



OPT/i RI IO TWIN

EN-US

Operating instructions

Robot option



42,0426,0314,EA 003-16122020

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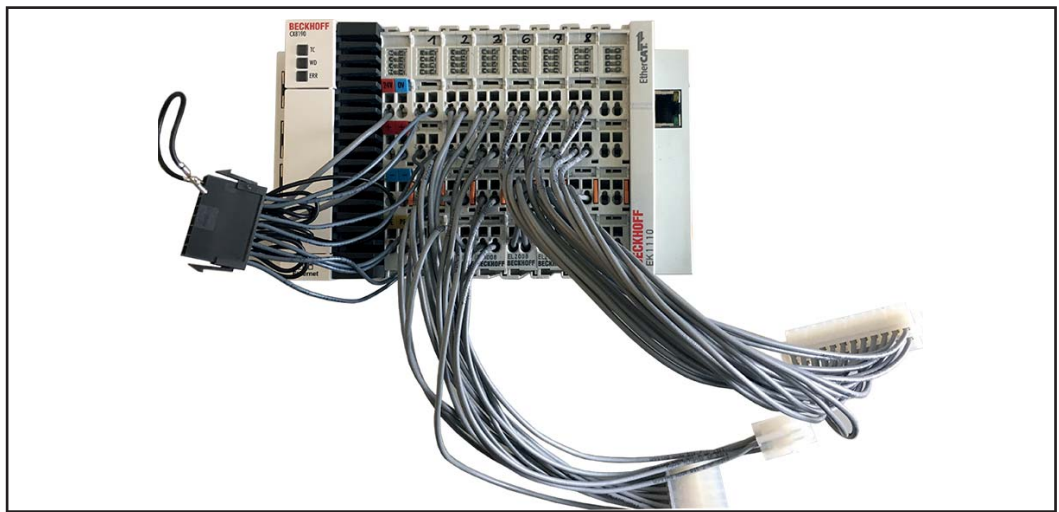
General

Device concept

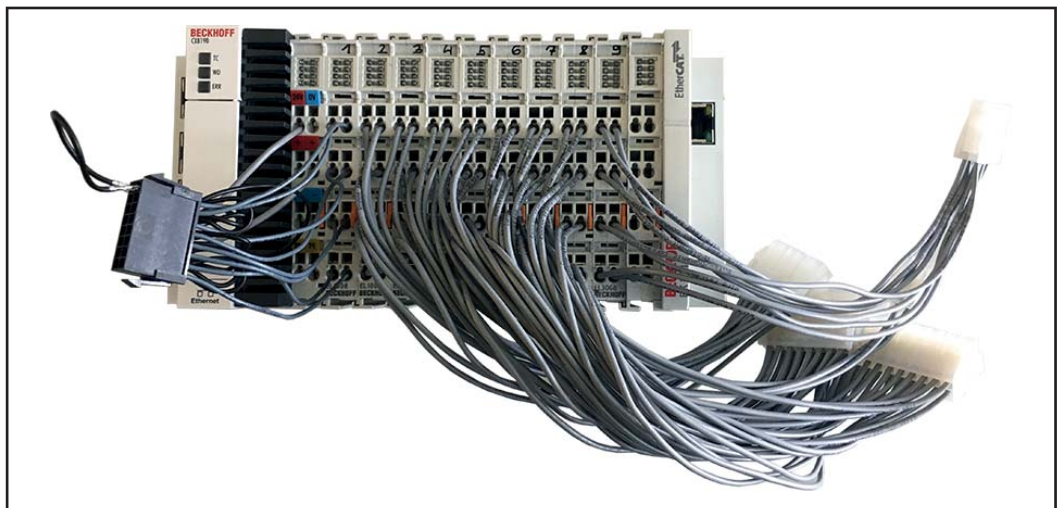
The OPT/i RI IO TWIN robot interface converts digital and analog inputs and outputs to EtherCAT. This allows robot control units with digital and analog inputs and outputs to be connected to a TPS/i TWIN welding system.

