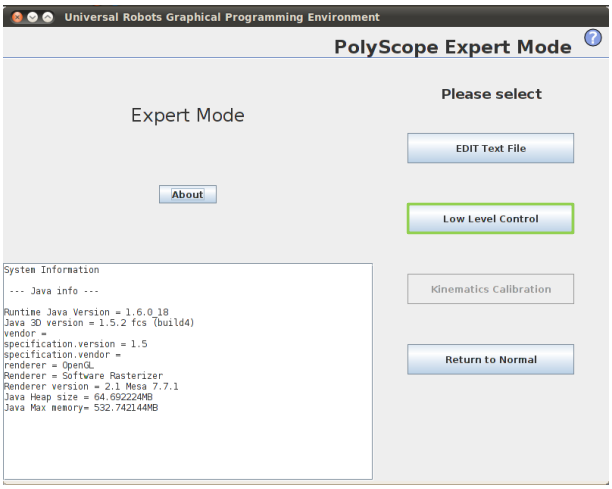
- Drag a finger from left to right across the *UNIVERSAL*-sign on main screen of PolyScope.



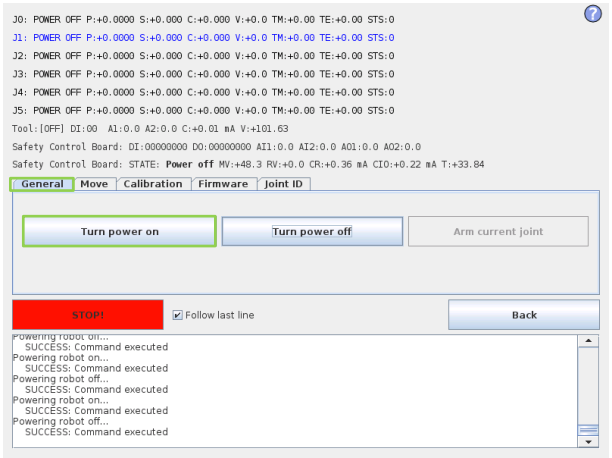
- Enter password *lightbot* and press *OK*.



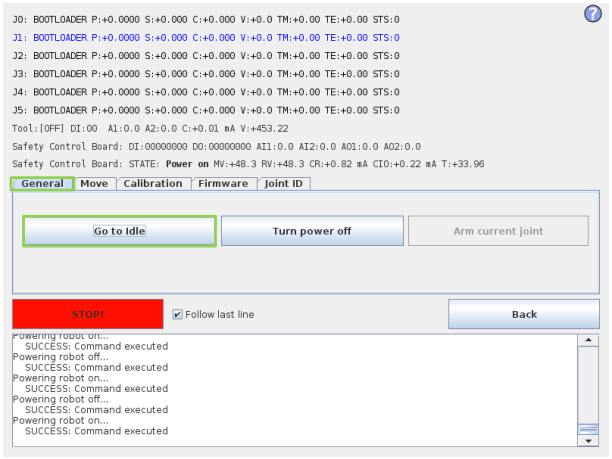
- You are now in *Expert Mode*, press *Low Level Control*.



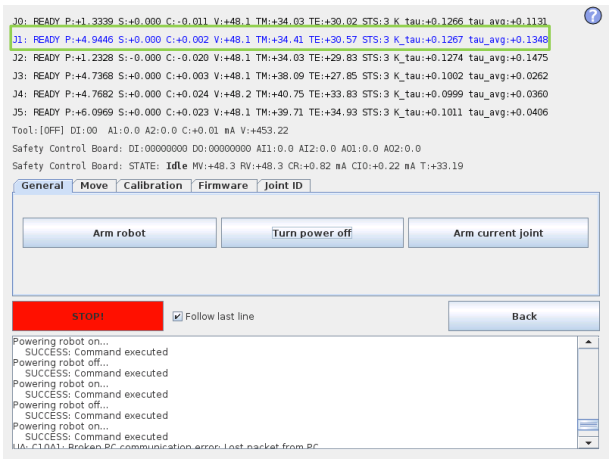
- Press *Turn power on* for enabling power to joints.



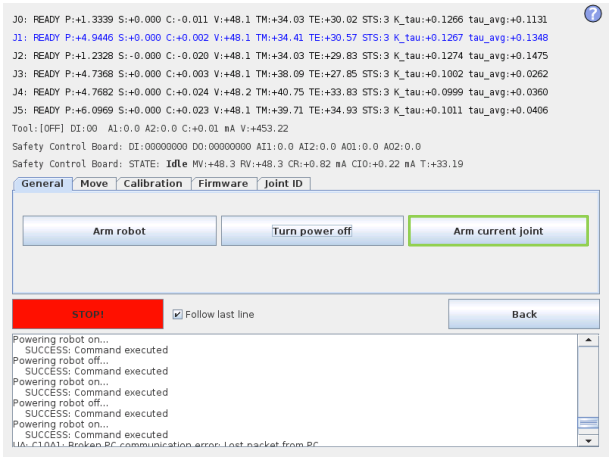
- Press *Go to Idle* for enabling the joints ready mode.



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

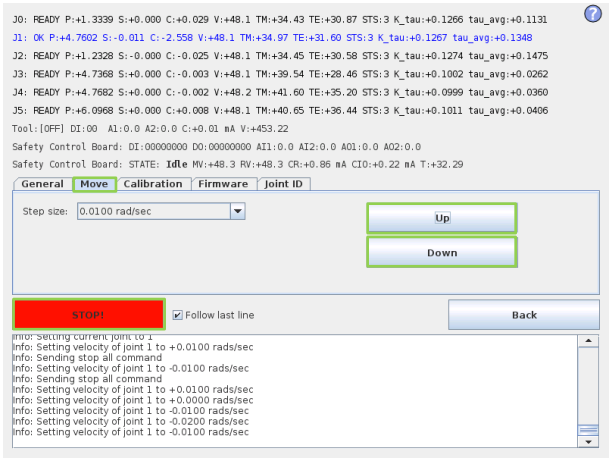


- Press *Arm current joint* to release the brake on the selected joint.



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

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

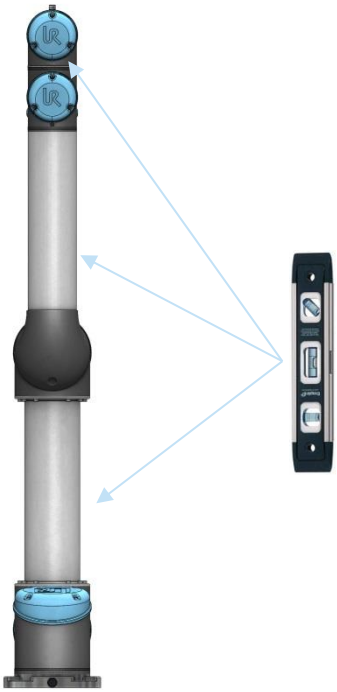


- Zero position illustrations

Base:

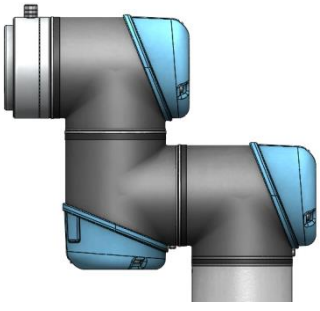
Base zero position is aligned so that the output flange is offset 180 degree from the cable in back of robot base.

Shoulder, Elbow, Wrist 1:



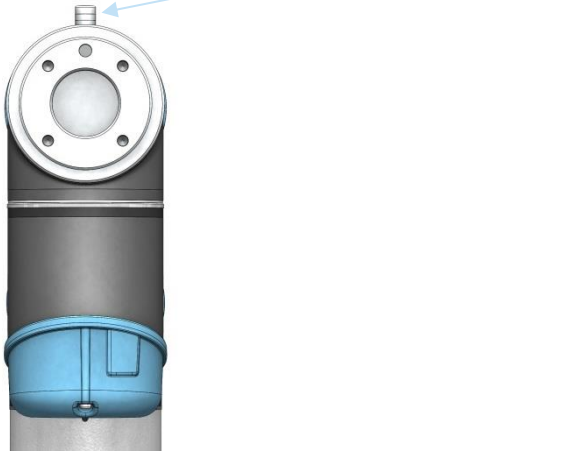
Shoulder, Elbow and Wrist 1 zero output flange is vertical aligned (if Base if horizontal).
Make sure that base of robot is horizontal, use spirit level to align joints.

Wrist 2:



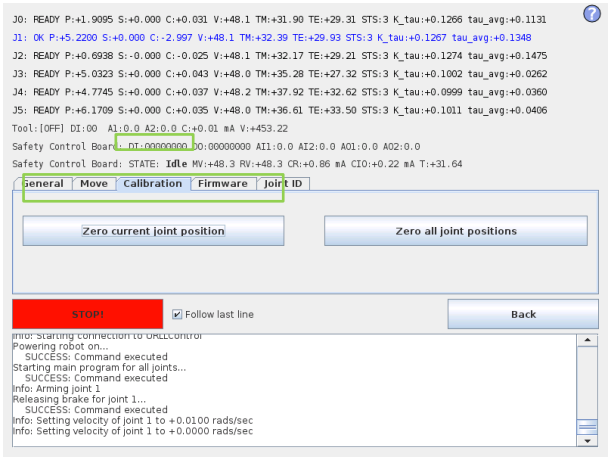
Wrist 2 zero position is aligned similar to Base joint, with tool flange parallel with wrist

Wrist 3:

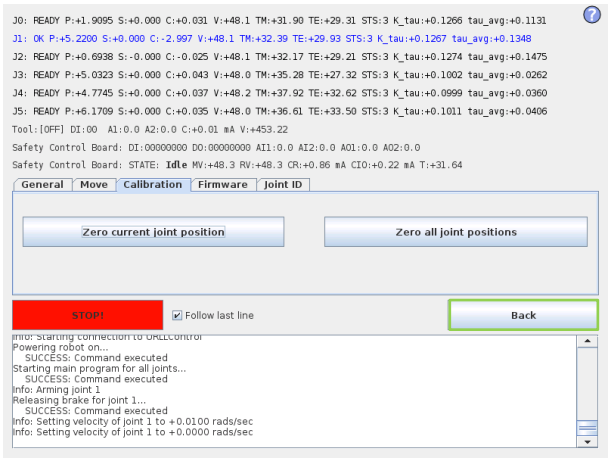


Wrist 3 zero position is aligned so tool connector is pointing upward.
Mount two bolts in tool holes and use spirit level to align joint.

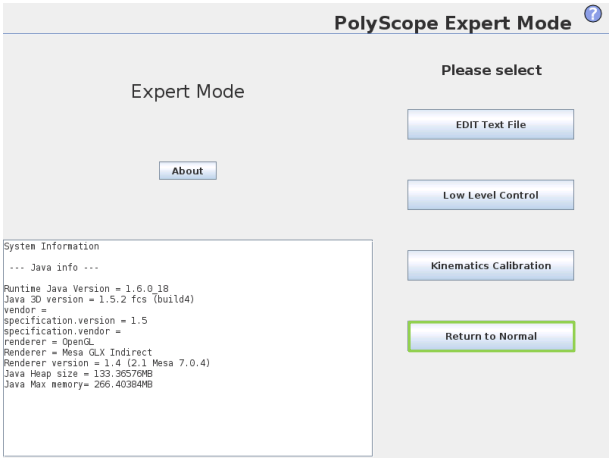
- Select *Calibration* tab and press *Zero current joint position* to calibrate the joint.



- Press *Back* to exit Low Level Control.



- Press *Return to Normal*.



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

3.1.15 Change joint ID

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

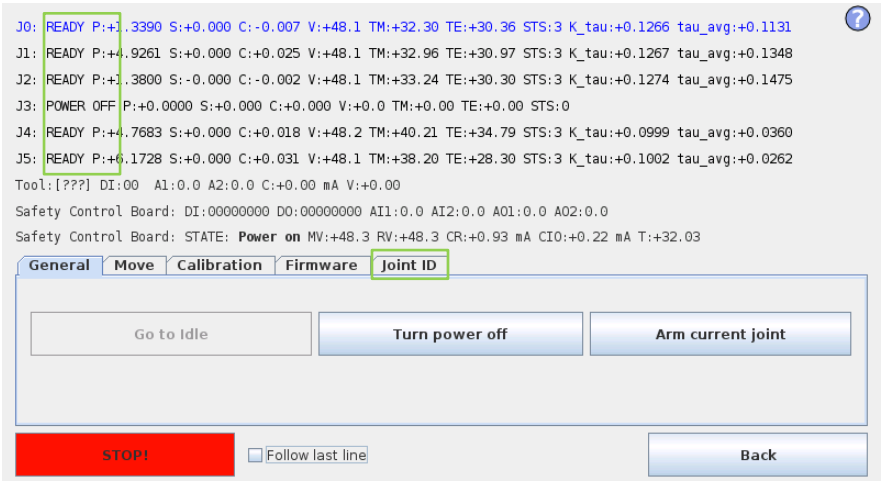
ID	Joint
J0	Base
J1	Shoulder
J2	Elbow
J3	Wrist 1
J4	Wrist 2
J5	Wrist 3

Example:

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

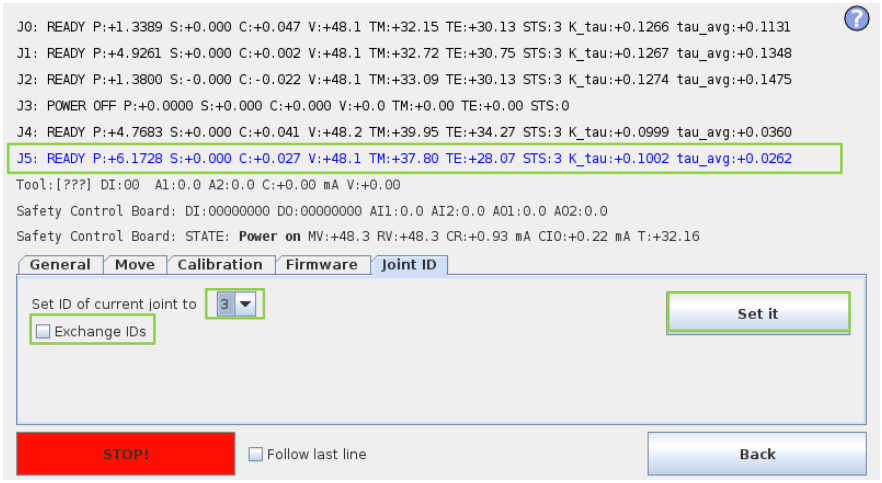
- Disconnect the joint with correct ID no.
- Enter Low Level Control
- Press *Turn power on* and the connected joints turn into BOOTLOADER

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

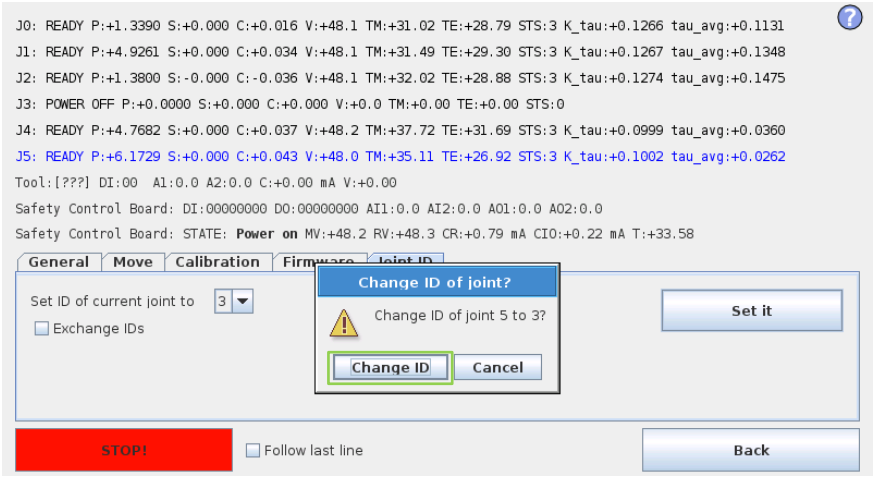


- Select *Joint ID*

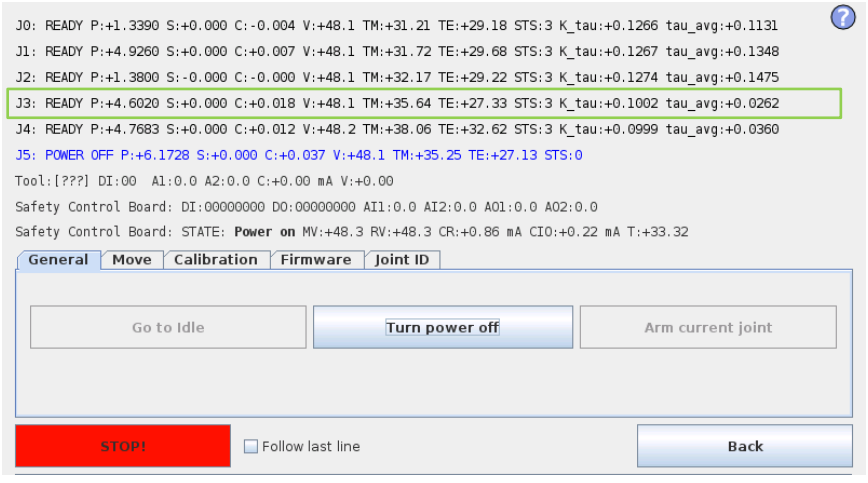
- Select *J5* (The one to be changed)
- Uncheck “Exchange IDs” box
- In dropdown box, select ID no. 3
- Press *Set it*



- Confirm *Change ID*



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

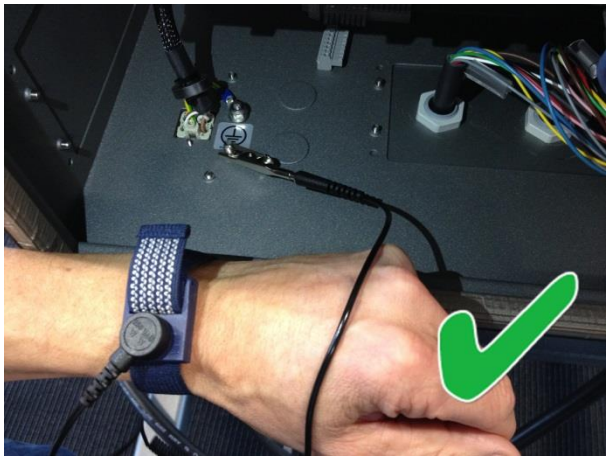


3.2 Controller

3.2.1 Handling ESD-sensitive parts

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

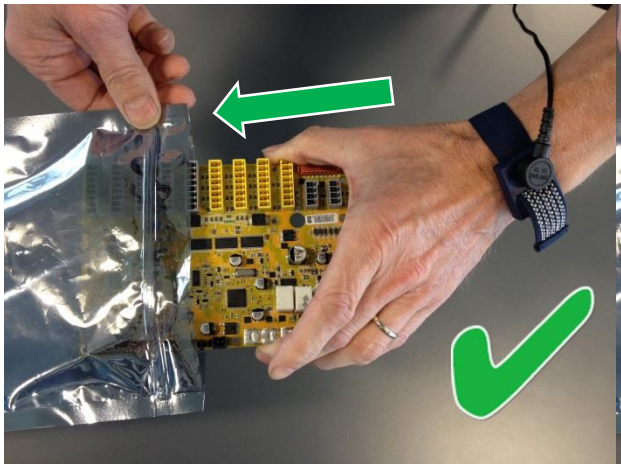
Keep the ESD-sensitive part in its original shipping container.
(a special "ESD bag") until the part is ready to be installed



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

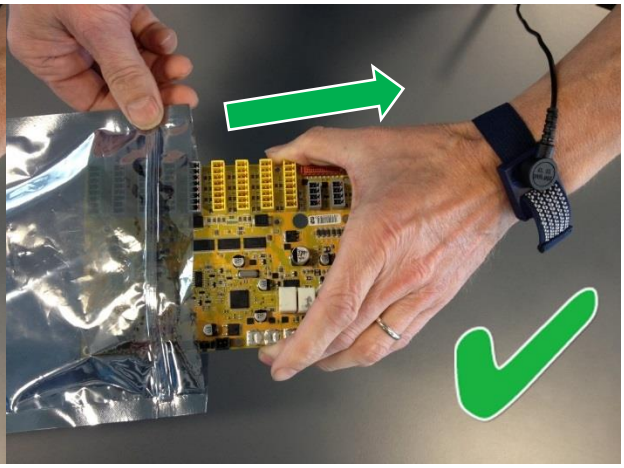
Step 1:

Put OLD board into spare ESD bag.

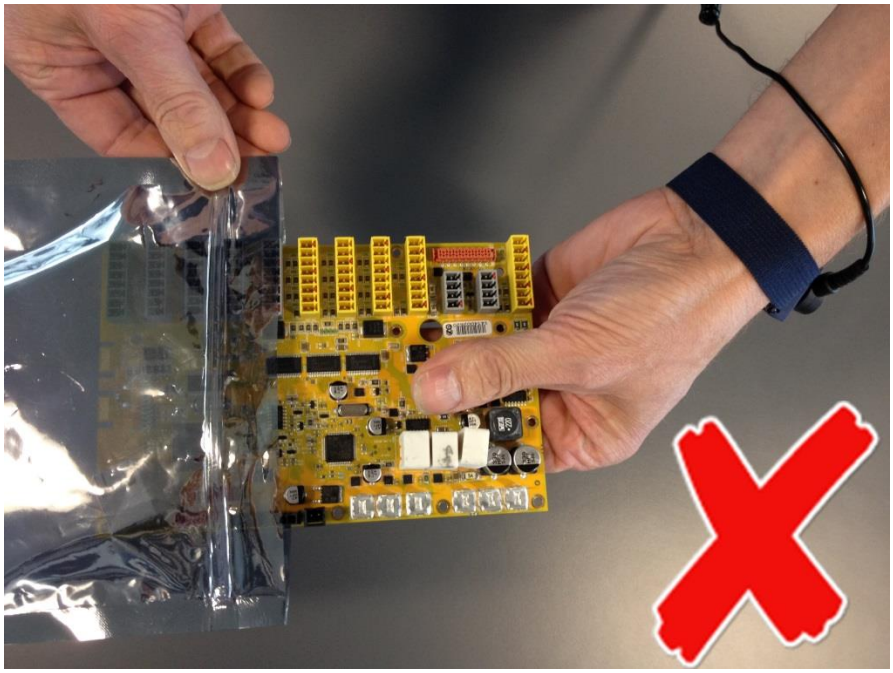


Step 2:

Take NEW board out of ESD bag.

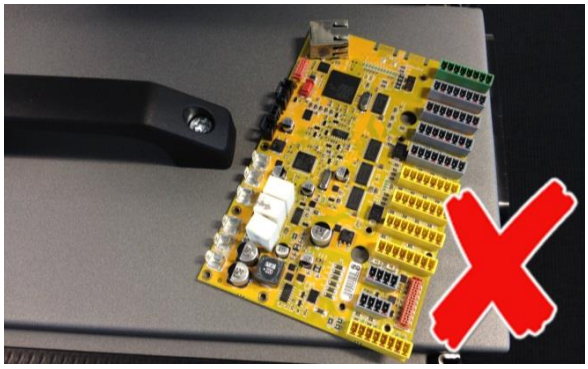


Hold the ESD-sensitive part by its edges;
do not touch its pins.
If a pluggable module is being removed, then use the correct tool.

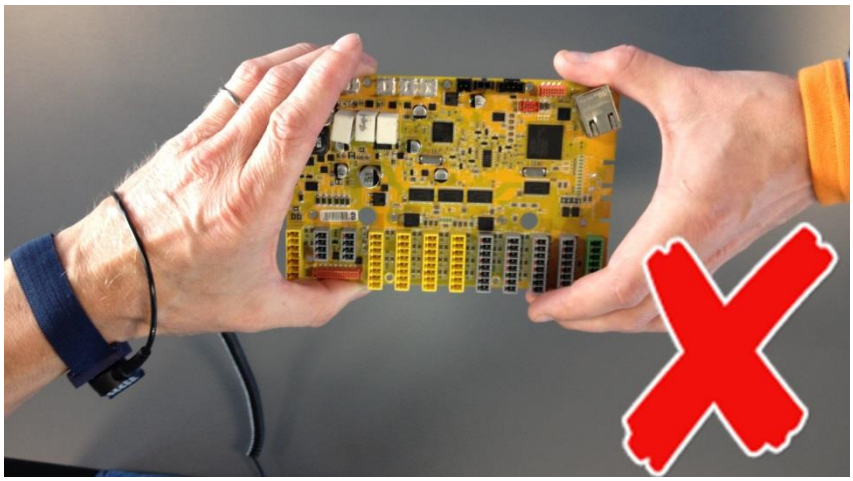


Do not place the ESD-sensitive part on nonconductive material or on a metal table.

