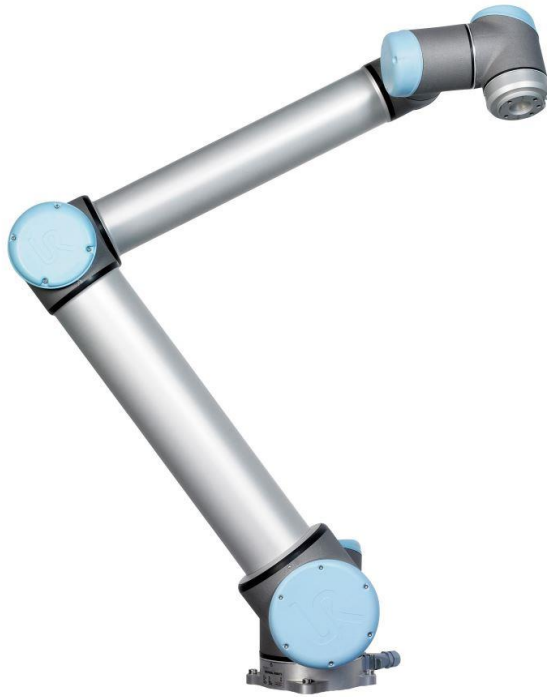




UNIVERSAL ROBOTS

UR Robots with Battery Supply

Installation guide



UR3, UR5 & UR10 (CB3)

Original Guide (en)



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Revision history

Revision	Description	Date	Responsible
A	First revision	June 2014	TDS
B	Changed wording in several paragraphs	December 2014	UN
2.0.1	Added UR3 support. Removed erroneous standby-functionality.	November 2015	TDS

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1 Introduction

- This document provides guidelines for implementation on applications with battery supply.
- It is solely intended for advanced integrators of UR robots.
- This document is not public information. It shall be considered confidential by the integrator, and thus shall be handled as such.
- Copies of this document or parts of this document are allowed by the integrator, for documentation purposes only.
- Before carrying out the rebuild of the controller (and thus voiding the warranty of the product), consider the possibility of placing a 48VDC-230VAC inverter in front of the normal unmodified UR controller.
- If remote ON/OFF functionality is required, i.e. turning off the robot without the use of the teach pendant, a detailed description of the implementation can be found in section 5.3.7 of the UR user manual.



WARNING:

1. Internal parts are easily damaged during the battery supply implementation process. The battery supply implementation voids the warranty of the controller and teach pendant including all original components. The warranty remains on the robot arm.
2. Read and understand the UR user manual before using this guide. Special attention shall be paid to safety, maintenance and repair precautions.
3. The battery supply implementation is not within intended use and voids the Safety System Certificate and the EMC Test Certificate
4. Always perform a thorough risk assessment for the specific application.
5. Universal Robots disclaims any liability, even though all guidelines contained within this document are followed.
6. The instructions in this document shall be considered as general guidelines. Universal Robots in general does not support technical questions regarding battery supply solutions. It is assumed that the integrator has a high level of technical knowledge.
7. Incorrect grounding and/or chassis connections can cause unpredictable behavior and in some cases damage the robot or its components. The grounding guidelines in this document must be followed closely.
8. Observe ESD precautions when handling the electronics.
9. Consult the safety section in the UR user manual for general precautions.

2 Guidelines

This guideline is based on 24V or 48V battery supply. The numbers in the list below corresponds to the numbers outlined in the wiring diagrams present on the following pages. Guidelines for connectors, crimps and troubleshooting can be found after this chapter.