The interface is available in the versions listed below.

4,044,051 OPT/i RI IO TWIN Job	4,044,052 OPT/i RI IO TWIN Synergic/Job
for internal mode and job mode	for internal mode, job mode and characteristic selection with specification of set values and corrections possible

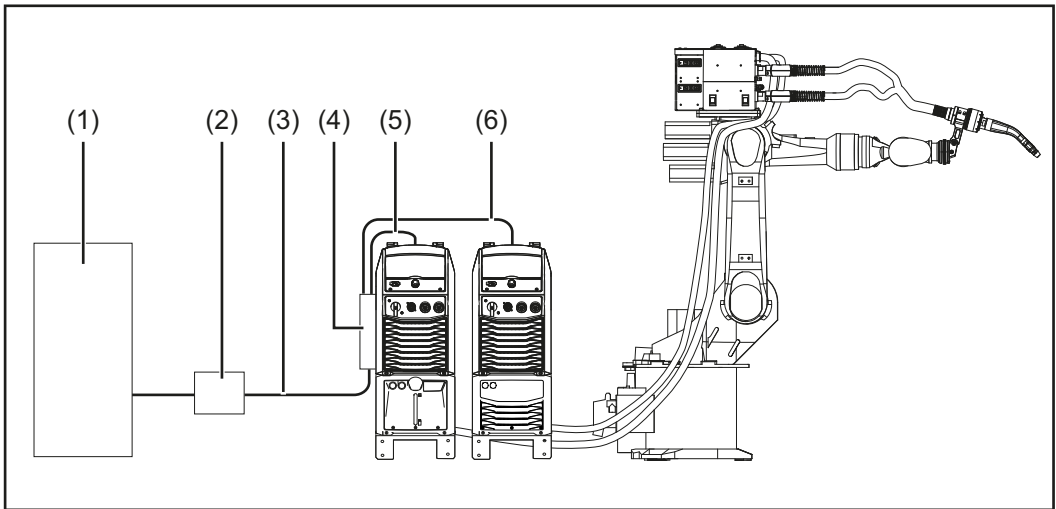


4,044,051 OPT/i RI IO TWIN Job



4,044,052 OPT/i RI IO TWIN Synergic/Job

System overview



- (1) **Robot control unit**

- (2) **OPT/i RI IO TWIN**

- (3) **EtherCat-cable between RI FB PRO/i TWIN Controller and the interface OPT/i RI IO TWIN Job / OPT/i RI IO TWIN Synergic/Job**

- (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 (in different versions)
- This document
- Cable harness for connection to the robot control unit
- 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

