DBR AUTOMATION

rexroth
A Bosch Company

Project Planning Manual

ctrlX DRIVE

Drive Systems

R911386579, Edition 13

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Disclaimer

The data specified above only serve to describe the product. As our products are constantly being further developed, no statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

DOK-XDRV**-X**********-PR13-EN-P DC-AE/EPI5 (UdSt); DC-AE/EPI4 (BaBo)

0582a66050ea48f50a347e8868cf1a78, 7, en_US

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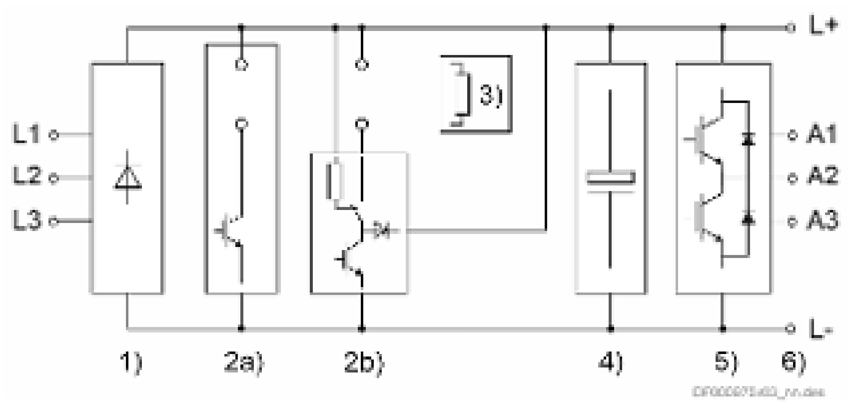
1.1 Product line of drives

1.1.1 Single-axis converter XCS

Single-axis converter



1) Mains input with rectifier
2a) Braking transistor (XCS ≥ W0100)
2b) Integrated braking transistor/braking resistor (XCS ≤ W0090)
3) Optional external braking resistor
4) DC bus capacitors
5) Inverter stage with output to motor
6) DC bus connection

Table 1: XCS type code

Short type designation	1	2	3	4	5	6	7	8	9	1 0	1	2	3	4	5	6	7	8	9	2 0	1	2	3	4	5	6	7	8	9	3 0	1	2	3	4	5	6	7	8	9	4 0
Example:	X	C	S	2	-	W	0	1	0	0	A	B	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	N	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

①	**Product:** 1: **X** = ctrlX DRIVE 2: **C** = Feeding converter 3: **S** = Single-axis 4: **2** = Generation 2; **1** = Generation 1
②	**Cooling type:** W = Air, internal C = Coldplate
③	**Maximum current:** 0100 = 100 A (example) Maximum currents: 10, 23, 54, 70, 90, 100, 120, 150, 180, 210, 250, 280, 330, 375
④	**Degree of protection, input voltage:** A = IP20, 3 × AC 200 ... 500 V +10% -15%
⑤	**Other power section options:** B = Braking transistor (XCS ≥ W0100) R = Integrated braking transistor/braking resistor (XCS ≤ W0070)
⑥	**Connector set:** N = Without motor connector set

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	X	C	S	2	-	W	0	1	0	0	A	B	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	N	0	N	N
	①					②		③			④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

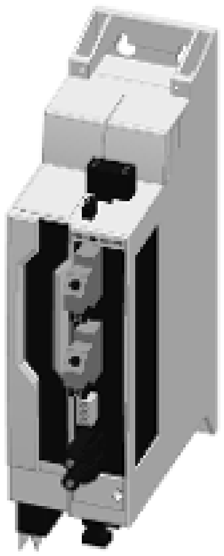
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVE plus
⑧	**Panel:** N = Without panel A = With panel
⑨	**Communication:** ET = Multi-Ethernet EX = Multi-Ethernet incl. ctrlX OS X3 = ctrlX CORE DL = DRIVElink
⑩	**Hardware option 1 - Safety:** T0 = Safe Torque Off (STO) M5 = SafeMotion (M5) M8 = SafeMotion (M8)
⑪	**Hardware option 2:** EC = Multi-encoder interface NN = Not equipped
⑫	**Hardware option 3:** EC = Multi-encoder interface ET = Multi-Ethernet DA = Digital/analog I/O extension NN = Not equipped
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 02 = Version 02 (XCS1) 03 = Version 03 (XCS2) 04 = Version 04 (XCS2) 05 = Version 05 (XCS2)
⑮	**Runtime release:** RS = Current release
⑯	**Export licenses required:** N = No (maximum output frequency < 599 Hz) E = Restricted export (maximum output frequency > 599 Hz)
⑰	**Protocol - communication:** 0 = Defined via ctrlX CORE apps (XCS2) 1 = Sercos III 2 = EtherCAT (SoE) 3 = EtherCAT (CoE) 4 = PROFINET IO

System presentation

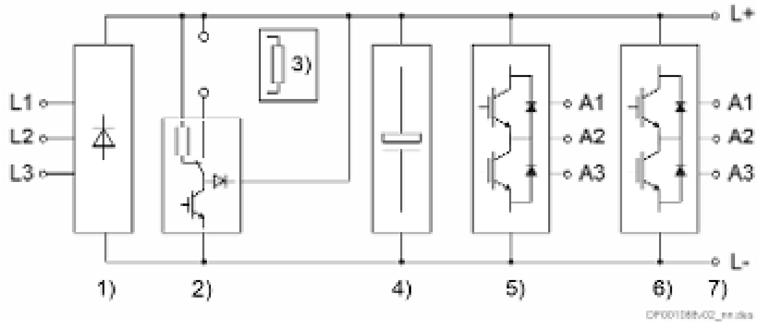
Short type designation	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	X	C	S	2	-	W	0	1	0	0	A	B	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	N	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

⑱	**Technology Function:** NNN = None TF1 = Uploading Technology Apps (XCS2) TE1 = Uploading/programming Technology Apps (XCS2) TX1 = Uploading/programming Technology Apps incl. LIBs (Bosch Rexroth libraries) (XCS2)
⑲	**Scope of functions, Runtime:** N = DRIVE Runtime P = DRIVE Runtime Productivity
⑳	**Scope of functions, SafeMotion:** 0 = Hardware option 1 ≠ SafeMotion 3 = SafeMotion Speed 5 = SafeMotion Position
㉑	**Other design:** NN = None

1.1.2 Double-axis converter XCD



Double-axis converter



1) Mains input with rectifier
2) Integrated braking transistor/braking resistor
3) Optional external braking resistor
4) DC bus capacitors
5) Inverter stage axis 1 with output to motor
6) Inverter stage axis 2 with output to motor
7) DC bus connection

Table 2: XCD type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	C	D	2	-	W	2	3	2	3	A	R	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	P	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

①	**Product:** 1: **X** = ctrlX DRIVE 2: **C** = Feeding converter 3: **D** = Double-axis 4: **2** = Generation 2; **1** = Generation 1
②	**Cooling type:** W = Air, internal
③	**Maximum current:** 2323 = 23A/23A (example) Maximum currents: 2323
④	**Degree of protection, input voltage:** A = IP20, 3 × AC 200 ... 500 V +10% -15%
⑤	**Other power section options:** R = Integrated braking transistor/braking resistor
⑥	**Connector set:** N = Without motor connector set
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVE^{plus}
⑧	**Panel:** N = Without panel A = With panel

Short type designation	1	2	3	4	5	6	7	8	9	1 0	1	2	3	4	5	6	7	8	9	2 0	1	2	3	4	5	6	7	8	9	3 0	1	2	3	4	5	6	7	8	9	4 0
Example:	X	C	D	2	-	W	2	3	2	3	A	R	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	P	0	N	N
		①				②		③			④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰		⑱		⑲	⑳	㉑	

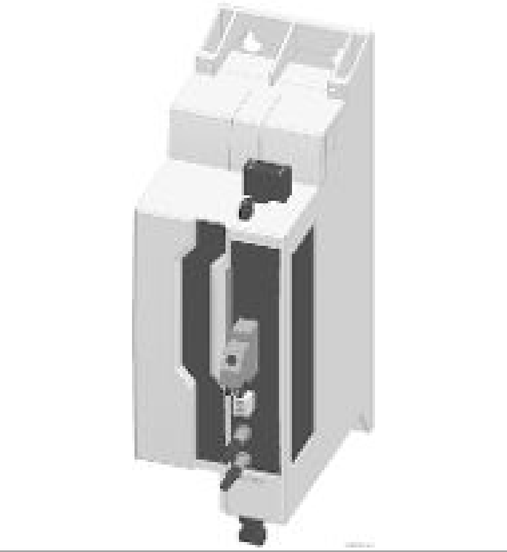
⑨	**Communication:** ET = Multi-Ethernet EX = Multi-Ethernet incl. ctrlX OS X3 = ctrlX CORE
⑩	**Hardware option 1 - Safety:** T0 = Safe Torque Off (STO) M5 = SafeMotion (M5) M8 = SafeMotion (M8)
⑪	**Hardware option 2:** EC = Multi-encoder interface NN = Not equipped
⑫	**Hardware option 3:** ET = Multi-Ethernet NN = Not equipped
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 02 = Version 02 (XCD1) 03 = Version 03 (XCD2) 04 = Version 04 (XCD2) 05 = Version 05 (XCD2)
⑮	**Runtime release:** RS = Standard (current release)
⑯	**Export licenses required:** N = No (maximum output frequency < 599 Hz) E = Restricted export (maximum output frequency > 599 Hz)
⑰	**Protocol - communication:** 0 = Defined via ctrlX CORE Apps (XCD2) 1 = Sercos III 2 = EtherCAT (SoE) 3 = EtherCAT (CoE) 4 = PROFINET IO
⑱	**Technology Function:** NNN = None TF1 = Uploading Technology Apps (XCD2) TE1 = Uploading/programming Technology Apps (XCD2) TX1 = Uploading/programming Technology Apps incl. LIBs (Bosch Rexroth libraries) (XCD2)
⑲	**Scope of functions, Runtime:** N = DRIVE Runtime P = DRIVE Runtime Productivity

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	X	C	D	2	-	W	2	3	2	3	A	R	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	P	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

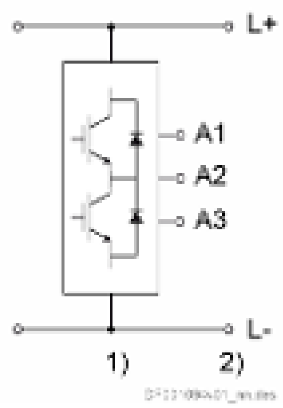
⑳	**Scope of functions, SafeMotion:** 0 = Option 1 ≠ SafeMotion 3 = SafeMotion Speed 5 = SafeMotion Position
㉑	**Other design:** NN = None

System presentation

1.1.3 Single-axis inverter XMS



Single-axis inverter



1) Inverter stage with output to motor
2) DC bus connection

Table 3: XMS type code

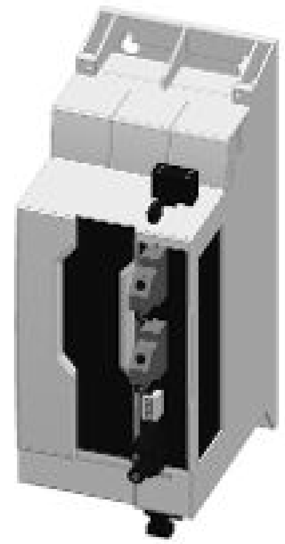
										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	M	S	2	-	W	0	1	0	0	A	N	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	P	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

①	**Product:** 1: **X** = ctrlX DRIVE 2: **M** = Inverter 3: **S** = Single-axis 4: **2** = Generation 2; **1** = Generation 1
②	**Cooling type:** W = Air, internal C = Coldplate
③	**Maximum current:** 0100 = 100 A (example) Maximum currents: 6, 10, 16, 23, 30, 36, 54, 70, 90, 100, 120, 150, 180, 210, 250, 280, 330, 375
④	**Degree of protection, input voltage:** A = IP20, DC 750 V
⑤	**Other power section options:** N = None
⑥	**Motor connector set:** N = Without motor connector set
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVEplus
⑧	**Control panel:** N = Without control panel A = With control panel
⑨	**Communication:** ET = Multi-Ethernet DL = DRIVElink

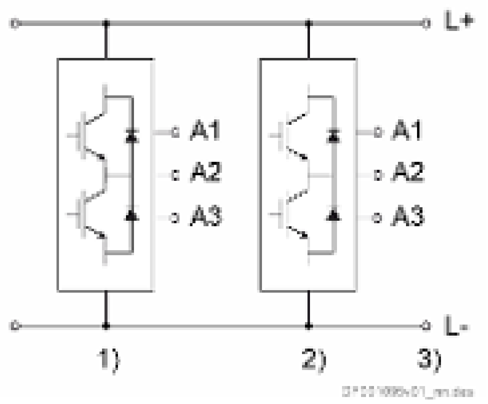
										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	M	S	2	-	W	0	1	0	0	A	N	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	P	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

⑩	**Hardware option 1 - Safety:** T0 = Safe Torque Off (STO) M5 = SafeMotion (M5) M8 = SafeMotion (M8)
⑪	**Hardware option 2:** EC = Multi-encoder interface NN = Not equipped
⑫	**Hardware option 3:** EC = Multi-encoder interface DA = Digital/analog I/O extension NN = Not equipped
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 02 = Version 02 (XMS1) 03 = Version 03 (XMS2) 04 = Version 04 (XMS2) 05 = Version 05 (XMS2)
⑮	**Runtime release:** RS = Standard (current release)
⑯	**Export licenses required:** N = No (maximum output frequency < 599 Hz) E = Restricted export (maximum output frequency > 599 Hz)
⑰	**Protocol - communication:** 1 = Sercos III 2 = EtherCAT (SoE) 3 = EtherCAT (CoE) 4 = PROFINET IO
⑱	**Technology Function:** NNN = None TF1 = Uploading Technology Apps (XMS2) TE1 = Uploading/programming Technology Apps (XMS2) TX1 = Uploading/programming Technology Apps incl. LIBs (Bosch Rexroth libraries) (XMS2)
⑲	**Scope of functions, Runtime:** N = DRIVE Runtime P = DRIVE Runtime Productivity
⑳	**Scope of functions, SafeMotion:** 0 = Option 1 ≠ SafeMotion 3 = SafeMotion Speed 5 = SafeMotion Position
㉑	**Other design:** NN = None

1.1.4 Double-axis inverter XMD



Double-axis inverter



1) Inverter stage axis 1 with output to motor
2) Inverter stage axis 2 with output to motor
3) DC bus connection

Table 4: XMD type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	M	D	2	-	W	2	3	2	3	A	N	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	N	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

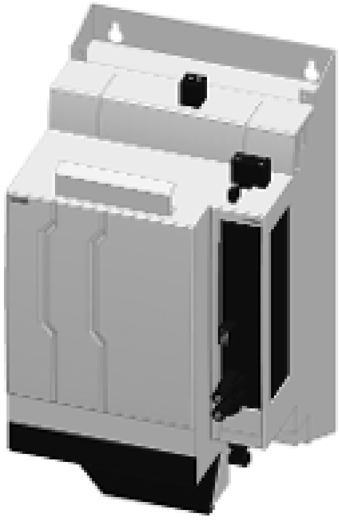
①	**Product:** 1: **X** = ctrlX DRIVE 2: **M** = Inverter 3: **D** = Double-axis 4: **2** = Generation 2; **1** = Generation 1
②	**Cooling type:** W = Air, internal C = Coldplate
③	**Maximum current:** 5454 = 54A / 54A (example) Maximum currents: 6/6, 10/10, 16/16, 23/23, 30/30, 36/36, 54/54, 70/70
④	**Degree of protection, input voltage:** A = IP20, DC 750 V
⑤	**Other power section options:** N = None
⑥	**Motor connector set:** N = Without motor connector set
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVEplus
⑧	**Panel:** N = Without panel A = With panel
⑨	**Communication:** ET = Multi-Ethernet

									1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	M	D	2	-	W	2	3	2	3	A	N	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	N	N	N	N	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

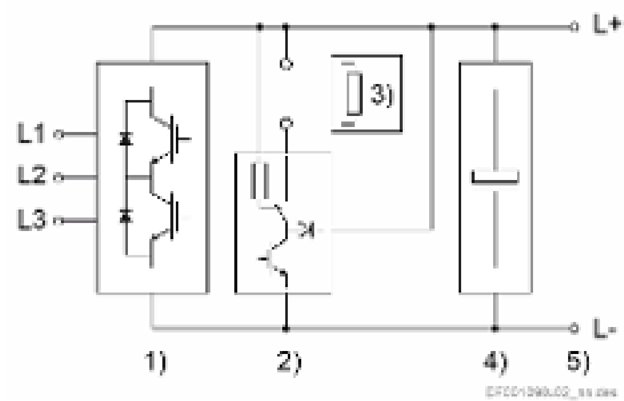
⑩	**Hardware option 1 - Safety:** T0 = Safe Torque Off (STO) M5 = SafeMotion (M5) M8 = SafeMotion (M8)
⑪	**Hardware option 2:** EC = Multi-encoder interface NN = Not equipped
⑫	**Hardware option 3:** NN = Not equipped
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 02 = Version 02 (XMD1) 03 = Version 03 (XMD2) 04 = Version 04 (XMD2) 05 = Version 05 (XMD2)
⑮	**Runtime release:** RS = Standard (current release)
⑯	**Export licenses required:** N = No (maximum output frequency < 599 Hz) E = Restricted export (maximum output frequency > 599 Hz)
⑰	**Protocol - communication:** 1 = Sercos III 2 = EtherCAT (SoE) 3 = EtherCAT (CoE) 4 = PROFINET IO
⑱	**Technology Function:** NNN = None TF1 = Uploading Technology Apps (XMD2) TE1 = Uploading/programming Technology Apps (XMD2) TX1 = Uploading/programming Technology Apps incl. LIBs (Bosch Rexroth libraries) (XMD2)
⑲	**Scope of functions, Runtime:** N = DRIVE Runtime P = DRIVE Runtime Productivity
⑳	**Scope of functions, SafeMotion:** 0 = Hardware option 1 ≠ SafeMotion 3 = SafeMotion Speed 5 = SafeMotion Position
㉑	**Other design:** NN = None

System presentation

1.1.5 Regenerative supply unit XVR



Supply unit



1) Mains input with mains inverter
2) Braking transistor
3) Optional external braking resistor
4) DC bus capacitors
5) DC bus connection

Table 5: XVR type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	V	R	2	-	W	0	0	4	8	A	R	N	-	0	1	N	E	T	N	N	N	N	N	N	-	S	0	3	R	S	N	1	N	N	N	N	N	N	N
		①				②		③			④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰		⑱		⑲	⑳	㉑	

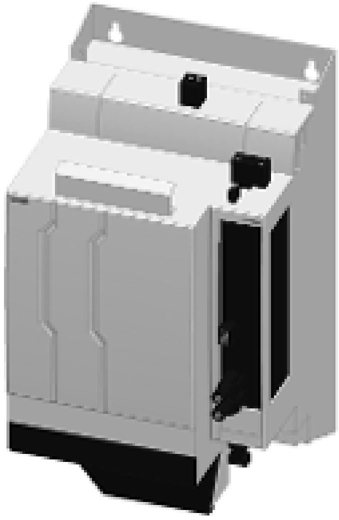
①	**Product:** 1: **X** = ctrlX DRIVE 2: **V** = Supply unit 3: **R** = Regenerative 4: **2** = Generation 2; **1** = Generation 1
②	**Cooling type:** W = Air, internal
③	**Rated power:** 0019 = 19 kW 0048 = 48 kW 0072 = 72 kW 0100 = 100 kW
④	**Degree of protection, input voltage:** A = IP20, 3 × AC 380 ... 500 V +10% -15%
⑤	**Other power section options:** R = Integrated braking transistor and braking resistor
⑥	**Connector set:** N = Without power connector set
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVEplus

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	X	V	R	2	-	W	0	0	4	8	A	R	N	-	0	1	N	E	T	N	N	N	N	N	N	-	S	0	3	R	S	N	1	N	N	N	N	N	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

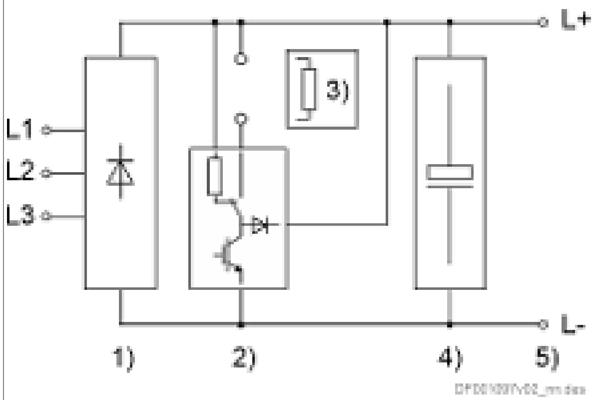
⑧	**Panel:** N = Without panel A = With panel
⑨	**Communication:** ET = Multi-Ethernet EX = Multi-Ethernet incl. ctrlX OS X3 = ctrlX CORE
⑩	**Hardware option 1:** NN = Not equipped
⑪	**Hardware option 2:** NN = Not equipped
⑫	**Hardware option 3:** NN = Not equipped ET = Multi-Ethernet
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 02 = Version 02 (XVR1) 03 = Version 03 (XVR2) 04 = Version 04 (XVR2) 05 = Version 05 (XVR2)
⑮	**Runtime release:** RS = Standard (current release)
⑯	**Export licenses required:** N = No
⑰	**Protocol - communication:** 0 = defined via ctrlX CORE apps (XVR2) 1 = Sercos III 2 = EtherCAT (SoE) 3 = EtherCAT (CoE) 4 = PROFINET IO
⑱	**Technology Function:** NNN = None TE1 = Uploading/programming Technology Apps (XVR2) TX1 = Uploading/programming Technology Apps incl. LIBs (Bosch Rexroth libraries) (XVR2)
⑲	**Scope of functions, Runtime:** N = DRIVE Runtime P = DRIVE Runtime Productivity
⑳	**Scope of functions, SafeMotion:** N = None
㉑	**Other design:** NN = None

System presentation

1.1.6 Feeding supply unit XVE



Supply unit



1) Mains input with rectifier
2) Integrated braking transistor/braking resistor
3) Optional external braking resistor
4) DC bus capacitors
5) DC bus connection

Table 6: XVE type code

Short type designation	1	2	3	4	5	6	7	8	9	1 0	1	2	3	4	5	6	7	8	9	2 0	1	2	3	4	5	6	7	8	9	3 0	1	2	3	4	5	6	7	8	9	4 0
Example:	X	V	E	2	-	W	0	0	7	5	A	R	N	-	0	1	A	E	T	N	N	N	N	N	N	-	S	0	3	R	S	N	2	N	N	N	N	N	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

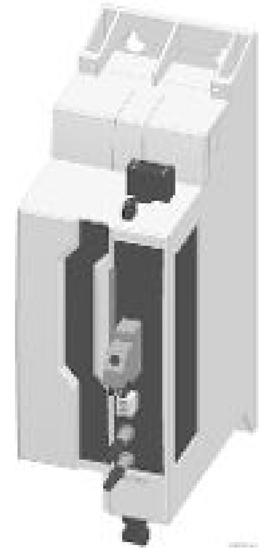
①	**Product:** 1: **X** = ctrlX DRIVE 2: **V** = Supply unit 3: **E** = Feeding 4: **2** = Generation 2
②	**Cooling type:** W = Air, internal
③	**Rated power:** 0030 = 30 kW 0075 = 75 kW 0125 = 125 kW
④	**Degree of protection, input voltage:** A = IP20, 3 × AC 380 ... 500 V +10% -15%
⑤	**Other design:** R = Integrated braking transistor and braking resistor
⑥	**Connector set:** N = Without
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVE[plus]
⑧	**Panel:** N = Without panel A = With panel

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	V	E	2	-	W	0	0	7	5	A	R	N	-	0	1	A	E	T	N	N	N	N	N	N	-	S	0	3	R	S	N	2	N	N	N	N	N	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

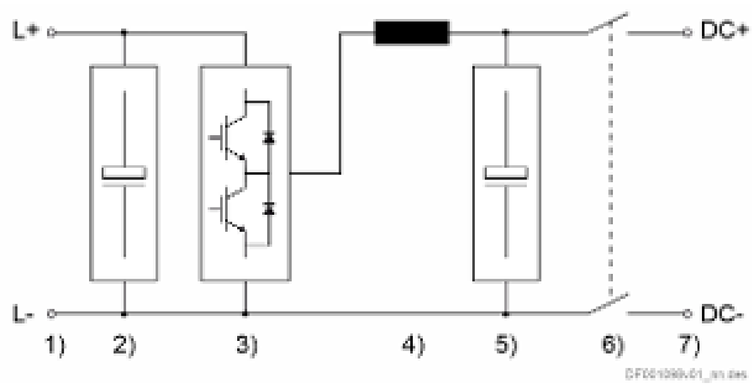
⑨	**Communication option:** ET = Multi-Ethernet EX = Multi-Ethernet incl. ctrlX OS X3 = ctrlX CORE
⑩	**Hardware option 1:** NN = None
⑪	**Hardware option 2:** NN = None
⑫	**Hardware option 3:** NN = None ET = Multi-Ethernet
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 03 = Version 03 04 = Version 04 05 = Version 05
⑮	**Runtime release:** RS = Standard (current release)
⑯	**Export licenses required:** N = No
⑰	**Protocol - communication:** 0 = Defined via ctrlX CORE Apps 1 = Standard (Sercos III) 2 = EtherCAT (SoE) 3 = EtherCAT (CoE) 4 = PROFINET IO
⑱	**Technology Function:** NNN = None TE1 = Uploading/programming Technology Apps TX1 = Uploading/programming Technology Apps incl. LIBs (Bosch Rexroth libraries)
⑲	**Scope of functions, Runtime:** N = DRIVE Runtime P = DRIVE Runtime Productivity
⑳	**Scope of functions, SafeMotion:** N = None
㉑	**Other design:** NN = None

System presentation

1.1.7 DC/DC converter XMV



DC/DC converter



1) DC input voltage
2) DC bus capacitor unit (optional)
3) DC/DC converter XMV
4) DC bus choke (smoothing choke)
5) DC bus capacitor unit
6) Contactor (application)
7) DC output voltage

Table 7: XMV type code

									1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	M	V	2	-	W	0	0	5	0	A	N	C	-	0	2	N	E	T	N	N	N	N	N	N	-	S	0	3	R	S	N	1	N	N	N	N	N	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	㉑	

①	**Product:** 1: **X** = ctrlX DRIVE 2: **M** = Modular device 3: **V** = Power supply 4: **2** = Generation 2
②	**Cooling type:** W = Air, internal
③	**Rated current:** 0050 = 50 A 0080 = 80 A 0210 = 210 A
④	**Degree of protection, input voltage:** A = IP20, DC 750 V
⑤	**Other power section options:** N = None
⑥	**Power connector set:** C = With power connector
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVEplus

Short type designation	1	2	3	4	5	6	7	8	9	1 0	1	2	3	4	5	6	7	8	9	2 0	1	2	3	4	5	6	7	8	9	3 0	1	2	3	4	5	6	7	8	9	4 0
Example:	X	M	V	2	-	W	0	0	5	0	A	N	C	-	0	2	N	E	T	N	N	N	N	N	N	-	S	0	3	R	S	N	1	N	N	N	N	N	N	N
		①				②		③			④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰		⑱		⑲	⑳	㉑	

⑧	**Panel:** N = Without panel A = With panel
⑨	**Communication:** ET = Multi-Ethernet X3 = ctrlX CORE
⑩	**Hardware option 1:** NN = Not equipped
⑪	**Hardware option 2:** NN = Not equipped
⑫	**Hardware option 3:** NN = Not equipped ET = Multi-Ethernet
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 03 = Version 03 04 = Version 04 05 = Version 05
⑮	**Runtime release:** RS = Standard (current release)
⑯	**Export licenses required:** N = No (maximum output frequency < 599 Hz)
⑰	**Protocol - communication:** 0 = Defined via ctrlX CORE Apps 1 = Sercos III 2 = EtherCAT (SoE) 3 = EtherCAT (CoE) 4 = PROFINET IO
⑱	**Technology Function:** NNN = None TE1 = Uploading/programming Technology Apps TX1 = Uploading/programming Technology Apps incl. LIBs (Bosch Rexroth libraries)
⑲	**Scope of functions, Runtime:** P = DRIVE Runtime Productivity
⑳	**Scope of functions, SafeMotion:** N = None
㉑	**Other design:** NN = None

System presentation

1.1.8 Compatibility of devices and functions

Some compatibilities and functions are only possible with a specific hardware index.

The hardware index can be found on the type plate or the additional plate.

Fig. 1: Hardware index

Table 8: Function vs. Hardware index

Function	Device													
	XMS1	XMS2	XMD1	XMD2	XCS1	XCS2	XCD1	XCD2	XVR1	XVR2	XVE1	XVE2	XMV1	XMV2
Compatibility with mains filters HNF, NFD, NFE ● XCS*-*0054 ● XCS*-*0070 ● XCD*-*2323	-	-	-	-	≥ DE1	≥ AG1	≥ DD1	≥ AF1	-	-	-	-	-	-
Compatibility with mains filters HNF, NFD, NFE ● XCS*-*0100 ● XCS*-*0120	-	-	-	-	≥ DF1	≥ AS1	-	-	-	-	-	-	-	-
SafeMotion certificate available	-	≥ AN1	-	≥ AN1	-	≥ AN1	-	≥ AN1	-	-	-	-	-	-
XE20 redesign	-	-	-	-	-	-	-	-	-	≥ tbd	-	-	-	-

Counting method: AA1, AB1, AC1, ... , AZ1, BA1, ... , ZZ1

1.2 Firmware/Runtime

Runtime

In the type codes of the drive controllers and supply units, the firmware is referred to as **Runtime**.

1.3 About this documentation

1.3.1 Purpose

- Overview of the drive system ctrlX DRIVE
- Description of the allowed combinations of ctrlX DRIVE system components
- Selection of the system components of the drive system ctrlX DRIVE
- Specification applying to all components (ambient and operating conditions)
- Application description of system characteristics

1.3.2 Editions

Table 9: Editions

Edition	Release date	Comment
01	2018-04	First edition
02	2019-04	More products included: • XCS1-W0210, -W0250, -W0280 • XMD1-W0606, -W1010, -W1616 • XMS1-W0006, -W0010, -W0016, -W0023, -W0030, -W0036 • Mains filter: 140A, 185A • Accessories: XAS2, shield connection • Accessories: XAS5, snap-on ferrite
03	2019-10	More products included: • XMS1-W0054, -W0070, -W0090
04	2020-05	More products included: • XMS1-W0100, -W0120, -W0210, -W0250, -W0280 • XCD1-W2323 • XVR1-W0048, -W0072 • XLI 48kW/72A, 72kW/106A • XNL 80A/146A/185A • XLC1-W01M2 • ctrlX DRIVEplus control sections • Internal ctrlX CORE control
05	2020-08	• Corrected data: – Inverter: Continuous output current; output frequency f_{out} < f_{out_still} – XCS1-W0120: DC bus power – XVR1: Integrated braking resistor Capacitance against housing – Derating vs. installation altitude: Distinction of cases according to devices not made anymore • Removed "XAS5, snap-on ferrite" accessory (external braking resistors always are to be connected with shielded lines) • XG21, motor encoder EC (multi-encoder) connection: Corrected list of supported encoder systems • XAS2, shield connection: Added information on the position of the clamping plate and the cable • XE20:

Edition	Release date	Comment
		Corrected condition as supplied
06	2021-03	• Updated type codes of the devices: Included devices of generation 2 (The generations have identical performance data and connection options of the devices. Therefore, the text specifies "XCS*-W0120" instead of "XCS1-W0120" or "XCS2-W0120", for example.) • More products included: – XCS*-W0150, -W0180 – XVR*-W0100 – XLI 100kW/150A – XMV*-W0050, -W0080, -W0210 (DC/DC converter) – XLL (DC bus choke) • Included optional safety technology SafeMotion M5 • Included ctrlX DRIVE panel XDP1 • Included XAS2, shield connection: – XAS2-007-001 – XAS2-007-002 – XAS2-008-001 – XAS2-008-002 • Included "XAS4, DC bus adapter" accessory: – XAS4-WM-U005-NN – XAS4-WL-U005-NN • XCD*-W2323: – Added connection point XD01 (mains, 10 mm²) – Added connection point XD04 (braking resistor, 10 mm²) • XCS*-W0054/70: – Added connection point XD01 (mains 16 mm²) – Added connection point XD04 (braking resistor 10 mm²) • Analog input (XG31): Included technical data • Updated technical data of the devices, such as power dissipation at continuous current and continuous power, continuous output current (at f_s = x kHz; output frequency f_{out} < f_{out_still}), mass, ... • Updated data of power requirement for sizing the control voltage supply • Included information on mains connection • Included information on DC bus coupling
07	2021-07	• Included XCS*-W0023 • Included XMS*-W0150, -W0180 • Included encoder evaluation ctrlX SENSEmotor • Included encoder evaluation EnDat 2.2 • Motor documentations: Included MS2S • XG03: Updated description • Connection points 35 mm²: Included cable feedthrough (R911410689)

Edition	Release date	Comment
08	2021-11	• Included feeding supply unit XVE*-W0075 • Included devices with "Coldplate" cooling type: – XCS*-C0054, -C0070 – XMS*-C0210, -C0280 – XMD*-C5454, -C7070 • Included "XAS4, DC bus adapter" accessory for devices with "Coldplate" cooling type: – XAS4-CM-U005-NN – XAS4-CL-U005-NN • Included optional I/O extension (XG37, XG38) ("DA" option) • Included redesign of ctrlX DRIVE control sections • Mechanical project planning: Updated horizontal spacing (d_{hor}) for all devices
09	2022-07	• Included XVR*-W0019 and XLI1-1R-W0019 • Included XCS*-W0330, -W0375 • Included XMS*-W0330, -W0375 • Multi-Ethernet: Included PROFINET IO • Included instructions on how to replace fans • Included ➦ Compatibility of devices and functions with regard to the hardware index of the devices
10	2022-11	• Included XVE*-W0125 • Included XMS*-C0054, -C0070, -C0090 • Included "DL" communication (DRIVElink) for "ctrlX DRIVEplus" single-axis control sections
11	2023-03	• Included XCS*-W0010, -W0090 • Included XVE*-W0030 • Included XMD*-W3636 • Included XAS2-009-003-NN (shield connection accessories XCS*-W0090) • "ctrlX DRIVEplus" single-axis control sections: included second multi-encoder interface "EC" (hardware option 3) • XCS, XCD, XVE: Technical data, mains voltage: included total power factor TPF • Included information on additional adhesive labels (warnings in 27 languages; R911337014, R911337015)
12	2023-07	• Included XMD*-W3030 • Inverter performance data: included current values at switching frequency 12 kHz (switching frequency 12 kHz available with Runtime AXS-V-0316 and higher) • Extended data of connection cross sections: rigid/flexible, with/without ferrule (with/without plastic sleeve), 1 or 2 conductors • XLI1-1RW0048: corrected maximum allowed capacitances • XNF1-1*-0100N-E0080, -0150N-E0140: corrected maximum allowed Y-capacitance • Included documentation "ctrlX Motor Cables and Connectors" • Included documentations of Runtime AXS-V-04 • Included "IT security" (➦ Chapter 4.7 IT security on page 178) • Multi-encoder interface "EC": included additional data (➦ Chapter 11.6 Encoder evaluation (EC) on page 384)

Edition	Release date	Comment
13	2023-11	• Included **Multi-Ethernet incl. ctrlX OS** communication ("EX" option) • Included optional safety technology **SafeMotion M8** • Included documentations of Runtime **AXS-V-05** • **XLI** mains connection module: included double-line mounting (➦ Chapter Double-line mounting on page 467) • Removed **EAC certification** • Description of the connection points: positions of **equipment grounding conductors** pictured for each device • **Hybrid cable**: included maximum allowed lengths and numbers of cable segments (➦ Chapter 4.4.2 RHB hybrid cable on page 173) • Included connection diagrams of encoders (1Vpp with EnDat 2.1, 1Vpp with reference track, SSI)

1.3.3 Documentations

Drive systems, system components

Table 10: Documentations – Drive systems, System Components

Title	Type of documentation	Document type 1)	Material number
ctrlX DRIVE Drive Systems	Project Planning Manual	DOK-XDRV**-X***********-PRxx-EN-P	➦R911386579
ctrlX DRIVE DC/DC Converter XMV	Application Manual	DOK-XDRV**-XMV********-APxx-EN-P	➦R911413650
Security Instructions Electric Drives and Controls	Project Planning Manual	DOK-IWORKS-SECURITY***-PRxx-EN-P	➦R911342562
Control Cabinet Air Conditioning, EMC, Design, IP Code, IndraDrive Electrics, Rexroth EFC/Fv, Sytronix	Project Planning Manual	DOK-DRIVE*-CABINET****-PRxx-EN-P	➦R911344988

1) In the document type codes, "xx" is a placeholder for the current edition of the documentation (e.g.: PR01 is the first edition of a Project Planning Manual)

Firmware/Runtime

Table 11: Documentations – firmware

Title ctrlX DRIVE	Type of documentation	Document type 1)	Material number
AXS-V-05 Functions	Application Manual	DOK-XDRV**-AXS-05VRS**-APxx-EN-P	➦R911422255
AXS-V-05 (CoE) Functions	Application Manual	DOK-XDRV**-AXS-05VRS*C-APxx-EN-P	➦R911422257
Diagnostic Messages of Runtime AXS-V-05RS	Reference Book	DOK-XDRV**-GEN5-DIAG**-RExx-EN-P	R911422251
Parameters/Objects of Runtime AXS-V-05RS	Reference Book	DOK-XDRV**-GEN5-PARA*C-RExx-EN-P	R911422253
AXS-V-04 Functions	Application Manual	DOK-XDRV**-AXS-04VRS**-APxx-EN-P	➦R911421281
AXS-V-04 (CoE) Functions	Application Manual	DOK-XDRV**-AXS-04VRS*C-APxx-EN-P	➦R911421283
Diagnostic Messages of Runtime AXS-V-04RS	Reference Book	DOK-XDRV**-GEN4-DIAG**-RExx-EN-P	➦R911421277
Parameters/Objects of Runtime AXS-V-04RS	Reference Book	DOK-XDRV**-GEN4-PARA*C-RExx-EN-P	➦R911421279
AXS-V-03 Functions	Application Manual	DOK-XDRV**-AXS-03VRS**-APxx-EN-P	➦R911410073
AXS-V-03 (CoE) Functions	Application Manual	DOK-XDRV**-AXS-03VRS*C-APxx-EN-P	➦R911398021
Diagnostic Messages of Runtime AXS-V-03RS	Reference Book	DOK-XDRV**-GEN3-DIAG**-RExx-EN-P	➦R911409763
Parameters of Runtime AXS-V-03RS	Reference Book	DOK-XDRV**-GEN3-PARA**-RExx-EN-P	➦R911409808
Parameters/Objects of Runtime AXS-V-03RS	Reference Book	DOK-XDRV**-GEN3-PARA*C-RExx-EN-P	➦R911419643

Title ctrlX DRIVE	Type of documentation	Document type 1)	Material number
AXS-V-02 Functions	Application Manual	DOK-XDRV**-AXS-02VRS**-APxx-EN-P	➦R911398021
Diagnostic Messages of Runtime AXS-V-02RS	Reference Book	DOK-XDRV**-GEN2-DIAG**-RExx-EN-P	➦R911383776
Parameters of Runtime AXS-V-02RS	Reference Book	DOK-XDRV**-GEN2-PARA**-RExx-EN-P	➦R911383778

1) In the document typecodes, xx is a placeholder for the current edition of the documentation (e.g.: RE02 is the second edition of a Reference Book)

Functional safety

Table 12: Documentations – functional safety

Title ctrlX DRIVE	Type of documentation	Document typecode1)	Material number
Integrated Safety Technology Safe Torque Off	Application Manual	DOK-XDRV**-SI-TX******-APxx-EN-P	➦R911383774
Integrated Safety Technology SafeMotion	Application Manual	DOK-XDRV**-SI-MX******-APxx-EN-P	➦R911404905

1) In the document typecodes, xx is a placeholder for the current edition of the documentation (e.g.: AP02 is the second edition of an Application Manual)

Motors

Table 13: Documentations – motors

Title	Type of documentation	Document typecode1)	Material number
MS2N Synchronous Servomotors	Project Planning Manual	DOK-MOTOR*-MS2N*******-PRxx-EN-P	➦R911347583
MS2S Synchronous Servomotors	Project Planning Manual	DOK-MOTOR*-MS2S*******-PRxx-EN-P	➦R911410075
MS2E Synchronous Servomotors acc. to ATEX Directive 2014/34/EU	Project Planning Manual	DOK-MOTOR*-MS2E*******-PRxx-EN-P	➦R911394140
MSK Synchronous Servomotors	Project Planning Manual	DOK-MOTOR*-MSK********-PRxx-EN-P	➦R911296289
MSK Synchronous Servomotors for Potentially Explosive Areas	Project Planning Manual	DOK-MOTOR*-MSK*EXGIIK3-PRxx-EN-P	➦R911312709
MKE Synchronous Motors Synchronous Servomotors acc. to ATEX Directive 2014/34/EU	Project Planning Manual	DOK-MOTOR*-MKE*GEN3***-PRxx-EN-P	➦R911411017
MAD / MAF Asynchronous Motors MAD / MAF	Project Planning Manual	DOK-MOTOR*-MAD/MAF****-PRxx-EN-P	➦R911295781
MLF Synchronous Linear Motors	Project Planning Manual	DOK-MOTOR*-MLF********-PRxx-EN-P	➦R911293635
ML3 Self-Cooled Linear Motors	Project Planning Manual	DOK-MOTOR*-ML3********-PRxx-EN-P	➦R911389760
MCL Ironless Linear Motors MCL	Project Planning Manual	DOK-MOTOR*-MCL********-PRxx-EN-P	➦R911330592

1) In the document type codes, "xx" is a placeholder for the current edition of the documentation (e.g.: PR01 is the first edition of a Project Planning Manual)

Cables

Table 14: Documentations – Cables

Title	Type of documentation	Document type [1)]	Material number
ctrlX Motor Cables and Connectors	Reference Book	DOK-CONNEC-XDRV*******-RExx-EN-P	➦R911420100
Motor cables and connections with IndraDrive	Product information	DOK-CONNEC-MS2N*INDRV*-CAxx-EN-P	➦R911401938
Rexroth Connection Cables IndraDrive and IndraDyn	Selection Data	DOK-CONNEC-CABLE*INDRV-CAxx-EN-P	➦R911322949

1) In the document type codes, xx is a placeholder for the current edition of the documentation (e.g.: CA03 is the third edition of the Catalog documentation)

1.3.4 Your suggestions

Your experience is an important part of the product and documentation improvement process.

In case of any errors or if you want to suggest changes to this documentation, please do not hesitate to contact us.

Please send your feedback to:

Address for feedback

Bosch Rexroth AG
Dept. DC-AE/EPI5
Buergermeister-Dr.-Nebel-Str. 2
97816 Lohr, Germany
E-mail: ➦dokusupport@boschrexroth.de

2 Important directions for use

2.1 Intended use

2.1.1 Introduction

The products of Rexroth are developed and manufactured to the state-of-the-art. Prior to delivery, the products are checked for their fail-safe state.

⚠ WARNING	**Personal injury or property damage due to incorrect use of the products!** These products are intended for use in an industrial environment and must only be used as intended. If the products are not used as intended, this may lead to situations resulting in property damage or personal injury.

NOTICE	**Damages resulting from unintended use** The user shall solely bear the risks for damages arising of unintended use of the products; Rexroth as manufacturer shall not assume any warranty, liability or compensation for damages.

Before using Rexroth products, make sure that all the prerequisites for an intended use of the products are satisfied:

- Anyone that in any way, shape or form uses our products must have read and understood the relevant safety provisions and the intended use.
- Do not change the original state of the hardware products, i.e., do not change the structure of the products. Software products must not be decompiled and their source codes must not be modified.
- Damaged or defective products must not be installed or commissioned.
- It has to be ensured that the products are installed according to the provisions specified in the documentation.

2.1.2 Areas of use and application

Drive controllers by Rexroth are designed to control electric motors and monitor their operation. Controlling and monitoring the drive controllers may require additional sensors and actuators.

The drive controllers may only be used with the accessories and attachments specified in this documentation. Components that are not expressly mentioned may neither be attached nor connected. The same applies to cables and lines.

The products must only be operated according to the software and firmware specified in the relevant functional description in the expressly specified configurations and combinations of the components.

Drive controllers have to be programmed before commissioning to ensure that the motor executes the functions specific to the application.

Drive controllers of the ctrlX DRIVE series have been developed for use in single-axis and multi-axis drive and control tasks.

Device types with different drive power and interfaces are available for using the drive controllers in specific applications.

Typical areas of application:

- Handling and assembly systems
- Packaging and food machines
- Printing and paper converting machines
- Machine tools

Drive controllers may only be operated under the assembly and installation conditions specified in this documentation, in the specified position of normal use and under the specified ambient conditions (temperature, degree of protection, humidity, EMC, etc.).

2.2 Unintended use

"Unintended use" refers to using the drive controllers outside of the operating conditions, technical data and specifications described in this documentation.

- Drive controllers must not be used if they are exposed to operating conditions that do not meet the specified ambient conditions. This includes, for example, operation under water, under extreme temperature fluctuations or extreme maximum temperatures.
- Furthermore, drive controllers may not be used in applications that have not been expressly authorized by Rexroth. Please refer to the specifications in the general safety instructions!

Components of the ctrlX DRIVE drive system are **products of category 3** (with limited availability) according to IEC 61800-3. This category comprises EMC limit values for conducted and radiated emission. To comply with this category (limit values), use appropriate measures to suppress inteferences in the drive system (e.g., mains filters, shielding measures).

These components are not intended for use in a public low voltage system for residential areas. If these components are operating in such a network, high frequency interferences are to be expected. Additional measures for interference suppression can be required.

3 Safety instructions for electric drive and control systems

3.1 Basic information

3.1.1 Using and passing on the safety instructions

Do not install and operate any components of the electric drive and control system before carefully reading all provided documents. These safety instructions and all other user instructions have to be read prior to working with these components. If you do not have the user documentation for the components, contact our Rexroth sales representative. Request the immediate delivery of these documents to the person or persons in charge of the safe operation of the components.

In the case of vending, rental and/or distribution of the components in any other form, include these safety instructions in the national language of the user.

Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, personal injury, electric shock or even death.

3.1.2 Requirements for safe use

Prior to initial commissioning of the components of the electric drive and control system, read the following instructions to avoid personal injury and/or property damage. You must comply with these safety instructions.

- In the case of damage due to non-compliance with the safety instructions, Rexroth shall not assume any liability.
- Prior to commissioning, read the operating, maintenance and safety instructions. If you are not able to sufficiently understand the language used in the application documentation, please contact and inform your vendor.
- Appropriate and professional transport, storage, assembly and installation, as well as thorough operation and maintenance, are the basis of correct and safe operation of the component.
- Only qualified personnel may use components of the electric drive and control system or work in its close proximity.
- Only use accessories and spare parts approved by Rexroth.
- Comply with the safety instructions and regulations of the country in which the components of the electric drive and control system are operated.
- Only use components of the electric drive and control system as intended. Please refer to chapter **Intended use**.
- The ambient and operating conditions specified in this application documentation have to be complied with.
- Applications for functional safety are only allowed if they are explicitly and unambiguously specified in the application documentation "Integrated Safety Technology". If this is not the case, these applications are excluded. Functional safety includes parts of the overall safety in which measures of risk reduction for personal safety depend on electric, electronic or programmable controls.
- The specifications contained in the application documentation regarding the use of the provided components are only application examples and recommendations.

- For their individual application, the machine manufacturer and the system installer have to
  - verify the applicability of the provided components and the specifications made for their use in this application documentation,
  - synchronize the applicability with the safety regulations and standards applicable for their application and to execute the required measures, modifications and additions.
- Commissioning of the provided components is prohibited until is has been established that the machine or the system in which the components are installed corresponds to the country-specific provisions, safety regulations and standards of the application.
- Operation is only allowed when complying with the national EMC regulations for the relevant application.
- For information about EMC-compliant installation, refer to the section on EMC in the relevant application documentation.
- The system or machine manufacturer is responsible for compliance with the limit values specified in the national regulations.
- The technical data, connection and installation conditions of the components are contained in the relevant application documentations and must be complied with.
- Country-specific laws and regulations must be observed.

3.1.3 Hazards due to incorrect use

- High electrical voltage and high operating current! Danger to life or serious personal injury due to electric shock!
- High electrical voltage due to incorrect connection! Danger to life or personal injury due to electric shock!
- Dangerous movements! Danger to life, serious personal injury or property damage due to unintended motor movements!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!
- Risk of burns by hot housing surfaces!
- Risk of injury by improper handling! Personal injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

3.2 Instructions with regard to specific dangers

3.2.1 Protection against contact with electrical parts and housings

This section concerns components of the electric drive and control system with voltages of **more than 50 volts**.

Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

High electrical voltage! Danger to life, risk of injury by electric shock or serious personal injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.

- Before switching on, the equipment grounding conductor must have been permanently connected to all electrical components in accordance with the connection diagram.
- Even for short measurements or tests, operation is only allowed with the equipment grounding conductor permanently connected to the specified points of the components.
- Before accessing electrical parts with voltage potentials higher than 50 V, disconnect electrical components from the mains or from the voltge source. Protect the electrical component against restart.
- Observe the following aspects in the case of electrical components:
  Prior to touching an electrical component, always wait for **30 minutes** after switching off power in order for live capacitors to discharge. Before beginning to work, measure the electrical voltage of live parts to make sure that the equipment is safe to touch.
- Install the provided covers and safety devices for protection against contact prior to switch-on.
- Do not touch any electrical connection points of the components while power is turned on.
- Do not connect or disconnect live parts.
- Under certain conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).
- Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Prior to switching on and commissioning, ground or connect the electric drive and control system components to the equipment grounding conductor at the grounding points.
- Connect the equipment grounding conductor of the electric drive and control system components permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Establish an equipment grounding connection with a minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm2 (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Table 15: Minimum cross section of equipment grounding connection

Cross section of outer conductor	Minimum cross section of equipment grounding conductor Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
1.5 mm2 (AWG 16)	10 mm2 (AWG 8)	2 × 1.5 mm2 (AWG 16)
2.5 mm2 (AWG 14)		2 × 2.5 mm2 (AWG 14)
4 mm2 (AWG 12)		2 × 4 mm2 (AWG 12)
6 mm2 (AWG 10)		2 × 6 mm2 (AWG 10)
10 mm2 (AWG 8)		-
16 mm2 (AWG 6)	16 mm2 (AWG 6)	-
25 mm2 (AWG 4)		-
35 mm2 (AWG 2)		-
50 mm2 (AWG 1/0)	25 mm2 (AWG 4)	-

Cross section of outer conductor	Minimum cross section of equipment grounding conductor Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
70 mm2 (AWG 2/0)	35 mm2 (AWG 2)	-

3.2.2 Protective extra-low voltage as protection against electric shock

Protective extra-low voltage is used to connect devices with basic insulation at extra-low voltage circuits.

At components of an electric drive and control system provided by Rexroth, all connections and terminals with voltages up to 50 volts are PELV (**Protective Extra-Low Voltage**) systems. It is allowed to connect devices equipped with basic insulation, such as programming devices, PCs, notebooks, display units, to these connections.

Danger to life, risk of injury by electric shock! High electrical voltage by incorrect connection!If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g., the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV (**Protective Extra-Low Voltage**).

3.2.3 Protection against dangerous movements

Dangerous movements can be caused by incorrect control of connected motors. In the following, the different reasons are listed:

- Improper or wrong wiring or cable connection
- Operating errors
- Incorrect parameter input prior to commissioning
- Malfunction of sensors and encoders
- Defective components
- Errors in the software or firmware

These errors can occur immediately after switch-on or after an undefined time of operation.

As far as possible, the monitoring functions in the components of the electric drive and control system rule out malfunction in the connected drives. Regarding personal safety, in particular the danger of personal injury and/or property damage, this alone cannot be relied upon to ensure complete safety. Until the implemented monitoring functions are active, it must be assumed in any case that faulty drive movements will occur. The faulty movements depend on the type of control and the operating state.

Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

Prepare a **risk assessment** for the system or machine, with their specific conditions, in which the components of the electric drive and control system are installed.

As specified in the risk assessment, the user has to provide monitoring functions and higher-level measures in the system for personal safety. The safety regulations applicable to the system or machine have to be included. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, personal injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
  - Safety fences
  - Safety guards
  - Protective covering
  - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stop switches in the immediate reach of the operator. Before commissioning, verify that the emergency stop equipment works. Do not operate the machine if the emergency stop switch is not working.
- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axis,
  - adding an external braking/arrester/clamping mechanism or
  - ensuring sufficient counterweight for the axis.
- The standard equipment **motor holding brake** or an external holding brake controlled by the drive controller is **not sufficient to guarantee personal safety**!
- De-energize the components of the electric drive and control system using the master switch, and make sure they cannot be switched back on in the case of:
  - Maintenance and repairs
  - Cleaning work
  - Long service interruptions
- Avoid operating high-frequency, remote control and radio equipment in close proximity to components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

3.2.4 Protection against electromagnetic and magnetic fields during operation and mounting

Electromagnetic and magnetic fields!

Health hazard for persons with active implantable medical devices (AIMD) such as pacemakers or passive metallic implants.

- Hazards for the above-mentioned groups of persons by electromagnetic and magnetic fields in the immediate vicinity of drive controllers and the associated current-carrying conductors.
- Access to these areas can pose an increased risk to the above-mentioned groups of persons. They should seek advice from their attending doctor.
- If overcome by possible effects on above-mentioned persons during operation of drive controllers and accessories, remove the exposed persons from the vicinity of conductors and devices.

3.2.5 Protection against contact with hot parts

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- After having switched them off, allow the motors to cool down long enough before touching them. Cooling down may require **up to 140 minutes**. The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching off chokes, supply units and drive controllers, wait **15 minutes** to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, and in accordance with the respective safety regulations, the manufacturer of the machine or system must take measures to avoid injuries caused by burns in the final application. Possible measures: warnings at the machine or system, guards (shieldings or barriers) or safety instructions in the application documentation.

3.2.6 Protection during handling and mounting

Risk of injury by improper handling! Personal injury by crushing, shearing, cutting, hitting!

- Comply with the relevant statutory regulations of accident prevention.
- Use suitable mounting and transport equipment.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

3.2.7 Battery safety

Batteries consist of active chemicals in a solid housing. Therefore, improper handling can cause injury or property damage. Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries since this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not disassemble any batteries.
- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.

Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separately from other waste. Comply with the national regulations of your country.

3.2.8 Protection against pressurized systems

According to the information given in the Project Planning Manuals, motors and components cooled with liquids and compressed air can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricants. Improper handling of the connected supply systems, supply lines or connections can cause injuries or property damage.

Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Comply with the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (safety goggles, safety shoes, safety gloves, for example).
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

Environmental protection and disposal! The agents (e.g., fluids) used to operate the product might not be environmentally friendly. Dispose of agents harmful to the environment separately from other waste. Comply with the national regulations of your country.

3.2.9 Explanation of signal words and the safety alert symbol

The safety instructions in the available application documentation contain specific signal words (DANGER, WARNING, CAUTION, NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2011).

The signal word is intended to draw the reader's attention to the safety instruction and describes the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

⚠ DANGER	Non-compliance with this safety instruction **will** result in death or serious personal injury.
⚠ WARNING	Non-compliance with this safety instruction **can** result in death or serious personal injury.
⚠ CAUTION	Non-compliance with this safety instruction can result in moderate or minor personal injury.
NOTICE	Non-compliance with this safety instruction can result in property damage.

4 Combining the individual components

4.1 Installation conditions

4.1.1 Ambient and operating conditions

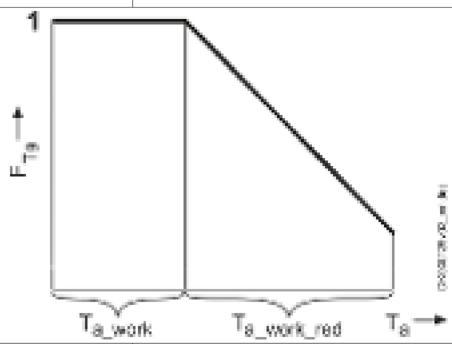
⚠ WARNING	Lethal electric shock due to live parts with more than 50 V!
	Only operate the device – with connected connectors (even if no lines are connected to the connectors) and – with connected equipment grounding conductor!

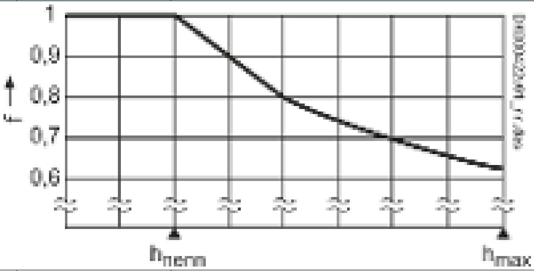
Control cabinet

The devices in the ctrlX DRIVE product range, as well as their additional components (except for some braking resistors), have to be mounted **in control cabinets**.

Check that the ambient and operating conditions, in particular the control cabinet temperature, are complied with by calculating the heat levels in the control cabinet. Afterwards, make the corresponding measurements to confirm that ambient and operating conditions have actually been observed. In the technical data of the individual components, the power dissipation is specified as an important input value for calculating the heat levels.

Table 16: Ambient and operating conditions

Designation	Symbol	Unit	Value
Conductive dirt contamination			Not allowed (Conductive dirt contamination can be prevented, for example, by mounting the devices in control cabinets of the degree of protection IP54 in accordance with IEC529.)
Degree of protection (IEC529)			IP20 [2)]
Use within scope of CSA / UL			For use in NFPA 79 Applications only!
Installation altitude	h_{nenn}	m	1000
Ambient temperature range	T_{a_work}	°C	0 ... 40
Derating vs. ambient temperature: The performance data are reduced by the factor F_{Ta} in the ambient temperature range $T_{a\_work\_red}$: $F_{TA} = 1 - [(T_a - 40) \times f_{Ta}]$ Example: With an ambient temperature T_a = 50 °C and a capacity utilization factor f_{Ta} = 2%, the rated power is reduced to $P_{DC\_cont\_red} = P_{DC\_cont} \times F_{Ta} =$ $P_{DC\_cont} \times (1 - [(50 - 40) \times 0.02]) =$ $P_{DC\_cont} \times 0.8$ Operation at ambient temperatures outside of T_{a_work} and $T_{a\_work\_red}$ is not allowed!	 		
	$T_{a\_work\_red}$	°C	40 ... 55
	f_{Ta}	%/K	2

<table>
<tr><th>Designation</th><th>Symbol</th><th>Unit</th><th colspan="4">Value</th></tr>
<tr><td rowspan="3">Derating vs. installation altitude:
At an installation altitude $h > h_{nenn}$, the available performance data are reduced by the factor f[1].
At an installation altitude in the range h_{max_ohne} to h_{max}, voltage-limiting measures (overvoltage limiters) have to be installed at the mains connection of the drive system.
Use above h_{max} is not allowed!</td><td colspan="6">
</td></tr>
<tr><td>h_{max_ohne}</td><td>m</td><td colspan="4">2000</td></tr>
<tr><td>h_{max}</td><td>m</td><td colspan="4">4000</td></tr>
<tr><td rowspan="11">Simultaneous derating for ambient temperature [°C] and installation altitude [m]</td><td rowspan="11"></td><td rowspan="11"></td><td colspan="4">allowed;
Reduce performance data with the product $f \times F_{Ta}$</td></tr>
<tr><td colspan="4">Derating factors (for f_{Ta} = 2 %/K)</td></tr>
<tr><td rowspan="2">[°C]</td><td colspan="3">[m]</td></tr>
<tr><td>1000</td><td>2000</td><td>4000</td></tr>
<tr><td>25</td><td>1</td><td>1</td><td>0.82</td></tr>
<tr><td>30</td><td>1</td><td>0.96</td><td>0.76</td></tr>
<tr><td>35</td><td>1</td><td>0.88</td><td>0.69</td></tr>
<tr><td>40</td><td>1</td><td>0.8</td><td>0.62</td></tr>
<tr><td>45</td><td>0.9</td><td>0.72</td><td>0.57</td></tr>
<tr><td>50</td><td>0.8</td><td>0.64</td><td>0.5</td></tr>
<tr><td>55</td><td>0.7</td><td>0.56</td><td>0.44</td></tr>
<tr><td>Relative humidity</td><td></td><td>%</td><td colspan="4">5 ... 95</td></tr>
<tr><td>Absolute humidity</td><td></td><td>g/m^3</td><td colspan="4">1 ... 29</td></tr>
<tr><td>Moisture condensation</td><td></td><td></td><td colspan="4">Not allowed</td></tr>
<tr><td>Climatic category (IEC 60721-3-3)</td><td></td><td></td><td colspan="4">3K3</td></tr>
<tr><td>Allowed pollution degree (IEC 60664-1)</td><td></td><td></td><td colspan="4">2</td></tr>
<tr><td>Resistance to chemically active substances</td><td></td><td></td><td colspan="4">Class 3C1 [3)]</td></tr>
<tr><td>Shock/vibration category (IEC 60721-3-3)</td><td></td><td></td><td colspan="4">3M4 (data from historical standard)</td></tr>
<tr><td>Vibration resistance (sine, 5 - 9,2Hz, number of cycles: 10)</td><td></td><td>mm (rms)</td><td colspan="4">3</td></tr>
<tr><td>Vibration resistance (sine, 9,2 – 200Hz, number of cycles: 10)</td><td></td><td>m/s^2</td><td colspan="4">10</td></tr>
<tr><td>Shock resistance (half sine, 3 shocks per spatial axis, a total of 18)</td><td></td><td>m/s^2</td><td colspan="4">100 (11 ms)</td></tr>
<tr><td>Overvoltage category</td><td></td><td></td><td colspan="4">III (according to IEC60664-1)</td></tr>
</table>

1) Reduced performance data for drive controllers: allowed DC bus continuous power, braking resistor continuous power, continuous current; additionally for converters: allowed mains voltage

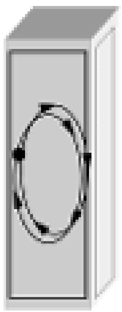
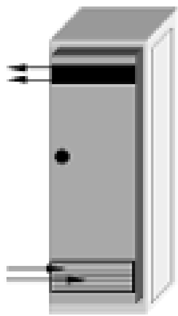
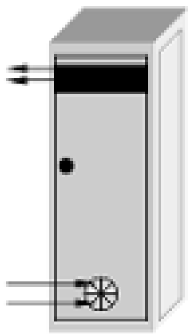
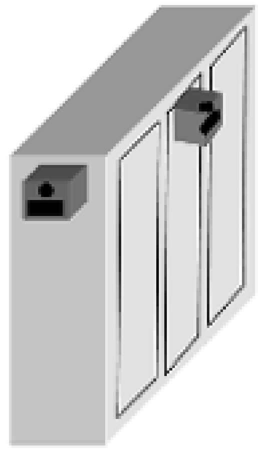
2) Prerequisite for IP20: Connector plugged in at the device, all phases connected and touch guard of DC bus connection available at the device. Without connector at the device, phases not connected (e.g., 1-phase mains connection) or without touch guard of DC bus connection at the device: IP10

3) Resistance to hydrogen sulfide H_2S tested according to ANSI/ISA-71.04 (Class G3) for 10 years

4.1.2 Control cabinet design and cooling system

G1 is the only mounting position allowed for supply units and drive controllers installed in control cabinets.

Table 17: Heat dissipation options

Closed control cabinet with air circulation	Closed control cabinet with heat exchanger	Control cabinet with fan	Closed control cabinet with air conditioning unit
			

The paragraphs below are about the "Control cabinet with fan".

Requirements on control cabinets with fan

NOTICE	Risk of damage due to polluted air in the control cabinet! If you operate a control cabinet with fan without appropriate filters, the devices may be damaged or malfunctions may occur.

- Install filters at the air inlet of the control cabinet to prevent polluted air from entering the control cabinet.
- Maintain the filters regularly according to the dust load in the environment.
- Only change the filters when the fan is switched off, otherwise the loosening dirt will be sucked in by the fan and get into the control cabinet.

Ventilation of the control cabinet (schematic diagram)

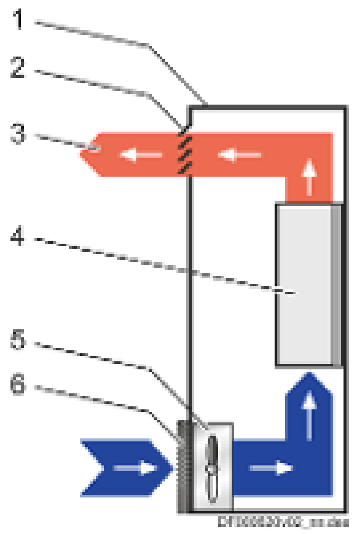


Fig. 2: Ventilation of the control cabinet (schematic diagram)
1 Control cabinet
2 Air outlet opening
3 Heat dissipation
4 Device in the control cabinet
5 Control cabinet fan
6 Filter at the air intake opening

Only clean air gets into the control cabinet through the filter at the air intake opening. The control cabinet fan behind the air inlet opening transports air into the control cabinet and generates overpressrue within it. The overpressure prevents polluted air from entering the control cabinet through possible leaks (leaking cable feedthroughs, damaged sealings, ...).

4.1.3 Compatibility with foreign materials

All Rexroth controls and drives are developed and tested to the state-of-the-art.

However, since it is impossible to follow the continuous development of all substances with which the controls and drives may come into contact (e.g., lubricants on machine tools), reactions with the materials we use cannot always be excluded.

For this reason, you must carry out a compatibility test between new lubricants, cleaning agents etc. and our housings/materials before use.

4.2 Mechanical project planning

4.2.1 Mounting positions of components

NOTICE	Risk of damage of components!
	Only operate components in their intended mounting positions.

Allowing mounting position of components

Only the mounting position **G1** is allowed for ctrlX DRIVE components.

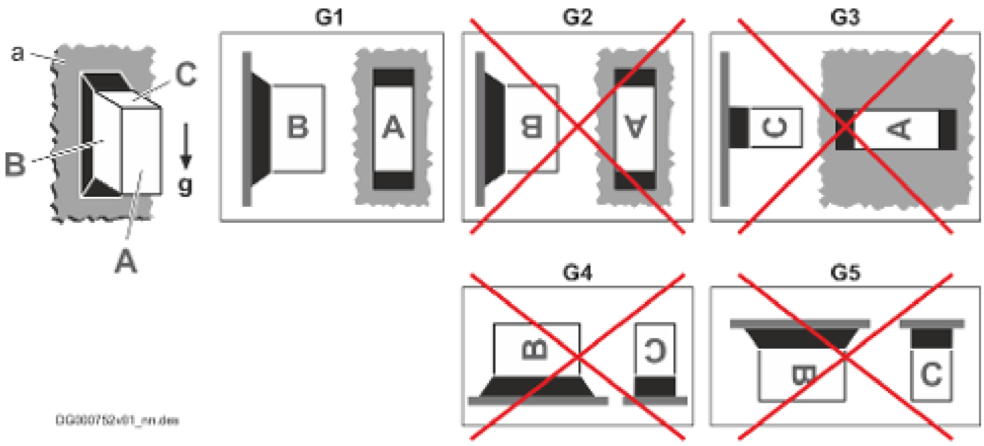
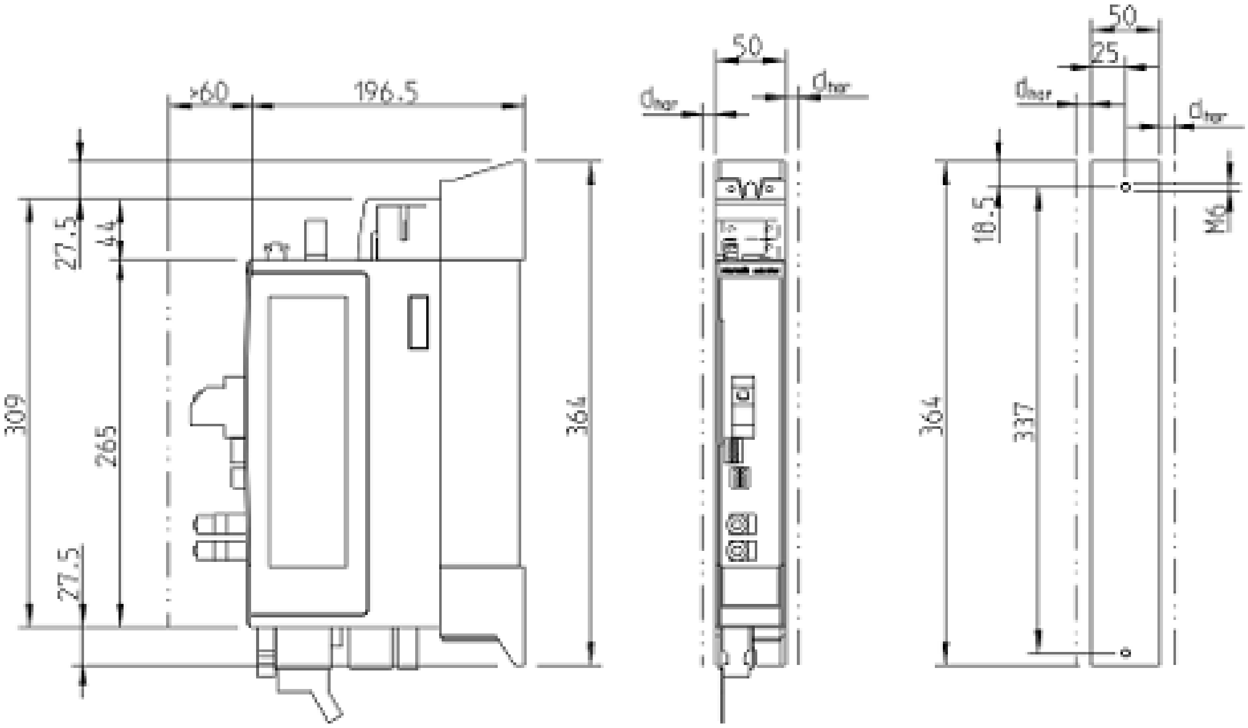


Fig. 3: Allowing mounting position of components

A, B, C Sides of a component: A = front, B = left or right side, C = top
a Mounting surface in the control cabinet
g Direction of gravity
G1 **Standard mounting position:** The natural convection supports the forced cooling air stream. Heat pockets in the component are avoided.
G2 180° to the standard mounting position
G3 90° to the standard mounting position
G4 Ground erection; seating on the bottom of the control cabinet
G5 Ceiling suspension; seating at the ceiling of the control cabinet

4.2.2 XCS*-W0010/-W0023

Dimensional drawing



d_{hor} ➦ Table 19 Cooling and power dissipation data on page 58

Dimensions, mass, insulation

Table 18: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Mass	m	kg	3	
Device height1)	H	mm	309	
Device depth2)	T	mm	196.5	
Device width3)	B	mm	50	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 19: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	
Volumetric capacity of forced cooling	V	m^3/h	36	

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	83	93
Minimum distance on the top of the device2)	d_{top}	mm	80	
Minimum distance on the bottom of the device2)	d_{bot}	mm	80	
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

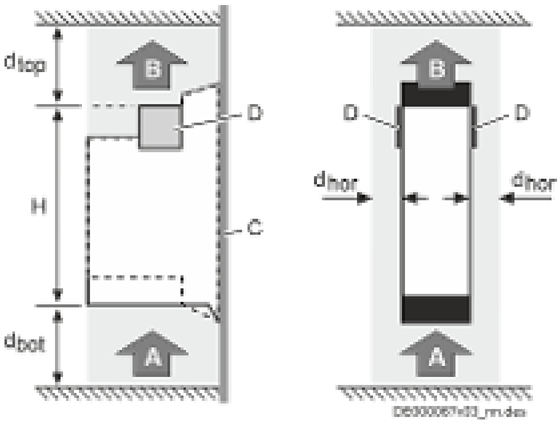
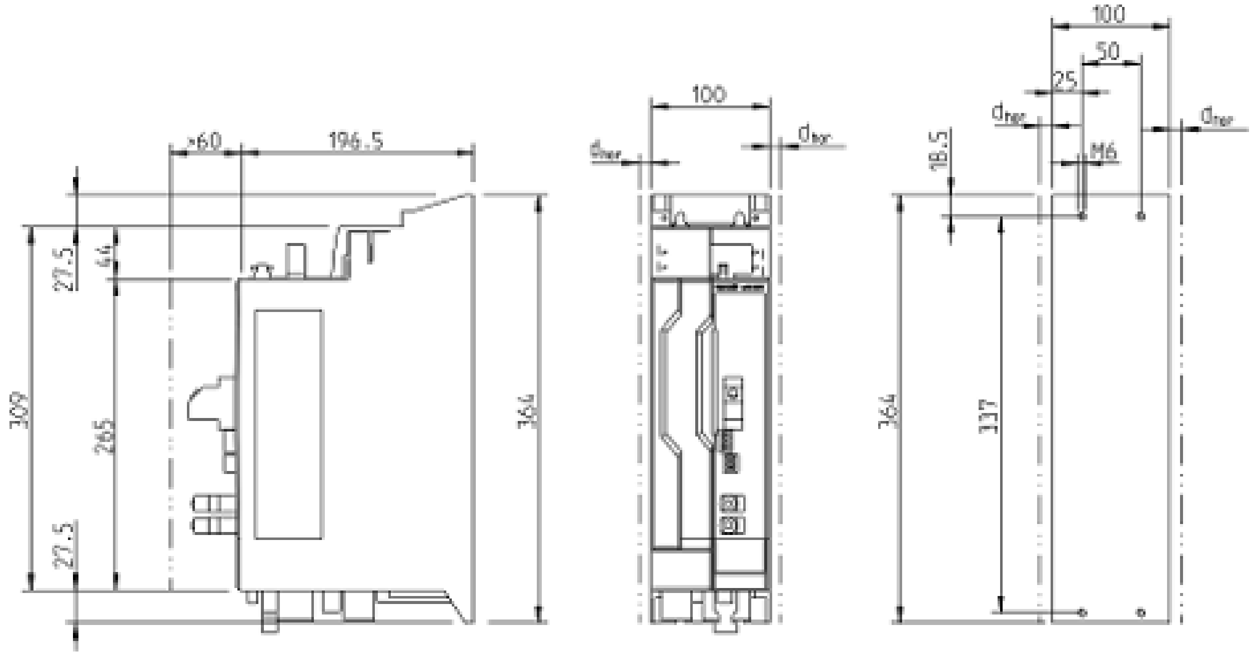


Fig. 4: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.3 XCS*-W0054/-W0070

Dimensional drawing



d_{hor} ➡Table 21 Cooling and power dissipation data on page 60

Dimensions, mass, insulation

Table 20: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070
Mass	m	kg	5.8	
Device height[1]	H	mm	309	
Device depth[2]	T	mm	196.5	
Device width[3]	B	mm	100	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 21: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	
Volumetric capacity of forced cooling	V	m^3/h	60	96
Power dissipation at continuous current and continuous DC bus power respectively[1]	P_{Diss_cont}	W	353	406

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070
Minimum distance on the top of the device[2)]	d_{top}	mm	80	
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80	
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

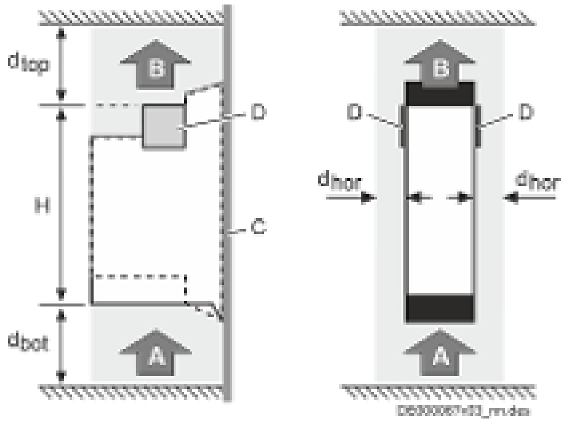
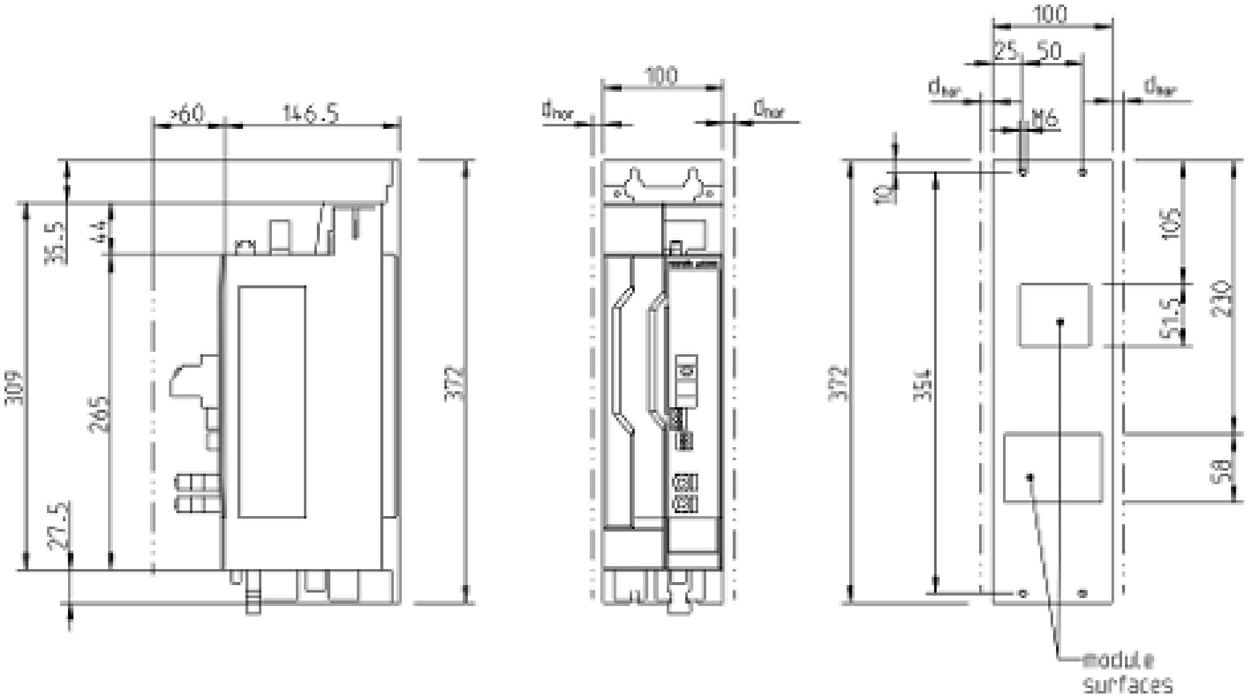