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



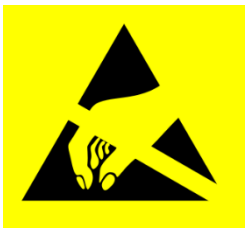
Machine covers and metal tables are electrical grounds. They increase the risk of damage because they make a discharge path from your body through the ESD-sensitive part. (Large metal objects can be discharge paths without being grounded.)



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

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

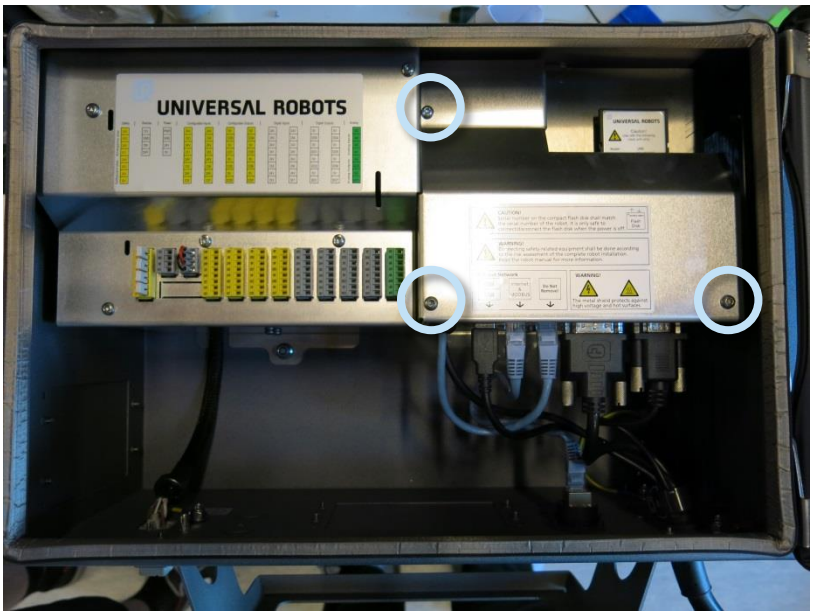
3.2.2 Replacement of motherboard



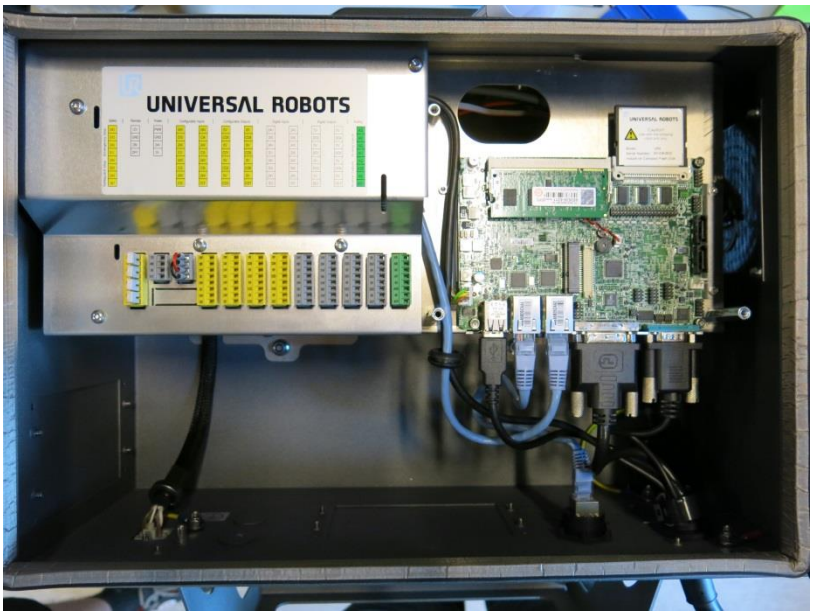
Take care of ESD handling *3.2.1 Handling ESD-sensitive parts*

How to replace motherboard in Controller box

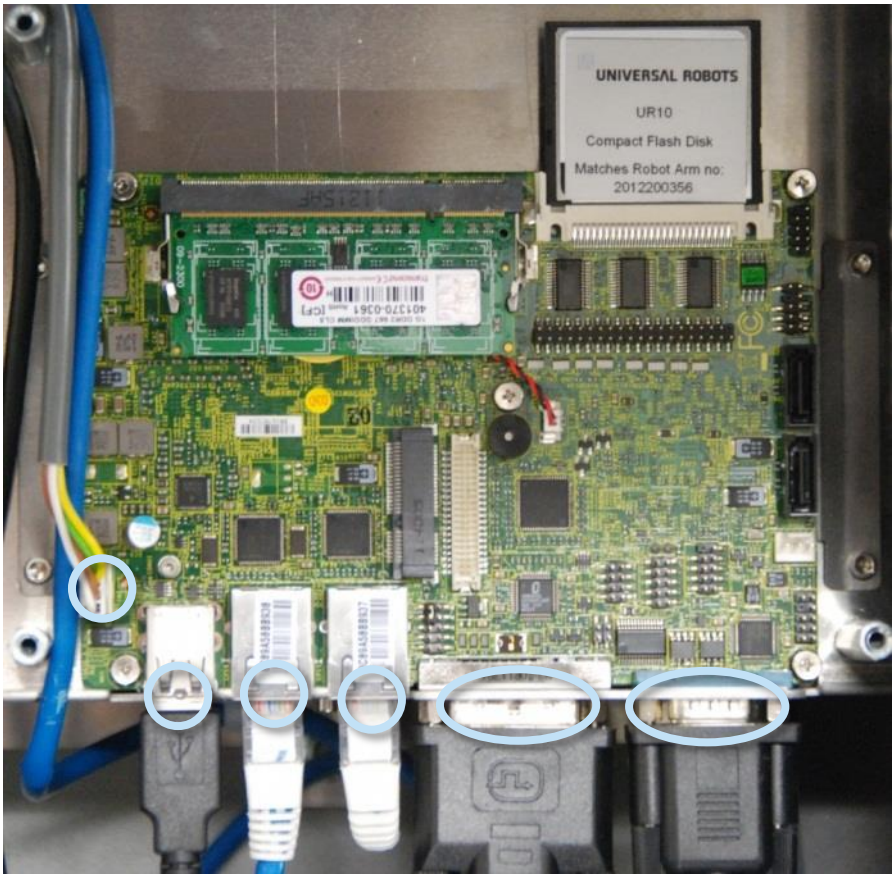
- Shut down the controller and disconnect the power cable, open the controller cabinet and loosen the 3 Torx screws



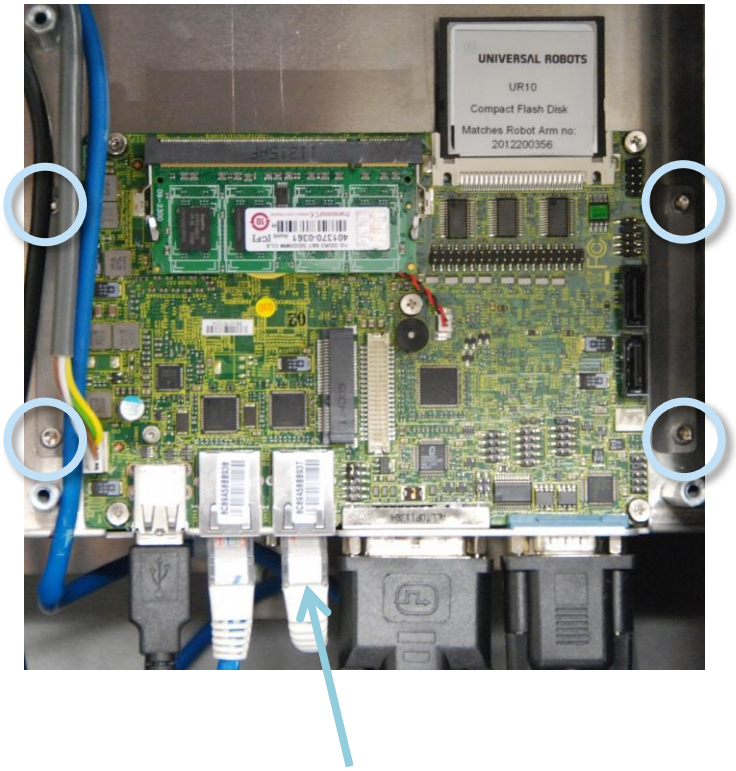
- Remove the aluminum cover plate



- Disconnect cable connections from motherboard:
  2x RJ45 network cables
  Black USB cable
  DVI-cable
  Black cable for RS232-connection
  White plug with white, brown, yellow and green wires



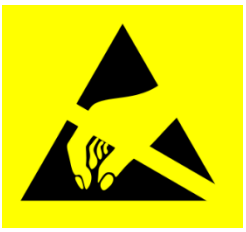
- Remove the 4 screws from the 2 holding brackets



NB! Ethernet cable to Safety control Board

- Replace Motherboard with new one
- If controller is equipped with long-hole brackets, make sure to replace them with circular-hole brackets. Tighten the 4 screws gently
- 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**
- Re-install Flash card and RAM block
- Carefully put back the grey aluminum cover plate, make sure to mount it correct and fix it with the 3 screws
- Connect power and verify that teach pendant works properly

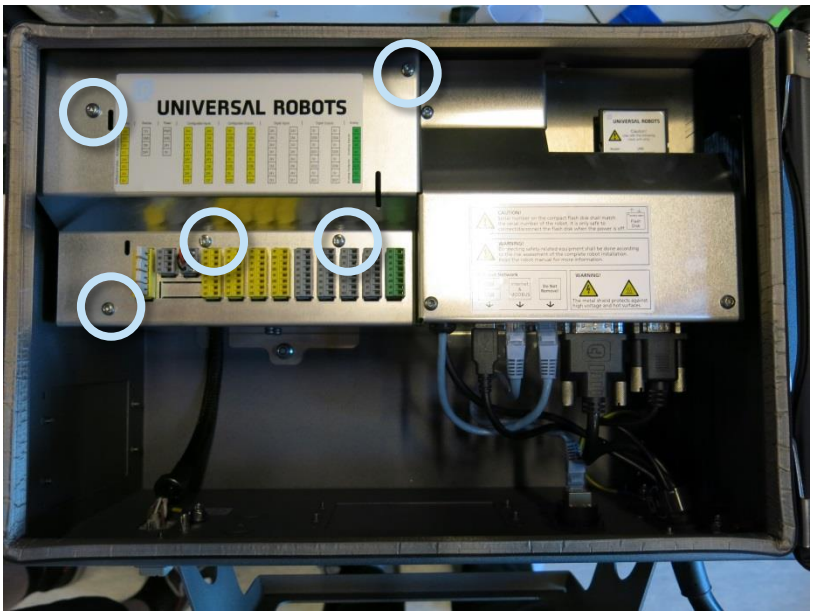
3.2.3 Replacement of Safety Control Board



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

How to replace Safety Control Board in Controller box

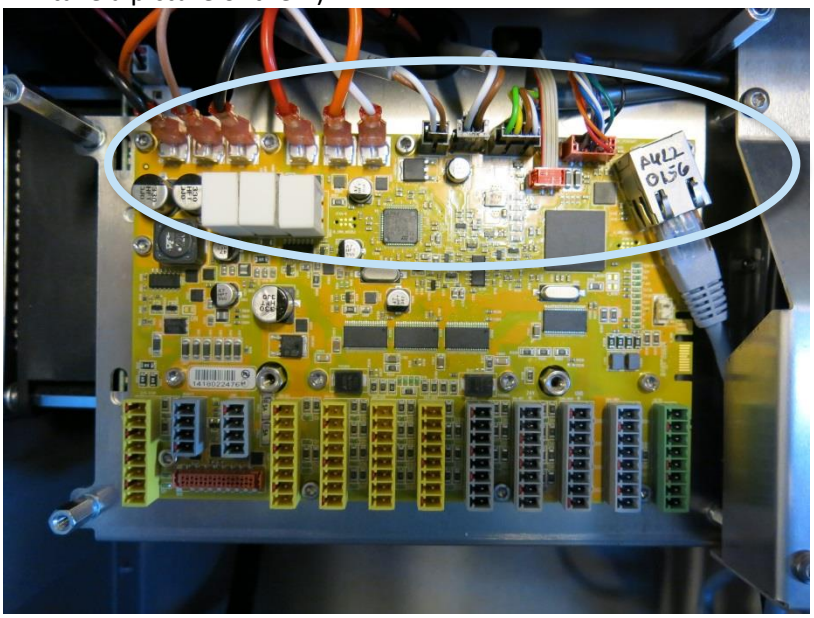
- Shut down the controller and disconnect the power cable, open the controller cabinet and loosen the 5 Torx screws

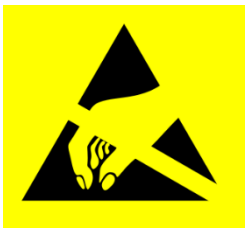


- Carefully remove all plugs and connectors (it is recommended to mark the cable positions or take a picture of them).

- Remove the aluminum cover plate.

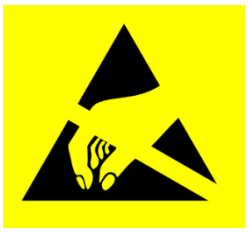
- Carefully remove all plugs and connectors (it is recommended to mark the cable positions or take a picture of them).





- Remove 13 screws holding the Safety Control Board.
- Replace Safety Control Board with new one and tighten the 13 screws to hold the board
- Insert all connectors and plugs in correct positions. Eventually see section *5.4.1 Schematic overview*
- Carefully put back the grey aluminum cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

3.2.4 Replacement of teach pendant

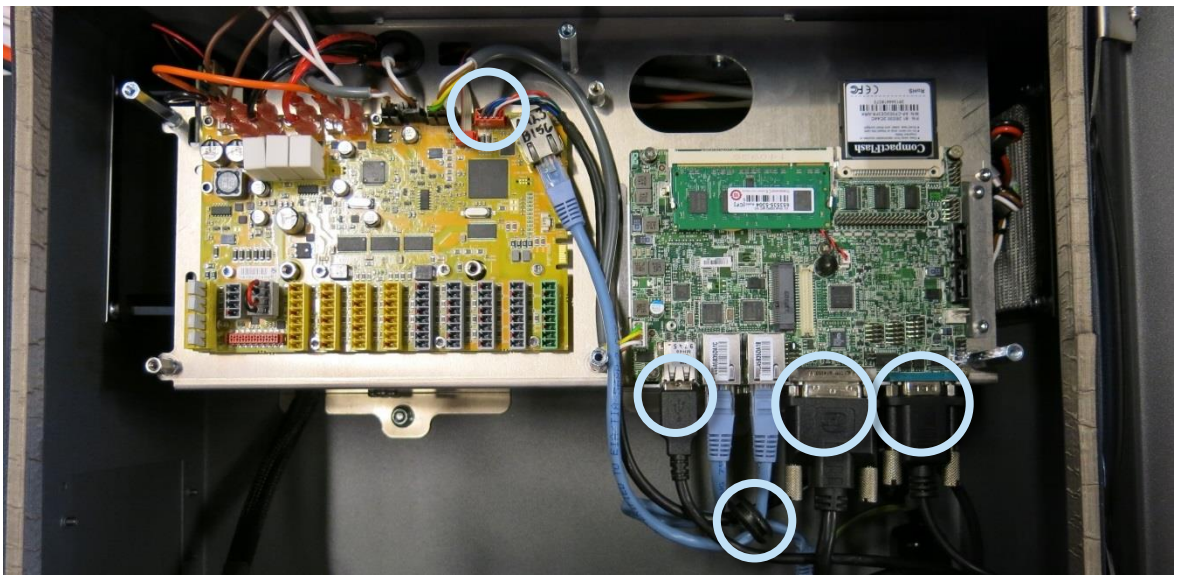


Take care of ESD handling *3.2.1 Handling ESD-sensitive parts*

How to replace Teach Pendant on Controller

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

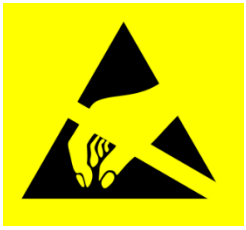
- Disconnect 4 cables:
  Red plug with black cable
  Black USB cable
  Black DVI cable
  Black cable for RS232-connection to touchscreen
  Pull Red plug with black cable through rubber gasket.



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

- Replace teach pendant with new, insert cable in cable inlet and perform reconnection of all plugs and mounting of aluminum cover in reverse order to the above description.
- Connect power and verify that teach pendant works properly.

3.2.5 Replacement of 48V power supply



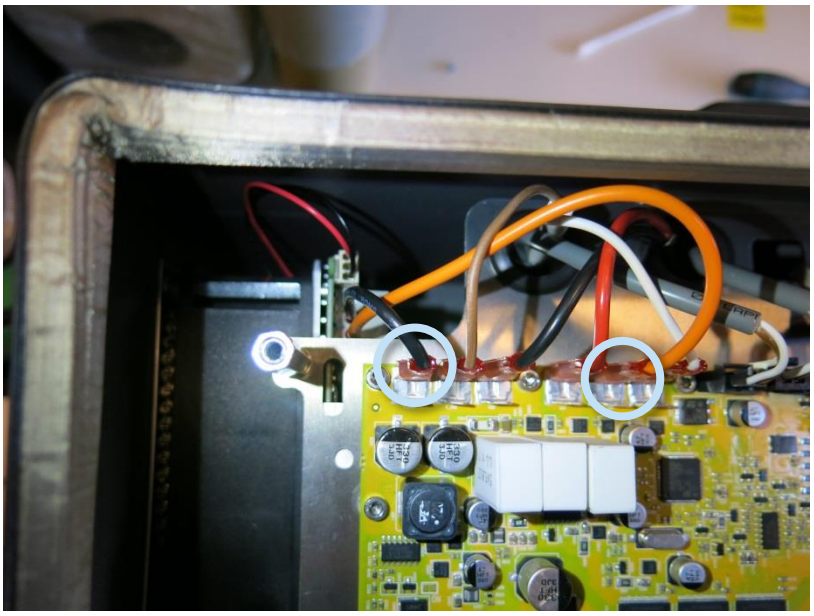
Take care of ESD handling *3.2.1 Handling ESD-sensitive parts*

How to replace 48V power supply in Controller box

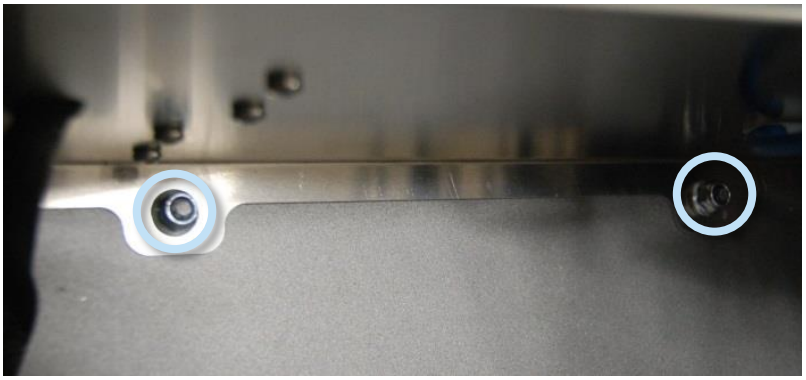
Note: use the same procedure for power down and removing the aluminum cover plates as in chapter *3.2.2 Replacement of motherboard* and *3.2.3 Replacement of Safety Control Board*

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

- Removes the 2 wires for the fan.



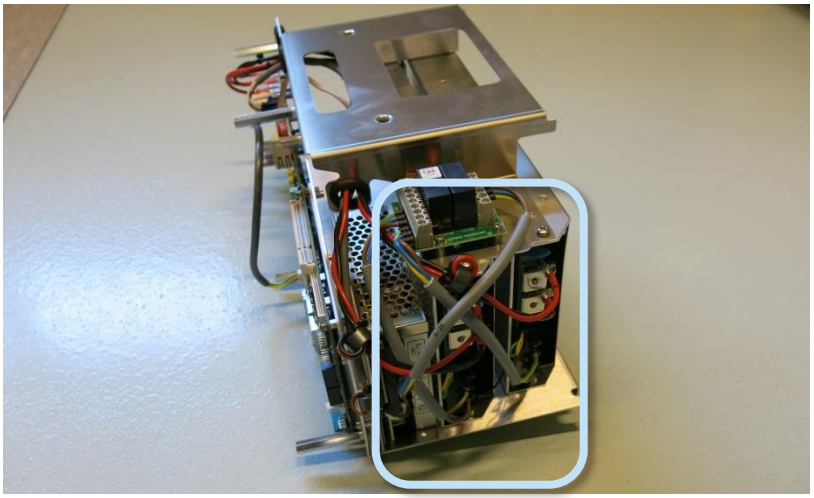
- Remove the 2 nuts in the bottom of Controller module.



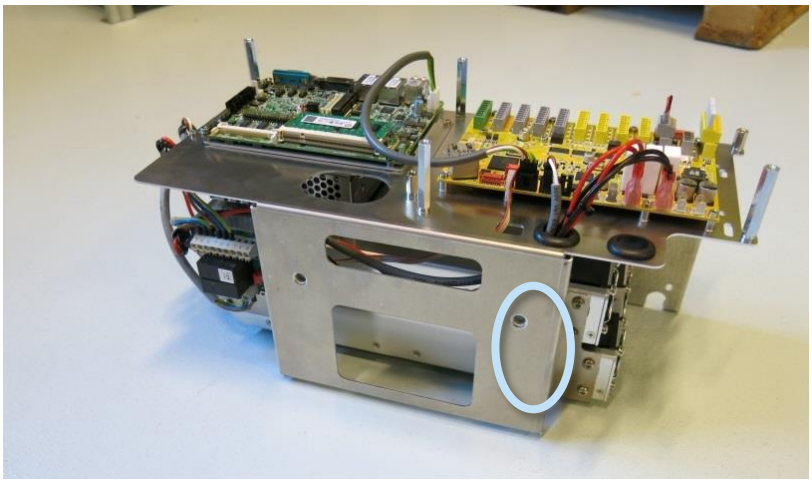
- Gently take out the controller module from the Controller box without disconnecting the robot cable and power cable.

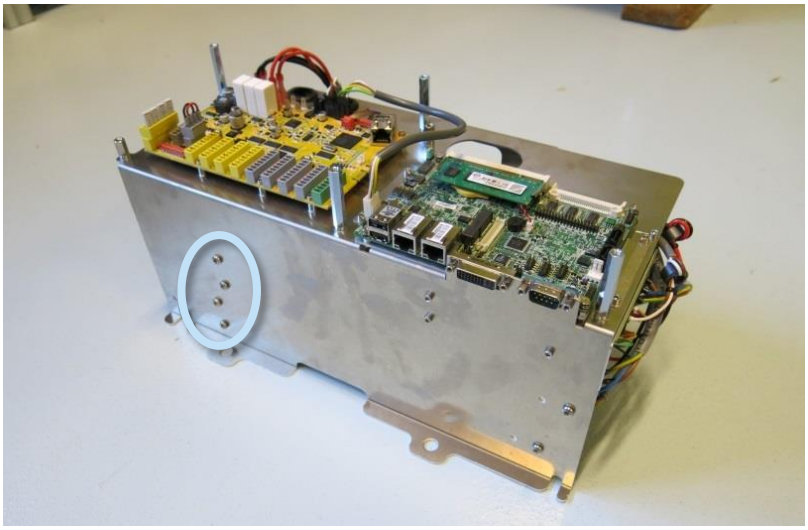
- Power supplies are located in the rack under the controller module, the two 48V power supplies are the lower ones in the rack. (UR5 have one and the UR10 have two 48V power supplies)

Before dismounting the 48V power supply, mark and disconnect the cables from that supply.



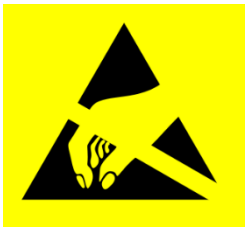
- Remove the screws respectively of the defective 48V power supply from the side of the rack.





