OPT/i RI IO TWIN RET

EN-US

Operating instructions

Robot option

42,0426,0380,EA 002-17122020

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General

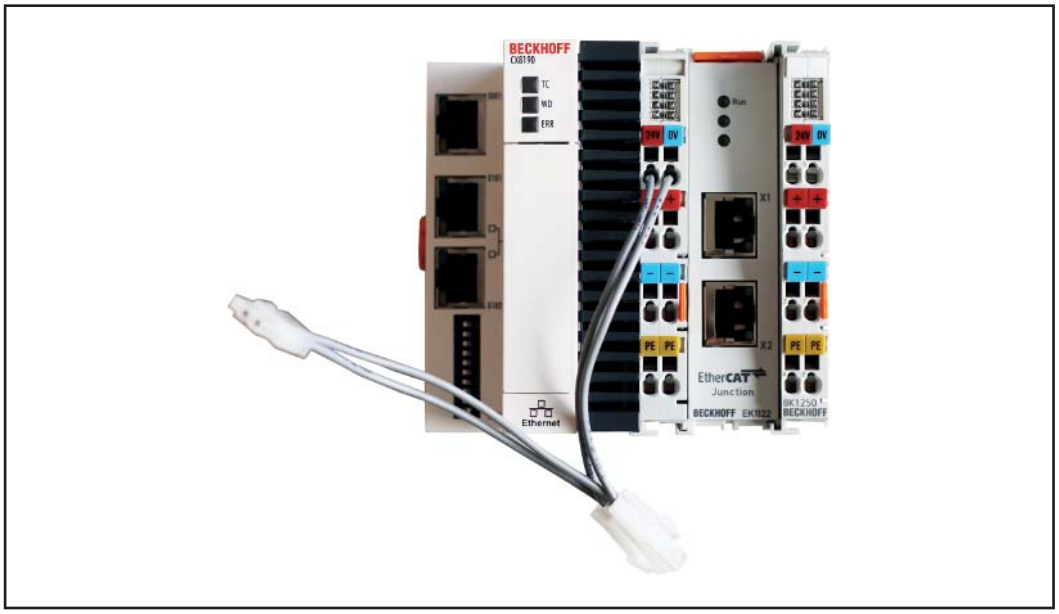
Device concept

With the robot interface OPT/i RI IO TWIN RET, interfaces 4,100,397 and 4,100,398 can be converted for operation with a TPS/i power source.

The OPT/i RI IO TWIN robot interface converts digital and analog inputs and outputs to EtherCAT.
This allows robot control units with digital and analog inputs and outputs to be connected to a TPS/i TWIN welding system.

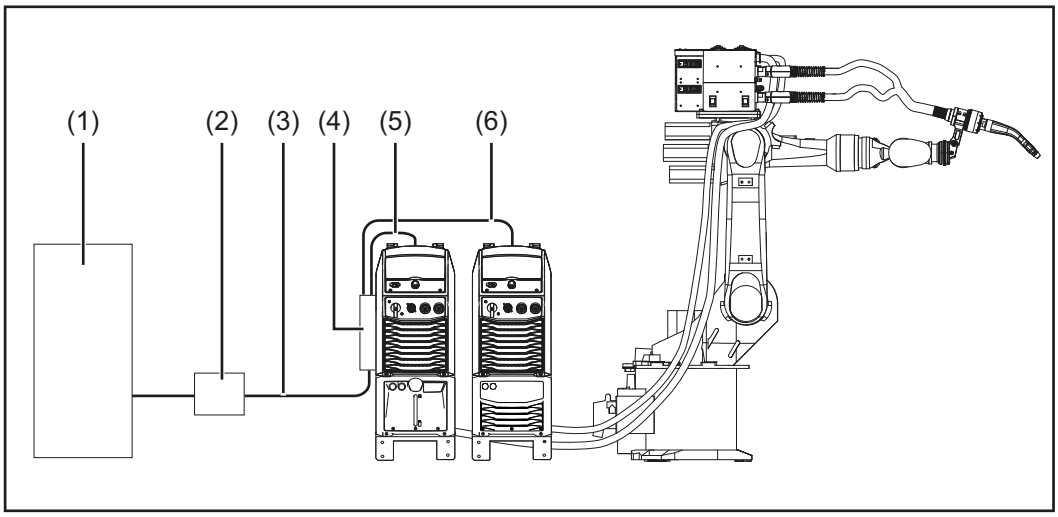
The interface is available in the versions listed below.

