RBX1

Technical Data

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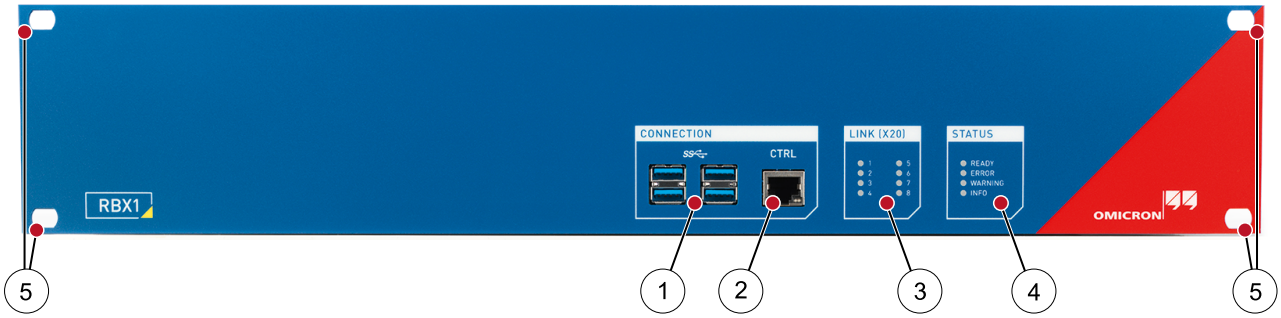
1 Device overview

RBX1 front view

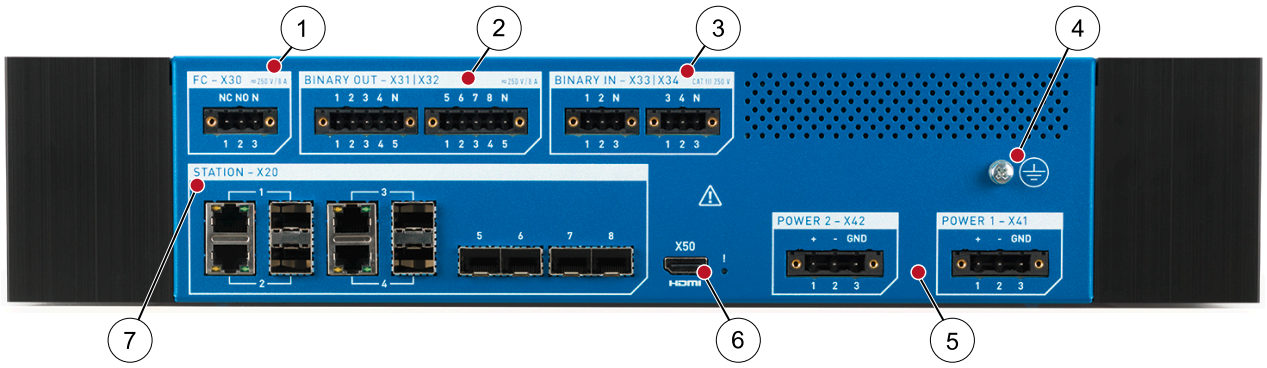


Front view		
CONNECTION		
1	USB connectors	*Future use – currently deactivated*
2	CTRL	Network connector Ethernet connector for control and management interface
LINK (X20)		
3	LEDs	Status LEDs for Ethernet connectors **Off:** no link **On:** link established but no activity **Flashing:** link and activity
STATUS		
4	Device status	
	READY	LED is on when *RBX1* is connected to power supply
	ERROR	Information is available in the software; severity corresponding to the LED
	WARNING	
	INFO	

5	Mounting holes (×4)	For mounting the *RBX1* to the rack panel

► For technical data refer to section RBX1 front connectors on page 12.

