8BVI0014HWDS.000-1

1 General information

- Clearly structured, straightforward implementation via network-based safety technology
- Modular expandability through virtual wiring
- Immediate triggering of safety function thanks to short cycle times
- Easy implementation with transparent control and status information in the standard application as well
- Compact design
- Complete safety functionality in dual-axis modules as well

2 Order data

Model number	Short description	Figure
	Wall mounting	
8BVI0014HWDS.000-1	ACOPOSmulti inverter module, 1.9 A, HV, wall mounting, 2 axes, SafeMC	
	Required accessories	
	Terminal block sets	
8BZVI0055DS.000-1A	Screw clamp set for ACOPOSmulti 8BVI00xxHxDS modules: 1x 8TB2108.2010-00, 1x 8TB2104.203L-00, 1x 8TB2104.203F-00, 1x 8TB3104.204G-11, 1x 8TB3104.204K-11	
	Optional accessories	
	Fan modules	
8BXF001.0000-00	ACOPOSmulti fan module, replacement fan for ACOPOSmulti modules (8BVP / 8B0C / 8BVI / 8BVE / 8B0K)	
	POWERLINK cables	
X20CA0E61.00020	POWERLINK connection cable, RJ45 to RJ45, 0.2 m	
X20CA0E61.00025	POWERLINK connection cable, RJ45 to RJ45, 0.25 m	
X20CA0E61.00030	POWERLINK connection cable, RJ45 to RJ45, 0.3 m	
X20CA0E61.00035	POWERLINK connection cable, RJ45 to RJ45, 0.35 m	
X20CA0E61.00050	POWERLINK connection cable, RJ45 to RJ45, 0.5 m	
X20CA0E61.00100	POWERLINK connection cable, RJ45 to RJ45, 1 m	
	Shield component sets	
8SCS000.0000-00	ACOPOSmulti shielding components set: 1x shielding plate 1fold type 0; 1x hose clamp, W 9 mm, D 12-22 mm	
8SCS002.0000-00	ACOPOSmulti shield component set: 1x clamping plate; 2x clamps D 4-13.5 mm; 4x screws	
8SCS009.0000-00	ACOPOSmulti shield component set: 1x ACOPOSmulti holding plate SK8-14; 1x shield terminal SK14	
	Terminal blocks	
8TB2104.203F-00	Screw clamp 4-pin, single row, spacing: 5.08 mm, label 3: T- T + B- B+, F keying: 0101	
8TB2104.203L-00	Screw clamp 4-pin, single row, spacing: 5.08 mm, label 3: T- T + B- B+, L keying: 1010	
8TB2108.2010-00	Screw clamp 8-pin, single row, spacing: 5.08 mm, label 1: numbered serially	
8TB3104.204G-11	Screw clamp 4-pin, single row, spacing: 7.62 mm, label 4: PE W V U, G coding: 0110	
8TB3104.204K-11	Screw clamp 4-pin, single row, spacing: 7.62 mm, label 4: PE W V U, K keying: 1001	

Table 1: 8BVI0014HWDS.000-1 - Order data

Information:

Only 8BCM motor cables from B&R may be used to connect the motor interfaces.

Information:

Only 8BCF EnDat 2.2 cables from B&R may be used to connect the encoder interfaces.