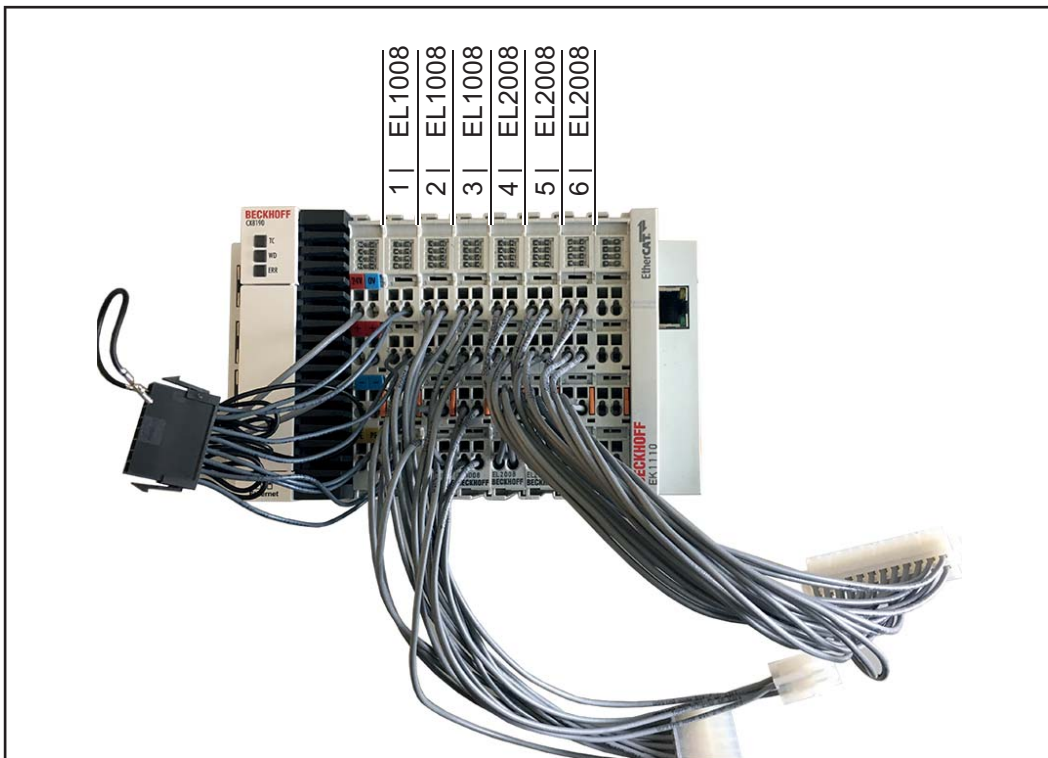
Application layer:
CANopen

Assigning the EtherCAT Address

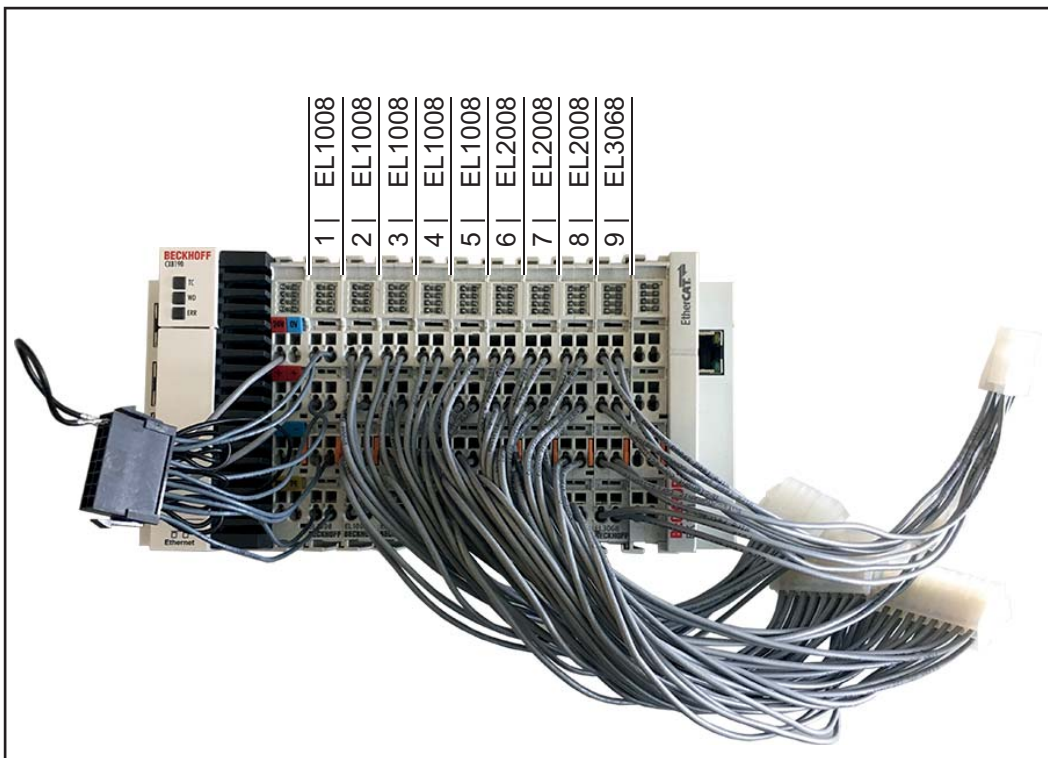
The EtherCAT address is assigned by the master.