RBX1 back view



Back view		
1	**FC – X30** Fault contact	Fault contact for *RBX1* status indication Form C contact with *Normally Closed* (NC) and *Normally Open* (NO) contact • **X30:1**: contact is open when the device is powered on and functional; otherwise closed • **X30:2**: contact closed when the device is powered on and functional; otherwise open
2	**BINARY OUT – X31|X32** Binary outputs	Binary output contacts to signal different states of the software running on the *RBX1* Default setting for *StationGuard*: • **X31:1** contact is closed when there is at least one unacknowledged alert (high priority) • **X31:2** contact is closed when there is at least one unacknowledged warning (low priority)
3	**BINARY IN – X33|X34** Binary inputs	Binary input contacts to signal different states to the software running on the *RBX1*
4	Grounding screw	For connection to protective earth

Back view		
5	**POWER 1 – X41**	Connection to power supply
	POWER 2 – X42	Optional second power supply
6	**X50 HDMI**	*Future use*
7	**STATION – X20**	Ethernet connectors for connection to substation
	Network connectors	Link state on *RBX1* front (→ LEDs on page 3)
		STATION – X20:1 ... 4 are combo ports, so either RJ45 or SFP can be used. If both are connected, SFP is preferred (→ SFP modules on page 6).

► For technical data refer to sections Power supply on page 10 and RBX1 back connectors on page 13.

2 Accessories

2.1 SFP modules

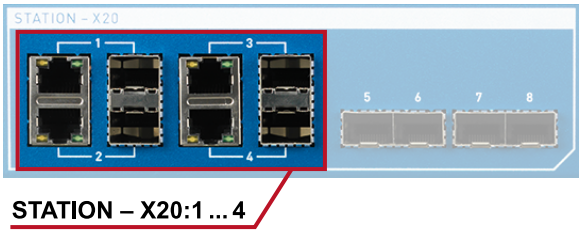
CAUTION

Eye injuries due to laser radiation possible

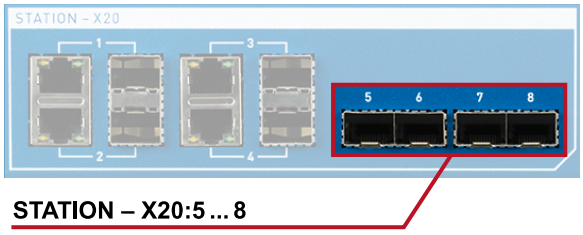
If the *RBX1* is equipped with an optical SFP module, it is a product of laser class 1 (IEC 60825), which emits invisible radiation.

► Do not look directly into the laser beam or direct it towards other people.

The **STATION – X20** connectors on the back side of the *RBX1* (→ page 5) support modules with the following characteristics:



1000 Mbit/s SerDes



1000 Mbit/s SerDes or 10/100/1000 Mbit/s SGMII with auto-negotiation

It is possible that modules compliant to the specifications above are incompatible with the *RBX1*. This can be the case if additional configuration data in a module's EEPROM do not match the *RBX1* SFP ports. To guarantee for compatibility, we recommend using SFP modules supplied by OMICRON (→ page 7).

Connecting and disconnecting SFP modules

► Disconnect the *RBX1* from mains before swapping SFP modules. A reboot of the *RBX1* is required for swapped SFP modules to work.

► Refer to the *RBX1* user documentation for wiring and safety instructions.

SFP modules available from OMICRON

Module	Usable in RBX1 ports
SFP module for 1000Base-SX with LC connector Multi-mode fiber, 850 nm wavelength Up to 500 m via 50/125 µm or 300 m via 62.5/125 µm	STATION – X20:1 ... 8
SFP module for 1000Base-LX with LC connector Single-mode fiber, 1310 nm wavelength Up to 10 km via 9/125 µm	
SFP module for 10/100/1000Base-TX (acc. to IEEE 802.3) with RJ45 connector	STATION – X20:5 ... 8
SFP module for 100Base-FX with LC connector* Multi-mode fiber, 1310 nm wavelength Up to 2 km via 50/125 µm	
SFP module for 100Base-LX with LC connector* Single-mode fiber, 1310 nm wavelength Up to 10 km via 9/125 µm	

* Operating temperature must be above 0 °C (32 °F).

2.2 Adapters

Mains adapter (C14)

A C14 mains adapter (cable length 180 mm) is included in the delivery of the *RBX1-40* and *RBX1-44* (→ 3.3 Power supply on page 10)

It is designed to supply the *RBX1-40* and *RBX1-44* in a laboratory environment.

WARNING

Death or severe injury caused by arc fault or electric shock possible

- ► Only connect the C14 mains adapter to AC supplies.
  It is not designed for DC supplies.
- ► First connect the adapter to the *RBX1* and tighten the screws, then connect to mains AC.