4,044,054 **OPT/i RI IO TWIN RET Job**	**4,044,055** **OPT/i RI IO TWIN RET Synergic/Job**
Used for conversion of 4,100,397 for internal mode and job mode	Used for conversion of 4,100,398 for internal mode, job mode and characteristic selection with specification of set values and corrections possible



4,044,054 and 4,044,055

System overview



(1)	**Robot controls**
(2)	**OPT/i RI IO TWIN RET**
(3)	**EtherCat-cable between RI FB PRO/i TWIN Controller and OPT/i RI IO TWIN RET**
(4)	**RI FB PRO/i TWIN Controller**
(5)	**SpeedNet-cable between RI FB PRO/i TWIN Controller and power source 1**
(6)	**SpeedNet-cable between RI FB PRO/i TWIN Controller and power source 2**

System requirements

To operate the interface, the following components must be present in the TPS/i welding system:
- RI FB PRO/i TWIN Controller
- RI MOD/i CC EtherCAT (built into the RI FB PRO/i TWIN Controller)

Scope of supply

The scope of supply is made up of the following components:
- Interface OPT/i RI IO TWIN RET (in different versions)
- EtherCAT-cable, for connection to the Twin Controller
- This document
- DIN rail, for mounting the interface in the automatic or robot switch cabinet
- EtherCAT-cable, for connection to the RI FB PRO/i TWIN Controller

Safety

⚠ WARNING!

Danger from incorrect operation and work that is not carried out properly.
Serious injury and damage to property may result.
- ▶ All the work and functions described in this document must only be carried out by trained and qualified personnel.
- ▶ Read and understand this document.
- ▶ Read and understand all the Operating Instructions for the system components, especially the safety rules.

⚠ WARNING!

Danger from unplanned signal transmission.
Serious injury and damage to property may result.
▶ Do not transfer safety signals via the interface.

Technical data and environmental conditions

Technical data

Supply voltage	+ 24 V (-15 % / +20 %)

Environmental conditions

⚠ **CAUTION!**

Danger from prohibited environmental conditions.
This can result in severe damage to equipment.
▶ Only store and operate the device under the following environmental conditions.

Temperature range of ambient air:
- during operation: -25 °C to 60 °C (-13 °F to 140 °F)
- during transport and storage: -25 °C to 60 °C (-13 °F to 140 °F)

Relative humidity:
- up to 50 % at 40 °C (104 °F)
- without condensation up to 95 % at 20 °C (68 °F)

Ambient air: free of dust, acids, corrosive gases or substances, etc.

Altitude above sea level: up to 2000 m (6500 ft).

Protect the device from mechanical damage during storage and operation.

EtherCAT information

Data transfer properties

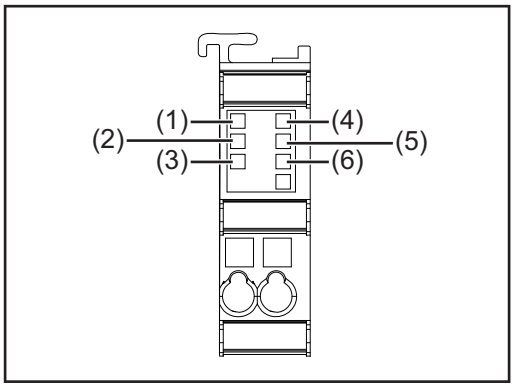
Transfer technology: EtherCAT
Medium: When selecting the cable and plug, IEC 61784-5-12 for the planning and installation of EtherCAT systems must be observed. The EMC tests were carried out by the manufacturer with an original Beckhoff cable (ZK1090-9191-xxxx).
Transmission speed: 100 Mbit/s
Bus connection: RJ45 Ethernet
Application layer: CANopen

Assigning the EtherCAT Address

The EtherCAT address is assigned by the master.

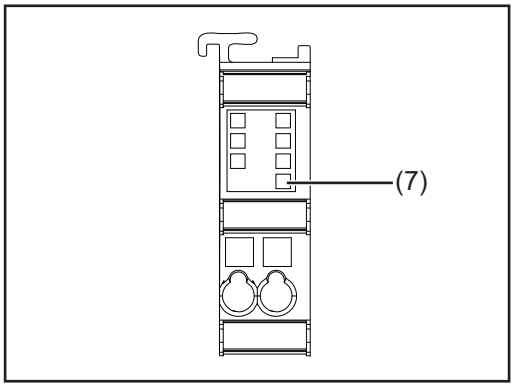
LED descriptions

LEDs on BK1250



BK1250

	LED designation	Display	Status	Description
(1)	Run	off	Init	The bus coupler is in initialization state
		flashes	Pre-Operational	The bus coupler is in the pre-operational state
		single flash	Safe-Operational	The bus coupler is in the safe-operational state
		on	Operational	The bus coupler is in the operational state
		flickers	Bootstrap	A firmware is being loaded
(2)	Link / Act	off	-	No connection / communication with the E-bus
		flashes	linked	Connection / communication with the E-bus established
(3)	Error	off	-	No error
		flashes	Err-Operational No Communication	PLC error / Lost Frames
(4)	Power supply	off	-	No operating voltage present on the bus coupler
		on	-	+ 24 V DC operating voltage present on the bus coupler
(5)	Power-contact	off	-	No operating voltage present on the power contacts
		on	-	+ 24 V DC operating voltage present on the power contacts
(6)	I/O-Run	off	-	Communication bus inactive
		on	-	Communication bus active