Position of bus terminals

Position of bus terminals on
OPT/i RI IO TWIN
Job

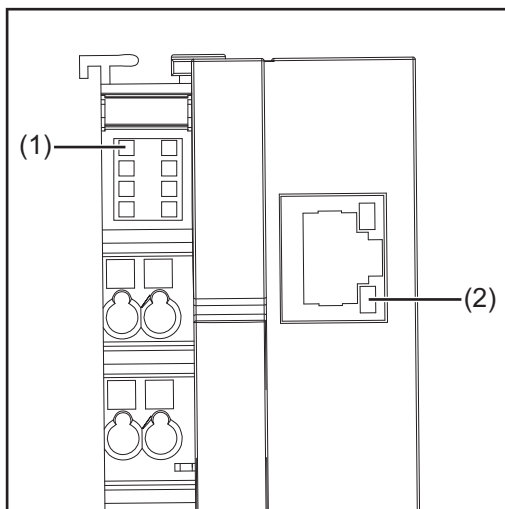


Position of bus terminals on
OPT/i RI IO TWIN
Synergic/Job



LED descriptions

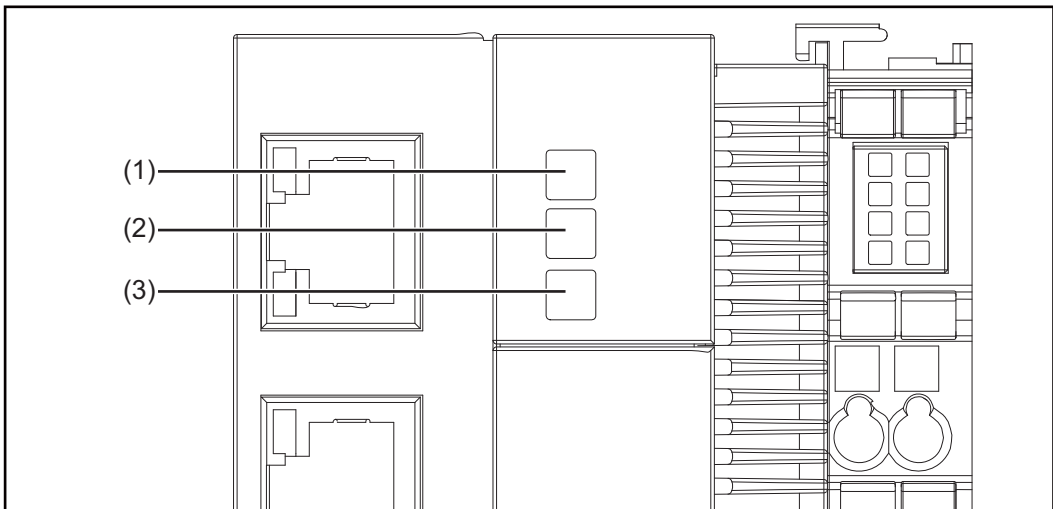
LEDs on EK1110



EK1110

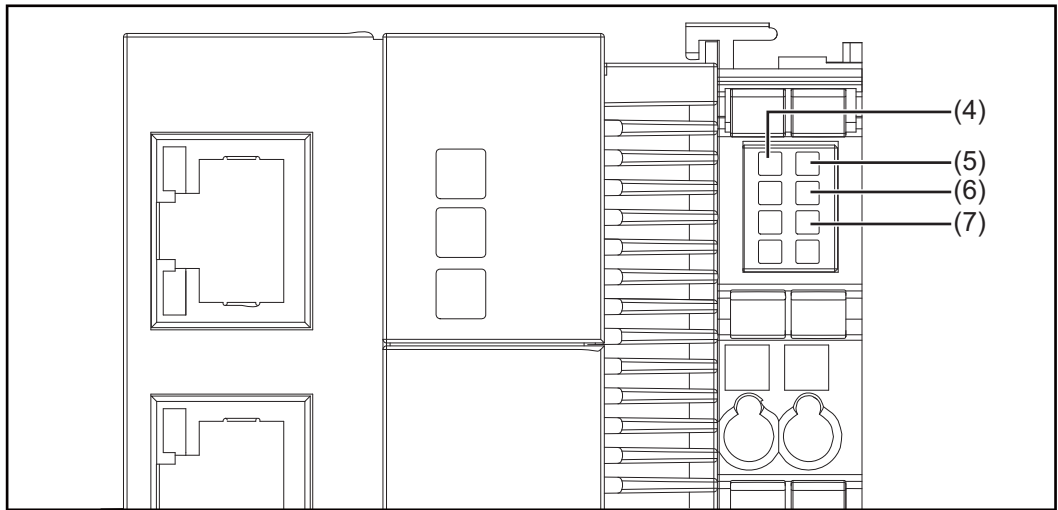
	LED designation	Display	Status	Description
(1)	Run	Off	INIT	Initialization of the terminal
		Slow flashing	PREOP	Mailbox communication and different standard settings set
		Single flash	SAFEOP	Check of the channels of the Sync manager and the distributed clocks. Outputs remain in safe state
		On	OP	Normal operating state; mailbox and process data communication is possible
		Fast flashing	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-participant

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	<p>Communication bus diagnosis. The LED flashes to indicate an error. The LED flashes with two different frequencies (fast flashing and slow flashing).</p> <p>The error code and reason for the error can be determined by the frequency and number of flashing pulses.</p> <p>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.