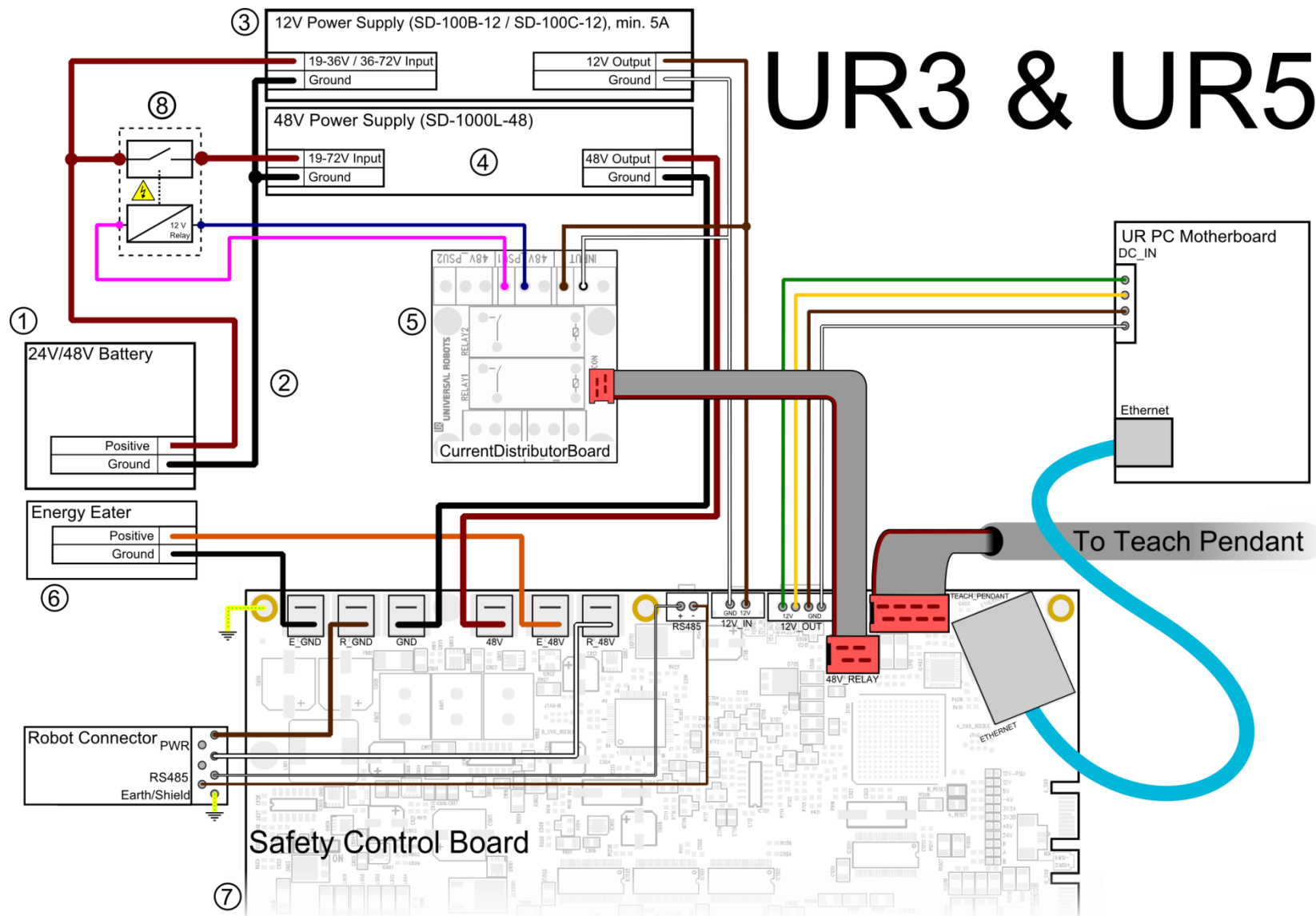
1. The battery must have a low internal resistance. The voltage must not drop below 19V at any point during operation. Note that the UR3 can draw up to 25A, UR5 can draw up to 50A, and the UR10 can draw up to 100A at peak conditions.
2. Adhere to the following guidelines when connecting the power supplies:
 - Use worst case conditions (i.e. minimum voltage, maximum power) when deciding upon cable gauge.
 - Use as short cables as possible.
 - In case a fuse is used, it shall have an extremely low resistance.
3. The 12V power supply supplying the Safety Control Board must fulfill the following requirements:
 - Max. voltage tolerance +/- 1%
 - Current rating of min. 5A.
 - Power supply recommended for 24V battery: Meanwell SD-100B-12 (RS Part no.: 491-241)
 - Power supply recommended for 48V battery: Meanwell SD-100C-12 (RS Part no.: 491-239)
4. Regulated DC-DC power supplies are mandatory, as the voltage from batteries vary too much. 48V power supply/supplies that fulfill the requirements below must be used:
 - Max. voltage tolerance of +/- 1%, including output voltage swing.
 - Current rating of min. 21A.
 - The power on- and off-times are critical for correct operation, as the Safety Control Board shall be able to turn the power supplies ON and OFF.
 - Power supply recommended: Meanwell SD-1000L-48 (RS Part no.: 678-3672)
5. The 48V power supply shall be controllable by the Safety Control Board. This is tested during startup and is used by the safety system. It is NOT possible to use a single 2 kW power supply in UR10, as the power supplies are tested individually during startup. The relays on the CurrentDistributorBoard are used to drive the high power relay(s).
6. The resistors on the Energy Eater may become very hot during operation. Ensure that the energy eater is placed in a well-ventilated area away from heat-sensitive components.
7. The Safety Control Board shall be mounted on a metal plate, and all screw holes shall be used. These screws act as strain reliefs, as well as heat-conductors. A proper GND/chassis connection shall be provided in the upper left corner as shown. Necessary safety-measures and emergency buttons shall be connected in accordance with the supplied UR3/UR5/UR10-manual.
8. The relays for the 48V power supplies shall be able to make/break a very high DC current (1000 W per relay, at down to 19V for the low voltage battery, resulting in > 50 A). Omron G9EA1B12DC (RS Part no.: 684-0309) is recommended for this application.