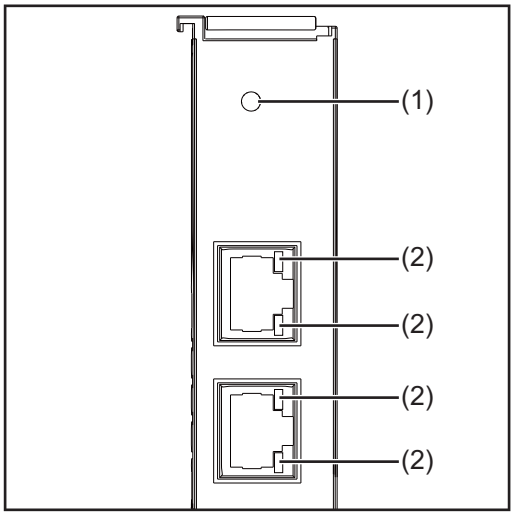


BK1250

(7) LED I/O-Error			
Display	**Reason for error**	**Description**	**Remedy**
Steady, constant flashing		EMC problems	- Check power supply for under- or over-voltage peaks - Take EMC measures - If there is a communication bus error, the error can be located by restarting (switching the coupler off and on again)
1 pulse	0	EEPROM-checksum error	- Reset factory settings using the KS2000 configuration software (Menu "Online -> Coupler -> Services -> Factory Settings")
	1	Overflow in code buffer	- Insert fewer bus terminals. Too many entries in the table for a programmed configuration
	2	Unknown data type	- Software update of the bus coupler is needed
2 pulses	0	Programmed configuration, incorrect table entry	- Check that programmed configuration is correct
	n (n>0)	Table comparison (bus terminal n)	- Incorrect table entry
3 pulses	0	Communication bus command error	- No bus terminal inserted - One of the bus terminals is faulty. Remove half of the inserted bus terminals and check whether or not there is still an error with the remaining bus terminals. Continue this until the faulty bus terminal is found
4 pulses	0	Communication bus data error, break behind the bus coupler	- Check whether or not the n+1 bus terminal is inserted correctly, replace if necessary
	n	Break behind bus terminal n	- Check whether or not the 9010 bus end terminal is inserted
5 pulses	n	Communication bus error during register communication with bus terminal n	- Replace nth bus terminal
14 pulses	n	nth bus terminal has an incorrect format	- Restart bus coupler. If the error reoccurs, replace the bus terminal
15 pulses	n	Number of bus terminals no longer matches	- Restart bus coupler. If the error reoccurs, reset the factory settings using the KS2000 configuration software

(7) LED I/O-Error			
Display	**Reason for error**	**Description**	**Remedy**
16 pulses	n	Length of communication bus data no longer matches	- Restart bus coupler. If the error reoccurs, reset the factory settings using the KS2000 configuration software