Laboratory adapter package

The *RBX1* laboratory adapter package is an optional accessory available from OMICRON.
It contains adapters to 4 mm banana sockets for **FC – X30** and all **BINARY IN – X33|X34** and **BINARY OUT – X31|X32** interfaces of the *RBX1*.

WARNING

Death or severe injury caused by arc fault or electric shock possible

- ► First connect the adapter to the *RBX1* and tighten the screws, then connect to the measurement/test signal.
- ► Outputs **FC – X30** and **BINARY OUT – X31|X32**, and inputs **BINARY IN – X33|X34** must be protected by a fuse with sufficient breaking capacity (→ Technical data – Connectors on page 12). This can also be an electronic fuse inside a laboratory supply.

3 RBX1 technical data

3.1 Computing performance

Computing performance	
Processors	Secure cryptoprocessor according to TPM 2.0 (ISO/IEC 11889) Quad-core processor with hardware multithreading
Memory	16 GB error-correcting code (ECC) memory 450 GB SSD

3.2 Mechanical data

Mechanical data	
Weight	Depending on the power supply option: 6.8 kg ... 7.5 kg 15 lb ... 16.5 lb
Dimensions W × H × D	482.6 × 88.1 × 303 mm 19 × 3.5 × 11.9 in Required height in rack: 2U
Ingress protection IEC 60529	IP30

3.3 Power supply

The *RBX1* is available with the following power supply options:

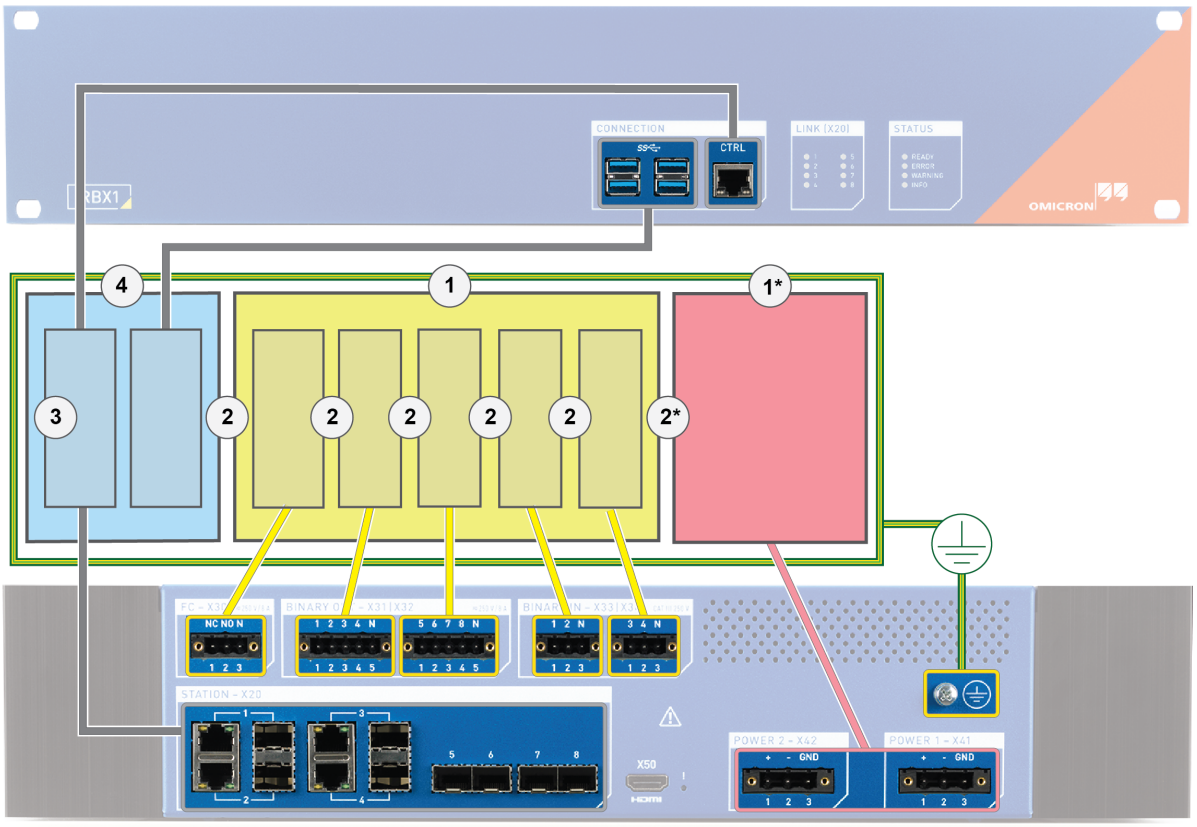
- **RBX1-20**: 1 × power supply option A
- **RBX1-22**: 2 × power supply option A
- **RBX1-40**: 1 × power supply option B
- **RBX1-44**: 2 × power supply option B