Fig. 5: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.4 XCS*-C0054/-C0070

Dimensional drawing



d_{hor} ➦Table 23 Cooling and power dissipation data on page 62
module surfaces Areas of heat-producing power modules
Coldplate ➦Chapter 9.2 Coldplate on page 190

Dimensions, mass, insulation

Table 22: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Mass	m	kg	4.2	
Device height[1)]	H	mm	309	
Device depth[2)]	T	mm	146.5	
Device width[3)]	B	mm	100	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 23: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Coldplate	

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Power dissipation at continuous current and continuous DC bus power respectively 1)	P_{Diss_cont}	W	285.86	405.57
Minimum distance on the top of the device 2)	d_{top}	mm	80	
Minimum distance on the bottom of the device 2)	d_{bot}	mm	80	
Horizontal spacing at the device 2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Distances at the device"

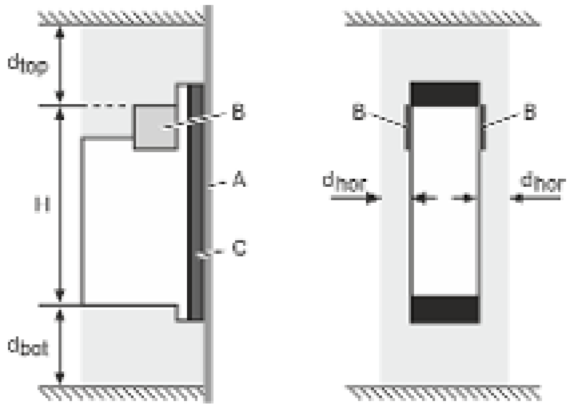


Fig. 6: Distances at the device

A Mounting surface in the control cabinet

B Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)

C Coldplate

H Device height

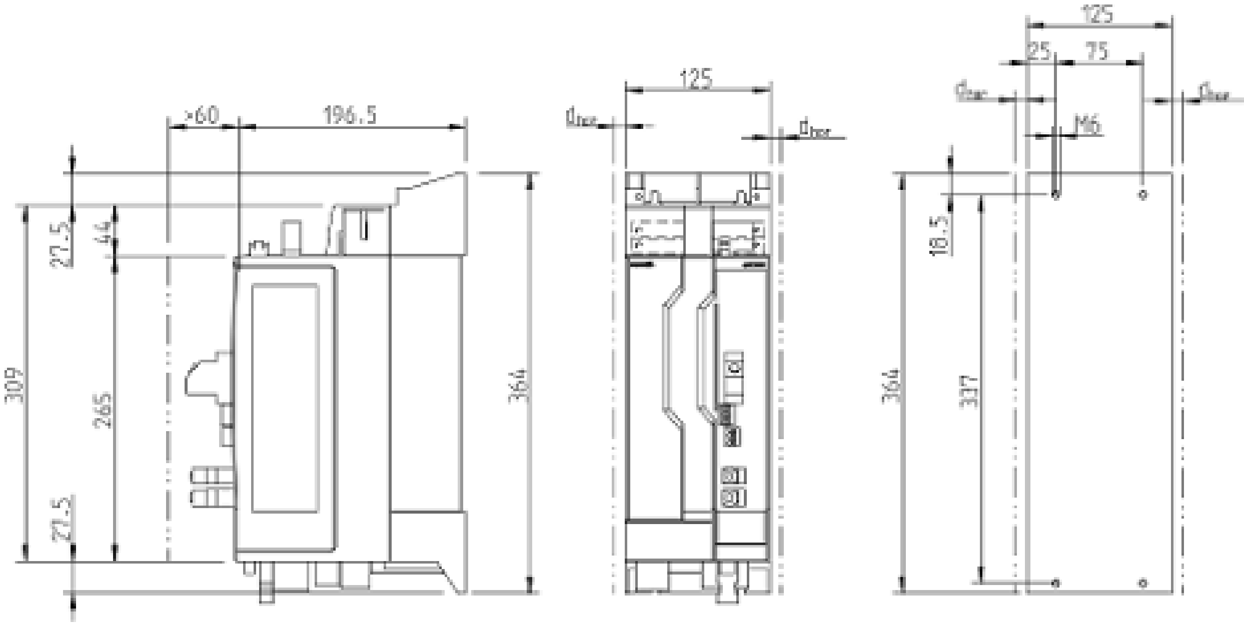
d_{top} Distance top

d_{bot} Distance bottom

d_{hor} Distance horizontal

4.2.5 XCS*-W0090

Dimensional drawing



d_{hor} ➡Table 25 Cooling and power dissipation data on page 64

Dimensions, mass, insulation

Table 24: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0090
Mass	m	kg	6.85
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	125
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 25: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0090
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	118
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	533

Designation	Symbol	Unit	XCS*-W0090
Minimum distance on the top of the device2)	d_{top}	mm	80
Minimum distance on the bottom of the device2)	d_{bot}	mm	80
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

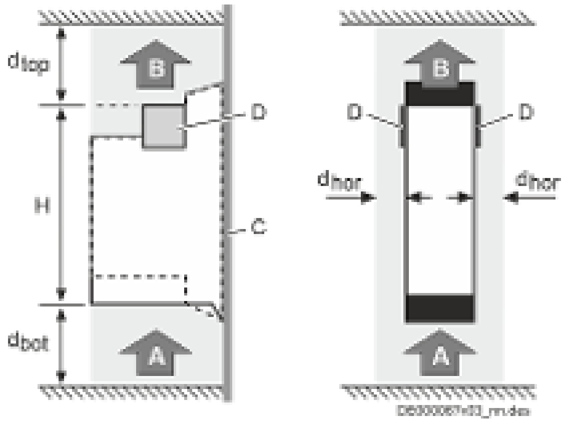
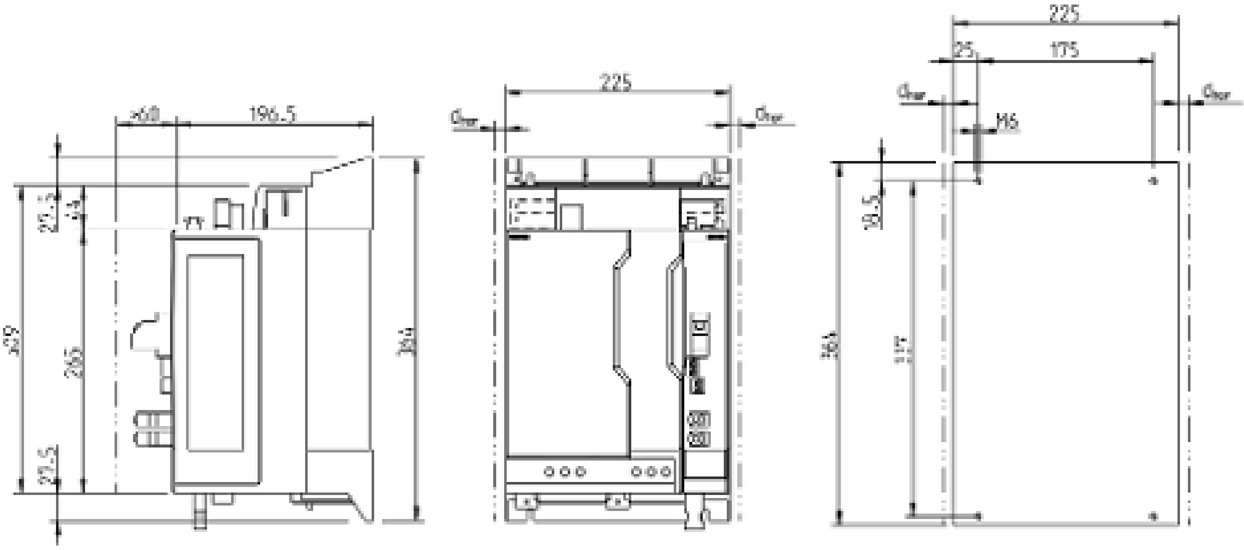


Fig. 7: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.6 XCS*-W0100/-W0120

Dimensional drawing



d_{hor} ➦Table 27 Cooling and power dissipation data on page 66

Dimensions, mass, insulation

Table 26: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Mass	m	kg	10.3	
Device height[1)]	H	mm	309	
Device depth[2)]	T	mm	196.5	
Device width[3)]	B	mm	225	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 27: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	
Volumetric capacity of forced cooling	V	m³/h	178	288
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	736	839
Minimum distance on the top of the device[2)]	d_{top}	mm	80	

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Minimum distance on the bottom of the device2)	d_{bot}	mm	80	
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

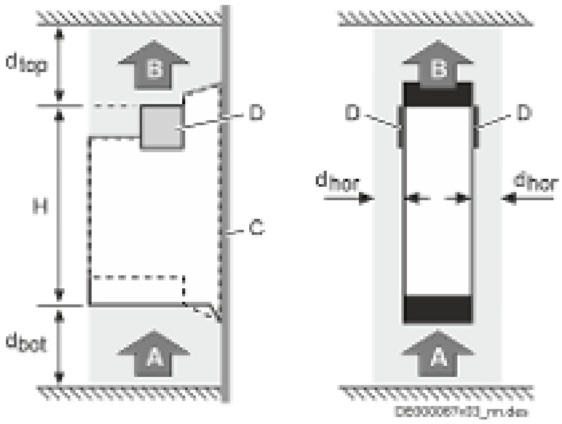
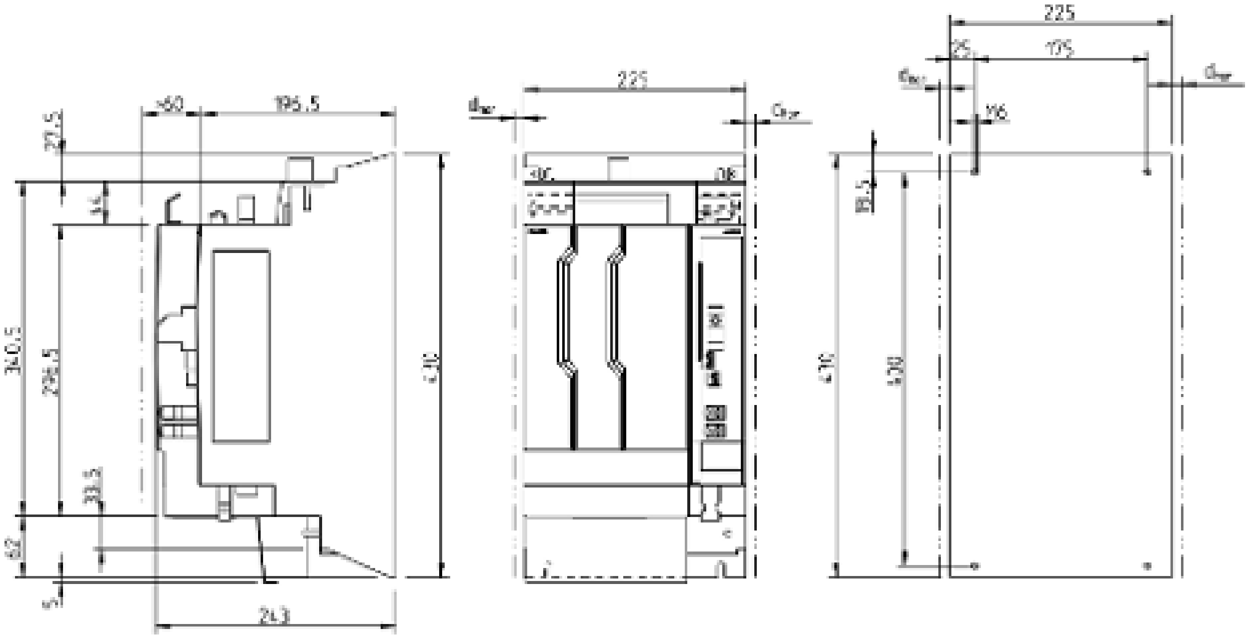


Fig. 8: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.7 XCS*-W0150/-W0180

Dimensional drawing



d_{hor} ➦ Table 29 Cooling and power dissipation data on page 68

Dimensions, mass, insulation

Table 28: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Mass	m	kg	17	
Device height1)	H	mm	340.5	
Device depth2)	T	mm	196.5	
Device width3)	B	mm	225	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 29: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	
Volumetric capacity of forced cooling	V	m^3/h	296	
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	1211	1485

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Minimum distance on the top of the device[2)]	d_{top}	mm	80	
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80	
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

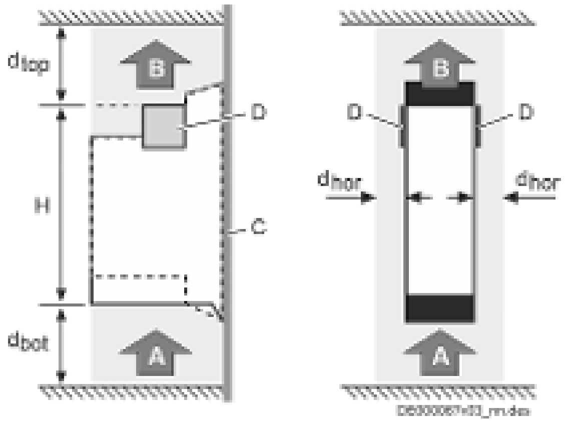
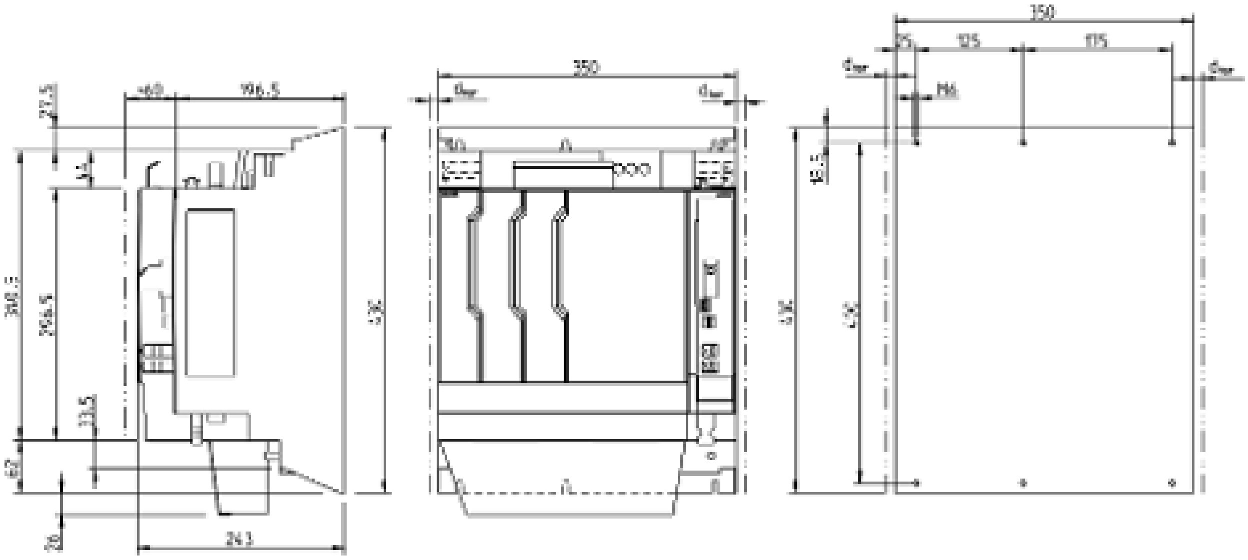


Fig. 9: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.8 XCS*-W0210 ... W0375

Dimensional drawing



d_{hor} ➜ Table 31 Cooling and power dissipation data on page 70

Dimensions, mass, insulation

Table 30: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Mass	m	kg	27			28	
Device height[1)]	H	mm	340.5				
Device depth[2)]	T	mm	196.5				
Device width[3)]	B	mm	350				
Insulation resistance at DC 500 V	R_{is}	Mohm	1				
Capacitance against ground	C_Y	nF	2 × 100				

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 31: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40				
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55				
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2				
Allowed mounting position			G1				
Cooling type			Forced ventilation				
Volumetric capacity of forced cooling	V	m^3/h	444				

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	1704	1882	1987	2331	2598
Minimum distance on the top of the device2)	d_{top}	mm	80				
Minimum distance on the bottom of the device2)	d_{bot}	mm	80				
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else				

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

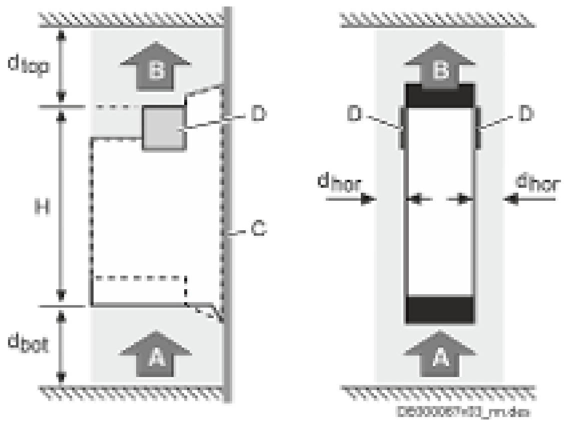
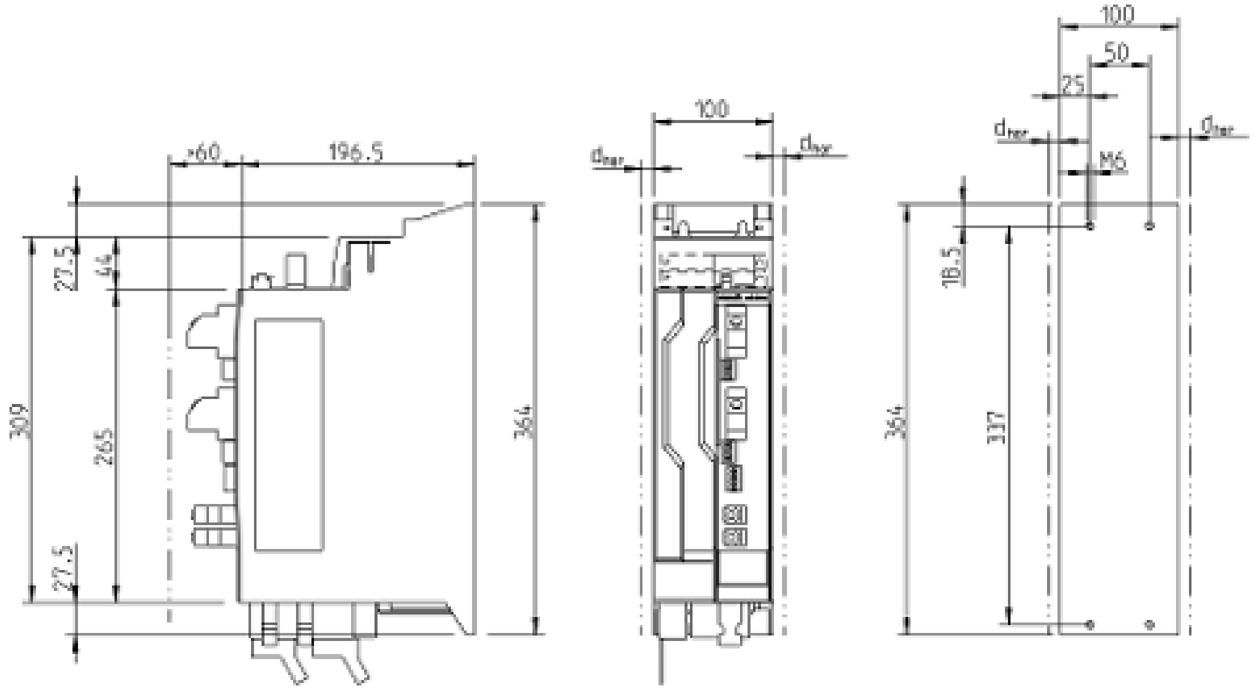


Fig. 10: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.9 XCD*-W2323

Dimensional drawing



d_{hor} ➦Table 33 Cooling and power dissipation data on page 72

Dimensions, mass, insulation

Table 32: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XCD*-W2323
Mass	m	kg	5.7
Device height1)	H	mm	309
Device depth2)	T	mm	196.5
Device width3)	B	mm	100
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 150

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 33: Cooling and power dissipation data

Designation	Symbol	Unit	XCD*-W2323
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	36

Designation	Symbol	Unit	XCD*-W2323
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	231
Minimum distance on the top of the device2)	d_{top}	mm	80
Minimum distance on the bottom of the device2)	d_{bot}	mm	80
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

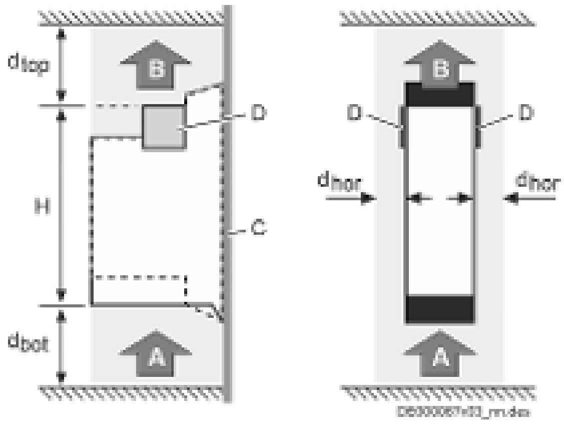
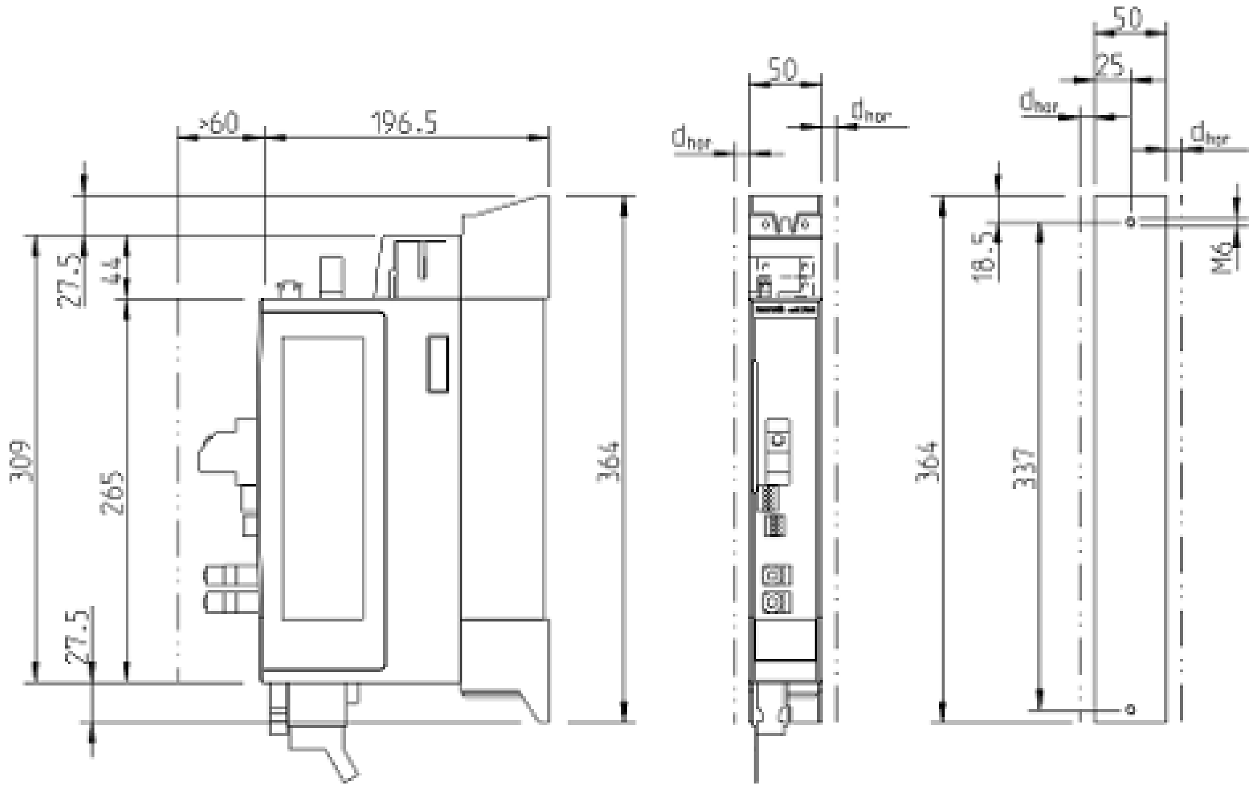


Fig. 11: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.10 XMS*-W0006 ... W0036

Dimensional drawing



d_{hor} ➦Table 35 Cooling and power dissipation data on page 75

Dimensions, mass, insulation

Table 34: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMS*-W0006	XMS*-W0010	XMS*-W0016	XMS*-W0023	XMS*-W0030	XMS*-W0036
Mass	m	kg	2.8					
Device height1)	H	mm	309					
Device depth2)	T	mm	196.5					
Device width3)	B	mm	50					
Insulation resistance at DC 500 V	R_{is}	Mohm	1					
Capacitance against ground	C_Y	nF	2 × 100					

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 35: Cooling and power dissipation data

Designation	Symbol	Unit	XMS*-W0006	XMS*-W0010	XMS*-W0016	XMS*-W0023	XMS*-W0030	XMS*-W0036
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40					
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55					
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2					
Allowed mounting position			G1					
Cooling type			Forced ventilation					
Volumetric capacity of forced cooling	V	m^3/h	36					
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	69	75	76	85	118	169
Minimum distance on the top of the device2)	d_{top}	mm	80					
Minimum distance on the bottom of the device2)	d_{bot}	mm	80					
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else					

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

Combining the individual components

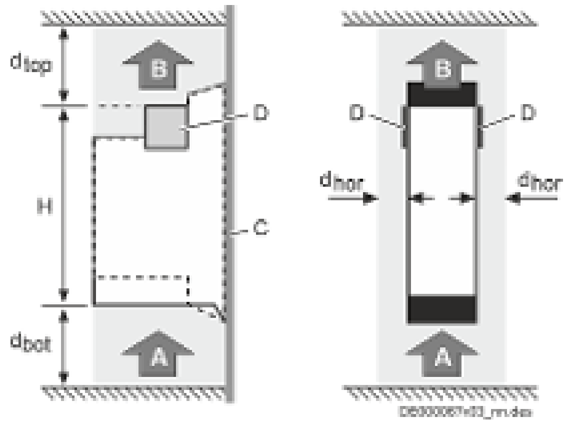
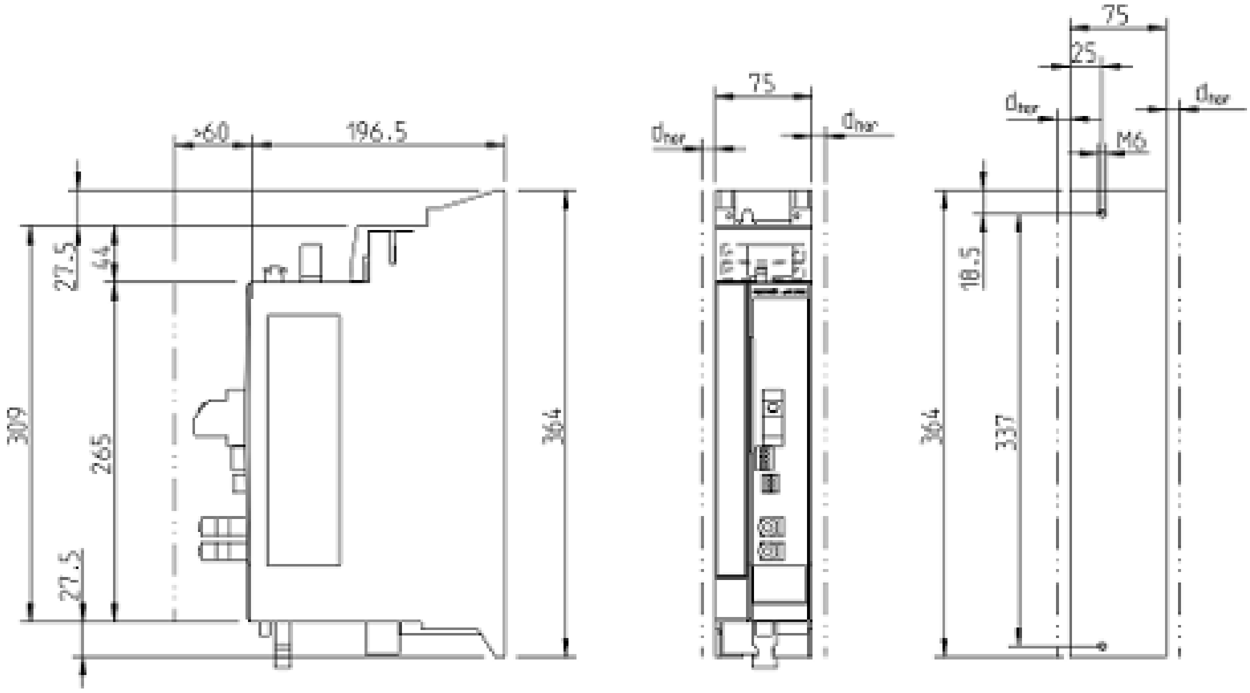


Fig. 12: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.11 XMS*-W0054 ... W0090

Dimensional drawing



d_{hor} ➦Table 37 Cooling and power dissipation data on page 77

Dimensions, mass, insulation

Table 36: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMS*-W0054	XMS*-W0070	XMS*-W0090
Mass	m	kg	4.25		
Device height1)	H	mm	309		
Device depth2)	T	mm	196.5		
Device width3)	B	mm	75		
Insulation resistance at DC 500 V	R_{is}	Mohm	1		
Capacitance against ground	C_Y	nF	2 × 100		

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 37: Cooling and power dissipation data

Designation	Symbol	Unit	XMS*-W0054	XMS*-W0070	XMS*-W0090
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40		
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55		
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2		
Allowed mounting position			G1		

Designation	Symbol	Unit	XMS*-W0054	XMS*-W0070	XMS*-W0090
Cooling type			Forced ventilation		
Volumetric capacity of forced cooling	V	m^3/h	129		
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	226	323	429
Minimum distance on the top of the device2)	d_{top}	mm	80		
Minimum distance on the bottom of the device2)	d_{bot}	mm	80		
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else		

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

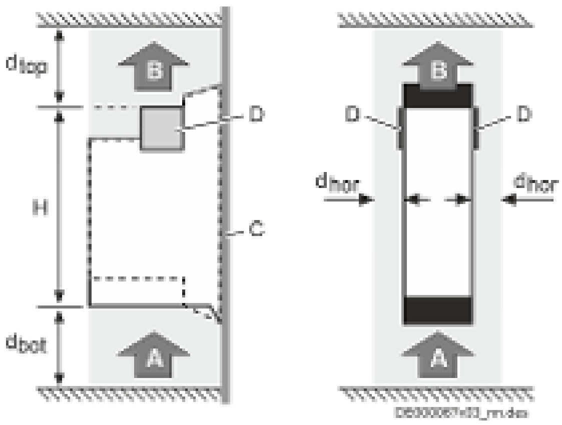
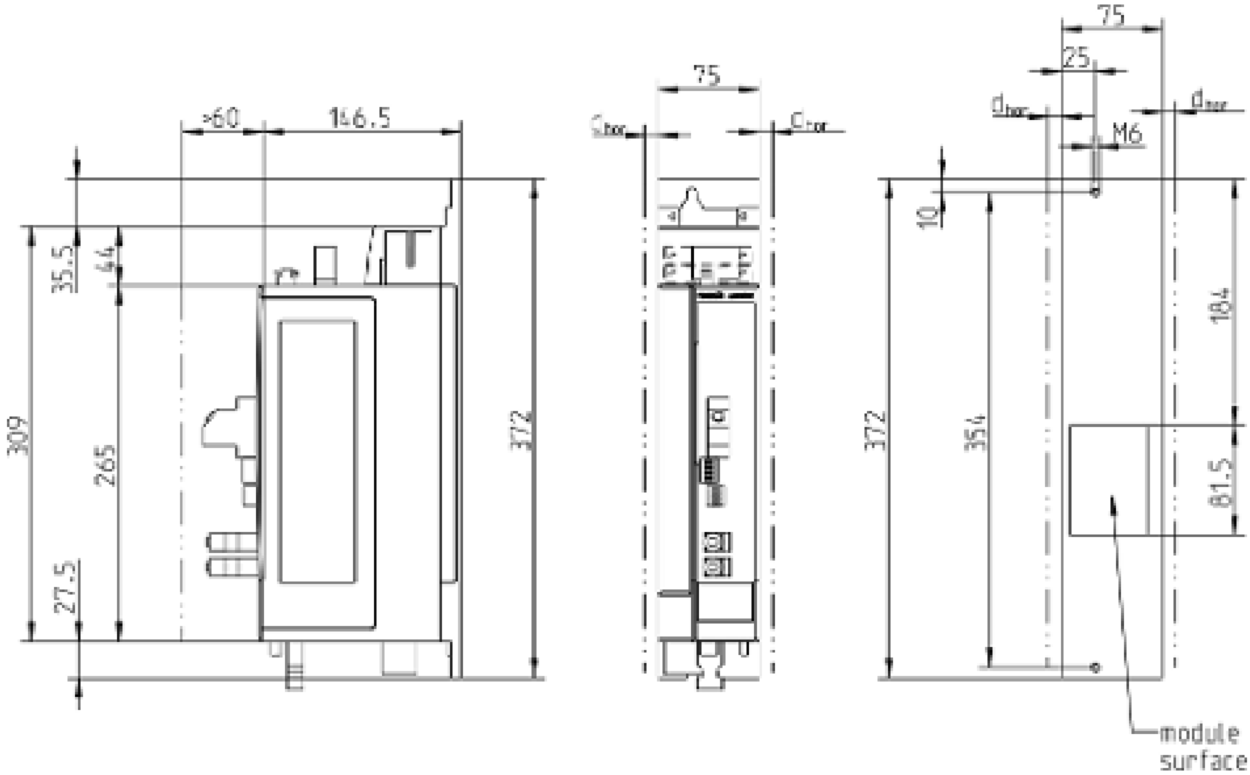


Fig. 13: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.12 XMS*-C0054 ... C0090

Dimensional drawing



d_{hor}	➦ Table 39 Cooling and power dissipation data on page 79
module surface	Areas of heat-producing power modules
Coldplate	➦ Chapter 9.2 Coldplate on page 190

Dimensions, mass, insulation

Table 38: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMS*-C0054	XMS*-C0070	XMS*-C0090
Mass	m	kg		3.13	
Device height1)	H	mm		309	
Device depth2)	T	mm		146.5	
Device width3)	B	mm		75	
Insulation resistance at DC 500 V	R_{is}	Mohm		1	
Capacitance against ground	C_Y	nF		2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 39: Cooling and power dissipation data

Designation	Symbol	Unit	XMS*-C0054	XMS*-C0070	XMS*-C0090
Ambient temperature range for operation with nominal data	T_{a_work}	°C		0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C		40 ... 55	

Designation	Symbol	Unit	XMS*-C0054	XMS*-C0070	XMS*-C0090
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2		
Allowed mounting position			G1		
Cooling type			Coldplate		
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	225.6	323.3	447.6
Minimum distance on the top of the device2)	d_{top}	mm	80		
Minimum distance on the bottom of the device2)	d_{bot}	mm	80		
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else		

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

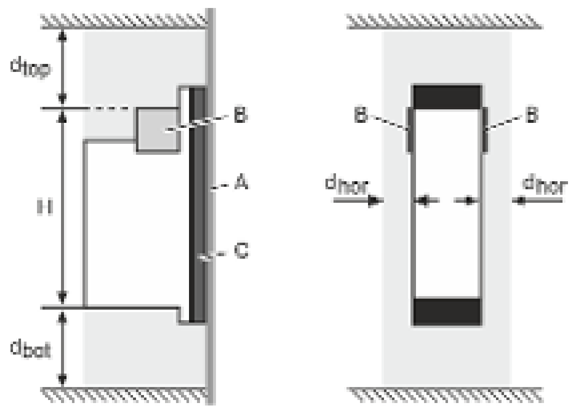


Fig. 14: Distances at the device

A Mounting surface in the control cabinet

B Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)

C Coldplate

H Device height

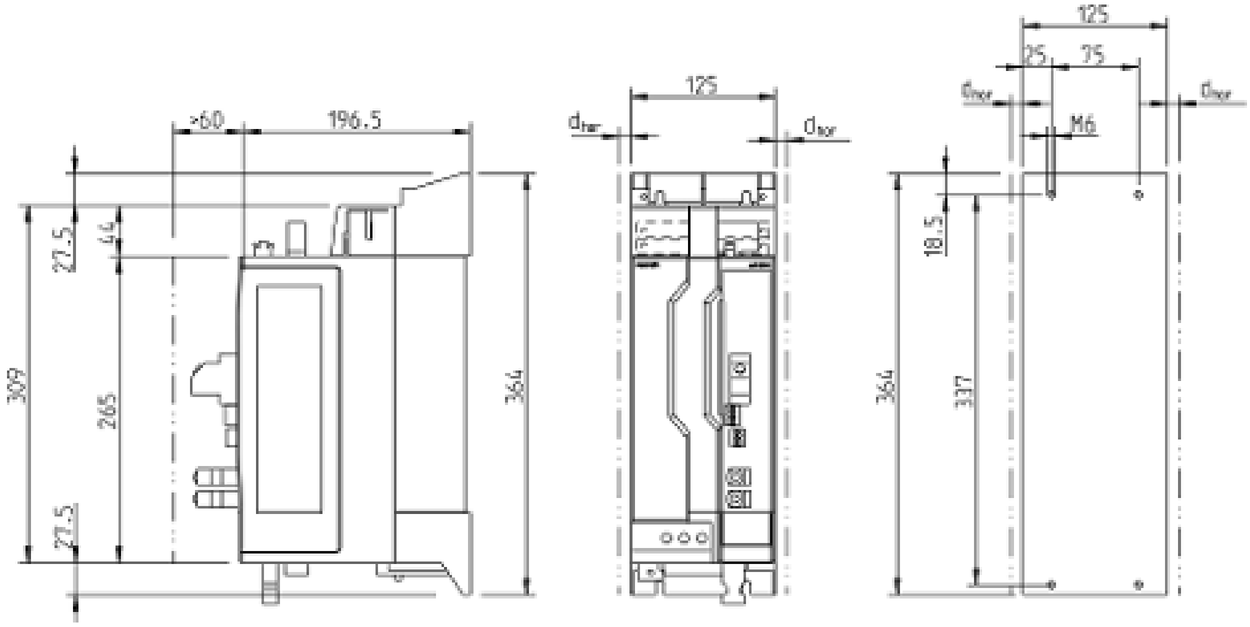
d_{top} Distance top

d_{bot} Distance bottom

d_{hor} Distance horizontal

4.2.13 XMS*-W0100/-W0120

Dimensional drawing



d_{hor} ➦ Table 41 Cooling and power dissipation data on page 81

Dimensions, mass, insulation

Table 40: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMS*-W0100	XMS*-W0120
Mass	m	kg	6.2	
Device height1)	H	mm	309	
Device depth2)	T	mm	196.5	
Device width3)	B	mm	125	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 41: Cooling and power dissipation data

Designation	Symbol	Unit	XMS*-W0100	XMS*-W0120
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	
Volumetric capacity of forced cooling	V	m³/h	74	

Designation	Symbol	Unit	XMS*-W0100	XMS*-W0120
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	587	625
Minimum distance on the top of the device[2)]	d_{top}	mm	80	
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80	
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

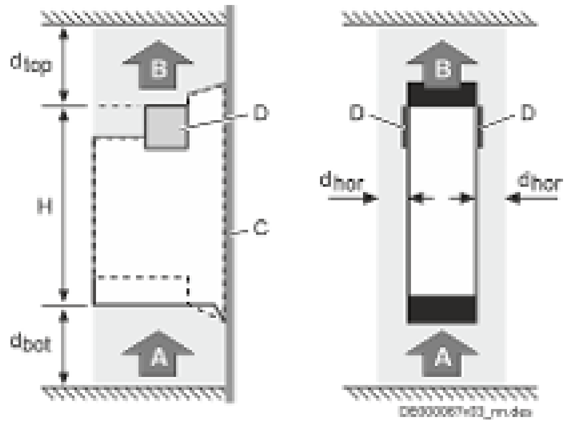
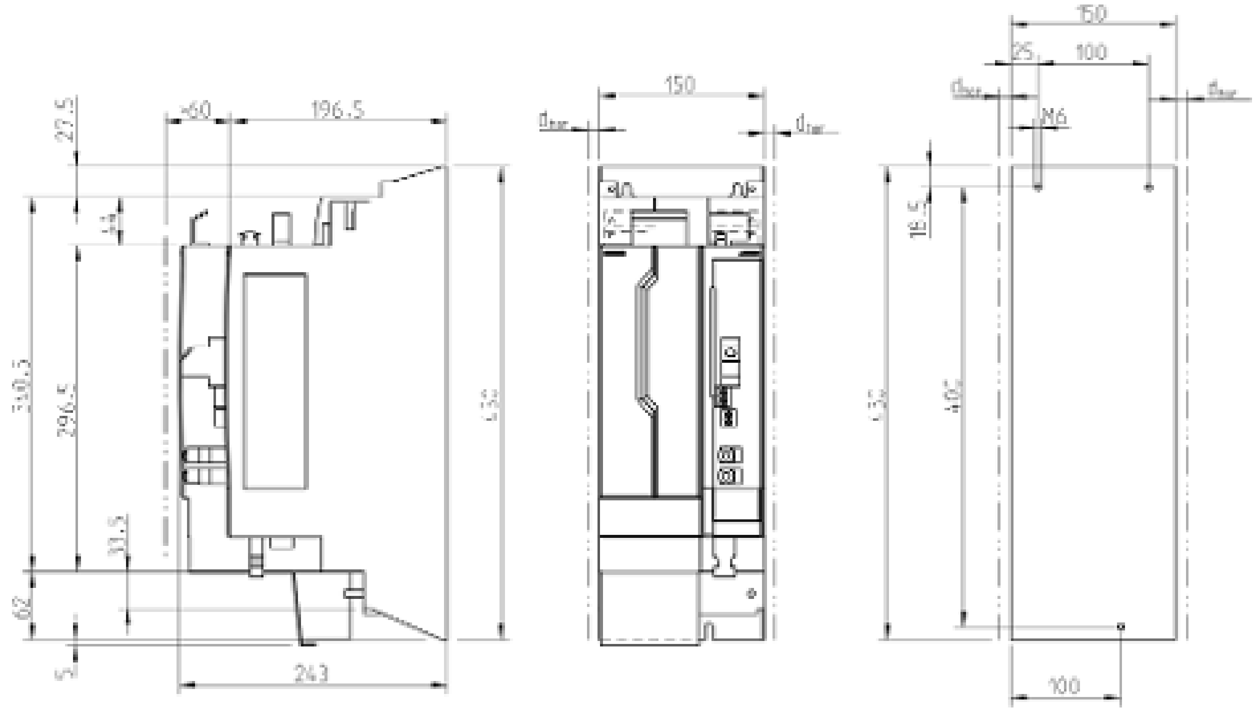


Fig. 15: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.14 XMS*-W0150/-W0180

Dimensional drawing



d_{hor} ➡Table 43 Cooling and power dissipation data on page 83

Dimensions, mass, insulation

Table 42: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMS*-W0150	XMS*-W0180
Mass	m	kg	11	
Device height1)	H	mm	340.5	
Device depth2)	T	mm	196.5	
Device width3)	B	mm	150	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 100	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 43: Cooling and power dissipation data

Designation	Symbol	Unit	XMS*-W0150	XMS*-W0180
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	

Designation	Symbol	Unit	XMS*-W0150	XMS*-W0180
Volumetric capacity of forced cooling	V	m^3/h	148	
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	910	1130
Minimum distance on the top of the device[2)]	d_{top}	mm	80	
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80	
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

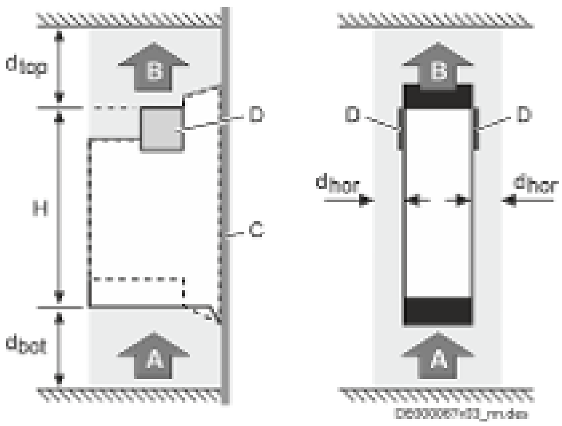
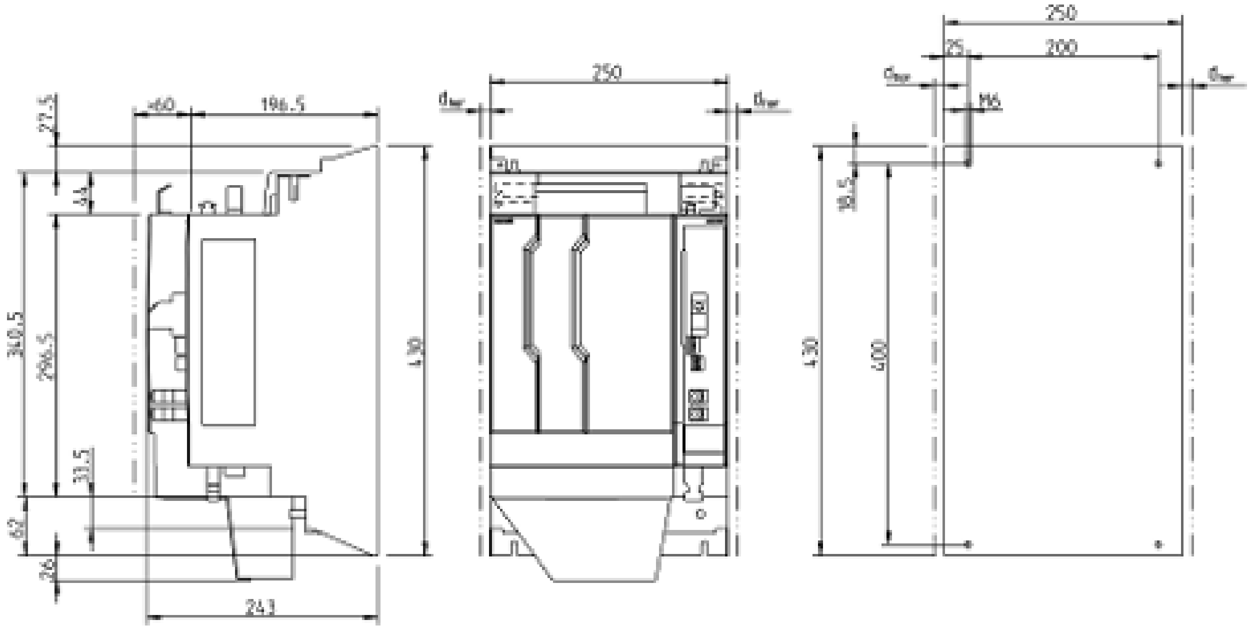


Fig. 16: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.15 XMS*-W0210 ... W0375

Dimensional drawing



d_{hor} ➦ Table 45 Cooling and power dissipation data on page 85

Dimensions, mass, insulation

Table 44: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMS*-W0210	XMS*-W0250	XMS*-W0280	XMS*-W0330	XMS*-W0375
Mass	m	kg	18.9				
Device height1)	H	mm	340.5				
Device depth2)	T	mm	196.5				
Device width3)	B	mm	250				
Insulation resistance at DC 500 V	R_{is}	Mohm	1				
Capacitance against ground	C_Y	nF	2 × 100				

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 45: Cooling and power dissipation data

Designation	Symbol	Unit	XMS*-W0210	XMS*-W0250	XMS*-W0280	XMS*-W0330	XMS*-W0375
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40				
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55				
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2				
Allowed mounting position			G1				
Cooling type			Forced ventilation				
Volumetric capacity of forced cooling	V	m³/h	222			390	

Designation	Symbol	Unit	XMS*-W0210	XMS*-W0250	XMS*-W0280	XMS*-W0330	XMS*-W0375
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	1374	1489	1546	1912	2146
Minimum distance on the top of the device[2)]	d_{top}	mm	80				
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80				
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else				

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

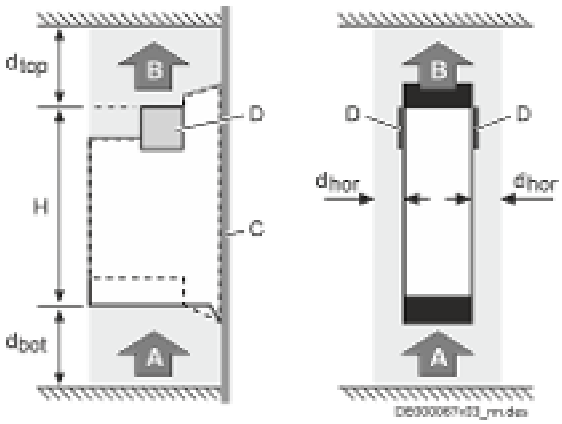
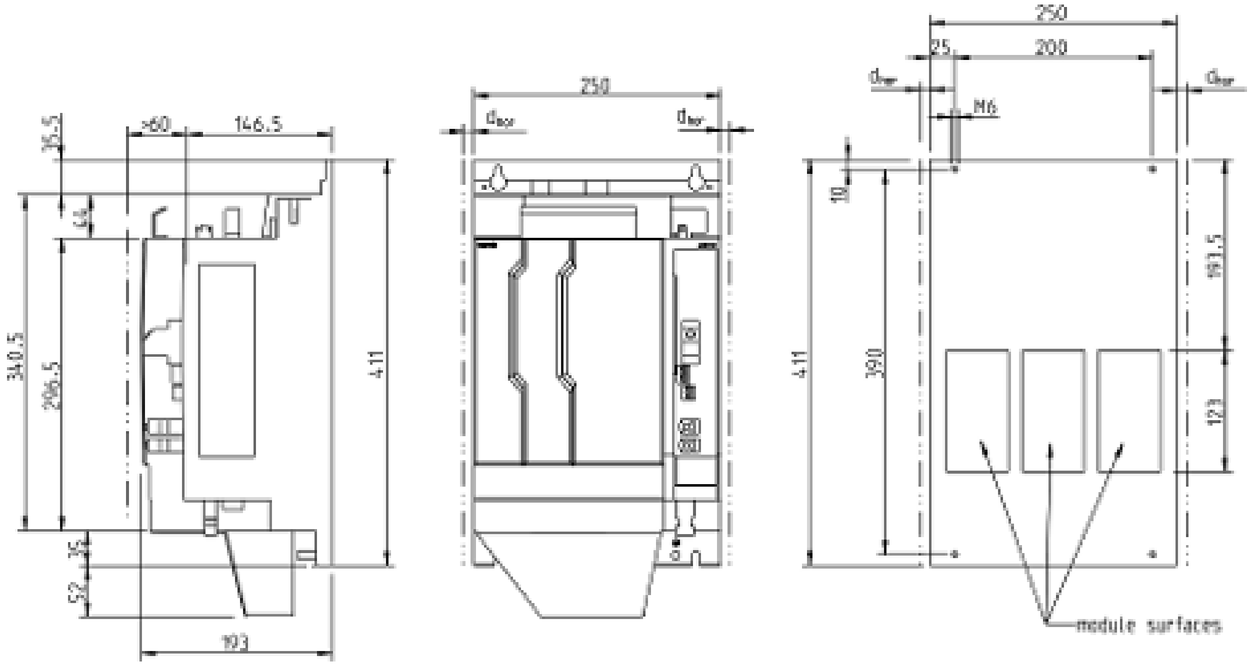


Fig. 17: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.16 XMS*-C0210 ... C0280

Dimensional drawing



d_{hor} ➦Table 47 Cooling and power dissipation data on page 87
module surfaces Areas of heat-producing power modules
Coldplate ➦Chapter 9.2 Coldplate on page 190

Dimensions, mass, insulation

Table 46: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMS*-C0210	XMS*-C0250	XMS*-C0280
Mass	m	kg	15		
Device height1)	H	mm	340.5		
Device depth2)	T	mm	146.5		
Device width3)	B	mm	250		
Insulation resistance at DC 500 V	R_{is}	Mohm	1		
Capacitance against ground	C_Y	nF	2 × 100		

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 47: Cooling and power dissipation data

Designation	Symbol	Unit	XMS*-C0210	XMS*-C0250	XMS*-C0280
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40		
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55		
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2		
Allowed mounting position			G1		
Cooling type			Coldplate		

Designation	Symbol	Unit	XMS*-C0210	XMS*-C0250	XMS*-C0280
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	1374	1489	1546
Minimum distance on the top of the device[2)]	d_{top}	mm	80		
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80		
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else		

1) Plus dissipation of braking resistor and control section

2) See fig. "Distances at the device"

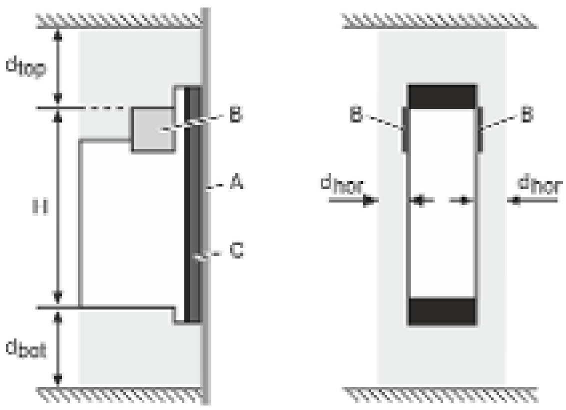


Fig. 18: Distances at the device

A Mounting surface in the control cabinet

B Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)

C Coldplate

H Device height

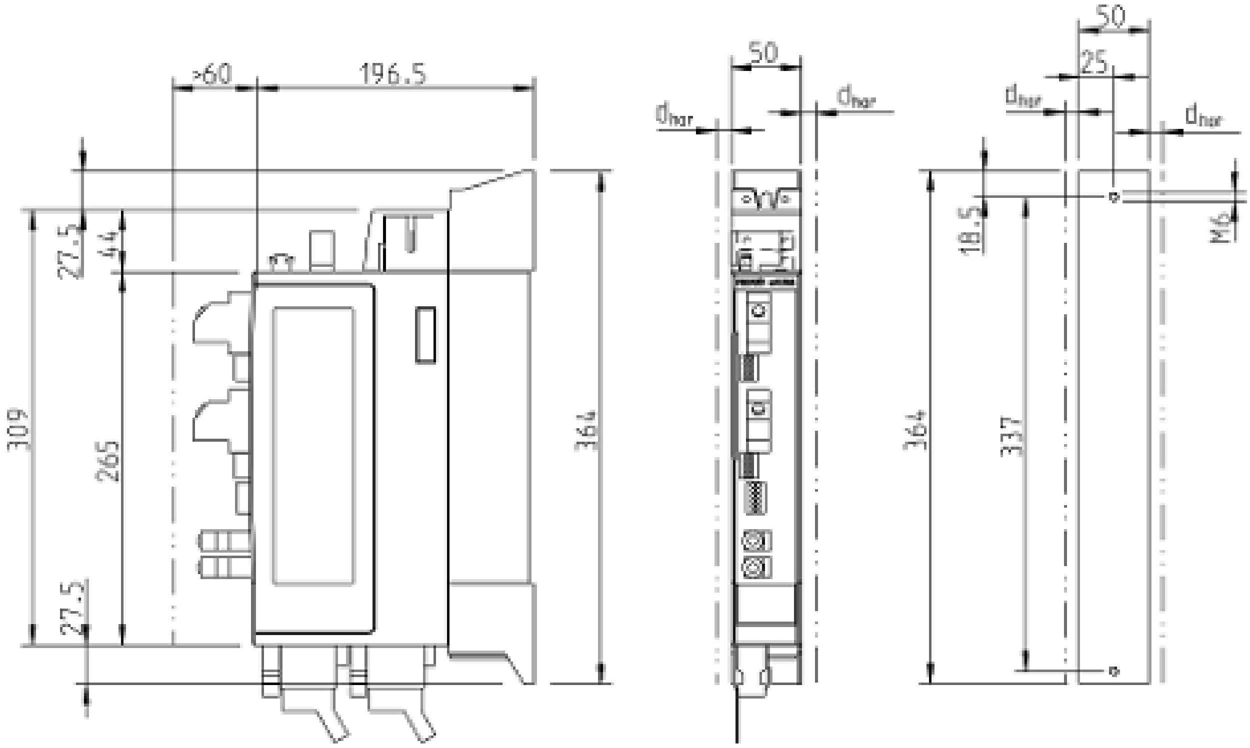
d_{top} Distance top

d_{bot} Distance bottom

d_{hor} Distance horizontal

4.2.17 XMD*-W0606 ... W2323

Dimensional drawing



dhor ➦Table 49 Cooling and power dissipation data on page 89

Dimensions, mass, insulation

Table 48: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMD*-W0606	XMD*-W1010	XMD*-W1616	XMD*-W2323
Mass	m	kg	3.3			
Device height1)	H	mm	309			
Device depth2)	T	mm	196.5			
Device width3)	B	mm	50			
Insulation resistance at DC 500 V	R_{is}	Mohm	1			
Capacitance against ground	C_Y	nF	2 × 150			

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 49: Cooling and power dissipation data

Designation	Symbol	Unit	XMD*-W0606	XMD*-W1010	XMD*-W1616	XMD*-W2323
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40			
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55			
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2			
Allowed mounting position			G1			

Designation	Symbol	Unit	XMD*-W0606	XMD*-W1010	XMD*-W1616	XMD*-W2323
Cooling type			Forced ventilation			
Volumetric capacity of forced cooling	V	m^3/h	36			
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	138	150	151	170
Minimum distance on the top of the device[2)]	d_{top}	mm	80			
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80			
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else			

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

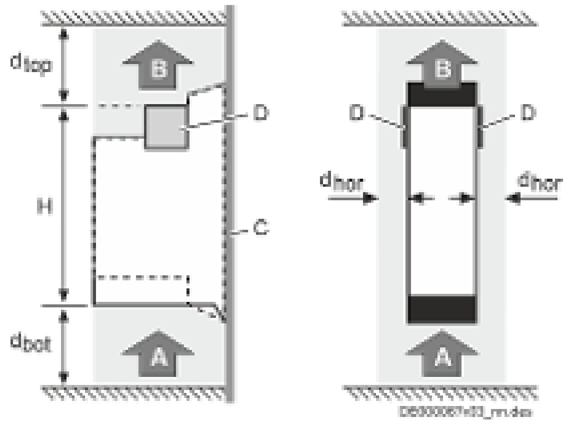


Fig. 19: Air intake and air outlet at device

A Air intake

B Air outlet

C Mounting surface in the control cabinet

D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)

H Device height

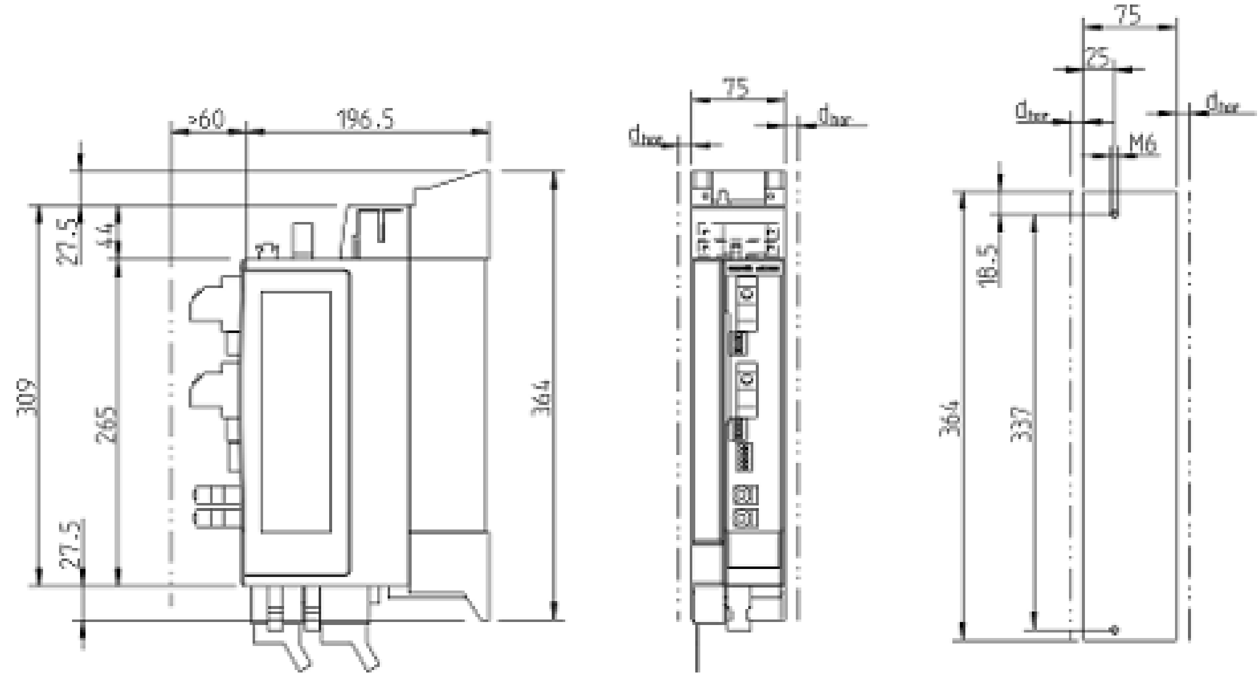
d_{top} Distance top

d_{bot} Distance bottom

d_{hor} Distance horizontal

4.2.18 XMD*-W3030, -W3636

Dimensional drawing



d_{hor} ➦Table 51 Cooling and power dissipation data on page 91

Dimensions, mass, insulation

Table 50: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMD*-W3030	XMD*-W3636
Mass	m	kg	4.2	
Device height1)	H	mm	309	
Device depth2)	T	mm	196.5	
Device width3)	B	mm	75	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 150	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 51: Cooling and power dissipation data

Designation	Symbol	Unit	XMD*-W3030	XMD*-W3636
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	
Volumetric capacity of forced cooling	V	m³/h	129	

Designation	Symbol	Unit	XMD*-W3030	XMD*-W3636
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	237	339
Minimum distance on the top of the device[2)]	d_{top}	mm	80	
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80	
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

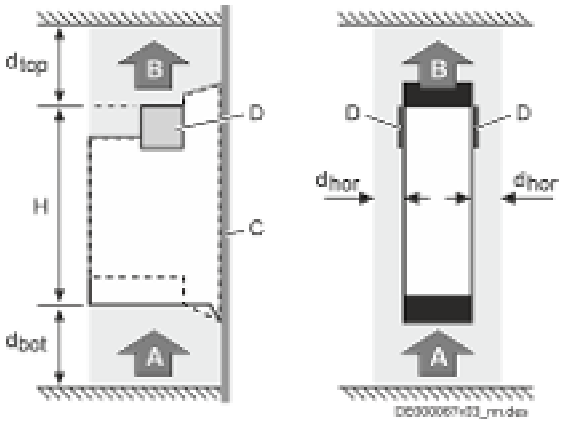
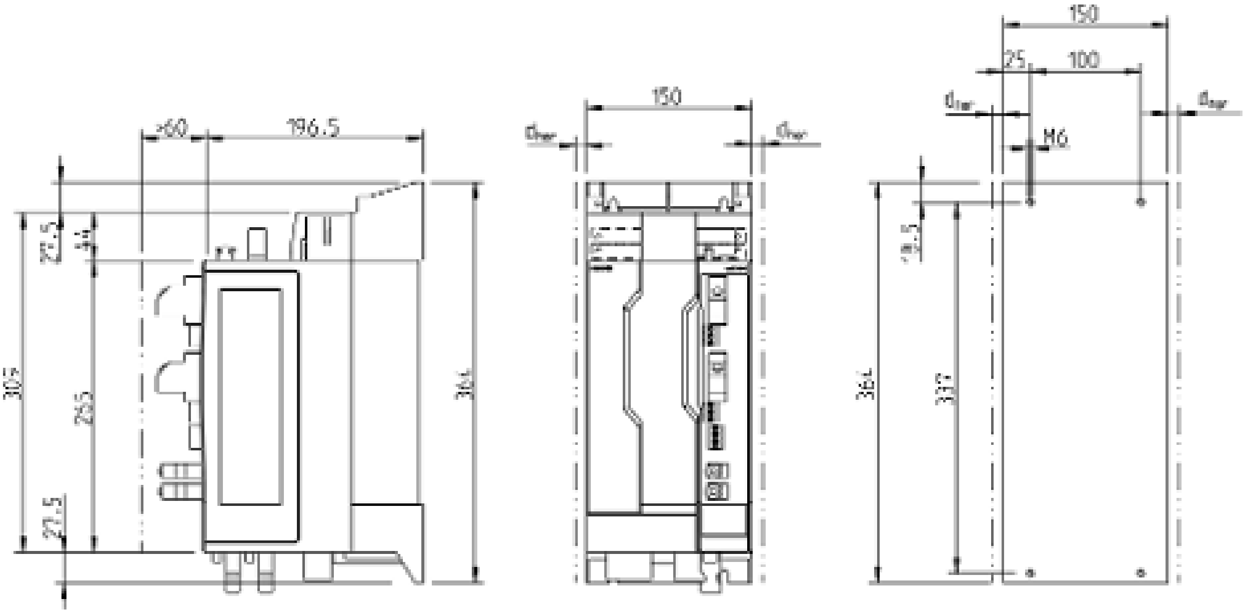


Fig. 20: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.19 XMD*-W5454/-W7070

Dimensional drawing



d_{hor} ➦ Table 53 Cooling and power dissipation data on page 93

Dimensions, mass, insulation

Table 52: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMD*-W5454	XMD*-W7070
Mass	m	kg	6.7	
Device height1)	H	mm	309	
Device depth2)	T	mm	196.5	
Device width3)	B	mm	150	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 200	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 53: Cooling and power dissipation data

Designation	Symbol	Unit	XMD*-W5454	XMD*-W7070
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Forced ventilation	
Volumetric capacity of forced cooling	V	m^3/h	74	

Designation	Symbol	Unit	XMD*-W5454	XMD*-W7070
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	585	647
Minimum distance on the top of the device[2)]	d_{top}	mm	80	
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80	
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

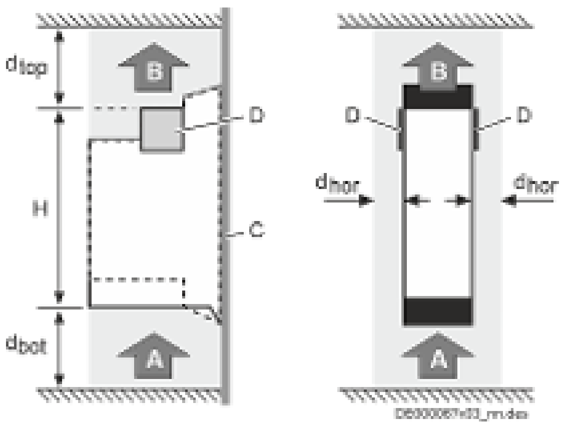
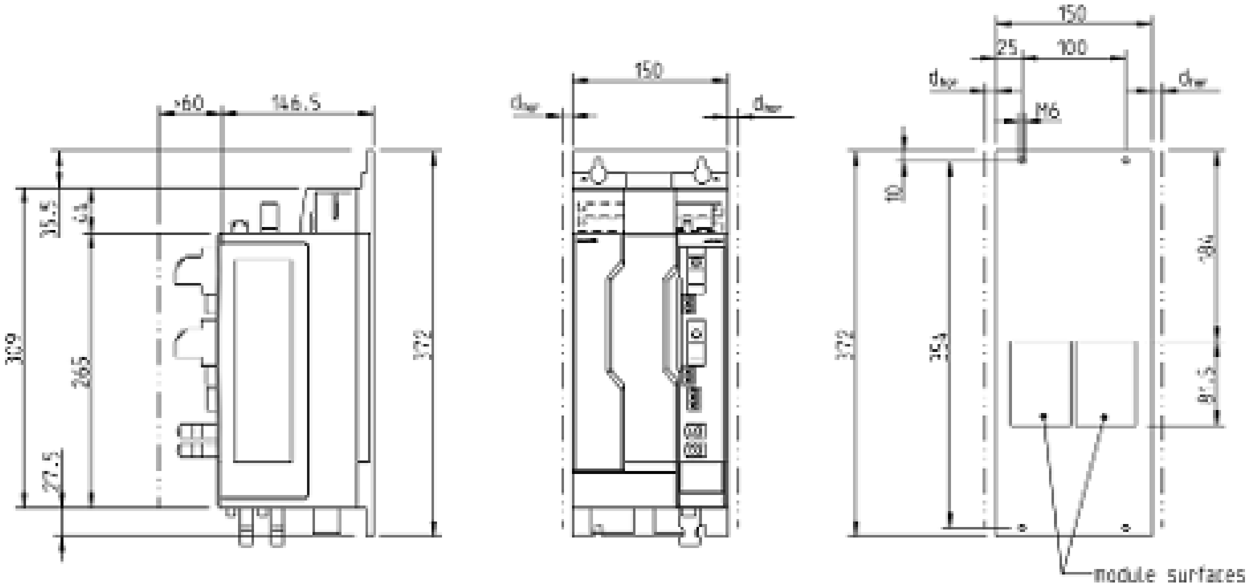


Fig. 21: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.20 XMD*-C5454/-C7070

Dimensional drawing



d_{hor} ➦Table 55 Cooling and power dissipation data on page 95
module surfaces Areas of heat-producing power modules
Coldplate ➦Chapter 9.2 Coldplate on page 190

Dimensions, mass, insulation

Table 54: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMD*-C5454	XMD*-C7070
Mass	m	kg	5	
Device height1)	H	mm	309	
Device depth2)	T	mm	146.5	
Device width3)	B	mm	150	
Insulation resistance at DC 500 V	R_{is}	Mohm	1	
Capacitance against ground	C_Y	nF	2 × 200	

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 55: Cooling and power dissipation data

Designation	Symbol	Unit	XMD*-C5454	XMD*-C7070
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40	
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55	
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2	
Allowed mounting position			G1	
Cooling type			Coldplate	
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	585	647

Designation	Symbol	Unit	XMD*-C5454	XMD*-C7070
Minimum distance on the top of the device2)	d_{top}	mm	80	
Minimum distance on the bottom of the device2)	d_{bot}	mm	80	
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else	

1) Plus dissipation of braking resistor and control section

2) See fig. "Distances at the device"

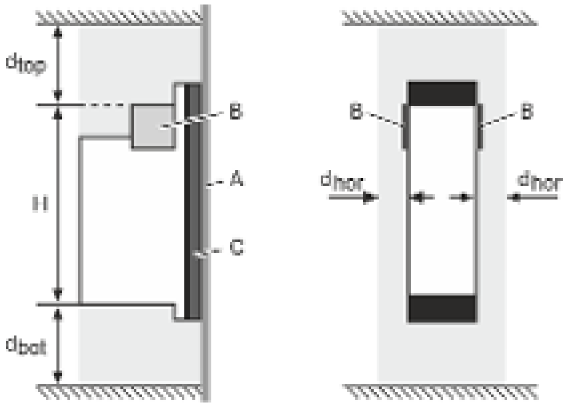
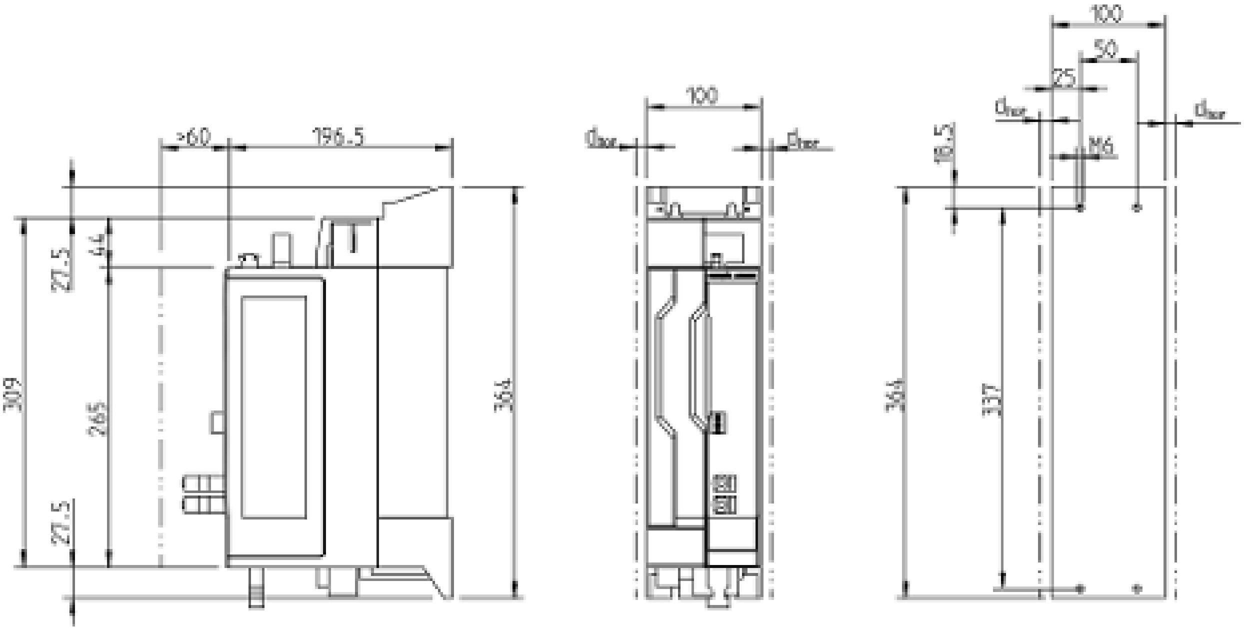


Fig. 22: Distances at the device

A Mounting surface in the control cabinet
B Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
C Coldplate
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.2.21 XVR*-W0019

Dimensional drawing



d_{hor} ➦Table 57 Cooling and power dissipation data on page 97

Dimensions, mass, insulation

Table 56: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XVR*-W0019
Mass	m	kg	5.8
Device height1)	H	mm	309
Device depth2)	T	mm	196.5
Device width3)	B	mm	100
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 300

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 57: Cooling and power dissipation data

Designation	Symbol	Unit	XVR*-W0019
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m³/h	96
Allowed switching frequencies	f_s	kHz	7.1

Designation	Symbol	Unit	XVR*-W0019
Power dissipation at continuous current and continuous DC bus power respectively[1)]	P_{Diss_cont}	W	352
Minimum distance on the top of the device[2)]	d_{top}	mm	80
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	80
Horizontal spacing at the device[2)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

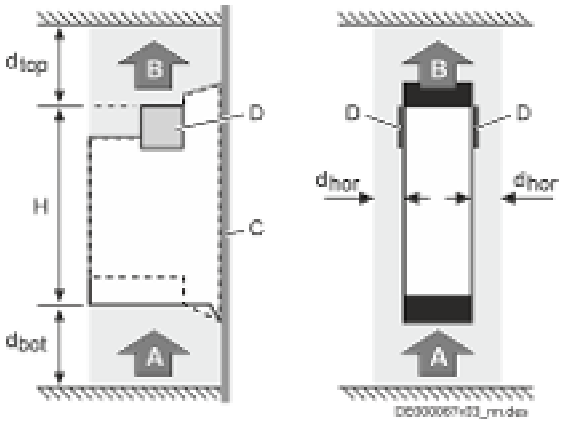


Fig. 23: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

Power loss vs. Output power

Regenerative supply units also generate power loss if they do not supply power at the DC bus.

The power dissipation in the working point P_{DC_cont} = 0 kW is approx. $P_{N3} + 0.2 \times P_{Diss\_cont}$

For other working points, use the following figure for interpolation.