- Replace 48V power supply with new one.
- Reconnect the wires for the 48V power supply.
- Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.
- Carefully put back the grey aluminum cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

3.2.6 Replacement of 12V power supply



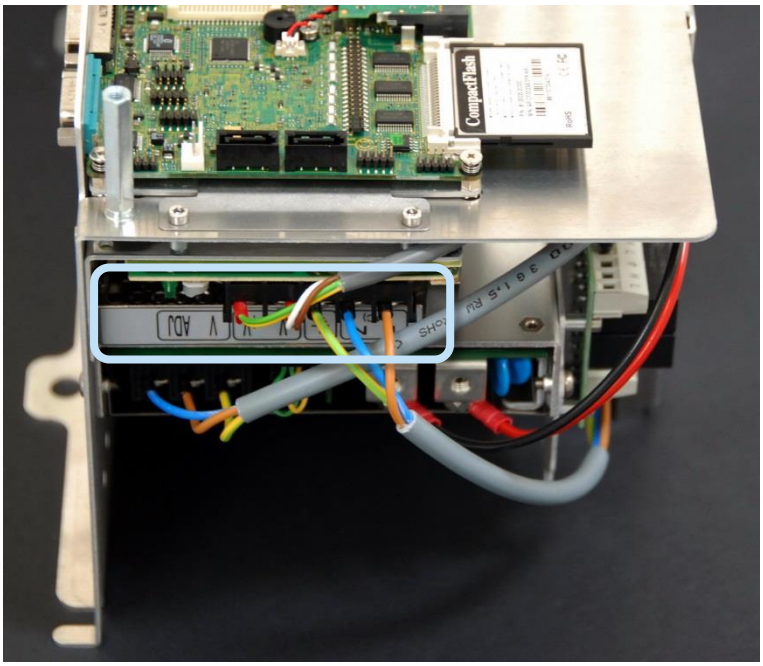
Take care of ESD handling *3.2.1 Handling ESD-sensitive parts*

How to replace 12V power supply in Controller box

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

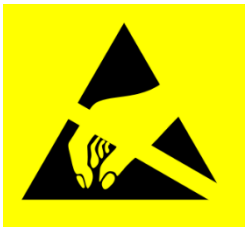
To replace the 12V power supply follow exactly the same steps as for the procedure in chapter 3.2.5 Replacement of 48V power supply

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



- Replace 12V power supply with new one.
- Reconnect the wires for the 12V power supply.
- Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.
- Carefully put back the grey aluminum cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

3.2.7 Replacement of current distributor

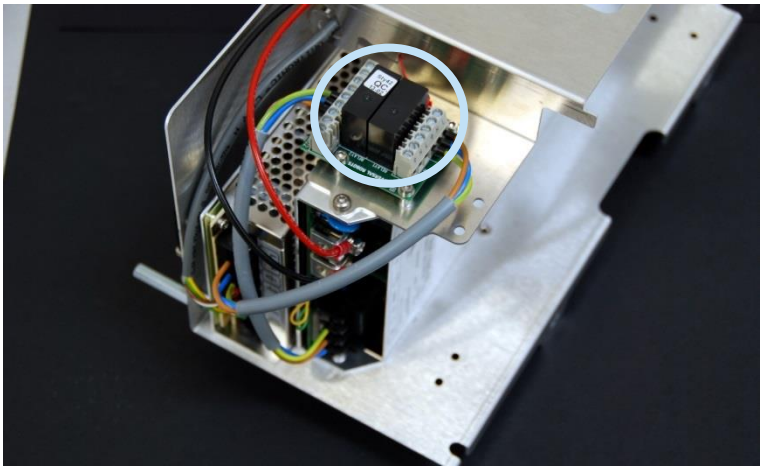


Take care of ESD handling *3.2.1 Handling ESD-sensitive parts*

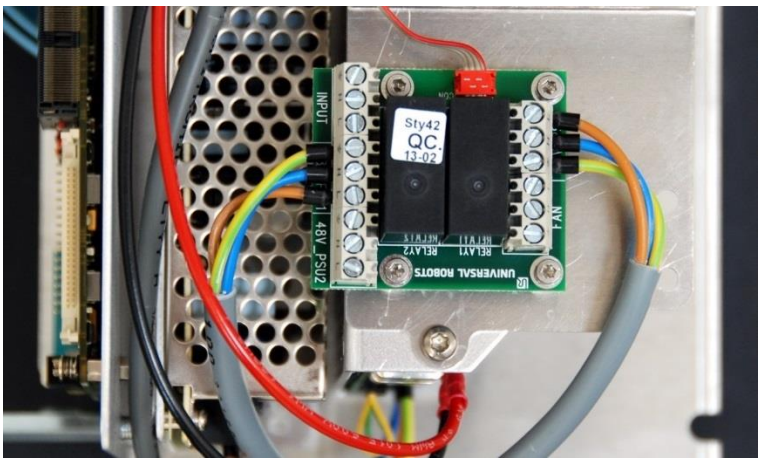
How to replace current distributor in Controller box

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

- Current distributor is placed on top of rack.



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



- Replace current distributor with new one.
- Reconnect the wires for the current distributor.
- Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.
- Carefully put back the grey aluminum cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

4. Software

4.1 Update software

Universal Robots software is named PolyScope.
This software can be updated, when new releases of software become available.

When updating software from an older version, updates must be installed sequentially.

If it ain't broke, don't fix it:
If a robot is operating in an existing application, Universal Robots do not recommend updating software, unless the use of new functions in a newer software release is required for this application.

IMPORTANT NOTICE:

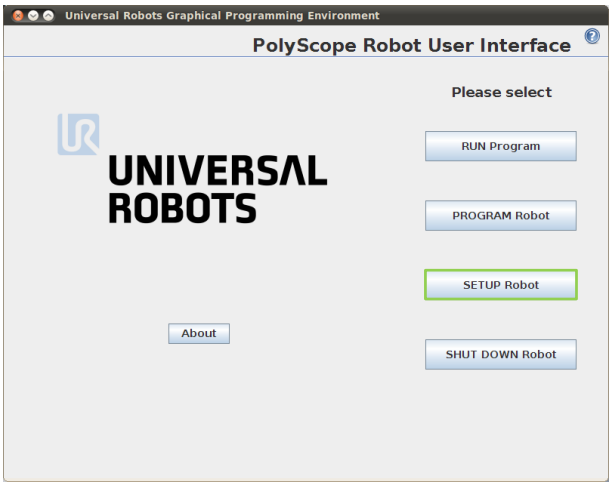
- Software should *only* be updated after consulting Distributor from which the robot has been purchased or after consulting Universal Robots if representing a Distributor.
- Universal Robots do *not* recommend updating software without proper instruction in how to carry out updates.
- When updating firmware controller power MUST NOT be turned off during update.
- Universal Robots can by no means be held responsible for any failed update caused by improper operation.

Go to www.support.universal-robots.com/download for downloading software updates.
A login is required, which is only available to Distributors.

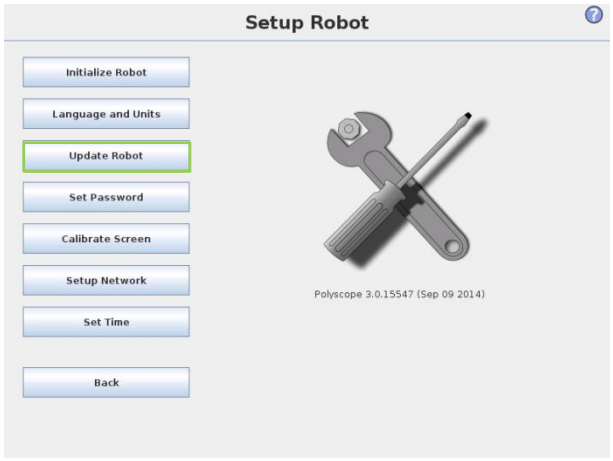
Please note: If representing an end customer, contact the Distributor from which the robot has been purchased to request software updates.

Instructions to updat software:

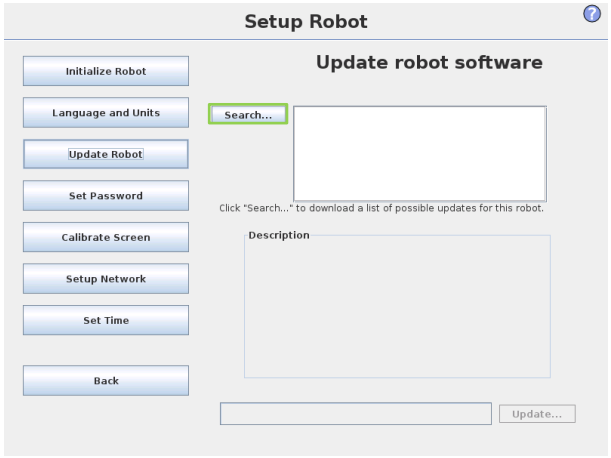
- Download software update. Carefully read requirements on support site relating to which software must be installed on robot prior to updating to the downloaded version.
- Save it in the root folder on a USB-stick.
- Insert USB-stick into USB-connector on right-hand side of teach pendant.
- Go to main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



- Press button *SETUP Robot*.
- In left side menu, select *UPDATE Robot*.



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



- Select the found software update and press *UPDATE*.
- Press YES to update the software.
- Wait for update to complete, after successful update controller will automatically power off.
- Remove USB-stick and boot robot.

4.2 Update joint firmware

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

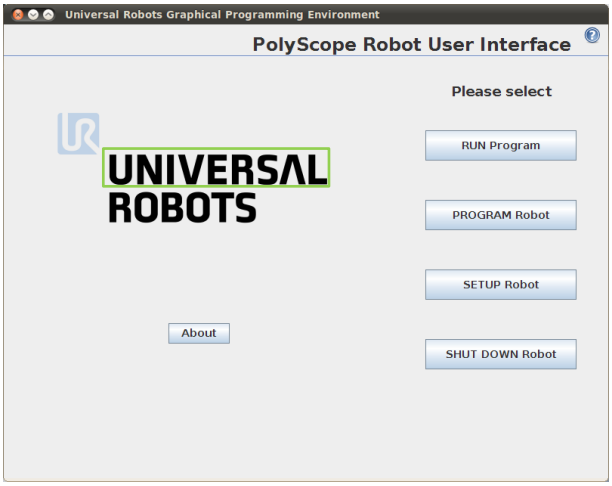
For normal operation firmware update is not required. Software can be updated on robot without updating the firmware.

IMPORTANT NOTICE:

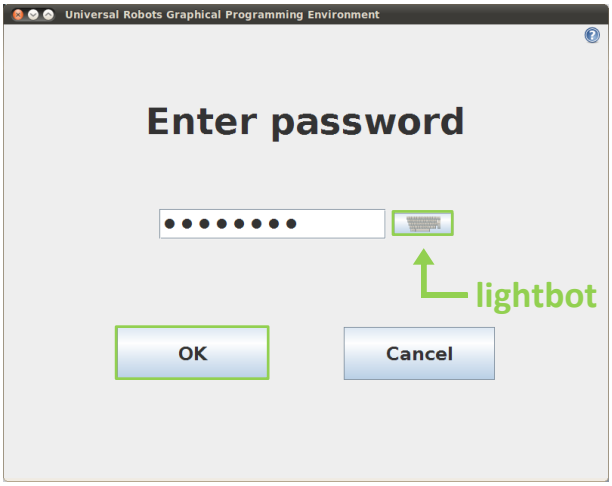
- Firmware should *only* be updated after consulting Distributor from which the robot has been purchased or after consulting Universal Robots if representing a Distributor.
- Universal Robots do *not* recommend updating firmware without proper instruction in how to update firmware.
- When updating firmware controller power MUST NOT be turned off during update.
- Universal Robots can by no means be held responsible for any failed update caused by improper operation.

Instructions for updating firmware:
Prior to updating firmware, robot software must be updated.
Please refer to chapter 4.1 for updating software. When updating robot software, the firmware will automatically be copied to a folder on the controller.

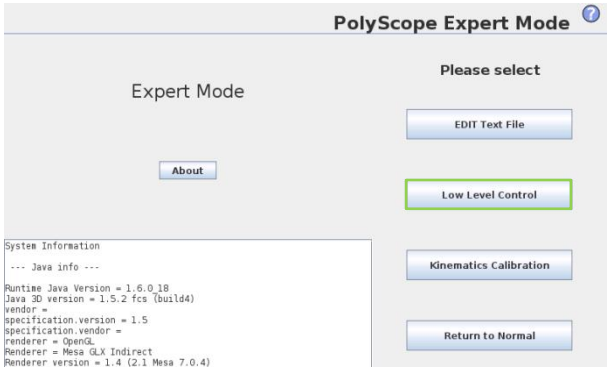
- Drag a finger from left to right across the *UNIVERSAL*-sign on main screen of PolyScope.



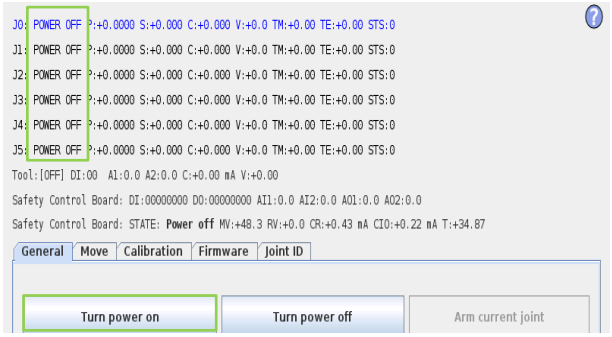
- Enter password *lightbot* and press *OK*.



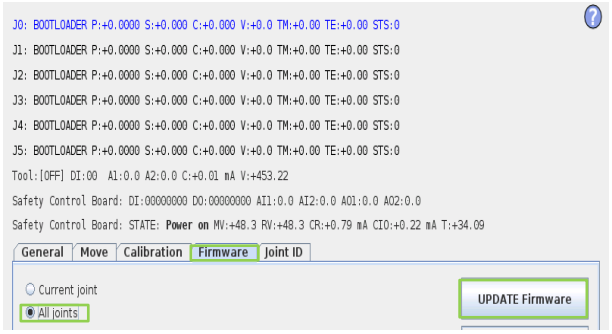
- You are now in *Expert Mode*, press *Low Level Control*.



- Press *Turn power on* to go into BOOTLOADER



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

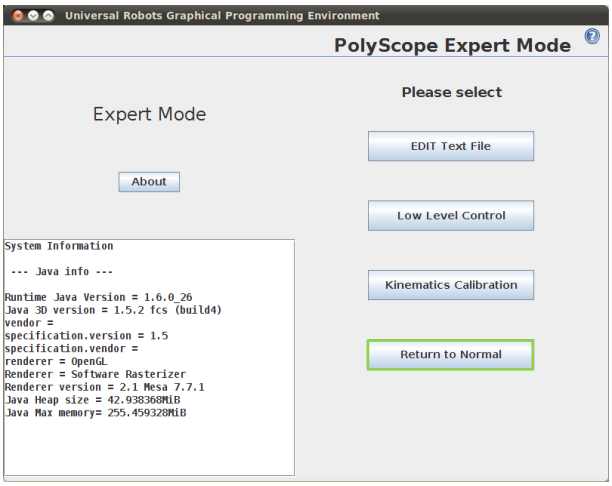


- Firmware update is being processed, await message that *robot firmware updated successfully*.

Controller MUST NOT be powered off during this update.

- After successful update, press *Back*.

- 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.support.universal-robots.com/download to download Magic files.
A login is required, which is only available to Distributors.

Please note: If representing an end customer, contact the Distributor from which the robot has been purchased to request Magic files.

Instruction for using Magic files

- Download Magic file.
- Save it in the root folder on a USB-stick.
- Insert USB-stick into USB-connector on right-hand side of teach pendant.
- 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.
- Await a green **<- USB** -sign appears on the screen, the USB-stick can then be safely removed.
- Remove USB-stick and the process is complete.

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

If more than one magic file is on USB-stick, they will be run in sequence; the warnings will then appear for each file. Do not remove the USB-stick until after the last file has been run. Multiple folders will be created and named with serial number plus a sequential no, like 201430xxxx_0, 201430xxxx_1etc.

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
- PC = Motherboard

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

5.1 Error codes

Code	Error description	Explanation	How to fix
CODE_0	No error		
CODE_1	Outbuffer overflow error		
CODE_1A1	Buffer of stored warnings overflowed		
CODE_1A2	Outbuffer to RS485 overflowed (problem with PCs message)		
CODE_2	Inbuffer overflow error		
CODE_3	Processor overloaded error	Processor in any part could give this error.	
CODE_4	Broken communication		
CODE_4A1	Communication with PC lost.	Between Safety Control Board and Motherboard	
CODE_4A2	Communication with Safety Control Board A uP lost	If either processor A or processer B is communicating, the Safety Control Board or cable between the Motherboard and Safety Control Board is defect	a) Check TCP/IP connection between Motherboard and Safety Control Board. b) Exchange Safety Control Board
CODE_4A3	Communication with Safety Control Board B uP lost	If either processor A or processer B is communicating, the Safety Control Board or cable between the Motherboard and Safety Control Board is defect	a) Check TCP/IP connection between Motherboard and Safety Control Board. b) Exchange Safety Control Board
CODE_4A4	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 TCP/IP-12V connection between Motherboard and Teach Pendant. b) Exchange Teach Pendant
CODE_4A5	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 TCP/IP-12V connection between Motherboard and Teach Pendant. b) Exchange Teach Pendant

CODE_4A6	Communication with primary EUROMAP67 uP lost	If either processor A or processer B is communicating, Euromap67 or cable between the Motherboard and Euromap is defect	a) Check Euromap67 connection between Motherboard and Euromap67. b) Exchange Euromap67
CODE_4A7	Communication with secondary EUROMAP67 uP lost	If either processor A or processer B is communicating, Euromap67 or cable between the Motherboard and Euromap is defect	a) Check Euromap67 connection between Motherboard and Euromap67. b) Exchange Euromap67
CODE_4A8	Primary EUROMAP67 uP present, but euromap67 is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
CODE_4A9	Secondary EUROMAP67 uP present, but euromap67 is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
CODE_4A10	Primary Teach Pendant present, but Teach Pendant safety is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
CODE_4A11	Secondary Teach Pendant uP present, Teach Pendant safety is disabled	Incorrect safety configuration	Update the miscellaneous settings in the Safety Configuration
CODE_4A12	Communication with joint 0 lost	More than 1 package lost	
CODE_4A13	Communication with joint 1 lost	More than 1 package lost	
CODE_4A14	Communication with joint 2 lost	More than 1 package lost	
CODE_4A15	Communication with joint 3 lost	More than 1 package lost	
CODE_4A16	Communication with joint 4 lost	More than 1 package lost	
CODE_4A17	Communication with joint 5 lost	More than 1 package lost	
CODE_4A18	Communication with tool lost	More than 1 package lost	
CODE_4A65	Lost package from Primary Teach Pendant	1 package lost - warning	
CODE_4A66	Lost package from Secondary Teach Pendant	1 package lost - warning	
CODE_4A67	Lost package from Primary Euromap67	1 package lost - warning	
CODE_4A68	Lost package from Secondary Euromap67	1 package lost - warning	
CODE_4A69	Lost package from Secondary Masterboard	1 package lost - warning	
CODE_4A70	Lost package from joint 0	1 package lost - warning	
CODE_4A71	Lost package from joint 1	1 package lost - warning	
CODE_4A72	Lost package from joint 2	1 package lost - warning	
CODE_4A73	Lost package from joint 3	1 package lost - warning	
CODE_4A74	Lost package from joint 4	1 package lost - warning	
CODE_4A75	Lost package from joint 5	1 package lost - warning	

CODE_4A76	Lost package from tool	1 package lost - warning	
CODE_4A77	Lost package from uPA to joints	1 package lost - warning	
CODE_4A78	Lost package from uPA to teach pendant	1 package lost - warning	
CODE_4A79	Lost package from uPA to uPB	1 package lost - warning	
CODE_4A80	Lost package from uPB	1 package lost - warning	
CODE_4A81	Packet counter disagreement in packet from Primary Screen		
CODE_4A82	Packet counter disagreement in packet from Secondary Screen		
CODE_4A83	Packet counter disagreement in packet from Primary Euromap67		
CODE_4A84	Packet counter disagreement in packet from Secondary Euromap67		
CODE_4A85	Packet counter disagreement in packet from Safety Control Board B		
CODE_4A86	Packet counter disagreement in packet from joint 0		
CODE_4A87	Packet counter disagreement in packet from joint 1		
CODE_4A88	Packet counter disagreement in packet from joint 2		
CODE_4A89	Packet counter disagreement in packet from joint 3		
CODE_4A90	Packet counter disagreement in packet from joint 4		
CODE_4A91	Packet counter disagreement in packet from joint 5		
CODE_4A92	Packet counter disagreement in packet from tool		
CODE_4A93	Packet counter disagreement in packet from processor A to joints		
CODE_4A94	Packet counter disagreement in packet from processor A to B		
CODE_4A95	Packet counter disagreement in packet from processor A to Teach Pendant and EUROMAP		
CODE_5	Heavy processor load warning		
CODE_10	Broken PC communication error		Eventually update the software
CODE_10A1	Lost packet from PC		Eventually update the software
CODE_10A101	PC packet received too early		Eventually update the

			software
CODE_10A102	Packet counter does not match		Eventually update the software
CODE_10A103	PC is sending packets too often		Eventually update the software
CODE_11	Bad CRC error	Serial communication problem with joint	Check black 2-wire connectors and wires in joints. Eventually 2 joints with the same ID.
CODE_12	Unknown message error		
CODE_14	Debug message		
CODE_17	Inbuffer overflow in package from PC	Communication error between Safety Control Board and Motherboard	Check ethernet connection between circuit boards. Eventually update the software
CODE_26	Motor Encoder index drift detected	Joint mechanical problem	Replace joint
CODE_27	Calibration data is invalid or does not exist, selftest is needed!		
CODE_29	Online Calibration data checksum failed	Calibration data is not in the joint	a) Power OFF and Power ON. b) replace joint
CODE_30	Master received data from too many joints		
CODE_31	Caught wrong message (not from master)	Serial communication problem with joint	Check black 2-wire connectors and wires in joints
CODE_32	Flash write verify failed	Debug message	Ignor
CODE_33	Calibration flash checksum failed		
CODE_34	Program flash checksum failed		Update Firmware
CODE_34A0	Program flash checksum failed during bootloading		Update Firmware
CODE_34A1	Program flash checksum failed at runtime		Update Firmware
CODE_35	Joint ID is undefined		
CODE_36	Illegal bootloader command	Debug message	Ignor
CODE_37	Inbuffer parse error	Serial communication problem with joint	Check black 2-wire connectors and wires in joints
CODE_38	Online RAM test failed		Replace Item
CODE_38A1	Data-bus test failed		Replace Item
CODE_38A2	Address-bus stuck-high test failed		Replace Item
CODE_38A3	Address-bus stuck-low test failed		Replace Item
CODE_38A4	Address-bus shorted test failed		Replace Item
CODE_38A5	Memory-cell test failed		Replace Item
CODE_39	Logic and Temporal		

	Monitoring Fault		
CODE_39A1	Max current deviation failure		
CODE_39A2	Max joint-encoder speed exceeded		
CODE_39A3	Max motor-encoder speed exceeded		
CODE_39A4	Illegal state change in joint detected		
CODE_39A5	Too fast state change in joint detected		
CODE_39A6	5V regulator voltage too low		Replace joint
CODE_39A7	5V regulator voltage too high		Replace joint
CODE_39A100	Watchpoint fault: ADC task timeout		
CODE_39A101	Watchpoint fault: Motor-Control task timeout		
CODE_39A102	Watchpoint fault: Motor-encoder task timeout		
CODE_39A103	Watchpoint fault: Joint-encoder task timeout		
CODE_39A104	Watchpoint fault: Communication task timeout		
CODE_39A105	Watchpoint fault: RAM-test task timeout		
CODE_39A106	Watchpoint fault: CalVal-test task timeout		
CODE_39A107	Watchpoint fault: ROM-test task timeout		
CODE_40	AD-Converter hit high limit joint	EMC issue external or electronics internal	Check grounding and shielding for EMC problems
CODE_44	CRC check failure on primary bus	Serial communication problem with joint or secondary bus node	Check black 2-wire connectors and wires in joints
CODE_44A0	Joint 0		Replace joint 0
CODE_44A1	Joint 1		Replace joint 1
CODE_44A2	Joint 2		Replace joint 2
CODE_44A3	Joint 3		Replace joint 3
CODE_44A4	Joint 4		Replace joint 4
CODE_44A5	Joint 5		Replace joint 5
CODE_44A6	Tool		Replace Tool mounting bracket
CODE_45	AD-Converter error		Replace Item
CODE_46	Loose gearbox or bad encoder mounting	Mechanical problem in gear related to encoder mounting	Replace joint
CODE_47	AD-Converter hit low limit	EMC issue external or electronics internal	a) Check grounding and shielding for EMC problems. b) Replace Item
CODE_48	Powerbus voltage drop detected.	Error on 48V powerbus to robot arm	Check 48V output from PSU. Check current-distributor PCB.