Power supply option A: RBX1-20 and RBX1-22	
Input voltage	
Connection	PHOENIX CONTACT GMSTB 2.5/3-GF-7.62 (socket) PHOENIX CONTACT GMSTB 2.5/3-STF-7.62 (plug) One terminal block for each power supply; maximum conductor cross-section 2.5 mm^2
Nominal voltage	48 V_{DC} ... 60 V_{DC}
Maximum voltage range	44 V_{DC} ... 70 V_{DC}
Nominal input power	65 W
Max. startup inrush current	< 2 A
Overvoltage category	III

Power supply option B: RBX1-40 and RBX1-44	
Input voltage, single phase	
Connection	PHOENIX CONTACT GMSTB 2.5/3-GF-7.62 (socket) PHOENIX CONTACT GMSTB 2.5/3-STF-7.62 (plug) One terminal block for each power supply; maximum conductor cross-section 2.5 mm^2
Nominal voltage	100 V_{DC} ... 240 V_{DC} (±10 %) 100 V_{AC} ... 240 V_{AC} (±10 %)
Nominal input power	65 W
Max. startup inrush current	< 6 A
Overvoltage category	III
Nominal frequency	50/60 Hz

3.4 Insulation coordination

The *RBX1* is a protection class I equipment according to IEC/EN 61140, with insulation designed for pollution degree 2. The image below outlines what types of insulation apply to different parts of the device.



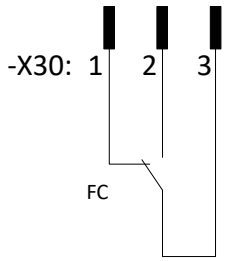
Insulation	#	Power supply	Test voltage	Impulse test voltage
Basic insulation (BI)	1*	RBX1-20/22	1350 V_{AC}	1500 V_{peak}
		RBX1-40/44	2200 V_{AC}	4000 V_{peak}
	1	RBX1-20/22 + RBX1-40/44	2200 V_{AC}	4000 V_{peak}
Reinforced insulation (RI)	2*	RBX1-20/22	2700 V_{AC}	4000 V_{peak}
		RBX1-40/44	3250 V_{AC}	6400 V_{peak}
	2	RBX1-20/22 + RBX1-40/44	3250 V_{AC}	6400 V_{peak}
Functional insulation (FI)	3	RBX1-20/22 + RBX1-40/44	2250 V_{DC}	N/A
N/A – SELV	4	RBX1-20/22 + RBX1-40/44	N/A	N/A

3.5 Connectors

RBX1 front

CONNECTION	
USB	
Type	4 × USB 3.0 (*SuperSpeed*, 5 GBit/s)
Connector	USB type A
CTRL	
Type	10/100/1000Base-TX, according to IEEE 802.3
Connector	RJ45
Cable type	LAN cable of category 5 (CAT5) or better
Status indication	Green LED: physical link present
	Yellow LED: network traffic on interface

RBX1 back

FC – X30 [1]	
Type	Potential-free contacts; software-controlled
Connection	PHOENIX CONTACT MSTB 2.5/3-GF-5.08 (socket) PHOENIX CONTACT MSTB 2.5/3-STF-5.08 (plug) Maximum conductor cross-section 2.5 mm²
Number of binary outputs	1 form C contact with *Normally Closed* (NC) and *Normally Open* (NO) contact
Number of potential groups	1 (FC – X30) 
AC loading capacity AC breaking capacity	V_{max} = 250 V, I_{max} = 8 A, P_{max} = 2000 VA
DC loading capacity DC breaking capacity	→ Load limit breaking capacity curve for binary output relays with DC voltages on page 15
Inrush current	15 A (max. 4 s at 10 % duty cycle)
Carry capacity	5 A continuous at 60 °C (140 °F)
Electrical lifetime	100,000 switching cycles at 230 V_{AC}/8 A and ohmic load
Operate time[2]	Max. 10 ms (no bouncing)
Release time[2]	Max. 5 ms (no bouncing)
Overvoltage category	II, according to IEC 61010-1 III, according to IEC 60255-27