The parts mentioned with part numbers in this document can be ordered from:

RS Online: <http://www.rs-online.com>

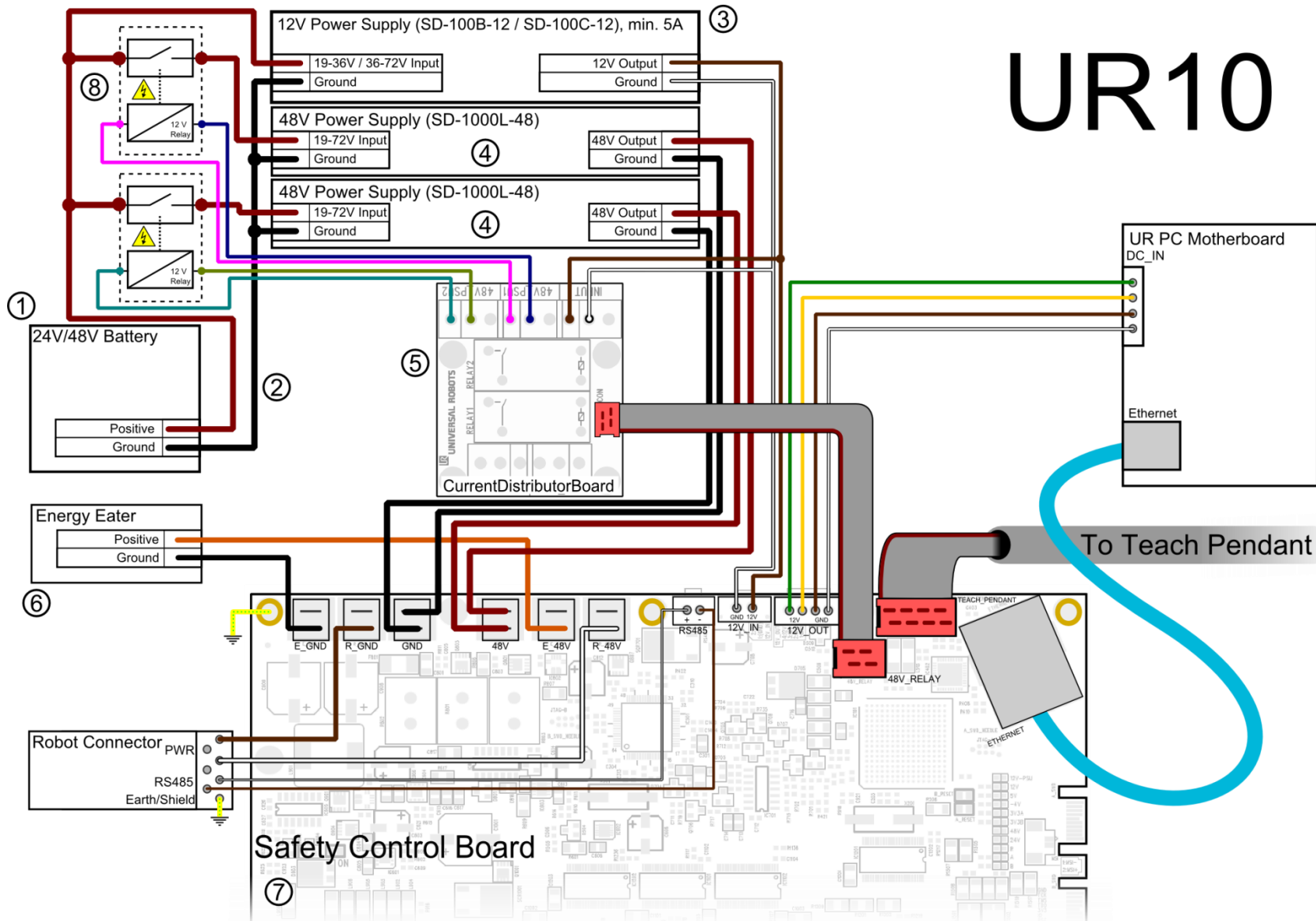
Farnell: <http://www.farnell.com>

3 Schematic overview UR3 & UR5



4 Schematic overview UR10

UR10



5 Troubleshooting

Symptom	Possible Cause(s)
Power button does not turn green when the power button is pushed	• 12V on Safety Control Board is absent • 12V voltage reverse polarity • 12V short circuited
Fails during power-up	• Energy eater revision F or earlier • Safety Control Board firmware version lower than 1.51 • Teach pendant connected incorrectly • The 48V power supply (including its control wires) may be connected incorrectly • 48V voltage reverse polarity
Error: Wrong robot type	• UR10: Only one power supply is connected • UR3 & UR5: Two power supplies are connected
Fails during operation	• The input-voltage for the 48V supplies drops below 19V • RS485 connected incorrectly
Error: Short circuit in robot detected	• Reverse polarity for robot supply • Reverse polarity for energy eater
System seems unstable	• 12V power supply unstable • 48V power supplies unstable • Voltage supplies not within +/- 1% tolerance • Incorrect grounding (this may be caused by ground-loops, or loose screws)

For general troubleshooting please consult the service manual located at:

www.universal-robots.com/support

Universal Robots in general does not support technical questions regarding battery supply solutions.

6 Connectors and crimps

The locations in the following table correlates to the connectors marked in the figure on the bottom of this page. The connectors suggested in the table are the ones used in the original robot assembly.

Loc.	Description	Manufacturer	MFG Part No.	DigiKey Part No.
1	Female cable crimps	TE Connectivity	2-520401-2	A27846CT-ND
2	RS485 terminal	Molex	50-57-9202	WM5363-ND
	- Matching crimps		16-02-1111	WM2570CT-ND
3	12V input terminal	Molex	43645-0200	WM1845-ND
	- Matching crimps		43030-0003	WM2776CT-ND
4	12V output terminal	Molex	50-57-9204	WM5364-ND
	- Matching crimps		16-02-1111	WM2570CT-ND
5	48V relay terminal	TE Connectivity	338095-4	A99417-ND
	- Matching crimps		1-338097-1	A99491CT-ND
6	Teach pendant term.	TE Connectivity	338095-8	A99415-ND
	- Matching crimps		1-338097-1	A99491CT-ND
7/8	Ethernet cable	CAT5E cable, w./ straight, 30u" gold plated RJ45 conn. recommended (0.76µm)		
9	12V input terminal	Molex	22-01-2045	WM2614-ND
	- Matching crimps		0850-0031	WM2625CT-ND
10	Screw terminals	Suitable ferrule for the chosen cable gauge		
14	Robot connector	Conventional industrial connector, silver plated crimps, e.g. Lapp Group EPIC		