3 Technical data

Product ID	8BVI0014HWDS.000-1
General information	
B&R ID code	0xAA0D
Cooling and mounting method	Wall mounting
Slots for plug-in modules	2 [1]
Certification	
CE	Yes
cULus	Yes
KC	Yes
FSC	Yes
DC bus connection	
Voltage	
Nominal	750 VDC
Continuous power consumption [2]	2.91 kW
Power loss depending on the switching frequency [3]	
Switching frequency 5 kHz	[1.2*I_M²+2.62*I_M+100] W
Switching frequency 10 kHz	[2.56*I_M²+2.8*I_M+200] W
Switching frequency 20 kHz	[6*I_M²-9.4*I_M+430] W
DC bus capacitance	165 µF
Design	ACOPOSmulti backplane
24 VDC supply	
Input voltage	25 VDC ±1.6%
Input capacitance	235 µF
Max. power consumption	28 W + P_{SMC1} + P_{SMC2} + $P_{24\ V\ Out}$ + $P_{HoldingBrake(s)}$ + $P_{Fan8B0M...}$ [4]
Design	ACOPOSmulti backplane
24 VDC output	
Quantity	2
Output voltage	
DC bus voltage (U_{DC}): 260 to 315 VDC	25 VDC * (U_{DC}/315)
DC bus voltage (U_{DC}): 315 to 800 VDC	24 VDC ±6%
protection	250 mA (slow-blow) electronic, automatic reset
Motor connection [5]	
Quantity	2
Continuous power per motor connection [2]	1.4 kW
Continuous current per motor connection [2]	1.9 A_{eff}
Reduction of continuous current depending on the switching frequency [6]	
Switching frequency 5 kHz	No reduction [7]
Switching frequency 10 kHz	No reduction
Switching frequency 20 kHz	0.11 A/K (from 15°C) [8]
Reduction of continuous current depending on the installation elevation	
Starting at 500 m above sea level	0.19 A_{eff} per 1000 m
Peak current per motor connection	4.7 A_{eff}
Nominal switching frequency	5 kHz
Possible switching frequencies [9]	5/10/20 kHz
Electrical stress of the connected motor in accordance with IEC TS 60034-25 [10]	Limit value curve A
Protective measures	
Overload protection	Yes
Short circuit and ground fault protection	Yes
Max. output frequency	600 Hz [11]
Design	
U, V, W, PE	Male connector
Shield connection	Yes
Terminal connection cross section	
Flexible and fine wire lines	
With wire end sleeves	0.25 to 4 mm²
Approbation data	
UL/C-UL-US	30 to 10
CSA	28 to 10
Terminal cable cross section dimension of the shield connection	12 to 22 mm
Max. motor line length depending on the switching frequency	
Switching frequency 5 kHz	25 m
Switching frequency 10 kHz	25 m
Switching frequency 20 kHz	10 m
Motor holding brake connection	
Quantity	2
Output voltage [12]	24 VDC +5.8% / -0% [13]
Continuous current	1.1 A

Table 2: 8BVI0014HWDS.000-1 - Technical data

Product ID	8BVI0014HWDS.000-1
Max. internal resistance	0.5 Ω
Extinction potential	Approx. 30 V
Max. extinction energy per switching operation	1.5 Ws
Max. switching frequency	0.5 Hz
Protective measures	
Overload and short circuit protection	Yes
Open line monitoring	Yes
Undervoltage monitoring	Yes
Response threshold for open line monitoring	Approx. 0.25 A
Response threshold for undervoltage monitoring	24 VDC +0% / -4%
Encoder interfaces [14)]	
Quantity	2
Type	EnDat 2.2 [15)]
Connections	9-pin female DSUB connector
Status indicators	UP/DN LEDs
Electrical isolation	
Encoder - ACOPOSmulti	No
Encoder monitoring	Yes
Max. encoder cable length	100 m Depends on the cross section of the encoder's supply wires [16)]
Encoder supply	
Output voltage	Typ. 12.5 V
Load capability	350 mA
Protective measures	
Short circuit protection	Yes
Overload protection	Yes
Synchronous serial interface	
Signal transmission	RS485
Data transfer rate	625 Mbit/s
Max. power consumption per encoder interface	P_{SMC} [W] = 19 V * $I_{Encoder}$ [A] [17)]
Trigger inputs	
Quantity	2
Wiring	Sink
Electrical isolation	
Input - Inverter module	Yes
Input - Input	Yes
Input voltage	
Nominal	24 VDC
Maximum	30 VDC
Switching threshold	
Low	<5 V
High	>15 V
Input current at nominal voltage	Approx. 10 mA
Switching delay	
Positive edge	52 µs ± 0.5 µs (digitally filtered)
Negative edge	53 µs ± 0.5 µs (digitally filtered)
Modulation compared to ground potential	Max. ±38 V
Electrical characteristics	
Discharge capacitance	0.2 µF
Operating conditions	
Permitted mounting orientations	
Hanging vertically	Yes
Lying horizontally	Yes
Standing horizontally	No
Installation at elevations above sea level	
Nominal	0 to 500 m
Maximum [18)]	4000 m
Degree of pollution in accordance with EN 60664-1	2 (non-conductive pollution)
Overvoltage category in accordance with IEC 60364-4-443:1999	III
EN 60529 protection	IP20
Environmental conditions	
Temperature	
Operation	
Nominal	5 to 40°C
Maximum [19)]	55°C
Storage	-25 to 55°C
Transport	-25 to 70°C
Relative humidity	
Operation	5 to 85%
Storage	5 to 95%
Transport	Max. 95% at 40°C