[1] Outputs **FC – X30** and **BINARY OUT – X31|X32** must be protected by a fuse with sufficient breaking capacity: slow-breaking fuse type, 8 A/250 V. Breaking capacity 50 kA (CAT III) can be decreased by the impedance value of the connection line.

[2] Relay timing without software delays

BINARY OUT – X31|X32 [1]	
Type	Potential-free contacts; software-controlled
Connection	PHOENIX CONTACT MSTB 2.5/5-GF-5.08 (socket) PHOENIX CONTACT MSTB 2.5/5-STF-5.08 (plug) One terminal block for each potential group; maximum conductor cross-section 2.5 mm²
Number of binary outputs	8
Number of potential groups	2 (X31 and X32)
AC loading capacity AC breaking capacity	V_{max} = 250 V, I_{max} = 8 A, P_{max} = 2000 VA
DC loading capacity DC breaking capacity	→ Load limit breaking capacity curve for binary output relays with DC voltages on page 15
Inrush current	15 A (max. 4 s at 10 % duty cycle)
Carry capacity	5 A continuous at 60 °C (140 °F)
Electrical lifetime	100,000 switching cycles at 230 V_{AC}/8 A and ohmic load
Operate time[2]	Max. 10 ms (no bouncing)
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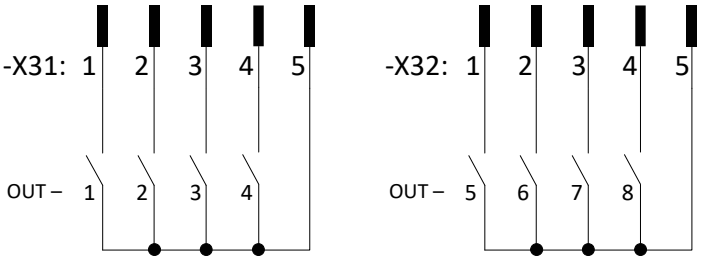
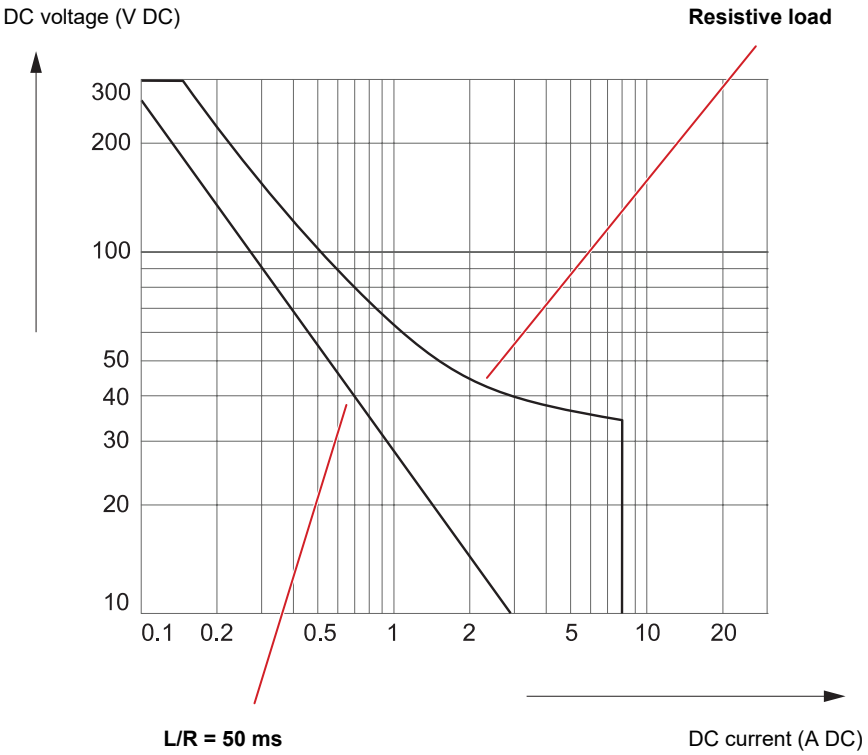
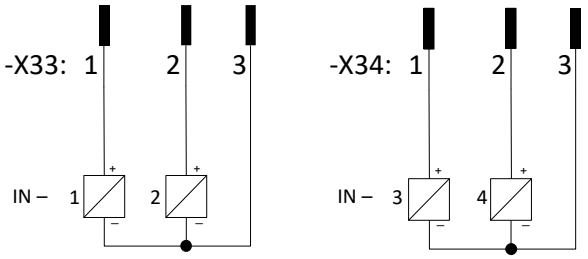