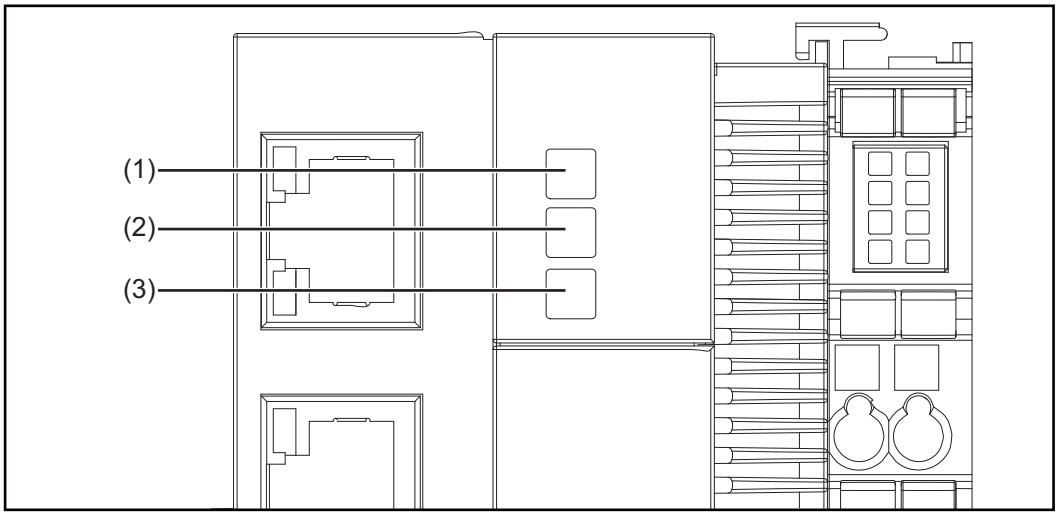
LEDs on EK1122



EK1122

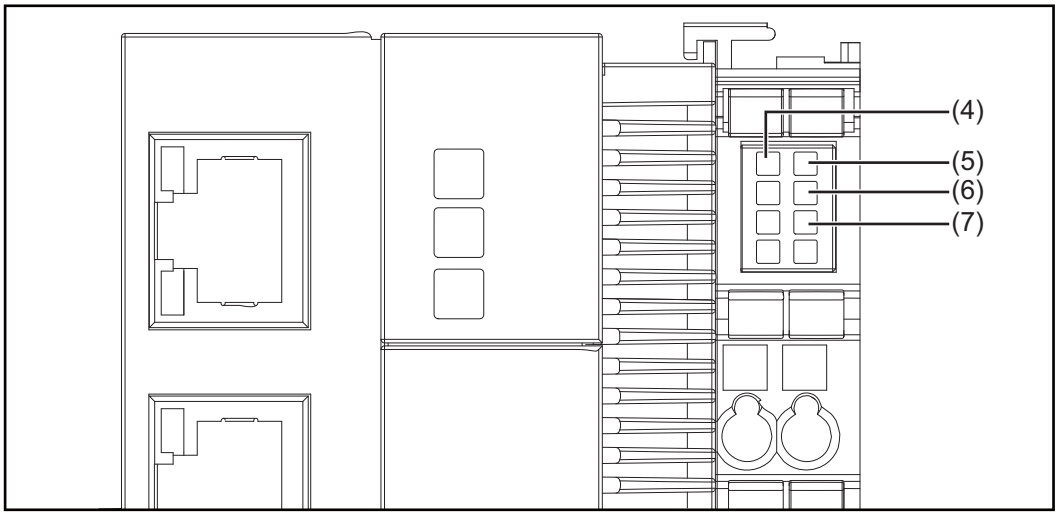
	LED designation	Display	Status	Description
(1)	Run	off	INIT	Initialization of the terminal
		flashes	PREOP	Mailbox communication and different standard settings set
		single flash	SAFEOP	Check of the channels of the Sync manager and the distributed clocks. Outputs remain in safe state
		on	OP	Normal operating state; mailbox and process data communication is possible
		flickers	BOOTSTRAP	Function for firmware updates on terminal
(2)	Link / Act	off	-	No connection on the EtherCAT-strand
		on	linked	EtherCAT-participant connected
		flashes	active	Communication with EtherCAT-participants

LEDs on CX8190



CX8190

	LED designation	Display	Description
(1)	TC	Green	TwinCAT is in run mode.
		Red	TwinCAT is in stop mode.
		Blue	TwinCAT is in config mode.
(2)	WD	-	No function ex works. The LED can be configured for user-specific diagnostic messages.
(3)	ERR	Red / Off	Lights up red when switching on and when loading software. Goes out if everything is okay. The LED can be configured for user-specific diagnostic messages.



CX8190

	LED designation	Display	Description
(4)	Us 24V	Green	Power supply for basic CPU module. LED lights up when the power supply is correct.
(5)	Up 24V	Green	Power supply of the terminal bus. LED lights up when the power supply is correct.
(6)	K-BUS-RUN	Green	Communication bus diagnosis. The LED lights up when there are no errors. No errors means that communication with the fieldbus system is also error-free.
(7)	K-BUS-ERR	Red	Communication bus diagnosis. The LED flashes to indicate an error. The LED flashes with two different frequencies (fast flashing and slow flashing). The error code and reason for the error can be determined by the frequency and number of flashing pulses. In the case of the reason for the error, the number of flashing pulses indicates the position of the last bus terminal before the error. Passive bus terminals, such as a supply terminal, are not counted. After troubleshooting, it is recommended to disconnect the power supply for a short time (reset). **Structure of the error display:** 1. Fast flashing = start of the error sequence 2. First slow sequence = error code 3. No display = pause, the LED is off 4. Second slow sequence = reason for the error See the following table for error identification.

Error code	Reason for error	Description	Remedy
Steady, constant flashing	-	EMC problems	- Check power supply for under- or overvoltage peaks - Take EMC measures - If there is a K-Bus-error, the error can be localized by restarting the power supply (switch the power supply off and on again)
3 pulses	0	K-Bus-command error	- No bus terminal inserted - One of the bus terminals is faulty, remove half of the inserted bus terminals and check whether or not there is still an error with the remaining bus terminals. Repeat this process until the faulty bus terminal is found.
4 pulses	0	K-Bus-data error, break behind the power supply unit	- Check that the 9010 bus end terminal is inserted
	n	Break behind bus terminal n	- Ensure that the bus terminal n+1 is correctly inserted behind the power supply unit; replace if necessary
5 pulses	n	K-Bus-error during register communication with bus terminal n	- Replace bus terminal at position n
6 pulses	0	Initialization error	- Replace the Embedded PC.
	1	Internal data error	- Hardware reset of the Embedded PC (switch off and on again).
	8	Internal data error	- Hardware reset of the Embedded PC (switch off and on again).
7 pulses	0	Process data lengths of the target and actual configuration do not match.	- Check configuration and bus terminals for consistency.