Table 2: 8BVI0014HWDS.000-1 - Technical data

Product ID	8BVI0014HWDS.000-1
Mechanical characteristics	
Dimensions [20]	
Width	53 mm
Height	317 mm
Depth	
Wall mounting	263 mm
Weight	Approx. 2.8 kg
Module width	1

Table 2: 8BVI0014HWDS.000-1 - Technical data

1) SLOT 1 and SLOT 2 of the ACOPOSmulti module are occupied by the encoder interfaces.
2) Valid in the following conditions: 750 VDC DC bus voltage, 5 kHz switching frequency, 40°C ambient temperature, installation altitude <500 m above sea level, no derating due to cooling type.
3) I_M ... Average value of the currents on both motor connectors [A].
4) P_{SMC1} ... Max. power consumption P_{SMC} [W] of the SafeMC module in SLOT1 (see the "Encoder interfaces" section).
   P_{SMC2} ... Max. power consumption P_{SMC} [W] of the SafeMC module in SLOT2 (see the section "Encoder interfaces")
   $P_{24\ V\ Out}$ ... Power [W] that is output to the connections X2/+24 V Out 1 and X2/+24 V Out 2 on the module (max. 10 W)
   $P_{Fan8B0M...}$ ... Portion of the power [W] that is used by the fan modules in the mounting plate or the 8B0M0040HFF0.000-1 fan module (see the technical data for the respective 8B0M... mounting plate / 8B0M0040HFF0.000-1 fan module).
5) Only 8BCM motor cables from B&R may be used to connect the motor interfaces.
6) Valid in the following conditions: 750 VDC DC bus voltage. The temperature specifications refer to the ambient temperature.
7) Value for the nominal switching frequency.
8) The module cannot supply the full continuous current at this switching frequency. This unusual value for the ambient temperature, at which a derating of the continuous current must be accounted for, ensures that the derating of the continuous current can be determined in the same manner as at other switching frequencies.
9) B&R recommends operating the module at its nominal switching frequency. Operating the module at a higher switching frequency for application-specific reasons reduces the continuous current and increases the CPU load. When using dual-axis modules, the increased CPU load reduces the functionality of the drive; if this is not taken into consideration, the computing time can be exceeded in extreme cases.
10) If necessary, the stress of the motor isolation system be reduced by an additional externally-wired dU/dt choke. For example, the RWK 305 three-phase du/dt choke from Schaffner (www.schaffner.com) can be used. IMPORTANT: Even when using a dU/dt choke, it is necessary to ensure that an EMC-compatible, low inductance shield connection is used!
11) The module's electrical output frequency (SCTRL_SPEED_ACT * MOTOR_POLEPAIRS) is monitored to protect against dual use in accordance with EC 428/2009 | 3A225. If the electrical output frequency of the module exceeds the limit value of 600 Hz uninterrupted for more than 0.5 s, then the current movement is aborted and error 6060 is output (Power element: Limit speed exceeded).
12) During project development, it is necessary to check if the minimum voltage can be maintained on the holding brake with the specified wiring. The operating voltage range of the holding brake can be found in the user's manual for the respective motor.
13) The specified values is only valid under the following conditions:
   - The 24 VDC supply for the module is provided by an 8B0C auxiliary supply module installed on the same mounting plate.
   If the 24 VDC supply for the module is applied to the mounting plate using an 8BVE expansion module, then the output voltage is reduced because of voltage drops on the expansion cable. In this case, undervoltage monitoring must be disabled.
14) Only 8BCF EnDat 2.2 cables from B&R may be used to connect the encoder interfaces.
15) An EnDat 2.2 functional safety encoder is required when using ACOPOSmulti with SafeMC! With standard EnDat 2.2 encoders, only the STO, SBC and SS1 functions are monitored with respect to timing!
16) The maximum encoder cable length l_{max} can be calculated as follows (the maximum permissible encoder cable length of 100 m must not be exceeded):