</p> <p>After troubleshooting, it is recommended to disconnect the power supply for a short time (reset).</p> <p>Structure of the error display:</p> <ol style="list-style-type: none"> 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 <p>See the following table for error identification.</p>

Error code	Reason for error	Description	Remedy
Steady, constant flashing	-	EMC problems	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Check that the 9010 bus end terminal is inserted
	n	Break behind bus terminal n	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Replace bus terminal at position n
6 pulses	0	Initialization error	<ul style="list-style-type: none"> - Replace the Embedded PC.
	1	Internal data error	<ul style="list-style-type: none"> - Hardware reset of the Embedded PC (switch off and on again).
	8	Internal data error	<ul style="list-style-type: none"> - 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.	<ul style="list-style-type: none"> - Check configuration and bus terminals for consistency.

Installing the interface

Safety

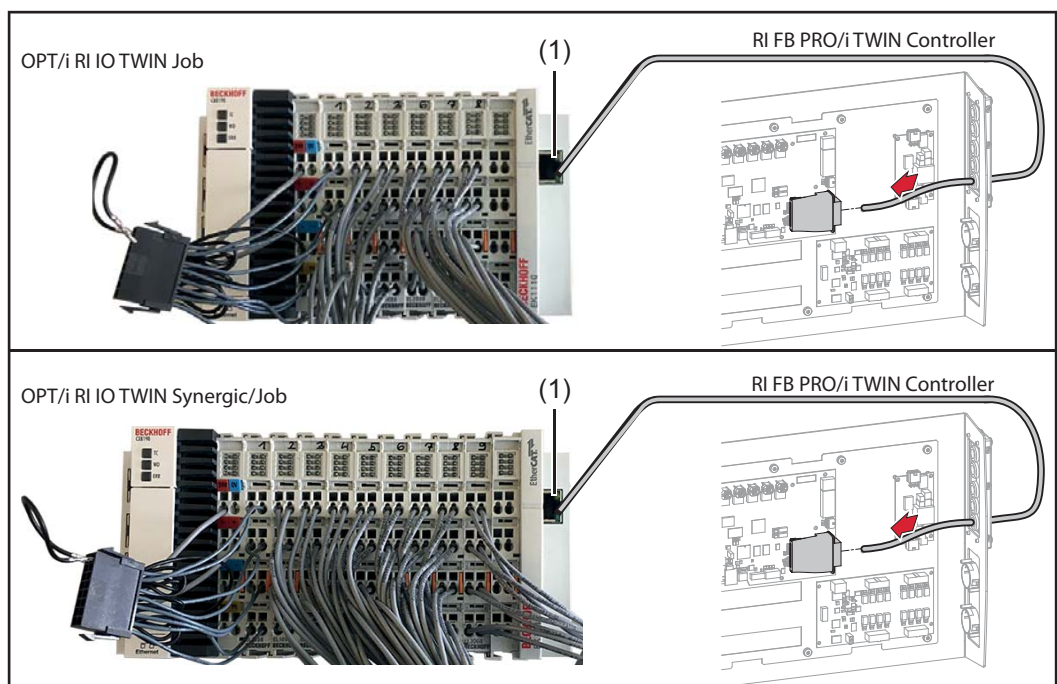
⚠ WARNING!