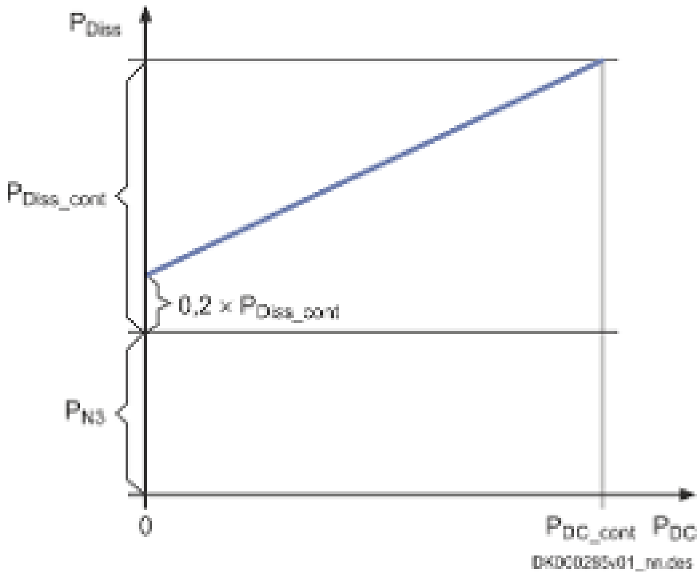


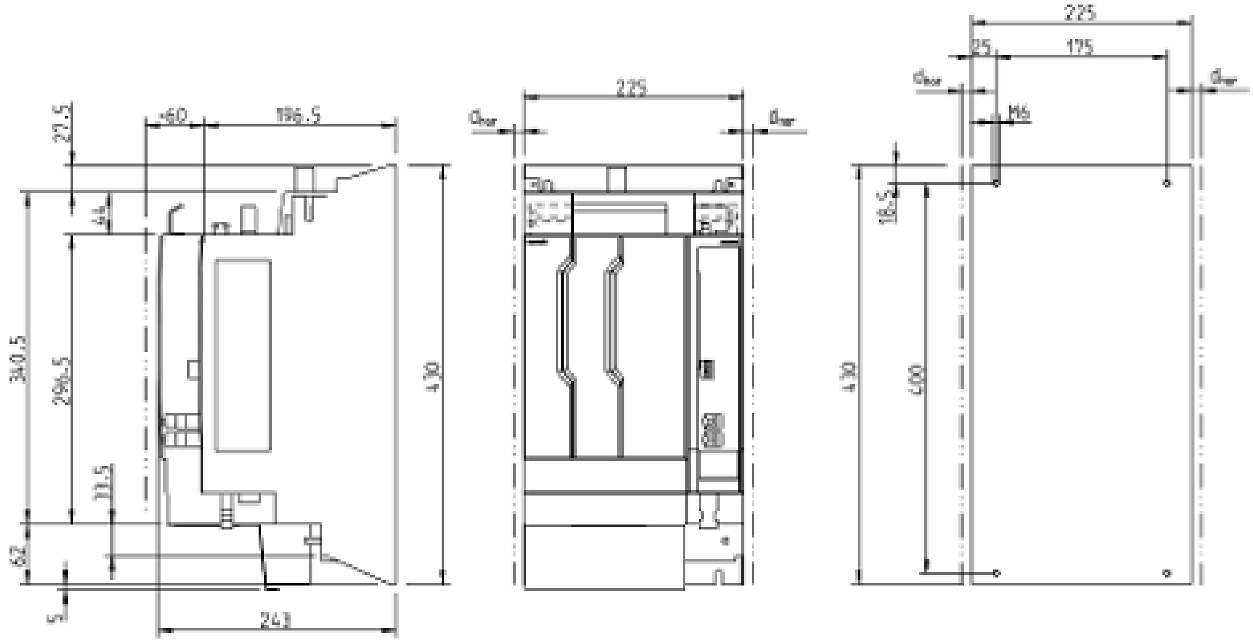
Fig. 24: Power loss vs. Output power

P_{Diss_cont} Power loss at P_{DC_cont}

P_{N3} Power consumption of control voltage

4.2.22 XVR*-W0048

Dimensional drawing



d_{hor} ➡ Table 59 Cooling and power dissipation data on page 100

Dimensions, mass, insulation

Table 58: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XVR*-W0048
Mass	m	kg	16
Device height[1)]	H	mm	340.5
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	225
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 400

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 59: Cooling and power dissipation data

Designation	Symbol	Unit	XVR*-W0048
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	150
Allowed switching frequencies[1)]	f_s	kHz	7.1

Designation	Symbol	Unit	XVR*-W0048
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	951
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Horizontal spacing at the device[3)]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

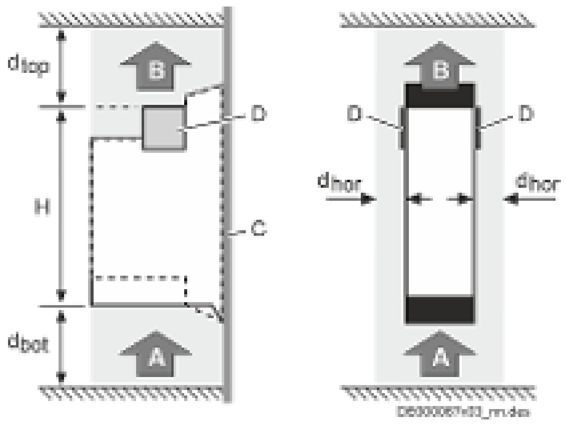


Fig. 25: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

Power loss vs. Output power

Regenerative supply units also generate power loss if they do not supply power at the DC bus.

The power dissipation in the working point P_{DC_cont} = 0 kW is approx. P_{N3} + 0.2 × P_{Diss_cont}

For other working points, use the following figure for interpolation.

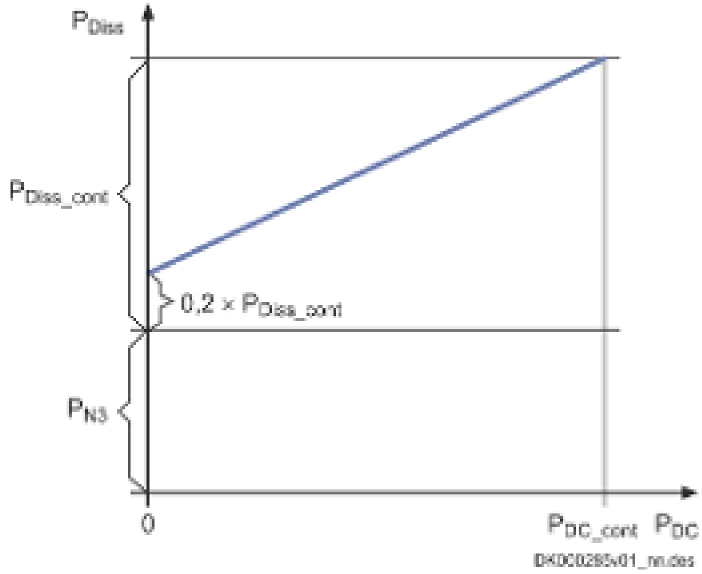


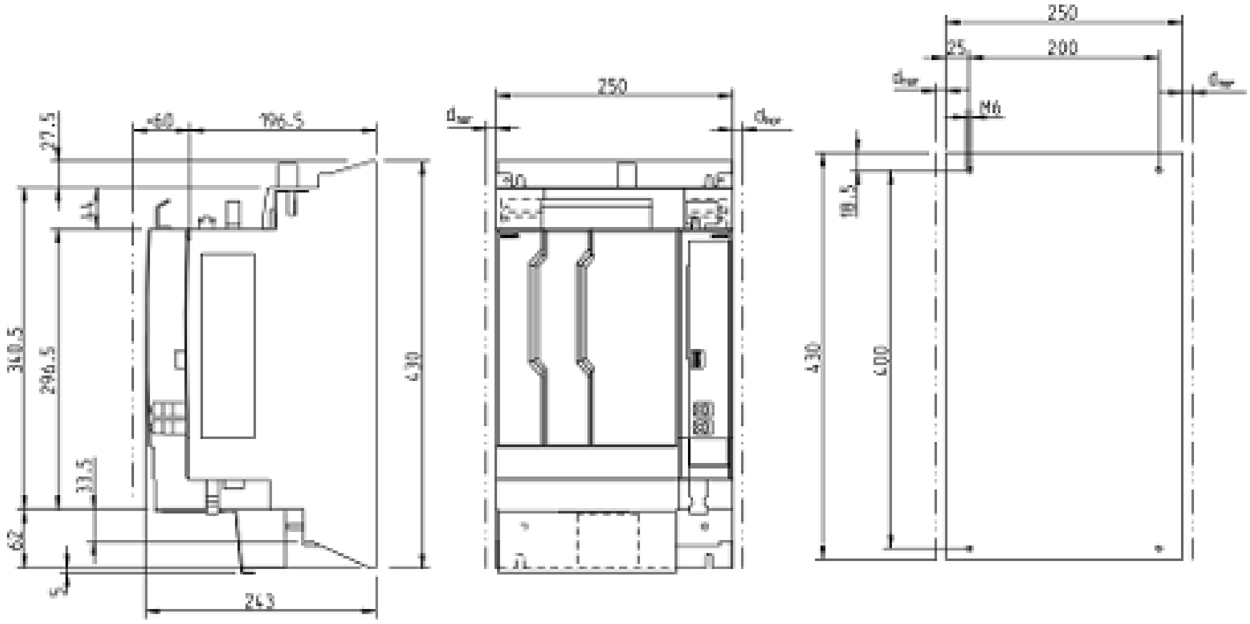
Fig. 26: Power loss vs. Output power

P_{Diss_cont} Power loss at P_{DC_cont}

P_{N3} Power consumption of control voltage

4.2.23 XVR*-W0072

Dimensional drawing



d_{hor} ➦ Table 61 Cooling and power dissipation data on page 103

Dimensions, mass, insulation

Table 60: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XVR*-W0072
Mass	m	kg	20
Device height[1)]	H	mm	340.5
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	250
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 300

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 61: Cooling and power dissipation data

Designation	Symbol	Unit	XVR*-W0072
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	150
Allowed switching frequencies[1)]	f_s	kHz	7.1
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	1418

Designation	Symbol	Unit	XVR*-W0072
Minimum distance on the top of the device3)	d_{top}	mm	80
Minimum distance on the bottom of the device3)	d_{bot}	mm	80
Horizontal spacing at the device3)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

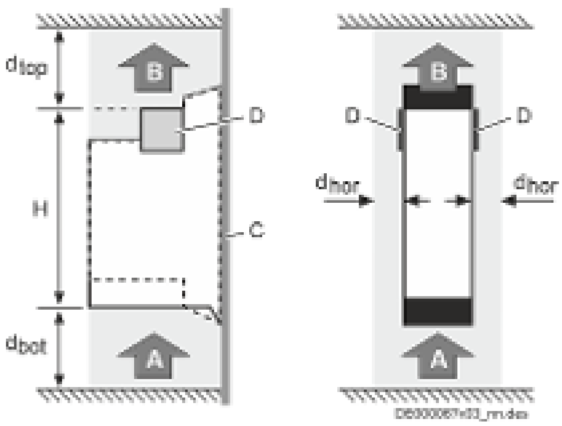


Fig. 27: Air intake and air outlet at device

A Air intake

B Air outlet

C Mounting surface in the control cabinet

D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)

H Device height

d_{top} Distance top

d_{bot} Distance bottom

d_{hor} Distance horizontal

Power loss vs. Output power

Regenerative supply units also generate power loss if they do not supply power at the DC bus.

The power dissipation in the working point P_{DC_cont} = 0 kW is approx. $P_{N3} + 0.2 \times P_{Diss\_cont}$

For other working points, use the following figure for interpolation.

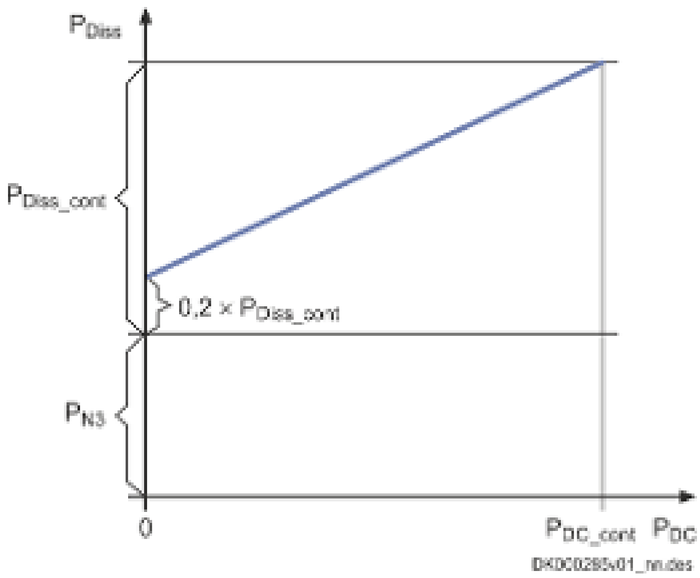
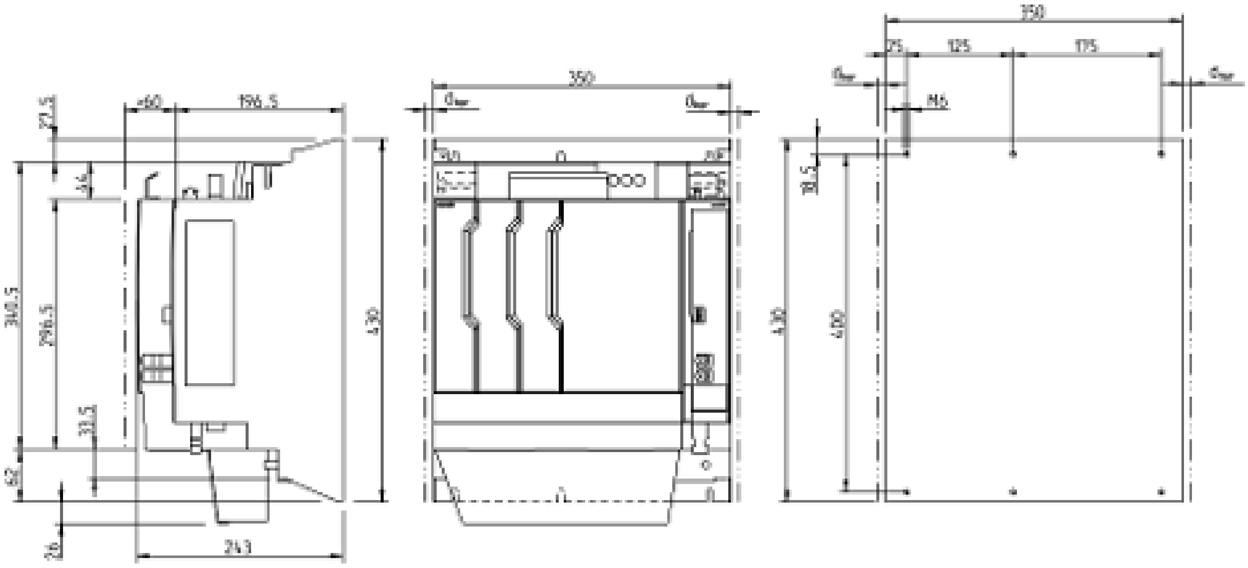


Fig. 28: Power loss vs. Output power

P_{Diss_cont}	Power loss at P_{DC_cont}
P_{N3}	Power consumption of control voltage

4.2.24 XVR*-W0100

Dimensional drawing



d_{hor} ➦ Table 63 Cooling and power dissipation data on page 106

Dimensions, mass, insulation

Table 62: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XVR*-W0100
Mass	m	kg	27
Device height1)	H	mm	340.5
Device depth2)	T	mm	196.5
Device width3)	B	mm	350
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 300

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 63: Cooling and power dissipation data

Designation	Symbol	Unit	XVR*-W0100
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m³/h	372
Allowed switching frequencies1)	f_s	kHz	7.1
Power dissipation at continuous current and continuous DC bus power respectively2)	P_{Diss_cont}	W	1969

Designation	Symbol	Unit	XVR*-W0100
Minimum distance on the top of the device3)	d_{top}	mm	80
Minimum distance on the bottom of the device3)	d_{bot}	mm	80
Horizontal spacing at the device3)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

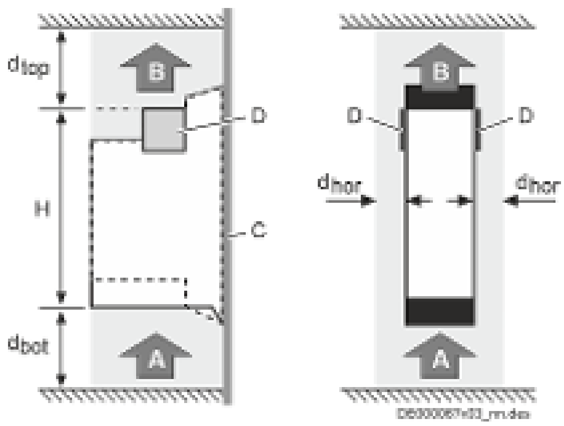


Fig. 29: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

Power loss vs. Output power

Regenerative supply units also generate power loss if they do not supply power at the DC bus.

The power dissipation in the working point P_{DC_cont} = 0 kW is approx. P_{N3} + 0.2 × P_{Diss_cont}

For other working points, use the following figure for interpolation.

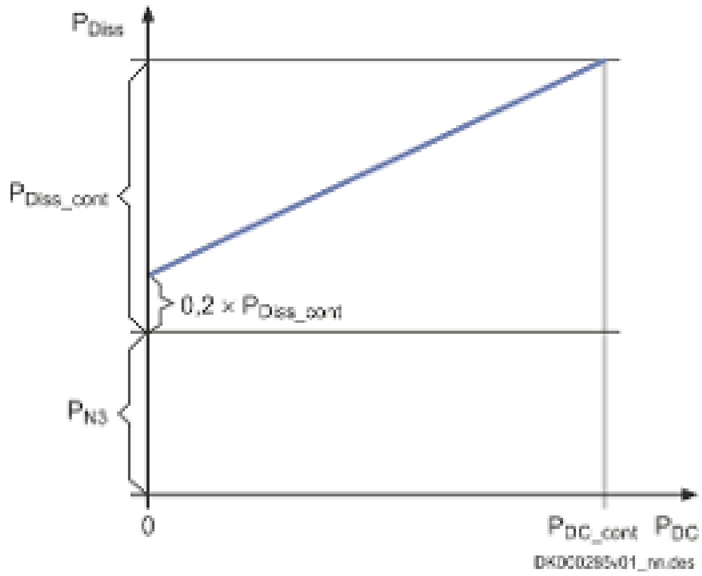


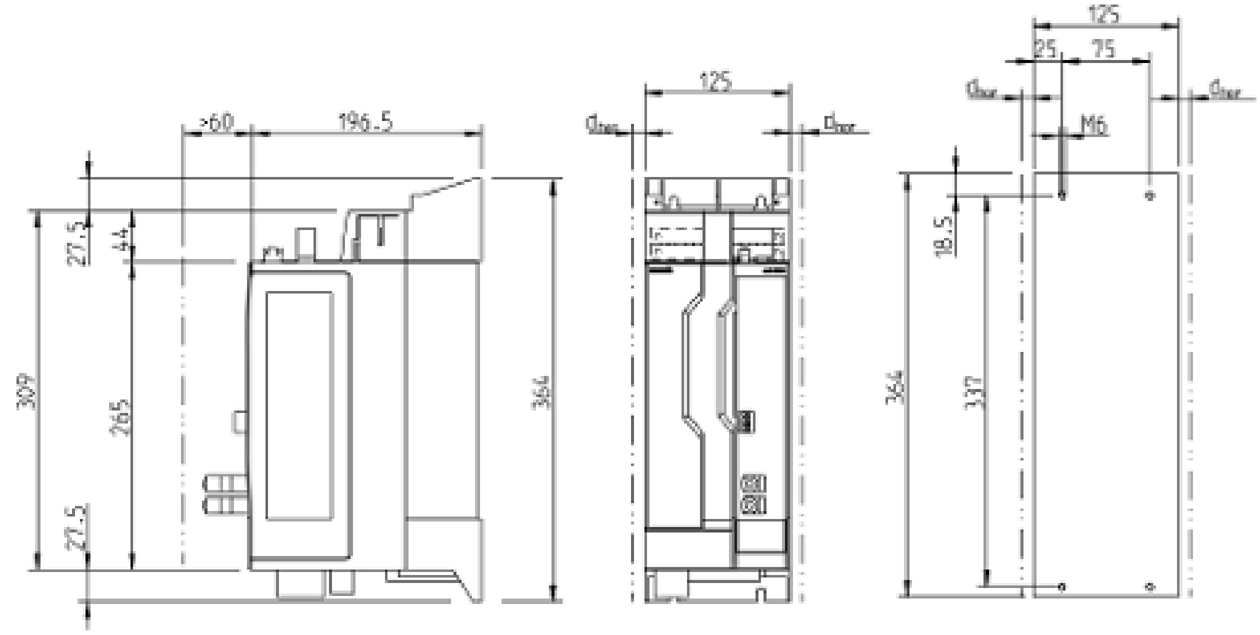
Fig. 30: Power loss vs. Output power

P_{Diss_cont} Power loss at P_{DC_cont}

P_{N3} Power consumption of control voltage

4.2.25 XVE*-W0030

Dimensional drawing



d_{hor} ➡Table 65 Cooling and power dissipation data on page 109

Dimensions, mass, insulation

Table 64: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XVE*-W0030
Mass	m	kg	6.2
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	125
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 65: Cooling and power dissipation data

Designation	Symbol	Unit	XVE*-W0030
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m³/h	124
Power dissipation at continuous current and continuous DC bus power respectively (without mains choke)[1)]	P_{Diss_cont}	W	77

Designation	Symbol	Unit	XVE*-W0030
Power dissipation at continuous current and continuous DC bus power respectively (with mains choke)[1]	P_{Diss_cont}	W	121
Minimum distance on the top of the device[2]	d_{top}	mm	80
Minimum distance on the bottom of the device[2]	d_{bot}	mm	80
Horizontal spacing at the device[2]	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

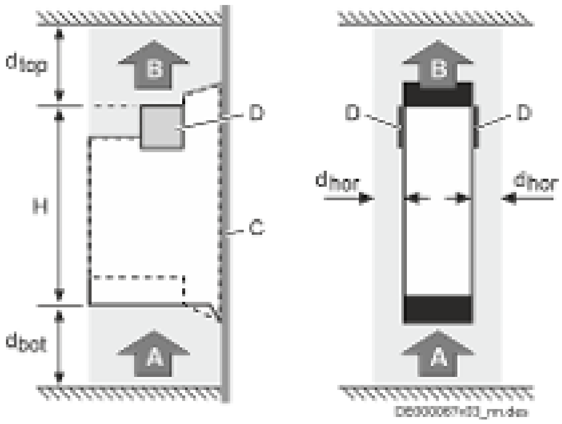


Fig. 31: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

Power dissipation vs. output power

Due to their operating principle, feeding supply units generate power dissipation even if they do not supply power at the DC bus.

The power dissipation in the working point P_{DC_cont} = 0 kW is approx. P_{N3}

For other working points, use the figure below for interpolation.

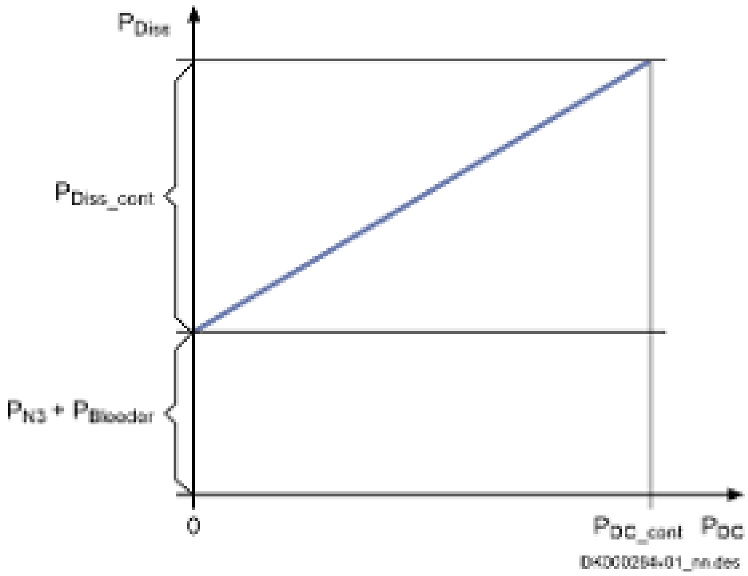
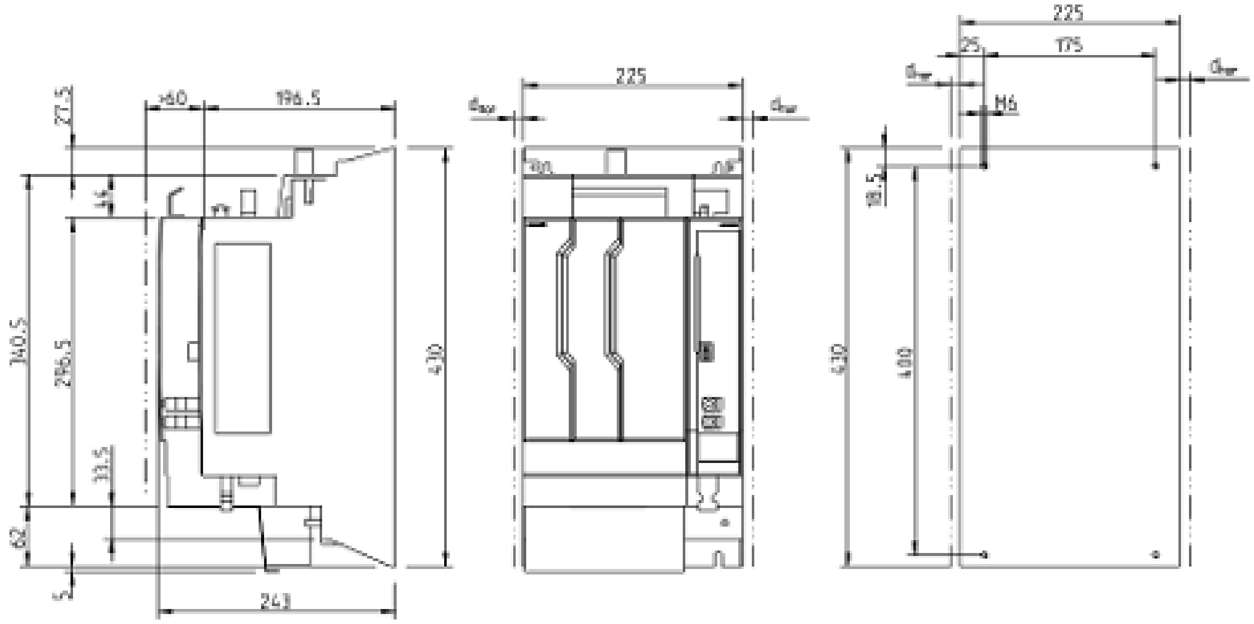


Fig. 32: Power dissipation vs. output power

P_{Diss_cont}	Power dissipation at P_{DC_cont}
P_{N3}	Power consumption of control voltage
$P_{Bleeder}$	Power generated at integrated braking resistor, max. P_{BD}

4.2.26 XVE*-W0075

Dimensional drawing



d_{hor} ➦Table 67 Cooling and power dissipation data on page 112

Dimensions, mass, insulation

Table 66: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XVE*-W0075
Mass	m	kg	16
Device height1)	H	mm	340.5
Device depth2)	T	mm	196.5
Device width3)	B	mm	225
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 67: Cooling and power dissipation data

Designation	Symbol	Unit	XVE*-W0075
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	402.5
Power dissipation at continuous current and continuous DC bus power respectively1)	P_{Diss_cont}	W	399

Designation	Symbol	Unit	XVE*-W0075
Minimum distance on the top of the device2)	d_{top}	mm	80
Minimum distance on the bottom of the device2)	d_{bot}	mm	80
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

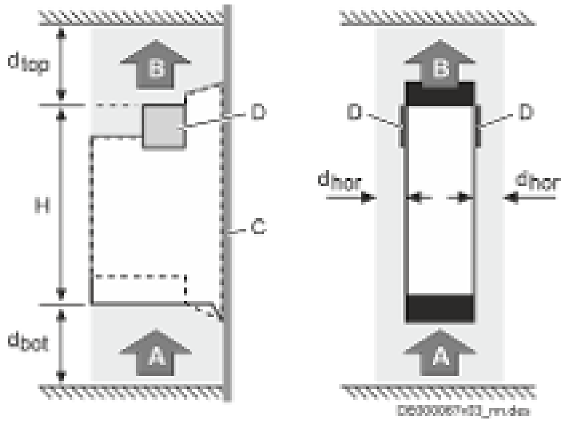


Fig. 33: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

Power dissipation vs. output power

Due to their operating principle, feeding supply units generate power dissipation even if they do not supply power at the DC bus.

The power dissipation in the working point P_{DC_cont} = 0 kW is approx. P_{N3}

For other working points, use the figure below for interpolation.

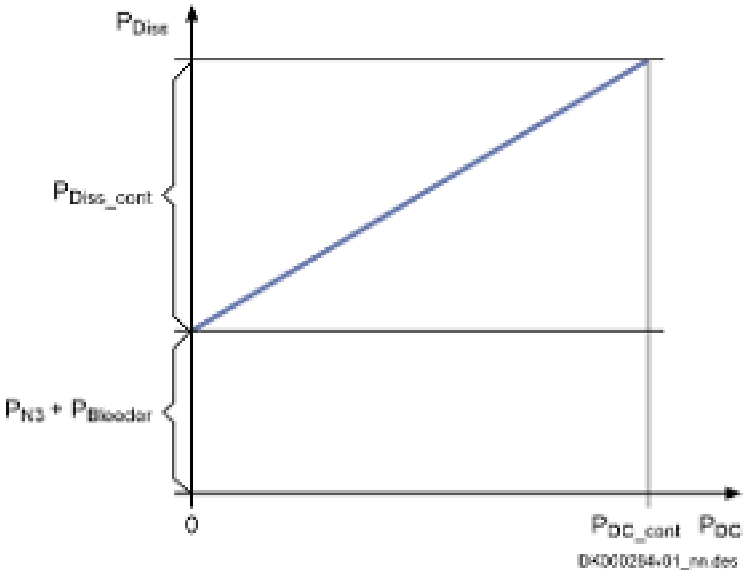
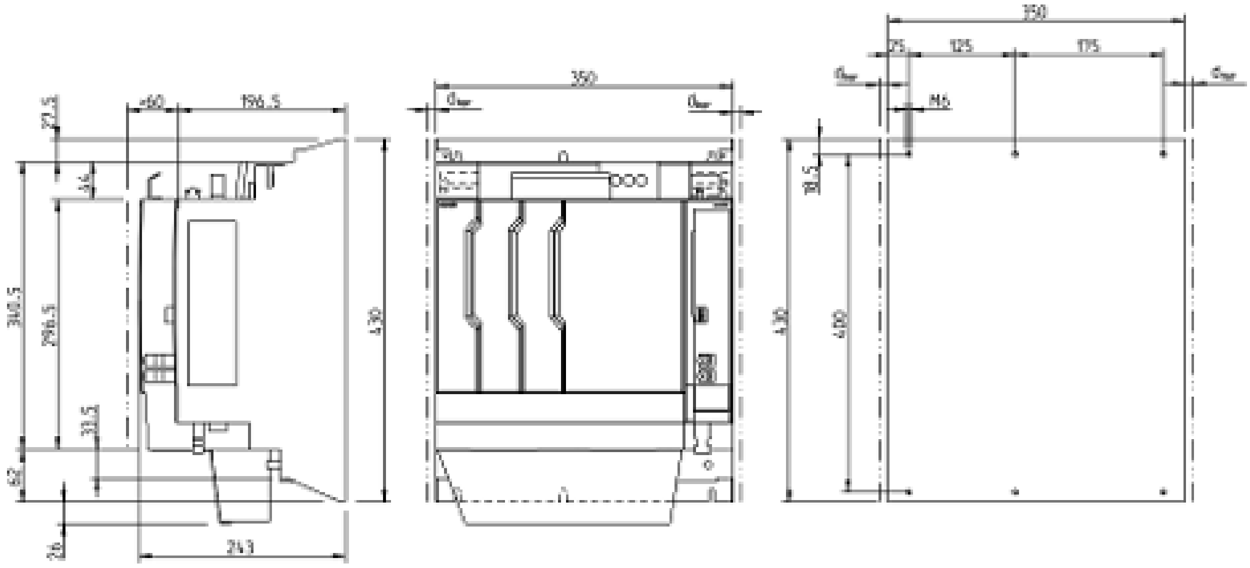


Fig. 34: Power dissipation vs. output power

P_{Diss_cont}	Power dissipation at P_{DC_cont}
P_{N3}	Power consumption of control voltage
$P_{Bleeder}$	Power generated at integrated braking resistor, max. P_{BD}

4.2.27 XVE*-W0125

Dimensional drawing



d_{hor} ➦Table 63 Cooling and power dissipation data on page 106

Dimensions, mass, insulation

Table 68: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XVE*-W0125
Mass	m	kg	34.5
Device height[1]	H	mm	340.5
Device depth[2]	T	mm	196.5
Device width[3]	B	mm	350
Insulation resistance at DC 500 V	R_{is}	Mohm	1
Capacitance against ground	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 69: Cooling and power dissipation data

Designation	Symbol	Unit	XVE*-W0125
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting position			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	372
Power dissipation at continuous current and continuous DC bus power respectively[1]	P_{Diss_cont}	W	568
Minimum distance on the top of the device[2]	d_{top}	mm	80

Designation	Symbol	Unit	XVE*-W0125
Minimum distance on the bottom of the device2)	d_{bot}	mm	80
Horizontal spacing at the device2)	d_{hor}	mm	• 0 For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • 1.5 For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • 10 For everything else

1) Plus dissipation of braking resistor and control section

2) See fig. "Air intake and air outlet at device"

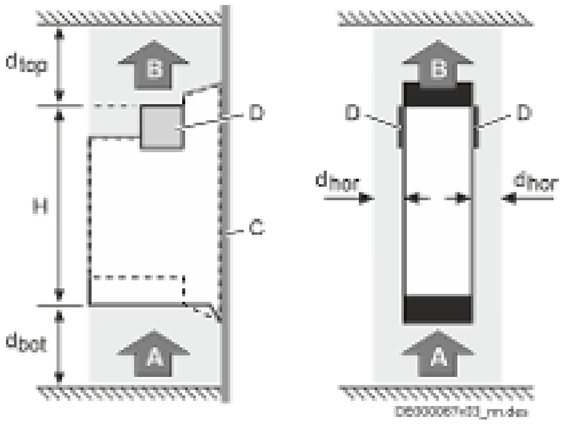


Fig. 35: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

Power dissipation vs. output power

Due to their operating principle, feeding supply units generate power dissipation even if they do not supply power at the DC bus.

The power dissipation in the working point P_{DC_cont} = 0 kW is approx. P_{N3}

For other working points, use the figure below for interpolation.

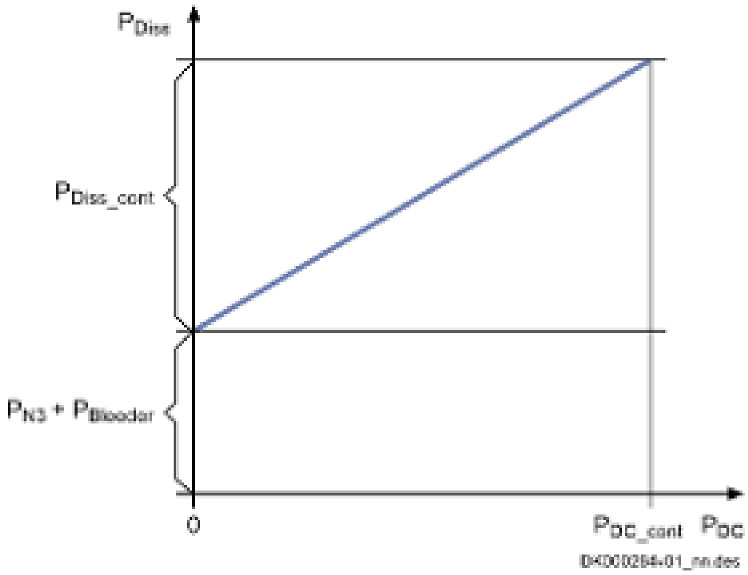


Fig. 36: Power dissipation vs. output power

P_{Diss_cont}	Power dissipation at P_{DC_cont}
P_{N3}	Power consumption of control voltage
$P_{Bleeder}$	Power generated at integrated braking resistor, max. P_{BD}

4.2.28 XMV*-W0050 ... 0210

Dimensional drawing

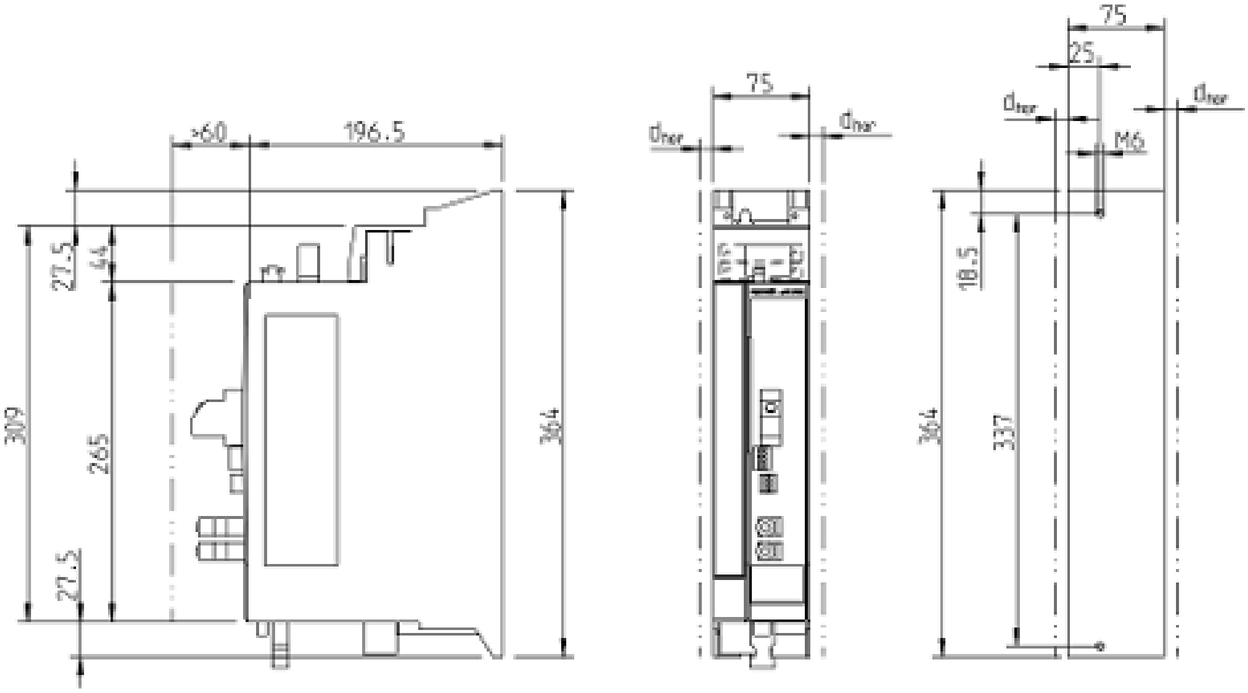


Fig. 37: Dimensional drawing XMV*-W0050

dhor ➦Table 71 Cooling and power dissipation data on page 119

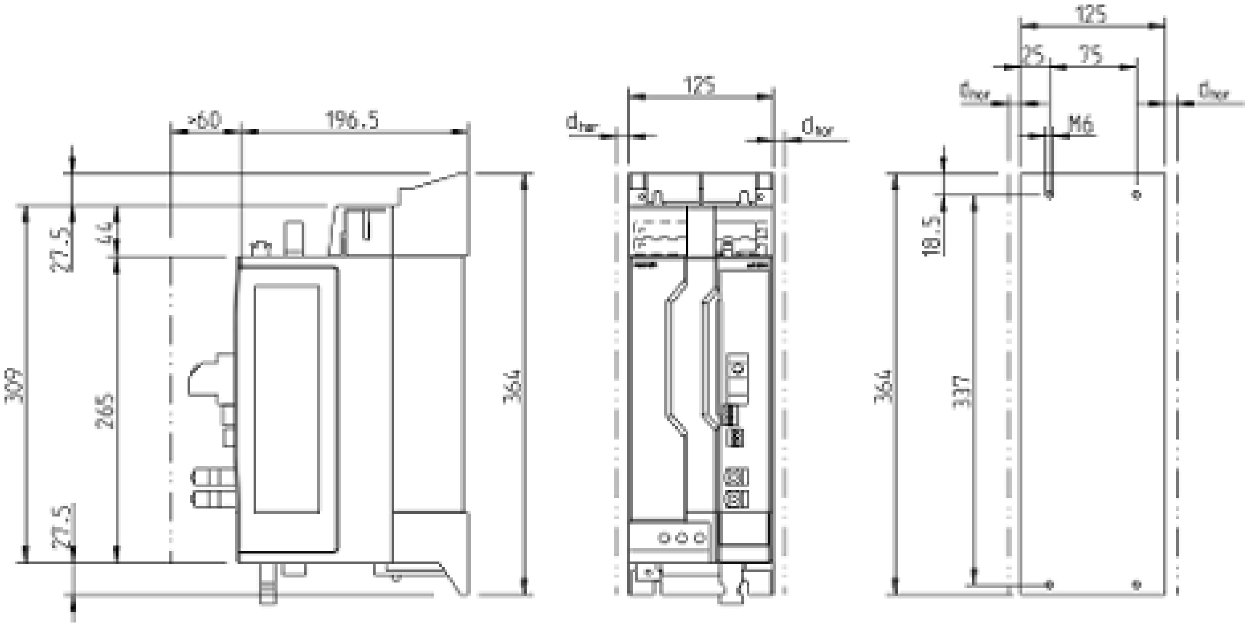


Fig. 38: Dimensional drawing XMV*-W0080

dhor ➦Table 71 Cooling and power dissipation data on page 119

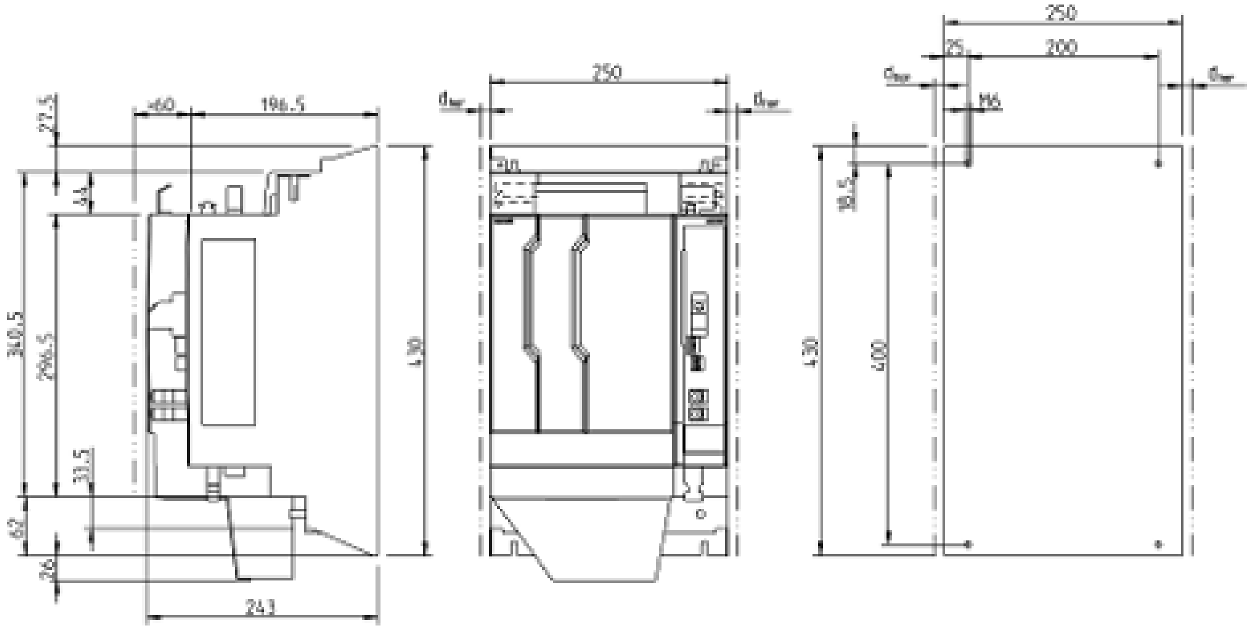


Fig. 39: Dimensional drawing XMV*-W0210

d_{hor} ➦ Table 71 Cooling and power dissipation data on page 119

Dimensions, mass, insulation

Table 70: Data for mass, dimensions, insulation

Designation	Symbol	Unit	XMV*-W0050	XMV*-W0080	XMV*-W0210
Mass	m	kg	4.25	6.2	18.9
Device height1)	H	mm	309		340.5
Device depth2)	T	mm	196.5		
Device width3)	B	mm	75	125	250
Insulation resistance at DC 500 V	R_{is}	Mohm	1		
Capacitance against ground	C_Y	nF	2 × 100		
1) 2) 3) Housing dimension; see also related dimensional drawing					

Temperatures, cooling, power dissipation, distances

Table 71: Cooling and power dissipation data

Designation	Symbol	Unit	XMV*-W0050	XMV*-W0080	XMV*-W0210
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40		
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55		
Derating of P_{DC_cont}, P_{BD} I_{out_cont} at T_{a_work} < T_a< $T_{a\_work\_red}$	f_{Ta}	%/K	2		
Allowed mounting position			G1		
Cooling type			Forced ventilation		
Volumetric capacity of forced cooling	V	m^3/h	tbd		

Designation	Symbol	Unit	XMV*-W0050	XMV*-W0080	XMV*-W0210
Allowed switching frequencies1)	f_s	kHz	8 ... 16		
Power dissipation at continuous current and continuous DC bus power respectively2)	P_{Diss_cont}	W	tbd	tbd	tbd
Minimum distance on the top of the device3)	d_{top}	mm	80		
Minimum distance on the bottom of the device3)	d_{bot}	mm	80		
Horizontal spacing at the device3)	d_{hor}	mm	• **0** For devices of the ctrlX DRIVE product range in the DC bus group (central supply) • **1.5** For devices of the ctrlX DRIVE product range outside of the DC bus group (individual supply) • **10** For everything else		
1) Also depending on firmware and control section 2) Plus dissipation of braking resistor and control section 3) See fig. "Air intake and air outlet at device"					

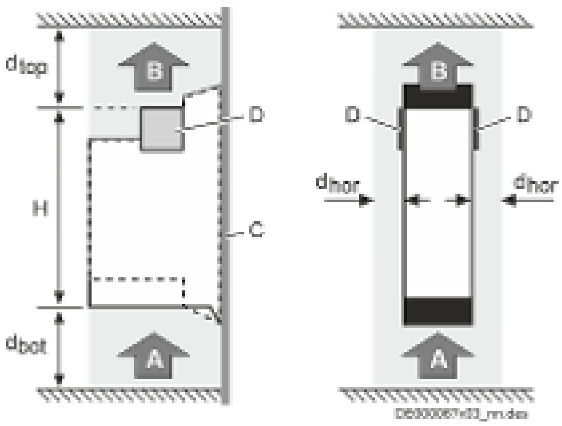


Fig. 40: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
H Device height
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

4.3 Electrical project planning

4.3.1 Overall connection diagram XCS*-W0010/W0023

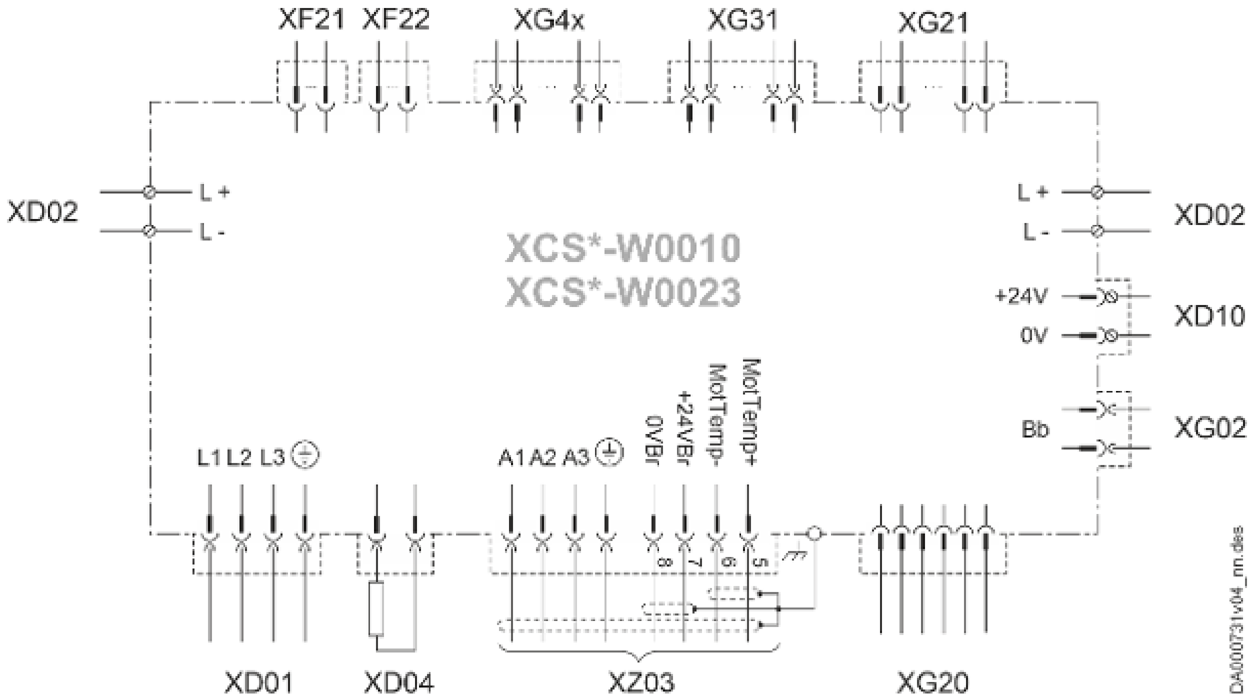


Fig. 41: Overall connection diagram XCS*-W0010/W0023

XD01	Mains	XG20	Digital encoder
XD02	DC bus	XG21	Multi-encoder (optional)
XD04	Internal/external braking resistor	XG31	Digital inputs/outputs; analog input
XD10	Control voltage	XG4x	Safety technology
XF21, XF22	Communication	XZ03	Motor, motor temperature monitoring, motor holding brake
XG02	Ready for operation relay contact		

4.3.2 Overall connection diagram XCS*-*0054/*0070

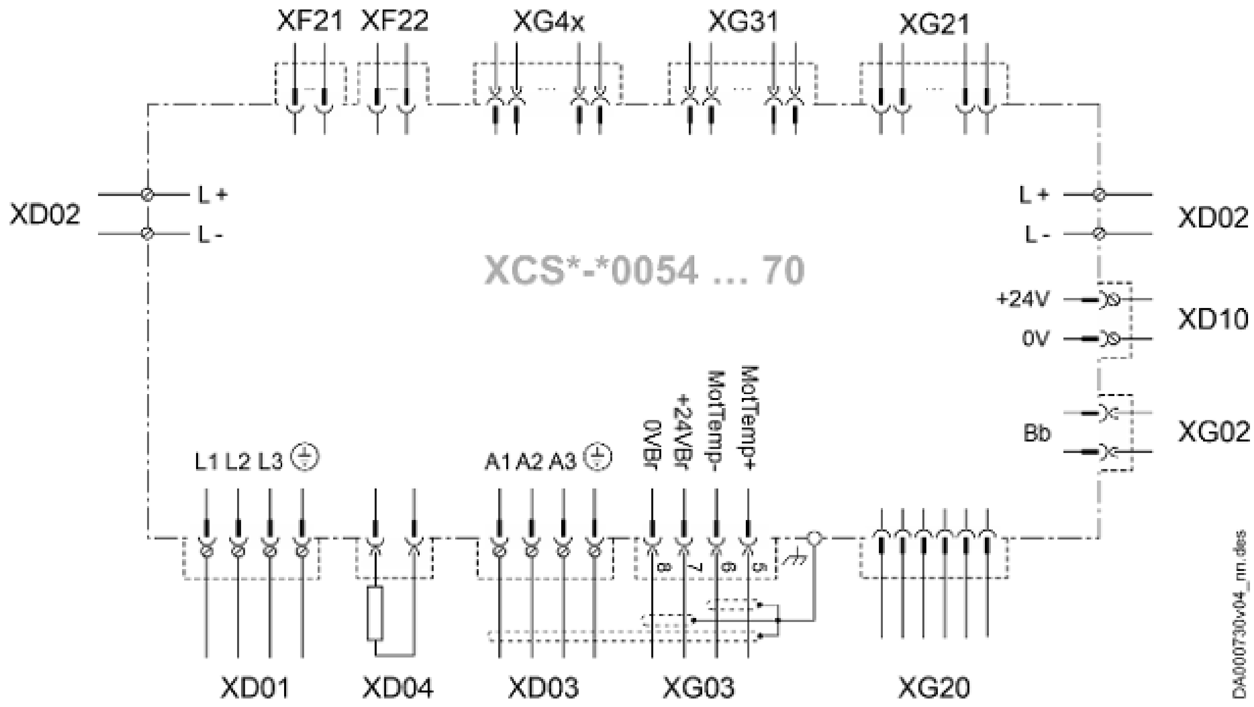


Fig. 42: Overall connection diagram XCS*-*0054/*0070

XD01	Mains	XG03	Motor temperature monitoring and motor holding brake
XD02	DC bus	XG20	Digital encoder
XD03	Motor	XG21	Multi-encoder (optional)
XD04	External braking resistor	XG31	Digital inputs/outputs; analog input
XD10	Control voltage	XG4x	Safety technology
XF21, XF22	Communication		
XG02	Ready for operation relay contact		

4.3.3 Overall connection diagram XCS*-*0090

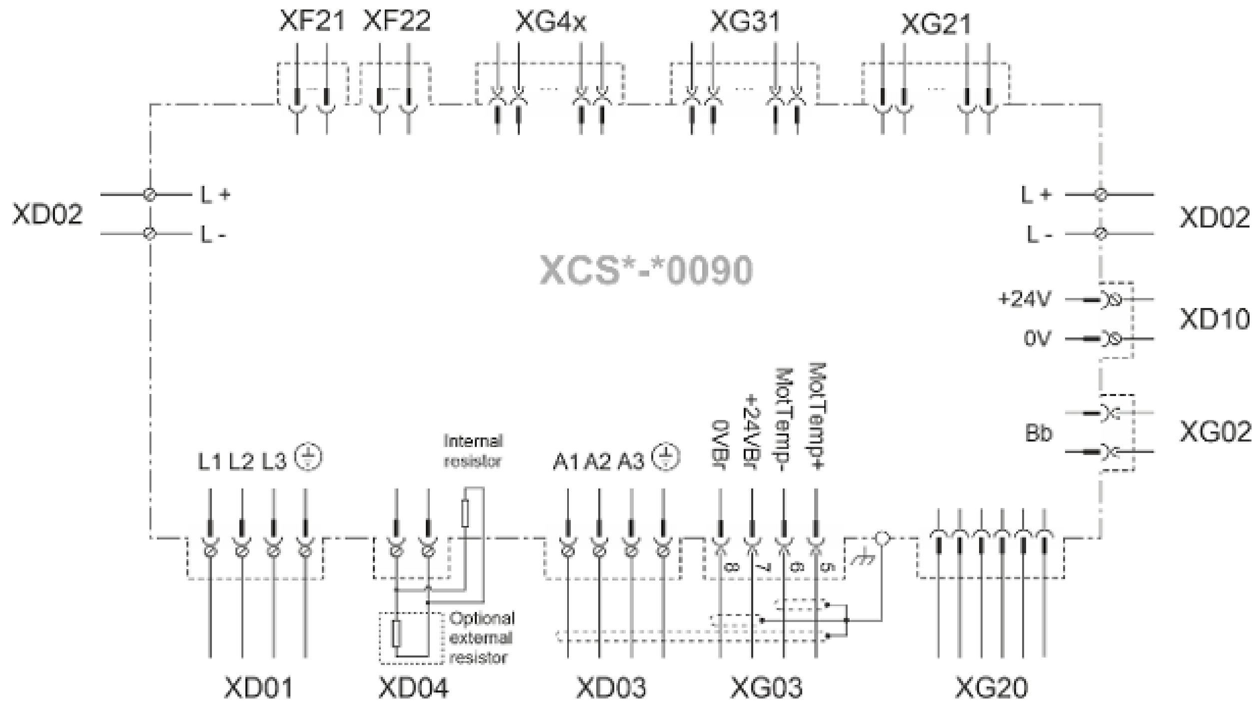


Fig. 43: Overall connection diagram XCS*-*0090

XD01	Mains	XG03	Motor temperature monitoring and motor holding brake
XD02	DC bus	XG20	Digital encoder
XD03	Motor	XG21	Multi-encoder (optional)
XD04	Internal/external braking resistor	XG31	Digital inputs/outputs; analog input
XD10	Control voltage	XG4x	Safety technology
XF21, XF22	Communication		
XG02	Ready for operation relay contact		

4.3.4 Overall connection diagram XCS*-W01xx

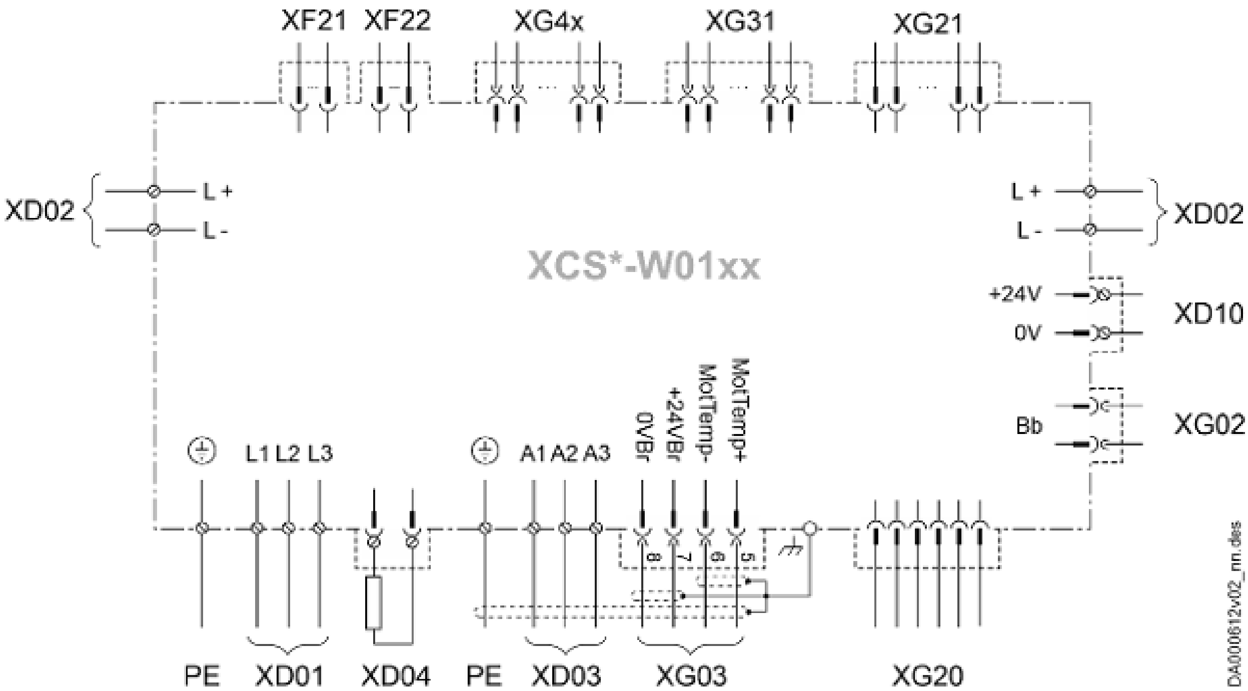


Fig. 44: Overall connection diagram XCS*-W01xx

XD01	Mains	XG03	Motor temperature monitoring and motor holding brake
XD02	DC bus	XG20	digital encoder
XD03	Motor	XG21	Multi encoder (optional)
XD04	external braking resistor	XG31	digital inputs/outputs; analog input
XD10	Control voltage	XG4x	Safety technology
XF21, XF22	Communication		
XG02	Ready for operation relay contact		

4.3.5 Overall connection diagram XCS*-*02xx/*03xx

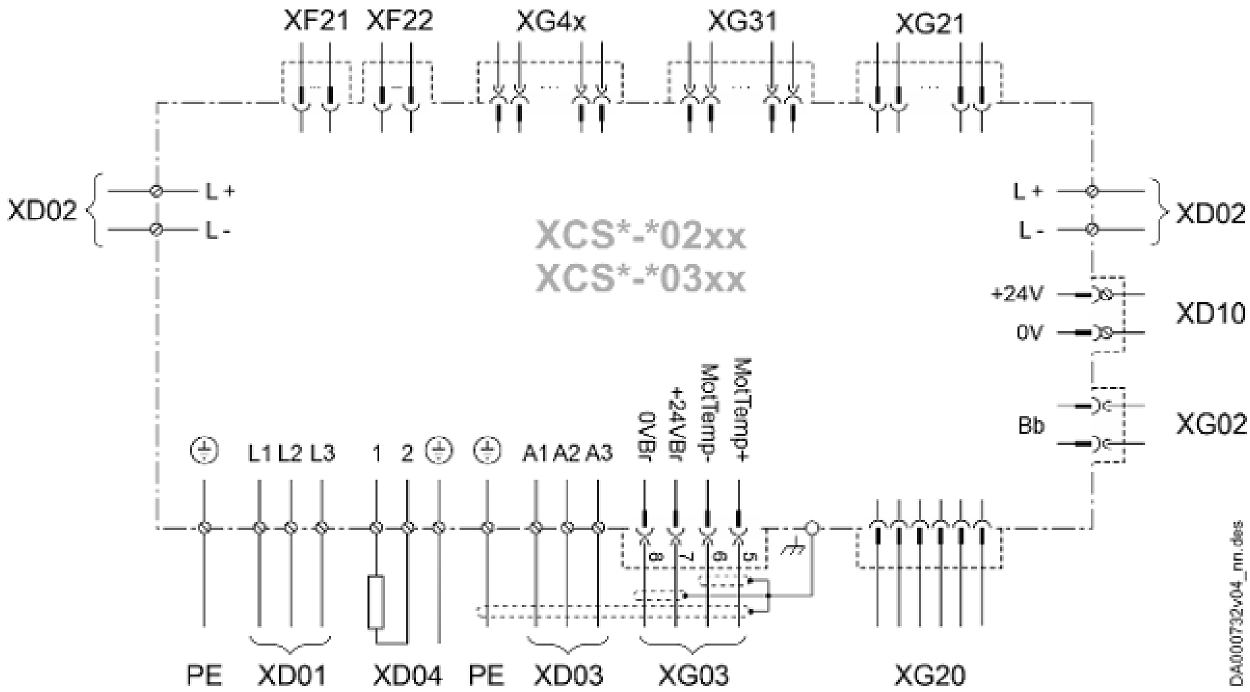


Fig. 45: Overall connection diagram XCS*-*02xx/*03xx

XD01	Mains	XG03	Motor temperature monitoring and motor holding brake
XD02	DC bus	XG20	Digital encoder
XD03	Motor	XG21	Multi-encoder (optional)
XD04	External braking resistor	XG31	Digital inputs/outputs; analog input
XD10	Control voltage	XG4x	Safety technology
XF21, XF22	Communication		
XG02	Ready for operation relay contact		

4.3.6 Overall connection diagram XCD

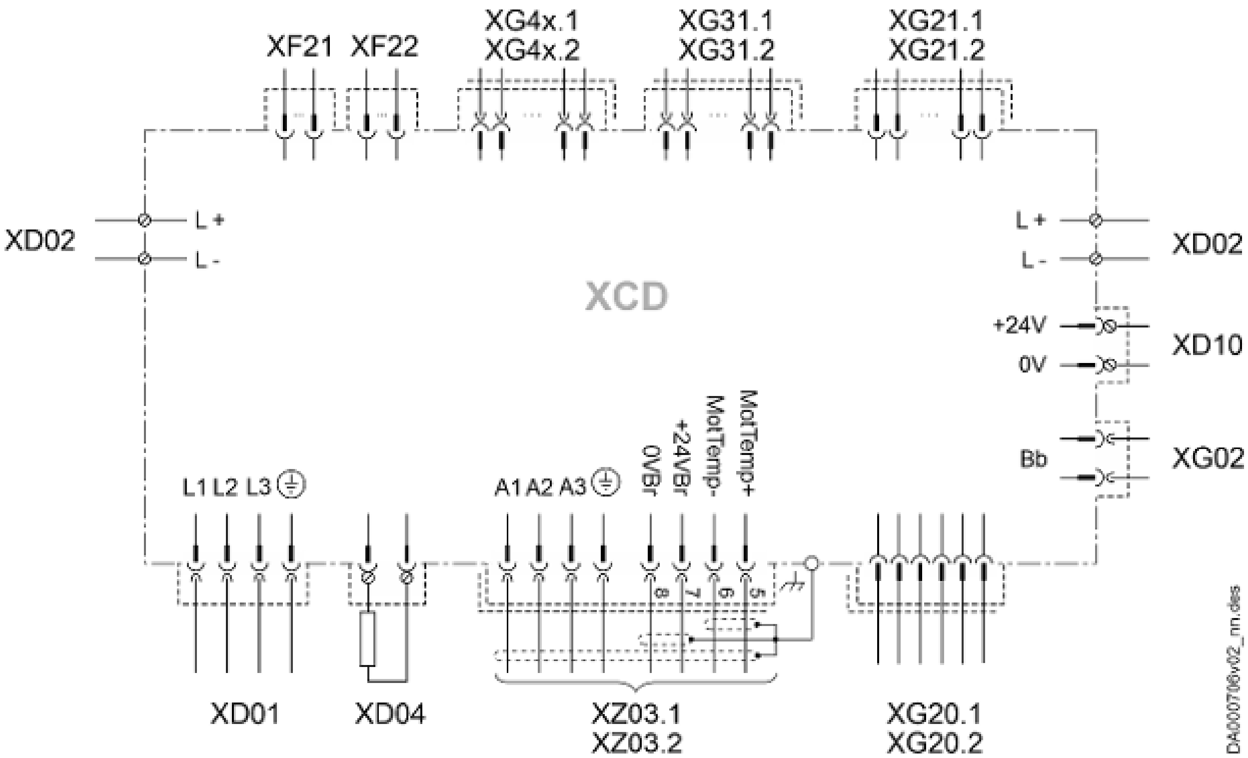


Fig. 46: Overall connection diagram XCD

XD01	Mains	XG20	digital encoder
XD02	DC bus	XG21	Multi encoder (optional)
XD04	external braking resistor	XG31	digital inputs/outputs; analog input
XD10	Control voltage	XG4x	Safety technology
XF21, XF22	Communication	XZ03	Motor, motor temperature moni-toring, motor holding brake
XG02	Ready for operation relay contact		

4.3.7 Overall connection diagram XMS*-W0006...W0036

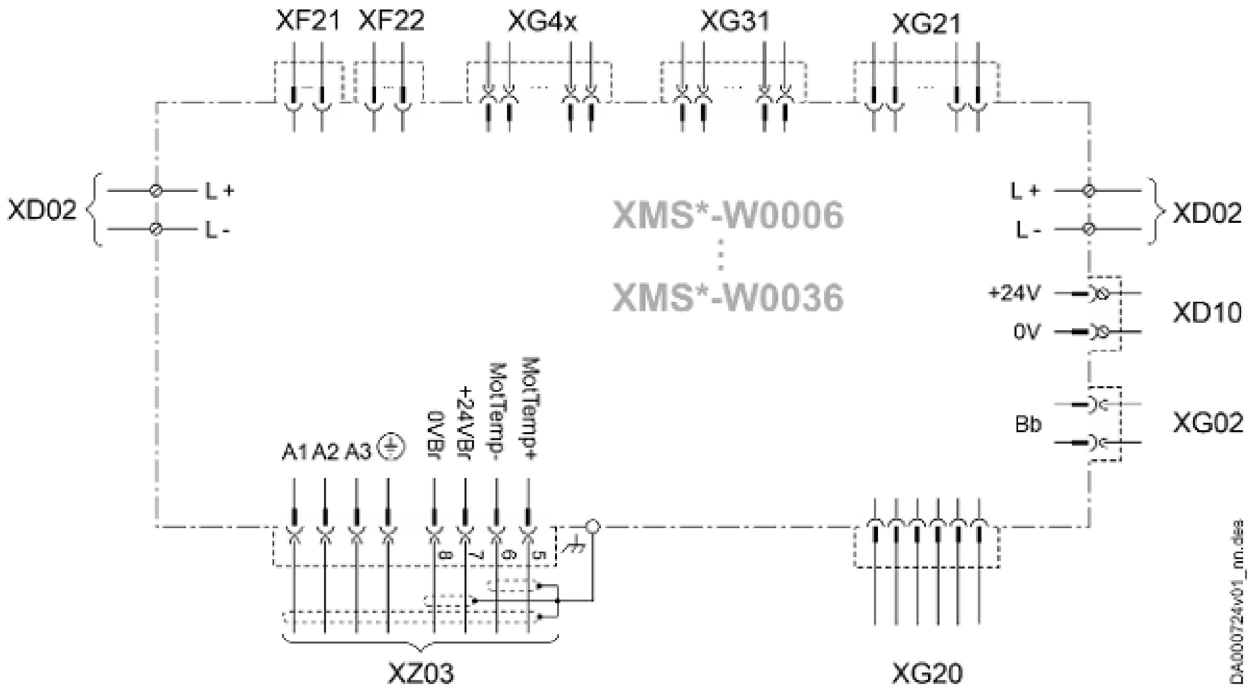


Fig. 47: Overall connection diagram XMS*-W0006...W0036

XD02	DC bus	XG21	Multi-encoder (optional)
XD10	Control voltage	XG31	Digital inputs/outputs; analog input
XF21, XF22	Communication	XG4x	Safety technology
XG02	Ready for operation relay contact	XZ03	Motor, motor temperature monitoring, motor holding brake
XG20	Digital encoder		

4.3.8 Overall connection diagram XCS*-W0054/W0090

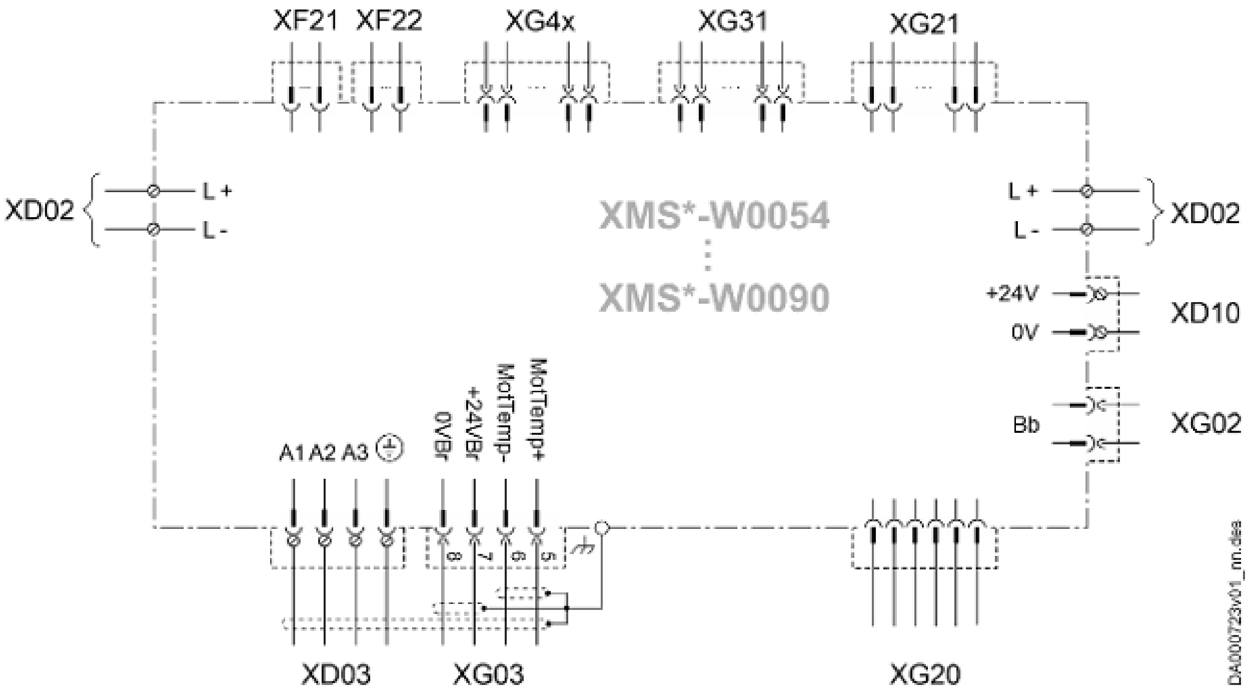


Fig. 48: Overall connection diagram XCS*-W0054/W0090

XD02	DC bus	XG20	Digital encoder
XD03	Motor	XG21	Multi-encoder (optional)
XD10	Control voltage	XG31	Digital inputs/outputs; analog input
XF21, XF22	Communication	XG4x	Safety technology
XG02	Ready for operation relay contact		
XG03	Motor temperature monitoring, motor holding brake		

4.3.9 Overall connection diagram XMS*-*0100...*0375

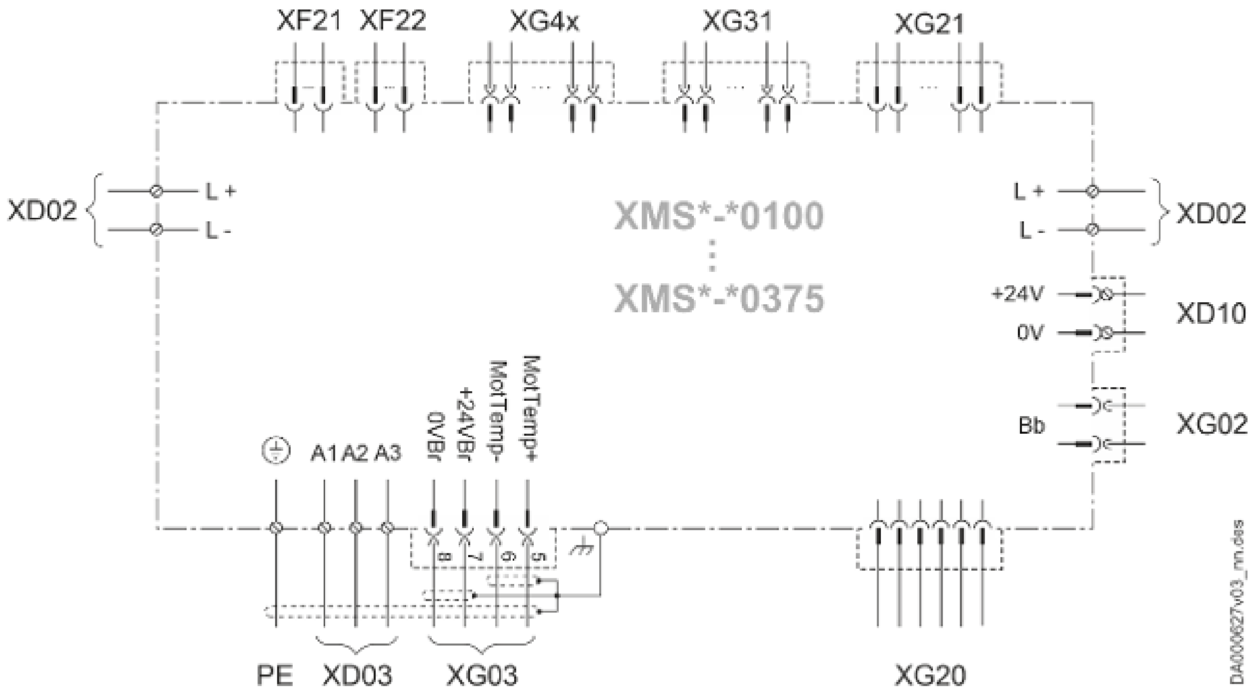


Fig. 49: Overall connection diagram XMS*-*0100...*0375

XD02	DC bus	XG20	Digital encoder
XD03	Motor	XG21	Multi-encoder (optional)
XD10	Control voltage	XG31	Digital inputs/outputs; analog input
XF21, XF22	Communication	XG4x	Safety technology
XG02	Ready for operation relay contact		
XG03	Motor temperature monitoring and motor holding brake		

4.3.10 Overall connection diagram XMD*-W0606 ... W3636

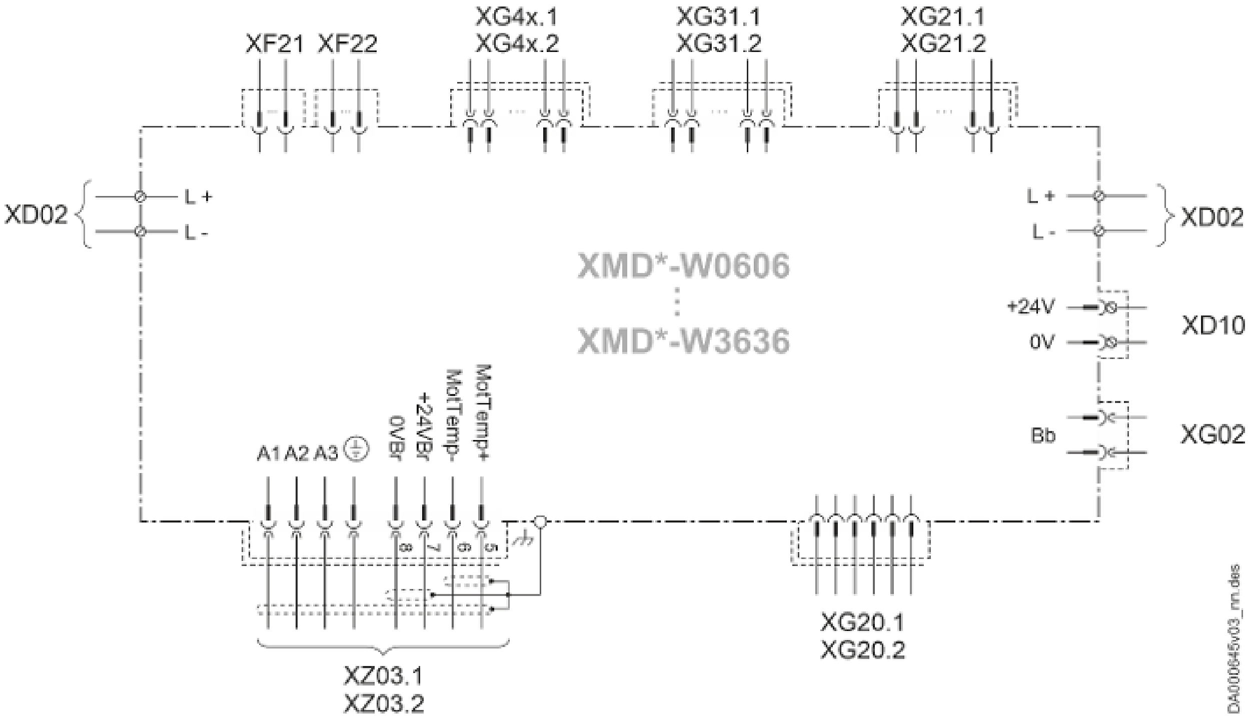


Fig. 50: Overall connection diagram XMD*-W0606 ... W3636

XD02	DC bus	XG21	Multi-encoder (optional)
XD10	Control voltage	XG31	Digital inputs/outputs; analog input
XF21, XF22	Communication	XG4x	Safety technology
XG02	Ready for operation relay contact	XZ03	Motor, motor temperature monitoring, motor holding brake
XG20	Digital encoder		