   $l_{max} = 7.9/I_G * A * 1/(2*\rho)$

   I_G ... Max. current consumption of the encoder [A]
   A ... Cross section of the supply wire [mm²]
   ρ ... Specific resistance [Ωmm²/m] (e.g. for copper: ρ = 0.0178)
17) $I_{Encoder}$ ... Max. power consumption of the connected encoder [A].
18) Continuous operation at altitudes ranging from 500 m to 4000 m above sea level is possible (taking the specified continuous current reductions into consideration).
19) Continuous operation at ambient temperatures ranging from 40°C to max. 55°C is possible (taking the specified continuous current reductions into consideration), but this will result in a shorter service life.
20) These dimensions refer to the actual device dimensions including the respective mounting plate. Make sure to leave additional space above and below the devices for mounting, connections and air circulation.

4 Dimension diagram and installation dimensions

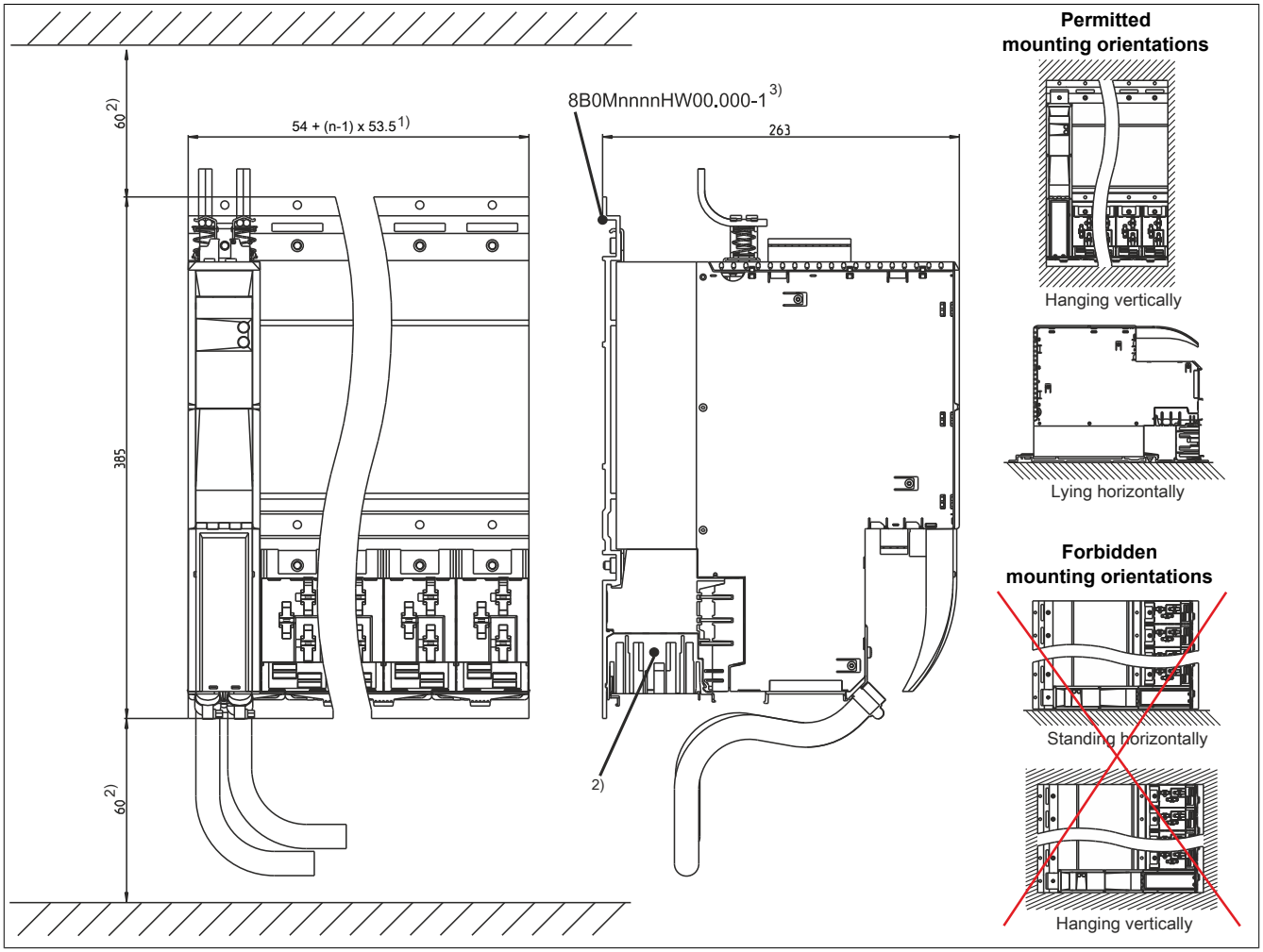


Figure 1: Dimension diagram and installation dimensions

1) n... Necessary width (slots) of the mounting plate.
2) For proper air circulation, at least 60 mm clearance must be available above and below the module.
To ensure that the fan modules in the mounting plate can be replaced easily, at least 250 mm clearance must be available below the module.
3) nnnn indicates the number of slots (e.g. 0160 refers to 16 slots).