[1] Outputs **FC – X30** and **BINARY OUT – X31|X32** must be protected by a fuse with sufficient breaking capacity: slow-breaking fuse type, 8 A/250 V. Breaking capacity 50 kA (CAT III) can be decreased by the impedance value of the connection line.

[2] Relay timing without software delays

Load limit breaking capacity curve for binary output relays with DC voltages



BINARY IN – X33|X34 [1]	
Connection	PHOENIX CONTACT MSTB 2.5/3-GF-5.08 (socket) PHOENIX CONTACT MSTB 2.5/3-STF-5.08 (plug) One terminal block for each potential group; maximum conductor cross-section 2.5 mm²
Number of binary inputs	4
Number of potential groups	2 (X33 and X34) 
Max. input voltage	250 V CAT III
Rated input voltage	250 V
Input impedance	148 kΩ
Measurement category	CAT III/250 V_{RMS} according to IEC 61010-2-030

[1] Inputs **BINARY IN – X33|X34** must be protected by a fuse with sufficient breaking capacity: slow-breaking fuse type, 8 A/ 250 V. Breaking capacity 50 kA (CAT III) can be decreased by the impedance value of the connection line.

STATION – X20	
STATION – X20:1 ... 4 [1]	
Type	10/100/1000Base-TX, according to IEEE 802.3
Connector	RJ45
Cable type	LAN cable of category 5 (CAT5) or better
Status indication	Green LED: physical link present
	Yellow LED: traffic on interface
STATION – X20:1 ... 8	
Type	1000BASE-X, according to IEEE 802.3
Connector	SFP
Status indication	LINK (X20), *RBX1* front

[1] **STATION – X20:1 ... 4** are combo ports, so either RJ45 or SFP can be used. If both are connected, SFP is preferred.

X50 HDMI	
Type	HDMI 1.4, up to 4096 × 2160 at 24 Hz
Connector	HDMI type A

3.6 Environmental conditions

The *RBX1* is cooled passively. We recommend to leave one rack unit above the *RBX1* free for ventilation.

If the *RBX1* is operated in a cabinet, make sure the temperature within the cabinet does not exceed the limits specified in this document. We recommend ventilating the rack to ensure optimal air flow.

Environmental conditions		
Temperature	Operating	–20 °C ... +55 °C –4 °F ... +131 °F
	Storage	–25 °C ... +70 °C –13 °F ... +158 °F
Maximum altitude	Operating	2,000 m 6,561 ft
	Storage	15,000 m 49,212 ft
Humidity	5 % ... 95 % relative humidity; non-condensing	

Mechanical tests [1]		
Vibration IEC 60068-2-6	Non-operational	1 g; 5 Hz ... 500 Hz; 40 sweeps per direction
	During operation	0.5 g; 10 Hz ... 150 Hz; 2 sweeps per direction
Shock IEC 60068-2-27	Non-operational	10 g/16 ms; 1000 impacts per direction 15 g/11 ms; 3 impacts per direction
	During operation	5 g/11 ms; 3 impacts per direction
Drop IEC 60068-2-31	Non-operational	5 cm, 2 drops per direction

[1] According to IEC 60255-21-1/2, Class 1

3.7 Product standards

Generic standards

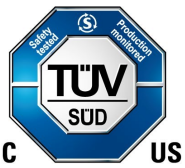
IEC/EN 61850-3 and IEEE 1613

Electromagnetic compatibility (EMC)