Converting and installing the interface

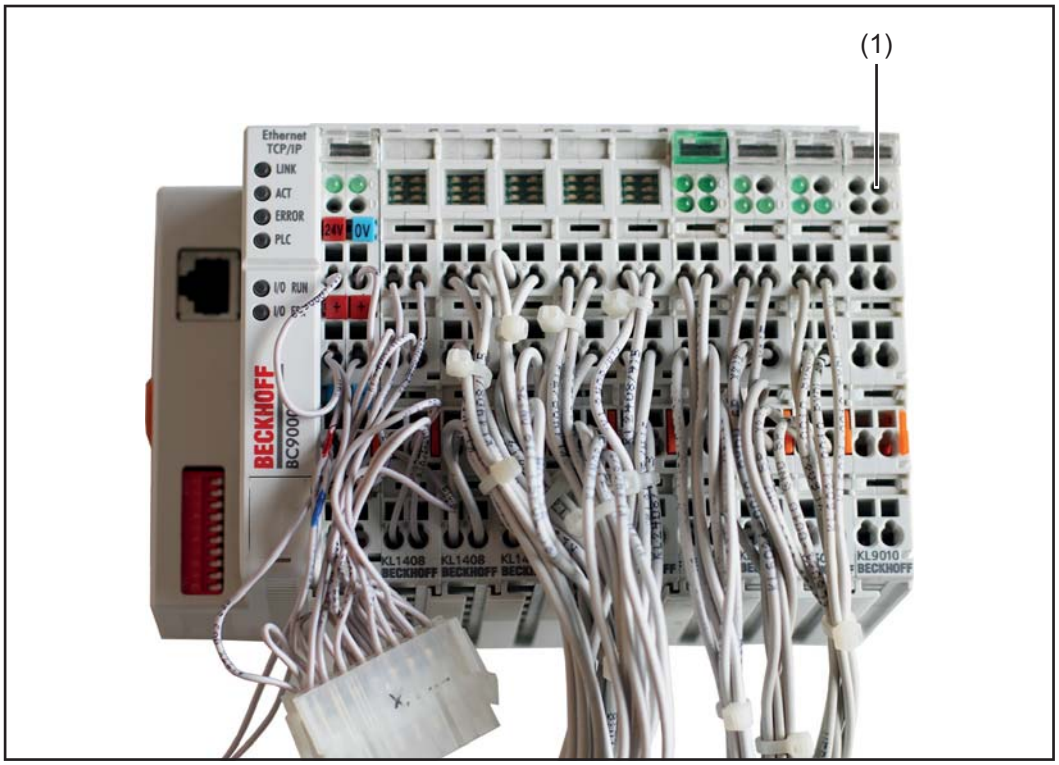
Safety

⚠ WARNING!

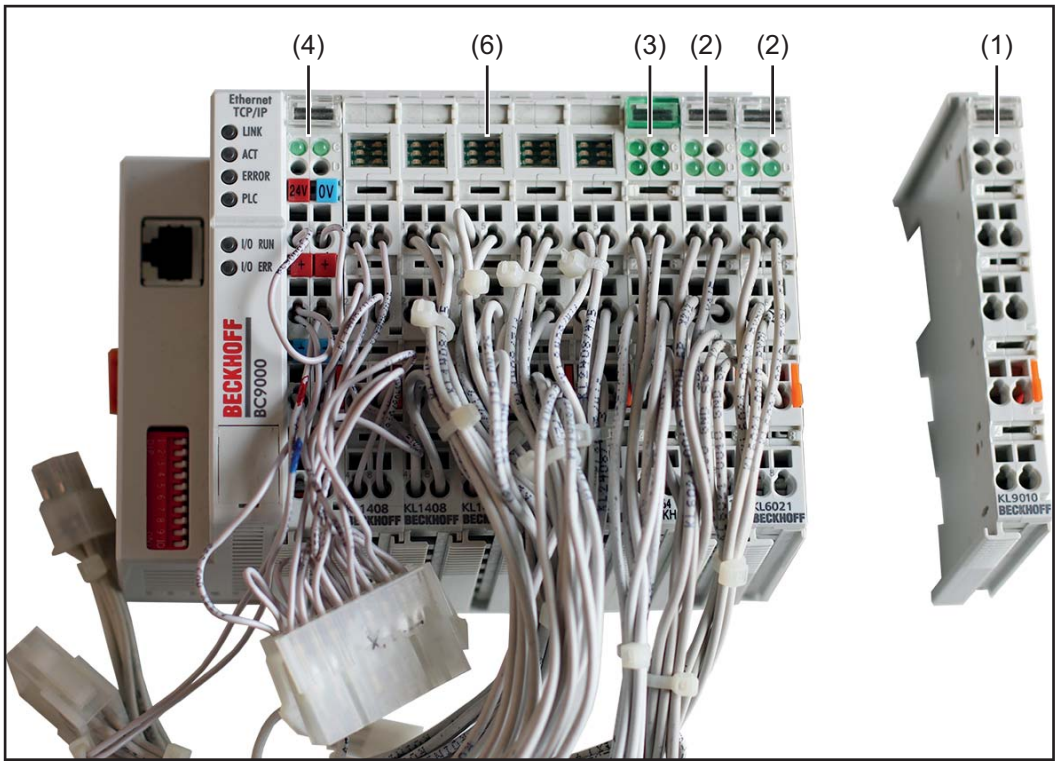
Danger from electrical current.
Could result in serious injury or death.

- ▶ Before starting work, switch off all devices and components involved, and disconnect them from the grid.
- ▶ Secure all devices and components involved so they cannot be switched back on.