5 Wiring: Safe single-width inverter modules (dual-axis modules)

5.1 Pinout overview

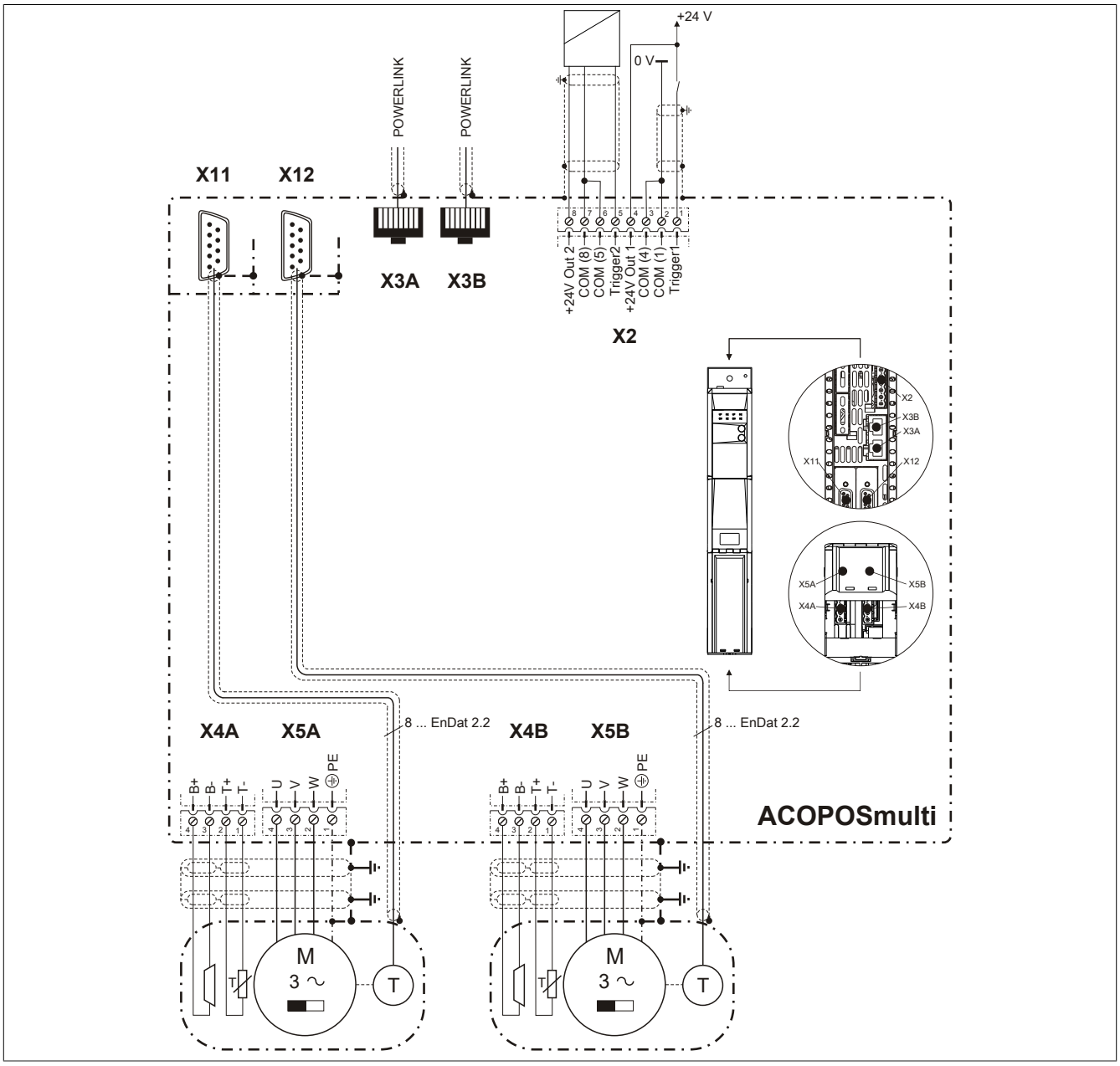


Figure 2: Pinout overview

5.2 X2 connector - Pinout

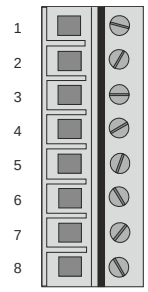
X2	Pin	Name	Function
	1	Trigger 1	Trigger 1
	2	COM (1)	Trigger 1 0 V
	3	COM (2)	+24 V output 1 0 V
	4	+24V Out 1	+24 V output 1
	5	Trigger 2	Trigger 2
	6	COM (5)	Trigger 2 0 V
	7	COM (8)	+24 V output 2 0 V
	8	+24V Out 2	+24 V output 2

Table 3: X2 connector - Pinout

5.3 X3A, X3B connectors - Pinout

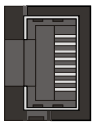
X3A, X3B	Pin	Name	Function
	1	RXD	Receive signal
	2	RXD\	Receive signal inverted
	3	TXD	Transmit signal
	4	Shield	Shield
	5	Shield	Shield
	6	TXD\	Transmit signal inverted
	7	Shield	Shield
	8	Shield	Shield

Table 4: X3A, X3B connectors - Pinout

5.4 X4A connector - Pinout

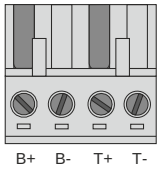
X4A	Name	Function
	T-	Axis 1: Temperature sensor -
	T+	Axis 1: Temperature sensor +
	B- 1)	Axis 1: Brake -
	B+ 1)	Axis 1: Brake +

Table 5: X4A connector - Pinout

1) Wiring is not permitted to exceed a total length of 3 m.

Danger!

The functional fail safe state is enabled if the SBC output B+ is shorted to 24V (i.e. safe pulse disabling is activated). However, the brake always remains on/released because of the short circuit to 24 V!
This can lead to dangerous situations because the motor holding brake (and in the case of hanging loads, the unrestrained reduction) cannot be halted/prevented!
Appropriate wiring measures must be implemented to ensure that the SBC output B+ is not shorted to 24V!

For a double-axis module, it is therefore especially important to prevent a cross fault between the two B+ connections of the two axes!