			Replacement of 48V PSU or current-distributor is necessary
CODE_49	RS485 receive warning		
CODE_49A200	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
CODE_50	Robot powerup failure	Electrical error control box	Remove all external connections to I/O-interface of Safty Control Board. Check for short circuit. Argument of error code specifies in details what causes the error.
CODE_50A1	Voltage detected at 24V rail before startup		
CODE_50A2	Voltage present at unpowered robot		
CODE_50A5	Powersupply voltage too low		
CODE_50A6	Powersupply voltage too high		
CODE_50A11	Voltage not detected at 24V rail after startup	24 V to the I/O interface in the controller	
CODE_50A15	Warning, waiting for SafetySYS2	SafetySYS2 = Processor B on Safety Control Board	
CODE_50A16	The Teach Pendant does not respond	Loose wire or incorrect safety configuration. Message comes from Safety Control Board	Check the cable or change in the Safety Configuration of the Installation the miscellaneous settings
CODE_50A17	The Euromap67 interface does not respond	Loose wire or incorrect safety configuration	Check the cable or change in the Safety Configuration of the Installation the miscellaneous settings
CODE_50A18	Warning, waiting for SafetySYS1	SafetySYS1 = Processor A on Safety Control Board	
CODE_50A20	5V, 3V3 or ADC error (5V too high)		
CODE_50A21	5V, 3V3 or ADC error (5V too low)		
CODE_50A22	Robot current sensor reading too high		
CODE_50A23	Robot current sensor reading too low		
CODE_50A24	48V not present (Check internal connection)		
CODE_50A25	Robot voltage present at 48V PSU powereup		
CODE_50A26	Voltage present on unpowered 48V power supply		
CODE_50A27	12V, 3V3 or ADC error (12V too high)		
CODE_50A28	12V, 3V3 or ADC error (12V		

	too low)		
CODE_50A29	Analog I/O error (-12V too high)		
CODE_50A30	Analog I/O error (-12V too low)		
CODE_50A31	The other safetySYS do not initialize		
CODE_50A80	Last CPU reset caused by Low-Power-Reset		
CODE_50A81	Last CPU reset caused by Window-Watchdog-Reset		
CODE_50A82	Last CPU reset caused by Independent-Watchdog-Reset		
CODE_50A83	Last CPU reset caused by Software-Reset		
CODE_50A84	Last CPU reset caused by External-Pin-Reset		
CODE_50A85	Last CPU reset caused by Brown-Out-Reset		
CODE_50A99	Wrong software on PCB		
CODE_50A100	Cable not connected	Robot Problem: Robot Cable is not detected	
CODE_50A101	Short circuit in robot detected	Robot Problem: 48V	
CODE_50A102	Voltage rising too slowly	Robot Problem: 48V	
CODE_50A103	Voltage failed to reach acceptable level	Robot Problem: 48V	
CODE_51	CRC check failure on secondary bus		
CODE_51A0	Processor B		
CODE_51A1	Primary screen processor		
CODE_51A2	Secondary screen processor		
CODE_51A3	Primary E67		
CODE_51A4	Secondary E67		
CODE_53	IO overcurrent detected	Safety Control Board error	Remove all external connections to I/O-interface of Safety Control Board. Check for short circuit
CODE_53AMASTER	IO overcurrent detected, max is 800mA	Safety Control Board error	Remove all external connections to I/O-interface of Safety Control Board. Check for short circuit
CODE_53ATOOL	IO overcurrent detected, max is 600mA	Tool error	Remove tool connector. Check for short circuit
CODE_55	Safety system error	Safety system malfunction	Check Motherboard, Safety Control Board, Screenboard, Current distributor(Euromap, if installed). Bypass safety

			connections to I/O-interface of Safety Control Board
CODE_55A23	Safety relay error (minus connection)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
CODE_55A24	Safety relay error (plus connection)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
CODE_55A33	Safety relay error (a relay is stuck)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
CODE_55A34	Safety relay error (relays are not on)	Current distributor error	Fault: Cable SCB-Current distributor or 48V Power supply or Current distributor.
CODE_55A50	Voltage present at unpowered robot	SCB hardware fault	Replace Safety Control Board (SCB)
CODE_55A51	Voltage will not disappear from robot	SCB hardware fault	Replace Safety Control Board (SCB)
CODE_55A52	5V, 3V3 or ADC error (5V too low)	SCB hardware fault	Replace Safety Control Board (SCB)
CODE_55A53	5V, 3V3 or ADC error (5V too high)	SCB hardware fault	Replace Safety Control Board (SCB)
CODE_55A90	Bootloader error, robot voltage too low or current too high		
CODE_55A91	Bootloader error, robot voltage too high		
CODE_55A100	Safety violation		
CODE_55A101	Safety Channel Error In Safety Control Board		
CODE_55A102	Safety Channel Error In Screen		
CODE_55A103	Safety Channel Error In Euromap67 Interface		
CODE_55A109	Received fault message from PC		
CODE_55A110	Safety State is changing too often		
CODE_55A111	On/Off State is changing too often		
CODE_55A112	Robot current sensors readings differ		
CODE_55A120	Robot current is too high while emergency stopped		
CODE_55A121	Robot current is too high while safeguard stopped		

CODE_56	Overvoltage shutdown	Voltage exceeded 55V	Check Energy Eater. Cable to Energy eater, Replace Energy Eater
CODE_57	Brake release failure		Check Brake, solonoide, Payload, TCP and Mount
CODE_57A1	Joint did not move or motor encoder is not functioning		Check Brake, solonoide, Payload, TCP and Mount
CODE_57A2	Large movement detected during brake release		Check Brake, solonoide, Payload, TCP and Mount
CODE_57A3	Robot was not able to brake release, see log for details		Check Brake, solonoide, Payload, TCP and Mount
CODE_58	Motor encoder not calibrated		Callibrate joint
CODE_59	Overcurrent shutdown	Overcurrent in joint. Argument = Current in Amps.	Check for short circuit. Check program for singularity issues. Replace joint if necessary
CODE_62	Joint temperature		
CODE_62A1	High (80 C)	Warning	
CODE_62A3	Static load too high warning	Warning	
CODE_62A11	Shut down (85 C)	Stop	
CODE_62A13	Static load too high	Stop	Check Payload
CODE_63	Selftest failed		
CODE_68	SPI error	Joint: Absolut encoder on joint communication error	Replace joint
CODE_70	Close to gearbox shear limit	Acceleration / deceleration to high. Mechanical problem in gear related to encoder mounting	Reduce acceleration in user program. Replace joint if necessary
CODE_71	Startup check error	Fault: Firmware in joint	
CODE_71A1	Hardware is size1, software is not	Fault: Firmware in joint	
CODE_71A2	Hardware is size2, software is not	Fault: Firmware in joint	
CODE_71A3	Hardware is size3, software is not	Fault: Firmware in joint	
CODE_71A4	Hardware is size4, software is not	Fault: Firmware in joint	
CODE_71A5	Invalid hardware size read		
CODE_71A6	Motor indication signal not working		
CODE_71A7	Phase 1 and phase 2 not working	The motor wires are damaged or bad connection in screwterminals	
CODE_71A8	Phase 2 not working	The motor wires are damaged or bad connection in screwterminals	
CODE_71A9	Phase 1 not working	The motor wires are damaged or bad connection in screwterminals	
CODE_71A10	Invalid motor test result		

CODE_71A11	ADC calibration failed	Only in joint	
CODE_72	Power Supply Unit failure	48 V Power problem	
CODE_72A1	0 PSUs are active	PSU was not able to deliver 48V (In UR10: No 48V)	Check power connection between power supply and Safety Control Board
CODE_72A2	1 PSU active, but we expect 2 (UR10)	PSU was not able to deliver 48V or UR10 flash card in UR5 robot	Check power connection between power supply and Safety Control Board and check that the flash card and robot match
CODE_72A3	2 PSUs active, but we expect 1 (UR5)	UR5 flash card in UR10 robot	Check that the flash card and robot match
CODE_73	Brake test failed during selftest, check brakepin		
CODE_74	Joint encoder warning	Magnetic encoder error (Absolut encoder)	
CODE_74A2	Speed reading is not valid	If more 74 errors on one time the argument is the sum	Look in the service manual
CODE_74A8	Supply voltage is out of range	If more 74 errors on one time the argument is the sum	Look in the service manual
CODE_74A16	Temperature is out of range	If more 74 errors on one time the argument is the sum	Look in the service manual
CODE_74A64	Signal low =Too far from magnetic ring	If more 74 errors on one time the argument is the sum	Look in the service manual
CODE_74A128	Signal saturation =Too close to magnetic ring	If more 74 errors on one time the argument is the sum	Look in the service manual
CODE_75	Joint encoder error	If more 75 errors on one time the argument is the sum	Look in the service manual
CODE_75A1	Invalid decode: Readhead misalignment, ring damaged or external magnetic field present.	If more 75 errors on one time the argument is the sum	Look in the service manual
CODE_75A4	System error=malfunction or inconsistent calibration detected	If more 75 errors on one time the argument is the sum	Look in the service manual
CODE_75A32	Signal lost =Misaligned readhead or damaged ring	If more 75 errors on one time the argument is the sum	Look in the service manual
CODE_75A128	Signal saturation =Too close to magnetic ring	If more 75 errors on one time the argument is the sum	Look in the service manual
CODE_76	Joint encoder communication CRC error	Error between sensor and joint circuit	Check connections or very heavy electrical noise
CODE_100	Robot changed mode	Status warning, general modus change	Check preceding errors in log history
CODE_101	Real Robot Connected		
CODE_102	Real Robot not connected - Simulating Robot		
CODE_103	UR Ethernet Error	Comm. Prob. between Mother Board and Safety Control Board	Check cable
CODE_103A1	3 packages in a row lost from Safety Control Board		
CODE_104	Error=Empty command sent to		

	robot		
CODE_111	Something is pulling the robot		Check Payload setting
CODE_116	Realtime part warning	Possible CPU-overload due to structure of user program	Restructure user program
CODE_117	Restart SCB failed	The Safety Control Board couldn't be rebooted from the controller.	Reboot the robot
CODE_150	Protective Stop: Position close to joint limits		
CODE_151	Protective Stop: Tool orientation close to limits		
CODE_152	Protective Stop: Position close to safety plane limits		
CODE_153	Protective Stop: Position deviates from path		
CODE_154	Protective Stop: Position in singularity	Robot can not move linear in a singularity	Use jointspace movement or change the motion
CODE_155	Protective Stop: Robot cannot maintain its position, check if payload is correct		
CODE_156	Protective Stop: Wrong payload or mounting detected, or something is pushing the robot when entering Teach mode	The robot may move unexpected due to wrong settings	Verify that the TCP configuration and mounting in the used installation is correct
CODE_172	Illegal control mode		
CODE_184	Joint self test not completed		
CODE_191	Safety system violation		
CODE_191A1	Joint position limit violated		
CODE_191A2	Joint speed limit violated		Reduce acceleration or speed for joint
CODE_191A3	TCP speed limit violated		Reduce acceleration or speed for joint
CODE_191A4	TCP position limit violated		
CODE_191A5	TCP orientation limit violated		
CODE_191A6	Power limit violated		Reduce acceleration or speed for joint
CODE_191A7	Joint torque window violated	Software problem	
CODE_191A8	Joint torque window too large	Software problem	
CODE_191A9	Reduced mode output violation	Software problem	
CODE_191A10	Safeguard stop output violation	Software problem	
CODE_191A11	Emergency stop output violation	Software problem	
CODE_191A12	Momentum limit violation		
CODE_191A13	Robot moving output violation		
CODE_191A14	Robot is not braking in stop mode		
CODE_191A15	Robot is moving in stop mode		

CODE_191A16	Robot did not stop in time		
CODE_191A17	Received a null vector for TCP orientation	Fault in config file, when no GUI is used	
CODE_191A18	Robot not stopping output violation	Software problem	
CODE_191A19	Invalid safety IO configuration	Fault in config file, when no GUI is used	
CODE_191A20	Configuration information or limit sets not received	Software problem	
CODE_191A21	The other safety processor detected a violation		
CODE_191A22	Received unknown command from PC		Check Firmware
CODE_191A23	Invalid setup of safety limits		Check Firmware
CODE_191A24	Reduced Mode Output set, while it should not be		Check Firmware
CODE_191A25	Reduced Mode Output not set, while it should be		Check Firmware
CODE_191A26	Not Reduced Mode Output set, while it should not be		Check Firmware
CODE_191A27	Not Reduced Mode Output not set, while it should be		Check Firmware
CODE_191A28	Robot Emergency Stop exceeded maximum stop time	Much too high payload	
CODE_191A29	System Emergency Stop exceeded maximum stop time	Much too high payload	
CODE_191A30	Safeguard Stop exceeded maximum stop time	Much too high payload	
CODE_192	Safety system fault		
CODE_192A1	Robot still powered in emergency stop		
CODE_192A2	Robot emergency stop disagreement	E-stop in teach pendant or in Robot E-stop circuit problem	Check cables or replace Safety Control Board (SCB)
CODE_192A3	System emergency stop disagreement	System E-stop circuit problem	Check cables or replace Safety Control Board (SCB)
CODE_192A4	Safeguard stop disagreement	Safeguard circuit problem	Check cables or replace Safety Control Board (SCB)
CODE_192A5	Euromap safeguard stop disagreement	Euromap circuit problem	Check cables from Safety Control Board to Euromap to external machine
CODE_192A6	Joint position disagreement		Reduce payload, check for encoder problems
CODE_192A7	Joint speed disagreement		Reduce payload, check for encoder problems
CODE_192A8	Joint torque disagreement		Reduce payload, check for encoder problems
CODE_192A9	TCP speed disagreement		Reduce payload, check for encoder problems
CODE_192A10	TCP position disagreement		Reduce payload, check for encoder problems
CODE_192A11	TCP orientation disagreement		Reduce payload, check for

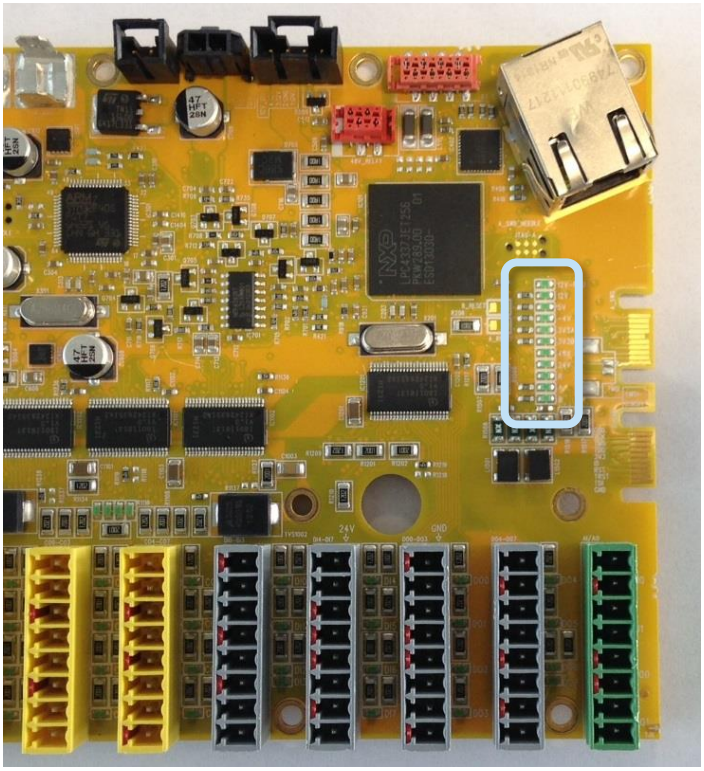
			encoder problems
CODE_192A12	Power disagreement	Only in joint	
CODE_192A13	Joint torque window disagreement	Communication error or	
CODE_192A14	Reduced mode input disagreement	Safety I/O uP-A and uP-B disagreement	Check cables
CODE_192A15	Reduced mode output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A16	Safety output failed		
CODE_192A17	Safeguard stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A18	The other safety processor is in fault		
CODE_192A19	Emergency stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A20	SPI output error detected	Cafety Control Board	Check 24 V supply
CODE_192A21	Momentum disagreement		
CODE_192A22	Robot moving output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A23	Wrong processor ID		
CODE_192A24	Wrong processor revision		
CODE_192A25	Potential brownout detected	Voltage drop on Safety Control Board(SCB) or defect SCB	
CODE_192A26	Emergency stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A27	Safeguard stop output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A28	Robot not stopping output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A29	Safeguard reset input disagreement	Safety I/O uP-A and uP-B disagreement	Check cables
CODE_192A30	Safety processor booted up in fault mode		
CODE_192A31	Reduced Mode Output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A32	Not Reduced Mode Output disagreement	Safety I/O uP-A and uP-B disagreement	Check Cables and Software error on motherboard
CODE_192A33	Checksum disagreement between uA and uB	Problem in Software	
CODE_192A34	User safety config checksum disagreement between uA and GUI	Problem in Software	
CODE_192A35	Robot config checksum disagreement between uA and GUI	Problem in Software	
CODE_192A36	Online RAM test failed		
CODE_192A37	Not all safety related functionalities are running		
CODE_193	One of the nodes is in fault mode	SCB has detected an error	See previous error

CODE_193A0	Joint 0	SCB has detected an error	See previous error
CODE_193A1	Joint 1	SCB has detected an error	See previous error
CODE_193A2	Joint 2	SCB has detected an error	See previous error
CODE_193A3	Joint 3	SCB has detected an error	See previous error
CODE_193A4	Joint 4	SCB has detected an error	See previous error
CODE_193A5	Joint 5	SCB has detected an error	See previous error
CODE_193A6	Tool	SCB has detected an error	See previous error
CODE_193A7	Screen 1	SCB has detected an error	See previous error
CODE_193A8	Screen 2	SCB has detected an error	See previous error
CODE_193A9	Euromap 1	SCB has detected an error	See previous error
CODE_193A10	Euromap 2	SCB has detected an error	See previous error
CODE_194	One of the nodes is not booted or not present		
CODE_194A0	Joint 0	SCB has detected an error	
CODE_194A1	Joint 1	SCB has detected an error	
CODE_194A2	Joint 2	SCB has detected an error	
CODE_194A3	Joint 3	SCB has detected an error	
CODE_194A4	Joint 4	SCB has detected an error	
CODE_194A5	Joint 5	SCB has detected an error	
CODE_194A6	Tool	SCB has detected an error	
CODE_194A7	Screen 1	SCB has detected an error	
CODE_194A8	Screen 2	SCB has detected an error	
CODE_194A9	Euromap 1	SCB has detected an error	
CODE_194A10	Euromap 2	SCB has detected an error	
CODE_195	Conveyor speed too high	Conveyor speed higher than robot is able to run	Make sure that conveyor tracking is set correct up
CODE_196	MoveP speed too high	Too high speed in relation to blend radius	Reduce speed or increase blend radius in user program
CODE_197	Blend overlap warning		
CODE_200	Safety Control Board hardware error	SCB: uP-A has detected an error	
CODE_200A1	Hardware ID is wrong	SCB: uP-A has detected an error: Wrong SCB	
CODE_200A2	MCU type is wrong	SCB: uP-A has detected an error	
CODE_200A3	Part ID is wrong	SCB: uP-A has detected an error	
CODE_200A4	RAM test failed	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
CODE_200A5	Register test failed	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
CODE_200A6	pRom Crc test failed	SCB: uP-A has detected an error: firmware error	Replace Safety Control Board (SCB)
CODE_200A7	Watchdog reset the processor	SCB: uP-A has detected an error	
CODE_200A8	OVG signal test not passed	SCB: uP-A has detected an error: over voltage generator	Replace Safety Control Board (SCB)
CODE_200A9	3V3A power good pin is low	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
CODE_200A10	3V3B power good pin is low	SCB: uP-A has detected an error	Replace Safety Control

			Board (SCB)
CODE_200A11	5V power good is low	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
CODE_200A12	3V3 voltage too low	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
CODE_200A13	3v3 voltage too high	SCB: uP-A has detected an error	Replace Safety Control Board (SCB)
CODE_200A14	48V input is too low		Check: 48 V power supply, current distributer energy eater or replace SCB
CODE_200A15	48V input is too high		Check: 48 V power supply, current distributer energy eater or replace SCB
CODE_200A16	24V IO short circuited	Too high current	Disconnect external connections
CODE_200A17	PC current is too high	Motherboard takes too high current	
CODE_200A18	Robot voltage is too low		Check: Short circuit in robot arm, 48 V power supply, current distributer energy eater or replace SCB
CODE_200A19	Robot voltage is too high		Check: 48 V power supply, current distributer energy eater or replace SCB
CODE_200A20	24V IO voltage is too low		Disconnect I/O or replace SCB
CODE_200A21	12V voltage is too high		Check 12 V power supply, cables or replace SCB
CODE_200A22	12V voltage is too low		Check 12 V power supply, cables or replace SCB
CODE_200A23	It took too long to stabilize 24V	SCB error	External 24 V problem or replace SCB
CODE_200A24	It took too long to stabilize 24V IO	SCB error	External 24 V problem or replace SCB
CODE_200A25	24V voltage is too high	Safety Control Board error(SCB)	Replace Safety Control Board (SCB)
CODE_200A26	24V IO voltage is too high		Disconnect I/O or replace SCB
CODE_201	Setup of safety board failed	Invalid safety parameters have been received	Verify that the setup of the Safety Configuration is valid
CODE_203	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	Reload the installation

5.2 LED indicators on Safety Control Board

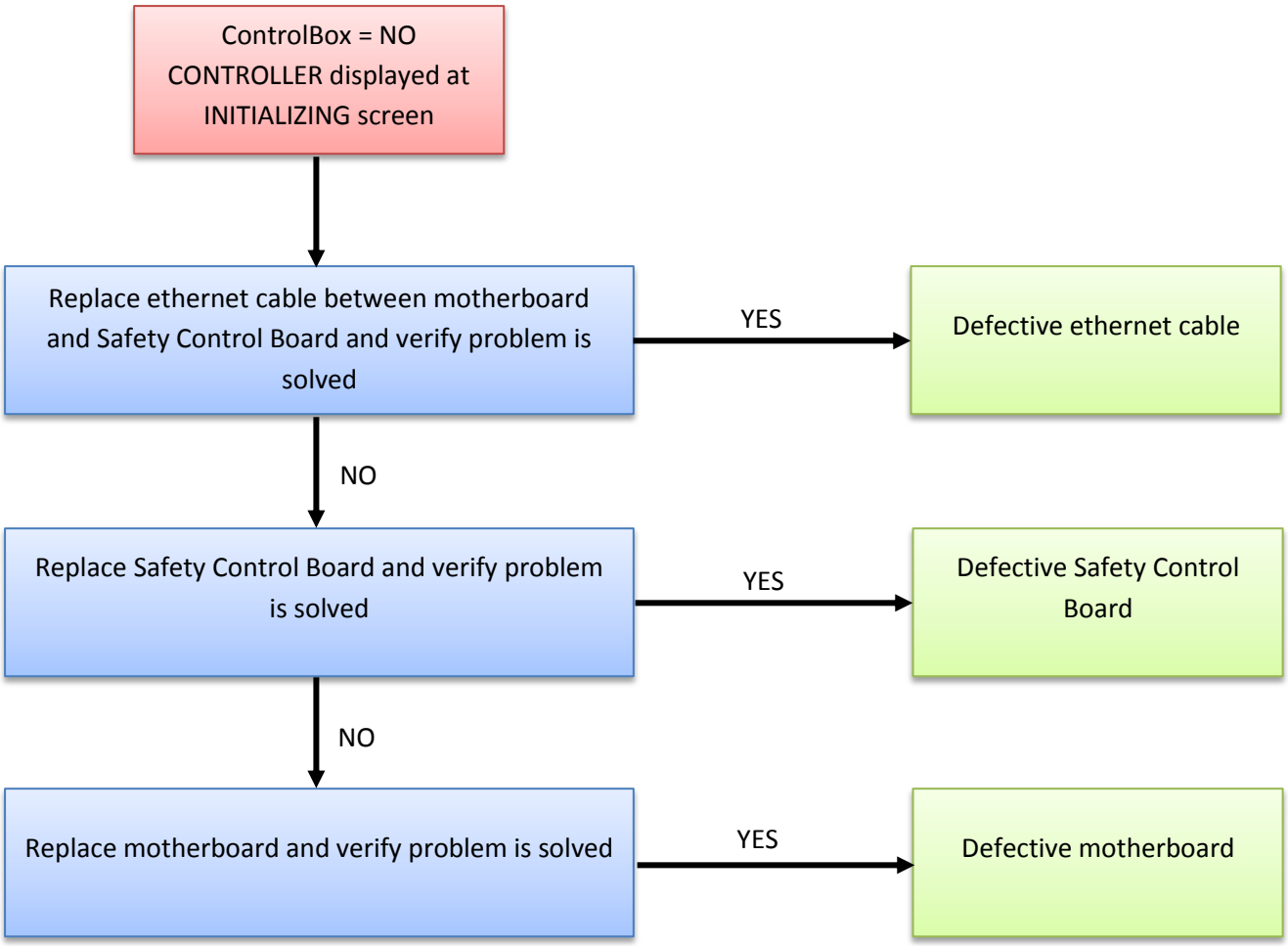
Safety Control Board (SCB)