4.3.11 Overall connection diagram XMD*-*5454/-*7070

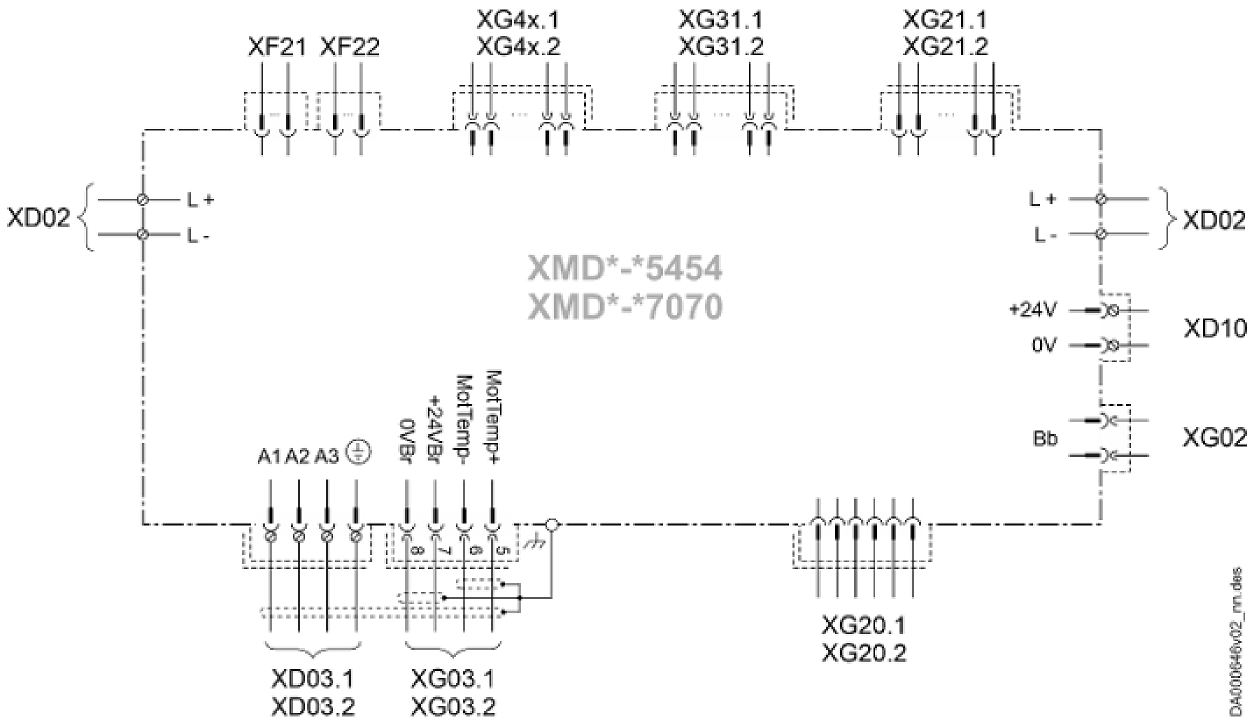


Fig. 51: Overall connection diagram XMD*-*5454/-*7070

XD02	DC bus
XD03	Motor
XD10	Control voltage
XF21, XF22	Communication
XG02	Ready for operation relay contact
XG03	Motor temperature monitoring and motor holding brake
XG20	Digital encoder
XG21	Multi-encoder (optional)
XG31	Digital inputs/outputs; analog input
XG4x	Safety technology

4.3.12 Overall connection diagram XVR*-W0019

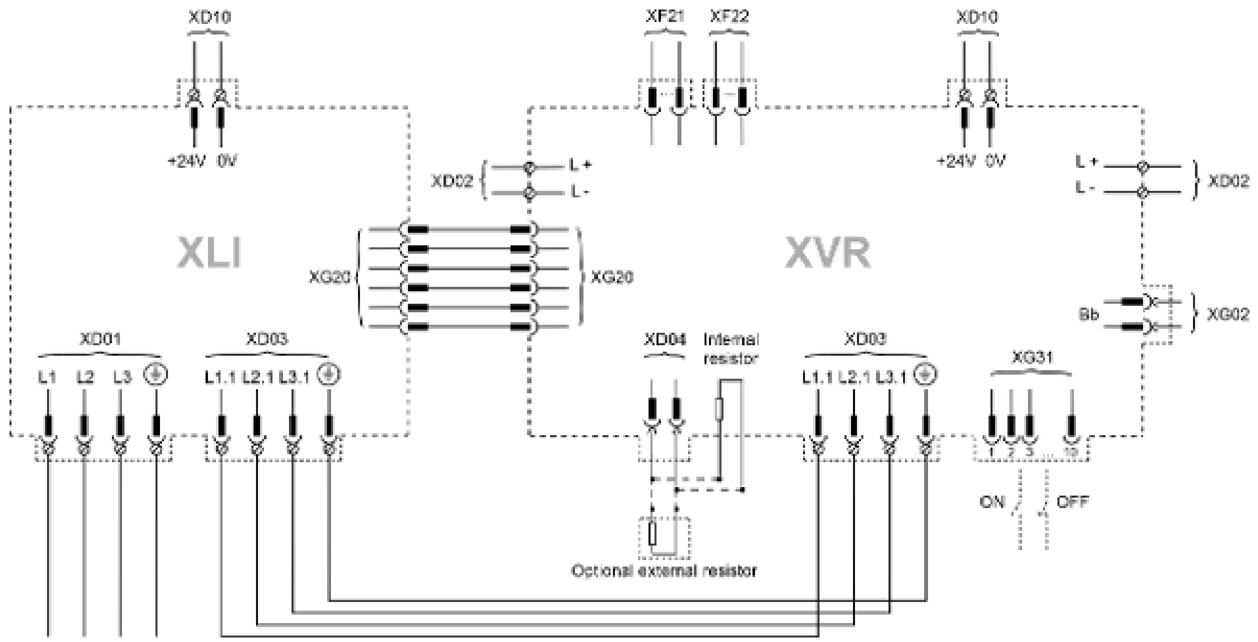


Fig. 52: Overall connection diagram XVR*-W0019

XD01	Mains	XG02	Ready for operation relay contact
XD02	DC bus	XG20	XLI bus
XD03	Mains XLI-XVR	XG31	Digital inputs/outputs; analog input
XD04	External **or** internal braking resistor	XLI	Mains connection module
XD10	Control voltage	XVR	Supply unit
XF21, XF22	Communication		

4.3.13 Overall connection diagram XVR*-W0048 ... W0100

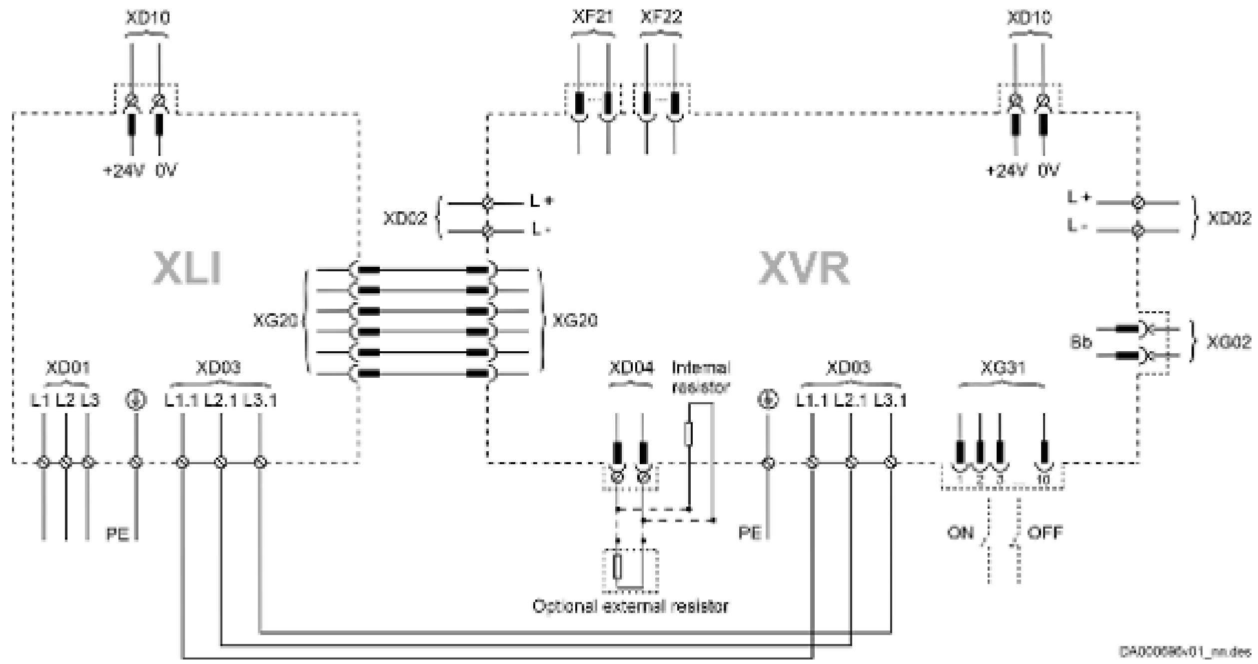


Fig. 53: Overall connection diagram XVR*-W0048 ... W0100

XD01	Mains	XG02	Ready for operation relay contact
XD02	DC bus	XG20	XLI bus
XD03	Mains XLI-XVR	XG31	Digital inputs/outputs; analog input
XD04	External **or** internal braking resistor	XLI	Mains connection module
XD10	Control voltage	XVR	Supply unit
XF21, XF22	Communication		

4.3.14 Overall connection diagram XVE*-W0030

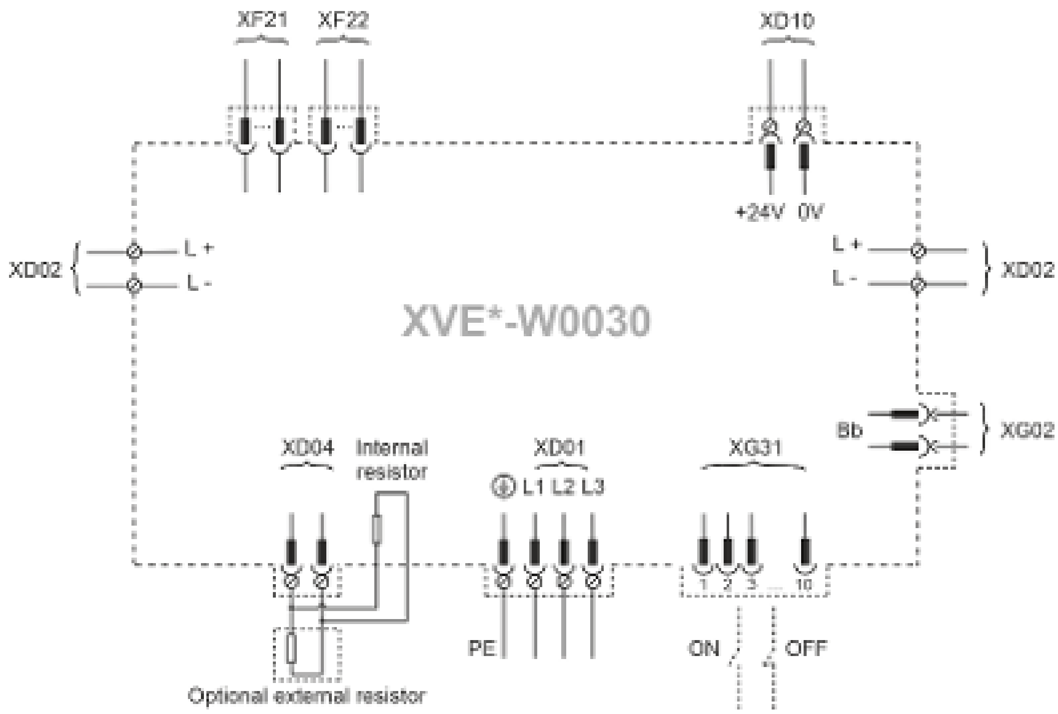


Fig. 54: Overall connection diagram XVE*-W0030

XD01	Mains connection	XF21, XF22	Communication
XD02	DC bus	XG02	Ready for operation relay contact
XD04	External/internal braking resistor	XG31	Digital inputs/outputs; analog input
XD10	Control voltage	XVE	Supply unit

Symbols: See ➡Chapter 4.3.17 Symbols (connection diagram) on page 137

4.3.15 Overall connection diagram XVE*-W0075/-W0125

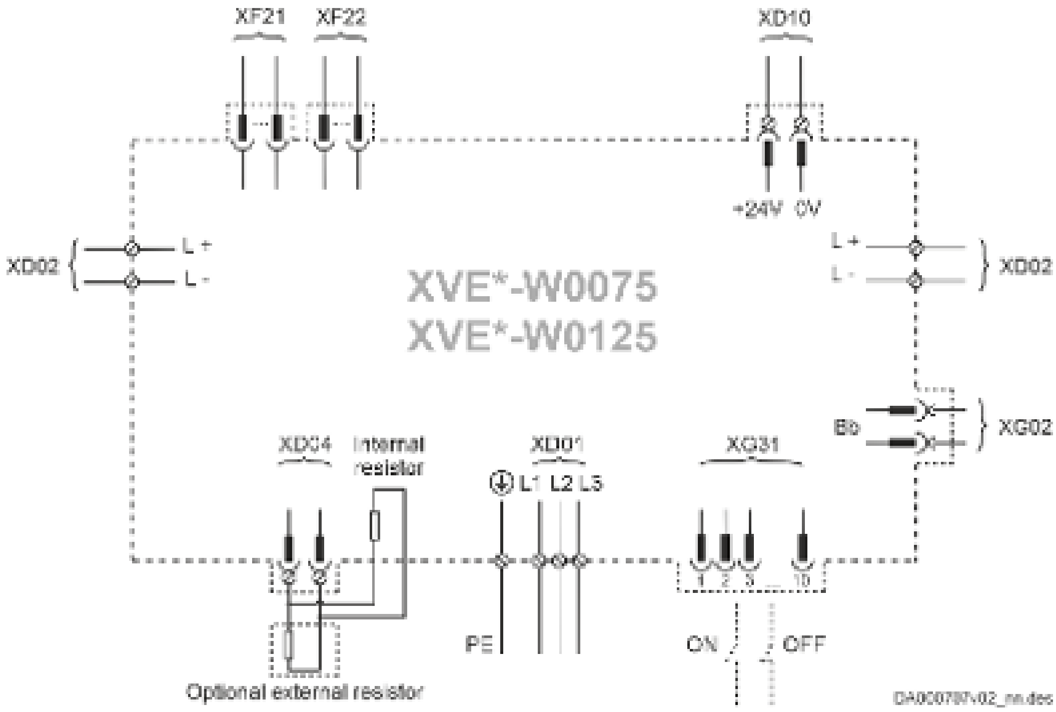


Fig. 55: Overall connection diagram XVE*-W0075/-W0125

XD01	Mains connection	XF21, XF22	Communication
XD02	DC bus	XG02	Ready for operation relay contact
XD04	External/internal braking resistor	XG31	Digital inputs/outputs; analog input
XD10	Control voltage	XVE	Supply unit

Symbols: See ➡Chapter 4.3.17 Symbols (connection diagram) on page 137

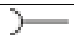
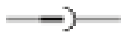
4.3.16 Overall connection diagram XMV

See documentation:

ctrlX DRIVE DC/DC Converter XMV; Application Manual; ➦R911413650

4.3.17 Symbols (connection diagram)

Table 72: Symbols (connection diagram)

Symbol	Description
	Pin
	Female connector
	Male connector (pin at male connector, female connector at device)
	Spring-loaded terminal (female connector at male connector, pin at device)
	Screw terminal (female connector at male connector, pin at device)
	Screw connection at device
	Electrical connection at the device housing (e.g. for shield connector of a cable)

4.3.18 Project planning of control voltage

Control voltage for drive systems

Some drive system components have to be supplied with control voltage. Comply with the requirements of the drive system components when configuring the control voltage supply.

- **Allowed tolerances of the supply voltage** depending on the motor cable length and the use of motor holding brakes
- Power consumption of the **drive controllers**
- Power consumption of **other loads** (e.g., motor holding brakes, digital outputs)
- **Current carrying capacity of the connection point** for control voltage supply at the component for the purpose of looping through the control voltage to other components

Sizing the control voltage supply

Determining the power requirement

Power requirement of the drive controller

The **total power requirement** of the control voltage supply of a drive controller results from the sum of the following power values:

- Basic device (drive controller without connected encoder)
- Optional connection interfaces (e.g. communication, additional encoder evaluation)
- Connected encoder systems
- External loads

For the configuration of your drive controller, see the type plate and the type code.

The tables below contain the individual power values required by the drive controller. The power requirement of the supplying 24 V power supply unit results from the sum of these individual power values.

Power requirement

Device		Power requirement [W]														
		Basic device	Options							External/customer-specific						Panel
			ET	EX	EC	T0[1]	M5[1] M8[1]	X3 CORE	DA	Digital output	Encoder EC	Encoder onboard	Safety-relevant outputs T0, M5, M8	I/Os DA	Brake	XDP1
XCS	W0010 … W0023	17	1.4	9.8	0.9	0.5	1	9.8	2.4	0...12	0...3.6	0...2.4	0...16.8	50.4[3]	24	0.9 1.9[2]
	C0054	12													36	
	C0070															
	W0054	47														
	W0070															
	W0090															
	W0100	30													48	
	W0120															
	W0150	70														
	W0180															
	W0210	65														
	W0250															
	W0280															
	W0330	178														
	W0375															
XCD	W2323	22	1.4	9.8	2× 0.9	2× 0.5	2× 1	9.8	-	2× 0...12	2× 0...3.6	2× 0...2.4	2× 0...16.8	-	2× 24	0.9 1.9[2]
XMS	W0006 … W0036	14	1.4	-	0.9	0.5	1	9.8	2.4	0...12	0...3.6	0...2.4	0...16.8	50.4[3]	24	0.9
	W0054	42													36	
	W0070															
	W0090															
	C0054	8														
	C0070															
	C0090															
	W0100	16													48	
	W0120															
	W0150	77														
	W0180															
	W0210	46														
	W0250															
	W0280															
	W0330	132														
	W0375															
	C0210	22														
	C0250															

Device		Power requirement [W]														
		Basic device	Options							External/customer-specific						Panel
			ET	EX	EC	T0[1]	M5[1] M8[1]	X3 CORE	DA	Digital output	Encoder EC	Encoder onboard	Safety-relevant outputs T0, M5, M8	I/Os DA	Brake	XDP1
	C0280															
XMD	W0606 … W2323	19	1.4	-	2× 0.9	2× 0.5	2× 1	9.8	-	2× 0...12	2× 0...3.6	2× 0...2.4	2× 0...16.8	-	2× 24	0.9
	W3030	44														
	W3636															
	C5454	16													2× 36	
	C7070															
	W5454	23														
	W7070															
XVE	W0030	41	1.4	9.8	-	-	-	9.8	-	0...12	-	-	-	-	-	0.9 1.9[2]
	W0075	64														
	W0125	158														
XVR	W0019	49	1.4	9.8	-	-	-	9.8	-	0...12	-	-	-	-	-	0.9 1.9[2]
	W0048	45														
	W0072	52														
	W0100	180														
XLI	W0019 … W0100	28.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1) ctrlX DRIVE: per device; ctrlX DRIVEplus: per axis

2) ctrlX DRIVE with CORE and optional USB on-the-go

3) "DA" option: 48 W (digital outputs); 2.4 W (analog inputs)

Requirements on the 24V power supply unit

PELV (Protective Extra Low Voltage) for 24V power supply unit

For the 24 V supply of the devices of the ctrlX DRIVE range, use a power supply unit or a control-power transformer with protection by PELV according to IEC 60204-1 (section 6.4).

A UL508-certified power supply unit has to be used in the scope of CSA/UL.

The following **characteristic values** contain the essential electrical requirements on the 24 V power supply unit:

- **Output voltage** or output voltage range
- **Continuous power** the 24 V power supply unit has to supply during operation
- **Peak current** the 24 V power supply unit has to supply when switching on

Required continuous power

The continuous power of the 24 V power supply unit has to be greater than the sum of the power consumptions P_{N3} of the components to be supplied.

To select the 24V power supply unit, determine the continuous current I_{N3} of all components:

$I_{N3} = P_{N3} / U_{N3}$

(P_{N3} : Power consumption of all components)

The calculated current I_{N3} corresponds to the continuous current of the 24 V power supply unit.

The power consumption is specified as the maximum value of the respective component and can occur at **individual components**.

In drive systems with **multiple components**, the occurring power consumption under statistical assumptions will be lower than the calculated one.

Required peak current

When the 24V control voltage unit is switched on, the 24V power supply unit is loaded with the charging current of the capacitors of the connected components. This charging current is electronically limited in the components.

The required peak current of the power supply unit is calculated with:

$I_{PeakCurrent\_PowerSupplyUnit} = 1.2 \times P_{N3} / U_{N3}$

(P_{N3} : Power consumption of all components)

The power supply unit has to provide the calculated peak current $I_{PeakCurrent\_PowerSupplyUnit}$ for at least one second.

Installing the 24 V supply

NOTICE	**Risk of damage to the braking resistor after the control voltage supply was switched back on**
	Do not switch off the control voltage supply during operation. In case the control voltage supply fails: Let the braking resistor cool down before switching back on. Cooling time: > 5 × (W_{R_max} [kWs] ÷ P_{BD} [kW]) W_{R_max}: absorbable regenerative power of braking resistor, P_{BD}: continuous power of the braking resistor

Installation instructions

- The 24 V supply of the ctrlX DRIVE system components should be installed in a **star** layout. This means it is necessary to run separate supply lines for each group of drive controllers or third-party components. This, too, applies to multiple-line arrangement in the case of supply from a supply unit, for example.
- Run lines with sufficiently dimensioned line cross sections to reduce load-dependent voltage drops.
- For looping through the control voltage, observe the maximum current carrying capacity of the connection points. The maximum current carrying capacity limits the number of devices to which the control voltage can be looped through.

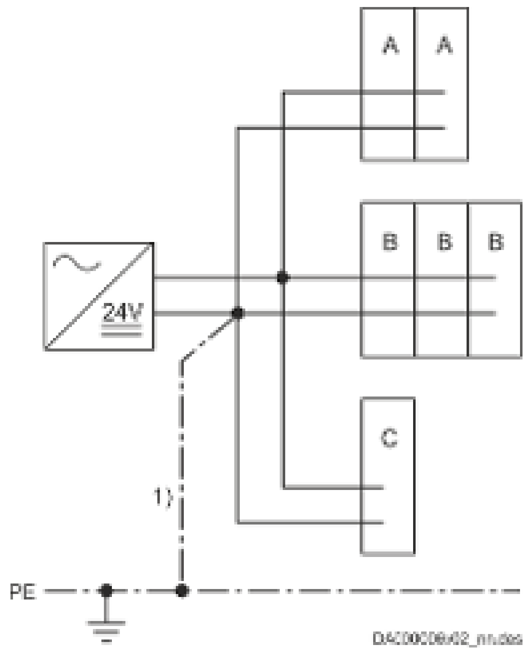


Fig. 56: Installing the 24 V supply

A Number of devices is limited to x components with a total current consumption smaller than the current carrying capacity of the connection point
B Number of devices is limited to y components with a total current consumption smaller than the current carrying capacity of the connection point
C Third-party component (e.g., PLC, valve etc.)
1) Connection to central ground point (e.g., earth-circuit connector PE)

If you use multiple 24V power supply units:

- Output voltages of the 24 V power supply units have to be within the allowed voltage range
- Interconnect 0 V reference conductors of the individual 24 V power supply units with low impedance
- Always switch 24V power supply units on and off synchronously

Looping through the control voltage

NOTICE	**Property damage in case of error from line cross section being too small!** Comply with the current carrying capacity of the connection points for control voltage supply at the components used.

You are only allowed to loop through the control voltage between the components, if the **sum** of current consumptions ΣI_{N3} of the individual components is smaller than the current carrying capacity of the connection point.

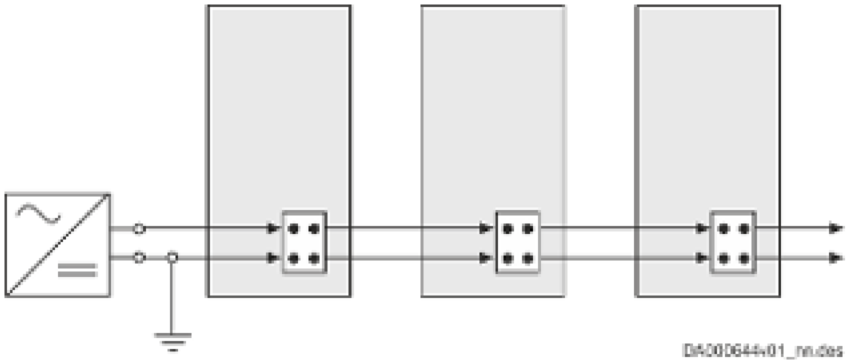


Fig. 57: Looping through the control voltage

Exemplary calculation for 3 drive controllers:

$$I_D = 3 \times \frac{P_{N3}}{U_{N3}}$$

Fig. 58: Continuous current

The result I_D has to be smaller than the specified current carrying capacity of the connection point.

4.3.19 Mains connection

Residual-current-operated circuit breakers (RCD, RCCB) as additional fusing

General information

The following names are used for residual-current-operated circuit breakers:

- RCCB (Residual-Current-operated Circuit Braker)
- RCD (Residual-Current-operated Device)
- RCM (Residual-Current Monitoring Device)
- Residual-current-operated circuit breaker (voltage-independent)
- Differential current circuit breaker (voltage-dependent)

It is only to a limited extent that residual-current-operated circuit breakers can be used with ctrlX DRIVE systems.

If these circuit breakers are to be used, the company erecting the installation has to check the mutual compatibility of the residual-current-operated circuit breakers and the installation or machine with the drive system to avoid accidental triggering of the residual-current-operated circuit breaker. This has to be taken into account

- for switch-on processes, due to high asymmetric inrush currents and
- during the operation of the installation due to leakage currents during normal operation.

Cause of leakage currents

For continuous speed adjustment with a high degree of positioning accuracy and dynamics, certain modulation processes are required for drive systems. Due to physical reasons, these modulation processes cause unavoidable leakage currents during normal operation. In particular in the case of unbalance of the mains phases or in the case of a large number of drives, these leakage currents can easily reach up to several ampere (rms value).

The leakage current is not sinusoidal but pulse-shaped. For this reason, measuring instruments normally sized for alternating currents in the range of 50 Hz are not suited. Use measuring instruments with rms value measuring ranges.

The level of the leakage current depends on the following system conditions:

- Type of inrush current limitation
- Number, type and size of drives used
- Length and cross section of connected motor power cables
- Grounding conditions of the mains at the place of installation
- Unbalance of the three-phase system
- Types of filters and chokes connected in the incoming circuit
- Implemented EMC measures

If measures are implemented to improve the electromagnetic compatibility (EMC) of the installation (mains filters, shielded lines), the leakage current in the ground wire automatically increases, in particular when switching on or in the case of mains unbalance. Residual-current-operated circuit breakers may be triggered in these operating states without an error having occurred.

The EMC measures are mainly based on capacitive short-circuiting of the interference currents within the drive system. Inductive filter measures can reduce leakage currents, but have an impact on the drive dynamics and result in

- higher construction volume
- higher weight
- expensive core material

Possibilities of use

Motor cable lengths

Keep the motor cable as short as possible. Only short motor cables make low leakage currents possible and thereby enable residual-current-operated circuit breakers to work.

Types of residual-current-operated circuit breakers

There are two types of residual-current-operated circuit breakers:

- **Pulsating DC sensitive residual-current-operated circuit breakers** (type A according to IEC 60755)

  These are usually used. However, they only safely switch off pulsating DC residual currents of maximum 5 mA and sinusoidal AC residual currents. Thus, they are not approved for devices generating smooth DC residual currents. In the case of smooth DC residual currents that can be caused in power supply units, mains rectifiers and drive controllers with power converters in B6 circuit, the residual-current-operated circuit breaker is not triggered. Triggering of a pulsating DC sensitive residual-current-operated circuit breaker is blocked in the case of ground contact, i.e. in the case of error.

  Pulsating DC sensitive residual-current-operated circuit breakers do not provide any protection against inadmissible contact voltage.
- **AC/DC sensitive residual-current-operated circuit breakers** (type B according to IEC 60755)

  These circuit breakers are also suited for smooth DC residual currents and safely switch off devices with B6 input rectifiers.

  If a current with 30 mA triggers the residual-current-operated circuit breaker, it is possible to use a residual-current-operated circuit breaker with a higher tripping current for machine protection.

If this residual-current-operated circuit breaker also triggers accidentally, check how to improve the previously mentioned conditions and dependencies (e.g., by upstream current-compensated mains chokes, increase in the inrush current limitation).

Using an isolating transformer to reduce leakage current in mains

If no improvement is achieved and the residual-current-operated circuit breaker, due to specific mains conditions on site, has to be used nevertheless on the mains input side, connect an isolating transformer between mains connection and power connection of the drive system. This reduces the leakage current in the ground wire of the mains that is produced during normal operation which allows the residual-current-operated circuit breaker to be used. Connect the neutral point of the secondary winding of the isolating transformer to the equipment grounding conductor of the drive system.

Match the ground-fault loop impedance to the overcurrent protection device so that the system is switched off in case an error occurs.

Before enabling the operation, check the correct function of the overcurrent protection device with triggering in the case of error.

Exclusive fusing by residual-current-operated circuit breaker

For drive systems with electronic drive controllers, the exclusive protection by a residual-current-operated circuit breaker normally is not possible and not allowed.

Electronic equipment that has a nominal power higher than 4 kVA or is destined for permanent connection normally does not need residual-current-operated circuit breakers. Comply with the country-specific standards.

According to IEC 60204-1 and IEC 61800-5-1, the mains-side protection against indirect contact, i.e. in the case of insulation failure, has to be provided in a different way, for example by means of an overcurrent protection device, protective grounding, protective-conductor system, protective separation or total insulation.

Using residual-current-operated circuit breakers at drive controllers

Drive controllers at residual-current-operated circuit breaker

A residual-current-operated circuit breaker can be used under the following conditions:

- Residual-current-operated circuit breaker is of type B (IEC60755)
- Trip limit of the residual-current-operated circuit breaker is ≥ 300 mA
- Supplying TN-S-mains
- Motor cable length: max. 20 m, shielded
- An XNF mains filter is used
- Each residual-current-operated circuit breaker only supplies one drive controller
- Only Rexroth components and accessories including cables and filters are used

Using residual-current-operated circuit breakers at supply units

XVR at residual-current-operated circuit breaker

Due to their function, regenerative supply units are unsuitable for using residual-current-operated circuit breakers.

Mains types

TN-S mains type

The TN-S mains type is the usual mains type in Europe.

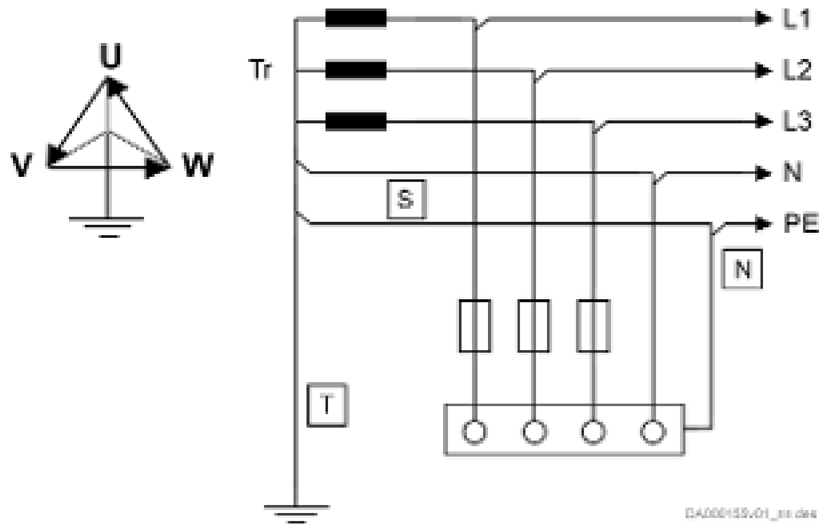


Fig. 59: TN-S mains type

T = Direct grounding of a point (station ground)
N = Exposed conductive parts directly connected to station ground
S = Separate neutral conductor and equipment grounding conductor in entire mains

TN-C mains type

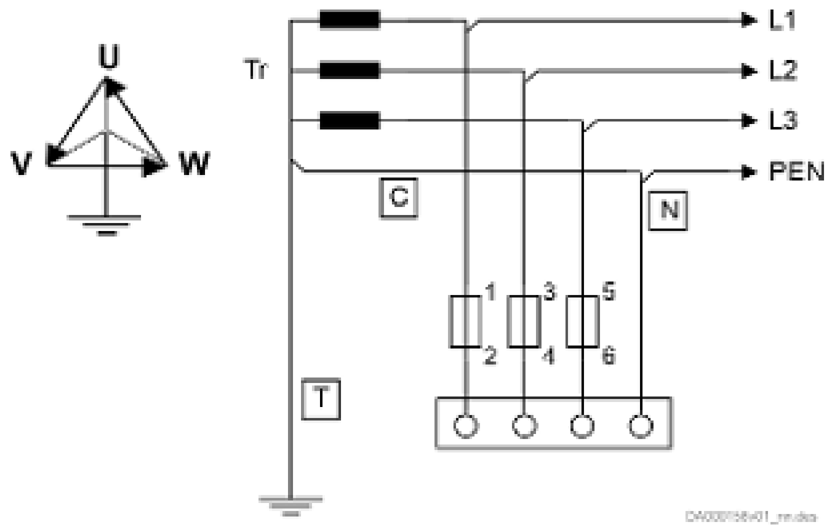


Fig. 60: TN-C mains type

T = Direct grounding of a point (station ground)
N = Exposed conductive parts directly connected to station ground
C = Neutral conductor and equipment grounding conductor functions in entire mains combined in a single conductor, the PEN conductor.

IT mains type

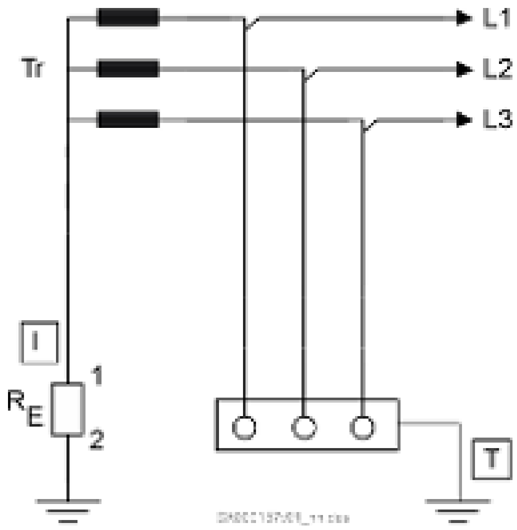


Fig. 61: IT mains type

I Isolation of all active parts from ground or connection of one point to ground via an R_E impedance

T Exposed conductive parts directly grounded, independent of grounding of current source (station ground)

Configuration instruction

NOTICE	**Risk of damage to the devices by voltage flashovers!** For applications with static charging (e.g., printing, packaging) and operation at **IT mains type**, use an **isolating transformer** with $U_K \leq 2.5\%$.

Voltage increase in the case of ground fault!

If a "ground fault" occurs in the IT mains type, the voltages against ground (device housing) acting on the device are higher than in error-free operation.

To operate the drive system at an IT mains type, electrically decouple the drive system including mains filter and mains choke via an **isolating transformer**.

Thus, an earth leakage detection or monitoring can remain active in the system.

TT system

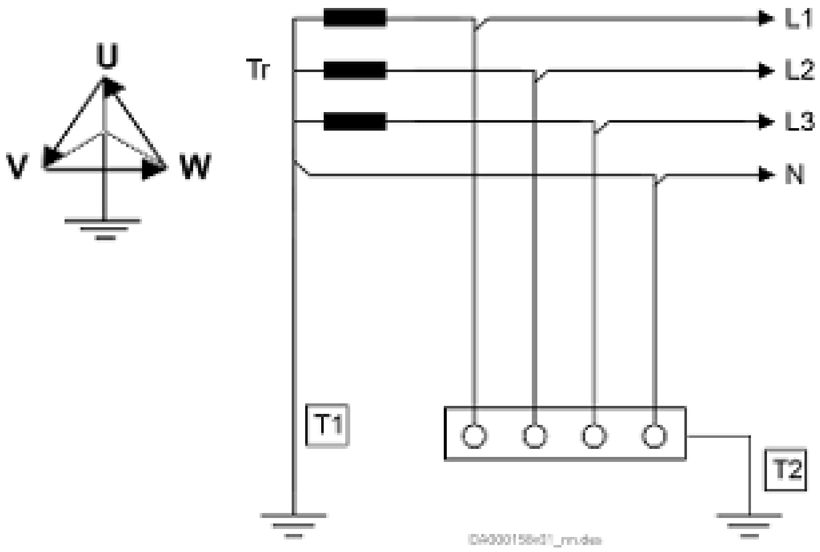


Fig. 62: TT mains system

T1 = Direct grounding of a point (station ground)

T2 = Exposed conductive parts directly grounded, independent of grounding of current source (station ground)

The EMC requirements are only complied with by specific measures (such as specific mains filters).

Mains with grounded outer conductor (corner-grounded-delta mains)

Operation at this mains type is **not allowed**.

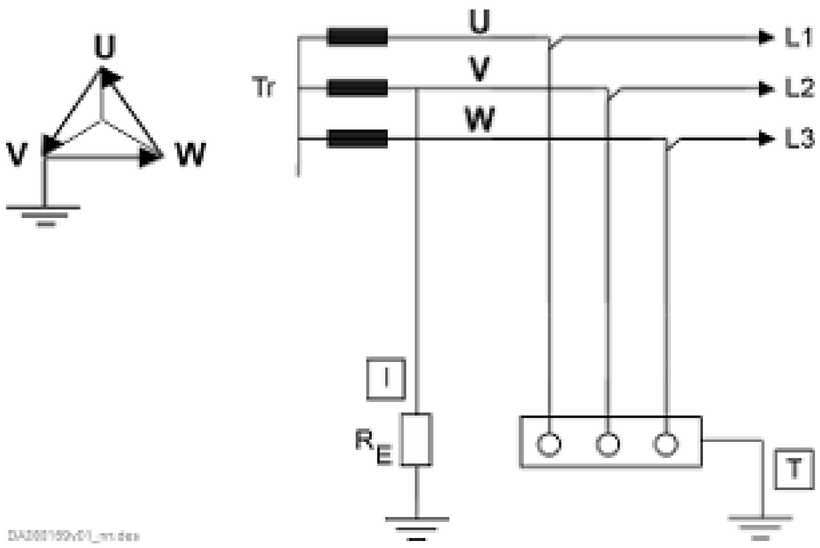


Fig. 63: Mains with grounded outer conductor

I = Isolation of all active parts from ground, connection of one phase - i. A. phase V - to ground or via an impedance R_E

T = Exposed conductive parts directly grounded, independent of grounding of current source (station ground)

Mains connection type

Table 73: Mains supply

1-phase	3-phase	
1 AC 230 V	3 AC 110 ... 230 V	3 AC 200/380 ... 500 V
XCS*-*0010 ... 70 XCD*-W2323	-	XCS XCD XVR XVE
Mains supply		
Individual supply		Individual supply Central supply

Connect the **Bb relay contacts** of the drive controllers, supplied with mains voltage, to the mains contactor control.

Individual supply

Each component is **individually** connected to the power grid. There is **no** DC bus connection between the devices.

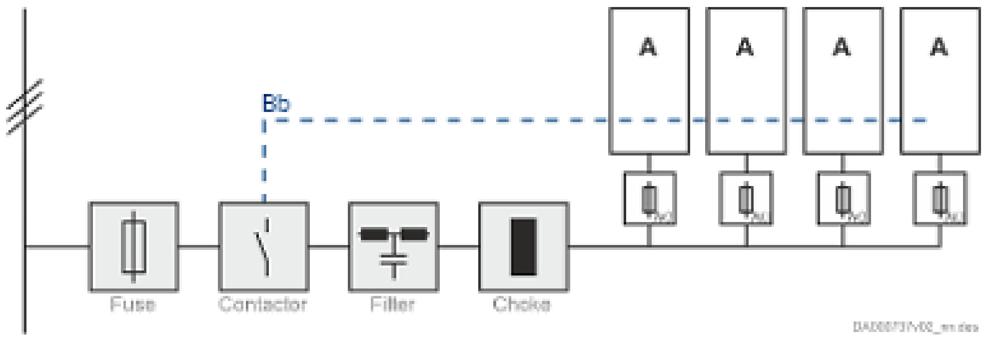


Fig. 64: Individual supply

Grayed out components: optional, depending on the application
A Xxxn-W/Cnnnn component
Bb Bb relay contact wiring

NOTICE

Risk of fire caused by missing fuses!

Install a fuse **in front of each drive controller**. In case a short circuit occurs in the drive controller, a fuse provides optimum safety against overheating or fire (see also IEC 61800-5-1 and UL 61800-5-1).

For the North American sales region, individual fuses are mandatory for this type of mains connection (refer to UL 508A).

In the scope of application of international and European standards (IEC/EN, excluding North America), a group fuse instead of individual fuses is allowed. When selecting the nominal current of the group fuse, take the loop impedance, the line length and the line cross section of the supply feeder into account (see IEC 60204-1, chapter Appendix A).

Comply with the data for sizing line cross sections and fuses (see also IEC 60204-1, UL 508A and NFPA 79).

Central supply

– Use mains chokes to increase the DC bus continuous power.
– Recommendation: Wire Bb relay contacts

One powerful component supplies other components via the common DC bus connection.

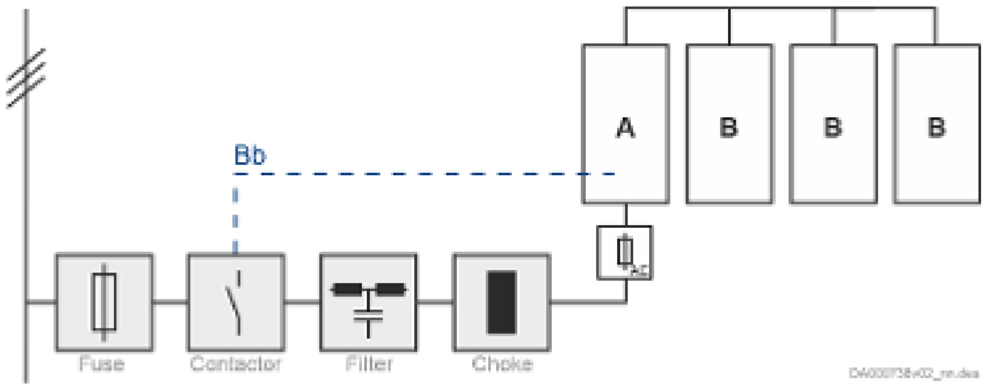


Fig. 65: Central supply

Grayed out components: optional, depending on the application
A Xxxn-W/Cnnnn component (more powerful than component B); connected to other components via DC bus
B Xxxn-W/Cnnnn component (less powerful than component A); connected to other components via DC bus
Bb Bb relay contact wiring

Group supply

Group supply is **not** allowed.

Multiple components in the DC bus group may not be connected in parallel to the mains as a group.

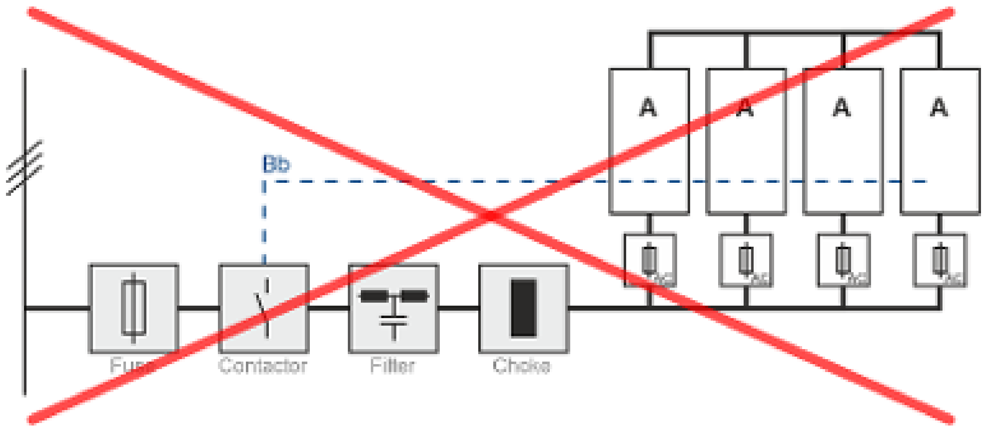


Fig. 66: Group supply is **not** allowed.

Calculating the mains-side phase current

The mains-side phase current is required for the following cases:

- Selecting the mains contactor
- Determining the fuses in the mains connection
- Determining the line cross section
- Selecting other components in the mains connection (mains filter, mains choke)

Operation under rated conditions

Information on the mains contactor, fusing and cross section in operation under rated conditions is listed in the technical data of the respective component.

Operation at partial load

Operation at partial load may involve smaller mains contactors, fuses and line cross sections.

If defined data for operation at partial load are available, the mains-side phase current can be determined as follows:

1. Determining the **motor power**

   Take the power of the drive controller-motor combination from Rexroth IndraSize or calculate it.

   $P_{mHa} = (M_n \times n_n) \div 9550$

P_{mHa}	Mechanical nominal power for main drives (shaft output) [kW]
T_n	Nominal motor torque [Nm]
n_n	Nominal motor speed [min^{-1}]

2. Determining the **DC bus power** from motor power and efficiency

   $P_{DC} = [(M_m \times n_m \times 2\pi) \div 60] \times k$

P_{DC}	Required DC bus continuous power [W]
T_a	Average torque in Nm
n_a	Average speed in min^{-1}
k	Factor for motor and controller efficiency = 1.25

3. Adding the **powers of all axes** at the common DC bus and putting them into relation to the rated power of the supply unit

   ➡ Partial load of P_{DC_cont} is known

4. Determining the **power factor TPF** for partial load (TPF = Total Power Factor)

   The technical data (mains voltage) of the component contain specifications of **TPF** at nominal power and **TPF$_{10}$** (at 10% nominal power).

5. Calculating the **mains connected load**

   $S_{LN} = P_{DC} \div TPF$

S_{LN}	Mains connected load [VA]
P_{DC}	DC bus continuous power [W]
TPF	Total Power Factor λ

6. Calculating the **mains-side phase current**

   3-phase: $I_{LN} = S_{LN} \div (U_{LN} \times \sqrt{3})$

   1-phase: $I_{LN} = S_{LN} \div U_{LN}$

I_{LN}	Mains-side phase current in [A]
S_{LN}	Mains connected load [VA]
U_{LN}	Voltage between the mains phases [V]

7. Selecting the **mains contactor**

8. Determining the **mains circuit breaker and line cross section**

   See ➦ Chapter 18.1 Dimensioning of wire cross sections and fuses on page 509

Sizing the mains filter

Criteria for mains filter selection

Take the following criteria when selecting the suitable mains filter:

- EMC limit value class of place of installation
- Ambient conditions at the place of installation
- Harmonics on mains voltage at the place of installation
- Load by mains voltage and frequency at the place of installation
- Load by harmonics at the place of installation
- Load by mains-side phase current
- Total length of the connected power cable
- Sum of leakage capacitances
- Clock frequency of the drive controller

How to proceed for selecting the mains filter

The mains filter selection is mainly determined by the operating conditions.

How to proceed to select a mains filter:

- Determine the required EMC limit value class for the application.
- Check if the mains voltage of the mains filter is loaded with harmonics and if it is still valid for the mains filter.
  If required, reduce harmonics at the place of installation.
- Determine the mains connection type, such as central supply, etc. (To do this, it is useful to outline the involved components and their interaction.)
- Calculate the **mains-side phase current** of the mains filter.
  Information on how to calculate the mains-side phase current is contained in an individual chapter
  ➦ Chapter Calculating the mains-side phase current on page 150
  To select the components, calculate the active RMS value.
  Check or determine the maximum ambient temperature. Select a mains filter with a higher nominal current, if the ambient temperature is above 45 °C.
- The nominal current of the selected mains fuse should not exceed the nominal current of the mains filter.
- Determine the number of drive axes.
- Determine the total length of the connected power cables.
- Determine the sum of leakage capacitances on the load side of the mains filter. The sum of leakage capacitances results from the number of operated axes and the length of the connected power cable.
  Information on how to determine the leakage capacitance is contained in an individual chapter
  ➦ Chapter 18.2 Determining the leakage capacitance on page 517
- Motor cables have different leakage capacitances per unit length $C_{Y\_K\_typ}$ [nF/m]. The maximum motor cable length can be calculated with the maximum leakage capacitance per device (motor + cable):
  $l_{cable\_max} = (C_{ab\_c\_max} - C_{ab\_m}) \div C_{Y\_K\_typ}$
  l_{cable_max}: maximum cable length [m]
  $C_{ab\_c\_max}$: maximum leakage capacitance per device [nF] (see tables below)
  C_{ab_m}: Motor leakage capacitance [nF]
  $C_{Y\_K\_typ}$: Cable leakage capacitance per unit length [nF/m]
- Take the clock frequency of the drive controller into consideration.
  The higher the clock frequency of the drive controller, the higher the leakage currents and the electromagnetic interferences.

Select a compatible mains connection (supply unit/converter, mains choke, mains filter) from the table in the corresponding chapter.

➦ Chapter Combining transformer, mains filter and mains choke on page 153

Selecting the mains filter

tbd

Determining the mains choke

When using mains chokes, take their effect on the connected drive controllers into account. Due to their inductivity, mains chokes have a smoothing effect on the current and thus reduce harmonics.

Take the rated current of the mains choke into account so that the inductivity of the mains choke is available.

Certain mains chokes are assigned to some drive controllers (refer to the technical data of the drive controller “Data for mains voltage supply → assigned mains choke type”).

Sizing the mains contactor

The mains contactor is optional.

Required information:

- Rated current I_{LN} of the drive controller
- Number of drive controllers connected to the mains contactor

When using mains contactors of the utilization category AC-1, take the conventional thermal continuous current I_{th} (see data sheet of mains contactor) into account when dimensioning the mains contactor.

The minimum required conventional thermal continuous current I_{th} is a result of the sum of the rated currents ΣI_{LN} of all connected drive controllers.

Combining transformer, mains filter and mains choke

tbd

Control circuit for the mains connection

1-phase mains connection

Configuring the 1-phase mains connection:

– Device must not be connected to the mains
– Configure the 1-phase mains connection with "ctrlX Engineering"
– Restart the device
– Connect device to mains via 1 phase

Recommendation for mains connection at connection point XD01:

– Connect L1 to L1
– Connect N to L2

Suppressor circuits for contactor coils required

At the coils of contactors, suppressor circuits have to be necessarily present and correctly connected!

Missing suppressor circuits cause loss of reference of encoders (F2174, F2175) after switching off and back on.

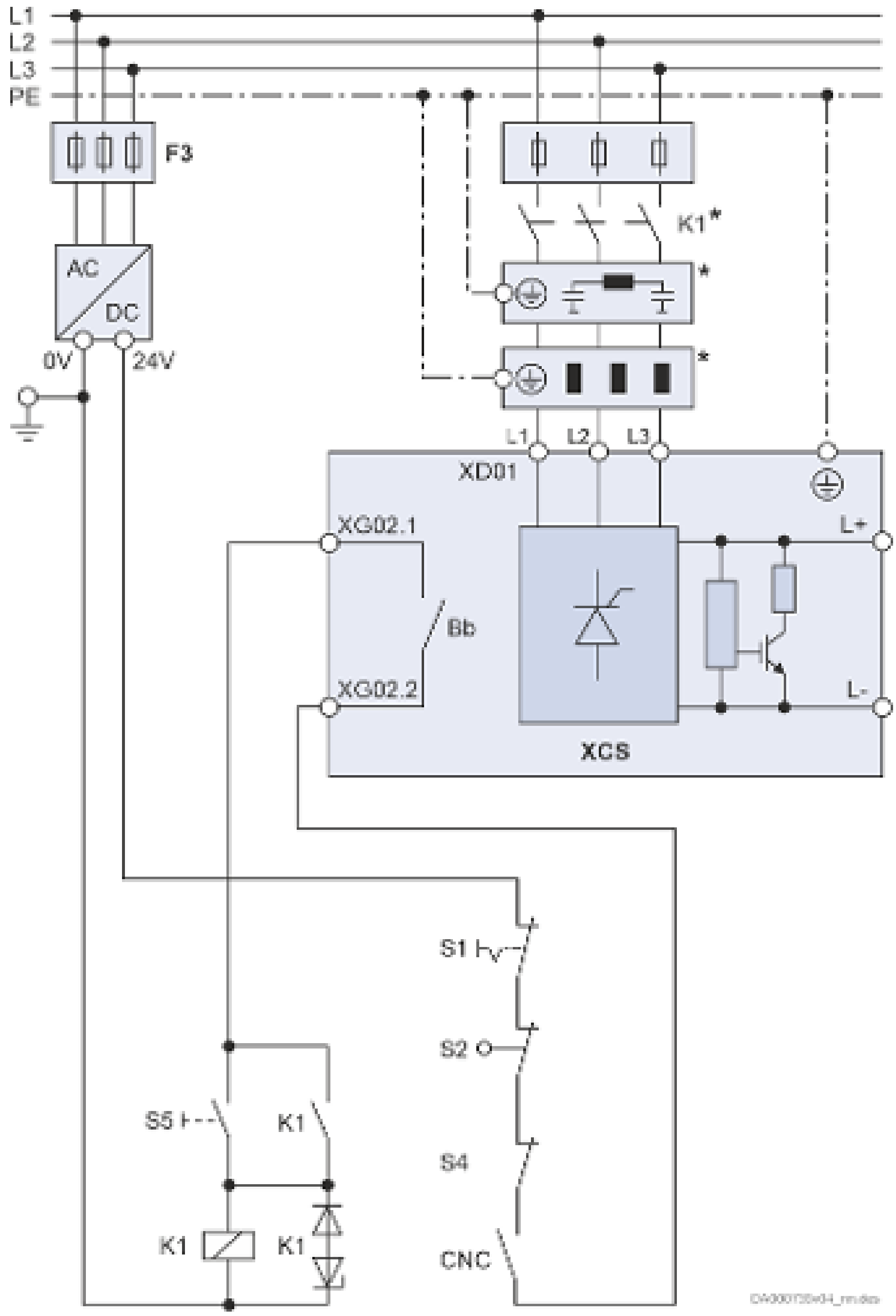


Fig. 67: Control circuit for the mains connection

*	Optional
Bb	Bb relay contact
CNC	Lag error message of control unit
F3	Fuse of 24 V power supply unit
K1	External mains contactor **with Zener diode suppressor circuit**
S1	Emergency stop
S2	Axis end position
S4	Power Off
S5	Power On

4.3.20 DC bus coupling

Implementing the DC bus coupling

Maximum number of devices

The maximum number of devices that can be interconnected via DC bus coupling depends on

- the power reserve of the supplying devices
  (The power reserve ($P_{reserve}$) is a result of the difference of the possible DC bus continuous power of the device and the power consumed by the motor connected to the device)
- the sum of the DC bus powers of all supplied devices
- the mains voltage value
- the maximum continuous power which can be looped through via the DC bus connection XD02
  (The continuous power results from the current carrying capacity of the DC bus connection XD02 and the mains voltage value.)

The **loading capacity of the DC bus connection** depends on the DC bus continuous power:

- Components ≤ 0036:
  $P_{DC\_Bus\_cont\_max\ (ULN)}$ = 22.5 kW × [1 – (400 - U_{LN}) × 0.0025] for U_{LN} ≤ 400 V
  $P_{DC\_Bus\_cont\_max\ (ULN)}$ = 22.5 kW × [1 + (U_{LN} - 400) × 0.002] for U_{LN} > 400 V
- Components 0036 < ... ≤ 0120:
  $P_{DC\_Bus\_cont\_max\ (ULN)}$ = 45 kW × [1 – (400 - U_{LN}) × 0.0025] for U_{LN} ≤ 400 V
  $P_{DC\_Bus\_cont\_max\ (ULN)}$ = 45 kW × [1 + (U_{LN} - 400) × 0.002] for U_{LN} > 400 V
- Components > 0120:
  $P_{DC\_Bus\_cont\_max\ (ULN)}$ = 120 kW × [1 – (400 - U_{LN}) × 0.0025] for U_{LN} ≤ 400 V
  $P_{DC\_Bus\_cont\_max\ (ULN)}$ = 120 kW × [1 + (U_{LN} - 400) × 0.002] for U_{LN} > 400 V

The application determines the required DC bus continuous power. The sum of the DC bus continuous power of all components at the common DC bus should not exceed the maximum allowed loading capacity of the DC bus connection ($P_{DC\_Bus\_max\ (ULN)}$).

Since usually not all components are loaded simultaneously, a simultaneity factor ≤ 1 can be taken into consideration.

Performance-dependent arrangement

The supply units can supply drive controllers **on both sides**.

- Arrange drive controllers according to their performance:
  Position drive controllers with a high performance as close as possible to the supplying device (supply unit or converter). Ideally, the drive controllers are evenly positioned to the left and right of the supplying device.
  With **XVR** supply units, the **drive controllers can only be positioned to the right**, since in the case of single-line mounting of the devices the XLI mains connection module is mounted to the left of XVR.
- Position the DC bus capacitor unit next to the supplying device.

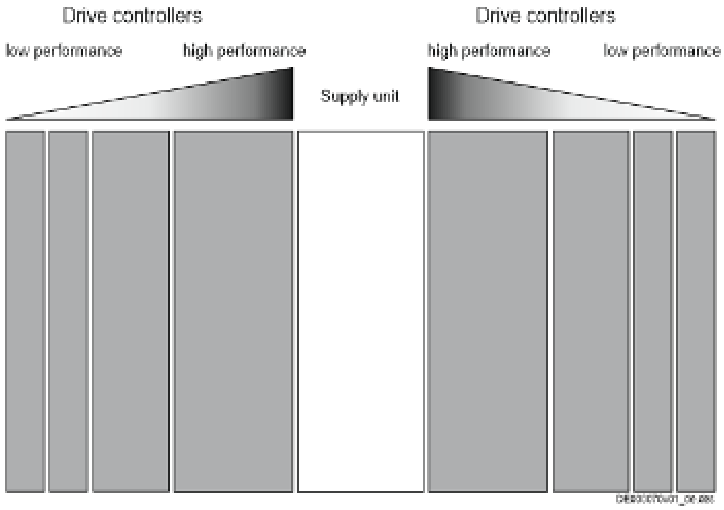


Fig. 68: Example of arrangement

Claw bolts for DC bus connection

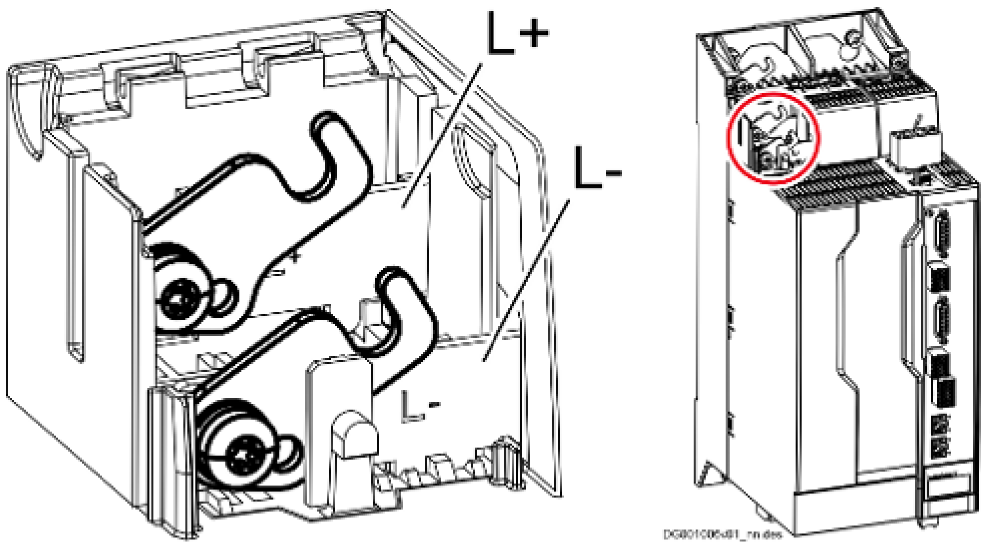


Fig. 69: Claw bolts for DC bus connection

- As a standard, the claw bolts for DC bus connection are pre-installed on the left of the devices.
- The claw bolts of drive controllers with a maximum current ≥ 150 A are thicker than the claw bolts of drive controllers with a maximum current ≤ 120 A.

  Thick claw bolts do not fit through the openings of devices with thin claw bolts.

However, thin claw bolts fit through the openings of devices with thick claw bolts.

- If you arrange drive controllers with a maximum current ≤ 120 A to the left of drive controllers with a maximum current ≥ 150 A, mount the thin claw bolts from the left to the right:

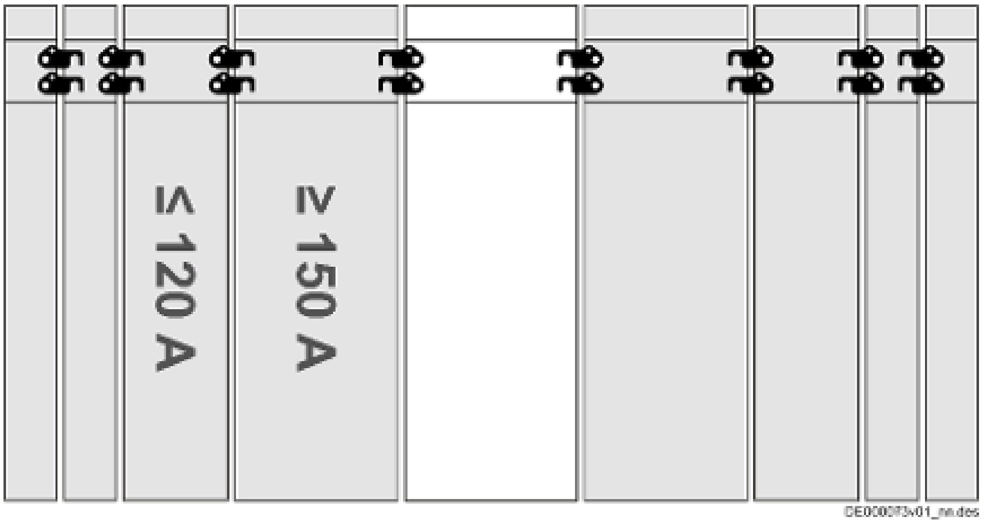


Fig. 70: Unassembled claw bolts for DC bus connection

DC bus capacitor unit

Function

DC bus capacitor units are optional additional components and increase

- the DC bus continuous power
- the available DC bus energy
- DC bus length (if cables are used for DC bus connection)

Mains choke

Always operate the DC bus capacitor units together with the mains choke assigned to the drive controller.

Connection

The maximum allowed capacitance of a DC bus capacitor unit depends on the device which assumes the DC bus supply.

For the maximum allowed external DC bus capacitance at U_{LN_nom}, see the technical data of the component.

Position the DC bus capacitor unit as close as possible to the supplying device controller or the most powerful drive controller. Connect the DC bus capacitor unit to the drive controller via the DC bus connection.

Bb relay contact

Generally, the following applies:

All F28xx errors generated by the drive system have an effect on the Bb relay (relay contact opens).

Include the Bb relay contact in the circuit of the mains contactor or mains disconnection device at all devices connected to the mains.

➡ Chapter 4.3.21 Axis group: Wiring on page 162

NOTICE	**Risk of fire caused by incorrect control of the mains contactor or mains disconnection device!** Include the Bb relay contact in the switch-off chain of the mains contactor or mains disconnection device so that the power supply is interrupted in the case of error.

Multiple-line arrangement of devices

NOTICE	**Property damage in case of error from line cross section being too small!** Take the current carrying capacity of the connection lines at the DC bus connections of the components into account. Install connection lines at the DC bus connections in such a way that they are protected by the line protection at the mains connection of the supply unit or by additional fuses before the connection line.

XLI / XVR:

Double-line arrangement of **XLI mains connection module** and **XVR supply unit**:

➦ Chapter Double-line mounting on page 467

DC bus adapter XAS4

For **multiple-line arrangement** of drive controllers, the connection for the DC bus is made **with twisted cables** and the **XAS4** accessory.

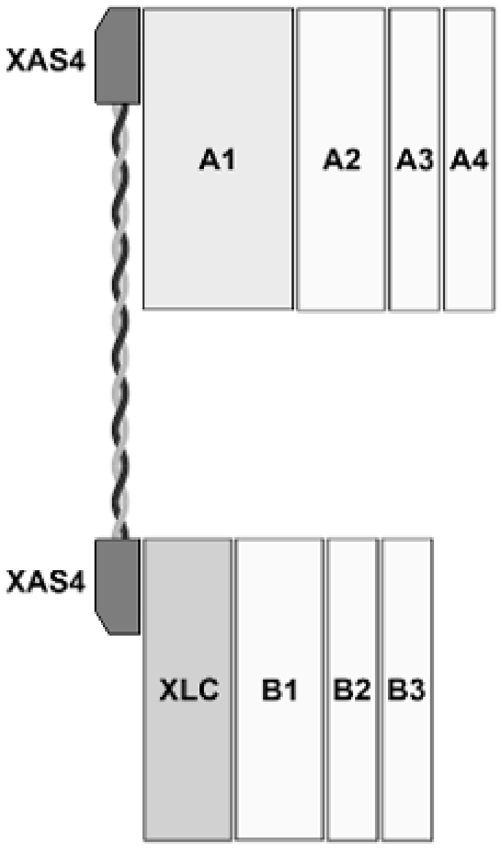
➦ Chapter 13.3.1 XAS4 - Purpose, type code, assignment, cable cross sections on page 416

- Always install **DC bus capacitor units XLC** at each displaced drive package (see also picture below).
- Install the DC bus capacitor units XLC at the point of DC bus infeed of the displaced drive package.
- Dimension the minimum size of the DC bus capacitor unit in accordance with the planned continuous power of the respective drive package:
  47 μF per kilowatt [kW] of continuous power
  Example: 50 kW of calculated continuous power in DC bus requires 2350 μF at this drive package, thus at least 2 XLC1-W01M2 (2 × 1.2 mF = 2400 μF).

⚠ CAUTION

Risk of damage to the drive controller!

- The DC bus connections of stacked drive controllers have to be connected to each other correctly.
- Only connect the L+ connections to other L+ connections. L- connections should only be connected to other L- connections.
- Comply with the minimum requirements to connection lines.



Drive package A:
- A1: Supply unit/converter
- A2, A3, A4: inverter

Drive package B:
- B1, B2, B3: inverter
- XLC: DC bus capacitor unit

XAS4: DC bus adapter

➦ Chapter 13.3.1 XAS4 - Purpose, type code, assignment, cable cross sections on page 416

For other options of multiple-line arrangement of devices, please contact Rexroth.

Minimum requirements to connection lines

Electric strength

The connection lines from the supply unit to drive packages and between drive packages require an electric strength of at least:

- 1000 V against each other
- 700 V against ground

Line cross section

Case 1: Combination of drive packages whose performance level is similar

- Combination of a drive package of high-performance devices (maximum current ≥ 150 A) with a drive package of high-performance devices (maximum current ≥ 150 A)
- Combination of a drive package of low-performance devices (maximum current ≤ 120 A) with a drive package of low-performance devices (maximum current ≤ 120 A)

Determine the minimum line cross section from the supply unit to and between the drive packages via the rated current. Use the higher value of the following calculations as the rated current:

- Calculating the mains-side phase current
  ➦ Chapter Calculating the mains-side phase current on page 150
- Determine the current in the branch with the greatest DC bus power
- Multiply determined current by √2 (due to harmonics and leakage currents)
- Select the cross section of the connection line in accordance with the determined current
- Select the mains fuse in accordance with the determined current

Case 2: Combination of high-performance drive packages with low-performance drive packages

- Combination of a drive package of high-performance devices (maximum current ≥ 150 A) with a drive package of low-performance devices (maximum current ≤ 120 A)

Line cross section: **35 mm²**

The line cross section neither depends on the rated current nor on the mains fuse.

Line length

≤ 20 m

Routing

Twist the cables:

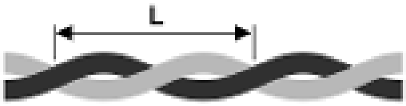


Fig. 71: Length of lay L

- Allowed length of lay L:
  - ≤ 10 mm²: L ≤ 60 mm
  - 10 mm² < ... ≤ 25 mm²: L ≤ 90 mm
  - ≥ 35 mm²: L ≤ 120 mm
- With minimum mechanical distance to ground potential
- With a distance of at least 200 mm to control voltage lines

With the XAS4-WL-U005-NN accessory, two lines (line pair) can be used per connection.

Twist the line pairs:

- Twist the lines at the connections L+ and L- to form one pair
- Keep the surface between the individual lines of a pair as small as possible
- Run the line pairs with the smallest possible distance to each other

Fig. 72: Twist the line pairs

4.3.21 Axis group: Wiring

An **axis group** consists of a supply unit (supply unit or converter) and one or multiple inverters.

The following **information** have to be exchanged between supply unit and inverter

- State of the **ready for operation contacts (Bb)** of the inverter.
  The information has to be transmitted from all inverters to the supply unit.
- State of **readiness for power output (LB)** of the supply unit.
  All inverters have to get the information from the supply unit that the pre-selected operation mode is active and the supply unit is ready for power output (LB). Only then may the inverters get drive enable (AF).

Options for **exchanging information**:

- Field bus solution
  Information exchange via field bus
  ➦ Chapter Field bus solution on page 163
- Digital I/O solution
  Information exchange via digital inputs/outputs
  ➦ Chapter Digital I/O solution on page 167
- Field bus and digital I/O solution
  Information exchange via field bus and digital inputs/outputs
  ➦ Chapter Field bus and digital I/O solution on page 169

Field bus solution

Rexroth recommends this option. Since the field bus normally is connected anyway, there is no additional wiring effort. If required, individual axes can be removed from an axis group using software.

Basic requirement of this solution: **Cycle time ≤ 10 msec** for control and field bus. (The maximum allowed cycle time is based on the releasing time required for disabling the mains (thyristor, mains contactor) and should be shorter than the releasing time required for disabling the mains.)

Supply unit: XVE, XCS or XCD

Field bus solution with external control

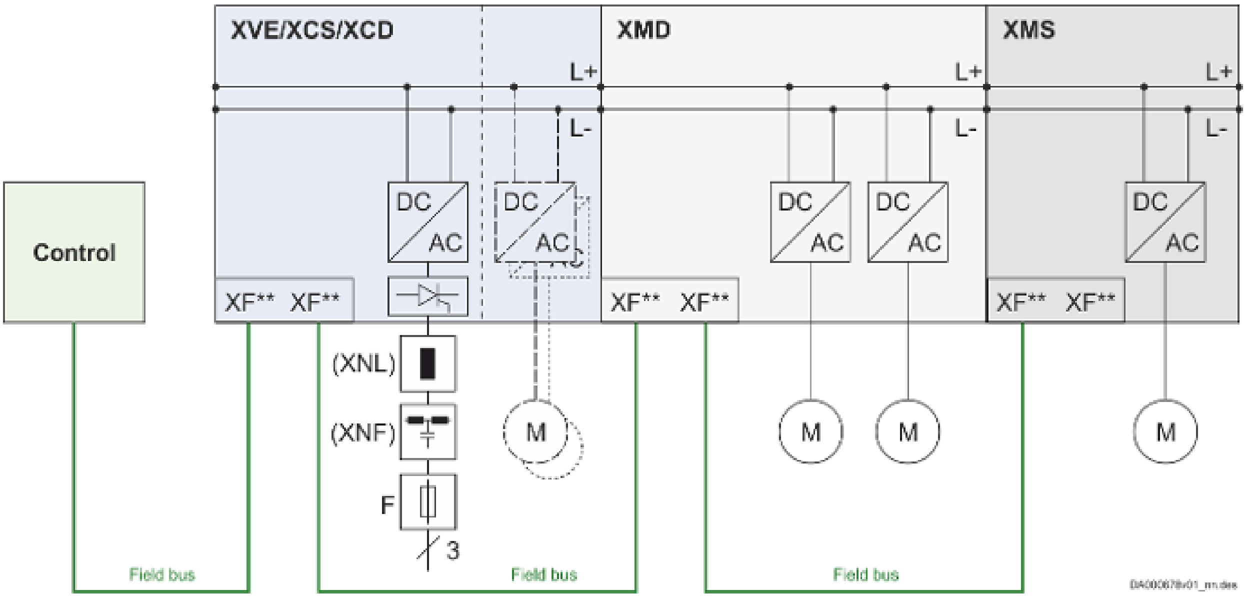


Fig. 73: Axis group with information exchange via field bus (solution with field bus and external control)

Control	Control component	XMD	Inverter (2-axis)
F	Fuse	XMS	Inverter (1-axis)
XCD	Converter (2-axis)	XNF	Mains filter (optional)
XCS	Converter (1-axis)	XNL	Mains choke (optional)
XF**	Communication (Ethernet-based field bus)	XVE	Supply unit (feeding)

Field bus solution with internal ctrlX CORE control

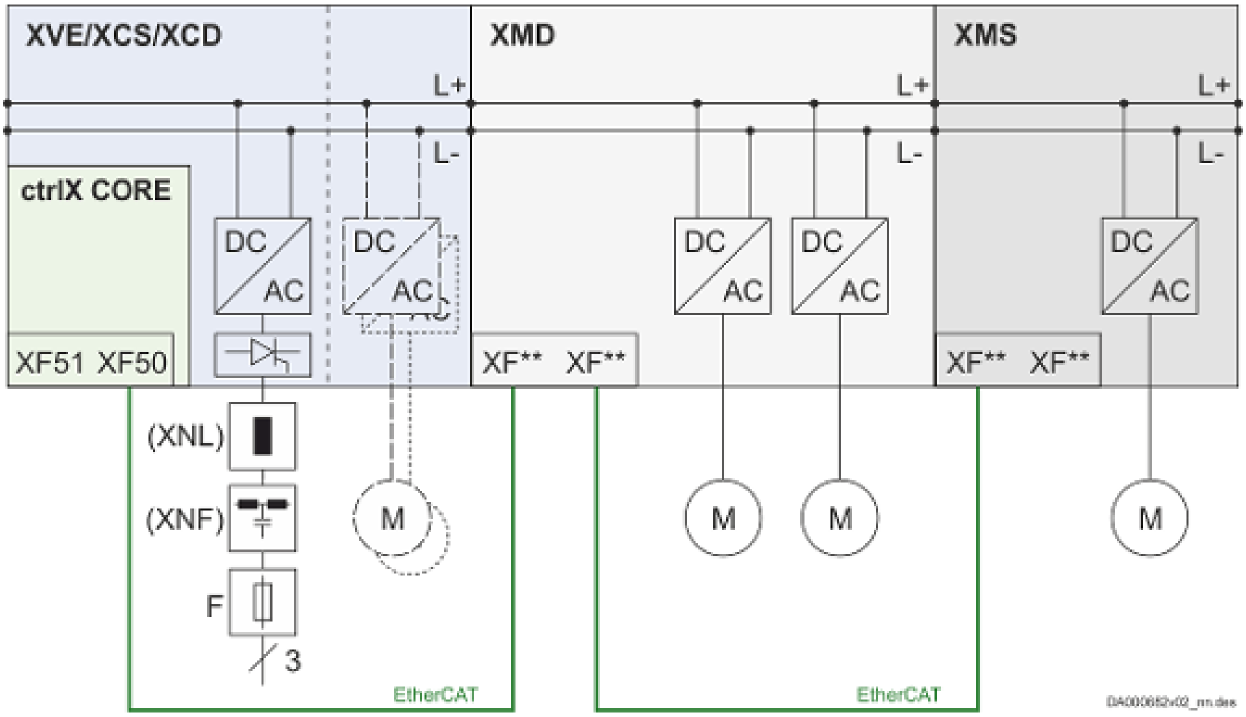


Fig. 74: Axis group with information exchange via field bus (solution with field bus and internal control)

ctrlX CORE	internal control	XMD	Inverter (2-axis)
F	Fuse	XMS	Inverter (1-axis)
XCD	Converter (2-axis)	XNF	Mains filter (optional)
XCS	Converter (1-axis)	XNL	Mains choke (optional)
XF50	EtherCAT master	XVE	Supply unit (feeding)
XF**	Communication (Ethernet-based field bus)		

Custom-made function blocks and parameter files are available for this solution.

Supply unit: XVR

Field bus solution with external control

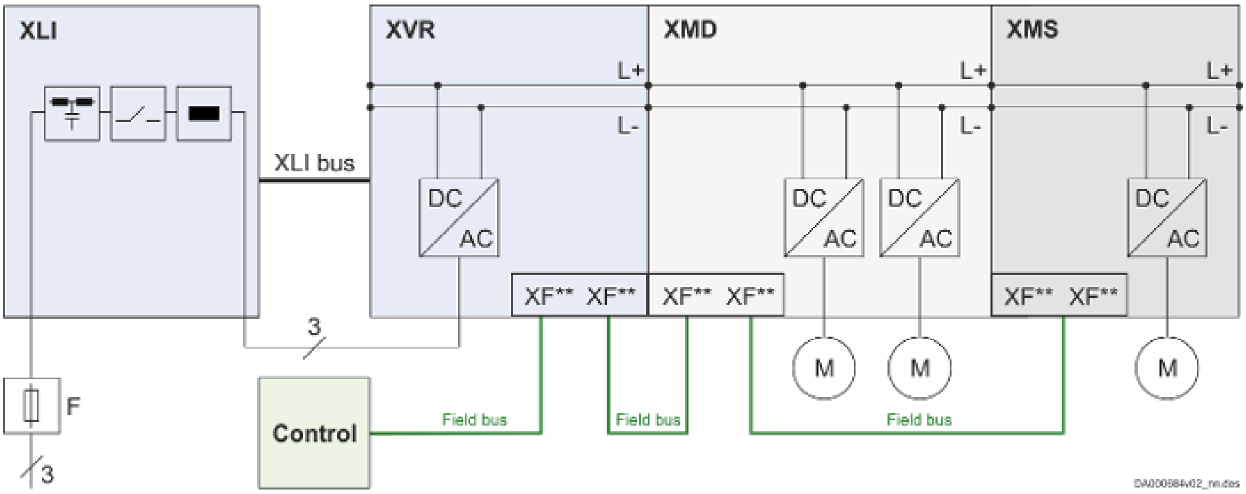


Fig. 75: Axis group with information exchange via field bus (solution with field bus and external control)

Control	Control component	XLI	Mains connection module
F	Fuse	XMD	Inverter (2-axis)
XF**	XF21, XF22: Communication (Ethernet-based field bus)	XMS	Inverter (1-axis)
		XVR	Supply unit (regenerative)

Field bus solution with internal ctrlX CORE control

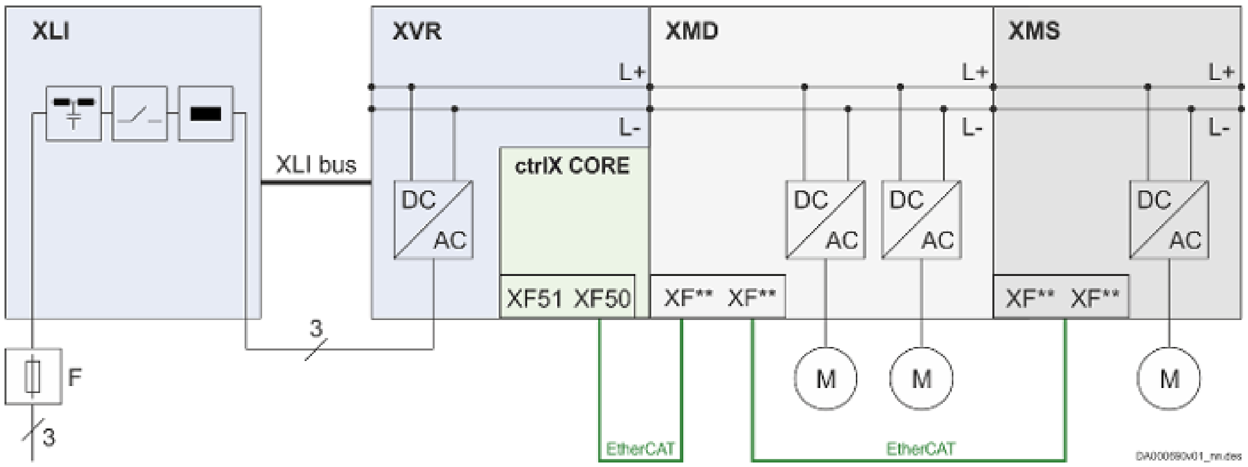


Fig. 76: Axis group with information exchange via field bus (solution with field bus and internal control)

ctrlX CORE	internal control	XLI	Mains connection module
F	Fuse	XMD	Inverter (2-axis)
XF50	EtherCAT master	XMS	Inverter (1-axis)
XF**	Communication (Ethernet-based field bus)	XVR	Supply unit (regenerative)

Custom-made function blocks and parameter files are available for this solution.