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.

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 interface and to the robot control unit
 - in doing so, make sure that the signal lines are no longer than 1.5 m (4.92 ft)



- 4 Connect the connection (1) on the interface and the bus module in 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)

Input and output signals OPT/i RI IO TWIN Job

Input signals (from robot to power source)

Terminal	Conne- ction	Signal	Signal level	Value range / Activity	Type of sig- nal
1	1	Config bit 0	0 V/24 V	See following table Value Range for Config Bit on page 17	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	Operating mode TWIN System Bit 0	0 V/24 V	See following table Value range for Operating mode TWIN System on page 17	Digital Input
2	5	Operating mode TWIN System Bit 1	0 V/24 V		Digital Input
2	2	Welding Start	0 V/24 V	Increasing	Digital Input
2	6	Robot ready	0 V/24 V	High	Digital Input
2	3	Gas on	0 V/24 V	Increasing	Digital Input
2	7	Wire forward	0 V/24 V	Increasing	Digital Input
2	4	Wire backward	0 V/24 V	Increasing	Digital Input
2	8	Error quit	0 V/24 V	Increasing	Digital Input
3	1	Touch sensing	0 V/24 V	High	Digital Input
3	5	Torch blow out	0 V/24 V	Increasing	Digital Input
3	2	Welding Simulation	0 V/24 V	High	Digital Input
3	6	Teach mode	0 V/24 V	High	Digital Input
3	3	Job number Bit 0	0 V/24 V	0 - 7	Digital Input
3	7	Job number Bit 1	0 V/24 V	0 - 7	Digital Input
3	4	Job number Bit 2	0 V/24 V	0 - 7	Digital Input
3	8	Job number Bit 3	0 V/24 V	0 - 7	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	+24 V	+24 V	OPT/i RI IO TWIN Job
0 V	0 V	0 V	0 V	0 V	+24 V	0 V	0 V	OPT/i RI IO TWIN Synergic / Job

Value range for Config bit

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
4	1	Heartbeat power source	0 V/24 V	1 Hz	Digital Output
4	5	Power source ready	0 V/24 V	High	Digital Output
4	2	Warning	0 V/24 V	High	Digital Output
4	6	Notification	0 V/24 V	High	Digital Output
4	3	Process active	0 V/24 V	High	Digital Output
4	7	Current flow	0 V/24 V	High	Digital Output
4	4	Arc stable-/touch signal	0 V/24 V	High	Digital Output
4	8	Main current signal	0 V/24 V	High	Digital Output
5	1	Touch signal	0 V/24 V	High	Digital Output
5	5	Collisionbox active	0 V/24 V	0 = collision or cable break	Digital Output
5	2	Wire stick workpiece	0 V/24 V	High	Digital Output
5	6	Reserve			
5	3	Robot Motion Release, Power source 1	0 V/24 V	High	Digital Output
5	7	Robot Motion Release, Power source 2	0 V/24 V	High	Digital Output
5	4	Limit signal, power source 1	0 V/24 V	High	Digital Output