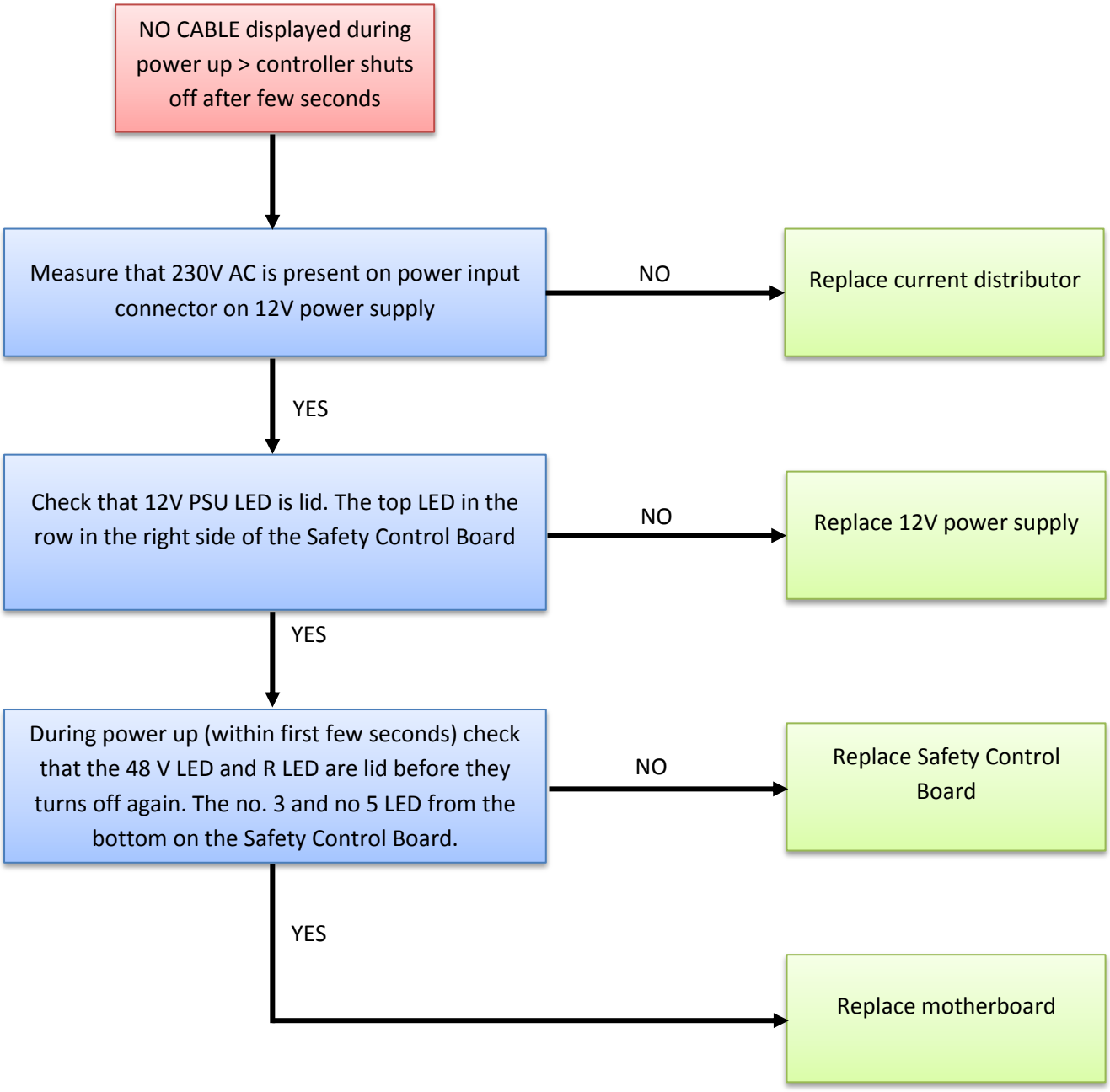
12V-PSU	On when the power plug is connected.
12V	System: On when the power on has been activated
5V	On when "12 V System" is on and indicate that 5 V is ok.
-4V	On when "12 V System" is on and indicate that - 4 V to analog I/O is ok.
3V3A	On when 5V is on and indicate 3.3 V for logic Safety circuit A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

5.3 Error phenomena

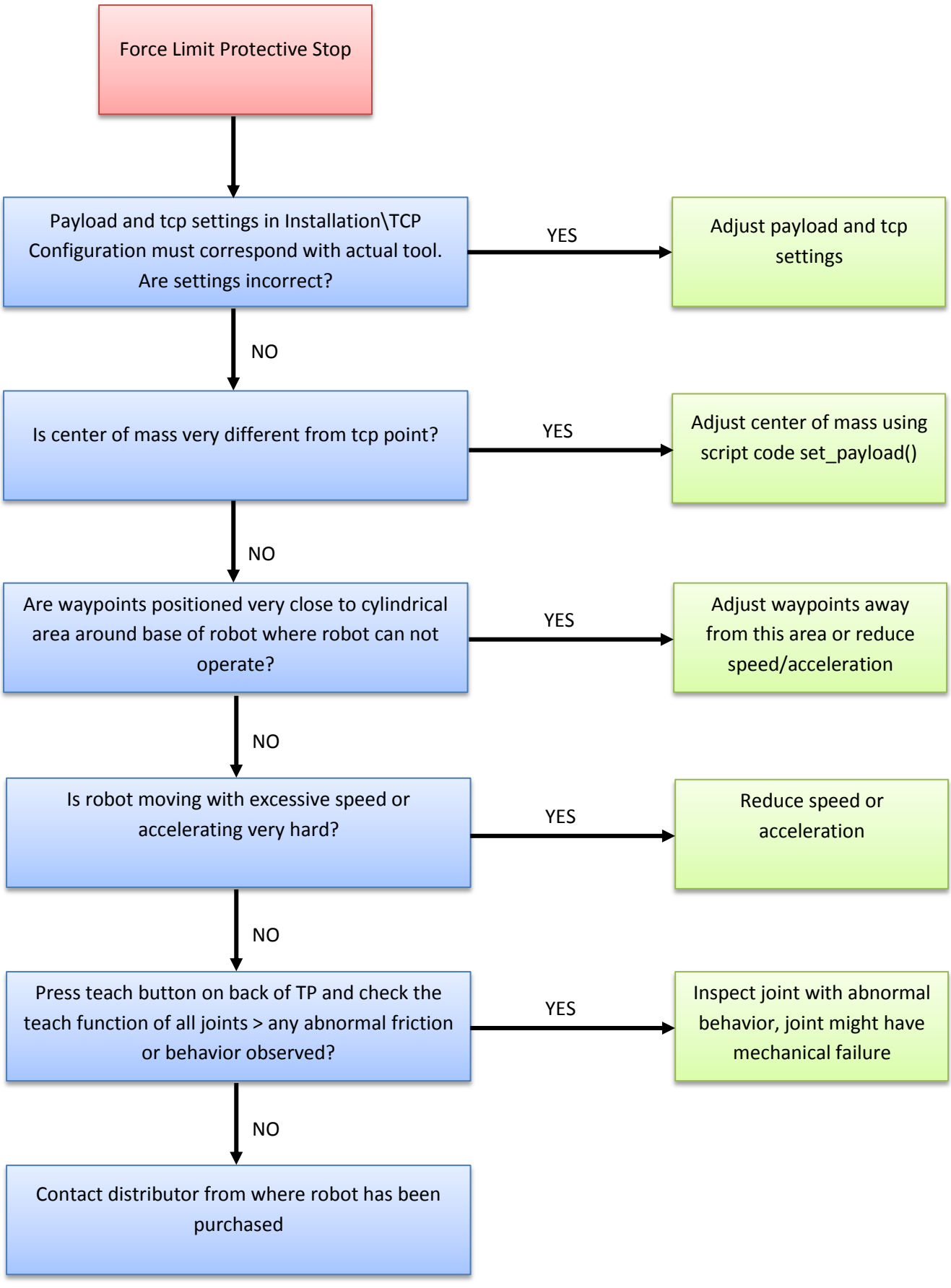
5.3.1 ControlBox: NO CONTROLLER displayed in Initializing



5.3.2 NO CABLE displayed during power up



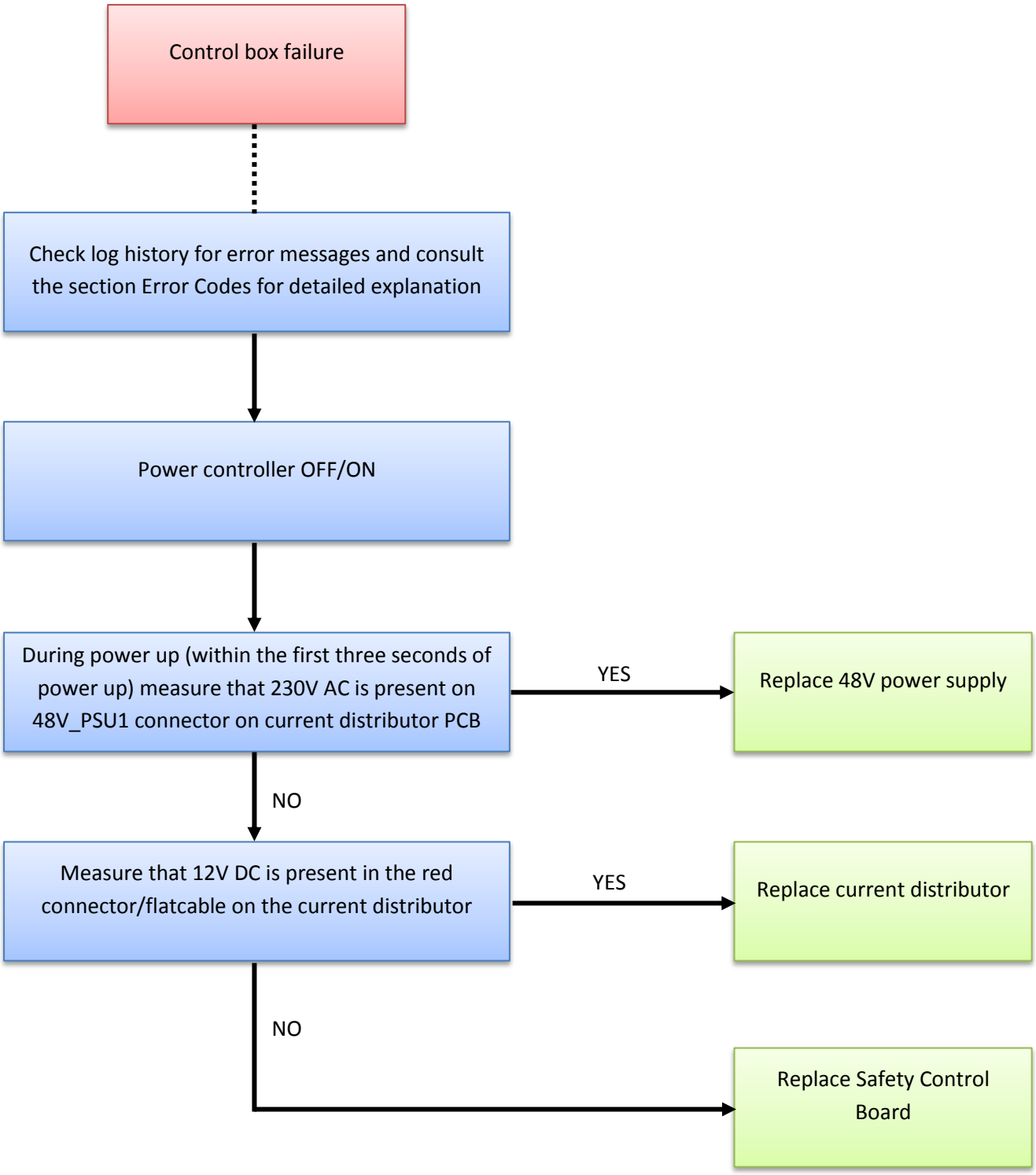
5.3.3 Force limit protective stop

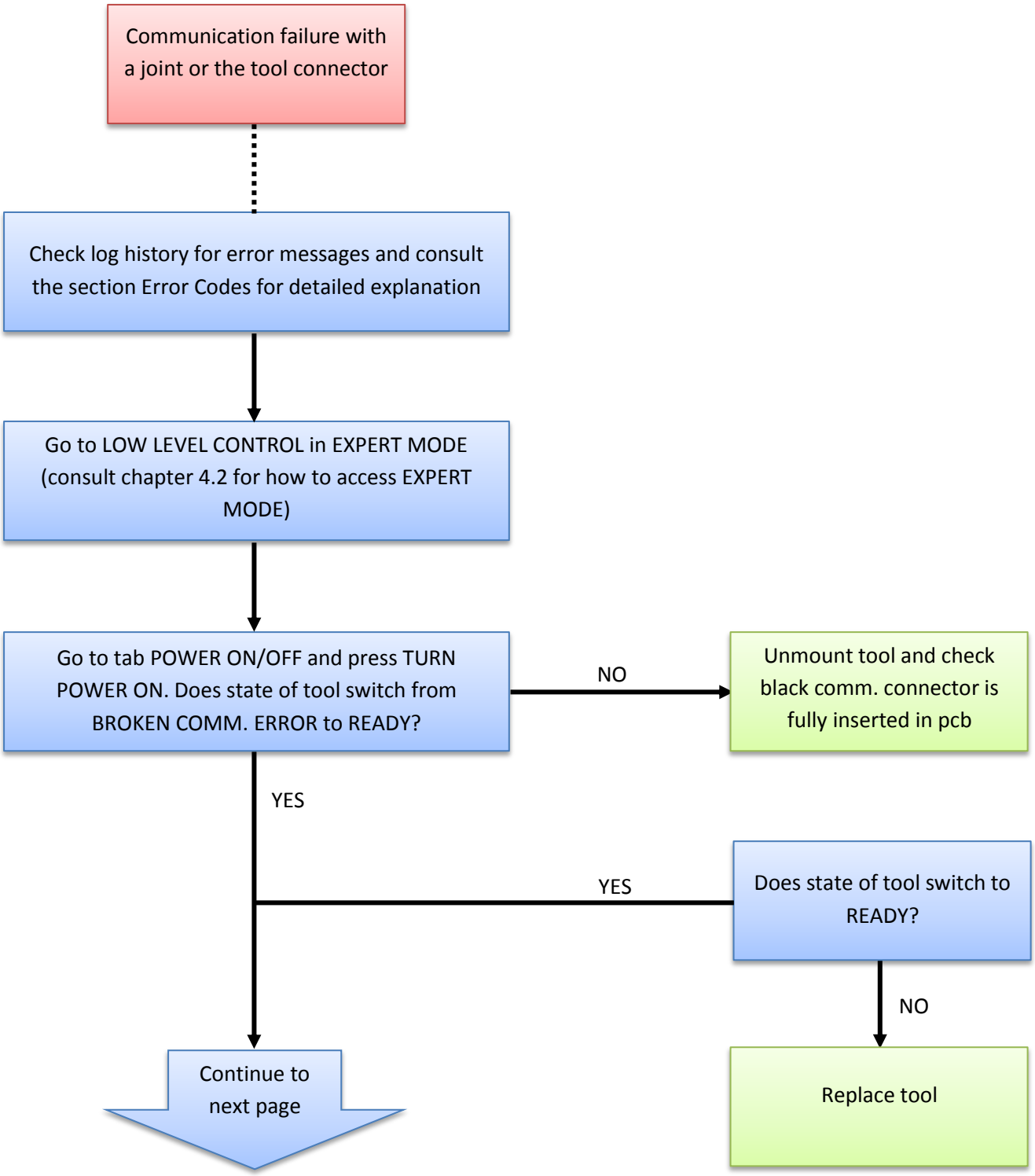


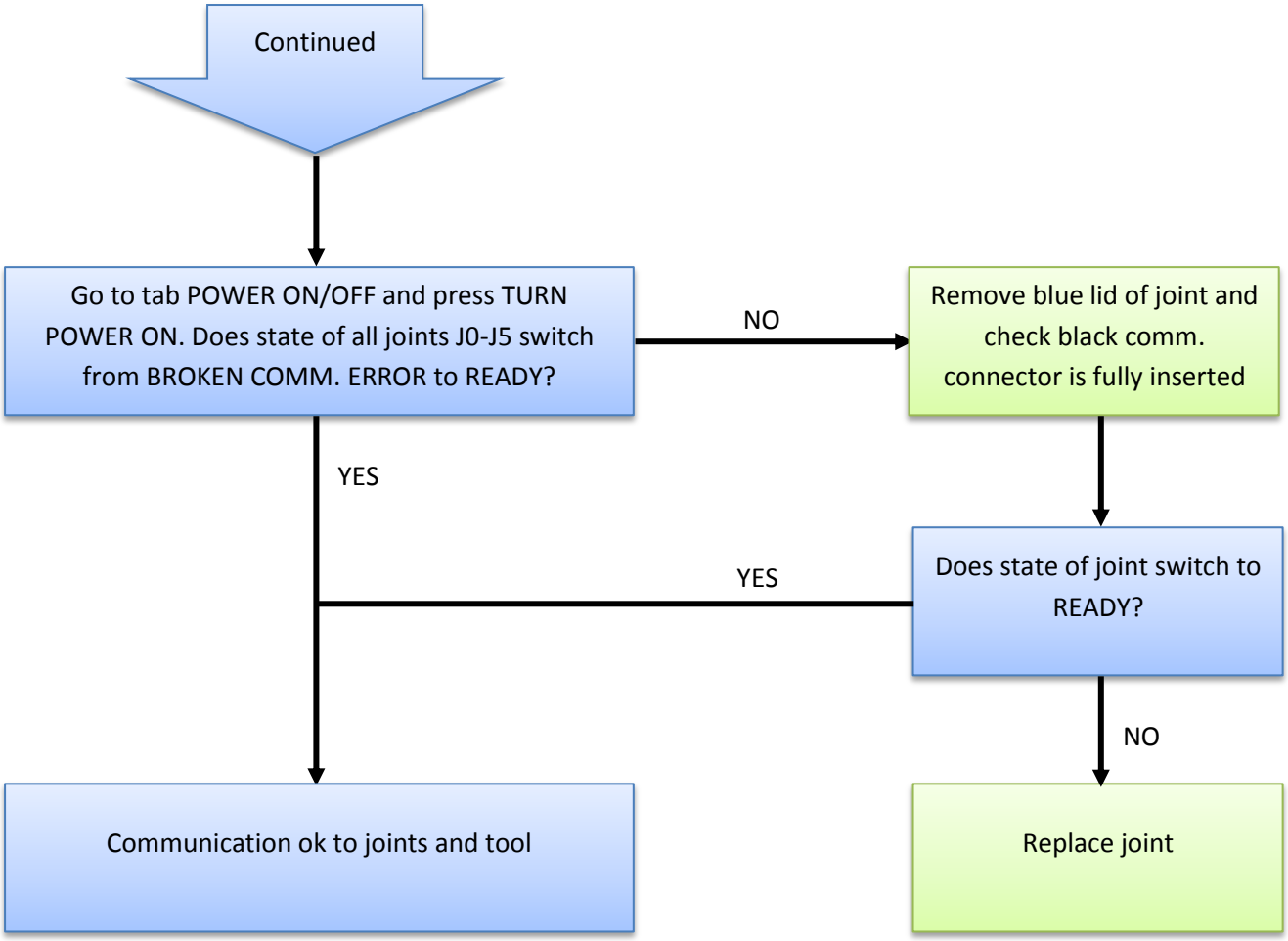
5.3.4 Power on failure in Initializing

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

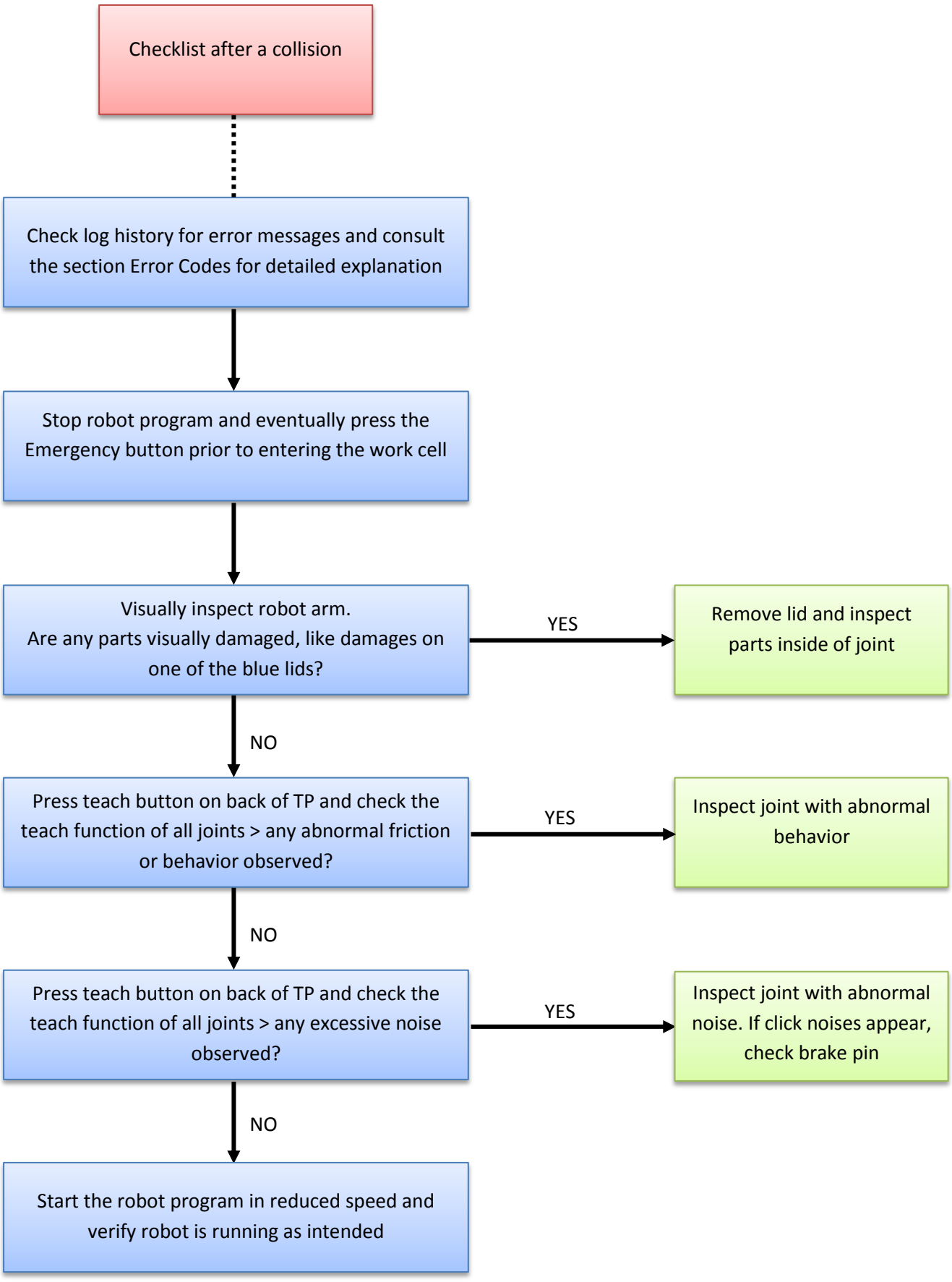
Most likely it is a control box failure or a communication failure with a joint or the tool.