Converting the interface



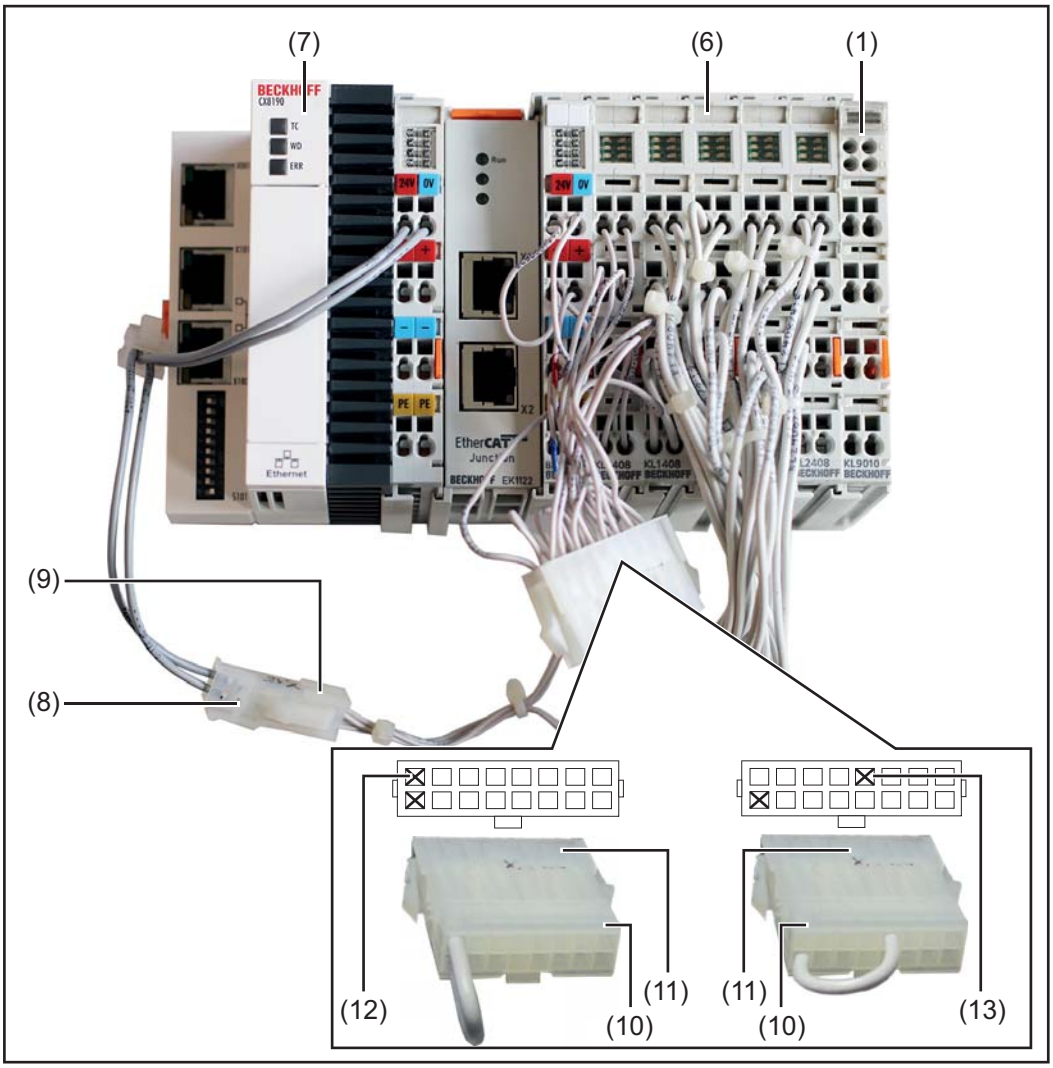
1. Disconnect the cable harness of the existing interface from all components (robot, external power supply, etc.)
2. Remove the existing interface from the DIN rail
3. Remove the KL9010 terminal (1) and store it for further use



4 Remove the two KL6021 terminals (2)
- The two KL6021 terminals (2) are no longer required
- The KL3064 terminal (3) is not present on all systems. If the terminal is present, do not remove the terminal and continue using it.

5 Remove the cables from the BC9000 terminal (4) and connect them to the KL1250 terminal of OPT/i RI IO TWIN RET
- Use the same pin assignment

6 Remove the bus coupler and terminal BC9000 (4)
- The terminal block (6) is now ready for mounting on OPT/i RI IO TWIN RET (7)



7 Mount the existing terminal block (6) on OPT/i RI IO TWIN RET (7)

8 Mount the KL9010 terminal (1) on the terminal block (6)

9 Only if OPT/i RI IO TWIN RET is used with interface 4,100,398:
- a) Disconnect connectors (10) and (11) from one another
- b) Remove the cable from slot (12) and insert it into slot (13)
- c) Reconnect connectors (10) and (11)