Terminal	Connection	Signal	Signal level	Value range / Activity	Type of signal
5	8	Limit signal, power source 2	0 V/24 V	High	Digital Output
6	1	Sensor status 1, Power Source 1	0 V/24 V	See table Assignment of Sensor Statuses 1–3 on page 18	Digital Output
6	5	Sensor status 2, Power Source 1	0 V/24 V		Digital Output
6	2	Sensor status 3, Power Source 1	0 V/24 V		Digital Output
6	6	Sensor status 1, Power Source 2	0 V/24 V		Digital Output
6	3	Sensor status 2, Power Source 2	0 V/24 V		Digital Output
6	7	Sensor status 3, Power Source 2	0 V/24 V		Digital Output
6	4	Command value out of range	0 V/24 V	High	Digital Output
6	8	Correction out of range	0 V/24 V	High	Digital Output

Assignment of Sensor Statuses 1–3

Bit 2	Bit 1	Bit 0	Description
0	0	1	OPT/i WF R wire end
0	1	0	OPT/i WF R DE wire drum
1	0	0	OPT/i WF R DE ring sensor

Input and output signals OPT/i RI IO TWIN 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 21	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	Operating mode TWIN System Bit 0	0 V/24 V	See following table Value range for Operating mode TWIN System on page 21	Digital Input
2	5	Operating mode TWIN System Bit 1	0 V/24 V		Digital Input
2	2	Welding Start	0 V/24 V	Increasing	Digital Input
2	6	Robot ready	0 V/24 V	High	Digital Input
2	3	Gas on	0 V/24 V	Increasing	Digital Input
2	7	Wire forward	0 V/24 V	Increasing	Digital Input
2	4	Wire backward	0 V/24 V	Increasing	Digital Input
2	8	Error quit	0 V/24 V	Increasing	Digital Input
3	1	Touch sensing	0 V/24 V	High	Digital Input
3	5	Torch blow out	0 V/24 V	Increasing	Digital Input
3	2	Welding Simulation	0 V/24 V	High	Digital Input
3	6	Teach mode	0 V/24 V	High	Digital Input
3	3	Working mode Bit 0	0 V/24 V	See following table Value Range for Working Mode on page 21	Digital Input
3	7	Working mode Bit 1	0 V/24 V		Digital Input
3	4	Working mode Bit 2	0 V/24 V		Digital Input
3	8	Job number Bit 3	0 V/24 V		Digital Input

Terminal	Connection	Signal	Signal level	Value range / Activity	Type of signal
4	1	Welding characteristic- / Job number Bit 0	0 V/24 V	0 to 65,535	Digital Input
4	5	Welding characteristic- / Job number Bit 1	0 V/24 V		Digital Input
4	2	Welding characteristic- / Job number Bit 2	0 V/24 V		Digital Input
4	6	Welding characteristic- / Job number Bit 3	0 V/24 V		Digital Input
4	3	Welding characteristic- / Job number Bit 4	0 V/24 V		Digital Input
4	7	Welding characteristic- / Job number Bit 5	0 V/24 V		Digital Input
4	4	Welding characteristic- / Job number Bit 6	0 V/24 V		Digital Input
4	8	Welding characteristic- / Job number Bit 7	0 V/24 V		Digital Input
5	1	Welding characteristic- / Job number Bit 8	0 V/24 V		Digital Input
5	5	Welding characteristic- / Job number Bit 9	0 V/24 V		Digital Input
5	2	Welding characteristic- / Job number Bit 10	0 V/24 V		Digital Input
5	6	Welding characteristic- / Job number Bit 11	0 V/24 V		Digital Input
5	3	Welding characteristic- / Job number Bit 12	0 V/24 V		Digital Input
5	7	Welding characteristic- / Job number Bit 13	0 V/24 V		Digital Input
5	4	Welding characteristic- / Job number Bit 14	0 V/24 V		Digital Input
5	8	Welding characteristic- / Job number Bit 15	0 V/24 V	Digital Input	
9	1	Wire feed speed command value, Power source 1	0 V – 10 V	-327.68 to 327.67 [m/min]	Analog Input
9	5	Arclength correction, Power source 1	0 V – 10 V	-10.0 to 10.0	Analog Input
9	2	Wire feed speed command value, Power source 2	0 V – 10 V	-327.68 to 327.67 [m/min]	Analog Input
9	6	Arclength correction, Power source 2	0 V – 10 V	-10.0 to 10.0	Analog Input
9	3	Pulse-/dynamic correction, Power source 1	0 V – 10 V	-10.0 to 10.0	Analog Input