Danger!

The SBC output

- **may not be wired to multiple modules!**
- **may not be wired as open emitter!**
- **may not be wired as open collector!**

Danger!

Only one output voltage of ≤5 V can be ensured for the safe motor holding brake output when shut off. When selecting a motor holding brake, the user has to make sure that the required braking torque is reached at a current voltage of 5 V.

Information:

The transistors of the SBC output stage are tested cyclically. When the output channels are active, this test emits low pulses on the output with a maximum length of 600 µs.

This must be taken into consideration when choosing the motor holding brake!

Danger!

The connections for the motor temperature sensors and the motor holding brake are safely isolated circuits. These connections are therefore only permitted to be connected to devices or components that have sufficient isolation in accordance with IEC 60364-4-41 or EN 61800-5-1.

Caution!

If B+ and B- are swapped when connecting the permanent magnet holding brakes, then the brakes cannot be opened! ACOPOSmulti inverter modules cannot determine if a holding brake is connected with reverse polarity!

Warning!

Temperature sensors are only permitted to be connected to the X4A/T+ and X4A/T- connectors on an ACOPOSmulti module under the following conditions:

- **There is no ACOPOSmulti plug-in module in SLOT1 on the ACOPOSmulti module with a temperature sensor connected to T+ and T-.**

Otherwise, the temperature monitoring functions on the ACOPOSmulti module may become ineffective, which in extreme cases can cause the hardware (e.g. motors) connected to the ACOPOSmulti module to be destroyed!