10 Connect connectors (8) and (9)
- The interface is now fully converted and can be installed - see next section

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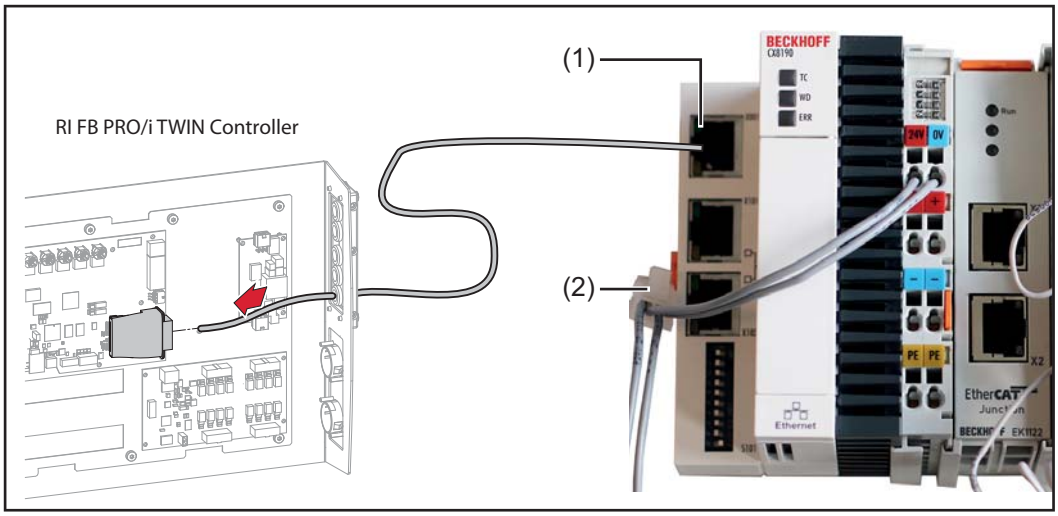
Installing the interface

1 Mount the interface on a DIN rail
- It is recommended that the interface is mounted in a horizontal position on a DIN rail in an automatic or robot switch cabinet
- The interface may be mounted in a non-horizontal position on the DIN rail. In this case, only operate the interface up to a maximum ambient temperature of +50 °C (140 °F)

2 Ground the interface properly

3 Connect the supplied cable harness to the OPT/i RI IO TWIN RET and to the robot controller
- In doing so, make sure that the signal lines are no longer than 1.5 m (4.92 ft)



4 Connect the connection (1) of OPT/i RI IO TWIN RET and the bus module in the RI FB PRO/i TWIN Controller with an EtherCat-cable
   - In doing so, make sure that the EtherCat-cable is no longer than 20 m (65.62 ft)

5 For information on installing the RI FB PRO/i TWIN Controller, refer to the corresponding Operating Instructions

Input and output signals OPT/i RI IO TWIN RET Job

Input signals (from robot to power source)

Terminal	Connection	Signal	Signal level	Value range / activity	Type of signal
1	1	Config bit 0	0 V / 24 V	See following table **Value range for Config Bit** on page **22**	Digital Input
1	5	Config bit 1	0 V / 24 V		Digital Input
1	2	Config bit 2	0 V / 24 V		Digital Input
1	6	Config bit 3	0 V / 24 V		Digital Input
1	3	Config bit 4	0 V / 24 V		Digital Input
1	7	Config bit 5	0 V / 24 V		Digital Input
1	4	Config bit 6	0 V / 24 V		Digital Input
1	8	Config bit 7	0 V / 24 V		Digital Input
2	1	Welding Start	0 V / 24 V		Digital Input
2	5	Robot ready	0 V / 24 V		Digital Input
2	2	Working mode Bit 0	0 V / 24 V	See following table **Value Range for Working Mode** on page **22**	Digital Input
2	6	Working mode Bit 1	0 V / 24 V		Digital Input
2	3	Operating mode TWIN System Bit 0	0 V / 24 V	See following table **Value range for Operating mode TWIN System** on page **22**	Digital Input
2	7	Operating mode TWIN System Bit 1	0 V / 24 V		Digital Input
2	4	Gas on	0 V / 24 V		Digital Input
2	8	Wire forward	0 V / 24 V		Digital Input
3	1	Wire backward	0 V / 24 V		Digital Input
3	5	Error quit	0 V / 24 V		Digital Input
3	2	Touch sensing	0 V / 24 V		Digital Input
3	6	Torch blow out	0 V / 24 V		Digital Input
3	3	Welding simulation	0 V / 24 V		Digital Input
3	7	Working mode Bit 2	0 V / 24 V		Digital Input
3	4	Reserved			
3	8	Reserved			
4	1	Job number Bit 0	0 V / 24 V		Digital Input
4	5	Job number Bit 1	0 V / 24 V		Digital Input
4	2	Job number Bit 2	0 V / 24 V		Digital Input

Terminal	Connection	Signal	Signal level	Value range / activity	Type of signal
4	6	Job number Bit 3	0 V / 24 V		Digital Input
4	3	Job number Bit 4	0 V / 24 V		Digital Input
4	7	Job number Bit 5	0 V / 24 V		Digital Input
4	4	Job number Bit 6	0 V / 24 V		Digital Input
4	8	Job number Bit 7	0 V / 24 V		Digital Input

Value range for Config Bit

Config bit								Configuration
7	6	5	4	3	2	1	0	
0 V	0 V	0 V	0 V	0 V	0 V	0 V	+24 V	Retrofit Job
0 V	0 V	0 V	+24 V	0 V	0 V	0 V	0 V	Retrofit Synergic / Job

Value range for Config bit

Value Range for Working Mode

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	Internal parameter selection
0	0	0	0	1	Special 2-step mode characteristics
0	0	0	1	0	Job mode
0	1	0	0	0	2-step mode characteristics