Digital I/O solution

This solution uses neither control nor field bus.

Supply unit: XVE, XCS or XCD

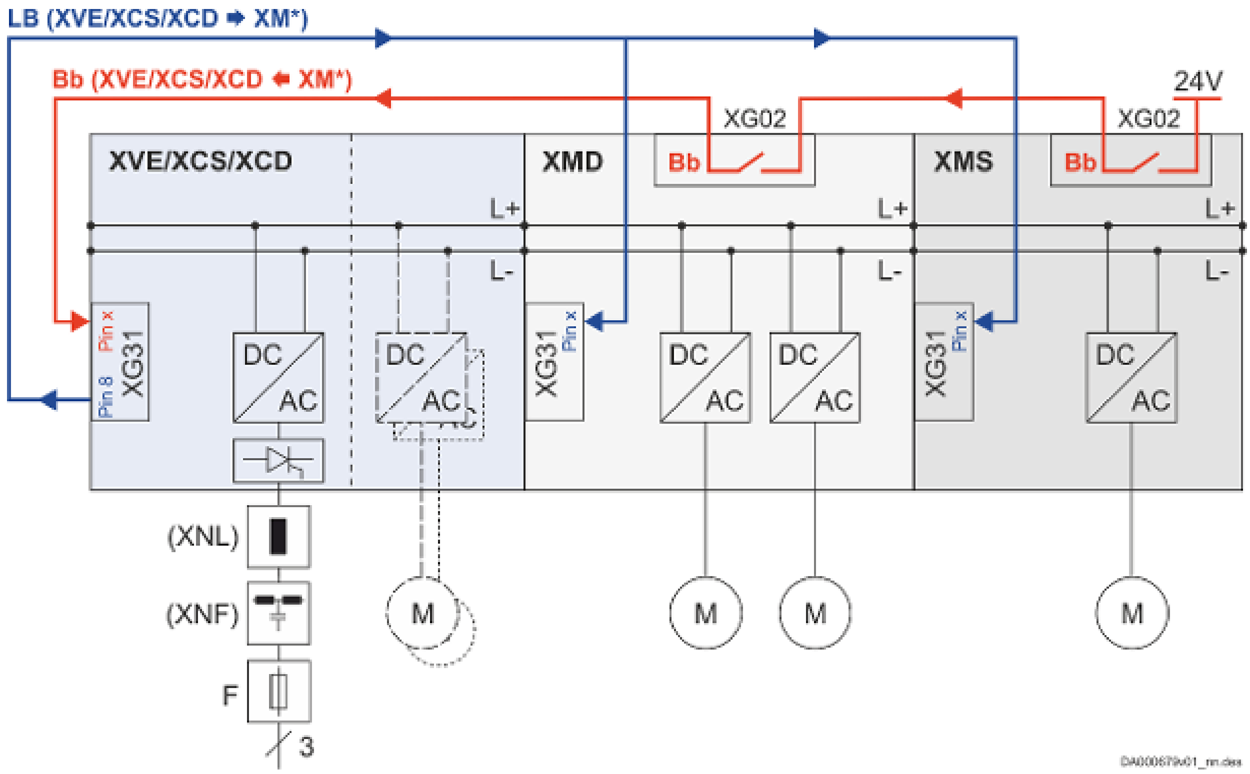


Fig. 77: Axis group with information exchange via digital inputs/outputs (solution with digital I/Os)

Bb	Readiness for operation	XMD	Inverter (2-axis)
F	Fuse	XMS	Inverter (1-axis)
LB	Readiness for power output	XNF	Mains filter (optional)
Pin x	Digital input	XNL	Mains choke (optional)
XCD	Converter (2-axis)	XVE	Supply unit (feeding)
XCS	Converter (1-axis)		

Supply unit: XVR

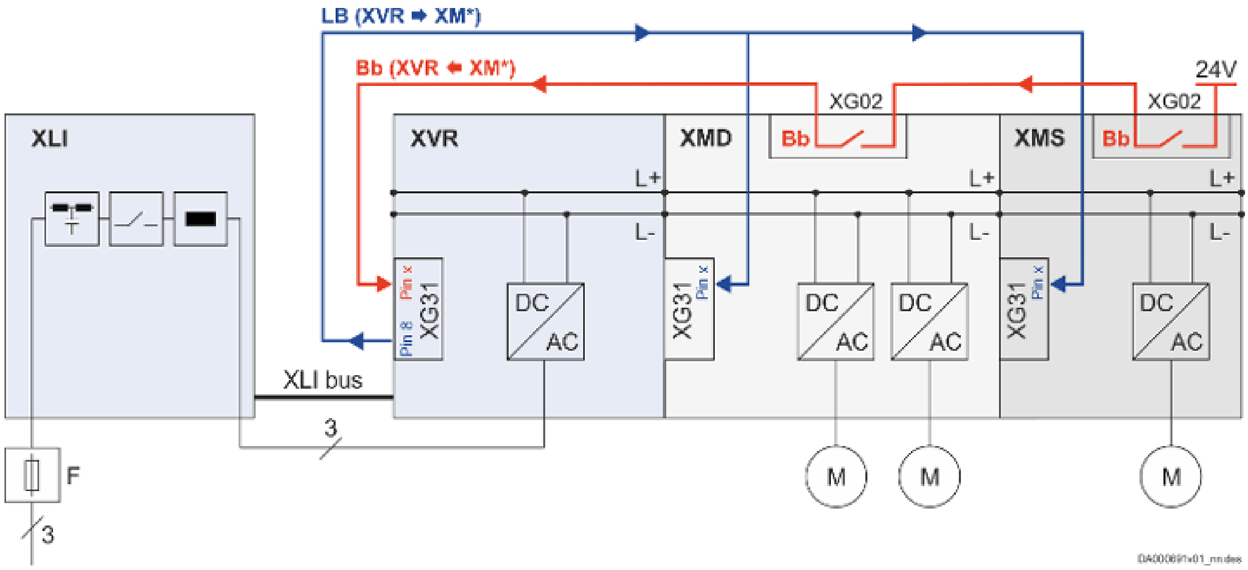


Fig. 78: Axis group with information exchange via digital inputs/outputs (solution with digital I/Os)

Bb	Readiness for operation	XLI	Mains connection module
F	Fuse	XMD	Inverter (2-axis)
LB	Readiness for power output	XMS	Inverter (1-axis)
Pin x	Digital input	XVR	Supply unit (regenerative)

Field bus and digital I/O solution

This solution allows power to be switched off without a control.

Supply unit: XVE, XCS or XCD

Field bus and digital I/O solution with external control

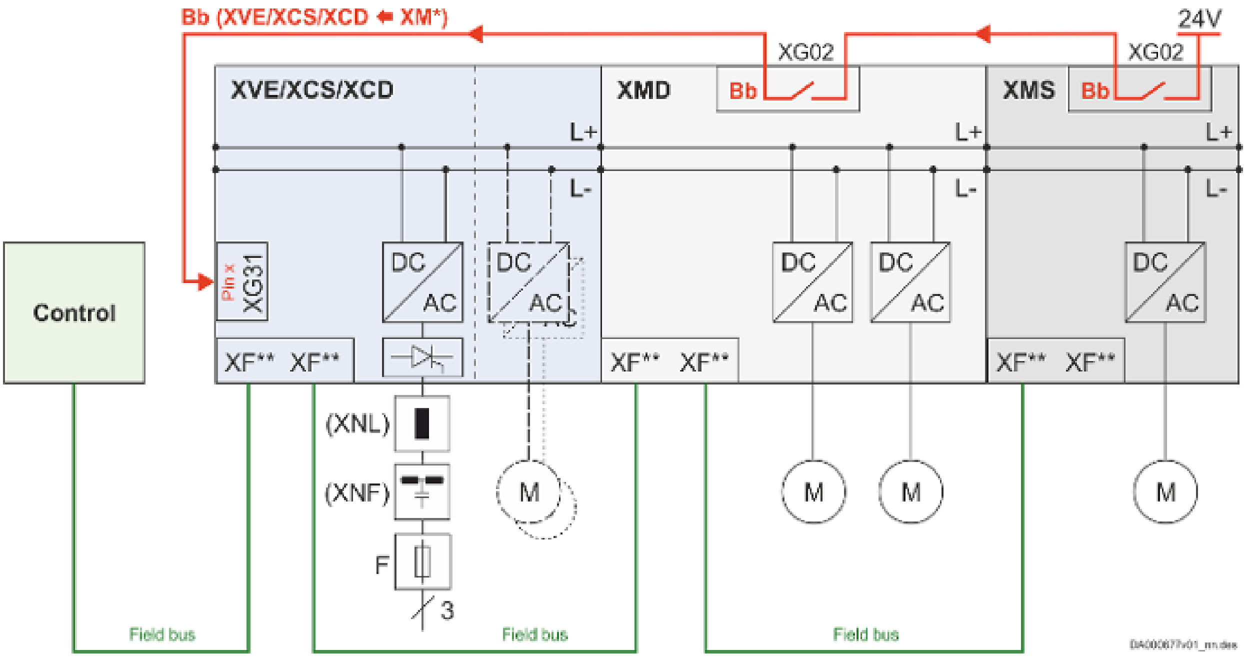


Fig. 79: Axis group with information exchange via field bus and digital inputs/outputs (solution with field bus, digital I/Os and external control)

Bb	Readiness for operation
Control	Control component
F	Fuse
Pin x	Digital input
XCS	Converter (1-axis)
XCD	Converter (2-axis)
XF**	Communication (Ethernet-based field bus)
XMD	Inverter (2-axis)
XMS	Inverter (1-axis)
XNF	Mains filter (optional)
XNL	Mains choke (optional)
XVE	Supply unit (feeding)

Field bus and digital I/O solution with internal control ctrlX CORE

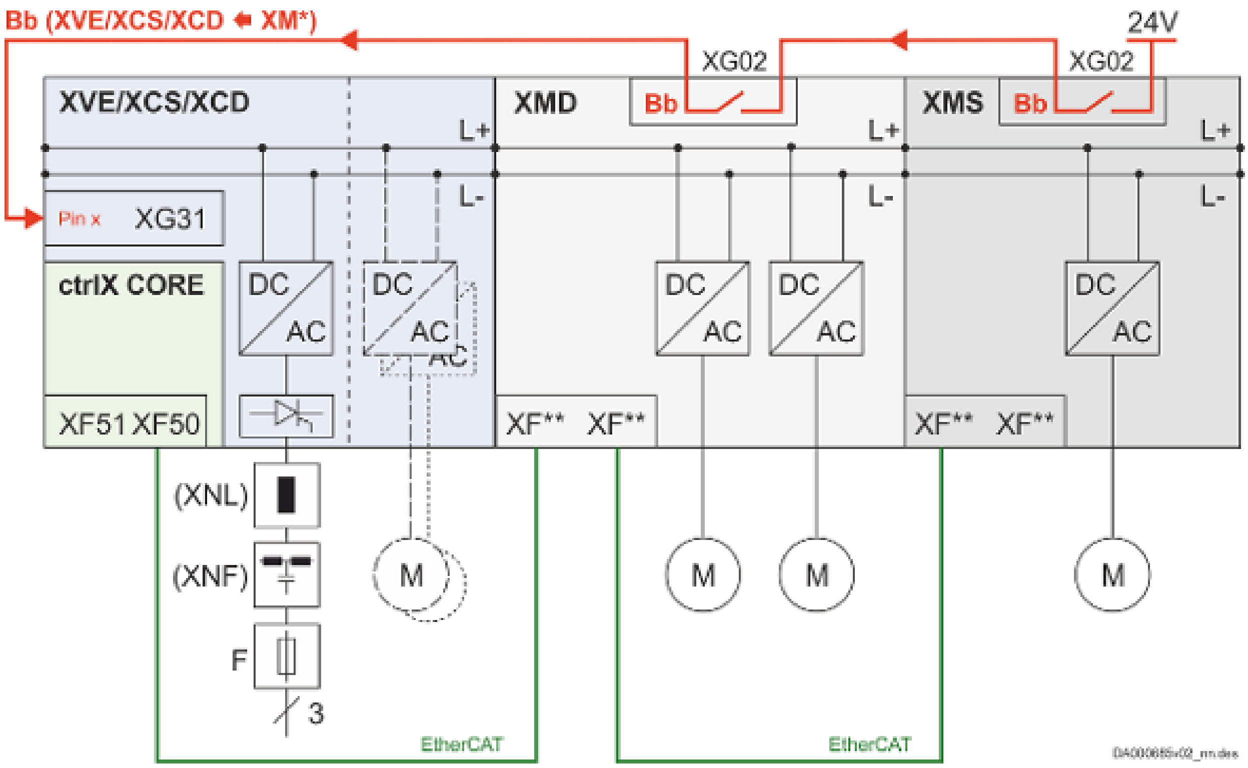


Fig. 80: Axis group with information exchange via field bus and digital inputs/outputs (solution with field bus, digital I/Os and internal control)

Bb	Readiness for operation	XF**	Communication (Ethernet-based field bus)
ctrlX CORE	internal control		
F	Fuse	XMD	Inverter (2-axis)
Pin x	Digital input	XMS	Inverter (1-axis)
XCD	Converter (2-axis)	XNF	Mains filter (optional)
XCS	Converter (1-axis)	XNL	Mains choke (optional)
XF50	EtherCAT master	XVE	Supply unit (feeding)

Custom-made function blocks and parameter files are available for this solution.

Supply unit: XVR

Field bus and digital I/O solution with external control

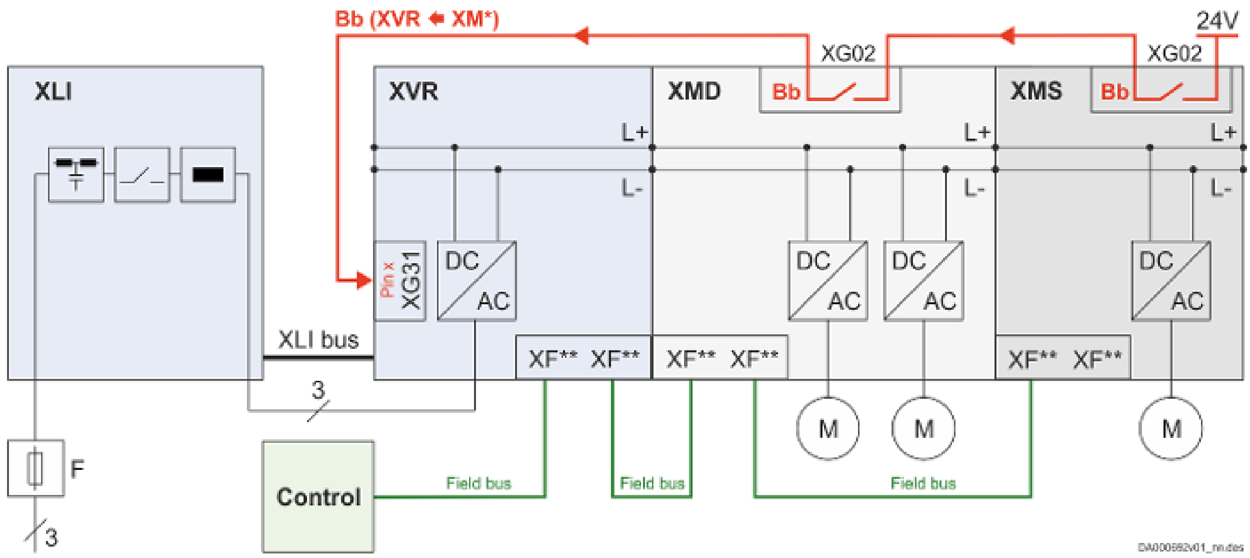


Fig. 81: Axis group with information exchange via field bus and digital inputs/outputs (solution with field bus, digital I/Os and external control)

Bb	Readiness for operation	XLI	Mains connection module
Control	Control component	XMD	Inverter (2-axis)
F	Fuse	XMS	Inverter (1-axis)
Pin x	Digital input	XVR	Supply unit (regenerative)
XF**	XF21, XF22: Communication (Ethernet-based field bus)		

Field bus and digital I/O solution with internal control ctrlX CORE

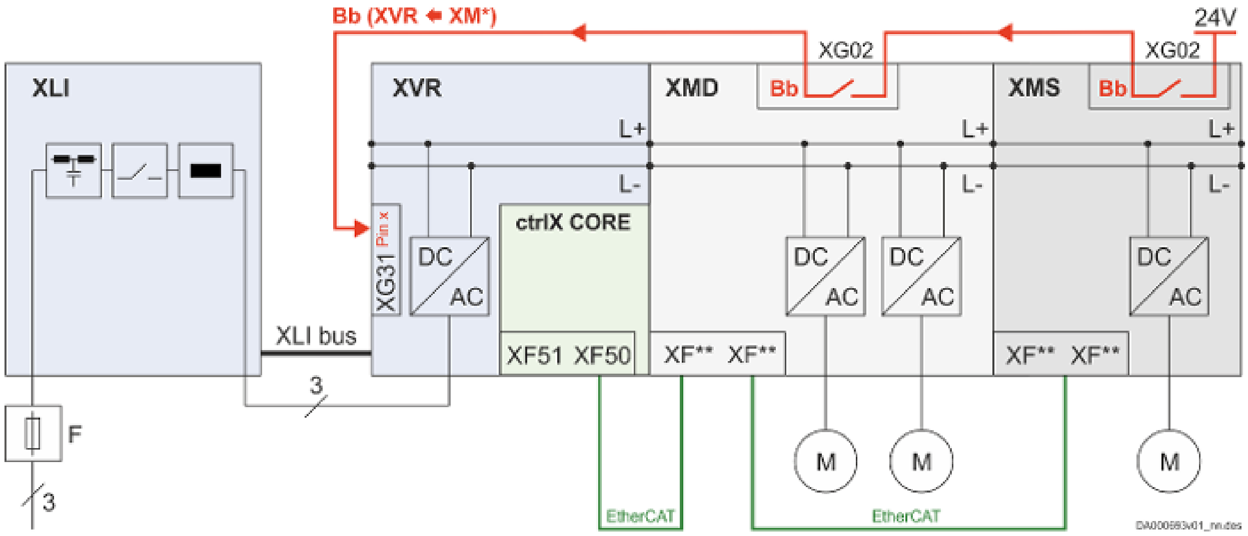


Fig. 82: Axis group with information exchange via field bus and digital inputs/outputs (solution with field bus, digital I/Os and internal control)

Bb	Readiness for operation	XLI	Mains connection module
ctrlX CORE	internal control	XMD	Inverter (2-axis)
F	Fuse	XMS	Inverter (1-axis)
Pin x	Digital input	XVR	Supply unit (regenerative)
XF50	EtherCAT master		
XF**	Communication (Ethernet-based field bus)		

Custom-made function blocks and parameter files are available for this solution.

4.4 Cables

4.4.1 Selection

How to select a suitable cable:

See documentation "ctrlX Motor Cables and Connectors" (de: R911420099; en: R911420100).

➦ R911420099/R911420100

4.4.2 RHB hybrid cable

- The maximum cable length depends on the PWM frequency.
- The maximum number of cable segments is limited. A panel feed-through counts as a cable segment.

Table 74: Maximum allowed cable length and maximum number of cable segments

Cross section [mm²]	Cable	Extension	Length [m]				Cable segments
			4 kHz	8 kHz	12 kHz	16 kHz	
0.75	RHB2-xxxBBB-xx-xxx,xx	RHB2-5xxBBB-xx-xxx,xx	45	38	25	18	3
1.5	RHB2-xxxDCB-xx-xxx,xx	RHB2-5xxDCB-xx-xxx,xx	75	38	25	18	4

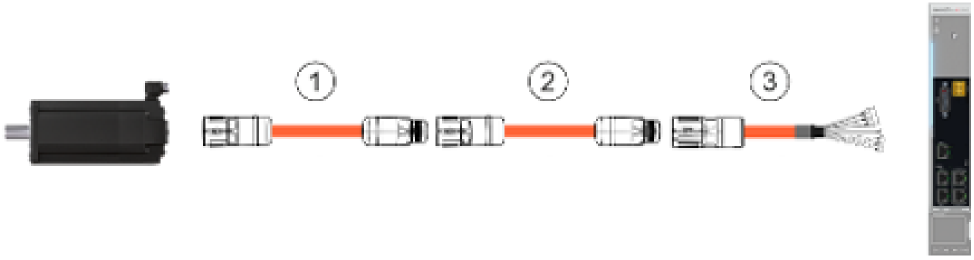


Fig. 83: Cable with extension ⇒ 3 cable segments

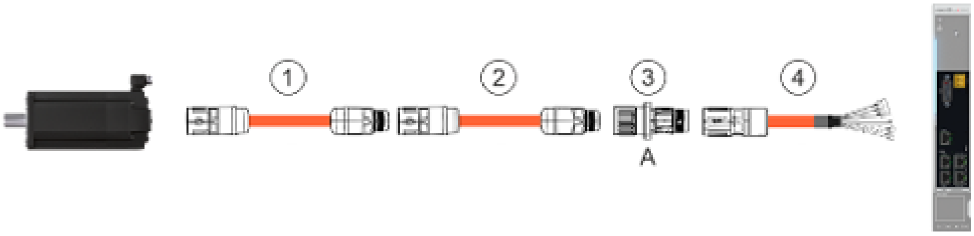


Fig. 84: Cable with extension and panel feed-through (A; M23, RHS2305/A03, R911384340) ⇒ 4 cable segments

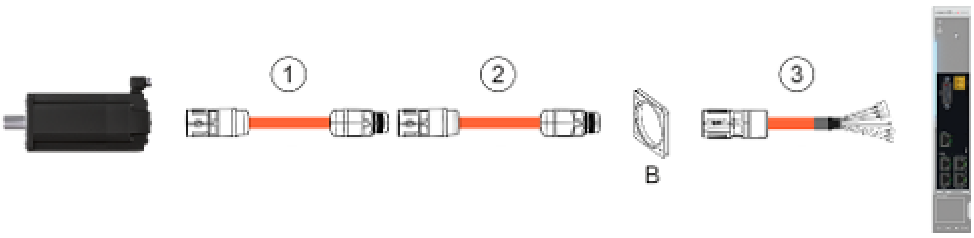


Fig. 85: Cable with extension and flange feed-through (B; M23, R911403772; M17, R911409836) ⇒ 3 cable segments

4.5 Acceptance tests and approvals

4.5.1 CE label

Overview

CE	Standard	Declaration of conformity *)
Low Voltage Directive 2014/35/EU	EN 61800-5-1	DCTC-30337-001
EMC Directive 2014/30/EU	EN 61800-3	DCTC-30337-002
ErP Directive 2009/125/EC	EN 61800-9-2	DCTC-30337-003
Machinery Directive 2006/42/EC	EN ISO 13849-1 EN 62061 EN 61800-5-1 EN 61800-5-2 EN 61508-1 ... 7	DCTC-30136-001 DCTC-30136-002 DCTC-30136-004
RoHS Directive	2011/65/EU	RoHS

*) Declaration of conformity in Bosch Rexroth media directory: www.boschrexroth.com/mediadirectory, search term e.g. "DCTC-30337-001"

4.5.2 UL/CSA certification

The components are listed by UL (Underwriters Laboratories Inc.®).

Find the proof of certification on the Internet. Enter the terms "UL" and "databases" in a search engine to access the relevant UL web page. Use the file number to find the proof of certification.

Table 75: C-UL listing

<table>
<tr><td rowspan="3">Listed
POW. CONV. EQ.
97Y4</td><td>• UL standard: 61800-5-1
• CSA standard: Canadian Standard CSA C22.2 No. 274-17</td></tr>
<tr><td>Company name
BOSCH REXROTH AG
Category Name:
• Power Conversion Equipment
• Transformers, General Purpose - Component</td></tr>
<tr><td>File numbers
ctrlX DRIVE components:
• E134201
• E328841
Additional components
• E329212
• E214694
• E181051</td></tr>
</table>

UL ratings

When using the component in the scope of CSA / UL, take the UL ratings for each component into account.

Make sure that the specified short-circuit current rating SCCR is not exceeded, e.g. by providing appropriate fuses in the mains connection of the supply unit.

UL wiring material

In the scope of CSA / UL, use copper 60/75 °C only; class 1 or equivalent only.

Allowed pollution degree

Comply with the allowed pollution degree of the components (see "Ambient and operating conditions").

4.5.3 UKCA marking

Overview

UK CA	Standard	Declaration of conformity *)
Electrical Equipment (Safety) Regulation	EN 61800-5-1	DCTC-30337-031 DCTC-30337-032 DCTC-30337-033
Electromagnetic Compatibility Regulation	EN 61800-3	
Ecodesign for Energy-Related Products and Energy Information	EN 61800-9-2	
Supply of Machinery (Safety) Regulation	EN ISO 13849-1 EN 62061 EN 61800-5-1 EN 61800-5-2 EN 61508-1 ... 7	DCTC-30136-031 DCTC-30136-032 DCTC-30136-034
*) Declaration of conformity in Bosch Rexroth media directory: ➦ www.boschrexroth.com/mediadirectory, search term e.g. "DCTC-30337-031"		

4.6 Ensuring the EMC requirements

Standards and laws

On the European level there are the EU Directives. The EMC Directive 2014/30/EU is relevant for EMC.

EMC properties of components

Drive and control components by Rexroth are designed and engineered in accordance with the regulations of the EMC Directive 2014/30/EU.

The compliance with EMC standards was tested using a typical arrangement with a test setup conforming to standard with the specified mains filters. The limit values according to product standard EN 61800-3 have been complied with.

Apart from the internal test at the factory, a conformity test was carried out for individual drive systems in an accredited laboratory of a CE-responsible authority.

Applicability for finished product

Measurements of the drive system with an arrangement typical for the system are not in all cases applicable to the state as installed in a machine or installation. Noise immunity and noise emission strongly depend on:

- Configuration of the connected drives
- Number of the connected drives
- Mounting conditions
- Site of installation
- Radiation conditions
- Wiring and installation

In addition, the required measures depend on the requirements of electric safety technology and economic efficiency in the application.

In order to prevent interference as far as possible, mounting and installation instructions are contained in the documentations of the components and in this documentation.

Observe the descriptions and notes of the Rexroth control cabinet documentation (R911344987 (de), R911344988 (en)).

Cases to distinguish for declaration of EMC conformity

For validity of the harmonized standards, we distinguish the following cases:

- Case 1: **Delivery** of the drive system.
  According to the regulations, the product standard EN 61800-3 is complied with for Rexroth drive systems. The drive system is listed in the declaration of EMC conformity. This fulfills the legal requirements according to EMC directive.
- Case 2: **Acceptance test** of a machine or installation with the installed drive systems.
  The product standard for the respective type of machine/installation, if existing, applies to the acceptance test of the machine or installation. In the last years, some new product standards were created for certain machine types and some are being created at present. These new product standards contain references to the product standard EN 61800-3 for drives or specify higher-level requirements demanding increased filter and installation efforts. If the machine manufacturer wants to place the machine/installation on the market, the product standard relevant to their machine/installation has to be complied with for their finished "machine/installation" product. The authorities and test laboratories responsible for EMC normally refer to this product standard.

This documentation specifies the EMC properties which can be achieved, in a machine or installation, with a drive system consisting of the standard components.

It also specifies the conditions under which the indicated EMC properties can be achieved.

4.7 IT security

Operating systems and machines requires the implementation of a comprehensive concept for state-of-the-art IT security. Bosch Rexroth products are part of this comprehensive concept. The properties of the Bosch Rexroth products have to be considered for a comprehensive IT Security concept. For the required properties, refer to the IT Security Guideline (➡R911342562).

5 Condition as supplied

5.1 Factory testing

5.1.1 Voltage test and insulation resistance test

According to standard, the **components** of the ctrlX DRIVE range are tested with voltage at the factory.

Table 76: Applied standards

Test	Test rate
Voltage test	100% (EN 61800-5-1)
Insulation resistance test	100% (EN 60204-1)

5.2 Customer testing

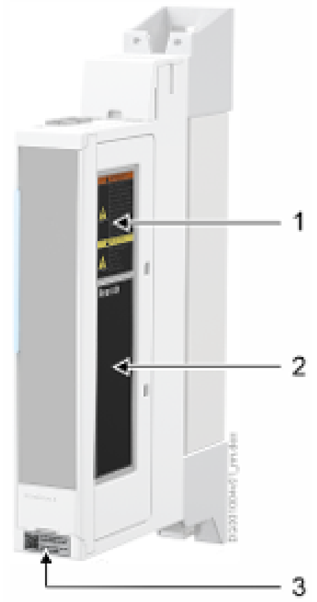
NOTICE	**Risk of damage to installed Rexroth components due to customer`s inspection of the machine or system!** Before you perform a voltage test or an insulation resistance test at the **system or machine** in which these components are used: Disconnect all connections of the Rexroth components or disconnect the plug-in connections to protect the electronic parts.

6 Identification

6.1 Plates

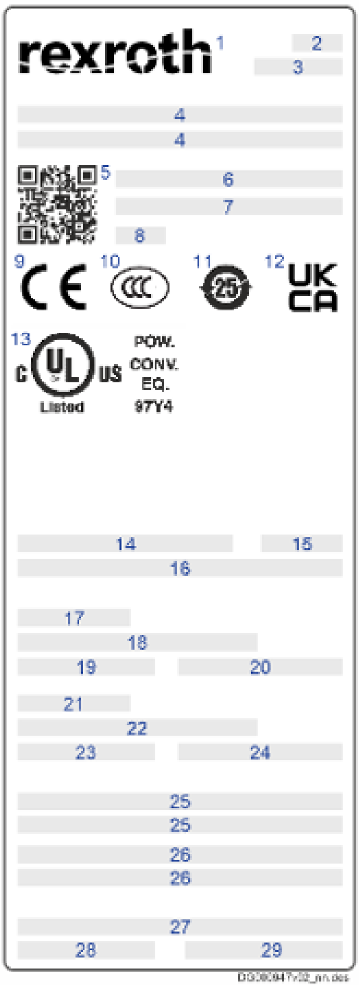
6.1.1 Positions of the plates

Table 77: Positions of the plates

<table>
<tr><td rowspan="3">
</td><td>1</td><td>Warning labels</td></tr>
<tr><td>2</td><td>Type plate</td></tr>
<tr><td>3</td><td>Additional plate</td></tr>
</table>

6.1.2 Type plate

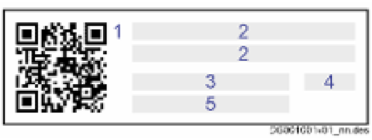
Table 78: Type plate



1	Word mark/logo	20	Rated frequency Input frequency
2	Factory	21	Output data of power supply
3	Production week; 18W23, for example, refers to year 2018, week 23	22	Output voltage
4	Type designation	23	Output current
5	QR code	24	Output frequency
6	Material number	25	UL text
7	Serial number	26	UL text
8	Hardware index	27	Company address
9	CE conformity mark	28	Country of manufacture
10	CCC label	29	Service hotline
11	China RoHS 2		
12	UKCA marking		
13	UL label		
14	Ambient temperature during operation		
15	Degree of protection provided by enclosure		
16	SCCR		
17	Supply input data		
18	Rated voltage Input voltage		
19	Rated current Input current		

6.1.3 Additional plate

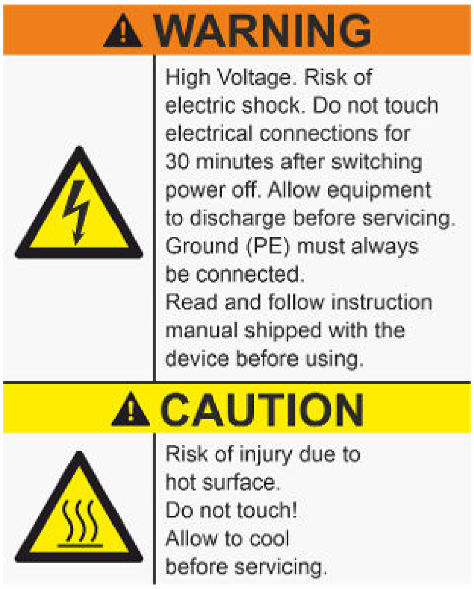
Table 79: Additional plate



1	QR code
2	Type designation
3	Material number
4	Hardware index
5	Serial number

6.1.4 Warning labels

Warning labels at the device



Foreign-language warning labels

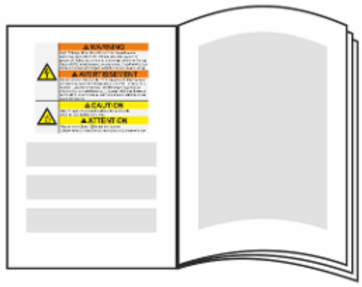
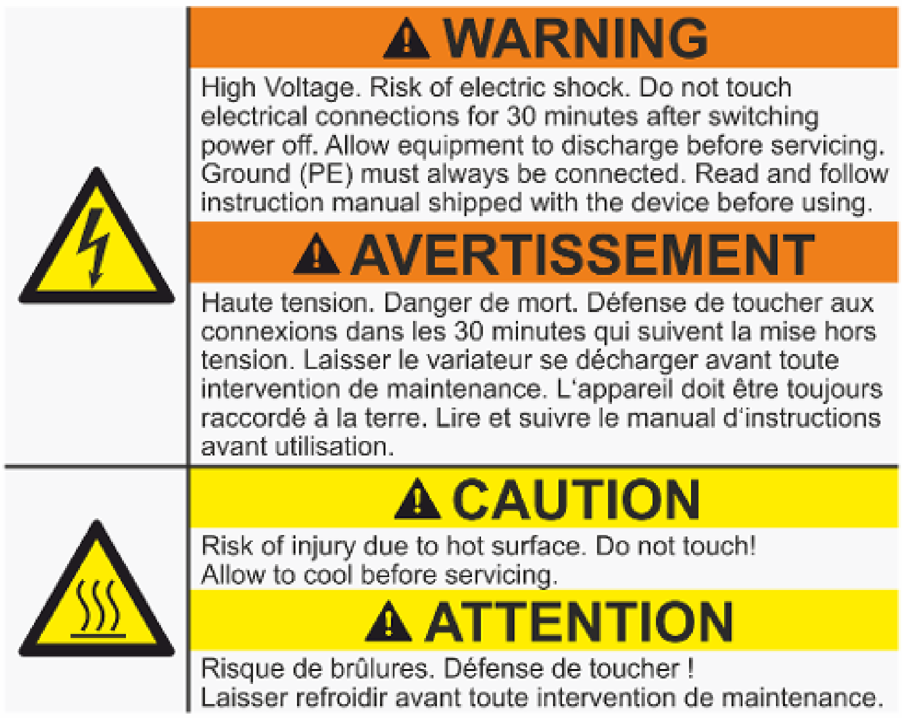
If you need the warning labels in a different language, you can order the required sheets with adhesive labels (material numbers: R911337015, R911337014).

Each sheet contains a warning in 27 languages (AR, BG, CS, DA, DE, EL, EN, ES, ET, FI, FR, HU, IT, JA, KO, LT, LV, NL, PL, PT (BR), RO, RU, SK, SL, SV, TR, ZH).

Warning "Electrical voltage" R911337015	Warning "Hot surface" R911337014
	

6.1.5 Warning labels (bilingual)

Table 80: Adhesive label in the documentation

<table>
<tr><td></td><td>The documentation that comes with the component contains an adhesive label with bilingual warnings.</td></tr>
<tr><td colspan="2">
</td></tr>
</table>

Do **not** stick this adhesive label with warnings directly on the component!

Place these warning labels clearly visibly in the immediate vicinity of the component, if the warning labels existing at the component are hidden by neighboring components.

7 Transporting the components

Table 81: Ambient and operating conditions - transport

Designation	Symbol	Unit	Value
Temperature range	T_{a_tran}	°C	-25 ... +70
Relative humidity		%	5 ... 95
Absolute humidity		g/m³	1 ... 60
Climatic category (IEC721)			2K3
Moisture condensation			Not allowed
Icing			Not allowed

8 Storing the components

NOTICE

Risk of damage to components from long-term storage!

Some components contain electrolytic capacitors which may deteriorate during storage.

When storing the following components for a longer period of time, run them **once a year for at least 1 hour**:

– Converters and supply units: Operated with mains voltage U_{LN}

– Inverters and DC bus capacitor units: Operated with DC bus voltage U_{DC}

Table 82: Ambient and operating conditions - storage

Designation	Symbol	Unit	Value
Temperature range	T_{a_store}	°C	-25 ... +55
relative humidity		%	5 ... 95
Absolute humidity		g/m³	1 ... 29
Climatic category (IEC721)			1K3
Moisture condensation			Not permitted
Icing			Not permitted

9 Mounting and installation

9.1 Information on control cabinet mounting

- Observe the **minimum distances** to be complied with for mounting (see technical data or dimensional drawings).

  The specified horizontal minimum distance (d_{hor}) refers to the distance to neighboring devices or equipment installed in the control cabinet (such as cable ducts).

  The horizontal distance to the control cabinet wall and to other Rexroth devices (e.g., IndraDrive C, EFC), or to devices of third party manufacturers, has to be ≥ 10 mm.

  If ctrlX DRIVE devices for **central supply** are mounted side by side in the control cabinet, there is no space between the devices.

  If ctrlX DRIVE devices for **individual supply** are mounted side by side in the control cabinet, there is a space of at least 3 mm between the devices (in this case, there is no space between the lateral touch guard plates of the DC bus connections).
- The devices were designed to be mounted in control cabinets. They are mounted with **screws** (M6; tightening torque: 10.4 Nm).
- The device comes with **adhesive labels with safety instructions**. These safety instructions always must remain at the device and be visible. Immediately replace damaged or illegible safety instructions by flawless safety instructions.

9.2 Coldplate

Table 83: Required Coldplate properties:

Designation	Unit	Value
Surface temperature	°C	≤ 60
Surface planeness	mm	≤ 0.1
Surface roughness	-	≤ Rz 6.3
Surface condition	• free from any kind of dirt (dust, grease, adhesions, etc.) • dry	

The **dimensional drawings** of the Coldplate devices show the areas of heat-producing power modules.

Coldplate devices are supplied with a **protective foil**.

Before mounting the device, remove the protective foil:

To do this, completely pull off the protective foil, slowly and smoothly at an angle > 90°.

Check the **surface** for damage and dirt.

Clean the surface if dirty.

Damaged surface: Contact Rexroth.

9.3 Electrical connection

9.3.1 Required electric strength of the connected lines

- Lines at connection points XD01, XD02, XD03, XD04, XD10, XG03, XZ03:
  - Dielectric strength according to basic insulation
  - Operational voltage designed for mains voltage and DC bus voltage (conductor-conductor: 500 VAC, conductor-ground: 300 VAC)
- Lines at connection points XG and XF:
  - Operational voltage of the corresponding control signal or communication signal
  - Lines run on the left or right side of the device have to be run at a minmimum distance of d_{hor} ≥ 10 mm to the device.
    If this minimum distance is fallen below, these lines have to be laid out for the mains and DC bus voltage.

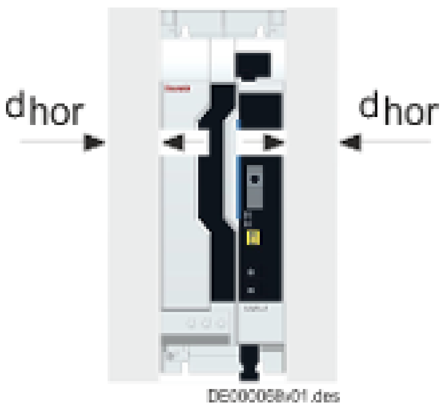


Fig. 86: d_{hor}: Horizontal distance

9.3.2 Connection points for power section/control section

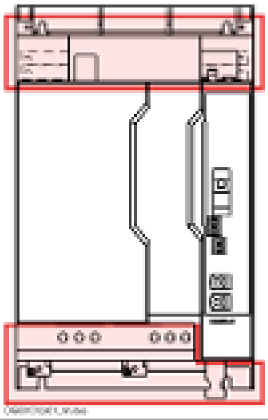
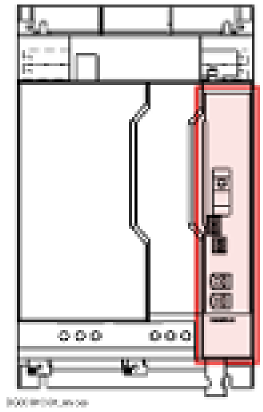
NOTICE

Installation:

- Install **strain relief** for all cables.
  This prevents inadmissible forces from acting on connectors and connection points at the power section/control section.
  Strain relief (examples):
  - Strain relief rail for top-hat rail/C-rail/screw mounting
  - Bracket clips for C-rail

  Shield connections of the devices (e.g., XAS2 accessories) cannot be used for strain relief!

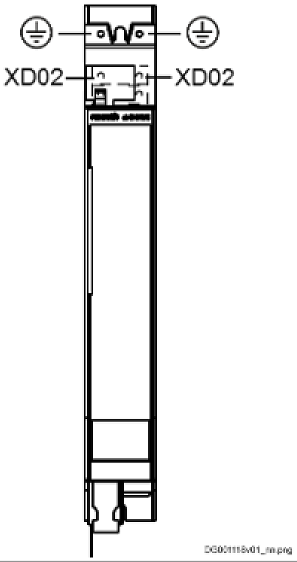
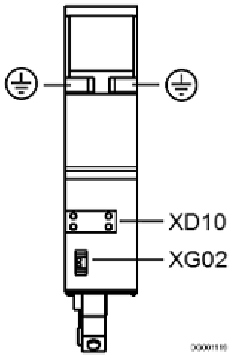
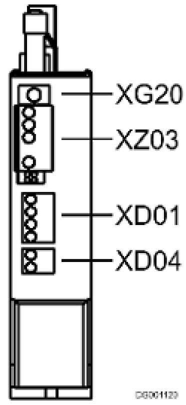
- **To minimize EMC problems:**
  - Run **control cables** (cables for digital/analog signals) upwards
  - Run **power cables** (power supply cables, motor cables) downwards
  - Mount cables for **analog encoders** (D-Sub) with cable outlet upwards
  - Cables for **digital encoders** may also be run downwards (with a distance > 10 cm to power cables)

Power section (example XCS)	Control section (example XCS)
	
➦ Chapter 9.3.3 XCS, power section connection points on page 192	➦ Chapter 9.3.10 Control section connection points on page 211

9.3.3 XCS, power section connection points

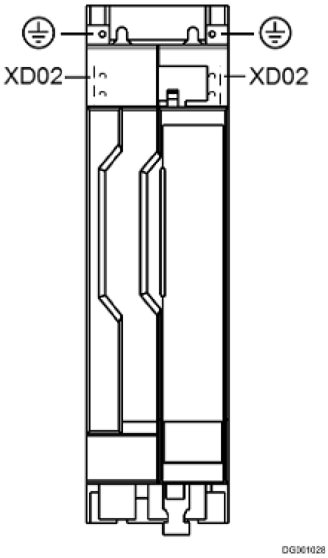
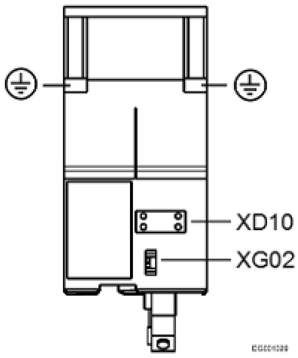
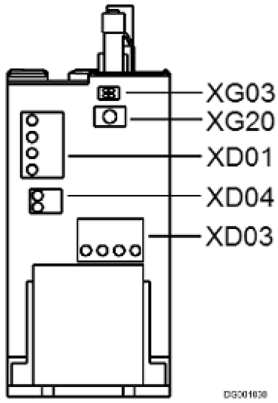
XCS*-*0010/23

Table 84: XCS*-*0010/23

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XD01: Mains connection XD04: Braking resistor XG20: Digital encoder connection XZ03: Hybrid connection (motor, motor temperature monitoring, motor holding brake)

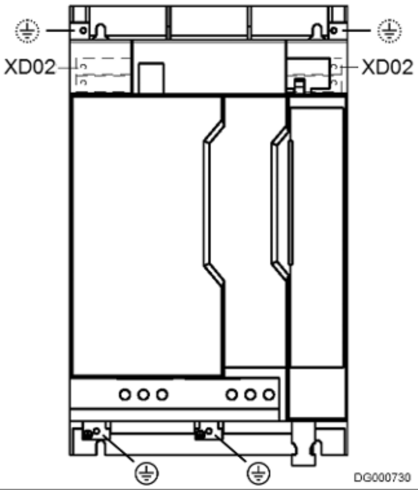
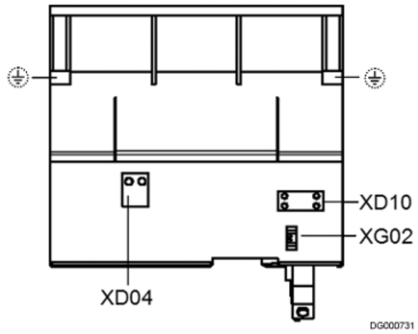
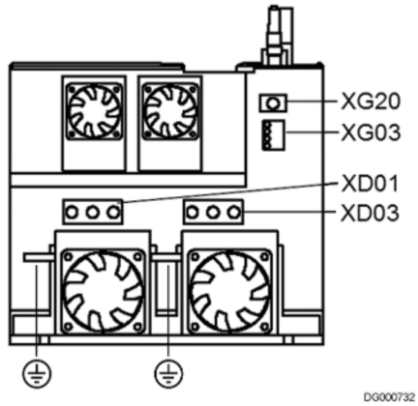
XCS*-*0054/70/90

Table 85: XCS*-*0054/70/90

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XD01: Mains connection XD03: Motor connection XD04: Braking resistor XG03: Motor temperature monitoring and motor holding brake XG20: Digital encoder connection

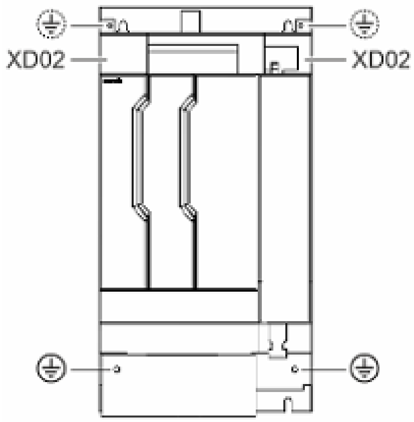
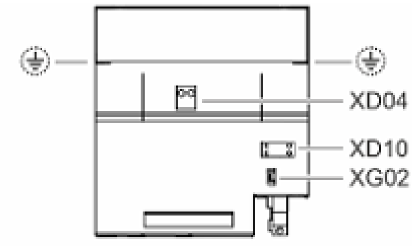
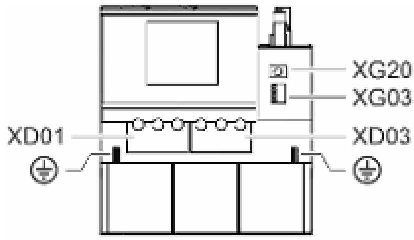
XCS*-W0100/120

Table 86: XCS*W0100/120

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD04: Braking resistor XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD01: Mains connection XD03: Motor connection XG03: Motor temperature monitoring and motor holding brake XG20: Digital encoder connection ⏚ Equipment grounding conductor (required)

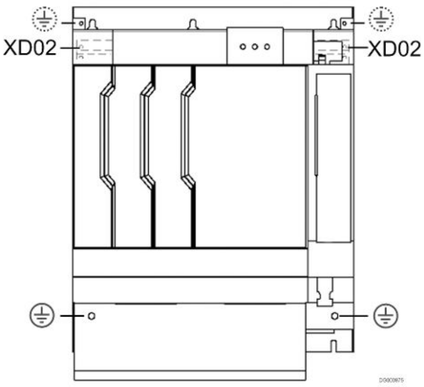
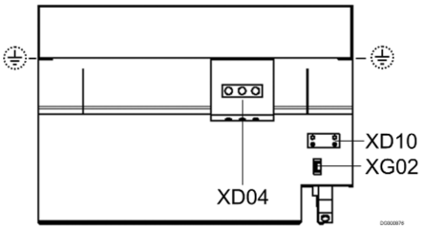
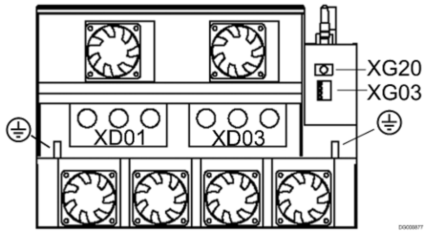
XCS*-W0150/180

Table 87: XCS*W0150/180

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD04: Braking resistor XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD01: Mains connection XD03: Motor connection XG03: Motor temperature monitoring and motor holding brake XG20: Digital encoder connection ⏚ Equipment grounding conductor (required)

XCS*-*02xx/*03xx

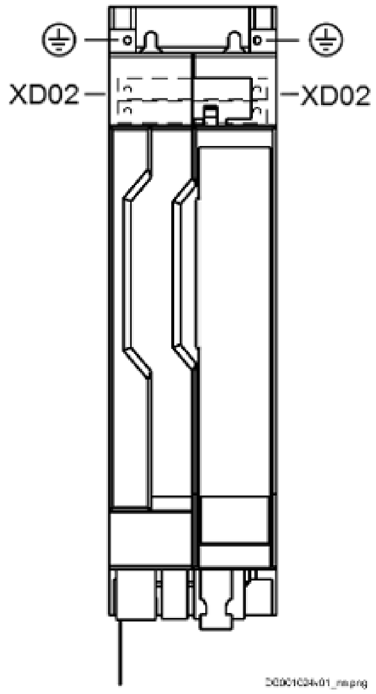
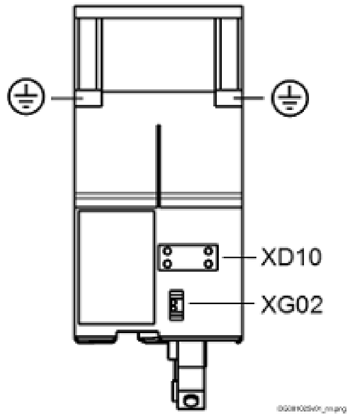
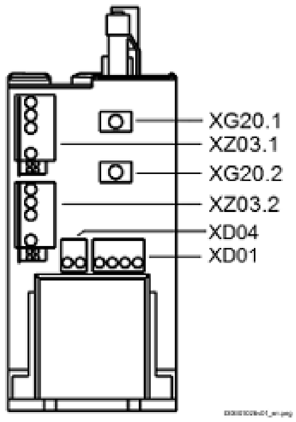
Table 88: XCS*-*02xx/*03xx

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD04: Braking resistor XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD01: Mains connection XD03: Motor connection XG03: Motor temperature monitoring and motor holding brake XG20: Digital encoder connection ⏚ Equipment grounding conductor (required)

9.3.4 XCD, power section connection points

XCD*-W2323

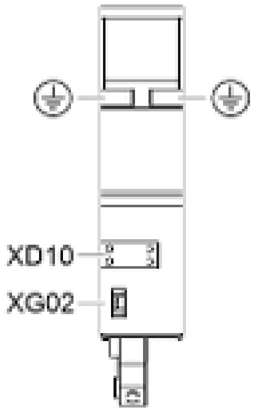
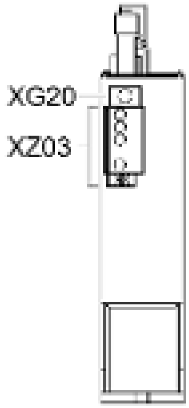
Table 89: Connection points

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XD01: Mains connection XD04: Braking resistor XG20: Digital encoder connection XZ03: Hybrid connection (motor, motor temperature monitoring, motor holding brake)

9.3.5 XMS, power section connection points

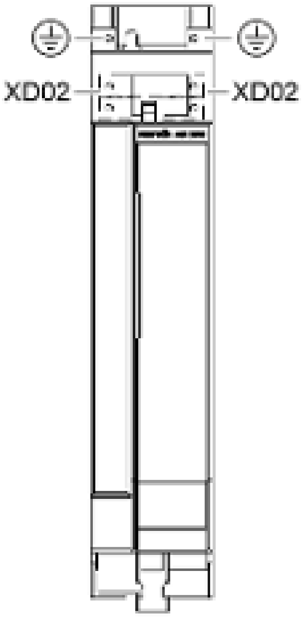
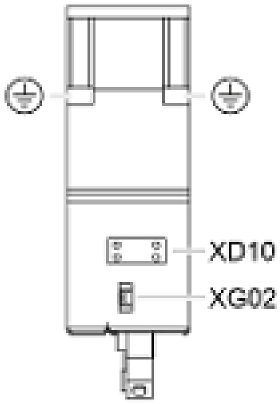
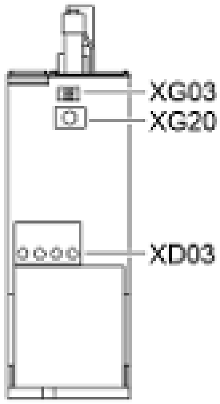
XMS*-W0006 ... 36

Table 90: Connection points XMS*-W0006 ... 36

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact	XG20: Digital encoder connection XZ03: Hybrid connection (motor, motor temperature monitoring, motor holding brake)

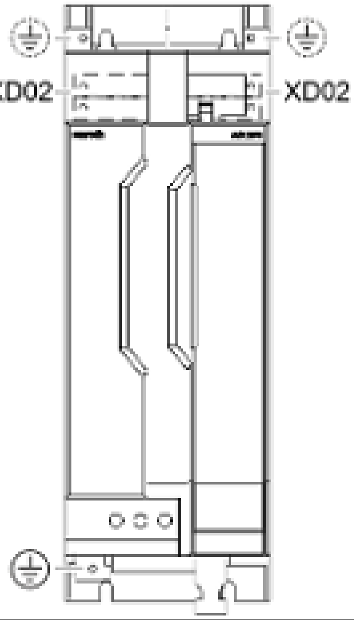
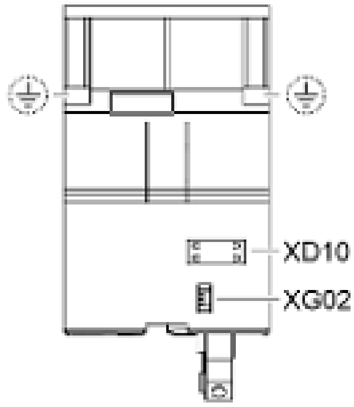
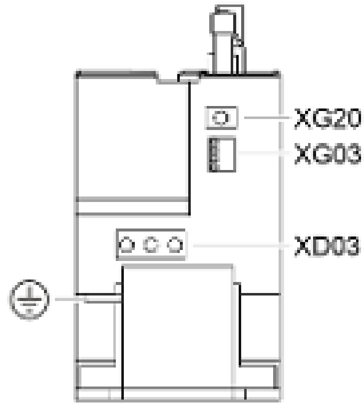
XMS*-*0054 ... 90

Table 91: Connection points XMS*-*W0054 ... 90

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XG20: Digital encoder connection XG03: Motor temperature monitoring and motor holding brake XD03: Motor connection

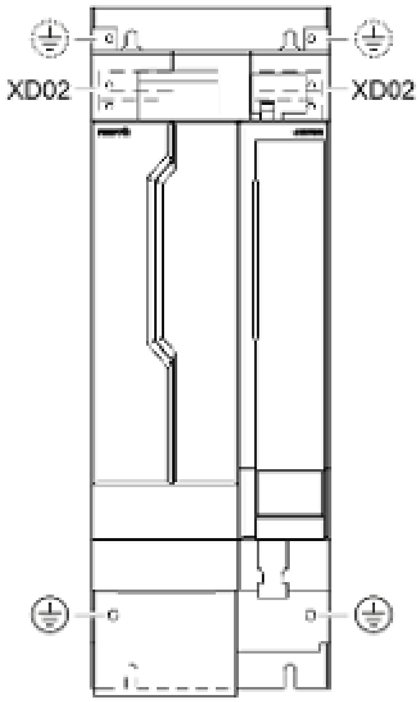
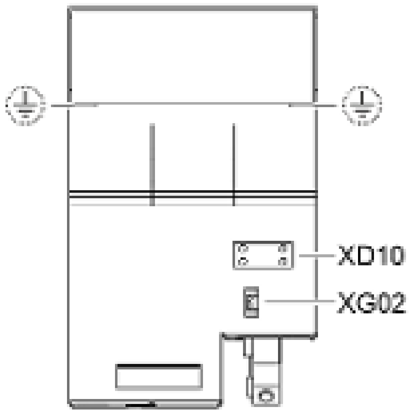
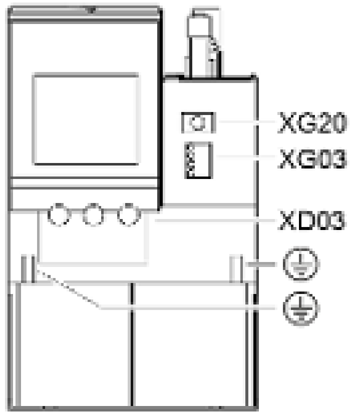
XMS*-W0100, -W0120

Table 92: Connection points XMS*-W0100, -W0120

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XG20: Digital encoder connection XG03: Motor temperature monitoring and motor holding brake XD03: Motor connection ⏚ Equipment grounding conductor (required)

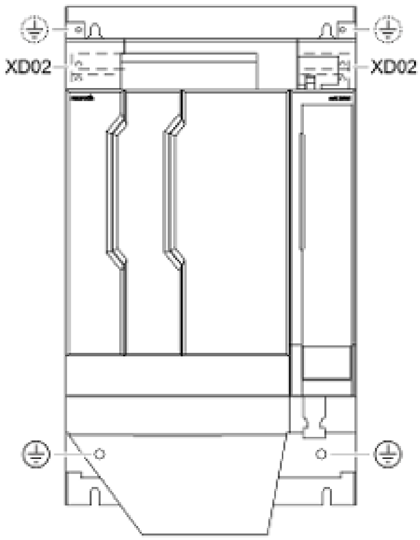
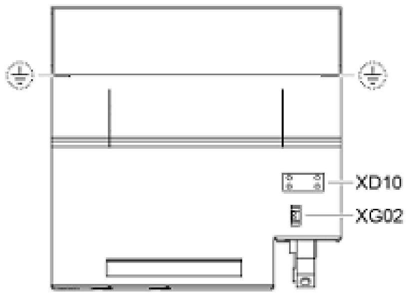
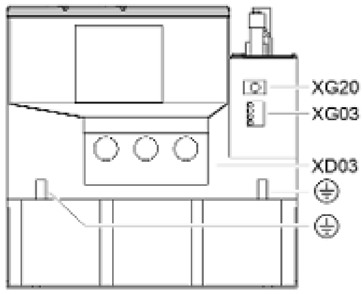
XMS*-W0150, -W0180

Table 93: Connection points XMS*-W0150, -W0180

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XG20: Digital encoder connection XG03: Motor temperature monitoring and motor holding brake XD03: Motor connection ⏚ Equipment grounding conductor (required; connection to the left or right)

XMS*-*0210 ... 375

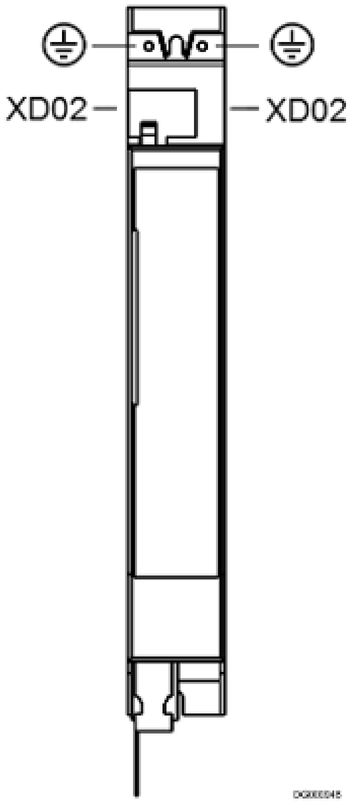
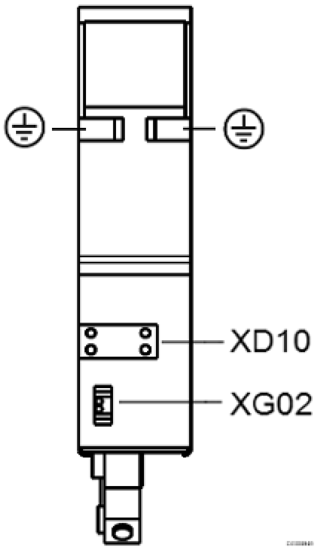
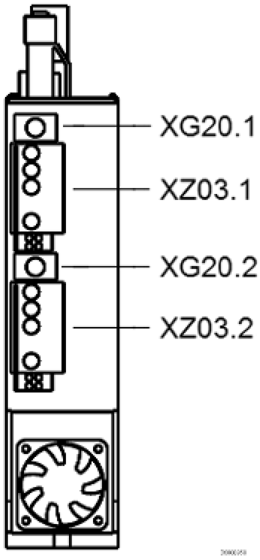
Table 94: Connection points XMS*-*0210 ... 375

Front	Top	Bottom
		
XD02: DC bus Equipment grounding conductor (required; connection to the left or right) Equipment grounding conductor (optional; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact Equipment grounding conductor (optional; connection to the left or right)	XG20: Digital encoder connection XG03: Motor temperature monitoring and motor holding brake XD03: Motor connection Equipment grounding conductor (required; connection to the left or right)

9.3.6 XMD, power section connection points

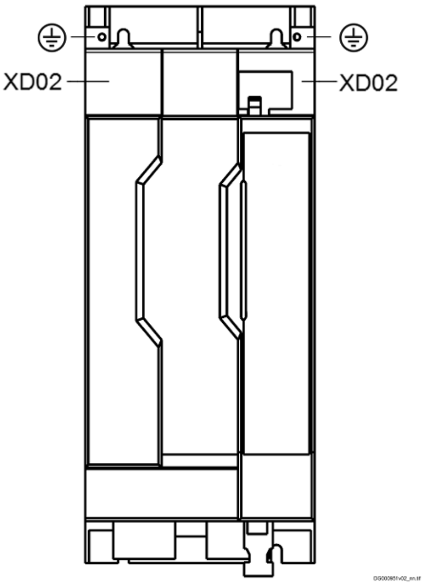
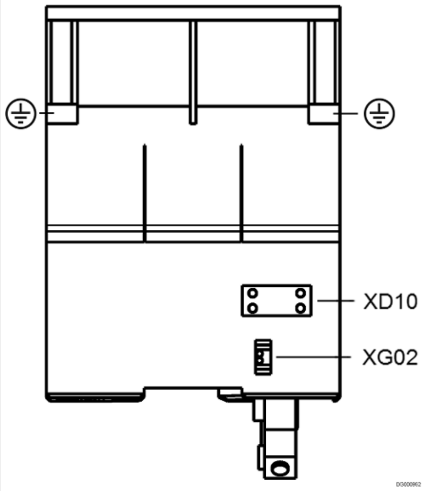
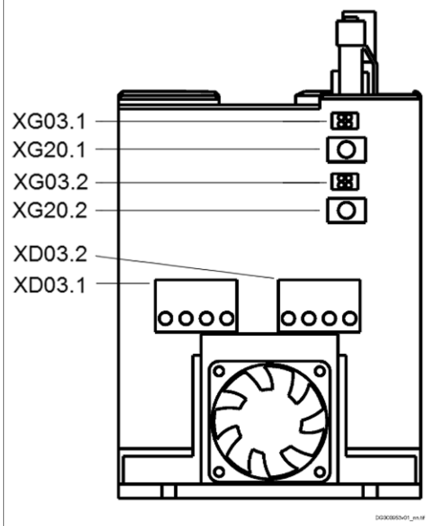
XMD*-W0606 ... W3636

Table 95: Connection points

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XG20: Digital encoder connection XZ03: motor connection + motor temperature monitoring and motor holding brake

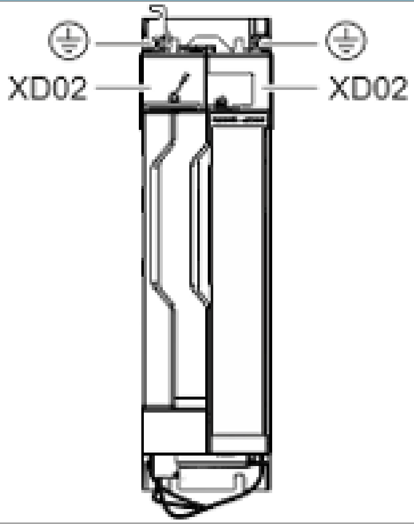
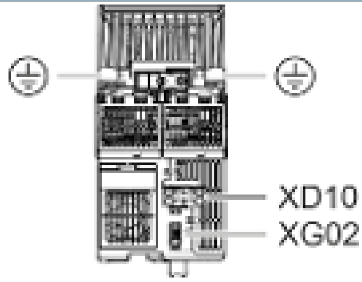
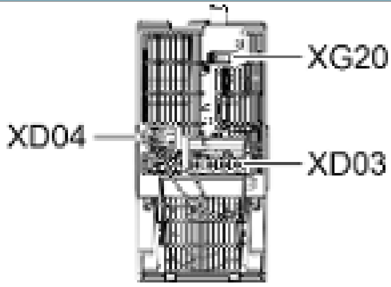
XMD*-*5454/-*7070

Table 96: Connection points

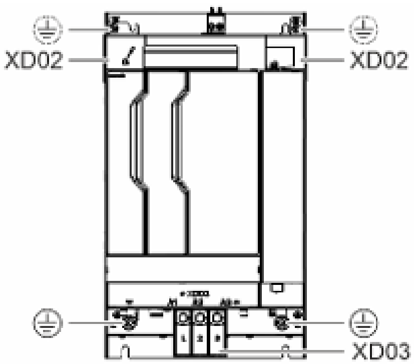
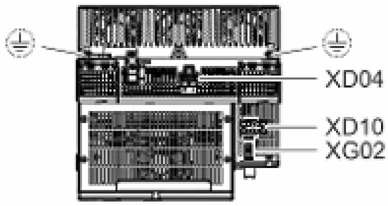
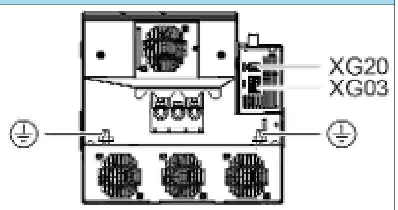
Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact	XG20: Digital encoder connection XD03: Motor connection XG03: Motor temperature monitoring and motor holding brake

9.3.7 XVR, power section connection points

XVR*-W0019

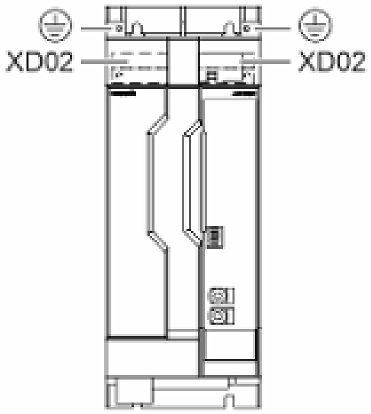
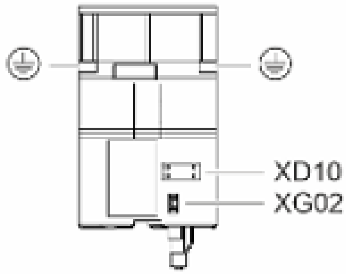
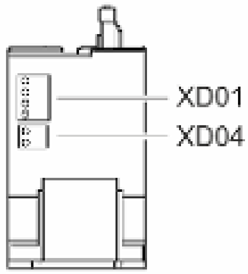
Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XD03: Mains XLI-XVR XD04: Braking resistor XG20: XLI bus

XVR*-W0048 ... W0100

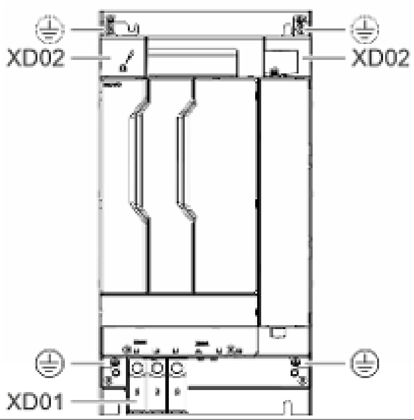
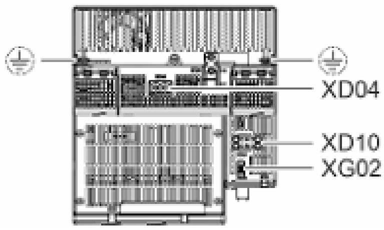
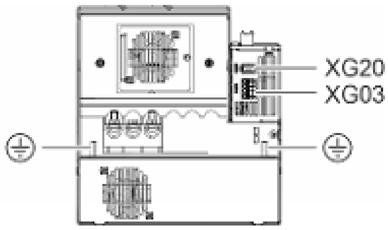
Front	Top	Bottom
		
XD02: DC bus XD03: Mains XLI-XVR ⏚ Equipment grounding conductor (required; connection to the left or right) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD04: Braking resistor XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XG20: XLI bus XG03: Without function ⏚ Equipment grounding conductor (required; connection to the left or right)

9.3.8 XVE, power section connection points

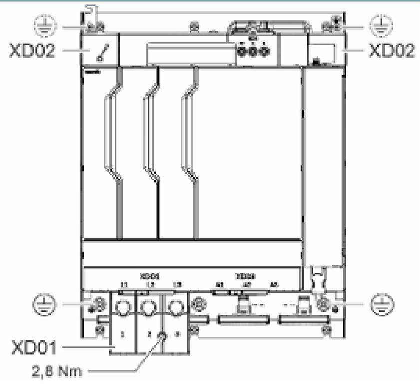
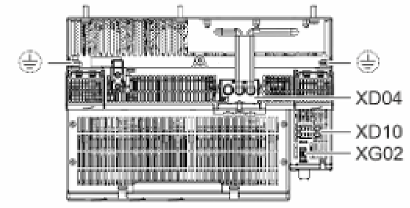
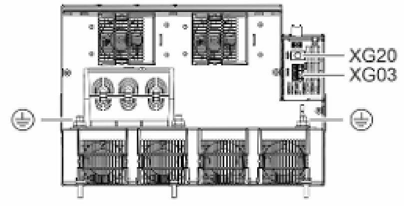
XVE*-W0030

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XD01: Mains XD04: Braking resistor

XVE*-W0075

Front	Top	Bottom
		
XD01: Mains XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD04: Braking resistor XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XG20: Without function XG03: Without function ⏚ Equipment grounding conductor (required; connection to the left or right)

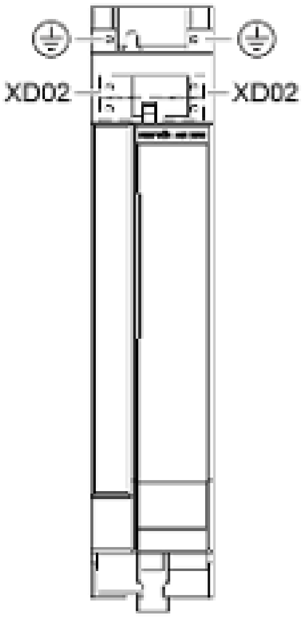
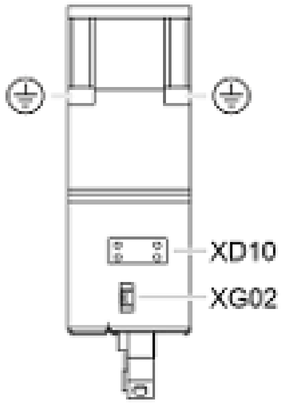
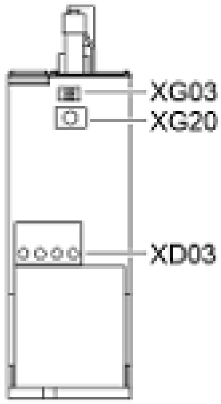
XVE*-W0125

Front	Top	Bottom
		
XD01: Mains (2.8 Nm: touch guard tightening torque) XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD04: Braking resistor XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XG20: Without function XG03: Without function ⏚ Equipment grounding conductor (required; connection to the left or right)

9.3.9 XMV, power section connection points

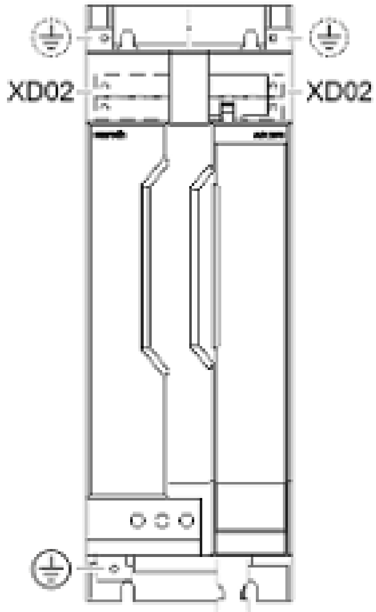
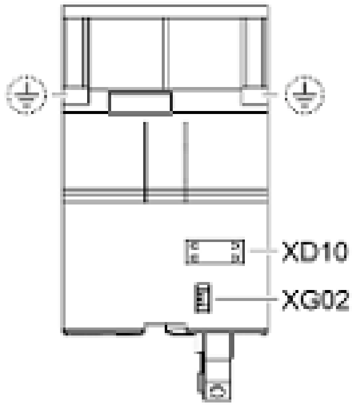
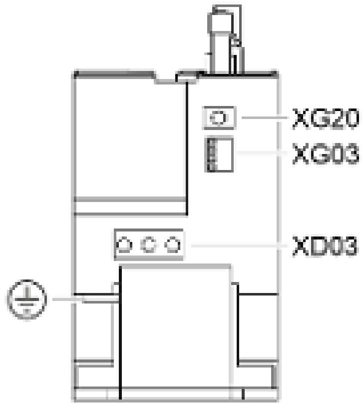
XMV*-W0050

Table 97: Connection points

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (required; connection to the left or right)	XG20: Without function XG03: Without function XD03: DC bus choke XLL

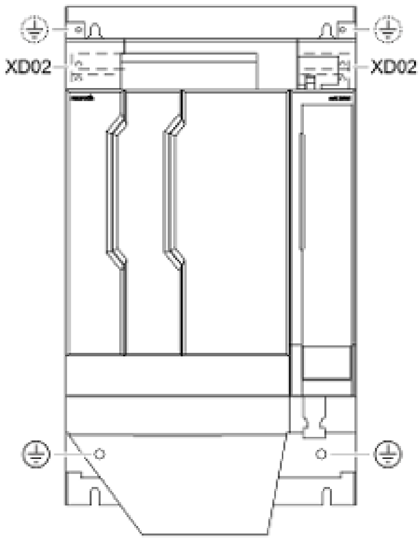
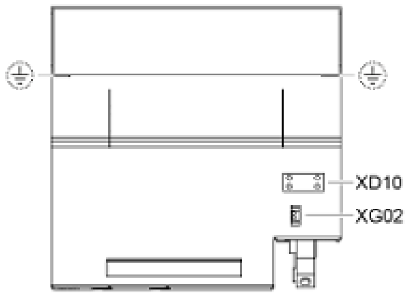
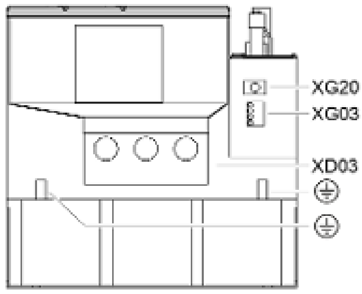
XMV*-W0080

Table 98: Connection points

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XG20: Without function XG03: Without function XD03: DC bus choke XLL ⏚ Equipment grounding conductor (required)

XMV*-W0210

Table 99: Connection points

Front	Top	Bottom
		
XD02: DC bus ⏚ Equipment grounding conductor (required; connection to the left or right) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD10: Control voltage XG02: Ready for operation relay contact ⏚ Equipment grounding conductor (optional; connection to the left or right)	XG20: Without function XG03: Without function XD03: DC bus choke XLL ⏚ Equipment grounding conductor (required; connection to the left or right)

9.3.10 Control section connection points

Control section types

Control sections are not stand-alone products, but integrated parts of the drive controllers and supply units.

Type code

The type code positions 15 ... 25 define the control sections.