5.5 Pinout - X4B connector

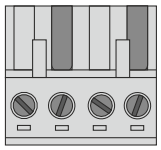
X4B	Name	Function
	T-	Axis 2: Temperature sensor -
	T+	Axis 2: Temperature sensor +
	B- 1)	Axis 2: Brake -
	B+ 1)	Axis 2: Brake +

Table 6: Pinout - X4B connector

1) Wiring is not permitted to exceed a total length of 3 m.

Danger!

The functional fail safe state is enabled if the SBC output B+ is shorted to 24V (i.e. safe pulse disabling is activated). However, the brake always remains on/released because of the short circuit to 24 V!
This can lead to dangerous situations because the motor holding brake (and in the case of hanging loads, the unrestrained reduction) cannot be halted/prevented!
Appropriate wiring measures must be implemented to ensure that the SBC output B+ is not shorted to 24V!

For a double-axis module, it is therefore especially important to prevent a cross fault between the two B+ connections of the two axes!

Danger!

The SBC output

- **may not be wired to multiple modules!**
- **may not be wired as open emitter!**
- **may not be wired as open collector!**

Danger!

Only one output voltage of ≤5 V can be ensured for the safe motor holding brake output when shut off. When selecting a motor holding brake, the user has to make sure that the required braking torque is reached at a current voltage of 5 V.

Information:

The transistors of the SBC output stage are tested cyclically. When the output channels are active, this test emits low pulses on the output with a maximum length of 600 µs.

This must be taken into consideration when choosing the motor holding brake!

Danger!

The connections for the motor temperature sensors and the motor holding brake are safely isolated circuits. These connections are therefore only permitted to be connected to devices or components that have sufficient isolation in accordance with IEC 60364-4-41 or EN 61800-5-1.

Caution!

If B+ and B- are swapped when connecting the permanent magnet holding brakes, then the brakes cannot be opened! ACOPOSmulti inverter modules cannot determine if a holding brake is connected with reverse polarity!

Warning!

Temperature sensors are only permitted to be connected to X4B/T+ and X4B/T- on an ACOPOSmulti module under the following conditions:

- **There is no ACOPOSmulti plug-in module in SLOT2 on the ACOPOSmulti module with a temperature sensor connected to T+ and T-**

Otherwise, the temperature monitoring functions on the ACOPOSmulti module may become ineffective, which in extreme cases can cause the hardware (e.g. motors) connected to the ACOPOSmulti module to be destroyed!

5.6 X5A connector - Pinout

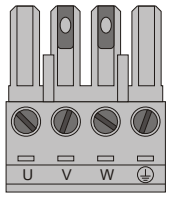
X5A	Name	Function
	⏚	Axis 1: Protective ground conductor
	W	Axis 1: Motor connection W
	V	Axis 1: Motor connection V
	U	Axis 1: Motor connection U

Table 7: X5A connector - Pinout

Information:

Only 8BCM motor cables from B&R may be used to connect the motor interfaces.

5.7 X5B connector - Pinout

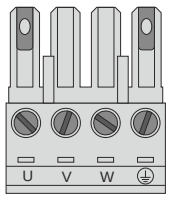
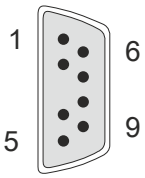
X5B	Name	Function
	⏚	Axis 2: Protective ground conductor
	W	Axis 2: Motor connection W
	V	Axis 2: Motor connection V
	U	Axis 2: Motor connection U

Table 8: X5B connector - Pinout

Information:

Only 8BCM motor cables from B&R may be used to connect the motor interfaces.

5.8 Pinout - SafeMC module

Figure	X11 (X12)	Pin	Name	Function
		1	U+	Encoder supply +125 V
		2	---	---
		3	---	---
		4	D	Data input
		5	T	Clock output
		6	COM (1)	Encoder supply 0 V
		7	---	---
		8	D\	Data input inverted
		9	T\	Clock output inverted

Information:

Only 8BCF EnDat 2.2 cables from B&R may be used to connect the encoder interfaces.

Information:

The SafeMC modules cannot be replaced! SafeMC modules and the corresponding inverter module form a single unit. In the event of an error, the entire inverter module must be replaced.