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


Continued
Go to tab POWER ON/OFF and press TURN POWER ON. Does state of all joints J0-J5 switch from BROKEN COMM. ERROR to READY?
NO
Remove blue lid of joint and check black comm. connector is fully inserted
YES
Does state of joint switch to READY?
YES
NO
Communication ok to joints and tool
Replace joint

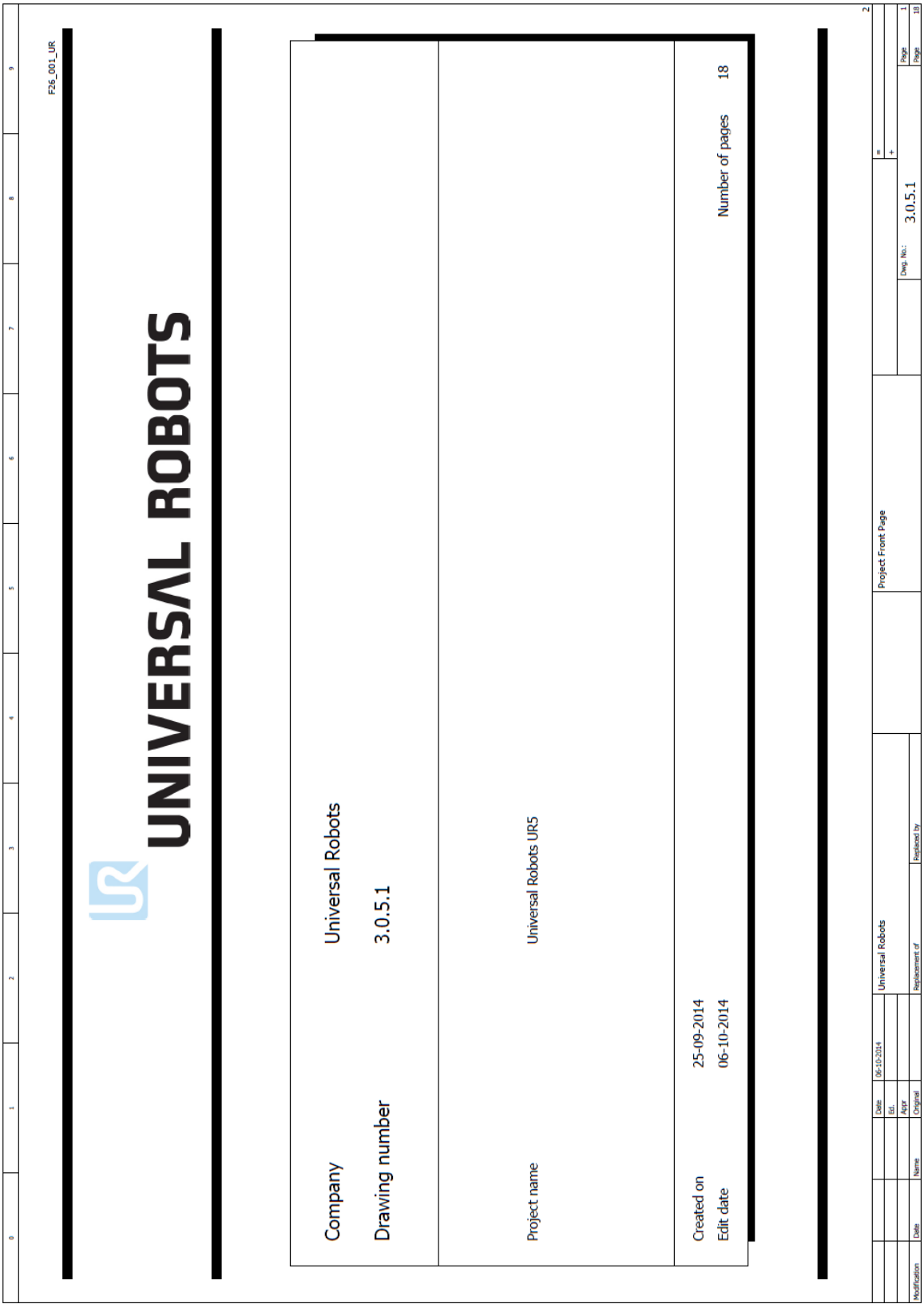
5.3.5 Checklist after a collision



5.4 Electrical drawing

5.4.1 Schematic overview

Diagrams in pdf or in E-plan format, can be found on our support platform under the download section.



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Column X: An automatically generated page was edited

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/ 1	Project Front Page		06-10-2014	VKV	
/ 2	Table of Contents (index)		06-10-2014	VKV	
=UR5 / 10	Overview UR5		06-10-2014	VKV	
=UR5 / 11	Controller UR5		06-10-2014	VKV	
=UR5 / 12	Robot arm UR5		06-10-2014	VKV	
=UR5 / 15	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 16	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 17	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 18	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 19	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 20	UR5 Controller I/O		06-10-2014	VKV	
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=UR5 / 22	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 23	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 24	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 25	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 26	UR5 Controller I/O		06-10-2014	VKV	
=UR5 / 27	UR5 Tools I/O		06-10-2014	VKV	
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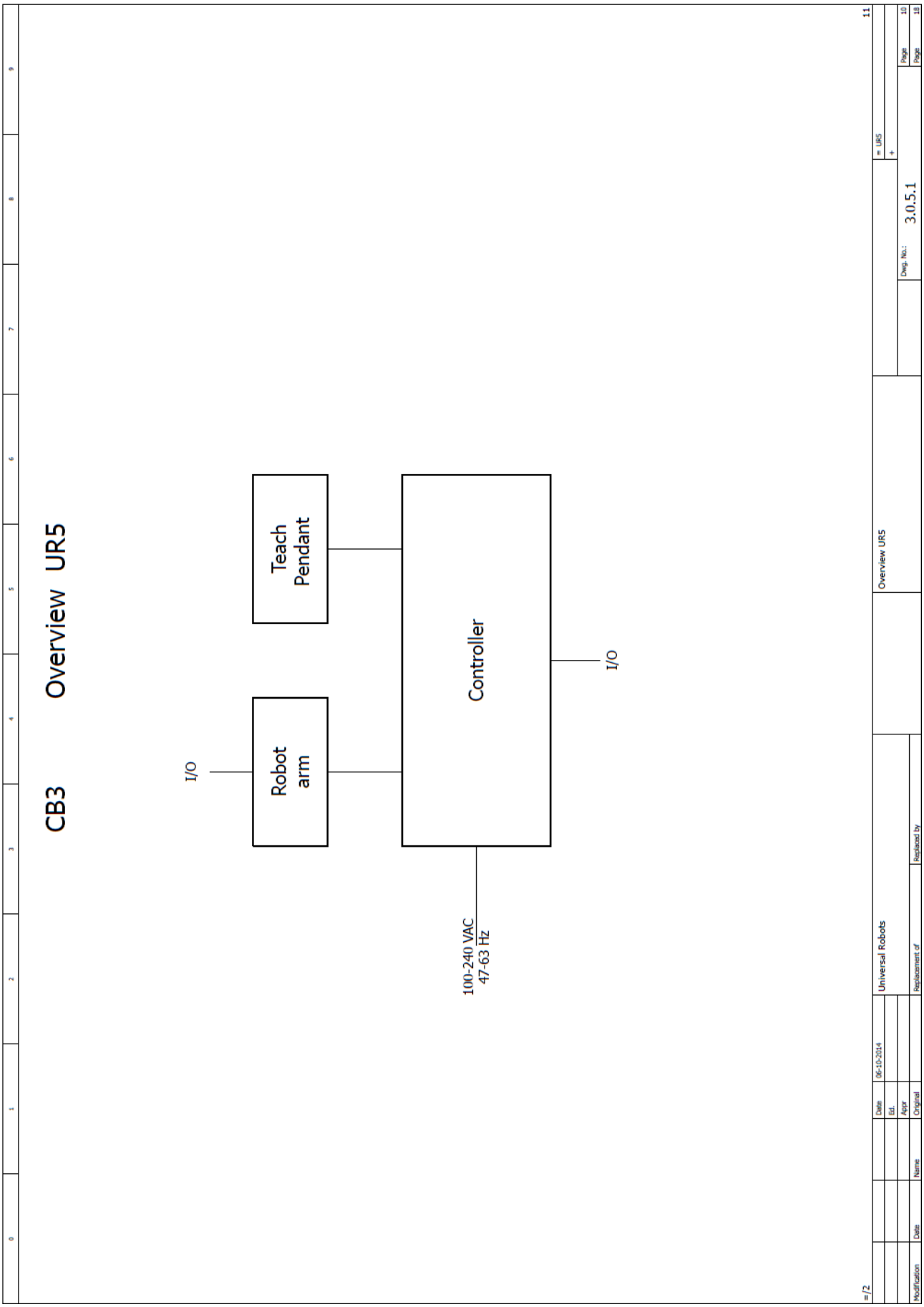
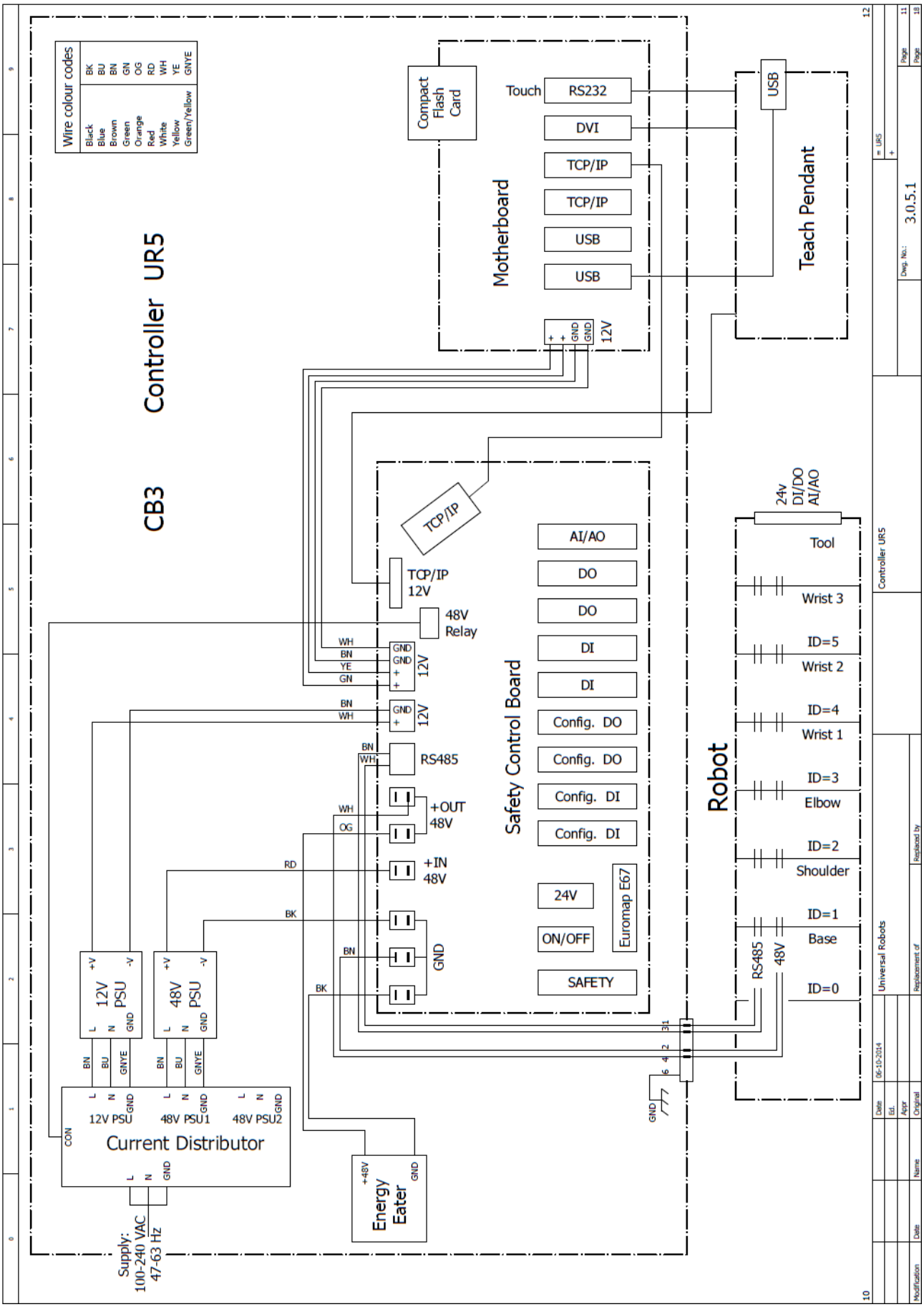
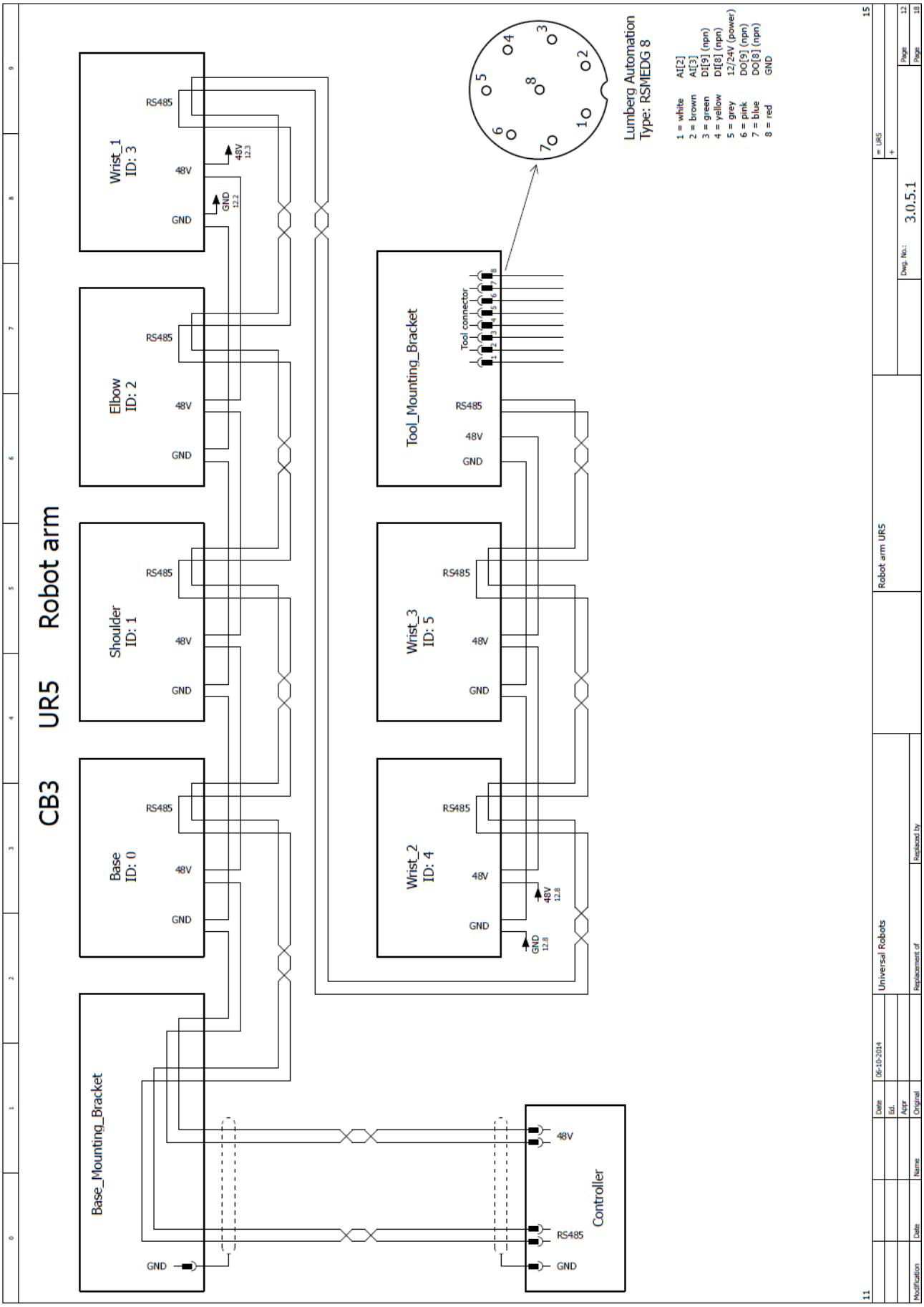
=UR5/10

			Date	06-10-2014	Universal Robots		Table of Contents (index)	=
			Ed.					+
			Appr				Dwg. No.: 3.0.5.1	Page 2
Modification	Date	Name	Original		Replacement of	Replaced by		Page 18

UNIVERSAL ROBOTS

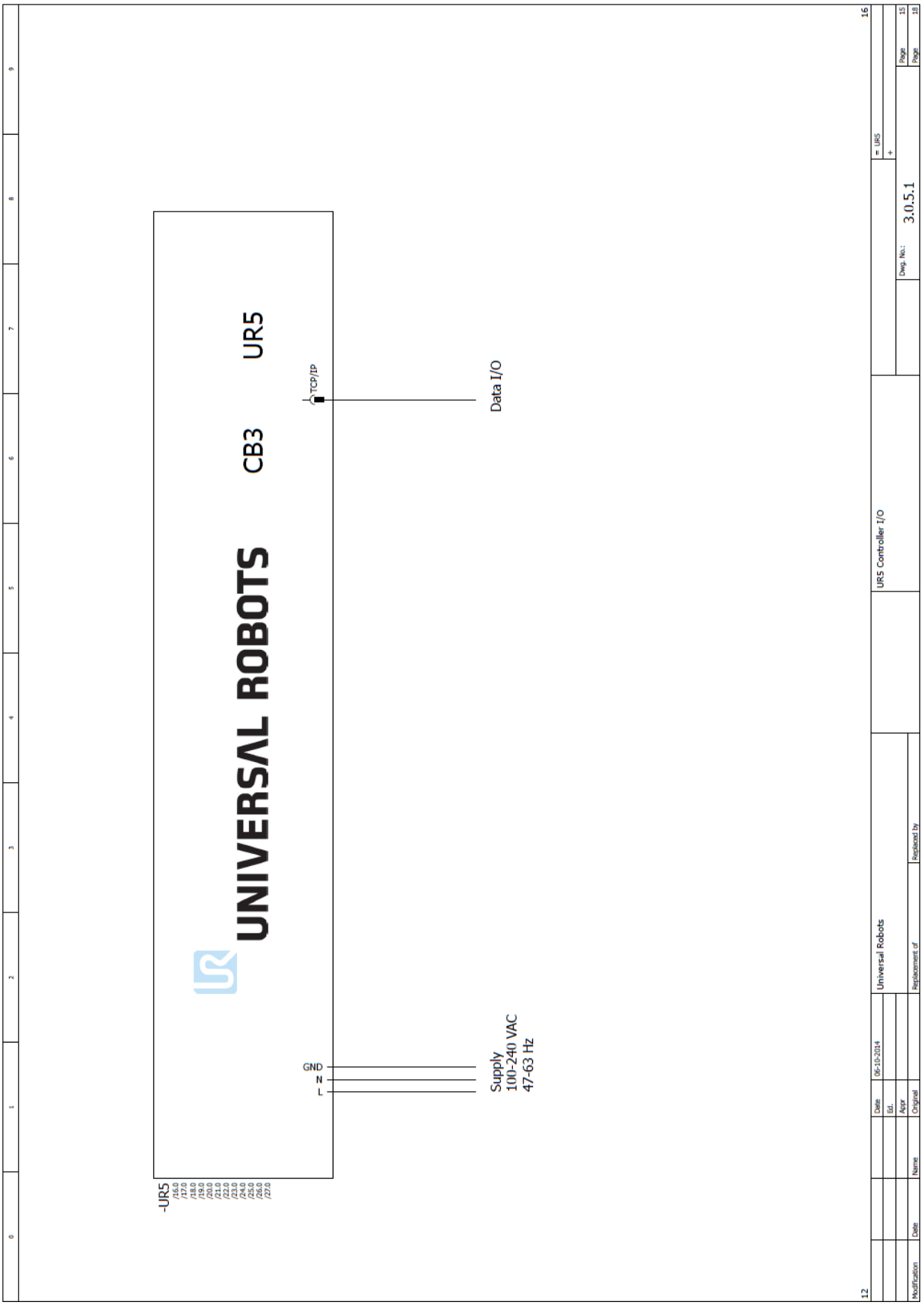

CB3
Overview UR5
Teach Pendant
Robot arm
Controller
I/O
I/O
100-240 VAC
47-63 Hz
Overview UR5
Universal Robots
3.0.5.1

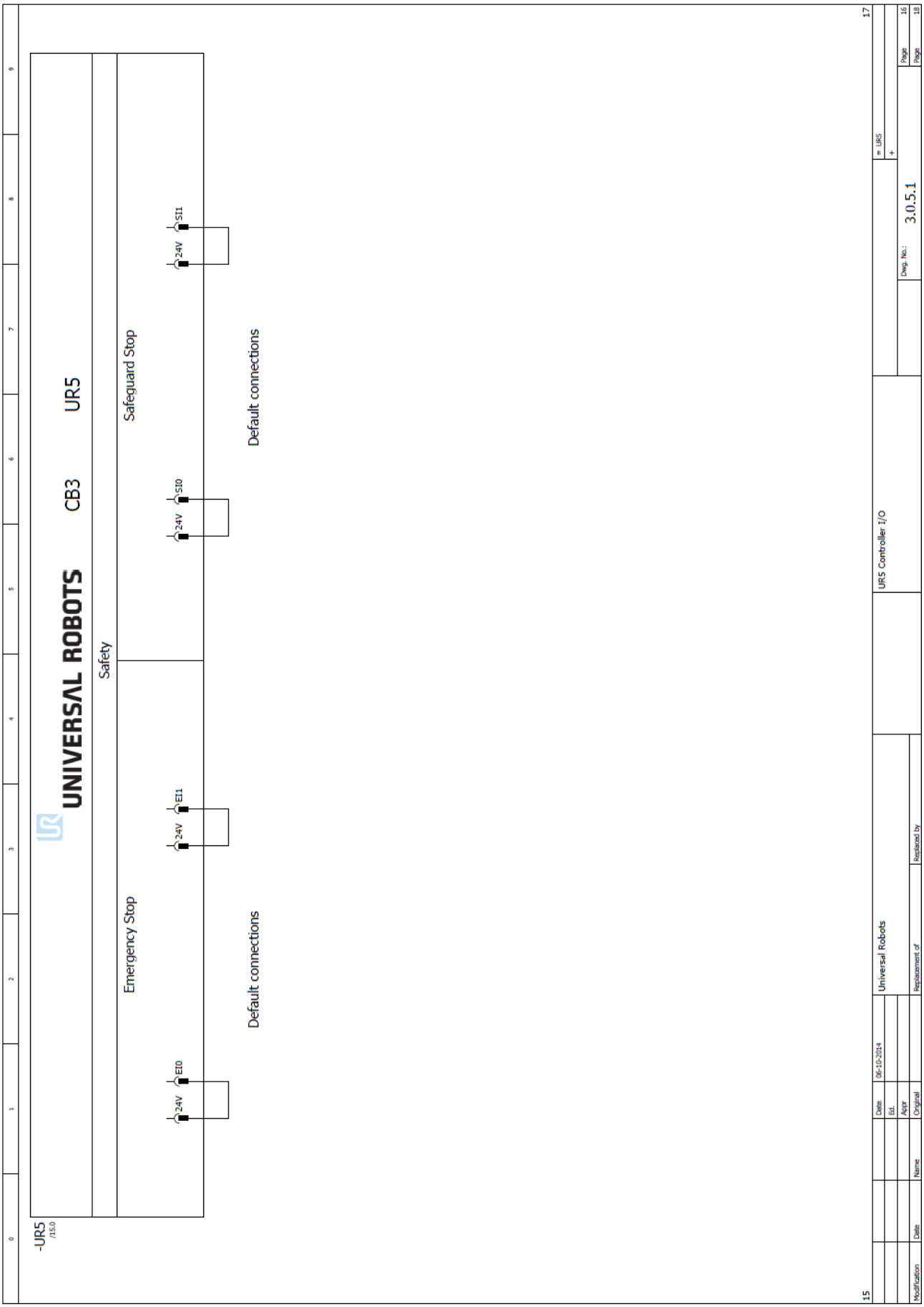

Controller UR5
CB3
Wire colour codes
Black BK
Blue BU
Brown BN
Green GN
Orange OG
Red RD
White WH
Yellow YE
Green/Yellow GNYE
Compact Flash Card
Motherboard
Touch
RS232
DVI
TCP/IP
TCP/IP
USB
USB
12V
USB
Teach Pendant
TCP/IP
TCP/IP 12V
48V Relay
Safety Control Board
AI/AO
DO
DO
DI
DI
Config. DO
Config. DO
Config. DI
Config. DI
24V
ON/OFF
SAFETY
Euromap E67
RS485
+OUT 48V
+IN 48V
GND
24v DI/DO AI/AO
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
Controller UR5
Universal Robots
3.0.5.1