Table 100: Type code (control unit)

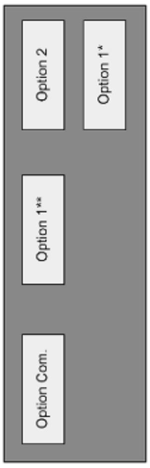
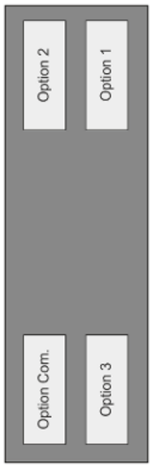
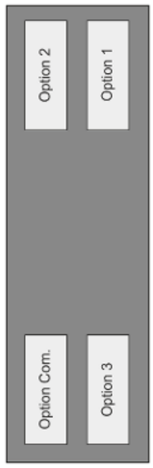
Short type designation										1										2										3										4
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	C	S	2	-	W	0	0	5	4	A	B	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	1	R	S	N	2	N	N	N	2	D	N	N
															⑦		⑧	⑨		⑩		⑪		⑫																

⑦	**Control section design:** 01 = ctrlX DRIVE 02 = ctrlX DRIVEplus
⑧	**Control panel:** N = Without A = With control panel
⑨	**Communication option:** ET = Multi-Ethernet EX = Multi-Ethernet incl. ctrlX OS X3 = ctrlX CORE DL = DRIVElink
⑩	**Option 1 (safety technology):** T0 = Safe Torque Off (STO) M5 = SafeMotion (M5) M8 = SafeMotion (M8)
⑪	**Option 2:** EC = Multi-encoder interface NN = Not equipped
⑫	**Option 3:** EC = Multi-encoder interface ET = Multi-Ethernet DA = Digital/analog I/O extension NN = Not equipped

Mounting and installation

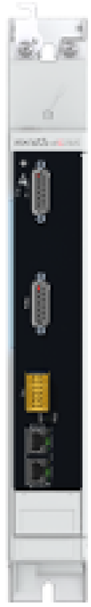
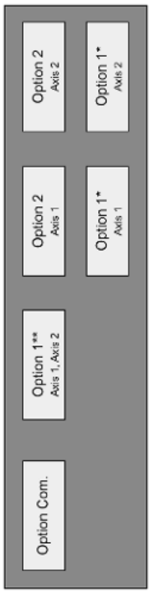
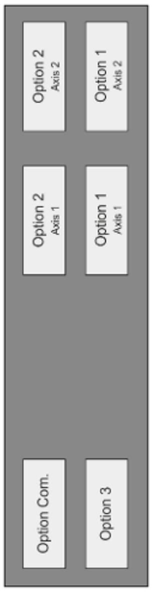
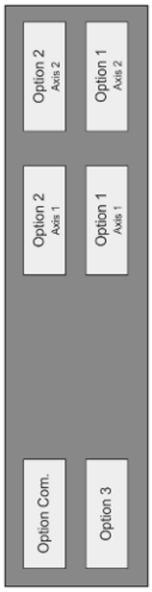
Single-axis (XMS, XCS)

Table 101: Single-axis

Example XCS with ctrlX DRIVEplus + ctrlX CORE			ctrlX DRIVE	ctrlX DRIVEplus	ctrlX DRIVEplus + ctrlX CORE
					
XMS	Option 1 (safety technology)	T0 = Safe Torque Off (STO)	✓	✓	-
		M5 = SafeMotion (M5)	-	✓	
		M8 = SafeMotion (M8)	-	✓	
	Option 2	EC = Multi-encoder interface	✓	✓	
		NN = Not equipped	✓	✓	
	Option 3	ET = Multi-Ethernet	-	-	
		EC = Multi-encoder interface	-	✓	
		DA = Digital/analog I/O extension	-	✓	
		NN = Not equipped	✓	✓	
	Option Com. (communication)	ET = Multi-Ethernet	✓	✓	
		DL = DRIVElink	-	✓	
		X3 = ctrlX CORE	-	-	
XCS	Option 1 (safety technology)	T0 = Safe Torque Off (STO)	✓	✓	✓
		M5 = SafeMotion (M5)	-	✓	✓
		M8 = SafeMotion (M8)	-	✓	✓
	Option 2	EC = Multi-encoder interface	✓	✓	✓
		NN = Not equipped	✓	✓	✓
	Option 3	ET = Multi-Ethernet	-	-	✓
		EC = Multi-encoder interface	-	✓	-
		DA = Digital/analog I/O extension	-	✓	-
		NN = Not equipped	✓	✓	-
	Option Com. (communication)	ET = Multi-Ethernet	✓	✓	-
		EX = Multi-Ethernet incl. ctrlX OS	-	✓	-
		DL = DRIVElink	-	✓	-
		X3 = ctrlX CORE	-	-	✓
* : XCS1, XMS1 ** : XCS2, XMS2					

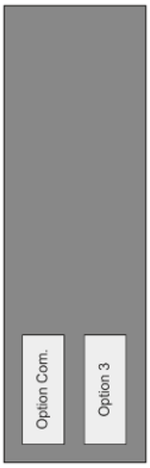
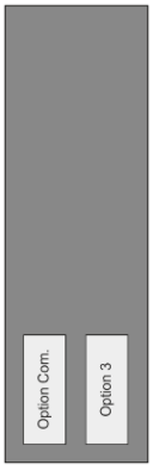
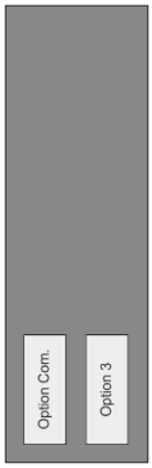
Double-axis (XMD, XCD)

Table 102: Double-axis

Example: XMD with ctrlX DRIVE			ctrlX DRIVE	ctrlX DRIVEplus	ctrlX DRIVEplus + ctrlX CORE
					
XMD	Option 1 (safety technology)	T0 = Safe Torque Off (STO)	✓	✓	-
		M5 = SafeMotion (M5)	-	✓	
		M8 = SafeMotion (M8)	-	✓	
	Option 2	EC = Multi-encoder interface	✓	✓	
		NN = Not equipped	✓	✓	
	Option 3	ET = Multi-Ethernet	-	-	
		NN = Not equipped	✓	✓	
	Option Com. (communication)	ET = Multi-Ethernet	✓	✓	
		DL = DRIVElink	-	-	
		X3 = ctrlX CORE	-	-	
XCD	Option 1 (safety technology)	T0 = Safe Torque Off (STO)	✓	✓	✓
		M5 = SafeMotion (M5)	-	✓	✓
		M8 = SafeMotion (M8)	-	✓	✓
	Option 2	EC = Multi-encoder interface	✓	✓	✓
		NN = Not equipped	✓	✓	✓
	Option 3	ET = Multi-Ethernet	-	-	✓
		NN = Not equipped	✓	✓	-
	Option Com. (communication)	ET = Multi-Ethernet	✓	✓	-
		EX = Multi-Ethernet incl. ctrlX OS	-	✓	-
		DL = DRIVElink	-	-	-
		X3 = ctrlX CORE	-	-	✓
* : XCD1, XMD1 ** : XCD2, XMD2					

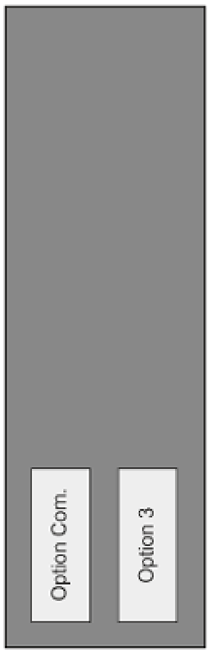
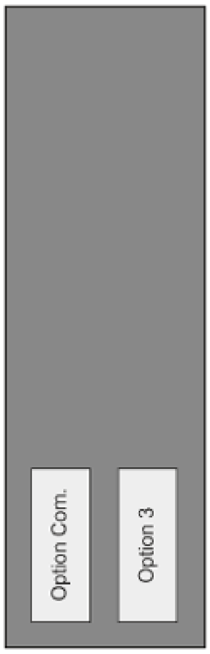
Supply unit (XVE, XVR)

Table 103: Supply unit

Example XVR with ctrlX DRIVEplus + ctrlX CORE			ctrlX DRIVE	ctrlX DRIVEplus	ctrlX DRIVEplus + ctrlX CORE
					
XVE XVR	Option 3	ET = Multi-Ethernet	-	-	✓
		NN = Not equipped	-	-	-
	Option Com. (communication)	ET = Multi-Ethernet	✓	✓	-
		EX = Multi-Ethernet incl. ctrlX OS	-	✓	-
		DL = DRIVElink	-	-	-
		X3 = ctrlX CORE	-	-	✓

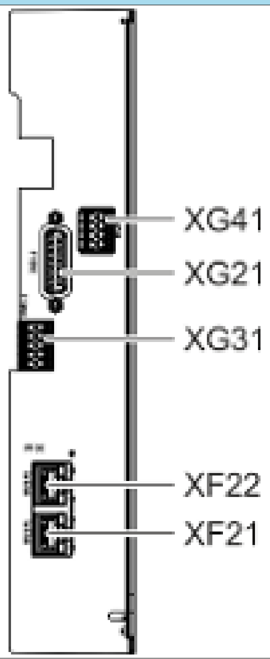
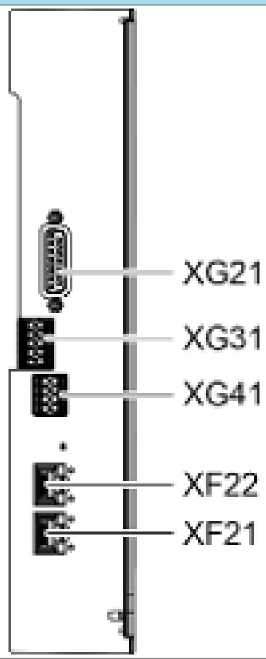
DC/DC converter (XMV)

Table 104: DC/DC converter

<table>
<tr><td colspan="3">Example: XMV with ctrlX DRIVEplus + ctrlX CORE
</td><td>ctrlX DRIVE

</td><td>ctrlX DRIVEplus + ctrlX CORE

</td></tr>
<tr><td rowspan="4">XMV</td><td rowspan="2">Option 3</td><td>ET = Multi-Ethernet</td><td>-</td><td>✓</td></tr>
<tr><td>NN = Not equipped</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Option Com. (communication)</td><td>ET = Multi-Ethernet</td><td>✓</td><td>-</td></tr>
<tr><td>X3 = ctrlX CORE</td><td>-</td><td>✓1)</td></tr>
<tr><td colspan="5">1) not for XMV*-W0050</td></tr>
</table>

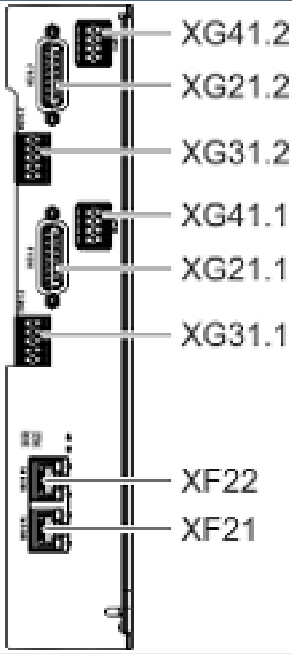
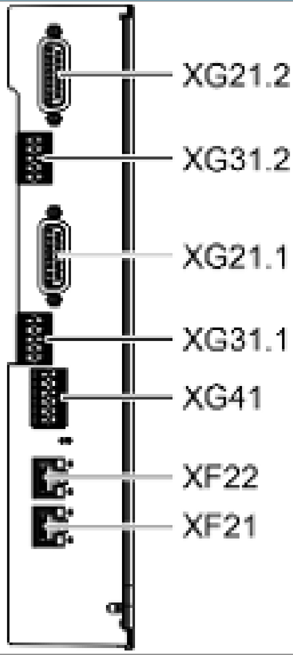
ctrlX DRIVE single-axis

Table 105: Connection points

<table>
<tr><th>XCS1, XMS1</th><th>XCS2, XMS2</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td colspan="2">XF21, XF22: ET communication
XG21: Multi-encoder; optional
XG31: Digital inputs/outputs, analog inputs
XG41, safety technology Safe Torque Off</td></tr>
</table>

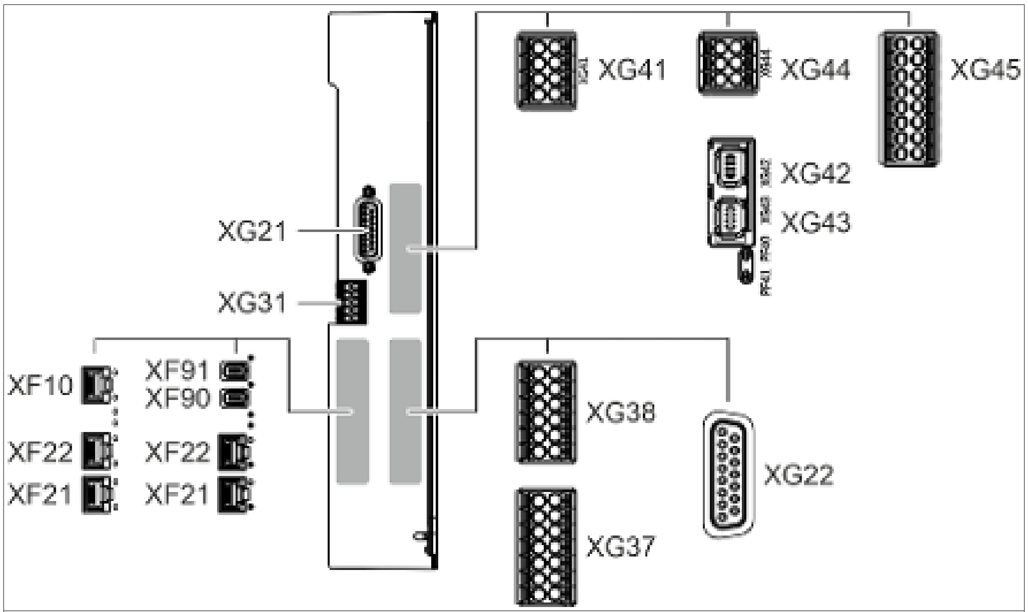
ctrlX DRIVE double-axis

Table 106: Connection points

<table>
<tr><th>XCD1, XMD1</th><th>XCD2, XMD2</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td colspan="2">Xxxx.1: Axis 1
Xxxx.1: Axis 2
XF21, XF22: ET communication
XG21: Multi-encoder; optional
XG31: Digital inputs/outputs, analog inputs
XG41, safety technology Safe Torque Off</td></tr>
</table>

ctrlX DRIVEplus single-axis

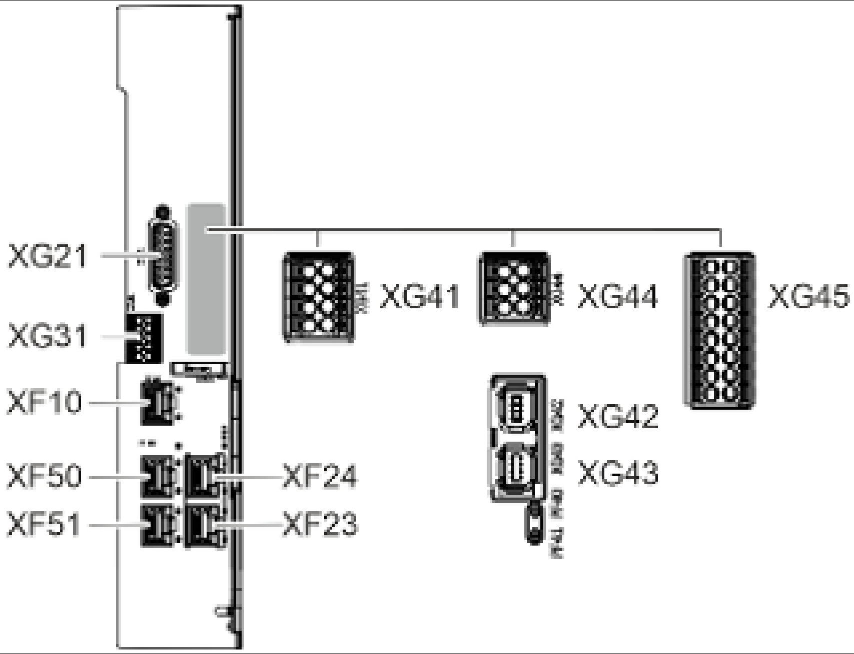
Table 107: Connection points



XF10, XF21, XF22: EX communication
XF21, XF22: ET communication
XF90, XF91: DL communication
XG21: Multi-encoder; optional
XG22: Multi-encoder; optional
XG31: Digital inputs/outputs, analog inputs
XG37, XG38: I/O extension digital/analog; optional
XG41: Safety technology (Safe Torque Off); optional
XG42, XG43, XG44: Safety technology (SafeMotion M5); optional
XG45: Safety technology (SafeMotion M8); optional

ctrlX DRIVEplus + CORE single-axis

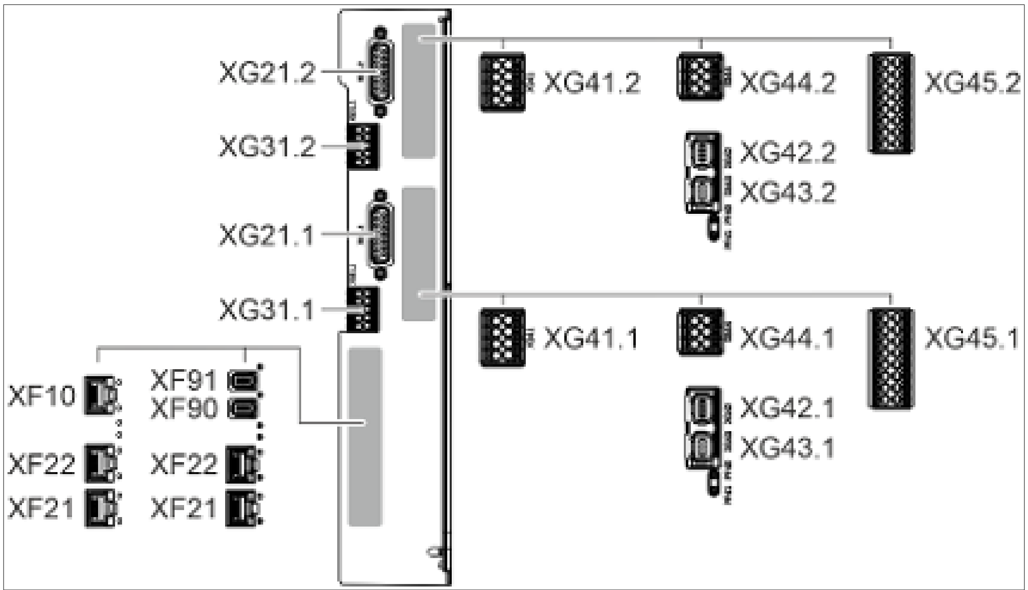
Table 108: Connection points



XF10, XF50, X51: ctrlX DRIVE CORE
XF23, XF24: ET communication
XG21: Multi-encoder; optional
XG31: Digital inputs/outputs, analog inputs
XG41: Safety technology (Safe Torque Off); optional
XG42, XG43, XG44: Safety technology (SafeMotion M5); optional
XG45: Safety technology (SafeMotion M8); optional

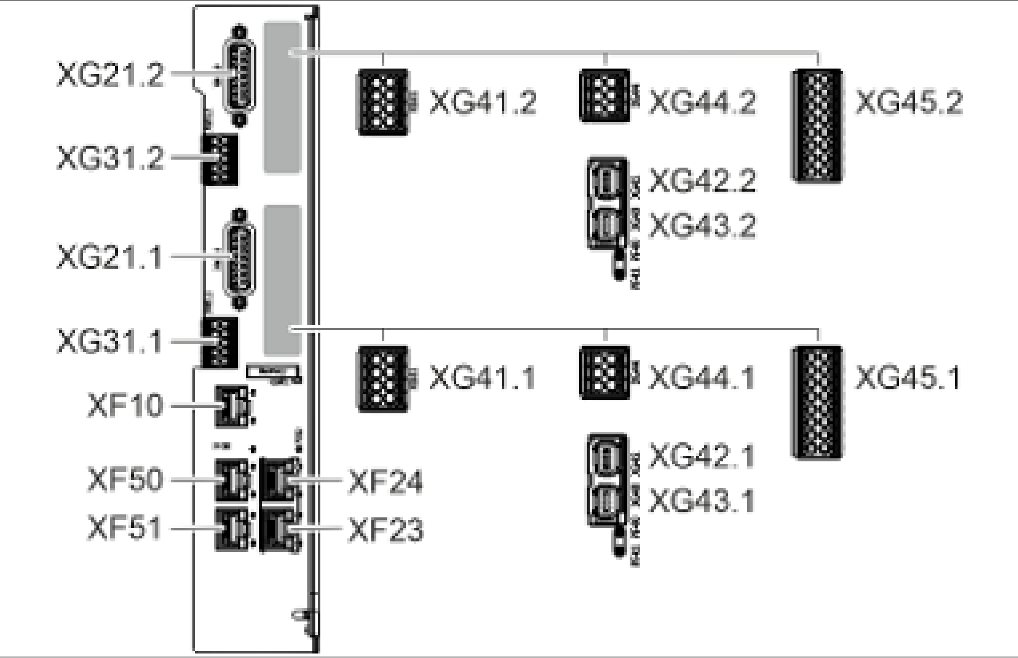
ctrlX DRIVEplus double-axis

Table 109: Connection points


Xxxx.1: Axis 1 Xxxx.1: Axis 2 XF10, XF21, XF22: EX communication XF21, XF22: ET communication XF90, XF91: DL communication XG21: Multi-encoder; optional XG31: Digital inputs/outputs, analog inputs XG41: Safety technology (Safe Torque Off); optional XG42, XG43, XG44: Safety technology (SafeMotion M5); optional XG45: Safety technology (SafeMotion M8); optional

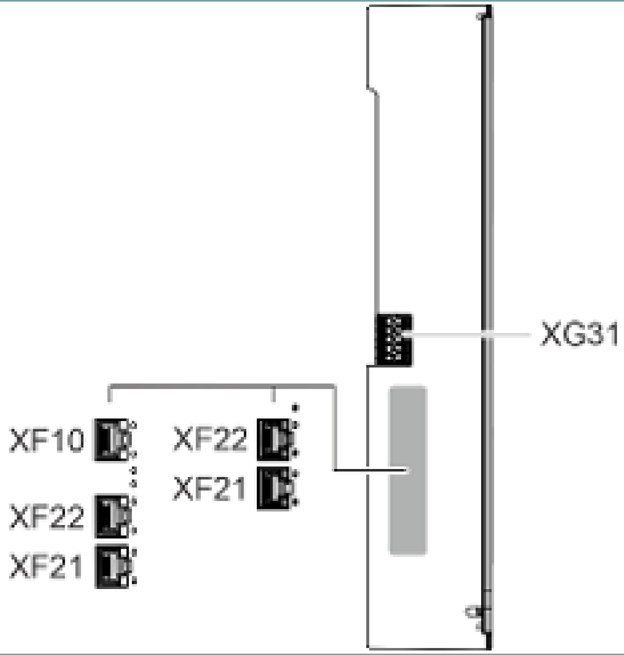
ctrlX DRIVEplus + CORE double-axis

Table 110: Connection points

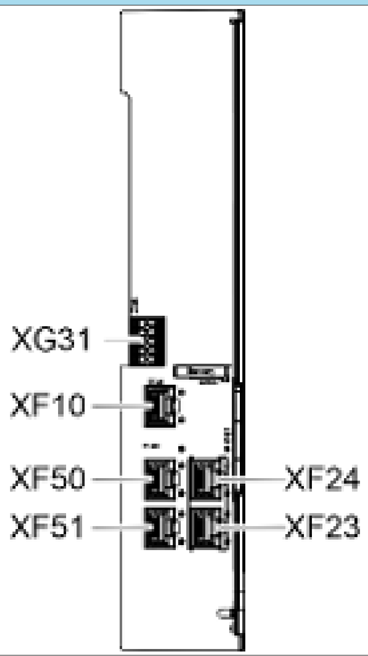


Xxxx.1: Axis 1
Xxxx.1: Axis 2
XF10, XF50, XF51: ctrlX DRIVE CORE
XF23, XF24: ET communication
XG21: Multi-encoder; optional
XG31: Digital inputs/outputs, analog inputs
XG41: Safety technology (Safe Torque Off); optional
XG42, XG43, XG44: Safety technology (SafeMotion M5); optional
XG45: Safety technology (SafeMotion M8); optional

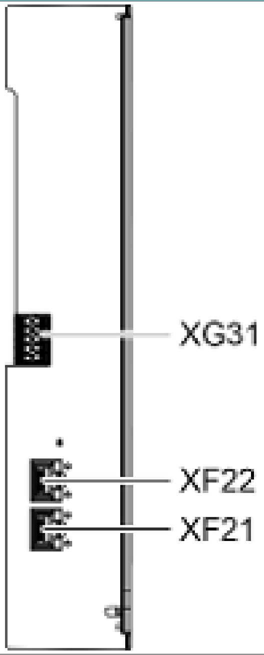
ctrlX DRIVE supply unit

XVE, XVR

XF10, XF21, XF22: EX communication XF21, XF22: ET communication XG31: Digital inputs/outputs, analog inputs

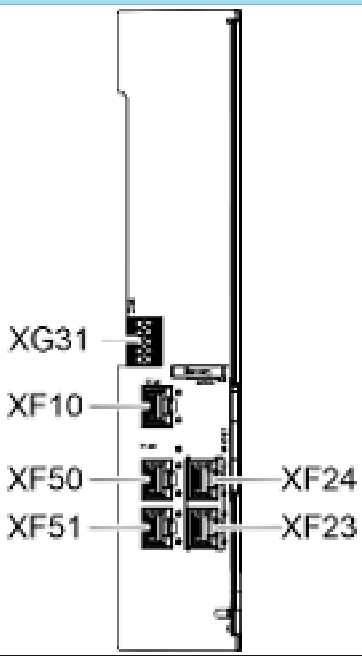
ctrlX DRIVEplus + CORE supply unit

XVE, XVR

XF10, XF50, XF51: ctrlX DRIVE CORE XF23, XF24: Communication XG31: Digital inputs/outputs, analog inputs

ctrlX DRIVE DC/DC converter

XMV

XF21, XF22: Communication XG31: Digital inputs/outputs, analog inputs

ctrlX DRIVEplus + CORE DC/DC converter

XMV

XF10, XF50, XF51: ctrlX DRIVE CORE (not for XMV*-W0050) XF23, XF24: Communication XG31: Digital inputs/outputs, analog inputs

9.3.11 On-board connection points

Equipment grounding conductor

⚠ WARNING	High housing voltage and high leakage current! Danger to life, risk of injury by electric shock! – Prior to commissioning the components, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points. – Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA. – Establish an equipment grounding connection with a copper wire of a cross section of at least 10 mm². Additionally run a second equipment grounding conductor of the same cross section as the original equipment grounding conductor.

⚠ WARNING	Lethal electric shock due to live parts with more than 50 V! Only operate the device – with connected connectors (even if no lines are connected to the connectors) and – with connected equipment grounding conductor!

Equipment grounding conductor: Material and cross section

Use the same metal (e.g., copper) for the equipment grounding conductor as for the outer conductors.

When connecting the equipment grounding conductor connection point of the device to the equipment grounding system within the control cabinet, take into account that a sufficient cable cross section is required.

Cross section of equipment grounding connection: **Minimum 10 mm²**, but not smaller than the cross section of the supply feeder.

Additionally mount the housing on a metallic, uncoated mounting plate. Also connect the mounting plate with at least the same cross-section to the protective conductor system in the control cabinet.

Required and **optional** connection points of the equipment grounding conductor:

See description of the device:

– ➦ Chapter 9.3.3 XCS, power section connection points on page 192
– ➦ Chapter 9.3.4 XCD, power section connection points on page 197
– ➦ Chapter 9.3.5 XMS, power section connection points on page 198
– ➦ Chapter 9.3.6 XMD, power section connection points on page 203
– ➦ Chapter 9.3.7 XVR, power section connection points on page 205
– ➦ Chapter 9.3.8 XVE, power section connection points on page 206
– ➦ Chapter 9.3.9 XMV, power section connection points on page 208

M5 (housing)

Connect ring cable lugs **M5** of equipment grounding conductors to device housing (⏚ symbol).

Tightening torque: 2.8 Nm

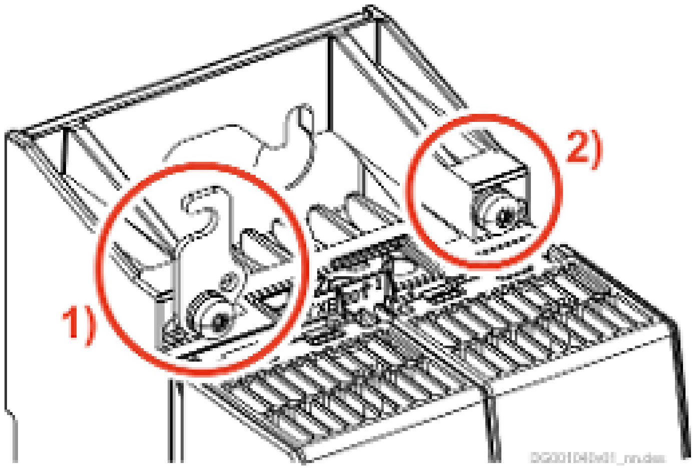


Fig. 87: Connection point of equipment grounding conductor

1) Equipment grounding conductor connection point with claw bolt for connection with neighboring device
2) Equipment grounding conductor connection

XCS*-W0100/120

Connect ring cable lugs **M5** of equipment grounding conductors to device housing (⏚ symbol).

Tightening torque: 4.5 Nm

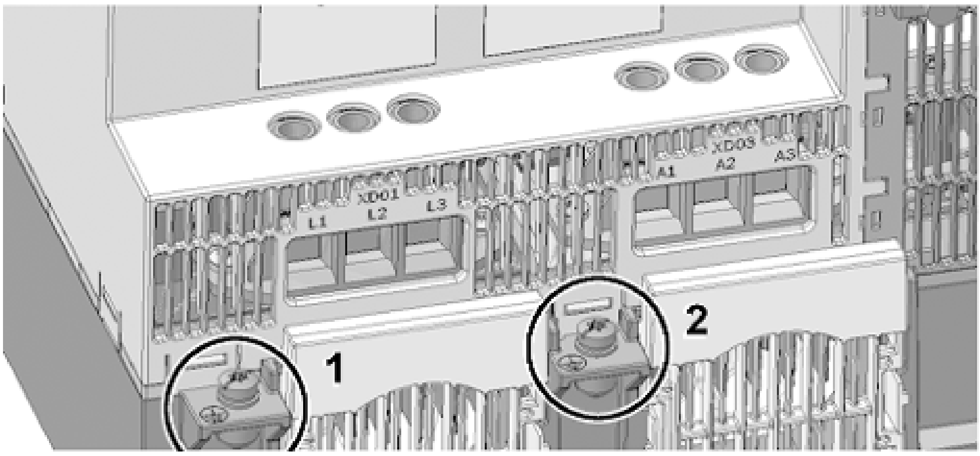


Fig. 88: Connection point of equipment grounding conductor

1 Mains
2 Motor

XCS*/XMS*-W0150/180, XVR*-W0048/72/100, XVE*-W0075

Connect ring cable lugs **M6** of equipment grounding conductors to device housing (⏚ symbol).

Tightening torque: 4 ... 5 Nm

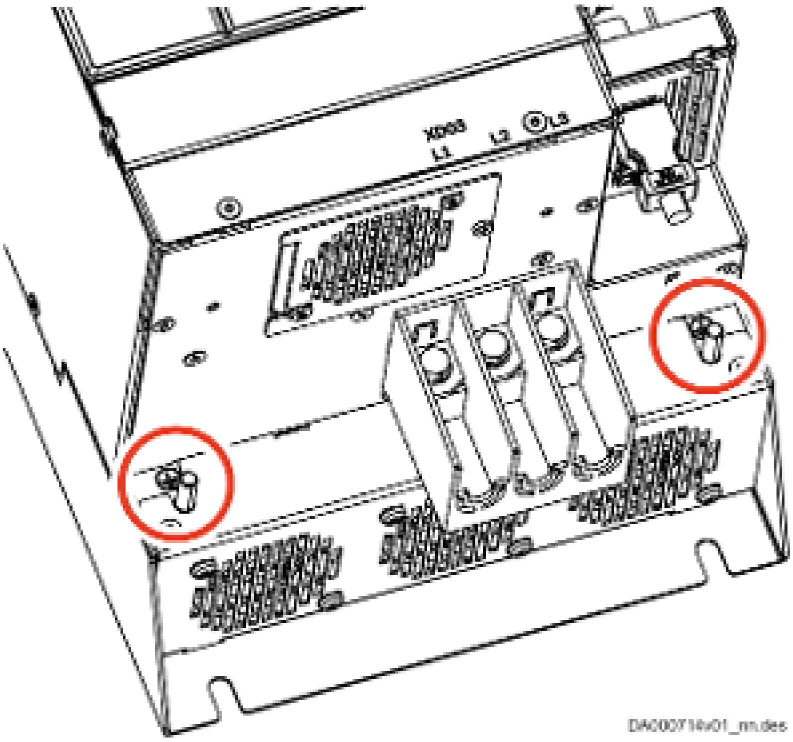


Fig. 89: Connection point of equipment grounding conductor (XVR*-W0048, for example)

XCS*/XMS*-*02xx/*03xx, XVE*-W0125

Connect ring cable lugs M8 of equipment grounding conductors to device housing (⏚ symbol).

Tightening torque: 8 Nm

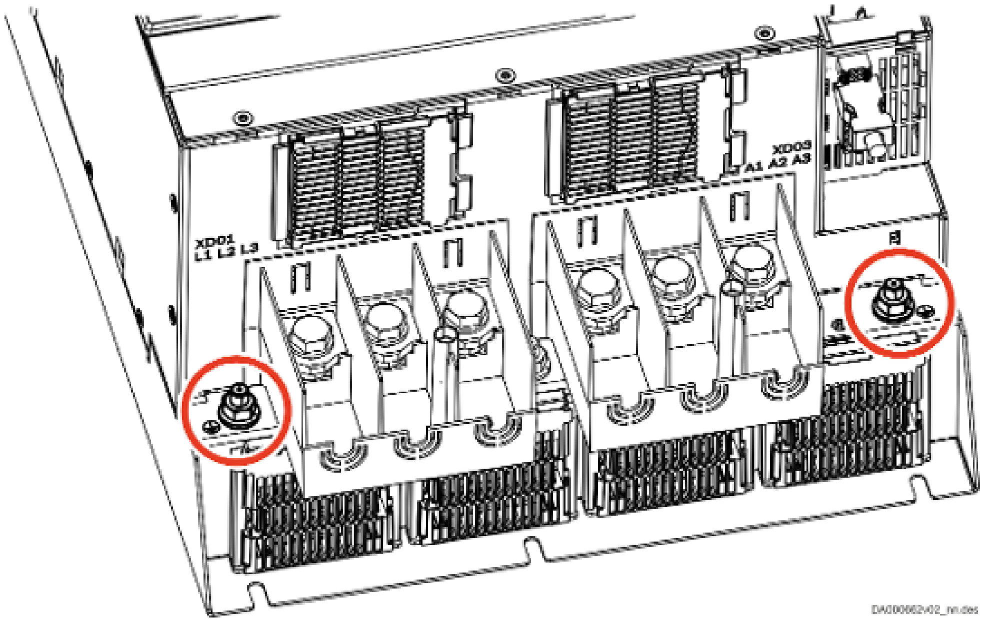


Fig. 90: Connection point of equipment grounding conductor (XCS*-W02xx, for example)

XD01, mains connection

Important information

⚠ WARNING	**Lethal electric shock due to live parts with more than 50 V!** Only operate the device – with connected connectors (even if no lines are connected to the connectors) and – with connected equipment grounding conductor!

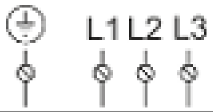
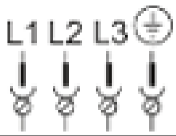
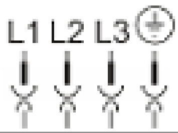
NOTICE	**Risk of damage to the device!** Provide strain relief for the terminals of the device in the control cabinet.

Connectors included in scope of delivery.

Overview

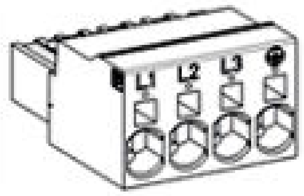
There are different types of connections:

- Screw connection at device ( ).
- Screw connection at connector ( ).
- Spring terminal at connector ( ).

Component	PE + XD01 	XD01 	XD01 
XCS	0100, 0120: 35 mm² 0150, 0180: 50 mm² 02xx: 120 mm² 03xx: 2×70 mm²	0054, 0070, 0090: 16 mm²	0010, 0023: 10 mm²
XCD	-	-	2323: 10 mm²
XVR/XLI	0048: 35 mm² 0072: 50 mm² 0100: 120 mm²	0019: 16 mm²	-
XVE	0075: 50 mm² 0125: 2×70 mm²	0030: 16 mm²	-

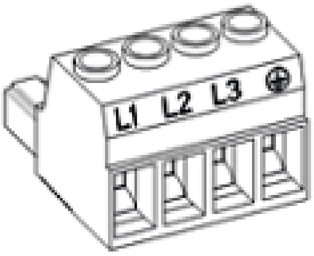
XD01, mains connection (10 mm²)

Table 111: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
	⏚	Equipment grounding conductor connection	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable Cross section flexible 1 conductor	mm^2	0.2	6
	AWG	24	10
with ferrule without plastic sleeve	mm^2	0.25	6
	AWG	24	10
with ferrule with plastic sleeve	mm^2	0.25	4
	AWG	24	12
Cross section flexible 2 conductors with twin ferrule with plastic sleeve	mm^2	0.25	1.5
	AWG	24	16
Cross section rigid	mm^2	0.2	10
	AWG	24	8
Stripped length	mm	15	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

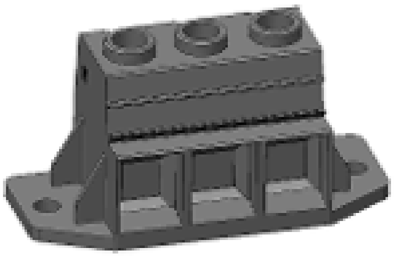
XD01, mains connection (16 mm²)

Table 112: Function, pin assignment, properties

<table>
<tr><th>View</th><th>Identifica-tion</th><th colspan="2">Function</th></tr>
<tr><td rowspan="4">
</td><td>L1</td><td colspan="2">Connection to power grid (L1)</td></tr>
<tr><td>L2</td><td colspan="2">Connection to power grid (L2)</td></tr>
<tr><td>L3</td><td colspan="2">Connection to power grid (L3)</td></tr>
<tr><td>⏚</td><td colspan="2">Equipment grounding conductor connection</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Screw connection at connector</td><td>Unit</td><td>min.</td><td>max.</td></tr>
<tr><td rowspan="2">Connection cable
Cross section flexible</td><td>mm²</td><td>0.5</td><td>16</td></tr>
<tr><td>AWG</td><td>20</td><td>6</td></tr>
<tr><td rowspan="2">With ferrule with/without plastic sleeve</td><td>mm²</td><td>0.25</td><td>16</td></tr>
<tr><td>AWG</td><td>22</td><td>6</td></tr>
<tr><td rowspan="2">Cross section rigid</td><td>mm²</td><td>0.2</td><td>16</td></tr>
<tr><td>AWG</td><td>22</td><td>6</td></tr>
<tr><td>Stripped length</td><td>mm</td><td colspan="2">12</td></tr>
<tr><td>Tightening torque</td><td>Nm</td><td>1.2</td><td>2</td></tr>
<tr><td>Occurring current load and minimum required connection cross section</td><td></td><td colspan="2">See technical data of device used (I_{LN} and A_{LN})</td></tr>
<tr><td>Occurring voltage load</td><td></td><td colspan="2">See technical data of device used (U_{LN} or U_{LN_nom})</td></tr>
</table>

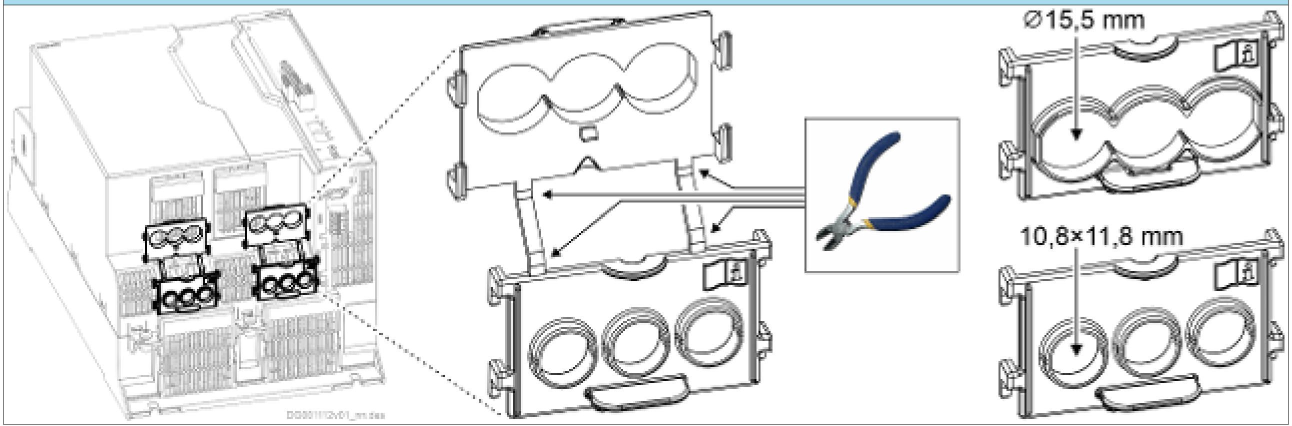
XD01, mains connection (35 mm²)

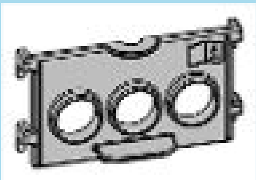
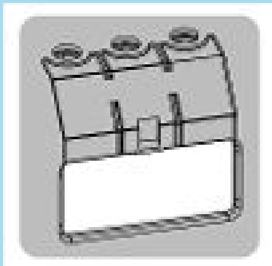
Table 113: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
Terminal block	**Unit**	**min.**	**max.**
Connection cable Cross section flexible 1 conductor	mm²	0.5	35
	AWG	20	2
with ferrule without plastic sleeve	mm²	1	35
	AWG	18	2
with ferrule with plastic sleeve	mm²	1.5	35
	AWG	16	2
Cross section flexible 2 conductors	mm²	0.5	6
	AWG	20	10
with ferrule without plastic sleeve	mm²	0.5	4
	AWG	20	12
with twin ferrule with plastic sleeve	mm²	0.5	16
	AWG	20	6
Cross section rigid 1 conductor	mm²	0.5	35
	AWG	20	2
Cross section rigid 2 conductors	mm²	0.5	6
	AWG	20	10
Stripped length	mm	18	
Tightening torque (< 25 mm²)	Nm	2.5	
Tightening torque (≥ 25 mm²)	Nm	4.5	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

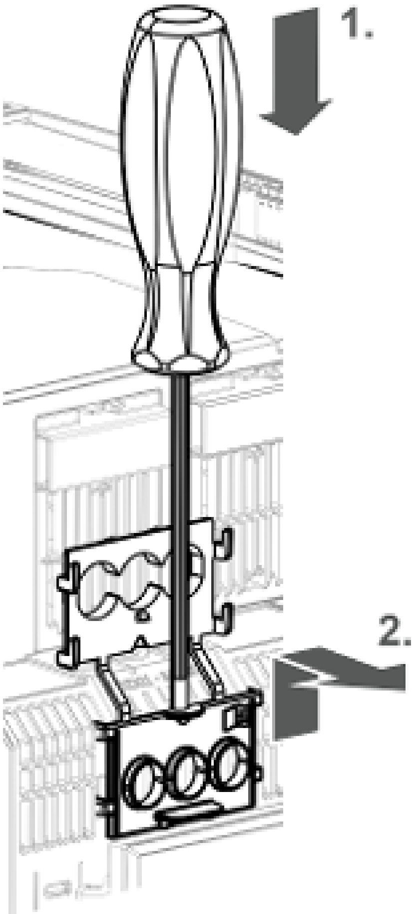
Cable feedthrough 35 mm²

The device comes with a cable feedthrough (R911410689) at **35 mm²** connection points.

Cable feedthrough


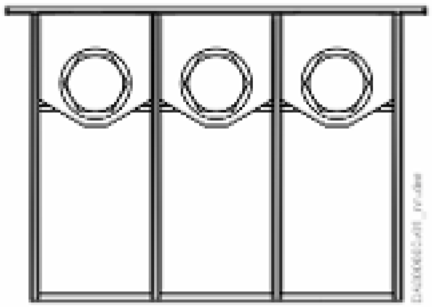
Use			
Cable Connection	Opening width [mm]		
	10.8×11.8 	⌀15.5 	44.1×21.4  Device; cable feed-through dismounted
⌀ cable (outer diameter)	2.5 ... 10.5 mm	10.6 ... 15 mm	-
1 × with/without ferrule	1.5 ... 16 mm^2 AWG16 ... 6	25 ... 35 mm^2 AWG4 ... 2	-
2 × with twin ferrule	1.5 ... 4 mm^2 AWG16 ... 12	6 ... 10 mm^2 AWG10 ... 8	16 mm^2 AWG6
2 × without ferrule	1.5 ... 6 mm^2 AWG16 ... 10	-	-
2 × with ferrule (without a plastic collar)	1.5 ... 4 mm^2 AWG16 ... 12	-	-

Notes for assembly		
Opening width 10.8×11.8 is matching	Opening width ⌀15.5 is required	No cable feedthrough required
Leave the cable feedthrough at the device and remove the excess part of the cable feedthrough (e.g. using a wire cutter).	• Dismount cable feedthrough (dismounting: see below). • Remove the excess part of the cable feedthrough (e.g. using a wire cutter). • Assemble cable feedthrough with opening width ⌀15.5.	Dismount cable feedthrough (dismounting: see below).

Dismounting	
	• Insert the screwdriver (Torx T20) into the cable feedthrough and carefully press it down as far as it will go and keep it pressed. • First move the cable feedthrough vertically upwards and subsequently remove it.

XD01, mains connection (50 mm²)

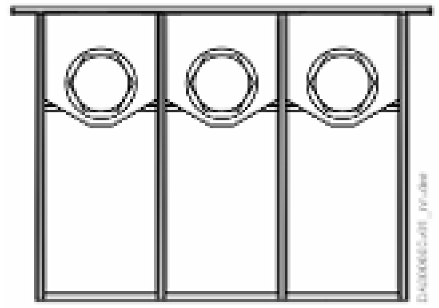
Table 114: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M6	
Tightening torque	Nm	4	5
Connection cable flexible with ring cable lug[1)]	mm^2	1×50 2×25	
	AWG	1×1/0	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**; with a cable cross section of 50 mm^2, the ring cable lug may not exceed a maximum width of **18 mm** in the contact area (recommendation: use DIN 46234-6-50 ring cable lugs)

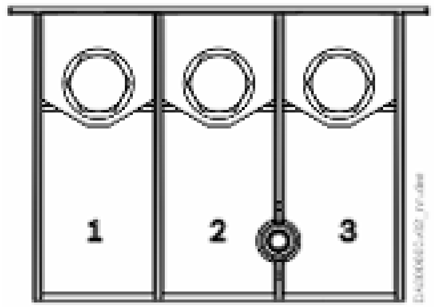
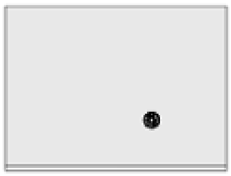
XD01, mains connection (120 mm²)

Table 115: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
Terminal block	**Unit**	**min.**	**max.**
Connection cable	mm²	1×16, 2×16	1×120, 2×120
Flexible	AWG	1×6, 2×4	1×4/0, 2×4/0
Thread		M10	
Tightening torque	Nm	16	20
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

XD01, mains connection (2×70 mm²)

Table 116: Function, pin assignment, properties

<table>
<tr><th colspan="2">View</th><th>Identifica-tion</th><th colspan="2">Function</th></tr>
<tr><td colspan="2" rowspan="3">
</td><td>L1</td><td colspan="2">Connection to power grid (L1)</td></tr>
<tr><td>L2</td><td colspan="2">Connection to power grid (L2)</td></tr>
<tr><td>L3</td><td colspan="2">Connection to power grid (L3)</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="2">Terminal block</td><td>Unit</td><td>min.</td><td>max.</td></tr>
<tr><td colspan="2" rowspan="2">Connection cable
Flexible</td><td>mm²</td><td>1×16, 2×16</td><td>1×120, 2×120</td></tr>
<tr><td>AWG</td><td>1×6, 2×4</td><td>1×4/0, 2×4/0</td></tr>
<tr><td colspan="2">Thread</td><td></td><td colspan="2">M10</td></tr>
<tr><td colspan="2">Tightening torque</td><td>Nm</td><td>16</td><td>20</td></tr>
<tr><td>Touch guard:
tightening torque (screw: torx T20, captive)</td><td></td><td>Nm</td><td>-</td><td>2</td></tr>
<tr><td colspan="2">Occurring current load and minimum required connection cross section</td><td></td><td colspan="2">See technical data of device used (I_{LN} and A_{LN})</td></tr>
<tr><td colspan="2">Occurring voltage load</td><td></td><td colspan="2">See technical data of device used (U_{LN} or U_{LN_nom})</td></tr>
</table>

XD02, L+ L-, DC bus connection

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** Before working with live parts: De-energize installation and secure power switch against unintentional or unauthorized reconnection. Before accessing the device, wait at least **30 minutes** after switching off the supply voltages to allow **discharging.** Make sure voltage has fallen below 50 V before touching live parts! **Never operate the drive controller without a touch guard.**

Function, pin assignment

The DC bus connection connects

- multiple drive controllers
- a drive controller to a DC bus capacitor unit (to backup the DC bus voltage)

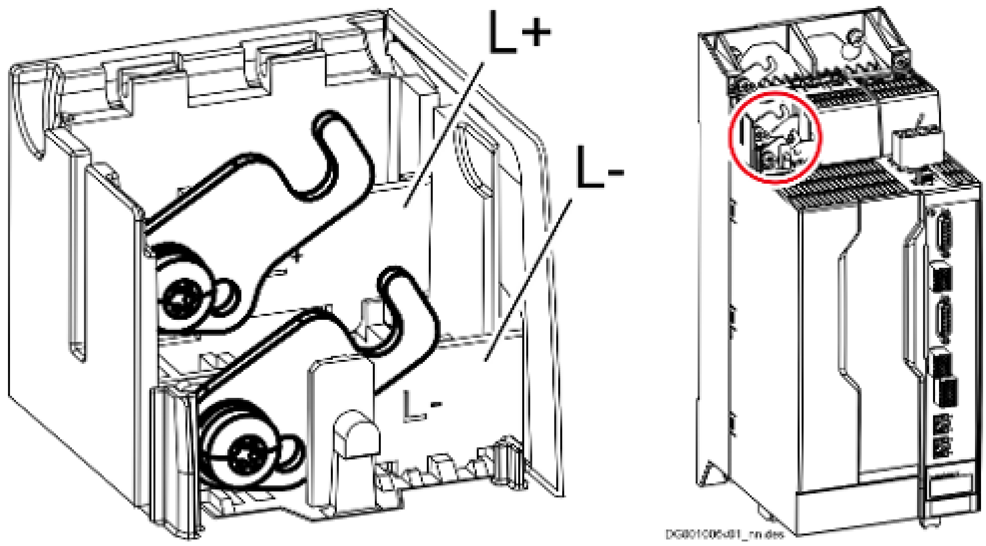


Fig. 91: Claw bolts for DC bus connection

Tightening torque 2.8 Nm

Short circuit protection	By fusing elements in the incoming circuit of the mains connection
Overload protection	
Current carrying capacity	120 A: • Drive controllers with a maximum current ≤ 120 A • Supply units with a rated power ≤ 30 kW 300 A: • Drive controllers with a maximum current ≥ 150 A • Supply units with a rated power ≥ 48 kW

Touch guard

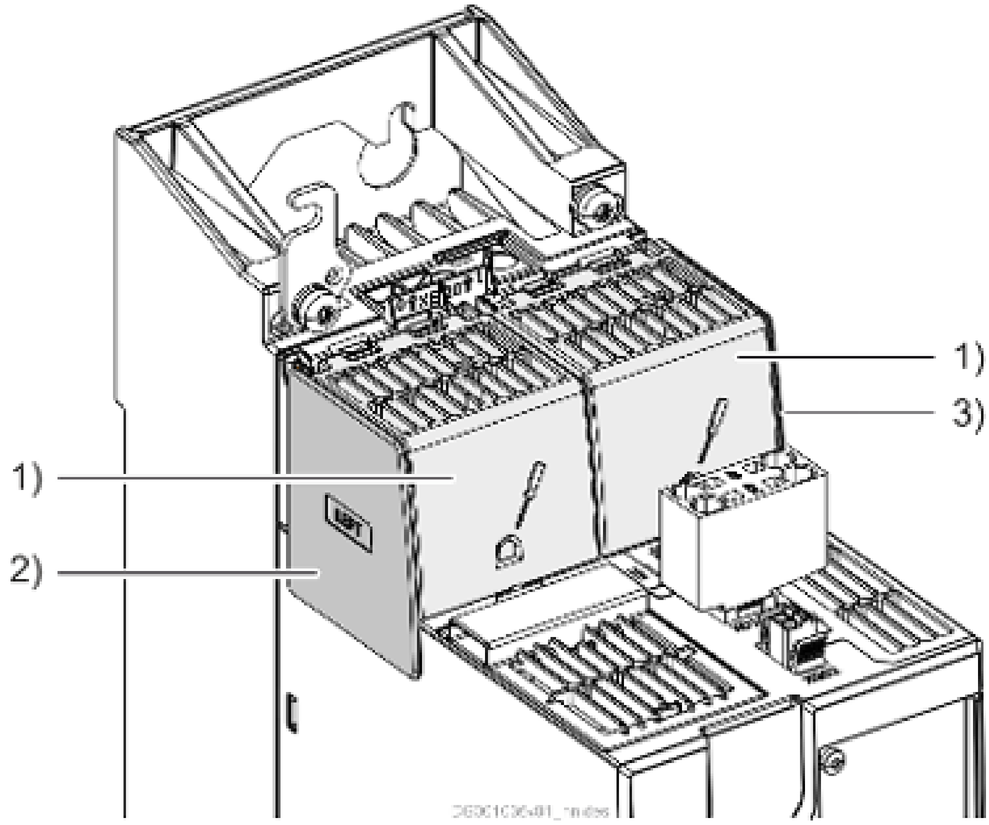


Fig. 92: Touch guard
1) Touch guard cover
2) Touch guard (LEFT; R911400453)
3) Touch guard (RIGHT; R911400452)

By default, these devices are provided with a touch guard.

The touch guard plate may only be removed to connect the DC buses of neighboring devices.

Disassemble touch guard

1. Unlock and open the touch guard cover.
2. Move the touch guard plate vertically upwards and remove it.

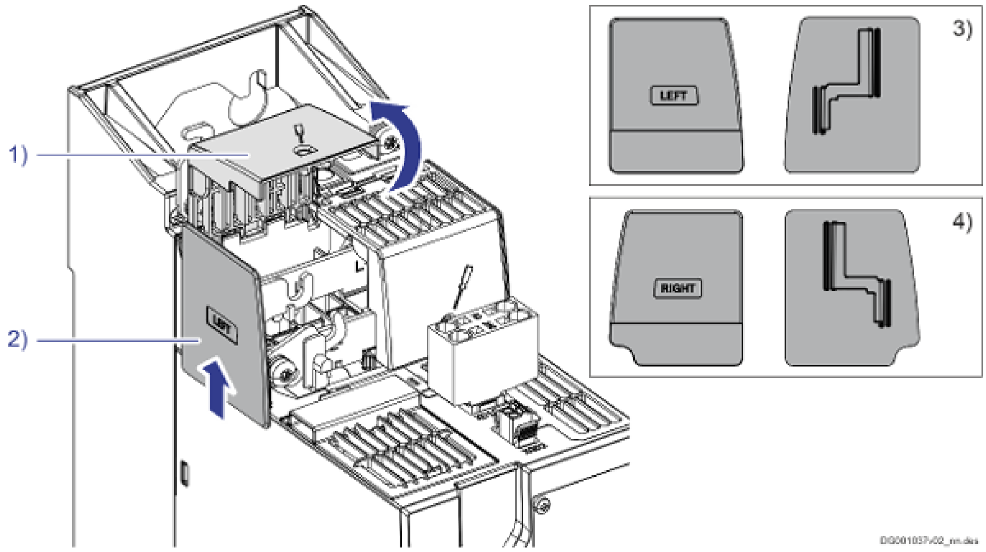
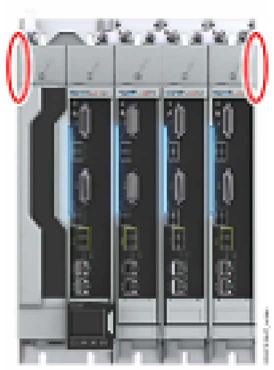


Fig. 93: Touch guard
1) Touch guard cover
2) Touch guard plate
3) Touch guard plate left (front side and back side)
4) Touch guard plate right (front side and back side)

Axis group

If multiple devices are mounted side by side in the axis group:

1. Before the assembly: Remove all unnecessary touch guard plates.
2. After the assembly: Make sure the touch guard plate has been fitted to the first and last device.



DC bus coupling of several devices

See ➦ Chapter 4.3.20 DC bus coupling on page 155.

XD03, motor connection

Important information

⚠ WARNING	**Lethal electric shock due to live parts with more than 50 V!** Only operate the device – with connected connectors (even if no lines are connected to the connectors) and – with connected equipment grounding conductor!

NOTICE	**Risk of damage to the device!** Provide strain relief for the terminals of the device in the control cabinet.

Connectors **not** included in scope of delivery.

Installation instructions

The specified connection cross sections are the cross sections that can be connected. Size the **required cross section** of the connection lines according to the occurring current load.

- Provide for optimum shield contact of the motor power cable.
- For the connection between drive controller and motor, use our ready-made motor power cables, where possible.

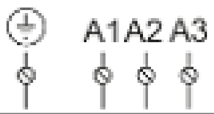
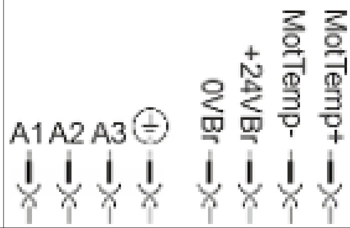
Motor connection: Overview

There are different types of connections:

- Screw connection at device ( ).
- Screw connection at connector ( ).
- Spring terminal at connector ( ).

The table below gives an overview of motor connections including the hybrid connection XZ03.

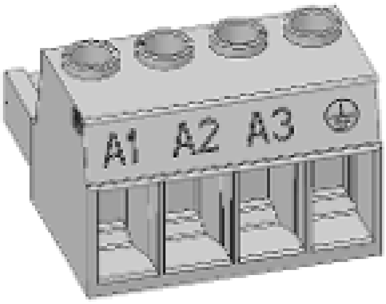
Table 117: Motor connection: Overview

Component	PE + XD03 	XD03 	XZ03 1) 
XCS	1× 0100, 0120: 35 mm² 0150, 0180: 50 mm² 02xx: 120 mm² 03xx: 2×70 mm²	1× 0054, 0070, 0090: 16 mm²	1× 0010, 0023: 10 mm²
XCD	-	-	2× 0606...2323: 10 mm²
XMS	1× 0100, 0120: 35 mm² 0150, 0180: 50 mm² 02xx: 120 mm² 03xx: 2×70 mm²	1× 0054, 0070, 0090: 16 mm²	1× 0006...0036: 10 mm²
XMD	-	2× W5454, W7070: 16 mm²	2× 0606...3636: 10 mm²

PE + XD03: Screw connection at device
XD03: Screw connection at connector
XZ03: Spring terminal at connector
1) See ➦ Chapter XZ03, hybrid connection (motor, motor temperature monitoring and motor holding brake) on page 278

XD03, motor connection (16 mm²)

Table 118: Function, pin assignment, properties

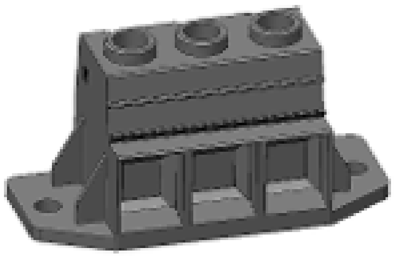
View	Identification	Function	
	A1	For power connection U1 at motor	
	A2	For power connection V1 at motor	
	A3	For power connection W1 at motor	
	⏚	For equipment grounding connection at motor	
Screw connection at connector	**Unit**	**min.**	**max.** 1)
Connection cable	mm^2	0.75	16
Cross section flexible 1 conductor	AWG	18	6
with wire end ferrule without plastics material sleeve	mm^2	0.5	16
	AWG	20	6
with wire end ferrule with plastics material sleeve	mm^2	0.5	10
	AWG	20	8
Cross section flexible 2 conductors	mm^2	0.75	6
	AWG	18	10
with wire end ferrule without plastics material sleeve	mm^2	0.5	4
	AWG	20	12
with twin wire end ferrule with plastics material sleeve	mm^2	0.5	6
	AWG	20	10
Cross section rigid	mm^2	0.75	16
	AWG	18	6
Cross section rigid 2 conductors	mm^2	0.75	6
	AWG	18	10
Stripped length	mm	12	
Tightening torque	Nm	1.7	1.8
Occurring current load and minimum required connection cross section	A	See technical data of device used (I_{out})	
Occurring voltage load	V	See technical data of device used (U_{out})	
Short circuit protection		A1, A2, A3 against each other and each of them against ground	

1) Wire end ferrule only allowed **without** plastic sleeve.

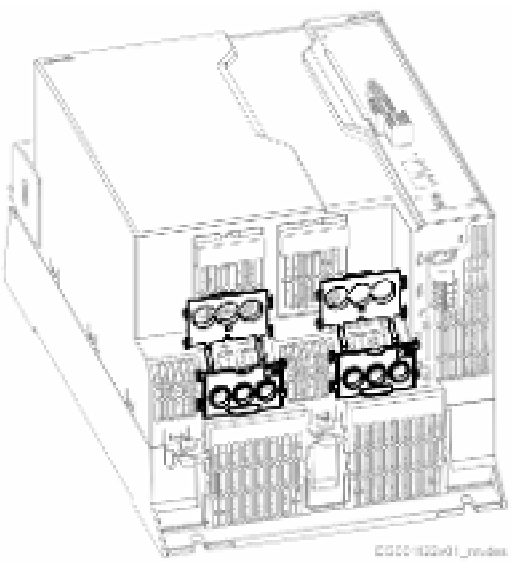
Shield connection accessories:

- XCS*-*0054/70: XAS2-006-003-NN; ➦ Chapter XAS2-006-003-NN on page 406
- XCS*-W0090: XAS2-009-003-NN; ➦ Chapter XAS2-009-003-NN on page 411
- XMS*-*0054/70: XAS2-005-003-NN; ➦ Chapter XAS2-005-003-NN on page 405
- XMS*-W0090: XAS2-005-003-NN; ➦ Chapter XAS2-005-003-NN on page 405

XD03, motor connection (35 mm²)

View	Identification	Function
	A1	For power connection U1 at motor
	A2	For power connection V1 at motor
	A3	For power connection W1 at motor

Terminal block	Unit	min.	max.
Connection cable	mm^2	0.5	35
Cross section flexible 1 conductor	AWG	20	2
with wire end ferrule without plastics material sleeve	mm^2	1	35
	AWG	18	2
with wire end ferrule with plastics material sleeve	mm^2	1.5	35
	AWG	16	2
Cross section flexible 2 conductors	mm^2	0.5	6
	AWG	20	10
with wire end ferrule without plastics material sleeve	mm^2	0.5	4
	AWG	20	12
with twin wire end ferrule with plastics material sleeve	mm^2	0.5	16
	AWG	20	6
Cross section rigid 1 conductor	mm^2	0.5	35
	AWG	20	2
Cross section rigid 2 conductors	mm^2	0.5	6
	AWG	20	10
Stripped length	mm	18	
Tightening torque (< 25 mm^2)	Nm	2.5	
Tightening torque (≥ 25 mm^2)	Nm	4.5	
Occurring current load and minimum required connection cross section	A	See technical data of device used (I_{out})	
Occurring voltage load	V	See technical data of device used (U_{out})	
Short circuit protection		A1, A2, A3 against each other and each of them against ground	

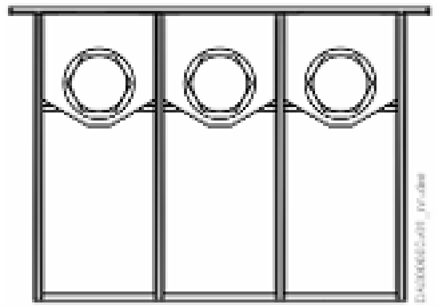
Cable feedthrough at the device:	➦Chapter XD01, mains connection (35 mm²) on page 231
	

Shield connection accessories:

- XCS*-W0100/120: XAS2-002-003-NN; ➦Chapter XAS2-002-003-NN on page 401

XD03, motor connection (50 mm²)

Table 119: Function, pin assignment, properties

View	Identification	Function
	A1	For power connection U1 at motor
	A2	For power connection V1 at motor
	A3	For power connection W1 at motor

Terminal block	Unit	min.	max.
Connection cable flexible with ring cable lug1)	mm²	1×50 2×25	
	AWG	1×1/0	
Screw thread		M6	
Tightening torque	Nm	4	5
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

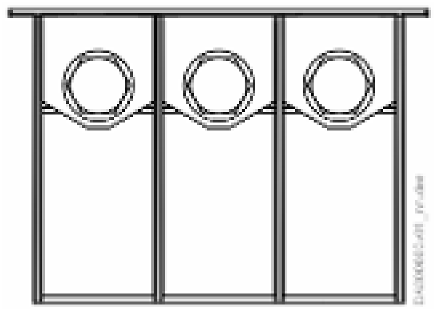
1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**; with a cable cross section of 50 mm², the ring cable lug may not exceed a maximum width of **18 mm** in the contact area (recommendation: use DIN 46234-6-50 ring cable lugs)

Shield connection accessories:

- XCS*-W0150/180:
  - XAS2-007-001-NN; ➦ Chapter XAS2-007-001-NN on page 407
  - XAS2-007-002-NN; ➦ Chapter XAS2-007-002-NN on page 408
- XMS*-W0150/180:
  - XAS2-008-001-NN; ➦ Chapter XAS2-008-001-NN on page 409
  - XAS2-008-002-NN; ➦ Chapter XAS2-008-002-NN on page 410

XD03, motor connection (120 mm²)

Table 120: Function, pin assignment, properties

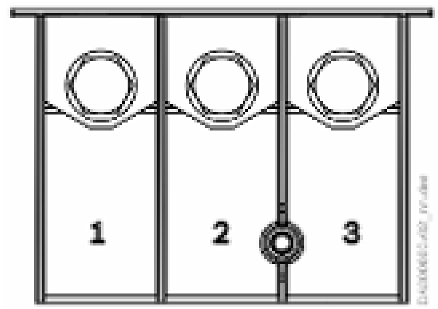
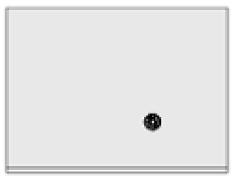
View	Identifica-tion	Function	
	A1	For power connection U1 at motor	
	A2	For power connection V1 at motor	
	A3	For power connection W1 at motor	
Terminal block	**Unit**	**min.**	**max.**
Connection cable flexible with ring cable lug[1)]	mm^2	1×16, 2×16	1×120, 2×120
	AWG	1×6, 2×6	1×4/0, 2×4/0
Screw thread		M10	
Tightening torque	Nm	16	20
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	
			1) Insulate ring cable lugs with heat shrink sleeves

Shield connection accessories:

- XCS*/XMS*-W0210/250/280/330/375:
  - XAS2-004-001-NN; ➦ Chapter XAS2-004-001-NN on page 403
  - XAS2-004-002-NN; ➦ Chapter XAS2-004-002-NN on page 404

XD03, motor connection (2×70 mm²)

Table 121: Function, pin assignment, properties

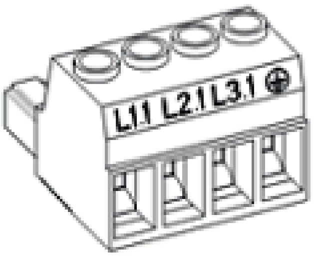
View	Identification	Function	
	A1	For power connection U1 at motor	
	A2	For power connection V1 at motor	
	A3	For power connection W1 at motor	
Terminal block	**Unit**	**min.**	**max.**
Connection cable flexible with ring cable lug[1]	mm^2	1×16, 2×16	1×120, 2×120
	AWG	1×6, 2×4	1×4/0, 2×4/0
Thread		M10	
Tightening torque	Nm	16	20
Touch guard: tightening torque (screw: torx T20, captive) 	Nm	-	2
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	
			1) Insulate ring cable lugs with heat shrink sleeves

Shield connection accessories:

- XCS*/XMS*-W0210/250/280/330/375:
  - XAS2-004-001-NN; ➦ Chapter XAS2-004-001-NN on page 403
  - XAS2-004-002-NN; ➦ Chapter XAS2-004-002-NN on page 404

XD03, mains XLI-XVR (XVR*-W0019, XLI1-1R-W0019)

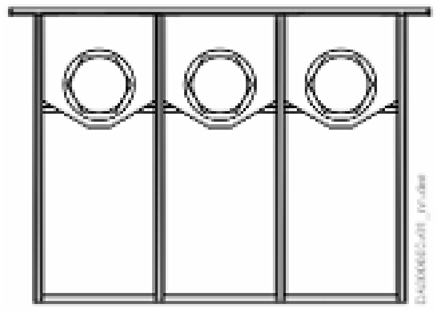
The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

View	Identification	Function	
	L1.1	Connection between supply unit and mains connection module	
	L2.1		
	L3.1		
	⏚		
Screw connection at connector	**Unit**	**min.**	**max.**
Connection cable	mm²	0.75	16
Cross section flexible 1 conductor	AWG	18	6
with ferrule without plastic sleeve	mm²	0.5	16
	AWG	20	6
with ferrule with plastic sleeve	mm²	0.5	10
	AWG	20	8
Cross section flexible 2 conductors	mm²	0.75	6
	AWG	18	10
with ferrule without plastic sleeve	mm²	0.5	4
	AWG	20	12
with twin ferrule with plastic sleeve	mm²	0.5	6
	AWG	20	10
Cross section rigid 1 conductor	mm²	0.75	16
	AWG	18	6
Cross section rigid 2 conductors	mm²	0.75	6
	AWG	18	10
Stripped length	mm	12	
Tightening torque	Nm	1.7	1.8
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

XD03, mains XLI-XVR (XVR*-W0048, XLI1-1R-W0048)

The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

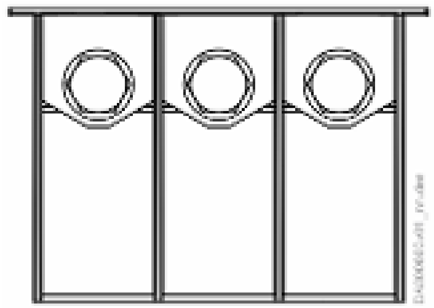
Table 122: Function, pin assignment, properties

<table>
<tr><th>View</th><th>Identifica-tion</th><th colspan="2">Function</th></tr>
<tr><td rowspan="3"></td><td>L1.1</td><td colspan="2" rowspan="3">Connection between supply unit and mains connection module</td></tr>
<tr><td>L2.1</td></tr>
<tr><td>L3.1</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Terminal block</td><td>Unit</td><td>min.</td><td>max.</td></tr>
<tr><td>Screw thread</td><td></td><td colspan="2">M6</td></tr>
<tr><td>Tightening torque</td><td>Nm</td><td>4</td><td>5</td></tr>
<tr><td rowspan="2">Connection cable
flexible with ring cable lug1)</td><td>mm^2</td><td colspan="2">1×35
2×16</td></tr>
<tr><td>AWG</td><td colspan="2">1×3</td></tr>
<tr><td>Occurring current load and minimum required connection cross section</td><td></td><td colspan="2">See technical data of device used (I_{LN} and A_{LN})</td></tr>
<tr><td>Occurring voltage load</td><td></td><td colspan="2">See technical data of device used (U_{LN} or U_{LN_nom})</td></tr>
<tr><td colspan="4">1) Maximum allowed length of ring cable lug: 38 mm; insulate ring cable lugs with heat shrink sleeves</td></tr>
</table>

XD03, mains XLI-XVR (XVR*-W0072, XLI*-1R-W0072)

The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

Table 123: Function, pin assignment, properties

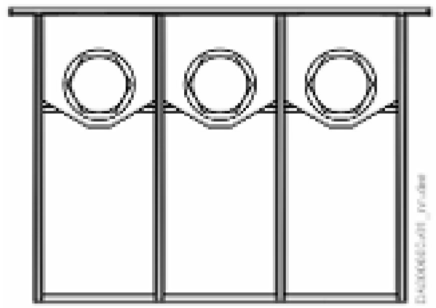
View	Identifica-tion	Function	
	L1.1	Connection between supply unit and mains connection module	
	L2.1		
	L3.1		
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M6	
Tightening torque	Nm	4	5
Connection cable flexible with ring cable lug1)	mm^2	1×50 2×25	
	AWG	1×1/0	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**; with a cable cross section of 50 mm^2, the ring cable lug may not exceed a maximum width of **18 mm** in the contact area (recommendation: use DIN 46234-6-50 ring cable lugs)

XD03, mains XLI-XVR (XVR*-W0100, XLI*-1R-W0100)

The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

Table 124: Function, pin assignment, properties

View	Identification	Function	
	L1.1	Connection between supply unit and mains connection module	
	L2.1		
	L3.1		
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M10	
Tightening torque	Nm	16	20
Connection cable	mm^2	1×16, 2×16	1×120, 2×120
flexible with ring cable lug1)	AWG	1×6, 2×4	1×4/0, 2×4/0
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

1) Maximum allowed length of ring cable lug: 38 mm

XD03 (XMV), smoothing choke XLL

Connectors included in scope of delivery.

XMV*-W0050	XMV*-W0080	XMV*-W0210
➦ Chapter XD03, motor connection (16 mm²) on page 242	➦ Chapter XD03, motor connection (35 mm²) on page 243	➦ Chapter XD03, motor connection (120 mm²) on page 246

XD04, external braking resistor

Important information

⚠ WARNING	**Lethal electric shock due to live parts with more than 50 V!** Only operate the device – with connected connectors (even if no lines are connected to the connectors) and – with connected equipment grounding conductor!

Connectors included in scope of delivery.

Function

Is used to connect the integrated or external braking resistor **HLR**. The braking resistor is connected to the DC bus via an internal switch.

Installation instructions

- Maximum allowed line length to external braking resistor: **5 m**
- Use **shielded** lines
- Connect shield **at both ends** over the largest possible surface area (on the drive side, with a cable clip at the mounting plate in the control cabinet, for example)

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V! Risk of burns by hot housing surfaces! Risk of fire!** The temperature of the housing surface of an external HLR braking resistor can rise up to 150 °C. Run the connection lines with a sufficient distance (> 200 mm) to the housing of the HLR braking resistor to avoid damaging the insulation of the connection lines. Outside of the control cabinet, run the connection lines of an HLR braking resistor in a metal pipe with a wall thickness of at least 1 mm. Do not touch any hot housing surfaces! Mount the HLR braking resistor on a temperature-resistant mounting surface. Provide a sufficient distance between the HLR braking resistor and heat-sensitive materials. Make sure the cooling air supply is unrestricted. Take care that the environment can discharge the dissipation heat.

NOTICE	**Danger by inadequate installation!** Protect the lines with the appropriate fusing elements in the supply feeder. For the connection lines at XD04, use at least the cross section of the lines for mains connection at XD03. If this is impossible, select the cross section of the connection line at XD04 in accordance with the continuous power of the braking resistor. With a smaller cross section of the connection line at XD04, the fusing element is not required if the following conditions have been fulfilled: – Distance of external braking resistor connection (XD04) to mains fuse < 3 m – Cross section of the connection line at XD04 in accordance with the continuous power of the braking resistor – Short-circuit and ground-fault-proof routing (cf. VDE 0100-520) Selecting the fusing element (only required if braking resistor line cross section < mains connection line): The connection lines of the braking resistor carry high DC voltages (up to 850 V DC). Therefore, select the fusing element according to this DC voltage. Use fusing elements, e.g. fuses of characteristic gG, or circuit breakers with tripping characteristics C: – Nominal fuse voltage ≥ 850 V DC – Nominal fuse current complies with continuous current of external braking resistor (check overload capacity of fuse with regard to the specific application) – Sizing depends on cross section of braking resistor line that is used, in accordance with the respective applicable national standards and local regulations Do not use any fast semiconductor fuses, since they might trigger in the range of standard operation.

Overview

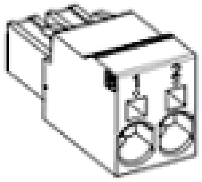
There are different types of connections:

- Screw connection at device ( ).
- Screw connection at connector ( ).
- Spring terminal at connector ( ).