Value range for operating mode

Value range for Operating mode TWIN System

Bit 1	Bit 0	Function power source 1	Function power source 2
0	0	Single mode	OFF
0	1	TWIN Lead	TWIN Trail
1	0	TWIN Trail	TWIN Lead
1	1	OFF	Single mode

Value range for TWIN System Mode

Output signals (from power source to robot)

Terminal	Connection	Signal	Signal level	Value range / activity	Type of signal
5	1	Current flow	0 V / 24 V		Digital Output

Terminal	Connection	Signal	Signal level	Value range / activity	Type of signal
5	5	Process active	0 V / 24 V		Digital Output
5	2	Main current signal	0 V / 24 V		Digital Output
5	6	Collisionbox active	0 V / 24 V	0 = collision or cable break	Digital Output
5	3	Power source ready	0 V / 24 V		Digital Output
5	7	Limit signal, power source 1 + 2	0 V / 24 V		Digital Output
5	4	Reserved			
5	8	Reserved			

Input and output signals OPT/i RI IO TWIN RET Synergic / Job

Input signals (from robot to power source)

Terminal	Connection	Signal	Signal level	Value range / activity	Type of signal
1	1	Config bit 0	0 V / 24 V	See following table **Value range for Config Bit** on page **25**	Digital Input
1	5	Config bit 1	0 V / 24 V		Digital Input
1	2	Config bit 2	0 V / 24 V		Digital Input
1	6	Config bit 3	0 V / 24 V		Digital Input
1	3	Config bit 4	0 V / 24 V		Digital Input
1	7	Config bit 5	0 V / 24 V		Digital Input
1	4	Config bit 6	0 V / 24 V		Digital Input
1	8	Config bit 7	0 V / 24 V		Digital Input
2	1	Welding Start	0 V / 24 V		Digital Input
2	5	Robot ready	0 V / 24 V		Digital Input
2	2	Working mode Bit 0	0 V / 24 V	See following table **Value Range for Working Mode** on page **25**	Digital Input
2	6	Working mode Bit 1	0 V / 24 V		Digital Input
2	3	Operating mode TWIN System Bit 0	0 V / 24 V	See following table **Value range for Operating mode TWIN System** on page **25**	Digital Input
2	7	Operating mode TWIN System Bit 1	0 V / 24 V		Digital Input
2	4	Gas on	0 V / 24 V		Digital Input
2	8	Wire forward	0 V / 24 V		Digital Input
3	1	Wire backward	0 V / 24 V		Digital Input
3	5	Error quit	0 V / 24 V		Digital Input
3	2	Touch sensing	0 V / 24 V		Digital Input
3	6	Torch blow out	0 V / 24 V		Digital Input
3	3	Welding simulation	0 V / 24 V		Digital Input
3	7	Working mode Bit 2	0 V / 24 V		Digital Input
3	4	Reserved			
3	8	Reserved			
4	1	Job number Bit 0	0 V / 24 V		Digital Input
4	5	Job number Bit 1	0 V / 24 V		Digital Input

Terminal	Connection	Signal	Signal level	Value range / activity	Type of signal
4	2	Job number Bit 2	0 V / 24 V		Digital Input
4	6	Job number Bit 3	0 V / 24 V		Digital Input
4	3	Job number Bit 4	0 V / 24 V		Digital Input
4	7	Job number Bit 5	0 V / 24 V		Digital Input
4	4	Job number Bit 6	0 V / 24 V		Digital Input
4	8	Job number Bit 7	0 V / 24 V		Digital Input
6	1	Power, Power Source 1	0 V – 10 V		Analog Input
6	5	Arclength correction, Power source 1	0 V – 10 V		Analog Input
6	2	Power, Power Source 2	0 V – 10 V		Analog Input
6	6	Arclength correction, Power source 2	0 V – 10 V		Analog Input

Value range for Config Bit

Config bit								Configuration
7	6	5	4	3	2	1	0	
0 V	0 V	0 V	0 V	0 V	0 V	0 V	+24 V	Retrofit Job
0 V	0 V	0 V	+24 V	0 V	0 V	0 V	0 V	Retrofit Synergic / Job

Value range for Config bit

Value Range for Working Mode

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	Internal parameter selection
0	0	0	0	1	Special 2-step mode characteristics
0	0	0	1	0	Job mode
0	1	0	0	0	2-step mode characteristics

Value range for operating mode

Value range for Operating mode TWIN System

Bit 1	Bit 0	Function power source 1	Function power source 2
0	0	Single mode	OFF
0	1	TWIN Lead	TWIN Trail
1	0	TWIN Trail	TWIN Lead
1	1	OFF	Single mode

Value range for TWIN System Mode

Output signals (from power source to robot)

Terminal	Connection	Signal	Signal level	Value range / activity	Type of signal
5	1	Current flow	0 V / 24 V		Digital Output
5	5	Process active	0 V / 24 V		Digital Output
5	2	Main current signal	0 V / 24 V		Digital Output
5	6	Collisionbox active	0 V / 24 V	0 = collision or cable break	Digital Output
5	3	Power source ready	0 V / 24 V		Digital Output
5	7	Limit signal, power source 1 + 2	0 V / 24 V		Digital Output
5	4	Reserved			
5	8	Reserved			

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