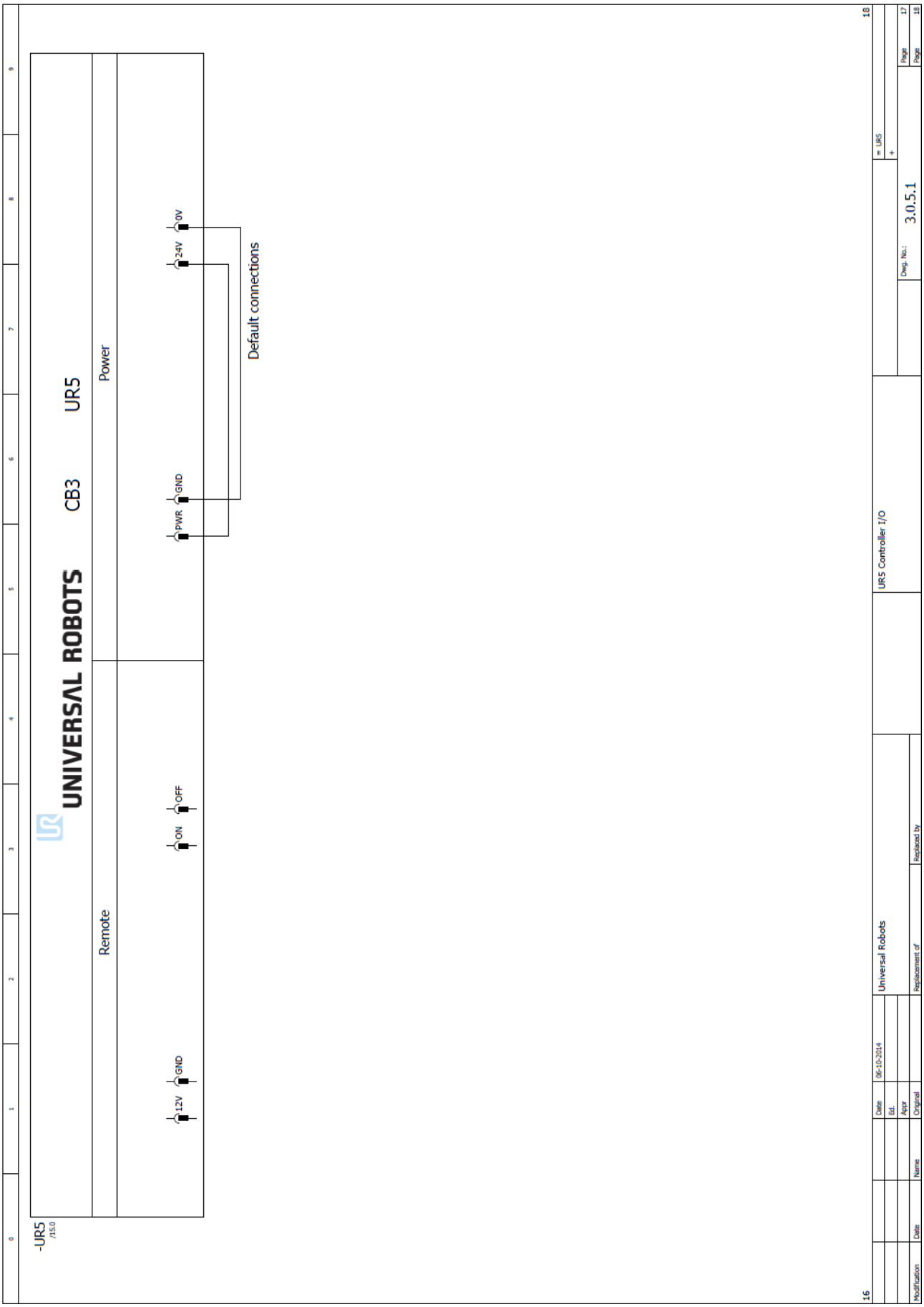

CB3
UR5
Robot arm
Base
ID: 0
Shoulder
ID: 1
Elbow
ID: 2
Wrist_1
ID: 3
Wrist_2
ID: 4
Wrist_3
ID: 5
Tool_Mounting_Bracket
Base_Mounting_Bracket
Controller
RS485
48V
GND
Tool connector
Lumberg Automation
Type: RSMEDG 8
1 = white AI[2]
2 = brown AI[3]
3 = green DI[9] (npn)
4 = yellow DI[8] (npn)
5 = grey 12/24V (power)
6 = pink DO[9] (npn)
7 = blue DO[8] (npn)
8 = red GND
Robot arm UR5
Universal Robots
3.0.5.1

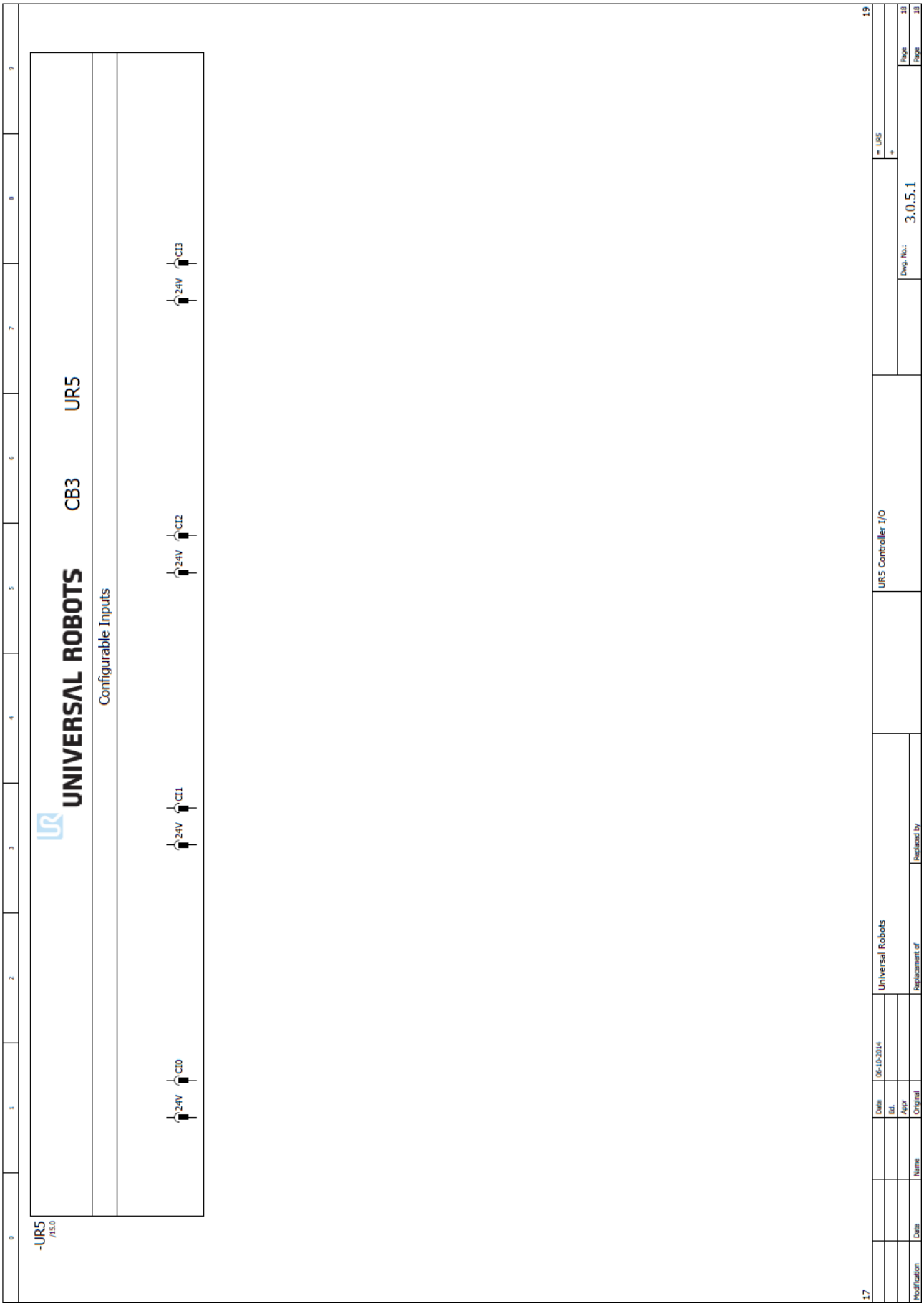
5.4.2 E-Plan diagrams

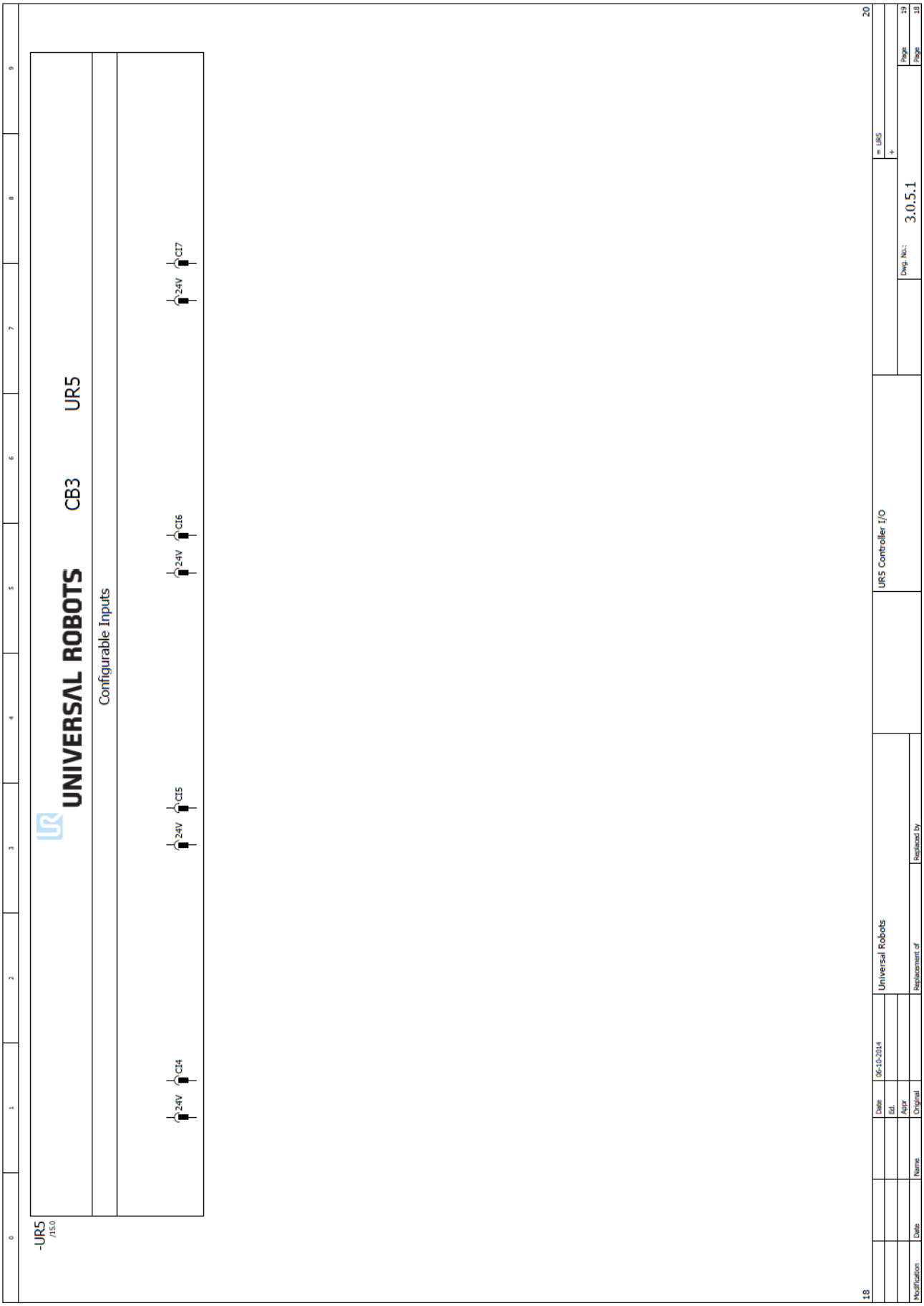
Diagrams in pdf or in E-plan format, can be found on our support platform under the downloads section.

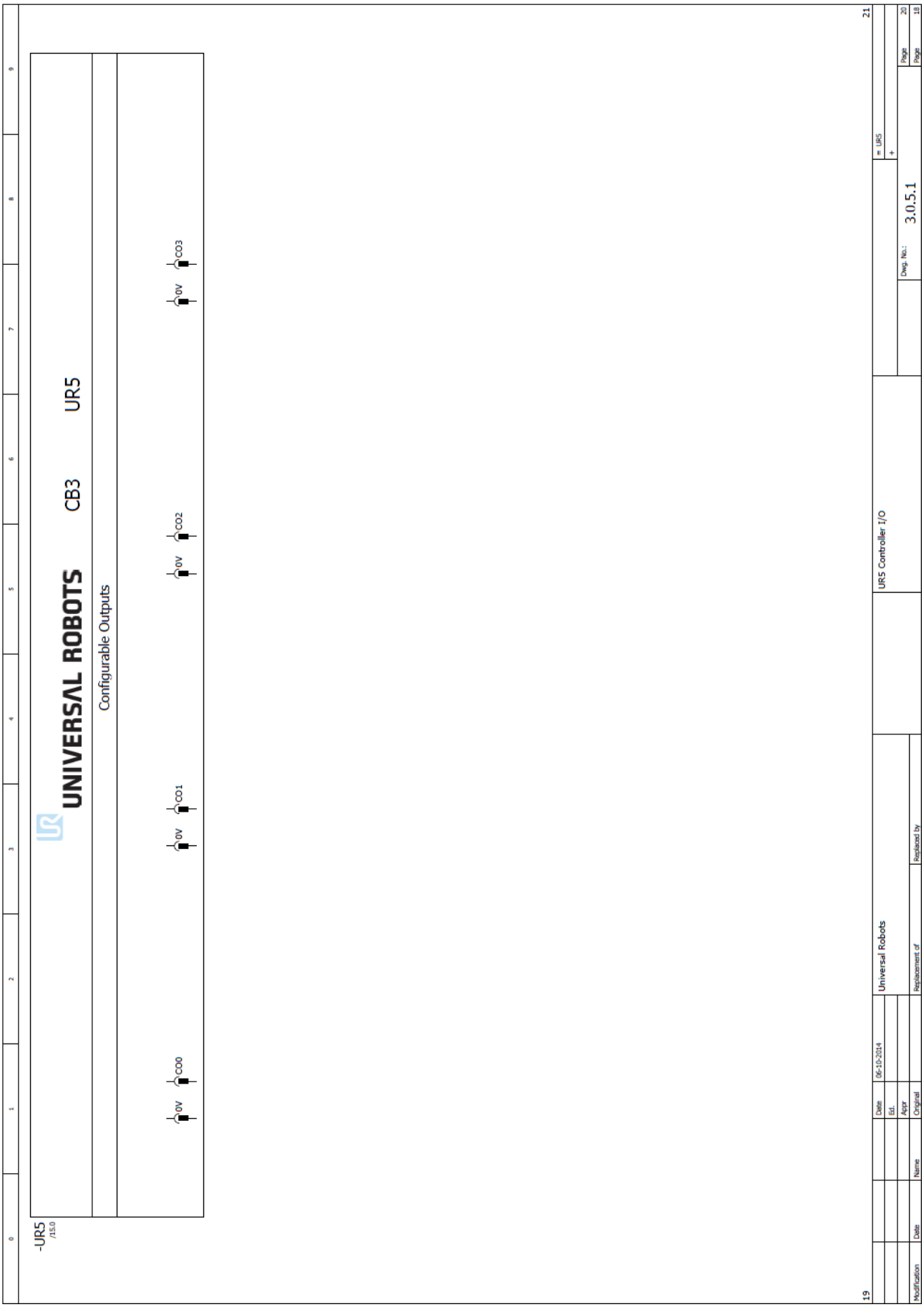


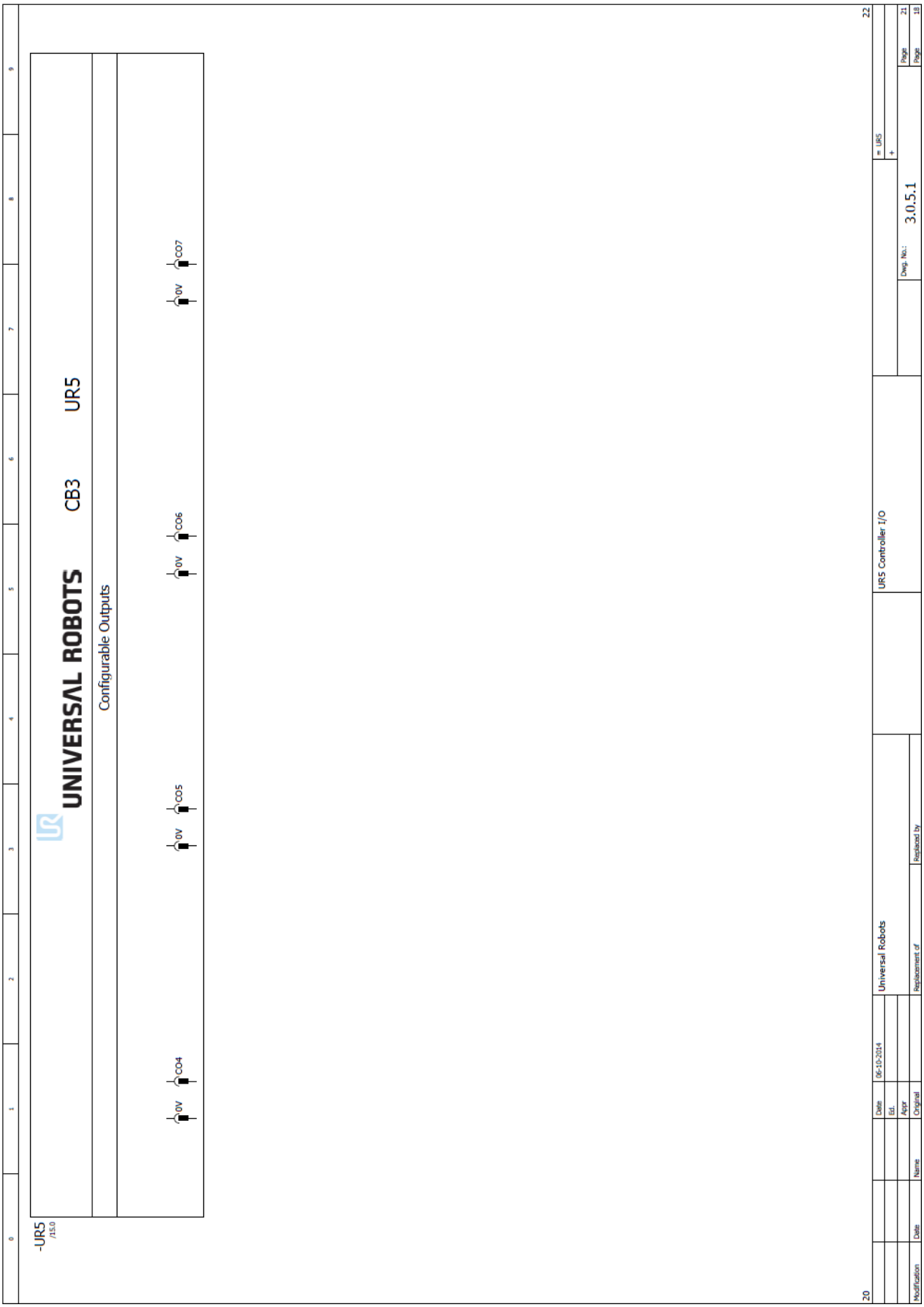

UNIVERSAL ROBOTS
CB3
UR5
Safety
Emergency Stop
Safeguard Stop
EI0
EI1
SI0
SI1
24V
Default connections
Default connections
-UR5
/15.0
UR5 Controller I/O
Universal Robots
3.0.5.1

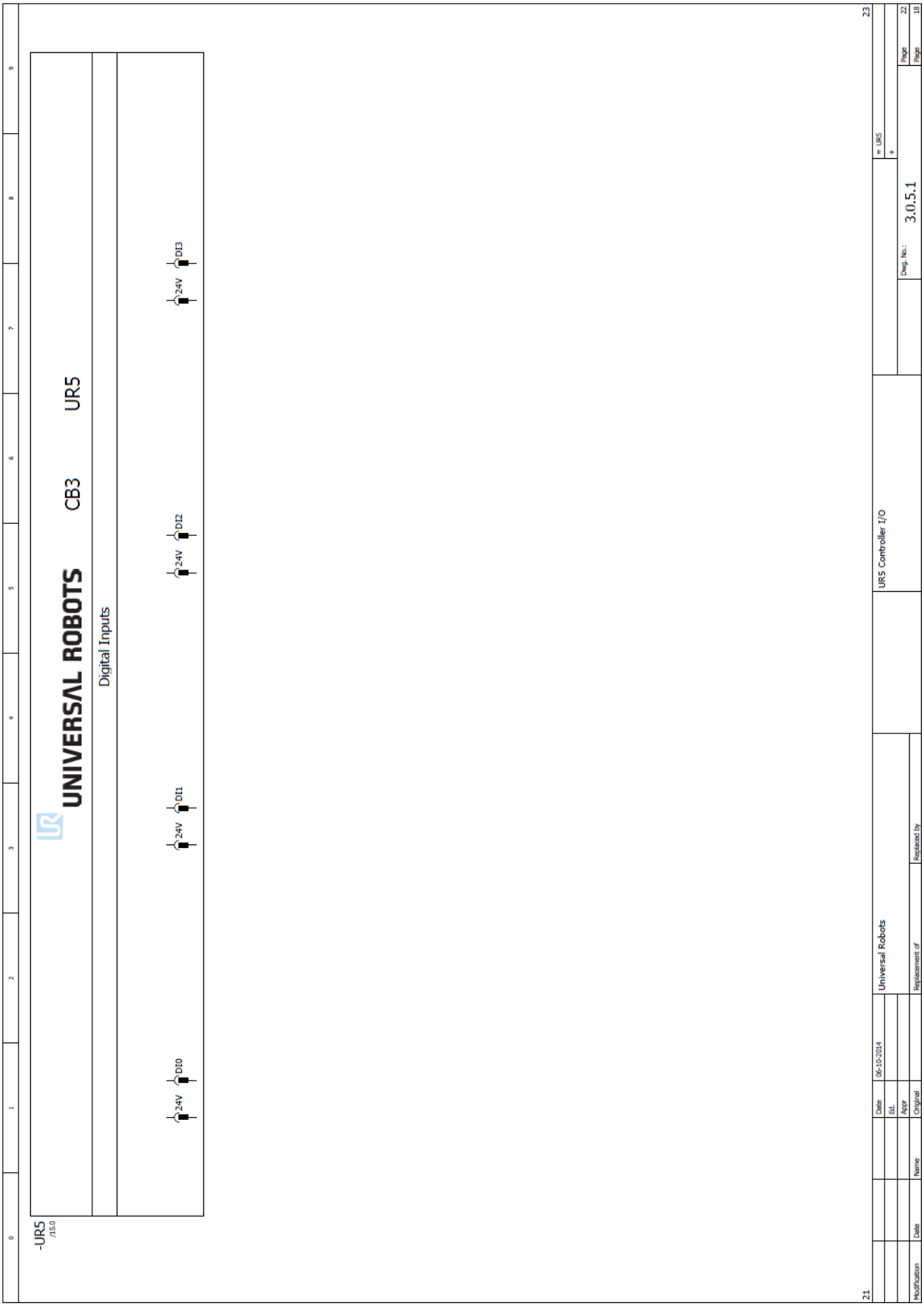

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Power
Remote
0V
24V
GND
PWR
OFF
ON
GND
12V
Default connections
UR5 Controller I/O
Universal Robots
3.0.5.1