Component	XD04 PE 2 1	XD04 1 2	XD04 1 2
XCS	02xx, 03xx: 35 mm^2	0090, 01xx: 16 mm^2	0010, 0023, 0054, 0070: 10 mm^2
XCD	-	-	2323: 10 mm^2
XVR/XLI	0100: 35 mm^2	0048, 0072: 16 mm^2	0019: 10 mm^2
XVE	0125: 35 mm^2	0030, 0075: 16 mm^2	-

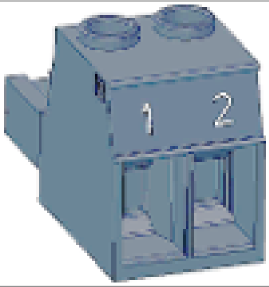
XD04 (10 mm²)

Table 125: Function, pin assignment, properties

View	Connection	Function	
	1	Braking resistor connection	
	2	Braking resistor connection	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm²	0.2	6
Cross section flexible 1 conductor	AWG	24	10
with ferrule without plastic sleeve	mm²	0.25	6
	AWG	24	10
with ferrule with plastic sleeve	mm²	0.25	4
	AWG	24	12
Cross section flexible 2 conductors	mm²	0.25	1.5
with twin ferrule with plastic sleeve	AWG	24	16
Cross section rigid	mm²	0.2	10
	AWG	24	8
Stripped length	mm	15	

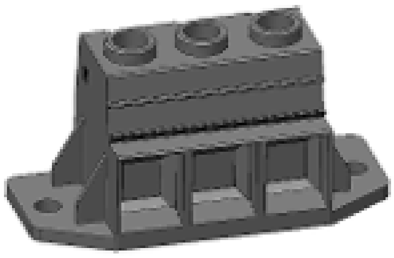
XD04 (16 mm²)

Table 126: Function, pin assignment, properties

View	Connection	Function
	1	Braking resistor connection
	2	Braking resistor connection

Screw connection at connector	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.75	16
Cross section flexible 1 conductor	AWG	18	6
with ferrule without plastic sleeve	mm^2	0.5	16
	AWG	20	6
with ferrule with plastic sleeve	mm^2	0.5	10
	AWG	20	8
Cross section flexible 2 conductors	mm^2	0.75	6
	AWG	18	10
with ferrule without plastic sleeve	mm^2	0.5	4
	AWG	20	12
with twin ferrule with plastic sleeve	mm^2	0.5	6
	AWG	20	10
Cross section rigid 1 conductor	mm^2	0.75	16
	AWG	18	6
Cross section rigid 2 conductors	mm^2	0.75	6
	AWG	18	10
Stripped length	mm	12	
Tightening torque	Nm	1.7	1.8

XD04 (35 mm²)

View	Identification	Function
	PE	Equipment grounding conductor
	2	Braking resistor
	1	Braking resistor

Terminal block	Unit	min.	max.
Connection cable	mm²	0.5	35
Cross section flexible 1 conductor	AWG	20	2
with ferrule without plastic sleeve	mm²	1	35
	AWG	18	2
with ferrule with plastic sleeve	mm²	1.5	35
	AWG	16	2
Cross section flexible 2 conductors	mm²	0.5	6
	AWG	20	10
with ferrule without plastic sleeve	mm²	0.5	4
	AWG	20	12
with twin ferrule with plastic sleeve	mm²	0.5	16
	AWG	20	6
Cross section rigid 1 conductor	mm²	0.5	35
	AWG	20	2
Cross section rigid 2 conductors	mm²	0.5	6
	AWG	20	10
Stripped length	mm	18	
Tightening torque (< 25 mm²)	Nm	2.5	
Tightening torque (≥ 25 mm²)	Nm	4.5	

XD10, 24 V supply (control voltage)

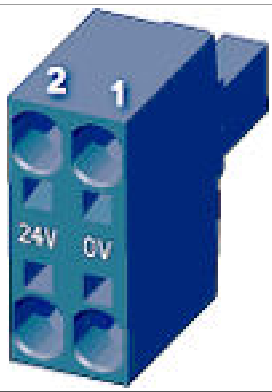
Function, pin assignment

Via the connection point, the 24 V supply is applied externally for

- the control section and power section of the drive controller
- the brake control
- the digital inputs and the digital output

Connectors included in scope of delivery.

Table 127: Function, pin assignment, properties

View	Connection	Signal name	Function
	1	0V	Reference potential for power supply
	2	+24V	Power supply
Spring terminal at connector	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.2	6
Cross section flexible 1 conductor	AWG	24	10
with ferrule without plastic sleeve	mm^2	0.25	6
	AWG	24	10
with ferrule with plastic sleeve	mm^2	0.25	4
	AWG	24	12
Cross section flexible 2 conductors	mm^2	0.25	1.5
with twin ferrule with plastic sleeve	AWG	24	16
Cross section rigid 1 conductor	mm^2	0.2	10
	AWG	24	8
Stripped length	mm	15	
Power consumption	W	P_{N3} (see control voltage data)	
Voltage load capacity	V	U_{N3} (see control voltage data)	
Current carrying capacity "looping through" from 0V to 0V, 24V to 24V	A	41	
Polarity reversal protection		Within the allowed voltage range by internal protective diode	
Insulation monitoring		Possible	

Installation instructions

Requirements on the connection for 24 V supply:

- Minimum cross section: 1 mm^2
- Maximum allowed inductance: 100 µH (2 twisted single strands, 75 m long)
- Parallel line routing where possible

Depending on the power consumption of the devices and the current carrying capacity of the connector, check the number of devices via which a line for 24 V supply can be looped through. If required, connect another device directly to the 24 V supply and then loop through the control voltage from this device to other devices.

XE20, Y capacitor ground connection

Leave XE20 in its condition as supplied until Rexroth has given you approval for using it.

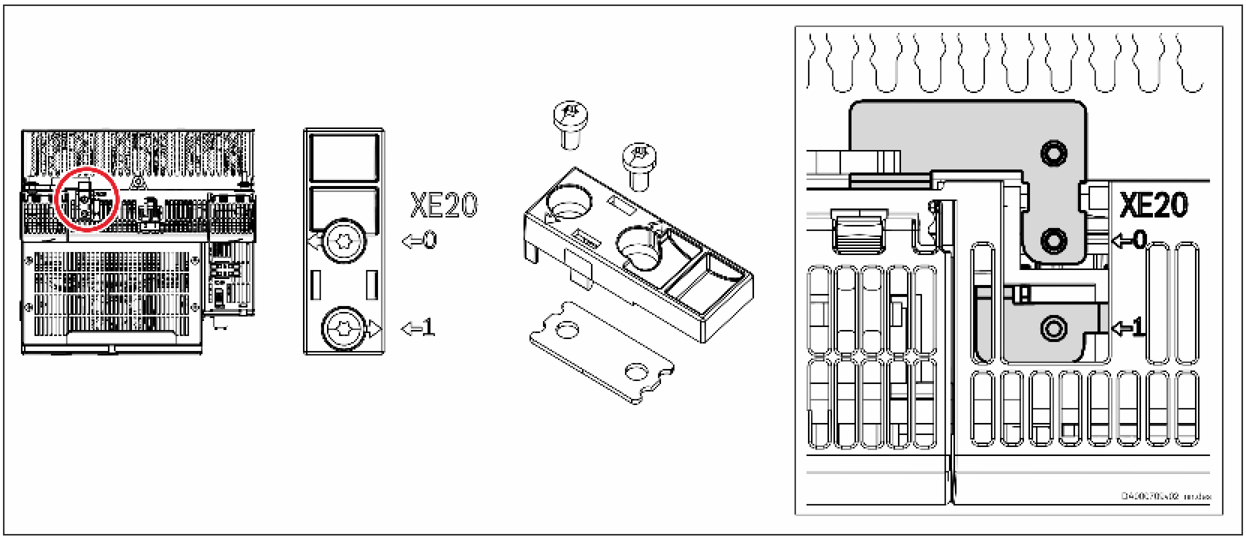
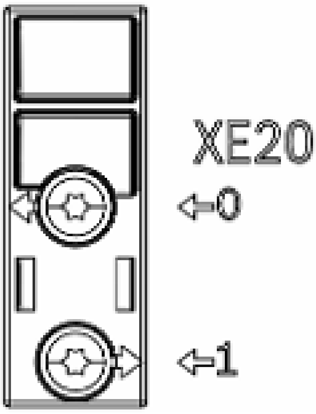
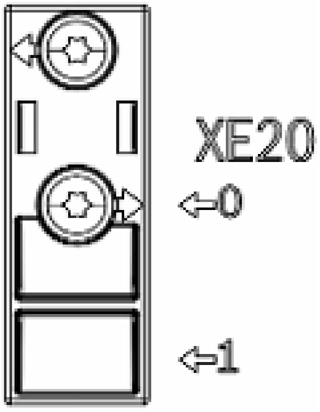


Fig. 94: XE20, Y capacitor ground connection

With ground connection	Without ground connection
 Condition as supplied	

XF21 P1, XF22 P2, communication (RJ-45)

Description

The connection point complies with IEEE 802.3 standard.

P1, P2

P1 means port 1 and P2 means port 2 etc.. Thus, the error counter of the firmware can be directly assigned to a port.

Connection

Sercos:

- Input: arbitrary
- Output: arbitrary

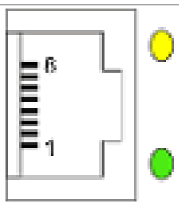
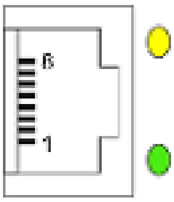
EtherCAT:

- Input: XF21 P1
- Output: XF22 P2

PROFINET IO:

- Input: arbitrary
- Output: arbitrary

Table 128: Function, pin assignment, properties

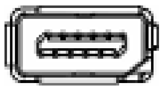
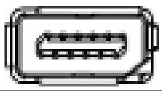
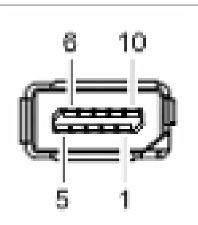
View	Connection	Signal name	Function
	8	n. c.	-
	7	n. c.	-
	6	RD-	Receive, Differential Input -
	5	n. c.	-
	4	n. c.	-
XF22 P2	3	RD+	Receive, Differential Input +
	2	TD-	Transmit, Differential Output -
	1	TD+	Transmit, Differential Output +
XF21 P1	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		

Compatibility	100Base-TX according to IEEE 802.3u
Recommended cable type	• According to CAT5e; shield type ITP (Industrial Twisted Pair) • Ready-made cables available for order: – RKB0021 Long cables (100 m at most) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: 48.75 mm with flexible routing 32.50 mm with permanent installation Order code for a cable with a length of 30 m: RKB0021/030,0 – RKB0013 Short cables to connect adjacent devices in the control cabinet. Lenghts: 0.19 m; 0.25 m; 0.35 m; 0.55 m; 1 m; 1.25 m; 2 m; 3 m; 5 m; 7 m Order code for a cable with a length of 0.55 m: RKB0013/00,55 Minimum bending radius: 30.75 mm

XF90, XF91, DRIVElink communication

- DRIVElink allows data to be **cyclically exchanged** between ctrlX DRIVE devices in parallel with master communication with minimum cycle times of **250 µs**
- A DRIVElink master (command value producer) can control **a maximum of 1 DRIVElink slave** (command value consumer)
- **Technology Function TE1**, **TF1** or **TX1** required

Table 129: Function, pin assignment, properties

View	Identification	Function
XF91  XF90 	XF91 XF90	Connection points for **DRIVElink**: • Input: arbitrary • Output: arbitrary
	**No.: Signal (100 Mbit/s)** 1: TX+ 2: TX- 3: n.c 4: n.c. 5: n.c. 6: RX+ 7: RX- 8: n.c. 9: n.c. 10: n.c.	
Connection cable	• According to **CAT5e**; shield type ITP (Industrial Twisted Pair) • Ready-made cables available for order: **RKB0070** Lenghts: 0.19 m; 0.35 m; 0.55 m; 2 m Order code for a cable with a length of 0.55 m: RKB0070/00,55 Minimum bending radius: 25 mm	

XF23 P1, XF24 P2, communication (RJ-45)

Description

The connection point complies with IEEE 802.3 standard.

P1, P2

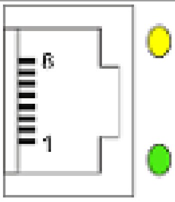
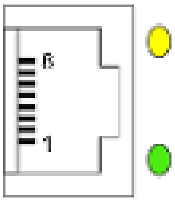
P1 means port 1 and P2 means port 2 etc.. Thus, the error counter of the firmware can be directly assigned to a port.

Connection

PROFINET IO (slave):

- Input: arbitrary
- Output: arbitrary

Table 130: Function, pin assignment, properties

View	Connection	Signal name	Function
 XF24 P2  XF23 P1	8	n. c.	-
	7	n. c.	-
	6	RD-	Receive, Differential Input -
	5	n. c.	-
	4	n. c.	-
	3	RD+	Receive, Differential Input +
	2	TD-	Transmit, Differential Output -
	1	TD+	Transmit, Differential Output +
	Housing		Shield connection
Properties			
Standard	● Ethernet ● Type: RJ-45, 8-pin		
Compatibility	100Base-TX according to IEEE 802.3u		
Recommended cable type	● According to **CAT5e**; shield type ITP (Industrial Twisted Pair) ● Ready-made cables available for order: – RKB0021 Long cables (100 m at most) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: 48.75 mm with flexible routing 32.50 mm with permanent installation Order code for a cable with a length of 30 m: RKB0021/030,0 – RKB0013 Short cables to connect adjacent devices in the control cabinet. Lenghts: 0.19 m; 0.25 m; 0.35 m; 0.55 m; 1 m; 1.25 m; 2 m; 3 m; 5 m; 7 m Order code for a cable with a length of 0.55 m: RKB0013/00,55 Minimum bending radius: 30.75 mm		

XG02, Bb relay contact

Table 131: Function, pin assignment, properties

View	Connection	Signal name	Function
	1	Rel1	Bb relay contact signals: ● Readiness for operation ● Inverter power enable
	2	Rel2	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm²	0.2	1.5
Cross section flexible	AWG	24	16
with ferrule without plastic sleeve	mm²	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm²	0.14	0.75
	AWG	26	18
Cross section rigid	mm²	0.2	1.5
	AWG	24	16
Stripped length	mm	10	
Loading capacity of the contacts	V		30
	A	0.01	1

Connectors included in scope of delivery.

Use

For use, also refer to:

➦ Chapter Digital I/O solution on page 167
➦ Chapter Field bus and digital I/O solution on page 169

XG03, motor temperature monitoring and motor holding brake

Important information

⚠ WARNING	**Dangerous movements! Danger to persons from falling or dropping axes!**
	The standard equipment motor holding brake or an external holding brake controlled by the drive controller is not sufficient to guarantee personal safety!
	Personal safety must be achieved using higher-ranking, fail-safe measures:
	– Block off danger zones with safety fences or safety guards.
	– Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
	  – mechanically securing the vertical axes
	  – external braking/arrester/clamping mechanism
	  – ensuring sufficient counterweight for the vertical axes

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** The input of the motor temperature evaluation is **not** galvanically isolated from the housing. Excess voltage at the input (e.g., by the motor winding voltage flashing over) can get to the housing. Make sure that the temperature sensor of the connected motor is **double**-insulated from the motor winding.

NOTICE	**Risk of damage to device from excess voltage at motor temperature evaluation input!** Only the allowed control voltage for the device is allowed at the motor temperature evaluation input. Excess voltage at the input may damage the device.

Motor holding brake: Installation instructions

Make sure the **power supply** is sufficient for the motor holding brake at the motor. Take into account that voltage drops on the supply line. Use connection lines with the largest possible cross section of single strands.

Use an **external contact element in accordance with the required safety category** if you wish to supply motor holding brakes with higher currents than the current load allowed at the connection point. Make sure to comply with the required minimum current consumption of 100 mA when using an external contact element. Otherwise, the brake current monitoring function will signal an error.

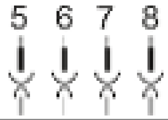
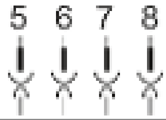
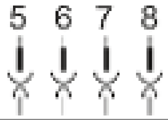
Function

The connection point contains the connections for

- monitoring the motor temperature
- controlling the motor holding brake

Overview

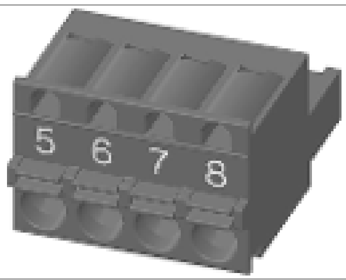
Spring terminal at connector ( ).

Component	XG03 (2.5 mm², 2 A) 	XG03 (1.5 mm², 1.5 A) 	XZ03[1] (1.5 mm², 1 A) 
XCS	0100...0375[2]	0054...0090[3]	0010, 0023[3]
XCD	-	-	2323[3]
XMS	0100...0375[2]	0054...0090[3]	0006...0036[3]
XMD	-	5454...7070[3]	0606...3636[3]

1) Hybrid connection (motor, temperature monitoring and motor holding brake)
2) Connectors included in the scope of supply
3) Connectors **not** included in the scope of supply

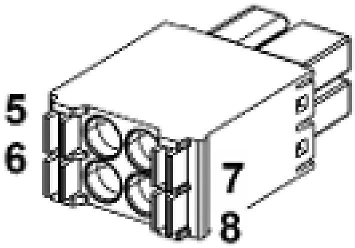
XG03 (2.5 mm²)

Table 132: Function, pin assignment

View	Connection	Signal name	Function
	5	MotTemp+	Input Motor temperature evaluation 1)
	6	MotTemp-	
	7	+24VBr	Output controlling the motor holding brake
	8	0VBr	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable Cross section flexible 1 conductor	mm²	0.2	2.5
	AWG	24	14
With ferrule with/without plastic sleeve	mm²	0.25	2.5
	AWG	24	14
Cross section flexible 2 conductors with twin ferrule with plastic sleeve	mm²	0.5	1.5
	AWG	20	16
Cross section rigid	mm²	0.2	2.5
	AWG	24	14
Stripped length	mm	10	
Current carrying capacity of outputs XG03	A	-	2
Time constant of load	ms	-	50
Number of switching actions at maximum time constant of load		Wear-free electronic contact	
Switching frequency	Hz	-	0.5
Short circuit protection		XG03.7 against XG03.8 (output for controlling the motor holding brake)	
Overload protection			
1) Motor temperature evaluation designed for Pt1000 resistors. Pt100 resistors cannot be evaluated.			

XG03 (1.5 mm²)

Table 133: Function, pin assignment

View	Connection	Signal name	Function
	5	MotTemp+	Input
	6	MotTemp-	Motor temperature evaluation 1)
	7	+24VBr	Output
	8	0VBr	controlling the motor holding brake
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm²	0.2	1.5
Cross section flexible	AWG	24	16
with ferrule without plastic sleeve	mm²	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm²	0.14	0.75
	AWG	26	18
Cross section rigid	mm²	0.2	1.5
	AWG	24	16
Stripped length	mm	10	
Current carrying capacity of outputs XG03	A	-	1.5
Time constant of load	ms	-	50
Number of switching actions at maximum time constant of load		Wear-free electronic contact	
Switching frequency	Hz	-	0.5
Short circuit protection		XG03.7 against XG03.8 (output for controlling the motor holding brake)	
Overload protection			
1) Motor temperature evaluation designed for Pt1000 resistors. Pt100 resistors cannot be evaluated.			

XZ03 (1.5 mm²)

See description of connection point XZ03.

➦ Chapter XZ03, hybrid connection (motor, motor temperature monitoring and motor holding brake) on page 278.

XG20, XLI bus

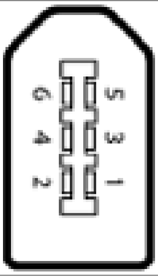
Function, pin assignment

The connection point is used to connect the supply unit to the mains connection module XLI.

Connection cable contained in XLI scope of supply:

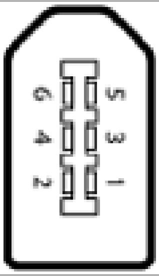
- **XLI1-1R-W0019/48/72**
  RG2-500AAB-NN-000,5; length incl. connector: **0.5 m**; R911403093
- **XLI1-1R-W0100**
  RG2-500AAB-NN-000,8; length incl. connector: **0.8 m**; R911407458

Table 134: XG20, XLI bus

View	Connection	Function	
	1	Communication	
	2		
	3		
	4		
	5		
	6		
Properties	**Unit**	**min.**	**max.**
Connection cable Stranded wire	mm^2	0.25	0.8
Type		RG2-500AAB	

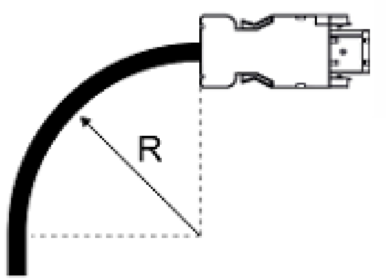
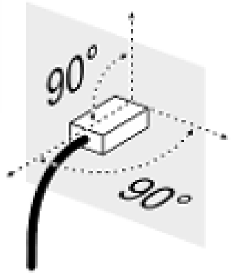
XG20, digital motor encoder connection

Table 135: XG20, digital motor encoder

View	Connection	Signal name	Function
	1	n.c.	-
	2	GND_Enc	Reference potential for power supplies
	3	+12V_Enc	Encoder supply 12 V
	4	n.c.	-
	5	Enc_Data+	Data transfer positive
	6	Enc_Data-	Data transfer negative
Properties	**Unit**	**min.**	**max.**
Connection cable Stranded wire	mm²	0.25	0.5
Encoder evaluation type	ACURO®link		
	ctrlX SENSEmotor		

Connectors/cables **not** included in scope of delivery.

Table 136: Encoder connection

	**R ≈ 30 mm** Minimum bending radius (4 × outer cable diameter) **90°** For permanently stable contact, the connector has to be in a vertical position. Install a **strain relief** so that no force is applied to the connector.

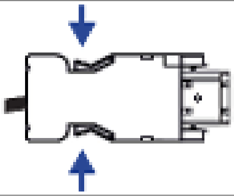
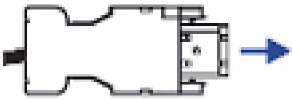
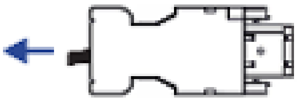
Encoder connection for hybrid cables

Hybrid cables (e.g., RHB2-021DCB) connect the drive controller to the motor (XZ03) and encoder (XG20).

Form a loop to lead the encoder cable to the connection point XG20 so that no force is applied to the encoder connector:

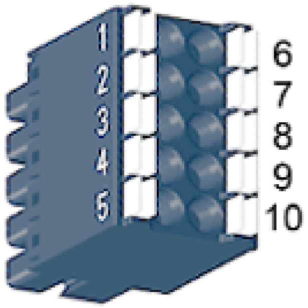
Fig. 95: Encoder cable forming a loop to be led to connection point XG20

Table 137: Disconnecting the plug connection

	Press and hold the buttons at the sides of the connector.
	Push the connector in plug-in direction.
	Disconnect the connector.

XG31, digital inputs, digital outputs, analog input

Table 138: Function, pin assignment, properties

View	Connection	Signal name	Function	Default assignment
	1	I_1	Digital input	Probe 1
	2	I_2	(type B)	Probe 2
	3	I_3	Digital input	E-Stop input
	4	0V	GND reference	-
	5	0V_EA_100_AnaIn	Analog input Connection for inner cable shield	-
	6	I_4	Digital input	Travel range limit switch input
	7	I_5	Digital input	Travel range limit switch input
	8	I_6/O_1	Digital input/output	Not assigned
	9	I_a_1+	Analog differential input	Not assigned
	10	I_a_1-		

Spring terminal (connector)	Unit	min.	max.
Connection cable	mm²	0.2	1.5
Cross section flexible	AWG	24	16
with ferrule without plastic sleeve	mm²	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm²	0.14	0.75
	AWG	26	18
Cross section rigid	mm²	0.2	1.5
	AWG	24	16
Stripped length	mm	10	

Connectors included in scope of delivery.

Technical data:

➡ Chapter 11.1.1 Digital inputs (standard), XG31 on page 369
➡ Chapter 11.1.2 Digital inputs (probe), XG31 on page 370
➡ Chapter 11.1.3 Digital outputs (standard), XG31 on page 371
➡ Chapter 11.1.4 Analog voltage input, XG31 on page 372

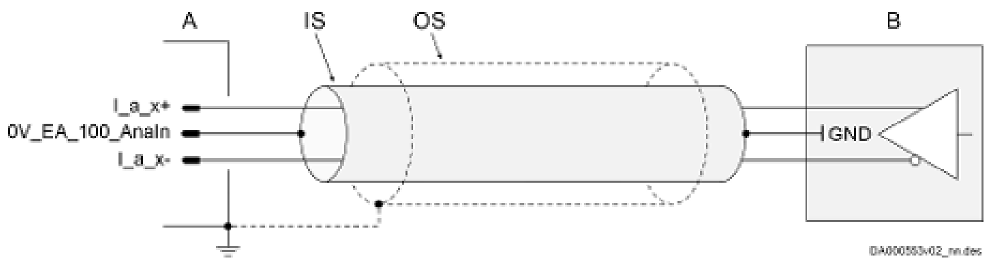


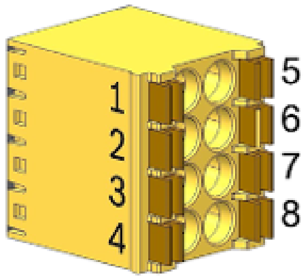
Fig. 96: Shield connection for analog inputs

A Analog input of the drive controller; **only connect the inner shield of the connection cable to the drive controller if GND has not been connected to ground in the external device.**
B External device
IS Inner shield of the connection cable
OS Overall shield of the connection cable

XG41, safety technology Safe Torque Off

Assigned devices:

- ctrlX DRIVE single-axis (XCS1, XCS2, XMS1, XMS2)
- ctrlX DRIVE double-axis (XCD1, XMD1)
- ctrlX DRIVEplus single-axis (XCS1, XCS2, XMS1, XMS2)
- ctrlX DRIVEplus double-axis (XCD1, XCD2, XMD1, XMD2)

View	Connection	Signal name	Function
	1	STO_DynOut_CH1	Channel 1 dynamization output
	2	-	n. c.
	3	STO_CH1	Input for selection of channel 1
	4	STO_CH1	Input for selection of channel 1
	5	STO_DynOut_CH2	Channel 2 dynamization output
	6	-	n. c.
	7	STO_CH2	Input for selection of channel 2
	8	STO_CH2	Input for selection of channel 2

Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.2	1.5
Flexible	AWG	24	16
with ferrule without plastic sleeve	mm^2	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm^2	0.25	0.75
	AWG	24	18
Rigid	mm^2	0.2	1.5
	AWG	24	16
Stripped length	mm	10	

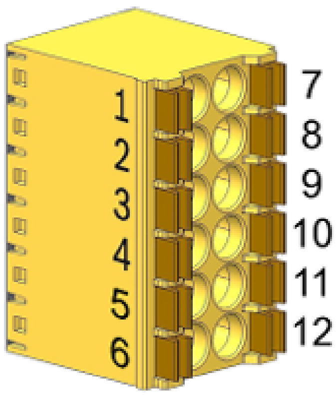
Connections XG41.3 and XG41.4 or XG41.7 and XG41.8 are **not** electrically connected in the connector.

When the connector is removed from the device, the STO function is selected for the following devices.

Connectors included in scope of delivery.

Assigned devices:

- ctrlX DRIVE double-axis (XCD2, XMD2)

View	Connection	Signal name	Function
	1	STO_DynOut_CH1	Channel 1 dynamization output
	2	-	n. c.
	3	STO_Ax1_CH1	Input for selection of axis 1, channel 1
	4	STO_Ax1_CH1	Input for selection of axis 1, channel 1
	5	STO_Ax2_CH1	Input for selection of axis 2, channel 1
	6	STO_Ax2_CH1	Input for selection of axis 2, channel 1
	7	STO_DynOut_CH2	Channel 2 dynamization output
	8	-	n. c.
	9	STO_Ax1_CH2	Input for selection of axis 1, channel 2
	10	STO_Ax1_CH2	Input for selection of axis 1, channel 2
	11	STO_Ax2_CH2	Input for selection of axis 2, channel 2
	12	STO_Ax2_CH2	Input for selection of axis 2, channel 2

Spring terminal (connector)	Unit	min.	max.
Connection cable	mm²	0.2	1.5
Flexible	AWG	24	16
with ferrule without plastic sleeve	mm²	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm²	0.25	0.75
	AWG	24	18
Rigid	mm²	0.2	1.5
	AWG	24	16
Stripped length	mm	10	

Connections XG41.3 and XG41.4, as well as XG41.5 and XG41.6 or XG41.9 and XG41.10, as well as XG41.11 and XG41.12 are **not** electrically connected in the connector.

When the connector is removed from the device, the STO function is selected for the following devices.

Connectors included in scope of delivery.

Technical data of inputs and outputs:

➦ Chapter 11.2.1 Digital inputs, XG41 on page 373
➦ Chapter 11.2.2 Digital outputs, XG41 on page 374

XZ03, hybrid connection (motor, motor temperature monitoring and motor holding brake)

⚠ WARNING

Dangerous movements! Danger to persons from falling or dropping axes!

The standard equipment motor holding brake or an external holding brake controlled by the drive controller is not sufficient to guarantee personal safety!

Personal safety must be achieved using higher-ranking, fail-safe measures:

- Block off danger zones with safety fences or safety guards.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axes
  - external braking/arrester/clamping mechanism
  - ensuring sufficient counterweight for the vertical axes

⚠ WARNING

Lethal electric shock from live parts with more than 50 V!

The input of the motor temperature evaluation is **not** galvanically isolated from the housing. Excess voltage at the input (e.g., by the motor winding voltage flashing over) can get to the housing. Make sure that the temperature sensor of the connected motor is **double**-insulated from the motor winding.

⚠ WARNING

Lethal electric shock due to live parts with more than 50 V!

Only operate the device

- with connected connectors (even if no lines are connected to the connectors) and
- with connected equipment grounding conductor!

NOTICE

Risk of damage to the device!

Provide strain relief for the terminals of the device in the control cabinet.

NOTICE

Risk of damage to device from excess voltage at motor temperature evaluation input!

Only the allowed control voltage for the device is allowed at the motor temperature evaluation input.

Excess voltage at the input may damage the device.

Connectors **not** included in scope of delivery.

Function

The connection point contains the connections for

- Motor power supply
- monitoring the motor temperature
- controlling the motor holding brake

Table 139: Motor power supply

View	Identification	Function	
	A1	For power connection U1 at motor	
	A2	For power connection V1 at motor	
	A3	For power connection W1 at motor	
	⏚	For equipment grounding connection at motor	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm²	0.5	6
Flexible	AWG	20	10
With ferrule with/without plastic sleeve	mm²	0.5	6
	AWG	20	10
Rigid	mm²	0.5	10
	AWG	20	8
Stripped length	mm	12	
Occurring current load and minimum required connection cross section	A	See technical data of device used (I_{out})	
Occurring voltage load	V	See technical data of device used (U_{out})	
Short circuit protection		A1, A2, A3 against each other and each of them against ground	

Table 140: Shield connection

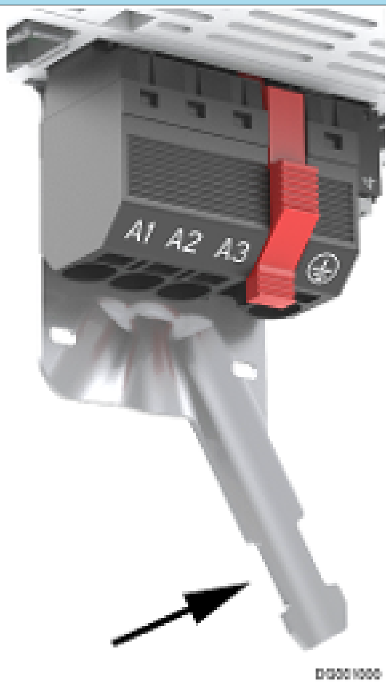
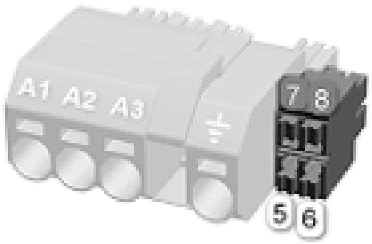
Motor cable shield connection


Table 141: Motor temperature monitoring, motor holding brake

View	Connection	Signal name	Function
	5	MotTemp+	Motor temperature evaluation input 1)
	6	MotTemp-	
	7	+24VBr	Output to control the motor holding brake
	8	0VBr	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm²	0.14	1.5
Flexible	AWG	26	16
With ferrule with/without plastic sleeve	mm²	0.25	1.5
	AWG	24	16
Rigid	mm²	0.14	1.5
	AWG	26	16
Stripped length	mm	8	
Current carrying capacity of brake outputs	A	-	1
Time constant of load	ms	-	50
Number of switching actions at maximum time constant of load		Wear-free electronic contact	
Switching frequency	Hz	-	0.5
Short circuit protection		XZ03.7 to XZ03.8 (output to control the motor holding brake)	
1) Motor temperature evaluation designed for Pt1000 resistors. Pt100 resistors cannot be evaluated.			

Motor holding brake: Installation instructions

Make sure the **power supply** is sufficient for the motor holding brake at the motor. Take into account that voltage drops on the supply line. Use connection lines with the largest possible cross section of single strands.

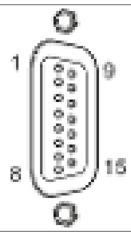
Use an **external contact element in accordance with the required safety category** if you wish to supply motor holding brakes with higher currents than the current load allowed at the connection point. Make sure to comply with the required minimum current consumption of 100 mA when using an external contact element. Otherwise, the brake current monitoring function will signal an error.

9.3.12 Optional connection points

XG21, XG22, multi-encoder EC

Connection point

Table 142: Function, properties

View	Identi-fica-tion	Function	
	XG21 XG22	Multi-encoder connection	
D-Sub, 15-pin, female	**Unit**	**min.**	**max.**
Connection cable Stranded wire	mm^2	0.25	0.5
Encoder evaluation type		EC	

Connectors/cables **not** included in scope of delivery.

Table 143: Pin assignment

Connec-tion	Signal	Function
1	GND_shld	Signal shields connection (inner shields)
2	A+	Track A analog positive
3	A-	Track A analog negative
4	GND_Encoder	Reference potential for power supplies
5	B+	Track B analog positive
6	B-	Track B analog negative
7	EncData+	Data transfer positive
	A+	Track A positive
8	EncData-	Data transfer negative
	A-	Track A negative
9	R+	Reference track, positive
10	R-	Reference track, negative
11	+12V	Encoder supply 12 V
12	+5V	Encoder supply 5 V
13	EncCLK+	Clock positive
	B+	Track B positive
14	EncCLK-	Clock negative
	B-	Track B negative
15	Sense-	Refeed of reference potential (Sense line)
	VCC_Resolver	Resolver supply
Connector housing		Overall shield

Input circuit, differential input:

➦ Chapter 11.6 Encoder evaluation (EC) on page 384

Supported encoder systems

Encoder systems with a supply voltage of **5 and 12 volt**:

- Sin-cos encoder 1Vpp with HIPERFACE®
- Sin-cos encoder 1Vpp with EnDat 2.1
- Sin-cos encoder 1Vpp with reference track
- Resolvers without encoder data memory
- EnDat 2.2
- SSI

12 V encoder systems

HIPERFACE® (12 V supply voltage)

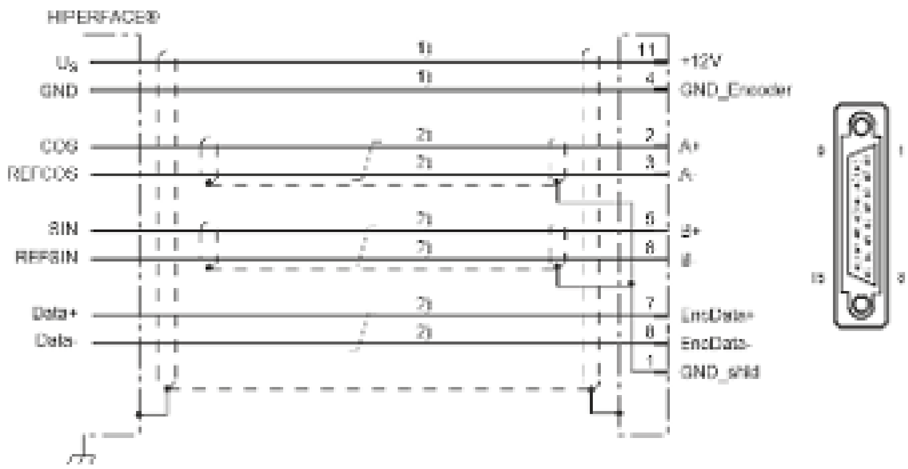


Fig. 97: HIPERFACE® encoder system connection plan
1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

The HIPERFACE® encoder system requires a 12 V supply voltage. This supply voltage is made available via the EC interface.

Technical specification of power supply: See ➦ Chapter Power supply on page 293

Please note that the used encoder has to be compatible with the voltage available at the EC interface as the encoder supply voltage.

EnDat 2.1 according to Heidenhain standard (12 V supply voltage)

Connection diagram

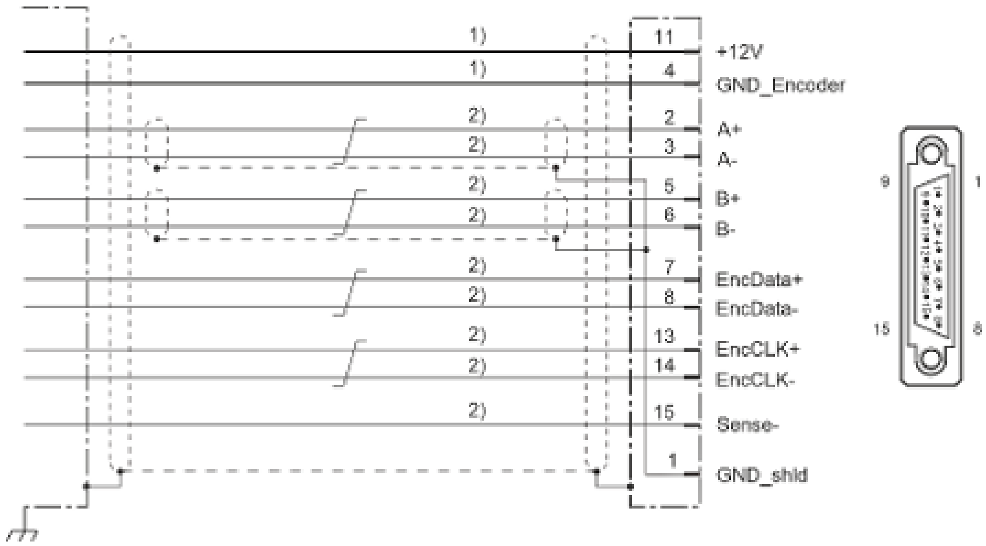


Fig. 98: Connection diagram with EnDat 2.1 encoder system

1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

12 V (the voltage is provided via the EC interface)

➡ Chapter Power supply on page 293

Cable length

Maximum **75 m** (when using the Sense function)

When you are not using the Sense function, the maximum cable length is reduced.

➡ Chapter Encoder cable length on page 294

Technical properties

Use the Sense function to ensure stable power supply at the encoder.

EnDat 2.2 according to Heidenhain standard (12 V supply voltage)

Connection diagram

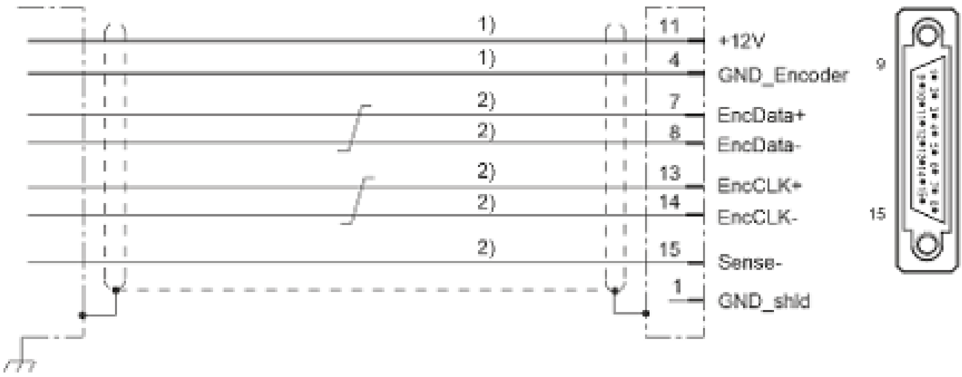


Fig. 99: Connection diagram with EnDat 2.2 encoder system

1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

12 V (the voltage is provided via the EC interface)

➦ Chapter Power supply on page 293

Cables

Only use Heidenhain cables.

If you have any questions on the cables or specific applications, please contact Heidenhain directly.

Cable length

Maximum 75 m (when using the Sense function)

When you are not using the Sense function, the maximum cable length is reduced.

➦ Chapter Encoder cable length on page 294

Technical properties

Use the Sense function to ensure stable power supply at the encoder.

Recommendation for multi-turn encoders: For permanent storing of encoder data, please use the external EBB 4000 battery box by Heidenhain.

1Vpp according to Heidenhain standard (12 V supply voltage)

Connection diagram

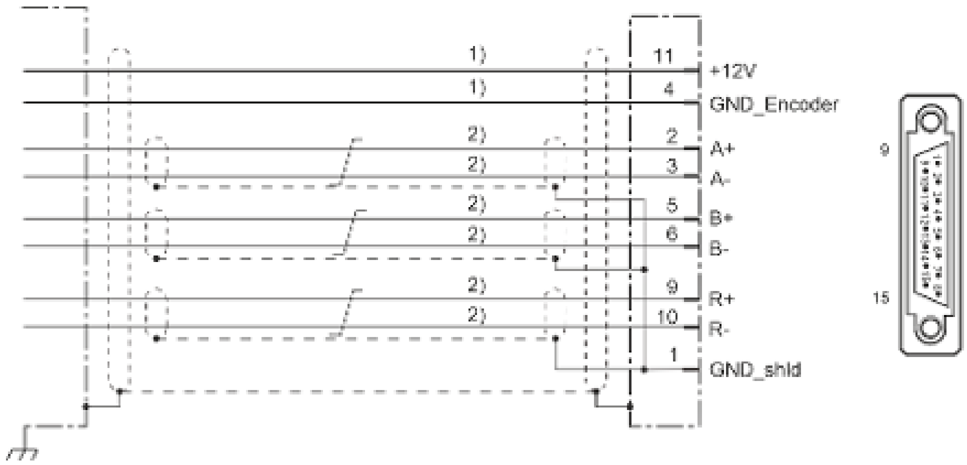


Fig. 100: Connection diagram with 1Vpp encoder system

1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

12 V (the voltage is provided via the EC interface)

➦ Chapter Power supply on page 293

Cable length

➦ Chapter Encoder cable length on page 294

SSI (12 V supply voltage)

Connection diagram

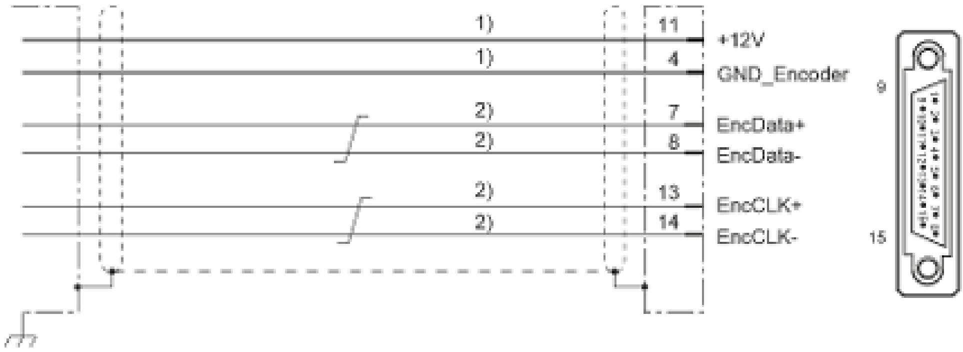


Fig. 101: Connection diagram with SSI encoder system
1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

12 V (the voltage is provided via the EC interface)

➦Chapter Power supply on page 293

Cable length

➦Chapter Encoder cable length on page 294

5 V encoder systems

EnDat 2.1 according to Heidenhain standard (5 V supply voltage)

5 V vs. 12 V

We recommend a 12 V supply voltage, since operation with 5 V might cause problems with longer cables.

➦ Chapter EnDat 2.1 according to Heidenhain standard (12 V supply voltage) on page 284

Connection diagram

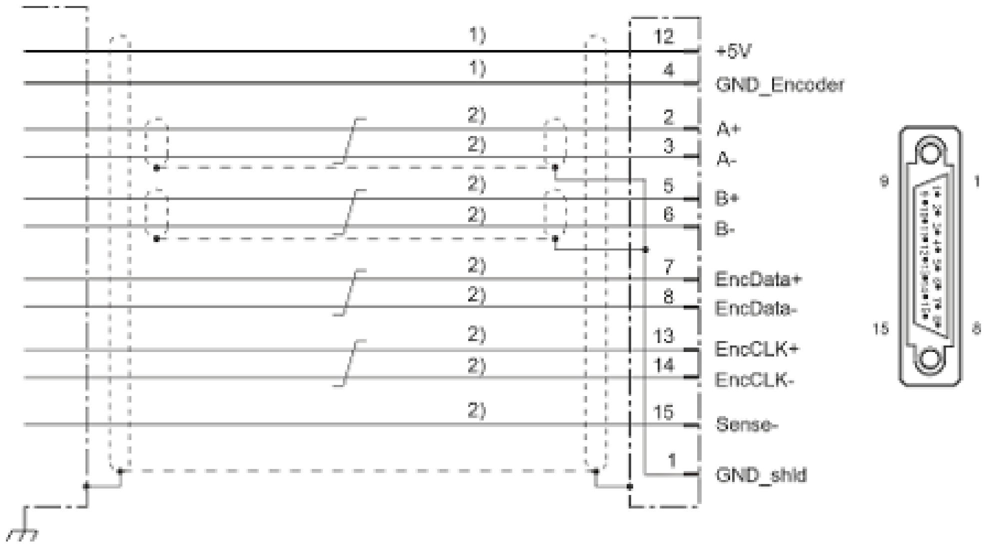


Fig. 102: Connection diagram with EnDat 2.1 encoder system
1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

5 V (the voltage is provided via the EC interface)

➦ Chapter Power supply on page 293

Cable length

Maximum **75 m** (when using the Sense function)

When you are not using the Sense function, the maximum cable length is reduced.

➦ Chapter Encoder cable length on page 294

Technical properties

Use the Sense function to ensure stable power supply at the encoder.

EnDat 2.2 according to Heidenhain standard (5 V supply voltage)

Wiring diagram

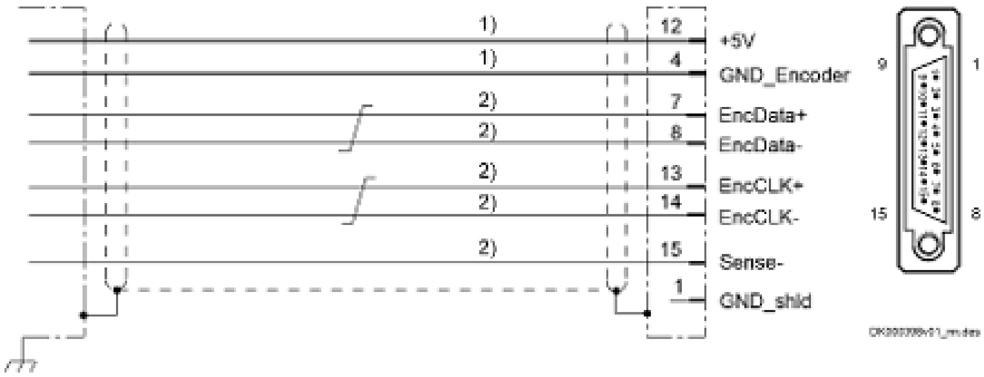


Fig. 103: EnDat 2.2 encoder system connection diagram

1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length

2) Line cross section ≥ 0.14 mm²

Power supply

5 V (the voltage is provided via the EC interface)

➦ Chapter Power supply on page 293

Cable

Only use Heidenhain cables.

If you have any questions on the cables or specific applications, please contact Heidenhain directly.

Cable length

Maximum 75 m (when using the Sense function)

When you are not using the Sense function, the maximum cable length is reduced.

➦ Chapter Encoder cable length on page 294

Technical properties

Use the Sense function to ensure stable power supply at the encoder.

1Vpp according to Heidenhain standard (5 V supply voltage)

Connection diagram

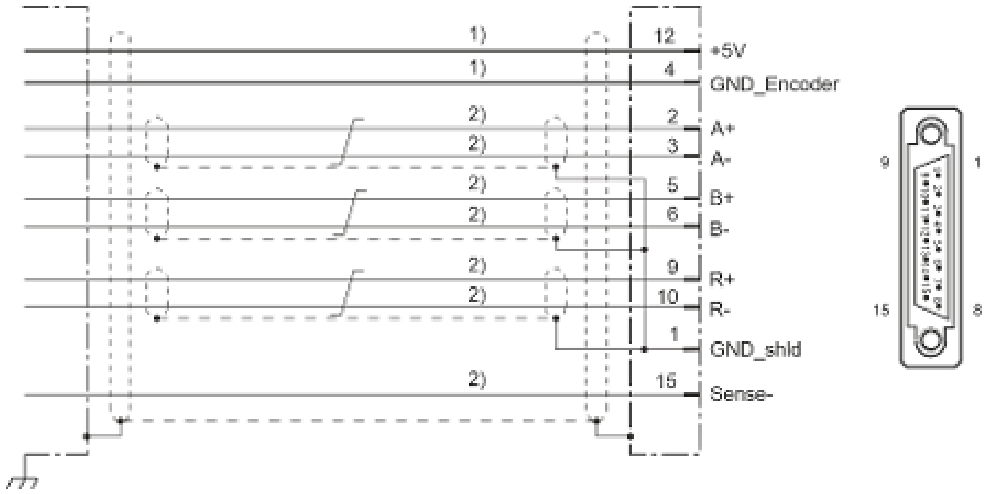


Fig. 104: Connection diagram with 1Vpp encoder system

1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

5 V (the voltage is provided via the EC interface)

➦ Chapter Power supply on page 293

Cable length

Maximum **75 m** (when using the Sense function)

When you are not using the Sense function, the maximum cable length is reduced.

➦ Chapter Encoder cable length on page 294

Technical properties

Use the Sense function to ensure stable power supply at the encoder.

SSI (5 V supply voltage)

Connection diagram

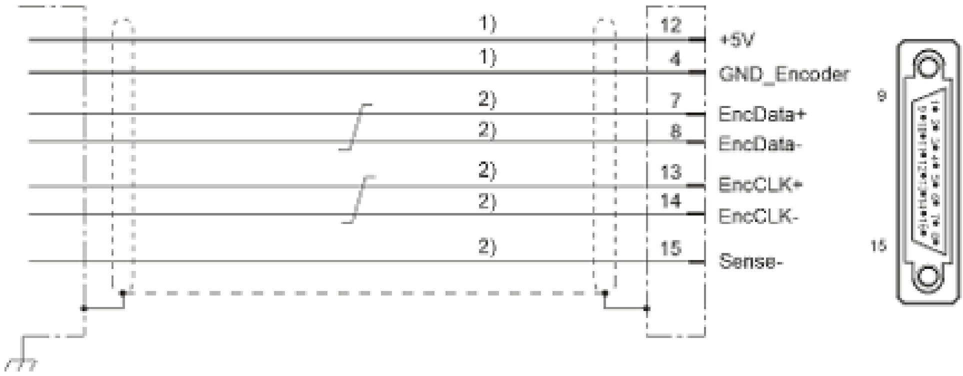


Fig. 105: Connection diagram with SSI encoder system

1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

5 V (the voltage is provided via the EC interface)

➡ Chapter Power supply on page 293

Cable length

Maximum 75 m (when using the Sense function)

When you are not using the Sense function, the maximum cable length is reduced.

➡ Chapter Encoder cable length on page 294

Technical properties

Use the Sense function to ensure stable power supply at the encoder.

Resolver encoder systems

Resolvers without encoder data memory

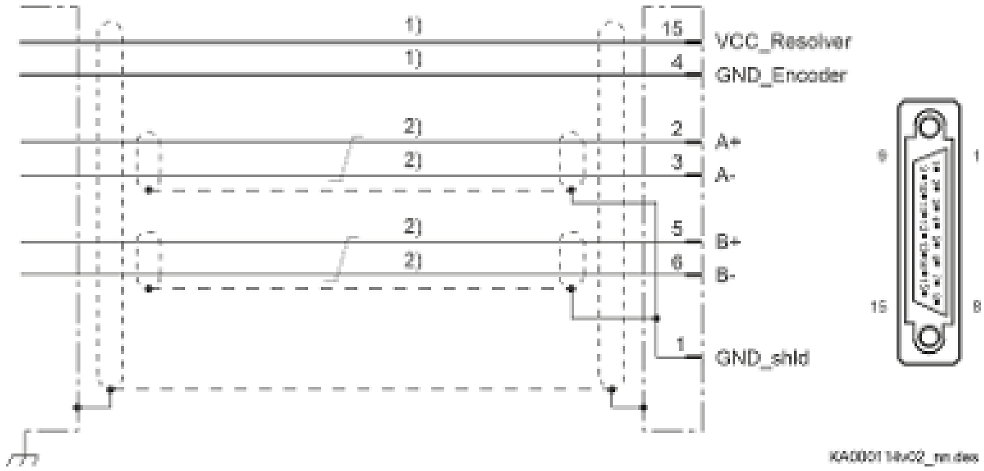


Fig. 106: EC connection diagram with resolver encoder system
1) Line cross section ≥ 0.5 mm²; comply with the allowed encoder cable length
2) Line cross section ≥ 0.14 mm²

Power supply

The EC interface supplies the resolver encoder system with a carrier voltage amplitude of 10 V_{pp}.

Technical specification of power supply: See ➦ Chapter Power supply on page 293

Please note that the resolver encoder used has to be suited for the voltage available at the EC interface as the encoder supply voltage.

Cable length

Maximum 75 m

Specific technical features

The encoder evaluation has been sized for resolvers with a transfer ratio of 0.5.

Power supply

12 V power supply

Table 144: 12 V power supply

Data	Unit	min.	typ.	max.
Voltage for encoder supply	V	10.7	12	12.3
Output current	mA			500 [1)]

1) The sum of the power consumptions of all connected encoder systems should not exceed 12 W.

5 V power supply

Table 145: 5 V power supply

Data	Unit	min.	typ.	max.
Voltage for encoder supply	V	5.0		5.25
Output current	mA			500 [1)]

1) The sum of the power consumptions of all connected encoder systems should not exceed 12 W.

Sense function

The EC encoder evaluation allows the 5 V supply voltage at the encoder to be corrected. It is thereby possible, within certain limits, to compensate for voltage drops on the encoder cable.

Functional principle: The current consumption of the connected encoder system generates a voltage drop due to the ohmic resistance of the encoder cable (line cross section and line length). This reduces the signal at the encoder input. The actual value of the 0 V encoder potential at the encoder is measured via a separate “Sense” line (Sense-) and fed back to the drive controller.

Thus, the drive controller can influence the voltage of the encoder supply.

For correct “Sense” evaluation, the encoder supply lines “+5V” and “GND_Encoder” have to have the same line cross section.

If the encoder has a “Sense-” connection, connect the “Sense” line to this connection. A potentially available “Sense” connection is not used.

If the encoder has no “Sense” connection, apply the 0 V encoder potential to the “Sense-” line on the encoder side.

Resolver power supply

Table 146: Resolver encoder supply

Data	Unit	min.	typ.	max.
AC output voltage VCC_Resolver (peak-peak value)	V	8.3	10	12
Sine output frequency	kHz		8	
Output current (peak value)	mA			60 [1)]
Output current (rms value)	mA			40 [1)]

1) The sum of the power consumptions of all connected encoder systems should not exceed 12 W.

Encoder cable length

Use lines with the same line cross section for encoder supply.

Allowed encoder cable length for 12-V encoder systems

Prerequisites:

- The **cross section** of the supply voltage lines is at least **0.5 mm²**
- The minimum allowed **supply voltage** at the encoder is **10 V**

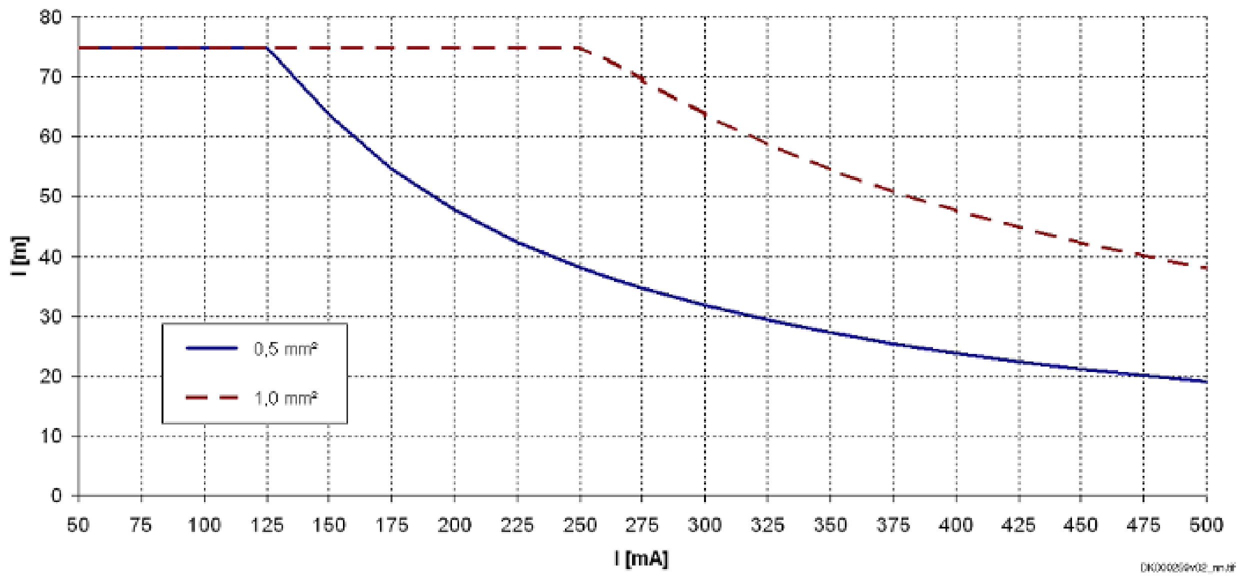


Fig. 107: Maximum allowed encoder cable lengths for 12 V encoder systems depending on the line cross-section at 10 V supply voltage

I [mA]	Encoder current consumption
l [m]	Cable length
0.5 mm²; 1.0 mm²	Line cross sections

Nominal current consumption of the MSK motor encoders: 60 mA

Allowed encoder cable length for 5-V encoder system without sense function

If the encoder system used does not support the Sense function, the maximum possible cable length results from the diagram below.

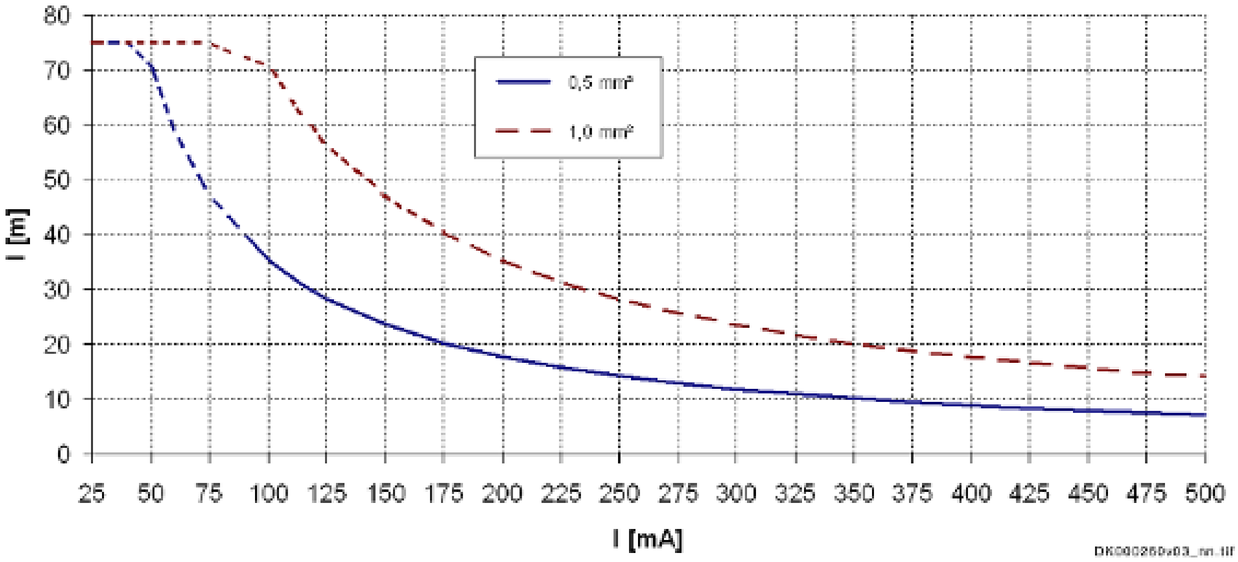


Fig. 108: Maximum allowed encoder cable lengths for 5 V encoder systems without Sense connection depending on cable cross section

I [mA]	Encoder current consumption
I [m]	Cable length
0.5 mm²; 1.0 mm²	Line cross sections

Allowed encoder cable length for 5-V encoder system with sense function

Maximum **75 m**

(Besides, the maximum allowed cable lengths depend on the motor size. See documentation of motor used.)

The cross section of the supply voltage lines has to be at least 0.5 mm².

Allowed encoder cable length for resolver encoder systems

Maximum **75 m**

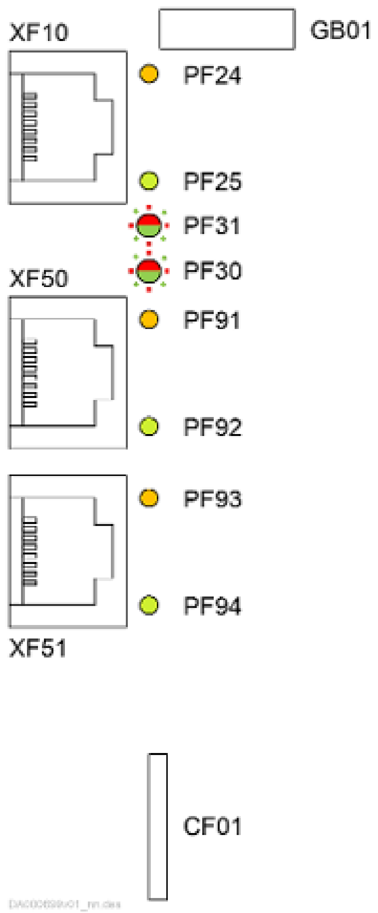
The cross section of the supply voltage lines has to be at least 0.5 mm².

ctrlX DRIVEplus with ctrlX CORE

Configurable ctrlX DRIVEplus drives can be equipped with an internal ctrlX CORE control.

ctrlX CORE connection points

Table 147: Function, pin assignment, properties

View	Connection	Function
	GB01	Battery compartment for buffer battery to buffer the system time; RTC (Real Time Clock)
	XF10	Ethernet Engineering Port
	PF24	Activity LED (yellow)
	PF25	Link LED (green)
	PF31	Status LED; Ethernet axis 2 (bicolor)
	PF30	Status LED; Ethernet axis 1 (bicolor)
	XF50	Ethernet-based field bus port 1
	PF91	Activity LED (yellow)
	PF92	Link LED (green)
	XF51	Ethernet-based field bus port 2
	PF93	Activity LED (yellow)
	PF94	Link LED (green)
	CF01	microSD memory card slot

XF10, XF50, XF51

Description

The connection point complies with IEEE 802.3 standard.

P1, P2, P3

P1 means "Port 1" and P2 means "Port 2" etc. Thus, the error counter of the firmware can be directly assigned to a port.

Connection XF10

Fast Ethernet interface for network connection

- Ethernet Engineering

Connection XF50

Fast Ethernet interface for Ethernet-based field buses (master)

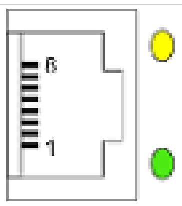
- EtherCAT master output

Connection XF51

Fast Ethernet interface for Ethernet-based field buses

- EtherCAT master output (option)
- Ethernet Engineering (option)

Function, pin assignment, properties

View	Connection	Signal name	Function
	8	n. c.	-
	7	n. c.	-
	6	RD-	Receive, Differential Input -
	5	n. c.	-
	4	n. c.	-
	3	RD+	Receive, Differential Input +
	2	TD-	Transmit, Differential Output -
	1	TD+	Transmit, Differential Output +
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin, shielded		

Compatibility	100Base-TX according to IEEE 802.3u
Recommended cable type	● According to CAT5e; shield type ITP (Industrial Twisted Pair) ● Ready-made cables available for order: – RKB0021 Long cables (100 m at most) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: 48.75 mm with flexible routing 32.50 mm with permanent installation Order code for a cable with a length of 30 m: RKB0021/030,0 – RKB0013 Short cables to connect adjacent devices in the control cab-inet. Lenghts: 0.19 m; 0.25 m; 0.35 m; 0.55 m; 1 m; 1.25 m; 2 m; 3 m; 5 m; 7 m Order code for a cable with a length of 0.55 m: RKB0013/00,55 Minimum bending radius: 30.75 mm

PF30, PF31

Table 148: LEDs

View	Connection	Function
	PF30	Status LED for Ethernet communication of axis 1
	PF31	Status LED for Ethernet communication of axis 2 (for double-axis only)

Diagnostic LED

➦Chapter 12.1 PF01 LED (Device State) on page 387

GB01

Battery holder for buffer battery.

Buffer battery: CR1025 3V lithium (e.g., Renata CR1025, 30 mAh)

Buffer time: > 3 years (with a new battery of Renata CR1025, 30 mAh type)

CF01

microSD slot (push-push SD card holder) for storing user data, such as log files, program data, etc.

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ctrlX DRIVEplus with ctrlX OS

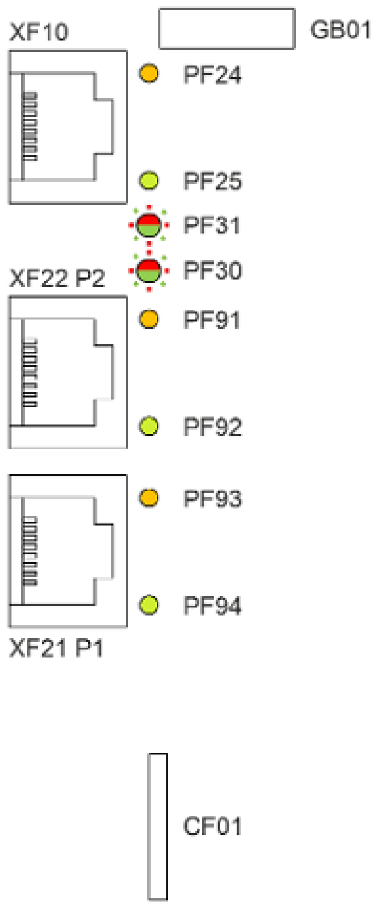
Configurable drives ctrlX DRIVEplus may be equipped with ctrlX OS ("EX" option; "Multi-Ethernet incl. ctrlX OS" communication).

Advanced Engineering:

- Engineering for multiple axes
- Web-based Engineering
- Using ctrlX Apps
- IT security for safely accessing data
- Device management via the ctrlX Device Portal for improved service incl. the option of remote maintenance
- Access to ctrlX World with solutions by partner companies

ctrlX OS connection points

Table 149: Function, pin assignment, properties

View	Connection	Function
	GB01	Battery compartment for buffer battery to buffer the system time; RTC (Real Time Clock)
	XF10	Ethernet Engineering Port
	PF24	Activity LED (yellow)
	PF25	Link LED (green)
	PF31	Status LED; Ethernet axis 2 (bicolor)
	PF30	Status LED; Ethernet axis 1 (bicolor)
	XF22 P2	Ethernet-based field bus port 2
	PF91	Activity LED (yellow)
	PF92	Link LED (green)
	XF21 P1	Ethernet-based field bus port 1
	PF93	Activity LED (yellow)
	PF94	Link LED (green)
	CF01	microSD memory card slot

XF10, XF21, XF22

Description

The connection point complies with IEEE 802.3 standard.

P1, P2, P3

P1 means "Port 1" and P2 means "Port 2" etc. Thus, the error counter of the firmware can be directly assigned to a port.

Connection XF10

Fast Ethernet interface for network connection

- Ethernet Engineering (EtherCAT slave)

Connection XF22 P2

Fast Ethernet interface for Ethernet-based field buses

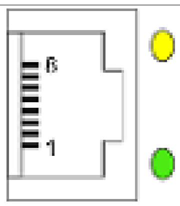
- EtherCAT slave output

Connection XF21 P1

Fast Ethernet interface for Ethernet-based field buses

- EtherCAT slave input

Function, pin assignment, properties

View	Connection	Signal name	Function
	8	n. c.	-
	7	n. c.	-
	6	RD-	Receive, Differential Input -
	5	n. c.	-
	4	n. c.	-
	3	RD+	Receive, Differential Input +
	2	TD-	Transmit, Differential Output -
	1	TD+	Transmit, Differential Output +
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin, shielded		

Compatibility	100Base-TX according to IEEE 802.3u
Recommended cable type	• According to **CAT5e**; shield type ITP (Industrial Twisted Pair) • Ready-made cables available for order: – RKB0021 Long cables (100 m at most) to connect the drive system to the higher-level control or remote communication nodes. Minimum bending radius: 48.75 mm with flexible routing 32.50 mm with permanent installation Order code for a cable with a length of 30 m: RKB0021/030,0 – RKB0013 Short cables to connect adjacent devices in the control cabinet. Lenghts: 0.19 m; 0.25 m; 0.35 m; 0.55 m; 1 m; 1.25 m; 2 m; 3 m; 5 m; 7 m Order code for a cable with a length of 0.55 m: RKB0013/00,55 Minimum bending radius: 30.75 mm

PF30, PF31

Table 150: LEDs

View	Connection	Function
	PF30	Status LED for Ethernet communication of axis 1
	PF31	Status LED for Ethernet communication of axis 2 (for double-axis only)

Diagnostic LED

➦ Chapter 12.1 PF01 LED (Device State) on page 387

GB01

Battery holder for buffer battery.

Buffer battery: CR1025 3V lithium (e.g., Renata CR1025, 30 mAh)

Buffer time: > 3 years (with a new battery of Renata CR1025, 30 mAh type)

CF01

microSD slot (push-push SD card holder) for storing user data, such as log files, program data, etc.

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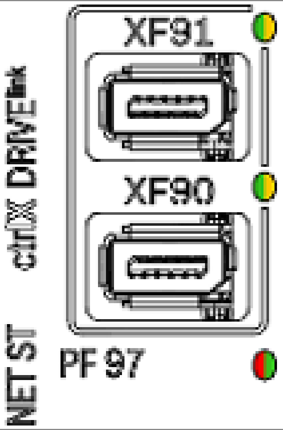
ctrlX DRIVEplus with DRIVElink

ctrlX DRIVElink connection points

Table 151: Function, pin assignment, properties

View	Connection	Function
	XF91	Output/input
	XF90	Input/output
	PF97	Status LED (multicolor)

XF90, XF91

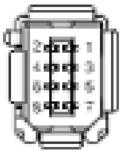
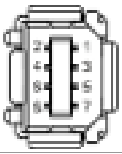
➦Chapter XF90, XF91, DRIVElink communication on page 263

PF97

➦Chapter 12.3 DRIVElink on page 393

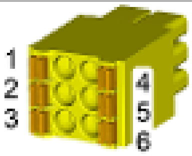
SafeMotion M5

XG42, XG43, Safe Motion safety technology (communication)

View	Identifi-cation	Function
XG42:  XG43: 	XG42 XG43	Connection points for safety bus **ctrlX SAFETYlink**: XG42: input XG43: output
Connection cable	• Maximum length of **one** cable between two connection points: **15 m** • Number of safety zone nodes: – maximum: 16 – minimum: 1 • Ready-made cables available for order: – RKB0061 Short cables to connect adjacent devices in the control cabinet. Available lengths: 0.25 m; 0.35 m; 0.55 m Minimum bending radius in the case of permanent installation: 4xD (= 4x6.3 mm = 25.2 mm) Minimum bending radius in the case of flexible routing: 8xD (= 8x6.3 mm = 50.4 mm) Order code for a cable with a length of 0.55 m: RKB0061/00,55 – RKB0062 Long cables to connect remote communication nodes outside the control cabinet. Available lengths: 1 m, 2 m, 3 m, ... 15 m, 20 m, 30 m, 50 m, 75 m, 100 m Minimum bending radius in the case of permanent installation: 4xD (= 4x6.3 mm = 25.2 mm) Minimum bending radius in the case of flexible routing: 8xD (= 8x6.3 mm = 50.4 mm) Order designation for a cable with a length of 5 m: RKB0062/005,0	

XG44, SafeMotion M5 safety technology

Table 152: Function, pin assignment

View	Connection	Signal name	Function
	1	SI_Out_Ch2	Safe output channel 2
	2	-	-
	3	SI_Out_Ch1	Safe output channel 1
	4	SI_In_Ch2	Safe input channel 2
	5	-	-
	6	SI_In_Ch1	Safe input channel 1

Spring terminal (connector)	Unit	min.	max.
Connection cable	mm^2	0.2	1.5
Flexible	AWG	24	16
with wire end ferrule without plastics material sleeve	mm^2	0.25	1.5
	AWG	24	16
with wire end ferrule with plastics material sleeve	mm^2	0.25	0.75
	AWG	24	18
Rigid	mm^2	0.2	1.5
	AWG	24	16
Stripped length	mm	10	
Polarity reversal protection for power supply	Available		
Overvoltage protection	Available In the case of an error, the control panel shows the corresponding error message: F3365		

Reference point of the inputs is the 0 V supply at connector XD10.
The **24V supply at connector XD10** supplies the outputs.

Connectors included in scope of delivery.

Technical data of inputs and outputs:

➦Chapter 11.3.1 Digital inputs, XG44 on page 376
➦Chapter 11.3.2 Digital outputs, XG44 on page 376

SafeMotion M8

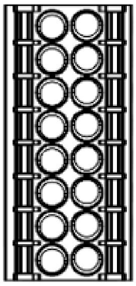
XG45, SafeMotion M8 safety technology

"SafeMotion M8" allows safety functions to be selected via digital inputs.

Inputs, outputs:

- 5 × digital input pairs
- 3 × digital output pairs

Table 153: Function, pin assignment

Function	Signal name	Connection	View	Connection	Signal name	Function
Input 1.1	SI_In1_Ch1	1		9	SI_In1_Ch2	Input 1.2
Input 2.1	SI_In2_Ch1	2		10	SI_In2_Ch2	Input 2.2
Input 3.1	SI_In3_Ch1	3		11	SI_In3_Ch2	Input 3.2
Input 4.1	SI_In4_Ch1	4		12	SI_In4_Ch2	Input 4.2
Input 5.1	SI_In5_Ch1	5		13	SI_In5_Ch2	Input 5.2
Safe output 1.1	SI_Out1_Ch1	6		14	SI_Out1_Ch2	Safe output 1.2
Safe output 2.1	SI_Out2_Ch1	7		15	SI_Out2_Ch2	Safe output 2.2
Safe output 3.1	SI_Out3_Ch1	8 1)		16 1)	SI_Out3_Ch2	Safe output 3.2

1) Output pair 3.1/3.2 can be configured for push-pull operation (0x305C:06 / P-0-3323.0.1)
➦ Chapter 11.4.3 Push-pull operation, XG45 output pair 3.1/3.2 on page 380

Table 154: Properties

Spring terminal (connector)	Unit	min.	max.
Connection cable	mm²	0.2	1.5
Flexible	AWG	24	16
with ferrule without plastic sleeve	mm²	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm²	0.14	0.75
	AWG	26	18
Rigid	mm²	0.2	1.5
	AWG	24	16
Stripped length	mm	10	

Reference point of the inputs is the 0 V supply at connector XD10.
The **24V supply at connector XD10** supplies the outputs.

Connectors included in scope of delivery.

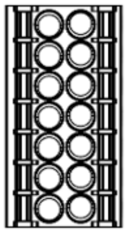
Technical data of inputs and outputs:
➦ Chapter 11.4.1 Digital inputs, XG45 on page 378
➦ Chapter 11.4.2 Digital outputs, XG45 on page 378

XG37, digital inputs, digital outputs

Inputs, outputs:

- 4 × digital input
- 4 × digital output
- 4 × digital input/output

Table 155: Function, pin assignment

Signal name[1)]	Connec-tion	View	Connec-tion	Signal name[1)]
IO_1	1		8	IO_3
IO_2	2		9	IO_4
I_5	3		10	O_5
I_6	4		11	O_6
I_7	5		12	O_7
I_8	6		13	O_8
24V_EA	7		14	0V_EA

1) **IO**: Input/output
I: Input
O: Output
24V_EA / 0V_EA: 24 V power supply

Table 156: Properties

Spring terminal (connector)	Unit	min.	max.
Connection cable	mm²	0.2	1.5
Flexible	AWG	24	16
with ferrule without plastic sleeve	mm²	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm²	0.14	0.75
	AWG	26	18
Rigid	mm²	0.2	1.5
	AWG	24	16
Stripped length	mm	10	

Connectors included in scope of delivery.

Technical data:

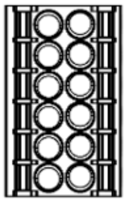
➦Chapter 11.5 I/O extension (DA) on page 381

XG38, analog inputs, analog outputs

Inputs, outputs:

- 3 × analog input
- 2 × analog output

Table 157: Function, pin assignment

Signal name1)	Connec-tion	View	Connec-tion	Signal name1)
I_a_1+	1		7	I_a_1-
I_a_2+	2		8	I_a_2-
I_a_3+	3		9	I_a_3-
0V_EA_100_AnaOut	4		10	0V_EA_100_AnaIn
O_a_1	5		11	O_a_2
0V_EA_Ana	6		12	0V_EA_Ana

1) **I_a_x+/I_a_x-**: Analog differential input
O_a_x: Analog output
0V_EA_Ana: Reference O_a_x
0V_EA_100_Ana: Inner cable shield

Table 158: Properties

Spring terminal (connector)	Unit	min.	max.
Connection cable	mm2	0.2	1.5
Flexible	AWG	24	16
with ferrule without plastic sleeve	mm2	0.25	1.5
	AWG	24	16
with ferrule with plastic sleeve	mm2	0.14	0.75
	AWG	26	18
Rigid	mm2	0.2	1.5
	AWG	24	16
Stripped length	mm	10	

Connectors included in scope of delivery.