Electromagnetic interference (EMI)	
Europe	EN 61326-1; EN 60255-26; EN 61000-6-4; EN 55032, Class A
International	IEC 61326-1; IEC 60255-26; IEC 61000-6-4; CISPR 32, Class A
USA	FCC Subpart B of Part 15 Class A

Electromagnetic susceptibility (EMS)/Immunity level	
Europe	EN 61326-1; EN 60255-26; EN 61000-6-2; EN 61000-6-5
International	IEC 61326-1; IEC 60255-26; IEC 61000-6-2; IEC 61000-6-5
Electrostatic discharge IEC 61000-4-2	Contact discharge: 6 kV Air discharge: 8 kV
Radiated, radio-frequency, electromagnetic field IEC 61000-4-3	10 V/m, 80 % AM, 1 kHz sinus 80 MHz ... 6 GHz horizontal/vertical 3 V/m, 80 % AM, 1 kHz sinus 1.4 GHz ... 2 GHz 1 V/m, 80 % AM, 1 kHz sinus 2 GHz ... 6 GHz
Power frequency magnetic field IEC 61000-4-8	Permanent: 100 A/m Short-term: 1 kA/m
Electrical fast transient/burst IEC 61000-4-4	At 5 kHz and 100 kHz: • *FC (X30)*, *BINARY IN/OUT* (X31|X32/X33|X34): 4 kV_{peak} • *POWER* (X41/X42): 4 kV_{peak} • *STATION* (X20) and *CTRL*: 2 kV_{peak}
Surge IEC 61000-4-5	*FC (X30)*, *BINARY IN/OUT* (X31|X32/X33|X34): • Common mode: 4 kV • Differential mode: 2 kV *POWER* (X41/X42): • Common mode: 2 kV • Differential mode: 1 kV *STATION* (X20) and *CTRL*: • Common mode (shield–ground): 4 kV

Electromagnetic susceptibility (EMS)/Immunity level	
Conducted disturbances induced by radio-frequency fields IEC 61000-4-6, level 3	0.15 ... 80 MHz, 10 $V_{unmod.}$ 27 MHz, 10 $V_{unmod.}$ 68 MHz, 10 $V_{unmod.}$ 80 % AM (1 kHz) *FC (X30)*, *BINARY IN/OUT* (X31|X32/X33|X34), *POWER* (X41/X42), *STATION* (X20) and *CTRL*
Voltage dips, short interruptions and voltage variations on DC input power port IEC 61000-4-29	*POWER* (X41/X42): Voltage interruption 20 ms
Voltage dips, short interruptions and voltage variations IEC 61000-4-11	*POWER* (X41/X42): 1 cycle (50 Hz)
Damped oscillatory wave IEC 61000-4-16	*FC (X30)*, *BINARY IN/OUT* (X31|X32/X33|X34), *POWER* (X41/X42): • Common mode: 2.5 kV, 100 kHz, 1 MHz, 10 MHz • Differential mode: 1 kV, 100 kHz, 1 MHz *STATION* (X20) and *CTRL*: • Common mode: 1 kV, 1 MHz
Conducted, common mode disturbances in the 0 Hz ... 150 kHz frequency range IEC 61000-4-18	*FC (X30)*, *BINARY IN/OUT* (X31|X32/X33|X34): • Common mode: 300 V (0 Hz, 50 Hz, 60 Hz) • Differential mode: 150 V (0 Hz, 50 Hz, 60 Hz) *POWER* (X41/X42): • Common mode: 30 V (0 Hz), 300 V (1 s, 0 Hz) *STATION* (X20) and *CTRL*: • Common mode: 30 V (0 Hz, 50 Hz, 60 Hz) 300 V (1 s) (0 Hz, 50 Hz, 60 Hz)
Ripple on DC input power port IEC 61000-4-17	DC ripple: 15 % nominal voltage, 100 Hz/120 Hz

Safety

Safety standards	
Europe	EN 61010-2-030; EN 60255-26; EN 61010-1
International USA Canada	IEC 61010-2-030; IEC 60255-26; IEC 61010-1 UL; 61010-2-030; UL 61010-1 CAN/CSA-C22.2 No 61010-2-030; CAN/CSA-C22.2 No 61010-1
Certificates