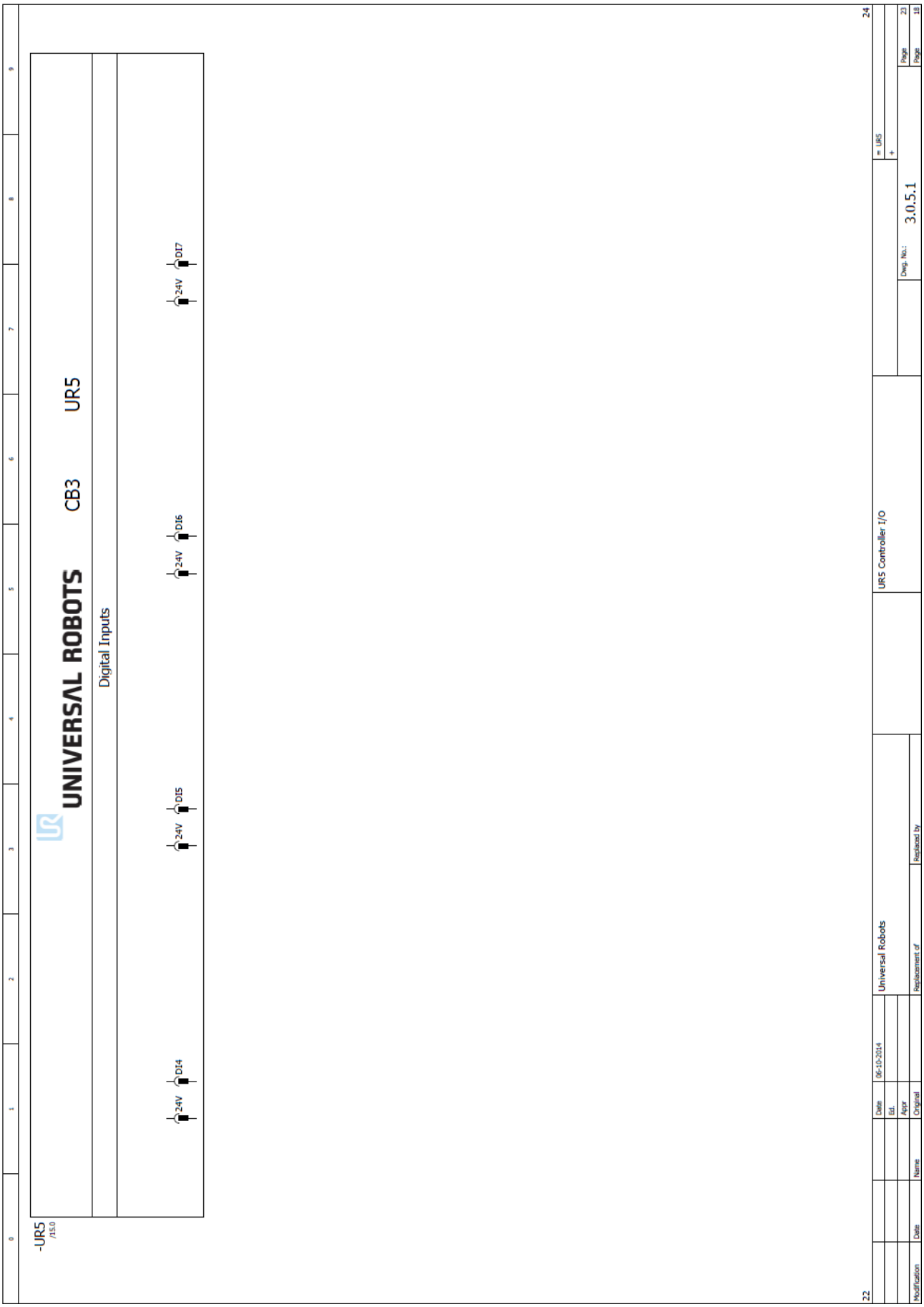

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Inputs
24V
CI0
24V
CI1
24V
CI2
24V
CI3
17
19
Modification
Date
Name
Original
Date
06-10-2014
Ed.
Appr
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
18
Page
18

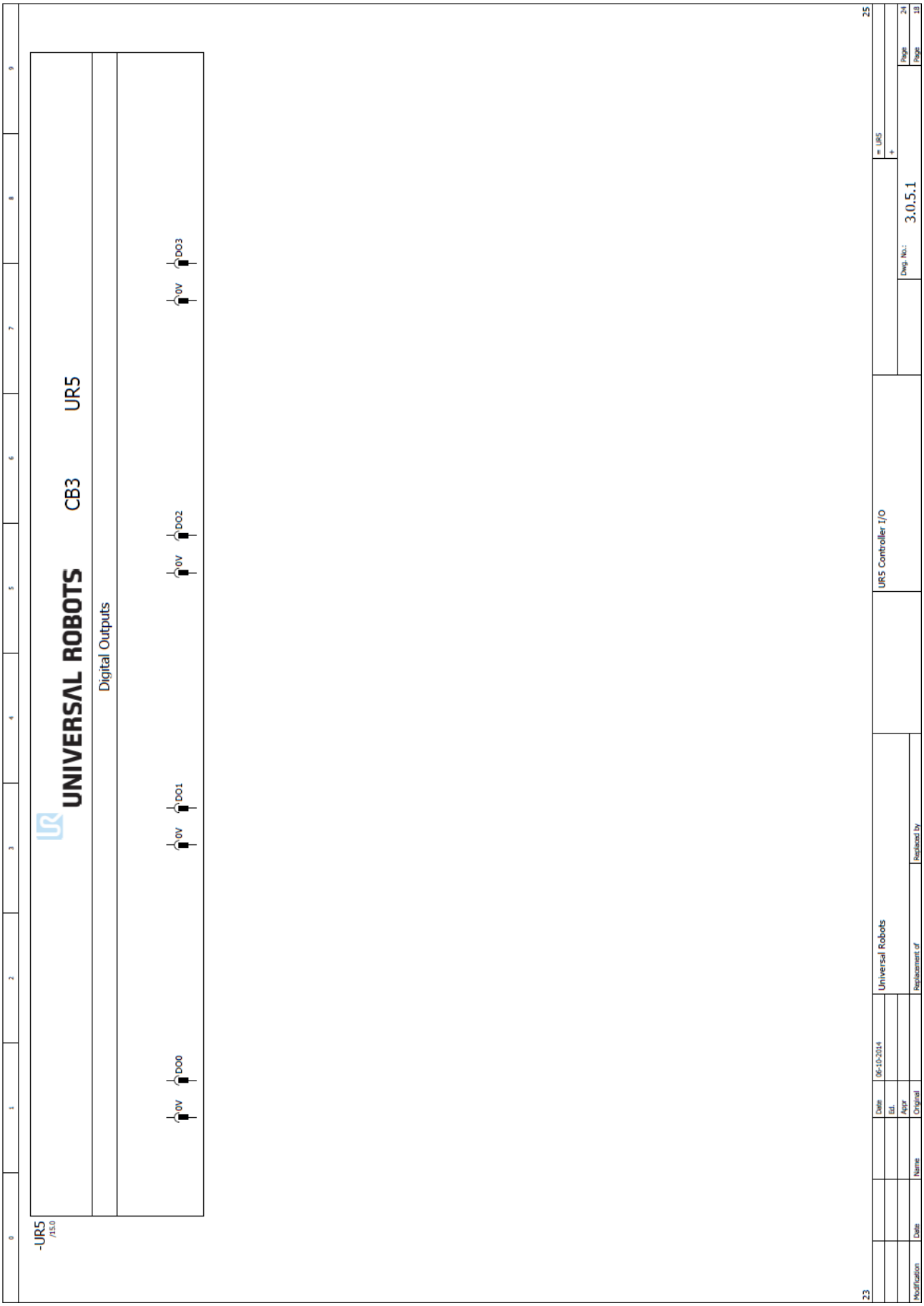

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Inputs
24V
CI4
24V
CI5
24V
CI6
24V
CI7
18
20
Date
06-10-2014
Ed.
Appr
Original
Name
Date
Modification
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
19
Page
18

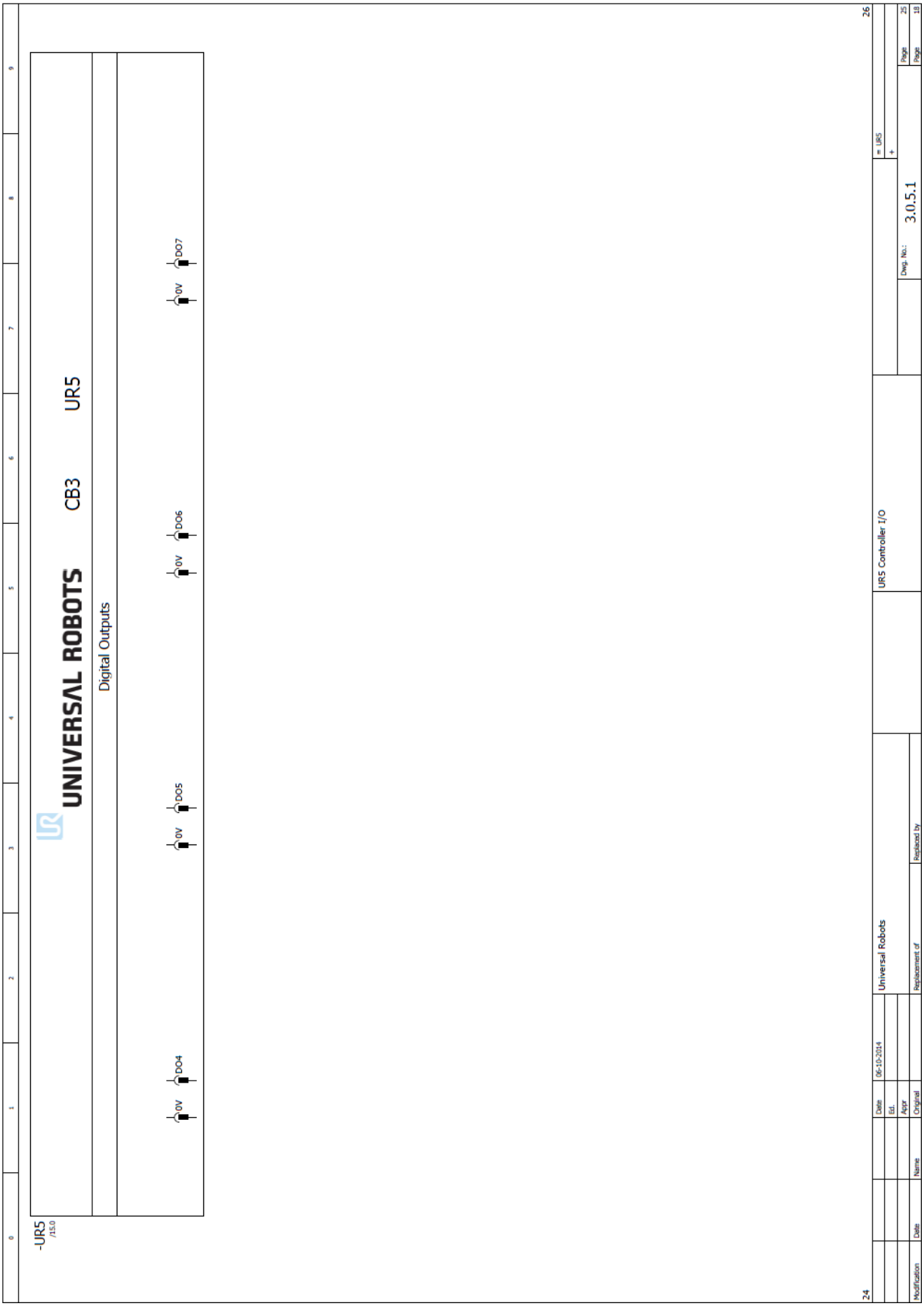

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Outputs
0V
CO0
0V
CO1
0V
CO2
0V
CO3
19
21
Modification
Date
Name
Original
Appr
Ed.
Date
06-10-2014
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
20
Page
18

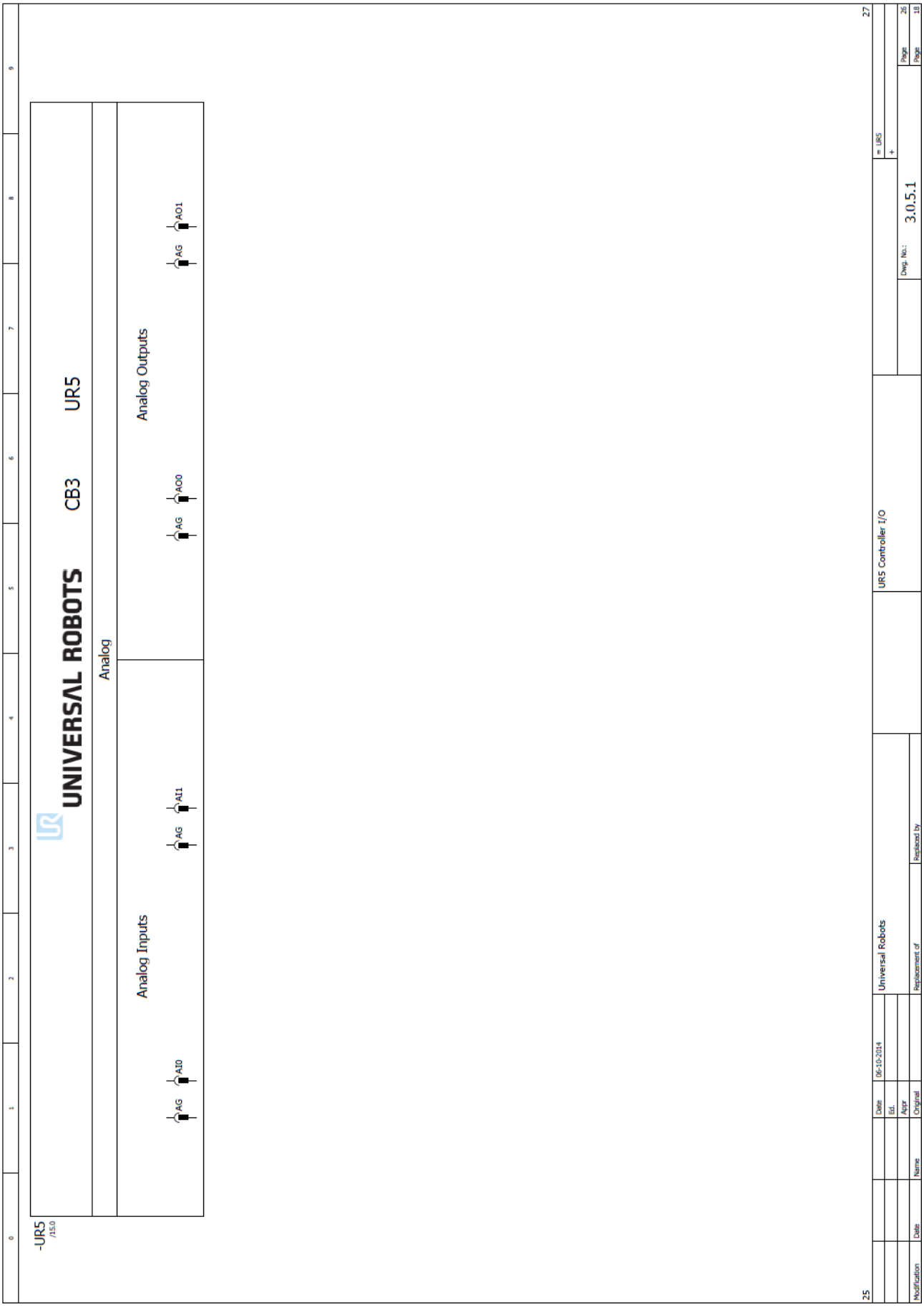

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Configurable Outputs
0V
CO4
0V
CO5
0V
CO6
0V
CO7
20
22
Modification
Date
Name
Original
Date
Ed.
Appr
06-10-2014
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
21
Page
18

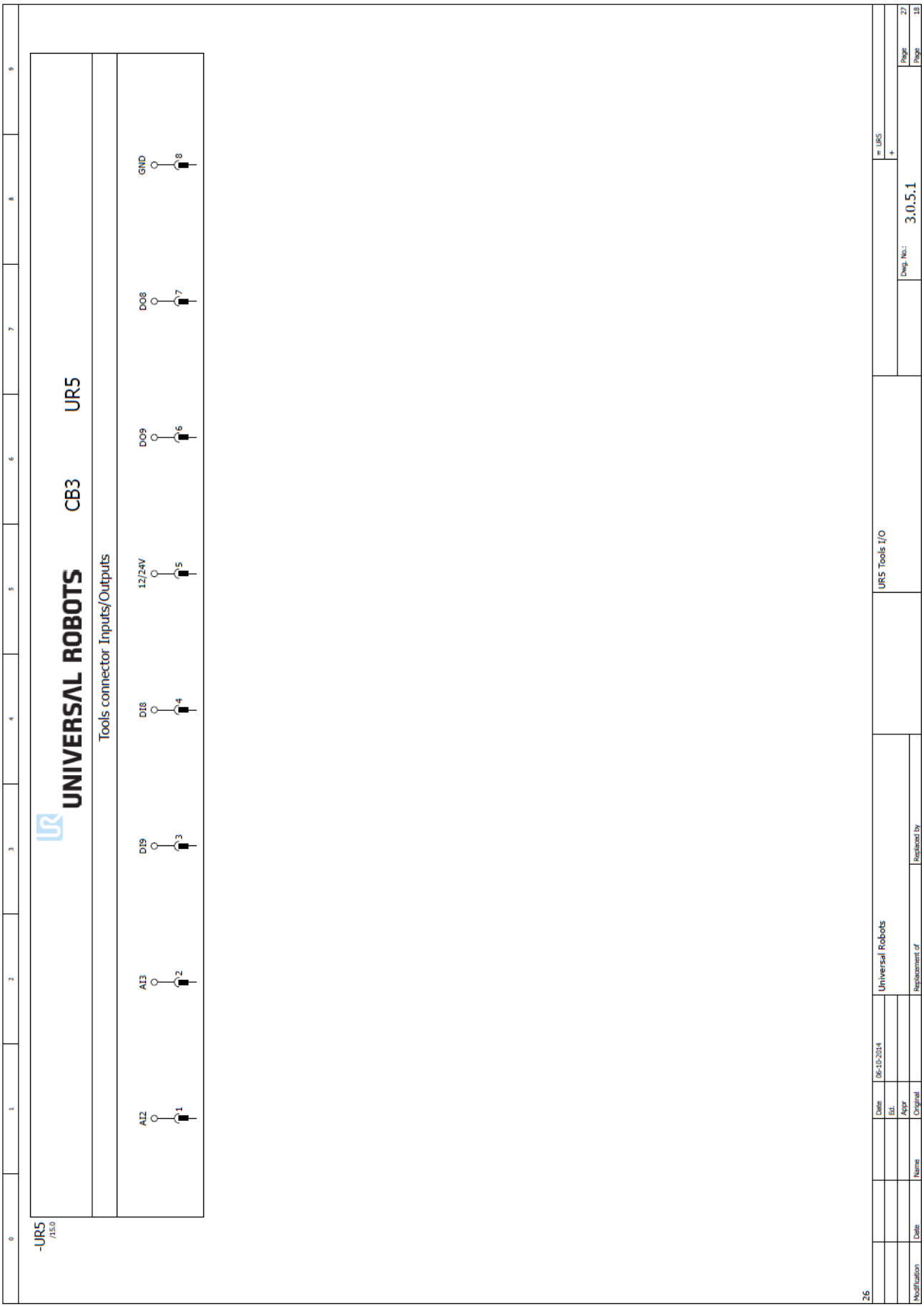

-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Digital Inputs
24V
DI0
24V
DI1
24V
DI2
24V
DI3
21
23
Date
Ed.
Appr
Original
06-10-2014
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
Page
22
18
Modification
Date
Name


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Digital Inputs
24V
DI4
24V
DI5
24V
DI6
24V
DI7
22
24
Universal Robots
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
23
Page
18
Date
06-10-2014
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by


UNIVERSAL ROBOTS
CB3
UR5
Digital Outputs
-UR5
/15.0
0V
DO0
0V
DO1
0V
DO2
0V
DO3
UR5 Controller I/O
Universal Robots
Date
Ed.
Appr
Original
Name
Date
Modification
Replacement of
Replaced by
Dwg. No.:
3.0.5.1
= UR5
+
Page
Page
23
25


UNIVERSAL ROBOTS
CB3
UR5
Digital Outputs
-UR5
/15.0
0V
DO4
0V
DO5
0V
DO6
0V
DO7
24
26
Universal Robots
UR5 Controller I/O
= UR5
3.0.5.1
Dwg. No.:
Page
25
Page
18
Modification
Date
Name
Original
Appr
Ed.
Date
06-10-2014
Replacement of
Replaced by


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Analog
Analog Inputs
AG
AI0
AG
AI1
Analog Outputs
AG
AO0
AG
AO1
25
27
Date
Ed.
Appr
Original
06-10-2014
Universal Robots
Replacement of
Replaced by
UR5 Controller I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
Page
26
18
Modification
Date
Name


-UR5
/15.0
UNIVERSAL ROBOTS
CB3
UR5
Tools connector Inputs/Outputs
AI2
1
AI3
2
DI9
3
DI8
4
12/24V
5
DO9
6
DO8
7
GND
8
26
Modification
Date
Name
Original
Appr
Ed.
Date
06-10-2014
Universal Robots
Replacement of
Replaced by
UR5 Tools I/O
= UR5
+
Dwg. No.:
3.0.5.1
Page
27
Page
18

6 Spare parts

6.1 Spare part list

Item no.	Item designation
Controller:	
122905	Controller incl. Teach Pendant UR5
122900	Controller excl. Teach Pendant UR5
122091	Teach Pendant incl. Touch Screen & power cable UR5 & UR10
180001	Stylus Pen
171021	Flash card
122600	Motherboard kit
172290	Safety Control board kit
177002	Power Supply Unit 12V
177003	Power Supply Unit 48V
172080	Current Distributor PCB
122745	Energy-eater incl. fan CB3
164219	Wire bundle controller output UR5
171030	RAM module
177503	Filter kit for controller
106800	Euromap E67 kit CB3
122671	Euromap E67 Bypass Plug
122673	Euromap E67 module CB3
123670	Euromap E67 cable 6 m
Robot arm:	
111105	UR5 robotarm stand-alone CB3
122050	Base Mounting Bracket incl. Cable 6 m UR5
122123	Joint Size 3 Base UR5
122223	Joint Size 3 Shoulder UR5
122323	Joint Size 3 Elbow UR5
123100	Elbow counterpart and Lower arm kit UR5
122121	Joint Size 1 Wrist 1 UR5
122221	Joint Size 1 Wrist 2 UR5
122321	Joint Size 1 Wrist 3 UR5
122041	Tool Mounting Bracket UR5
103305	Sealing set UR5, external. Visible flat rings between joints
103405	Lid set complete UR5 incl. seal in the lid
Asessories:	
173100	Cable for tool: external

131099	Lid Tool protective cap Alu. For tool connector
139033	Bracket for Mounting Teach Pendant
132407	Bracket for Mounting Controller
107000	Safety Control board Terminal kit
131501	Bracket for mounting robot arm UR5 (Item profile)
131502	Bracket for mounting robot arm UR5 (Bosch profile)

6.2 Service kit

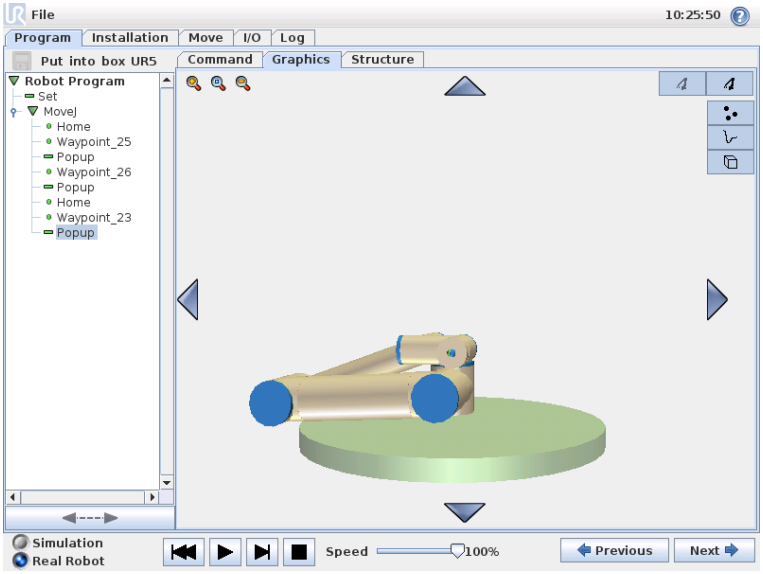
Item no.	Item designation	
109010	Service kit UR5/UR10	(kit includes all of the below part no.'s)
109101	Spanner Hex 5.5mm	UR5 & UR10
109102	Spanner Hex 7.0mm	UR5 & UR10
109110	Spanner Hex 10.0mm	UR10 only
182200	Screwdriver Flat 2.5	UR5 & UR10
109103	Screwdriver torx T10	UR5 & UR10
109105	Torque wrench Hex 5.5mm Size 1 and Size 2 (1.3 Nm)	UR5 & UR10
109106	Torque wrench Hex 7.0mm Size 3 (3.0 Nm)	UR5 & UR10
109107	Torque wrench Hex 10.0mm Size 4 (8.0 Nm)	UR10 only
109104	Torque screwdriver torx T10 (0.4 Nm)	UR5 & UR10
164084	Bypass cable (for setting joint-ID)	UR5 & UR10
109180	ESD wrist strap	UR5 & UR10

7 Packing of robot

Packing of robot and controller box for shipment

- Remove any external tooling and external electrical connections.

- Load program *Put_into_box_ur5.urp* and follow instructions while removing mounting bolts.



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

Note: If robot cannot run or power is not available, it is possible to manually release the brakes for each joint individually and pack the robot accordingly. For brake release, see chapter 3.1.2.

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

- Pack robot arm and Controller box in designated boxes.

8 Changelog

8.1 Changelog

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.