Terminal	Connection	Signal	Signal level	Value range / Activity	Type of signal
9	7	Wire retract correction, Power source 1	0 V – 10 V	0.0 to 10.0	Analog Input
9	4	Pulse-/dynamic correction, Power source 2	0 V – 10 V	-10.0 to 10.0	Analog Input
9	8	Wire retract correction, Power source 2	0 V – 10 V	0.0 to 10.0	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	+24 V	+24 V	OPT/i RI IO TWIN Job
0 V	0 V	0 V	0 V	0 V	+24 V	0 V	0 V	OPT/i RI IO TWIN Synergic / Job

Value range for Config bit

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

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

Output signals (from power source to robot)

Terminal	Connection	Signal	Signal level	Value range / Activity	Type of signal
6	1	Heartbeat power source	0 V/24 V	1 Hz	Digital Output

Terminal	Connection	Signal	Signal level	Value range / Activity	Type of signal
6	5	Power source ready	0 V/24 V	High	Digital Output
6	2	Warning	0 V/24 V	High	Digital Output
6	6	Notification	0 V/24 V	High	Digital Output
6	3	Process active	0 V/24 V	High	Digital Output
6	7	Current flow	0 V/24 V	High	Digital Output
6	4	Arc stable-/touch signal	0 V/24 V	High	Digital Output
6	8	Main current signal	0 V/24 V	High	Digital Output
7	1	Touch signal	0 V/24 V	High	Digital Output
7	5	Collisionbox active	0 V/24 V	0 = collision or cable break	Digital Output
7	2	Wire stick workpiece	0 V/24 V	High	Digital Output
7	6	Torch body gripped	0 V/24 V	High	Digital Output
7	3	Robot Motion Release, Power source 1	0 V/24 V	High	Digital Output
7	7	Robot Motion Release, Power source 2	0 V/24 V	High	Digital Output
7	4	Limit signal, power source 1	0 V/24 V	High	Digital Output
7	8	Limit signal, power source 2	0 V/24 V	High	Digital Output
8	1	Sensor status 1, Power Source 1	0 V/24 V	See table Assignment of Sensor Statuses 1–3 on page 22	Digital Output
8	5	Sensor status 2, Power Source 1	0 V/24 V		Digital Output
8	2	Sensor status 3, Power Source 1	0 V/24 V		Digital Output
8	6	Sensor status 1, Power Source 2	0 V/24 V		Digital Output
8	3	Sensor status 2, Power Source 2	0 V/24 V		Digital Output
8	7	Sensor status 3, Power Source 2	0 V/24 V		Digital Output
8	4	Command value out of range	0 V/24 V	High	Digital Output
8	8	Correction out of range	0 V/24 V	High	Digital Output

Assignment of Sensor Statuses 1–3

Bit 2	Bit 1	Bit 0	Description
0	0	1	OPT/i WF R wire end
0	1	0	OPT/i WF R DE wire drum
1	0	0	OPT/i WF R DE ring sensor

FRONIUS INTERNATIONAL GMBH

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