Technical data:
➡Chapter 11.5 I/O extension (DA) on page 381

Shield connection for analog inputs

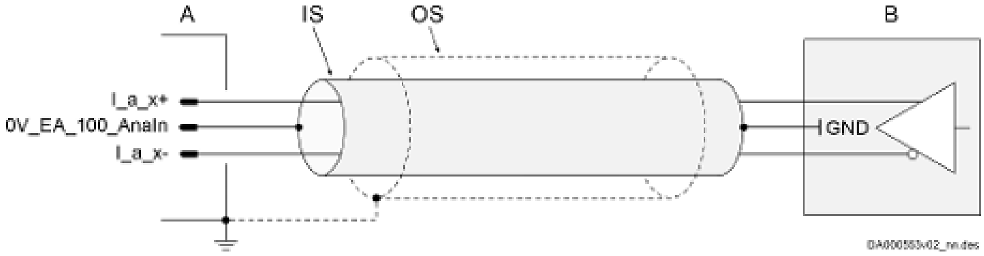


Fig. 109: Shield connection for analog inputs

A Analog input of the drive controller; **only connect the inner shield of the connection cable to the drive controller if GND has not been connected to ground in the external device.**
B External device
IS Inner shield of the connection cable
OS Overall shield of the connection cable

Shield connection for analog outputs

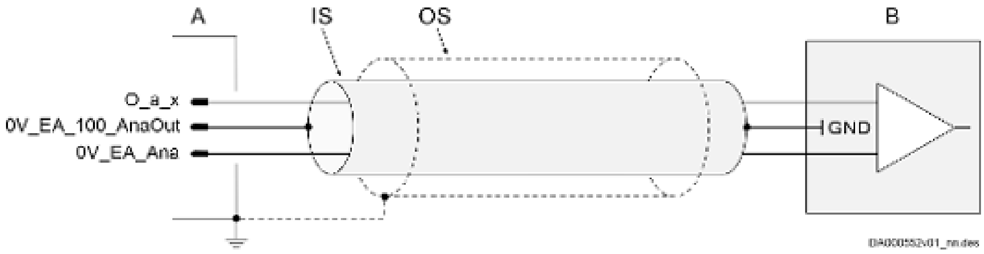


Fig. 110: Shield connection for analog outputs

A Analog output of drive controller
B External device; **only connect the inner shield of the connection cable to the external device if GND has not been connected to ground in the external device.**
IS Inner shield of the connection cable
OS Overall shield of the connection cable

10 Technical data of components

10.1 Notes

This chapter contains the **electrical data** of the devices.

Data:

- Control voltage
- Mains voltage
- DC bus
- Inverter
- External braking resistor/integrated braking transistor
- Integrated braking resistor

For the **mechanical, thermal and other data**, please see the chapter on mechanical project planning.

➦ Chapter 4.2 Mechanical project planning on page 57

Data:

- Dimensions
- Mass
- Power dissipation
- Insulation
- Temperatures
- Cooling
- Distances

10.2 XCS*-W0010/-W0023

10.2.1 Control voltage

Table 159: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Control voltage input[1]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	1.4	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	94	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.2.2 Mains voltage

Table 160: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Mains frequency	f_{LN}	Hz	50 ... 60	
Tolerance input frequency		Hz	±2	
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2	
Rotating field condition			none	
Short circuit current rating	SCCR	A rms	42000	
Nominal mains voltage 3-phase	U_{LN_nom}	V	400	
Nominal mains voltage 1-phase	U_{LN_nom}	V	230	
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed	
Tolerance U_{LN}		%	+10 / -15	
Minimum inductance of mains supply (mains phase inductance)	L_{min}	µH	40	
Inrush current	$I_{L\_trans\_max\_on}$	A	$U_{LN} \times \sqrt{2} \div R_{DC\_Bleeder\_nom}$	
Maximum allowed ON-OFF cycles per minute			tbd	tbd

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase; **without** mains choke)1)	I_{LN}	A	5.8	
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase; **with** mains choke)2)	I_{LN}	A	Operation with mains choke not allowed	
Mains input continuous current (1-phase, **without** mains choke)1)	I_{LN}	A	5.8	
Mains input continuous current (1-phase, **with** mains choke)1)	I_{LN}	A	Operation with mains choke not allowed	
Mains fuse according to EN 60204-1 (3-phase)		A	10	
Mains fuse according to EN 60204-1 (1-phase)		A	10	
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring)3)	A_{LN}	AWG	14	
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase)	S_{LN}	kVA	4	
Mains connected load at U_{LN_nom} and P_{DC_cont} (1-phase)	S_{LN_1ph}	kVA	1.34	
Total power factor TPF at P_{DC_cont} (3-phase)			0.5	
Total power factor TPF at P_{DC_cont} (1-phase)			0.3	

1) Find interim values by interpolation

2) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

10.2.3 DC bus

Table 161: DC bus performance data

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
DC bus voltage	U_{DC}	V	approx. 250 ... 850	
Nominal DC bus voltage	U_{DC_nom}	V	540	
Capacitance in DC bus	C_{DC}	mF	0.2	
Rated power (t > 10 min); U_{LN_nom}	P_{DC_cont}	kW	2	
Rated power with 1-phase mains voltage U_{LN_nom}	P_{DC_cont}	kW	0.4	
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$	
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$	
Maximum allowed DC bus power at U_{LN_nom}	P_{DC_max}	kW	7.99	
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850	
Monitoring value minimum DC bus voltage, under-voltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Allowed external DC bus capacitance (nom.) at U_{LN_nom}	C_{DCext}	mF	2.4	
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	

10.2.4 Integrated braking resistor

Table 162: Integrated braking resistor data

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Nominal resistance	$R_{DC\_Bleeder\_nom}$	ohm	75	
Braking resistor continuous power	P_{BD}	W	80	
Braking resistor peak power	P_{BS}	kW	8	
Absorbable regenerative power	W_{R_max}	kWs	3.2	

10.2.5 External braking resistor/integrated braking transistor

Table 163: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	68	
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	100	
Resistor tolerance		%	±10	
Braking transistor continuous power	P_{BD}	kW	2.3	
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	400	
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	(U_{LN} × √2 × 1.05 + 15) ... 820	
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850	
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	500	

10.2.6 Inverter

Table 164: Inverter performance data

Designation	Symbol	Unit	XCS*-W0010	XCS*-W0023
Allowed switching frequencies	f_s	kHz	4 / 8	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	tbd	tbd
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1)]	
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	-	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	-	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	10	23
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	7.5	16
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	-	-
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	-	-
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	3.3	7.7
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	2.2	3.5
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	-	-
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	-	-
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	3	5.53
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	1.3	2.13
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	-	-
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	-	-
1) Depending on firmware (restricted export)				

10.3 XCS*-W0054 ... W0090

10.3.1 Control voltage

Table 165: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
Control voltage input1)	U_{N3}	V	24 ±20%		
Control voltage when using motor holding brake with motor cable length < 50 m2)	U_{N3}	V	24 ±5%		
Control voltage when using motor holding brake with motor cable length > 50 m3)	U_{N3}	V	26 ±5%		
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4		
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20		
Input capacitance	C_{N3}	mF	1.7		
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	133		

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.3.2 Mains voltage

Table 166: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
Mains frequency	f_{LN}	Hz	50 ... 60		
Tolerance input frequency		Hz	±2		
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2		
Rotating field condition			none		
Short circuit current rating	SCCR	A rms	42000		
Nominal mains voltage 3-phase	U_{LN_nom}	V	400		
Nominal mains voltage 1-phase	U_{LN_nom}	V	230		Not allowed
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500		
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500		
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed		
Tolerance U_{LN}		%	+10 / -15		
Minimum inductance of mains supply (mains phase inductance)1)	L_{min}	μH	40		

Technical data of components

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
Assigned mains choke type (3-phase)			HNL01.1E-0600-N0032-A-500	HNL01.1E-0571-N0050-A-500	
Inrush current	$I_{L\_trans\_max\_on}$	A	I_{LN}		
Maximum allowed ON-OFF cycles per minute			tbd		
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)2)	I_{LN}	A	23.1	26	35.6
Mains input continuous current (1-phase, without mains choke)2)	I_{LN}	A	20.4	23.4	-
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)3)	I_{LN}	A	26.6	34.6	44.4
Mains input continuous current (1-phase, with mains choke)	I_{LN}	A	1-phase operation with mains choke not allowed		-
Mains fuse according to EN 60204-1 (3-phase, without mains choke)		A	32		50
Mains fuse according to EN 60204-1 (1-phase, without mains choke)		A	32		-
Mains fuse according to EN 60204-1 (3-phase, with mains choke)		A	32	50	63
Mains fuse according to EN 60204-1 (1-phase, with mains choke)		A	1-phase operation with mains choke not allowed		-
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);4)	A_{LN}	AWG	8		6
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	S_{LN}	kVA	16	18	24.7
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	S_{LN}	kVA	18.4	23.9	30.8
Mains connected load at U_{LN_nom} and P_{DC_cont} (1-phase, without mains choke)	S_{LN_1ph}	kVA	4.69	5.38	-
Total power factor TPF at P_{DC_cont} (3-phase, without mains choke)			0.51	0.52	0.58
Total power factor TPF at P_{DC_cont} (3-phase, with mains choke)			0.87	0.87	0.87
Total power factor TPF at P_{DC_cont} (1-phase)			0.35	0.34	-

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

10.3.3 DC bus

Table 167: DC bus performance data

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
DC bus voltage	U_{DC}	V	approx. 250 ... 850		
Nominal DC bus voltage	U_{DC_nom}	V	540		
Capacitance in DC bus	C_{DC}	mF	0.78		1.36

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
Rated power (t > 10 min); U_{LN_nom}; with mains choke	P_{DC_cont}	kW	15.9	20.6	26.5
Rated power (t > 10 min); U_{LN_nom}; without mains choke	P_{DC_cont}	kW	8.1	9.2	14
Rated power with 1-phase mains voltage U_{LN_nom}	P_{DC_cont}	kW	1.62	1.84	-
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \le U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$		
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$		
Maximum allowed DC bus power at U_{LN_nom}; with mains choke	P_{DC_max}	kW	31.8	41.2	53
Maximum allowed DC bus power at U_{LN_nom}; without mains choke	P_{DC_max}	kW	17.3	27	42.7
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850		
Monitoring value minimum DC bus voltage, under-voltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable		
Allowed external DC bus capacitance (nom.) at U_{LN_nom} 1)	C_{DCext}	mF	150		
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120		

1) Use assigned mains choke

10.3.4 Integrated braking resistor

Table 168: Integrated braking resistor data

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
Nominal resistance	$R_{DC\_Bleeder\_nom}$	ohm	14.2		11
Braking resistor continuous power	P_{BD}	W	320	410	530
Braking resistor peak power	P_{BS}	kW	31.8	41.2	53
Absorbable regenerative power	W_{R_max}	kWs	13		16.7

10.3.5 External braking resistor/integrated braking transistor

Table 169: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	14.2	13	11.2
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	40.3		
Resistor tolerance		%	±10		
Braking transistor continuous power	P_{BD}	kW	8	10.3	13.3
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000		
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	($U_{LN} \times \sqrt{2} \times 1.05 + 15$) ... 820		
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850		
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	500		

10.3.6 Inverter

Table 170: Inverter performance data

Designation	Symbol	Unit	XCS*-W0054	XCS*-W0070	XCS*-W0090
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16		
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	tbd	tbd	tbd
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5		
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400		
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800 1)		
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200 1)		
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600 1)		
Output frequency threshold to reduce output current	f_{out_still}	Hz	3		
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	54	70	90
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	40	55	85
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	32	40	65
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	20	33	50
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	27	35	45
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	18	20	25
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	14	15	20
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	4.5	7	15
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	17.1	22.5	34.2
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	10.3	13.8	20.7
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	7	9.1	14
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	2	3.7	10
1) Depending on firmware (restricted export)					

10.4 XCS*-C0054/-C0070

10.4.1 Control voltage

Table 171: Control voltage supply data

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Control voltage input[1]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	1.7	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	98	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

– 24V power supply units that reduce incoming overvoltage to the allowed value.
– Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.4.2 Mains voltage

Table 172: Mains voltage supply data

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Mains frequency	f_{LN}	Hz	50 ... 60	
Tolerance input frequency		Hz	±2	
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2	
Rotating field condition			none	
Short circuit current rating	SCCR	A rms	42000	
Nominal mains voltage 3-phase	U_{LN_nom}	V	400	
Nominal mains voltage 1-phase	U_{LN_nom}	V	230	
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed	
Tolerance U_{LN}		%	+10 / -15	
Minimum inductance of mains supply (mains phase inductance)[1]	L_{min}	µH	40	
Assigned mains choke type (3-phase)			HNL01.1E-0600-N0032-A-500-NPNN	HNL01.1E-0571-N0050-A-500

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Inrush current	$I_{L\_trans\_max\_on}$	A	I_{LN}	
Maximum allowed ON-OFF cycles per minute			tbd	
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)2)	I_{LN}	A	23.1	26
Mains input continuous current (1-phase, without mains choke)2)	I_{LN}	A	20.4	23.4
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)3)	I_{LN}	A	26.6	34.6
Mains input continuous current (1-phase, with mains choke)	I_{LN}	A	1-phase operation with mains choke not allowed	
Mains fuse according to EN 60204-1 (3-phase, without mains choke)		A	32	
Mains fuse according to EN 60204-1 (1-phase, without mains choke)		A	32	
Mains fuse according to EN 60204-1 (3-phase, with mains choke)		A	32	50
Mains fuse according to EN 60204-1 (1-phase, with mains choke)		A	1-phase operation with mains choke not allowed	
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);4)	A_{LN}	AWG	8	
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	S_{LN}	kVA	16	18
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	S_{LN}	kVA	18.4	23.9
Mains connected load at U_{LN_nom} and P_{DC_cont} (1-phase, without mains choke)	S_{LN}	kVA	4.7	5.38
Total power factor TPF at P_{DC_cont} (3-phase, without mains choke)			0.51	0.52
Total power factor TPF at P_{DC_cont} (3-phase, with mains choke)			0.87	0.87
Total power factor TPF at P_{DC_cont} (1-phase)			0.35	0.34

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

10.4.3 DC bus

Table 173: DC bus performance data

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
DC bus voltage	U_{DC}	V	approx. 250 ... 850	
Nominal DC bus voltage	U_{DC_nom}	V	540	
Capacitance in DC bus	C_{DC}	mF	0.78	
Rated power (t > 10 min); U_{LN_nom}; with mains choke	P_{DC_cont}	kW	15.9	20.6
Rated power (t > 10 min); U_{LN_nom}; without mains choke	P_{DC_cont}	kW	8.1	9.2
Rated power with 1-phase mains voltage U_{LN_nom}	P_{DC_cont}	kW	8.1	9.2
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$	

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$	
Maximum allowed DC bus power at U_{LN_nom}; with mains choke	P_{DC_max}	kW	31.8	41.2
Maximum allowed DC bus power at U_{LN_nom}; without mains choke	P_{DC_max}	kW	17.3	27
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850	
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Allowed external DC bus capacitance (nom.) at U_{LN_nom} 1)	C_{DCext}	mF	150	
Charging time for maximum external DC bus capacitance C_{DCext} at U_{LN_nom}	$t_{lade\_DC\_Cext}$	s	tbd	tbd
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	

1) Use assigned mains choke

10.4.4 Integrated braking resistor

The devices do not have an integrated braking resistor.

10.4.5 External braking resistor/integrated braking transistor

Table 174: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	14.2	13
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	40.3	
Resistor tolerance		%	±10	
Braking transistor continuous power	P_{BD}	kW	8	10.3
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000	
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	$(U_{LN} \times \sqrt{2} \times 1.05 + 15)$ ... 820	
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850	
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	500	

10.4.6 Inverter

Table 175: Inverter performance data

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	tbd	
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	$\sim U_{DC} \times 0.71$	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1)]	

Technical data of components

Designation	Symbol	Unit	XCS*-C0054	XCS*-C0070
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1)]	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1)]	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	54	70
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	40	55
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	32	40
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	20	33
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	27	35
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	18	20
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	14	15
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	4.5	7
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	19.9	26.5
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	12.2	16.6
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	8.4	11.2
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	3.2	5.5
1) Depending on firmware (restricted export)				

10.5 XCS*-W0100/-W0120

10.5.1 Control voltage

Table 176: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Control voltage input[1]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	1.7	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	128	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.5.2 Mains voltage

Table 177: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Mains frequency	f_{LN}	Hz	50 ... 60	
Tolerance input frequency		Hz	±2	
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2	
Rotating field condition			none	
Short circuit current rating	SCCR	A rms	42000	
Nominal mains voltage 3-phase	U_{LN_nom}	V	400	
Nominal mains voltage 1-phase	U_{LN_nom}	V	Not allowed	
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed	
Tolerance U_{LN}		%	+10 / -15	
Minimum inductance of mains supply (mains phase inductance)[1]	L_{min}	µH	40	
Assigned mains choke type (3-phase)			XNL1-1E-0362-N0080-B-500	
Inrush current	$I_{L\_trans\_max\_on}$	A	I_{LN}	

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Maximum allowed ON-OFF cycles per minute			tbd	
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)[2)]	I_{LN}	A	46.1	51
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)[3)]	I_{LN}	A	59.5	79.3
Mains fuse according to EN 60204-1 (3-phase, without mains choke)		A	50	63
Mains fuse according to EN 60204-1 (3-phase, with mains choke)		A	63	100
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	3	
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	S_{LN}	kVA	32	35.3
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	S_{LN}	kVA	41.2	54.9
Total power factor TPF at P_{DC_cont} (3-phase, without mains choke)			0.6	0.62
Total power factor TPF at P_{DC_cont} (3-phase, with mains choke)			0.87	0.87

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

10.5.3 DC bus

Table 178: DC bus performance data

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
DC bus voltage	U_{DC}	V	approx. 250 ... 850	
Nominal DC bus voltage	U_{DC_nom}	V	540	
Capacitance in DC bus	C_{DC}	mF	2.04	
Rated power (t > 10 min); U_{LN_nom}; with mains choke	P_{DC_cont}	kW	35.5	47.3
Rated power (t > 10 min); U_{LN_nom}; without mains choke	P_{DC_cont}	kW	18.9	21.6
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$	
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$	
Maximum allowed DC bus power at U_{LN_nom}; with mains choke	P_{DC_max}	kW	67.5	90
Maximum allowed DC bus power at U_{LN_nom}; without mains choke	P_{DC_max}	kW	48.6	54
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850	
Monitoring value minimum DC bus voltage, under-voltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Allowed external DC bus capacitance (nom.) at U_{LN_nom} 1)	C_{DCext}	mF	150	
Charging time for maximum external DC bus capacitance C_{DCext} at U_{LN_nom}	$t_{lade\_DC\_Cext}$	s	tbd	tbd

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	

1) Use assigned mains choke

10.5.4 External braking resistor/integrated braking transistor

Table 179: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	8.4	
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	40.3	
Resistor tolerance		%	±10	
Braking transistor continuous power	P_{BD}	kW	7	
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000	
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	(U_{LN} × √2 × 1.05 + 15) ... 820	
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850	
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	5000	

10.5.5 Inverter

Table 180: Inverter performance data

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	tbd	
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1)]	
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1)]	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1)]	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	100	120
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	67	80
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	47	57
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	37	45
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	67	71
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	45	48
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	24	26
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	20	22
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	56.8	
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	33.1	

Designation	Symbol	Unit	XCS*-W0100	XCS*-W0120
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	21.6	
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	14	
1) Depending on firmware (restricted export)				

10.6 XCS*-W0150/-W0180

10.6.1 Control voltage

Table 181: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Control voltage input[1)]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	1.7	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	168	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.6.2 Mains voltage

Table 182: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Mains frequency	f_{LN}	Hz	50 ... 60	
Tolerance input frequency		Hz	±2	
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2	
Rotating field condition			none	
Short circuit current rating	SCCR	A rms	42000	
Nominal mains voltage 3-phase	U_{LN_nom}	V	400	
Nominal mains voltage 1-phase	U_{LN_nom}	V	Not allowed	
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500	
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed	
Tolerance U_{LN}		%	+10 / -15	
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40	
Assigned mains choke type			HNL01.1E-0200-N0125-A-480	
Inrush current	$I_{L\_trans\_max\_on}$	A	I_{LN}	

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Maximum allowed ON-OFF cycles per minute			tbd	
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)[2)]	I_{LN}	A	56	70
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)[3)]	I_{LN}	A	101	117
Mains fuse according to EN 60204-1 (3-phase, without mains choke)		A	80	125
Mains fuse according to EN 60204-1 (3-phase, with mains choke)		A	100	160
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	1/0	
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	S_{LN}	kVA	38.7	49
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	S_{LN}	kVA	68.9	81
Total power factor TPF at P_{DC_cont} (3-phase, without mains choke)			0.73	0.72
Total power factor TPF at P_{DC_cont} (3-phase, with mains choke)			0.94	0.93

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

10.6.3 DC bus

Table 183: DC bus performance data

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
DC bus voltage	U_{DC}	V	approx. 250 ... 850	
Nominal DC bus voltage	U_{DC_nom}	V	540	
Capacitance in DC bus	C_{DC}	mF	3.06	
Rated power (t > 10 min); U_{LN_nom}; with mains choke	P_{DC_cont}	kW	58.9	71
Rated power (t > 10 min); U_{LN_nom}; without mains choke	P_{DC_cont}	kW	27	34
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$	
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$	
Maximum allowed DC bus power at U_{LN_nom}; with mains choke	P_{DC_max}	kW	88.3	106
Maximum allowed DC bus power at U_{LN_nom}; without mains choke	P_{DC_max}	kW	64.8	89
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850	
Monitoring value minimum DC bus voltage, under-voltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Allowed external DC bus capacitance (nom.) at U_{LN_nom} [1)]	C_{DCext}	mF	150	
Charging time for maximum external DC bus capacitance C_{DCext} at U_{LN_nom}	$t_{lade\_DC\_Cext}$	s	tbd	tbd

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	300	

1) Use assigned mains choke

10.6.4 External braking resistor/integrated braking transistor

Table 184: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	6.7	5.6
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	40.3	
Resistor tolerance		%	±10	
Braking transistor continuous power	P_{BD}	kW	29.45	35.5
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	650	
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	(U_{LN} × √2 × 1.05 + 15) ... 820	
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850	
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	5000	

10.6.5 Inverter

Table 185: Inverter performance data

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	tbd	
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800 1)	
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200 1)	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600 1)	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	150	180
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	100	120
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	75	90
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	52	62
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	100	120
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	60	72
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	43	52
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	31	37
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	85.5	
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	53.2	

Designation	Symbol	Unit	XCS*-W0150	XCS*-W0180
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	38.1	
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	28.8	
1) Depending on firmware (restricted export)				

10.7 XCS*-W0210 ... W0375

10.7.1 Control voltage

Table 186: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Control voltage input[1]	U_{N3}	V	24 ±20%				
Control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ±5%				
Control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ±5%				
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4				
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20				
Input capacitance	C_{N3}	mF	1.7				
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	163			276	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.7.2 Mains voltage

Table 187: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Mains frequency	f_{LN}	Hz	50 ... 60				
Tolerance input frequency		Hz	±2				
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2				
Rotating field condition			none				
Short circuit current rating	SCCR	A rms	42000				
Nominal mains voltage 3-phase	U_{LN_nom}	V	400				
Nominal mains voltage 1-phase	U_{LN_nom}	V	Not allowed				
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500				
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500				

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed				
Tolerance U_{LN}		%	+10 / -15				
Minimum inductance of mains supply (mains phase inductance)1)	L_{min}	µH	40				
Assigned mains choke type			XNL1-1E-0170-N0146-B-500	XNL1-1E-0135-N0185-B-500		HNL01.1E-0100-N0220-A-480-NNNN	
Inrush current	$I_{L\_trans\_max\_on}$	A	I_{LN}				
Maximum allowed ON-OFF cycles per minute			tbd				
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)2)	I_{LN}	A	117.5	141.5	166	155.9	165.3
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)3)	I_{LN}	A	139.9	160.8	175.9	184.3	184.3
Mains fuse according to EN 60204-1 (3-phase, without mains choke)		A	160	200			
Mains fuse according to EN 60204-1 (3-phase, with mains choke)		A	160	200		250	
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);4)	A_{LN}	AWG	kcmil 250				
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	S_{LN}	kVA	84.4	98	115	108	114.5
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	S_{LN}	kVA	96.9	111.4	121.9	127.7	127.7
Total power factor TPF at P_{DC_cont} (3-phase, without mains choke)			0.7	0.72	0.73	0.78	0.76
Total power factor TPF at P_{DC_cont} (3-phase, with mains choke)			0.87	0.87	0.87	0.87	0.87

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

10.7.3 DC bus

Table 188: DC bus performance data

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
DC bus voltage	U_{DC}	V	approx. 250 ... 850				

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Nominal DC bus voltage	U_{DC_nom}	V	540				
Capacitance in DC bus	C_{DC}	mF	4.08	4.76		5.44	
Rated power (t > 10 min); U_{LN_nom}; with mains choke	P_{DC_cont}	kW	83.5	96	105	110	110
Rated power (t > 10 min); U_{LN_nom}; without mains choke	P_{DC_cont}	kW	56.7	70.2	83.7		86.4
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$				
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$				
Maximum allowed DC bus power at U_{LN_nom}; with mains choke	P_{DC_max}	kW	167	192	210		210
Maximum allowed DC bus power at U_{LN_nom}; without mains choke	P_{DC_max}	kW	123.6	140.4	168.5		
Maximum allowed DC bus power at U_{LN_nom}; with special choke	P_{DC_max}	kW	169	-			
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850				
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable				
Allowed external DC bus capacitance (nom.) at U_{LN_nom} 1)	C_{DCext}	mF	150				
Charging time for maximum external DC bus capacitance C_{DCext} at U_{LN_nom}	$t_{lade\_DC\_Cext}$	s	tbd	tbd	tbd	tbd	tbd
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	300				

1) Use assigned mains choke

10.7.4 External braking resistor/integrated braking transistor

Table 189: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	4			2.8	
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	40.3			20.1	
Resistor tolerance		%	±10				
Braking transistor continuous power	P_{BD}	kW	30				
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	5000				
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	$(U_{LN} \times \sqrt{2} \times 1.05 + 15)$ ... 820				
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850				
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	5000				

10.7.5 Inverter

Table 190: Inverter performance data

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16				
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	tbd				
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	$\sim U_{DC} \times 0.71$				
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5				
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5				
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400				
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1)]				
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1)]				
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1)]				
Output frequency threshold to reduce output current	f_{out_still}	Hz	3				
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	210	250	280	330	375
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	210	220		250	
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	135	150		183	
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	135			143	
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	140	147	165	194	221
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	93	98	104	112	130
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	67	70	73	77	86
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	46			58	60
Continuous output current when f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	91.6	116		149.3	
Continuous output current when f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	55.3	67.2		81.1	
Continuous output current when f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_12}$	A	38.2	41.6		51	

Designation	Symbol	Unit	XCS*-W0210	XCS*-W0250	XCS*-W0280	XCS*-W0330	XCS*-W0375
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	27.8	28.8		34.3	
1) Depending on firmware (restricted export)							

10.8 XCD*-W2323

10.8.1 Control voltage

Table 191: Control voltage supply data

Designation	Symbol	Unit	XCD*-W2323
Control voltage input[1]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	6
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20
Input capacitance	C_{N3}	mF	2.4
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	158

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

– 24V power supply units that reduce incoming overvoltage to the allowed value.
– Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.8.2 Mains voltage

Table 192: Mains voltage supply data

Designation	Symbol	Unit	XCD*-W2323
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance input frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			none
Short circuit current rating	SCCR	A rms	42000
Nominal mains voltage 3-phase	U_{LN_nom}	V	400
Nominal mains voltage 1-phase	U_{LN_nom}	V	230
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1]	L_{min}	µH	40
Assigned mains choke type (3-phase)			HNL01.1E-0600-N0032-A-500-NPNN
Inrush current	$I_{L\_trans\_max\_on}$	A	I_{LN}

Designation	Symbol	Unit	XCD*-W2323
Maximum allowed ON-OFF cycles per minute			tbd
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)2)	I_{LN}	A	23.1
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)3)	I_{LN}	A	26.6
Mains input continuous current (1-phase, without mains choke)2)	I_{LN}	A	20.4
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (1-phase, with mains choke)	I_{LN}	A	1-phase operation with mains choke not allowed
Mains fuse according to EN 60204-1 (3-phase, without mains choke)		A	32
Mains fuse according to EN 60204-1 (3-phase, with mains choke)		A	32
Mains fuse according to EN 60204-1 (1-phase, without mains choke)		A	32
Mains fuse according to EN 60204-1 (1-phase, with mains choke)		A	1-phase operation with mains choke not allowed
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);4)	A_{LN}	AWG	8
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	S_{LN}	kVA	16
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	S_{LN}	kVA	18.4
Mains connected load at U_{LN_nom} and P_{DC_cont} (1-phase, without mains choke)	S_{LN}	kVA	4.69
Total power factor TPF at P_{DC_cont} (3-phase, without mains choke)			0.51
Total power factor TPF at P_{DC_cont} (3-phase, with mains choke)			0.87
Total power factor TPF at P_{DC_cont} (1-phase)			0.35

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

10.8.3 DC bus

Table 193: DC bus performance data

Designation	Symbol	Unit	XCD*-W2323
DC bus voltage	U_{DC}	V	approx. 250 ... 850
Nominal DC bus voltage	U_{DC_nom}	V	540
Capacitance in DC bus	C_{DC}	mF	0.78
Rated power (t > 10 min); U_{LN_nom}; with mains choke	P_{DC_cont}	kW	15.9
Rated power (t > 10 min); U_{LN_nom}; without mains choke	P_{DC_cont}	kW	8.1
Rated power with 1-phase mains voltage U_{LN_nom}	P_{DC_cont}	kW	1.62
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$

Designation	Symbol	Unit	XCD*-W2323
Maximum allowed DC bus power at U_{LN_nom}; with mains choke	P_{DC_max}	kW	31.8
Maximum allowed DC bus power at U_{LN_nom}; without mains choke	P_{DC_max}	kW	17.3
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850
Monitoring value minimum DC bus voltage, under-voltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable
Allowed external DC bus capacitance (nom.) at U_{LN_nom} 1)	C_{DCext}	mF	150
Charging time for maximum external DC bus capacitance C_{DCext} at U_{LN_nom}	$t_{lade\_DC\_Cext}$	s	tbd
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120

1) Use assigned mains choke

10.8.4 Integrated braking resistor

Table 194: Integrated braking resistor data

Designation	Symbol	Unit	XCD*-W2323
Nominal resistance	$R_{DC\_Bleeder\_nom}$	ohm	14.2
Braking resistor continuous power	P_{BD}	W	320
Braking resistor peak power	P_{BS}	kW	31.8
Absorbable regenerative power	W_{R_max}	kWs	13
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	(U_{LN} × √2 × 1.05 + 15) ... 820
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850

10.8.5 External braking resistor/integrated braking transistor

Table 195: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCD*-W2323
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	14.2
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	40.3
Resistor tolerance		%	±10
Braking transistor continuous power	P_{BD}	kW	8
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000
Braking resistor switch-on threshold	$U_{R\_DC\_On\_f}$	V	nominal: 820 minimum: (mains peak value + 10%) × 1.05
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	500

10.8.6 Inverter

Table 196: Inverter performance data

Designation	Symbol	Unit	XCD*-W2323
Allowed switching frequencies	f_s	kHz	4 / 8
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	tbd
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1)]
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	-
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	-
Output frequency threshold to reduce output current	f_{out_still}	Hz	3
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	2 × 23
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	2 × 16
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	-
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	-
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	2 × 7.7
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	2 × 3.5
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	-
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	-
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	2 × 5.5
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	2 × 2.1
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	-
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	-

1) Depending on firmware (restricted export)

10.9 XMS*-W0006 ... W0036

10.9.1 Control voltage

Table 197: Control voltage supply data

Designation	Symbol	Unit	XMS*-W0006	XMS*-W0010	XMS*-W0016	XMS*-W0023	XMS*-W0030	XMS*-W0036
Control voltage input[1)]	U_{N3}	V	24 ±20%					
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%					
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%					
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4					
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20					
Input capacitance	C_{N3}	mF	1.7					
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	79					

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

10.9.2 DC bus

Table 198: DC bus performance data

Designation	Symbol	Unit	XMS*-W0006	XMS*-W0010	XMS*-W0016	XMS*-W0023	XMS*-W0030	XMS*-W0036
DC bus voltage	U_{DC}	V	approx. 250 ... 860					
Nominal DC bus voltage	U_{DC_nom}	V	750					
Capacitance in DC bus	C_{DC}	mF	-					
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900					
Monitoring value minimum DC bus voltage, under-voltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable					
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120					

10.9.3 Inverter

Table 199: Inverter performance data

Designation	Symbol	Unit	XMS*-W0006	XMS*-W0010	XMS*-W0016	XMS*-W0023	XMS*-W0030	XMS*-W0036
Allowed switching frequencies	f_s	kHz	4 /8					
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71					

Designation	Symbol	Unit	XMS*-W0006	XMS*-W0010	XMS*-W0016	XMS*-W0023	XMS*-W0030	XMS*-W0036
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71					
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5					
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5					
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400					
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800 1)					
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	-					
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	-					
Output frequency threshold to reduce output current	f_{out_still}	Hz	3					
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	6	10	16	23	30	36
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	4.7	7.5	10	16	21	25
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	-	-	-	-	-	-
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	-	-	-	-	-	-
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	2	3.3	5.3	7.7	12	18
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	1.7	2.2	2.9	3.5	6.7	10
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	-	-	-	-	-	-
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	-	-	-	-	-	-
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	1.9	3.0	4.7	5.5	9.6	12.6
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	1.1	1.3	1.6	2.1	3.9	5.4
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	-	-	-	-	-	-
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	-	-	-	-	-	-
1) Depending on firmware (restricted export)								

10.10 XMS*-W0054 ... W0090

10.10.1 Control voltage

Table 200: Control voltage supply data

Designation	Symbol	Unit	XMS*-W0054	XMS*-W0070	XMS*-W0090
Control voltage input[1)]	U_{N3}	V	24 ±20%		
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%		
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%		
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4		
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20		
Input capacitance	C_{N3}	mF	1.7		
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	120		

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

10.10.2 DC bus

Table 201: DC bus performance data

Designation	Symbol	Unit	XMS*-W0054	XMS*-W0070	XMS*-W0090
DC bus voltage	U_{DC}	V	approx. 250 ... 860		
Nominal DC bus voltage	U_{DC_nom}	V	750		
Capacitance in DC bus	C_{DC}	mF	-		
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900		
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable		
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120		

10.10.3 Inverter

Table 202: Inverter performance data

Designation	Symbol	Unit	XMS*-W0054	XMS*-W0070	XMS*-W0090
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16		
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71		
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5		
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400		

Designation	Symbol	Unit	XMS*-W0054	XMS*-W0070	XMS*-W0090
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1]		
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1]		
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1]		
Output frequency threshold to reduce output current	f_{out_still}	Hz	3		
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	54	70	90
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	40	55	85
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	32	40	65
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	20	33	50
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	27	35	45
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	18	20	29
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	14	15	20
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	4.5	7	15
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	17.1	22.5	34.2
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	10.3	13.8	20.7
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	7	9.1	14
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	2	3.7	10
1) Depending on firmware (restricted export)					

10.11 XMS*-C0054 ... C0090

10.11.1 Control voltage

Table 203: Control voltage supply data

Designation	Symbol	Unit	XMS*-C0054	XMS*-C0070	XMS*-C0090
Control voltage input[1)]	U_{N3}	V	24 ±20%		
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%		
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%		
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4		
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20		
Input capacitance	C_{N3}	mF	1.7		
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	85		

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➡ Chapter 4.3.18 Project planning of control voltage on page 138.

10.11.2 DC bus

Table 204: DC bus performance data

Designation	Symbol	Unit	XMS*-C0054	XMS*-C0070	XMS*-C0090
DC bus voltage	U_{DC}	V	approx. 250 ... 860		
Nominal DC bus voltage	U_{DC_nom}	V	750		
Capacitance in DC bus	C_{DC}	mF	-		
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900		
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable		
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120		

10.11.3 Inverter

Table 205: Inverter performance data

Designation	Symbol	Unit	XMS*-C0054	XMS*-C0070	XMS*-C0090
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16		
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71		
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5		
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400		

Designation	Symbol	Unit	XMS*-C0054	XMS*-C0070	XMS*-C0090
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1]		
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1]		
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1]		
Output frequency threshold to reduce output current	f_{out_still}	Hz	3		
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	54	70	90
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	40	55	85
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	32	40	65
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	20	33	50
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	27	35	45
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	18	20	29
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	14	15	20
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	4.5	7	15
Continuous output current when f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	19.8	26.4	34.5
Continuous output current when f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	12.2	16.5	18.6
Continuous output current when f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_12}$	A	8.3	11.2	12.3
Continuous output current when f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_16}$	A	3.2	5.5	8.8
1) Depending on firmware (restricted export)					

10.12 XMS*-W0100/-W0120

10.12.1 Control voltage

Table 206: Control voltage supply data

Designation	Symbol	Unit	XMS*-W0100	XMS*-W0120
Control voltage input[1)]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	1.7	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	105	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦Chapter 4.3.18 Project planning of control voltage on page 138.

10.12.2 DC bus

Table 207: DC bus performance data

Designation	Symbol	Unit	XMS*-W0100	XMS*-W0120
DC bus voltage	U_{DC}	V	approx. 250 ... 860	
Nominal DC bus voltage	U_{DC_nom}	V	750	
Capacitance in DC bus	C_{DC}	mF	-	
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900	
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	

10.12.3 Inverter

Table 208: Inverter performance data

Designation	Symbol	Unit	XMS*-W0100	XMS*-W0120
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	$\sim U_{DC} \times 0.71$	
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	$\sim U_{DC} \times 0.71$	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	

Designation	Symbol	Unit	XMS*-W0100	XMS*-W0120
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1]	
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1]	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1]	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	100	120
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	67	80
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	47	57
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	37	45
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	67	71
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	45	48
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	24	26
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	20	22
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	56.8	
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	33.1	
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	21.6	
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	14	
1) Depending on firmware (restricted export)				

10.13 XMS*-W0150/-W0180

10.13.1 Control voltage

Table 209: Control voltage supply data

Designation	Symbol	Unit	XMS*-W0150	XMS*-W0180
Control voltage input[1)]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	1.7	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	166	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦Chapter 4.3.18 Project planning of control voltage on page 138.

10.13.2 DC bus

Table 210: DC bus performance data

Designation	Symbol	Unit	XMS*-W0150	XMS*-W0180
DC bus voltage	U_{DC}	V	approx. 250 ... 860	
Nominal DC bus voltage	U_{DC_nom}	V	750	
Capacitance in DC bus	C_{DC}	mF	-	
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900	
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	300	

10.13.3 Inverter

Table 211: Inverter performance data

Designation	Symbol	Unit	XMS*-W0150	XMS*-W0180
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71	
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	

Designation	Symbol	Unit	XMS*-W0150	XMS*-W0180
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1]	
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1]	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1]	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	150	180
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	100	120
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	75	90
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	52	62
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	100	120
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	60	72
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	43	52
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	31	37
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	87.8	
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	54.8	
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	39.3	
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	29.7	

1) Depending on firmware (restricted export)

10.14 XMS*-W0210 ... W0375

10.14.1 Control voltage

Table 212: Control voltage supply data

Designation	Symbol	Unit	XMS*-W0210	XMS*-W0250	XMS*-W0280	XMS*-W0330	XMS*-W0375
Control voltage input[1)]	U_{N3}	V	24 ±20%				
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%				
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%				
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4				
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20				
Input capacitance	C_{N3}	mF	1.8				
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	135			222	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

10.14.2 DC bus

Table 213: DC bus performance data

Designation	Symbol	Unit	XMS*-W0210	XMS*-W0250	XMS*-W0280	XMS*-W0330	XMS*-W0375
DC bus voltage	U_{DC}	V	approx. 250 ... 860				
Nominal DC bus voltage	U_{DC_nom}	V	750				
Capacitance in DC bus	C_{DC}	mF	2.04	2.72			
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900				
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable				
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	300				

10.14.3 Inverter

Table 214: Inverter performance data

Designation	Symbol	Unit	XMS*-W0210	XMS*-W0250	XMS*-W0280	XMS*-W0330	XMS*-W0375
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16				
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71				
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71				
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5				

Designation	Symbol	Unit	XMS*-W0210	XMS*-W0250	XMS*-W0280	XMS*-W0330	XMS*-W0375
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5				
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400				
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800 1)				
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200 1)				
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600 1)				
Output frequency threshold to reduce output current	f_{out_still}	Hz	3				
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	210	250	280	330	375
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	210	220		250	
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	135	150		183	
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	135			120	
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	140	147	165	194	221
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	93	98	104	118	135
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	67	70	73	79	90
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	46			59	66
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	91.6	116		tbd	tbd
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	55.3	67.2		tbd	tbd
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	38.3	41.7		tbd	tbd
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	27.7	28.8		tbd	tbd

1) Depending on firmware (restricted export)

Technical data of components

10.15 XMS*-C0210 ... C0280

10.15.1 Control voltage

Table 215: Control voltage supply data

Designation	Symbol	Unit	XMS*-C0210	XMS*-C0250	XMS*-C0280
Control voltage input[1)]	U_{N3}	V	24 ±20%		
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%		
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%		
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4		
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20		
Input capacitance	C_{N3}	mF	1.7		
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	113		

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

10.15.2 DC bus

Table 216: DC bus performance data

Designation	Symbol	Unit	XMS*-C0210	XMS*-C0250	XMS*-C0280
DC bus voltage	U_{DC}	V	approx. 250 ... 860		
Nominal DC bus voltage	U_{DC_nom}	V	750		
Capacitance in DC bus	C_{DC}	mF	2.04	2.72	
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900		
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable		
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	300		

10.15.3 Inverter

Table 217: Inverter performance data

Designation	Symbol	Unit	XMS*-C0210	XMS*-C0250	XMS*-C0280
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16		
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	$\sim U_{DC} \times 0.71$		
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	$\sim U_{DC} \times 0.71$		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5		
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5		
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400		

Designation	Symbol	Unit	XMS*-C0210	XMS*-C0250	XMS*-C0280
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800[1]		
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200[1]		
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600[1]		
Output frequency threshold to reduce output current	f_{out_still}	Hz	3		
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	210	250	280
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	210	220	
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	135	150	
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	135		
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	140	147	165
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	93	98	104
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	67	70	73
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	46		
Continuous output current when f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	104.3	133.4	
Continuous output current when f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	63.8	79.1	
Continuous output current when f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_12}$	A	44.5	50.8	
Continuous output current when f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_16}$	A	32.7	36.2	

1) Depending on firmware (restricted export)

10.16 XMD*-W0606 ... W3636

10.16.1 Control voltage

Table 218: Control voltage supply data

Designation	Symbol	Unit	XMD*-W0606	XMD*-W1010	XMD*-W1616	XMD*-W2323	XMD*-W3030	XMD*-W3636
Control voltage input[1)]	U_{N3}	V	24 ±20%					
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%					
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%					
Max. inrush current at 24 V supply	I_{EIN3_max}	A	6					
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20					
Input capacitance	C_{N3}	mF	1.7				2.4	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	146				171	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

10.16.2 DC bus

Table 219: Power section data - DC bus

Designation	Symbol	Unit	XMD*-W0606	XMD*-W1010	XMD*-W1616	XMD*-W2323	XMD*-W3030	XMD*-W3636
DC bus voltage	U_{DC}	V	approx. 250 ... 860					
Nominal DC bus voltage	U_{DC_nom}	V	750					
Capacitance in DC bus	C_{DC}	µF	-					
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900					
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable					
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120					

10.16.3 Inverter

Table 220: Power section data - inverter

Designation	Symbol	Unit	XMD*-W0606	XMD*-W1010	XMD*-W1616	XMD*-W2323	XMD*-W3030	XMD*-W3636
Allowed switching frequencies	f_s	kHz	4 / 8					
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71					
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71					
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5					

Designation	Symbol	Unit	XMD*-W0606	XMD*-W1010	XMD*-W1616	XMD*-W2323	XMD*-W3030	XMD*-W3636
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5					
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400					
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800 1)					
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	-					
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	-					
Output frequency threshold to reduce output current	f_{out_still}	Hz	3					
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	2 × 6	2 × 10	2 × 16	2 × 23	2 × 30	2 × 36
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	2 × 4.7	2 × 7.5	2 × 10	2 × 16	2 × 21	2 × 25
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	-	-	-	-	-	-
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	-	-	-	-	-	-
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	2 × 2	2 × 3.3	2 × 5.3	2 × 7.7	2 × 12	2 × 18
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	2 × 1.7	2 × 2.2	2 × 2.9	2 × 3.5	2 × 6.7	2 × 10
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	-	-	-	-	-	-
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	-	-	-	-	-	-
Continuous output current when f_s = 4 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_4}$	A	2 × 1.9	2 × 3	2 × 4.7	2 × 5.5	2 × tbd	2 × tbd
Continuous output current when f_s = 8 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_8}$	A	2 × 1.1	2 × 1.3	2 × 1.6	2 × 2.1	2 × tbd	2 × tbd
Continuous output current when f_s = 12 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_12}$	A	-	-	-	-	-	-
Continuous output current when f_s = 16 kHz; output frequency f_{out} < f_{out_still}	$I_{out\_cont0Hz\_16}$	A	-	-	-	-	-	-

1) Depending on firmware (restricted export)

Technical data of components

10.17 XMD*-W5454/-W7070

10.17.1 Control voltage

Table 221: Control voltage supply data

Designation	Symbol	Unit	XMD*-W5454	XMD*-W7070
Control voltage input[1)]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	6	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	2.4	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	175	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

10.17.2 DC bus

Table 222: Power section data - DC bus

Designation	Symbol	Unit	XMD*-W5454	XMD*-W7070
DC bus voltage	U_{DC}	V	approx. 250 ... 860	
Nominal DC bus voltage	U_{DC_nom}	V	750	
Capacitance in DC bus	C_{DC}	µF	-	
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900	
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	

10.17.3 Inverter

Table 223: Power section data - inverter

Designation	Symbol	Unit	XMD*-W5454	XMD*-W7070
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71	
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	

Designation	Symbol	Unit	XMD*-W5454	XMD*-W7070
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800 1)	
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200 1)	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600 1)	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	2 × 54	2 × 70
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	2 × 40	2 × 55
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	2 × 32	2 × 40
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	2 × 20	2 × 33
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	2 × 27	2 × 35
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	2 × 18	2 × 20
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	2 × 14	2 × 14
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	2 × 4.5	2 × 7
Continuous output current when f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	2 × 17.1	2 × 22.5
Continuous output current when f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	2 × 10.3	2 × 13.8
Continuous output current when f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_12}$	A	2 × 7	2 × 9.1
Continuous output current when f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_16}$	A	2 × 2	2 × 3.7

1) Depending on firmware (restricted export)

10.18 XMD*-C5454/-C7070

10.18.1 Control voltage

Table 224: Control voltage supply data

Designation	Symbol	Unit	XMD*-C5454	XMD*-C7070
Control voltage input[1)]	U_{N3}	V	24 ±20%	
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%	
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%	
Max. inrush current at 24 V supply	I_{EIN3_max}	A	6	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20	
Input capacitance	C_{N3}	mF	2.4	
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	167	

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

10.18.2 DC bus

Table 225: Power section data - DC bus

Designation	Symbol	Unit	XMD*-C5454	XMD*-C7070
DC bus voltage	U_{DC}	V	approx. 250 ... 860	
Nominal DC bus voltage	U_{DC_nom}	V	750	
Capacitance in DC bus	C_{DC}	µF	-	
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900	
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable	
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	

10.18.3 Inverter

Table 226: Power section data - inverter

Designation	Symbol	Unit	XMD*-C5454	XMD*-C7070
Allowed switching frequencies	f_s	kHz	4 / 8 / 12 / 16	
Output voltage, fundamental wave in V/Hz (U/f) control	U_{out_eff}	V	~U_{DC} × 0.71	
Output voltage, fundamental wave in closed-loop operation	U_{out_eff}	V	~U_{DC} × 0.71	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-phase (10-90%)	dv/dt	kV/µs	5	
Rise of voltage at output with U_{LN_nom} and 15 m motor cable length phase-ground (10-90%)	dv/dt	kV/µs	5	
Output frequency range when f_s = 4 kHz	f_{out_4k}	Hz	0 ... 400	

Designation	Symbol	Unit	XMD*-C5454	XMD*-C7070
Output frequency range when f_s = 8 kHz	f_{out_8k}	Hz	0 ... 800 1)	
Output frequency range when f_s = 12 kHz	f_{out_12k}	Hz	0 ... 1200 1)	
Output frequency range when f_s = 16 kHz	f_{out_16k}	Hz	0 ... 1600 1)	
Output frequency threshold to reduce output current	f_{out_still}	Hz	3	
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	2 × 54	2 × 70
Maximum output current when f_s = 8 kHz	I_{out_max8}	A	2 × 40	2 × 55
Maximum output current when f_s = 12 kHz	I_{out_max12}	A	2 × 32	2 × 40
Maximum output current when f_s = 16 kHz	I_{out_max16}	A	2 × 20	2 × 33
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	2 × 27	2 × 35
Continuous output current when f_s = 8 kHz	I_{out_cont8}	A	2 × 18	2 × 20
Continuous output current when f_s = 12 kHz	I_{out_cont12}	A	2 × 14	2 × 14
Continuous output current when f_s = 16 kHz	I_{out_cont16}	A	2 × 4.5	2 × 7
Continuous output current when f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	2 × 19.9	2 × 26.5
Continuous output current when f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	2 × 12.2	2 × 16.5
Continuous output current when f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_12}$	A	2 × 8.4	2 × 11.2
Continuous output current when f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_16}$	A	2 × 3.2	2 × 5.5
1) Depending on firmware (restricted export)				

10.19 XVR*-W0019 ... W0100

10.19.1 Control voltage

Table 227: Control voltage supply data

Designation	Symbol	Unit	XVR*-W0019	XVR*-W0048	XVR*-W0072	XVR*-W0100
Control voltage input[1)]	U_{N3}	V	24 ±20%			
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%			
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%			
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4			10
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20			
Input capacitance	C_{N3}	mF	1.7			3.4
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	79	72	79	208

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➡Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.19.2 Mains voltage

Table 228: Mains voltage supply data

Designation	Symbol	Unit	XVR*-W0019	XVR*-W0048	XVR*-W0072	XVR*-W0100
Mains frequency	f_{LN}	Hz	50 ... 60			
Tolerance input frequency		Hz	±2			
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2			
Rotating field condition			none			
Short circuit current rating	SCCR	A rms	tbd	42000		
Nominal mains voltage 3-phase	U_{LN_nom}	V	400			
Nominal mains voltage 1-phase	U_{LN_nom}	V	Not allowed			
Mains voltage, three-phase at TN-S, TN-C, TT mains[2)]	U_{LN}	V	380 ... 500			
Mains voltage, three-phase at IT mains	U_{LN}	V	Not allowed			
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed			
Tolerance U_{LN}		%	+10 / -15			
Minimum inductance of mains supply (mains phase inductance)[4)]	L_{min}	µH	40			
Assigned mains connection module			XLI1-1R-W0019	XLI1-1R-W0048	XLI1-1R-W0072	XLI1-1R-W0100
Maximum allowed ON-OFF cycles per minute			tbd			
Power factor TPF (λ_L) at P_{DC_cont}, U_{LN_nom}, U_{DC_nom}	TPF		> 0.99			
Power factor of fundam. component DPF at P_{DC_cont}, U_{LN_nom}, U_{DC_nom}	cosφ		> 0.99			
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase)	I_{LN}	A	29.5	76	109	150
Nominal current AC1 for mains contactor at nom. data	I_{LN}×1.1	A	32.4	84	120	165
Mains fuse according to EN 60204-1 (3-phase)		A	50	100	125	200
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[1)]	A_{LN}	AWG	8	3	1/0	3/0
		mm^2	10	35	70	95
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase)[3)]	S_{LN}	kVA	19.9	50.3	75.2	104.3

1) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

2) XLI mains connection module may limit the voltage range

3) Mains connected load includes power dissipation of XLI mains connection module

4) Otherwise, use XNL mains choke

Technical data of components

10.19.3 DC bus

Table 229: DC bus performance data

Designation	Symbol	Unit	XVR*-W0019	XVR*-W0048	XVR*-W0072	XVR*-W0100
Maximum allowed DC bus power at U_{LN_nom}	P_{DC_max}	kW	57.4	120	180	250
Rated power at U_{LN_nom}, U_{DC_nom}	P_{DC_cont}	kW	19	48	72	100
Rated power, rectifier mode at U_{LN_nom}, U_{DC_nom}	$P_{DC\_cont\_RF}$	kW	4.8	12	18	25
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	P_{DC_cont}			
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$			
P_{DC_cont} and P_{DC_max} vs. DC bus voltage; $U_{DC} > U_{DC\_nom}$	$P_{DC\_cont\ (U_{DC})}$	kW	P_{DC_cont}			
P_{DC_cont} and P_{DC_max} vs. DC bus voltage; $U_{DC} \leq U_{DC\_nom}$	$P_{DC\_cont\ (U_{DC})}$	kW	$P_{DC\_cont\ (U_{DC})} = P_{DC\_cont} \times [1 - (U_{DC\_nom} - U_{DC}) \times 0.001333]$			
DC bus voltage, closed-loop controlled 1)	U_{DC_nom}	V	750			
DC bus voltage setting range, upper limit	$U_{DC\_limit\_max}$	V	800			
DC bus voltage setting range, lower limit	$U_{DC\_limit\_min}$	V	$U_{LN} \times \sqrt{2} \times 1.1$			
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_mon\_limit\_max}$	V	850			
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_mon\_limit\_min}$	V	$U_{LN} \times \sqrt{2} \times 0.86$			
Nominal DC bus current for P_{DC_cont} and U_{DC_nom}	I_{DC_nom}	A	DC 25.3	DC 64	DC 96	DC 133
Capacitance in DC bus	C_{DC}	mF	0.78	2.04	3.06	4.08
Allowed external DC bus capacitance (nom.) at U_{LN_nom}	C_{DCext}	mF	150			
Charging time for maximum external DC bus capacitance C_{DCext} at U_{LN_nom}	$t_{lade\_DC\_Cext}$	s	50			
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	300		
1) The DC bus voltage can be adjusted in the "voltage control, floating DC bus voltage" mode.						

10.19.4 Integrated braking resistor

Table 230: Integrated braking resistor data

Designation	Symbol	Unit	XVR*-W0019	XVR*-W0048	XVR*-W0072	XVR*-W0100
Nominal braking resistor	$R_{DC\_Bleeder\_nom}$	ohm	11	5.6	3.6	2.6
Braking resistor continuous power	P_{BD}	W	50		80	100
Braking resistor peak power	P_{BS}	kW	57.4	120	180	250
Regenerative power, maximum absorbable [1]	W_{R_max}	kWs	57	92.4	180	250
Regenerative power, absorbable without limitation [2]	$W_{R\_wo\_limit}$	kWs	16.7	92.4	180	250
Cooling of integrated braking resistor			Air cooling			
1) Emergency bleeder for mains failure: A maximum of 300 full load cycles over entire service life						
2) Energy that the internal braking resistor can absorb an unlimited number of times over the entire service life						

10.19.5 External braking resistor/integrated braking transistor

Table 231: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XVR*-W0019	XVR*-W0048	XVR*-W0072	XVR*-W0100
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	10.3	5	3.4	2.5
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	85			
Resistor tolerance		%	±10			
Braking transistor continuous power	P_{BD}	kW	9.6	24	36	50
Absorbable regenerative power of external braking resistor (limited by internally used braking transistor)	W_{R_max}	kWs	250	360	540	750
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	820			
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850			
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	Power control not possible			

10.20 XVE*-W0030/-W0075/-W0125

10.20.1 Control voltage

Table 232: Control voltage supply data

Designation	Symbol	Unit	XVE*-W0030	XVE*-W0075	XVE*-W0125
Control voltage input1)	U_{N3}	V	24 ±20%		
Control voltage when using motor holding brake with motor cable length < 50 m2)	U_{N3}	V	24 ±5%		
Control voltage when using motor holding brake with motor cable length > 50 m3)	U_{N3}	V	26 ±5%		
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4		10
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	20		
Input capacitance	C_{N3}	mF	1.7		3.4
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	70	94	188

1) 2) 3) Comply with supply voltage for motor holding brake

See also ➦ Chapter 4.3.18 Project planning of control voltage on page 138.

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

10.20.2 Mains voltage

Table 233: Mains voltage supply data

Designation	Symbol	Unit	XVE*-W0030	XVE*-W0075	XVE*-W0125
Mains frequency	f_{LN}	Hz	50 ... 60		
Tolerance input frequency		Hz	±2		
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2		
Rotating field condition			none		
Short circuit current rating	SCCR	A rms	42000		
Nominal mains voltage 3-phase	U_{LN_nom}	V	400		
Nominal mains voltage 1-phase	U_{LN_nom}	V	Not allowed		
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500		
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500		
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not allowed		
Tolerance U_{LN}		%	+10 / -15		
Minimum inductance of mains supply (mains phase inductance)	L_{min}	µH	40		
Assigned mains choke type			HNL01.1E-0571-N0050-A-500	XNL1-1E-0170-N0146-B-500-NNNN-NN	HNL01.1E-0100-N0220-A-480-NNNN
Inrush current	$I_{L\_trans\_max\_on}$	A	I_{LN}		
Maximum allowed ON-OFF cycles per minute			tbd	tbd	tbd
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	I_{LN}	A	50.3	125.6	209.5
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	I_{LN}	A	44.7	98.3	150
Nominal current AC1 for mains contactor at nom. data		A	$I_{LN} \times 1.1$		
Mains fuse according to EN 60204-1 (3-phase, with mains choke)		A	63	160	250
Mains fuse according to EN 60204-1 (3-phase, without mains choke)		A	63	160	200
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);1)	A_{LN}	AWG	6	2/0	2×2/0
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, with mains choke)	S_{LN}	kVA	34.9	87	145.1
Mains connected load at U_{LN_nom} and P_{DC_cont} (3-phase, without mains choke)	S_{LN}	kVA	31	68.1	103.9
Total power factor TPF at P_{DC_cont} (3-phase, without mains choke)			0.59	0.67	0.7
Total power factor TPF at P_{DC_cont} (3-phase, with mains choke)			0.87		

1) Copper wire; PVC-insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Technical data of components

10.20.3 DC bus

Table 234: DC bus performance data

Designation	Symbol	Unit	XVE*-W0030	XVE*-W0075	XVE*-W0125
DC bus voltage	U_{DC}	V	approx. 250 ... 850		
Nominal DC bus voltage	U_{DC_nom}	V	540		
Capacitance in DC bus	C_{DC}	mF	1.36	3.06	5.44
Rated power (t > 10 min); U_{LN_nom}; with mains choke	P_{DC_cont}	kW	30	75	125
Rated power (t > 10 min); U_{LN_nom}; without mains choke	P_{DC_cont}	kW	18	45	72
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 - (U_{LN\_nom} - U_{LN}) \times 0.0025]$		
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nom}$	$P_{DC\_cont\ (U_{LN})}$	kW	$P_{DC\_cont\ (U_{LN})} = P_{DC\_cont} \times [1 + (U_{LN} - U_{LN\_nom}) \times 0.002]$		
Maximum allowed DC bus power at U_{LN_nom}; with mains choke	P_{DC_max}	kW	70	112	210
Maximum allowed DC bus power at U_{LN_nom}; without mains choke	P_{DC_max}	kW	45	112	180
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	850		
Monitoring value minimum DC bus voltage, under-voltage threshold	$U_{DC\_limit\_min}$	V	parmeterizable		
Allowed external DC bus capacitance (nom.) at U_{LN_nom}	C_{DCext}	mF	150		
Charging time for maximum external DC bus capacitance C_{DCext} at U_{LN_nom}	$t_{lade\_DC\_Cext}$	s	tbd	tbd	tbd
Current carrying capacity of DC bus connection	$I_{DC\_connect}$	A	120	300	

10.20.4 Integrated braking resistor

Table 235: Integrated braking resistor data

Designation	Symbol	Unit	XVE*-W0030	XVE*-W0075	XVE*-W0125
Nominal resistance	$R_{DC\_Bleeder\_nom}$	ohm	9.6	5.6	3
Braking resistor continuous power	P_{BD}	W	700	750	2000
Braking resistor peak power	P_{BS}	kW	70	113	210
Braking resistor switch-on threshold, setting range	$U_{R\_DC\_On\_f}$	V	(U_{LN} × √2 × 1.05 + 15) ... 820		
Workload-based delay of braking transistor switch-on threshold	$U_{R\_DC\_On\_v}$	V	820 ... 850		
Absorbable regenerative power	W_{R_max}	kWs	37	113	210
Cooling of integrated braking resistor			Air cooling		

10.20.5 External braking resistor/integrated braking transistor

Table 236: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XVE*-W0030	XVE*-W0075	XVE*-W0125
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	8.2	5.1	2.7
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	40		
Resistor tolerance		%	±10		
Braking transistor continuous power	P_{BD}	kW	15	37.5	62.5
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000	650	248
Maximum command value of power control (heating tape control)	$P_{max\_set\_Bleeder\_PowCtrl}$	W	500[1)]	500	
1) Power control for braking resistor only allowed for operation with mains choke					

10.21 XMV*-W0050 ... W0210

See documentation:

ctrlX DRIVE DC/DC Converter XMV; Application Manual; ➦R911413650

11 Specifying the digital/analog inputs/outputs

11.1 Basic device, basic equipment

11.1.1 Digital inputs (standard), XG31

The digital inputs correspond to IEC 61131−2 (type 1).

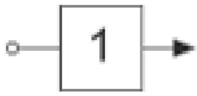


Table 237: Data

Data	Unit	min.	max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Input current (in high state)	mA	2	5
Delay time	µs		100 + position controller clock

11.1.2 Digital inputs (probe), XG31

Function

See Functional Description of firmware.

Technical data

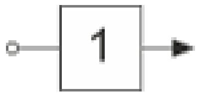


Table 238: Data

Data	Unit	min.	max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Input current	mA	2	5
Pulse width t_{Pulse}	µs	4	
Measuring accuracy t_x	µs	-1	1
Delay time [1]	µs		4 + position controller clock
1) Applies when used as a digital input. Does not apply when used as a probe.			

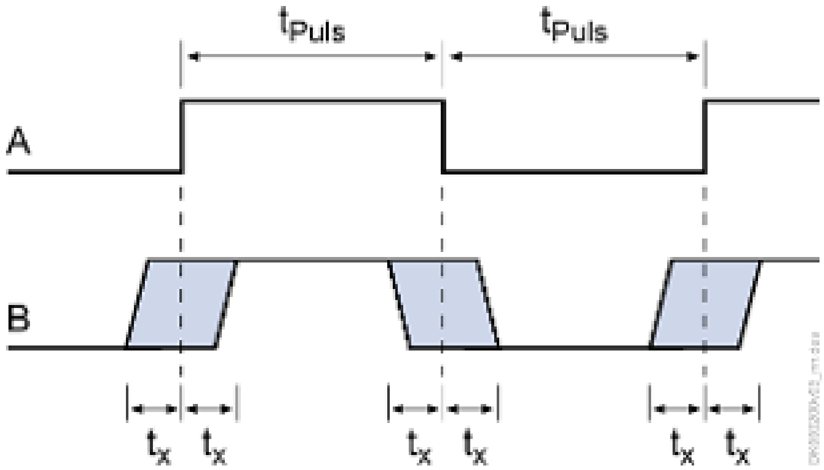


Fig. 111: Signal detection at the probe input

A Signal
B Signal detection at the probe input
t_{Pulse} Pulse width
t_x Measuring accuracy of signal edges

Use

For recording measuring marks that are difficult to measure, e.g. when positioning adhesive dots.

Probe inputs are "fast" inputs. Use bounce-free control elements (e.g. switches) for actuation to avoid incorrect evaluations.

In the case of bouncing probes, a warning is output by the controller indicating the loss of accuracy due to the detected probe bouncing!

11.1.3 Digital outputs (standard), XG31

The digital outputs are compatible with digital inputs of types 1, 2 and 3 (IEC 61131–2).

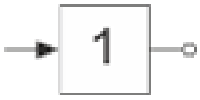


Table 239: Data

Data	Unit	min.	max.
Output voltage ON 1)	V	U_{ext} - 1	U_{ext}
Output current OFF	mA		0.05
Output current ON	mA		500
Allowed energy content of connected inductive loads 2) 3)	mJ		
• f < 0.5 Hz			500
• f < 2 Hz			200
Delay time	µs		100 + position controller clock
Short circuit protection		included	
Overload protection		included	

1) U_{ext}: Supply voltage

2) In the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

3) The maximum energy content depends on the switching frequency f of the outputs

11.1.4 Analog voltage input, XG31

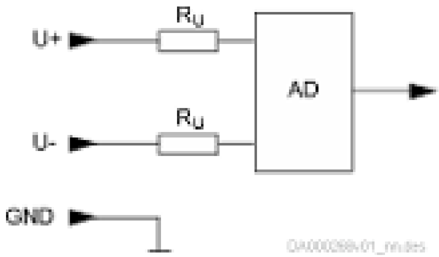


Fig. 112: Analog voltage input

AD: Analog/digital converter

Table 240: Data

Data	Unit	min.	typ.	max.
Allowed input voltage	V	-30		+30
Workspace input voltage U_{ein_work}	V	-10		+10
Input resistance R_u	kΩ	150		300
Input bandwidth (-3 dB)	kHz		1.3	
Common-mode range	V	-30		+30
Common-mode rejection	dB	50		
Relative measuring error at 90% U_{ein_work}	%	-1		+1
Resolution	Bit		12	
Cable		Only use **shielded** cables for cable lengths > 30 m.		

11.2 Safe Torque Off (T0)

11.2.1 Digital inputs, XG41

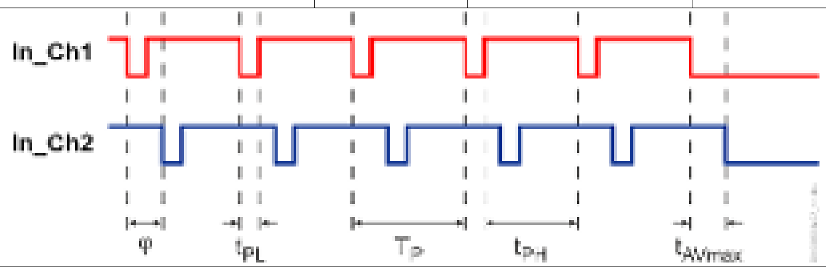
The digital inputs correspond to IEC 61131-2.

Table 241: Data

Data	Unit	min.	max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Current consumption	mA	2	5

Table 242: Time response

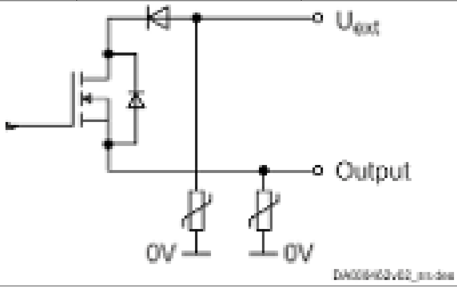
Description	Unit	min.	max.
Test pulse width (t_{PL})	µs	50	3000
Cycle duration (T_P)		500 µs	1 h
Reaction time for selection or deselection (t_{AVmax})	s		1
Duty cycle of selection signals ($t_{PH} \div T_P$)	%	90	
Phase shift between two test pulses on both channels (φ)	ms	not specified	
Bounce time for selection or deselection	ms		400



11.2.2 Digital outputs, XG41

The digital outputs are compatible with the digital inputs IEC 61131-2.

Table 243: Data

Data	Unit	min.	max.
Output voltage ON	V	U_{ext} - 1	U_{ext}
Output voltage OFF	V		5
Allowed output current per output	mA		350
Allowed energy content of con-nected inductive loads, e.g. relay coils	mJ		400 1) 2)
Capacitive load	nF		50 × n_{DI} 3)
Short circuit protection		Available	
Overload protection		Available	
Block diagram, output:			
Error detection	The following errors are detected: ● Wiring error with short circuit to high ● Wiring error with short circuit to low ● Wiring error with short circuit between both channels ● Internal error In the case of an error, the control panel shows the corresponding error message: F830x, F3134		

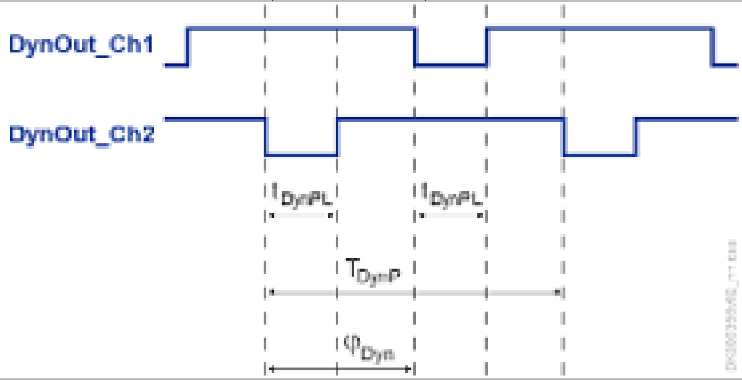
1) At a maximum switching frequency of 1 Hz

2) In the case of inductive loads with currents > 200 mA or in the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

3) n_{DI}: Number of digital inputs used for a digital output

Table 244: Time response

Description	Unit	typ.
Test pulse width (t_{DynPL})	µs	500 ±10%
Cycle duration (T_{DynP})	ms	400 ±10%
Phase shift between two test pulses on both channels (φ_{Dyn})	ms	200 ±10%



11.3 SafeMotion (M5)

11.3.1 Digital inputs, XG44

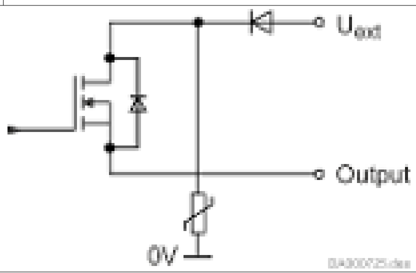
Table 245: Data

Data	Unit	min.	max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Input current (in high state)	mA	2	5
Delay time	µs		500

11.3.2 Digital outputs, XG44

The digital **outputs** are compatible with digital inputs of **types 1, 2 and 3 (IEC 61131–2)**.

Table 246: Data

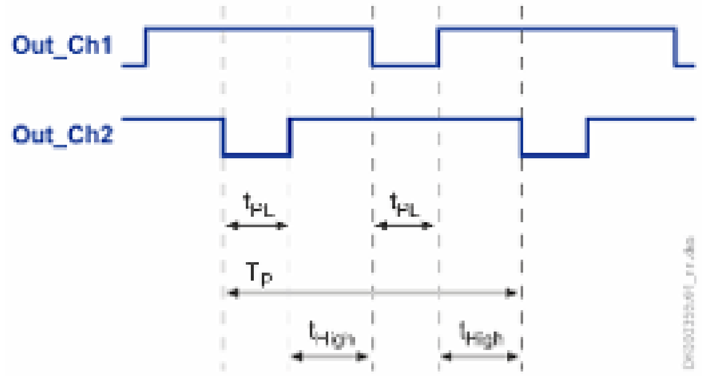
Data	Unit	min.	max.
Output voltage ON	V	U_{ext} - 2	U_{ext}
Output voltage OFF	V		5
Allowed output current per output	mA		350
Allowed energy content of connected inductive loads, e.g. relay coils	mJ		400 1) 2)
Capacitive load	nF		200
Short circuit protection		Available	
Overload protection		Available	
Block diagram, output:			
Error detection	The following errors are detected: ● Wiring error with short circuit to high ● Wiring error with short circuit to low ● Wiring error with short circuit between both channels ● Internal error In the case of an error, the control panel shows the corresponding error message: F83xx		

1) At a maximum switching frequency of 1 Hz

2) In the case of inductive loads with currents > 200 mA or in the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

Table 247: Time response

Designation	Unit	min.	max.
Test pulse width (t_{PL})	µs	50	200
Periodic time (T_P)	ms	500	1000
Time between two test pulses (t_{High})	ms	50	-



11.4 SafeMotion (M8)

11.4.1 Digital inputs, XG45

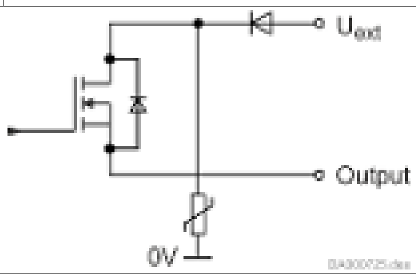
Table 248: Data

Data	Unit	min.	max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Input current (in high state)	mA	2	5
Delay time	µs		500

11.4.2 Digital outputs, XG45

The digital **outputs** are compatible with digital inputs of **types 1, 2 and 3 (IEC 61131–2)**.

Table 249: Data

Data	Unit	min.	max.
Output voltage ON	V	U_{ext} - 2	U_{ext}
Output voltage OFF	V		5 [3)]
Allowed output current per output	mA		350
Sum, output current of all outputs	mA		700
Allowed energy content of connected inductive loads, e.g. relay coils	mJ		400 [1) 2)]
Capacitive load	nF		300
Short circuit protection		Available	
Overload protection		Available	
Block diagram, output:			
Error detection	The following errors are detected: ● Wiring error with short circuit to high ● Wiring error with short circuit to low ● Wiring error with short circuit between both channels ● Internal error In the case of an error, the control panel shows the corresponding error message: F83xx		

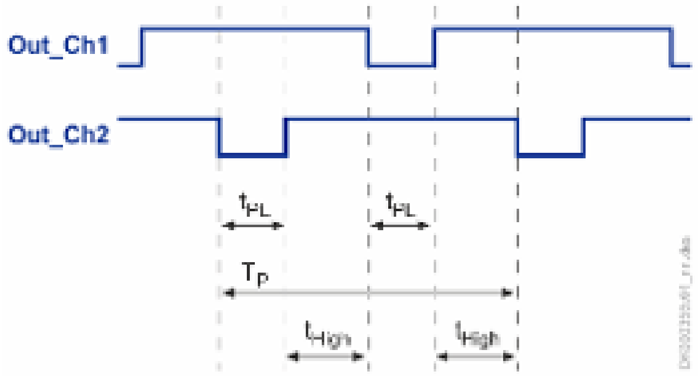
1) At a maximum switching frequency of 1 Hz

2) In the case of inductive loads with currents > 200 mA or in the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

3) When using relays, please observe: The minimum withstand voltage of the relay has to be higher than the value "Output voltage OFF".

Table 250: Time response

Designation	Unit	min.	max.
Test pulse width (t_{PL})	µs	50	200
Periodic time (T_P)	ms	500	1000
Time between two test pulses (t_{High})	ms	50	-

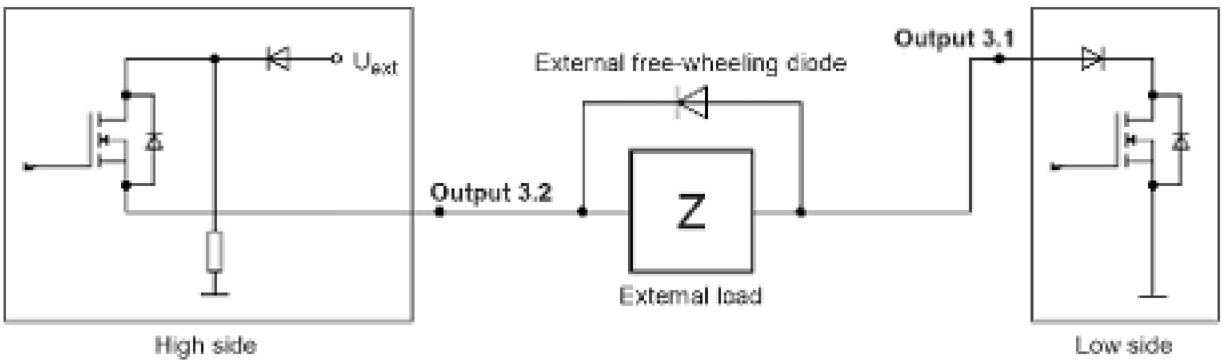


11.4.3 Push-pull operation, XG45 output pair 3.1/3.2

Table 251: Data

Data	Unit	min.	max.
Output voltage ON	V	16	U_{ext}
Output voltage OFF	V	0	5 [3]
Output current ON	mA	10	350
Output current OFF	mA		1
Allowed energy content of connected inductive loads, e.g. relay coils	mJ		400 [1,2]
Capacitive load	nF		300
Short circuit protection		Available	
Overload protection		Available	

Block diagram:



Low-side operation of the external load at output 3.1 with a different power supply than output 3.2 is not allowed.

1) At a maximum switching frequency of 1 Hz

2) In the case of inductive loads, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

3) When using relays, please observe: The minimum withstand voltage of the relay has to be higher than the value "Output voltage OFF".

11.5 I/O extension (DA)

11.5.1 Digital inputs, XG37

The digital inputs type A correspond to IEC 61131−2 (type 1).

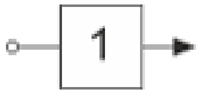


Table 252: Data

Data	Unit	min.	max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Input current (in high state)	mA	2	5
Delay time	µs		200 + position controller clock

11.5.2 Digital outputs, XG37

The digital outputs are compatible with digital inputs of types 1, 2 and 3 (IEC 61131−2).

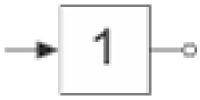


Table 253: Data

Data	Unit	min.	max.
Output voltage ON 1)	V	U_{ext} - 1	U_{ext}
Output current OFF	mA		0.05
Output current ON	mA		500
Sum of output currents 4) ■ 4 outputs ■ 8 outputs	mA		 ■ 1000 ■ 2000
Allowed energy content of connected inductive loads 2) 3) ● f < 0.5 Hz ● f < 2 Hz	mJ		 500 200
Delay time	µs		200 + position controller clock
Short circuit protection		included	
Overload protection		included	

1) U_{ext}: Supply voltage

2) In the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

3) The maximum energy content depends on the switching frequency f of the outputs

4) When several outputs supply current simultaneously, the maximum allowed total current of these outputs has to be taken into account. According to the number of outputs, the total current has to be related to to 4 or 8 outputs.

- The digital outputs have been implemented with high-side switches. This means that these outputs only can actively supply current.
- The energy absorption capacity of the outputs is used to limit voltage peaks caused when inductive loads are switched off.
  Limit voltage peaks by using free-wheeling diodes directly at the relay coil.

11.5.3 Analog voltage input, XG38

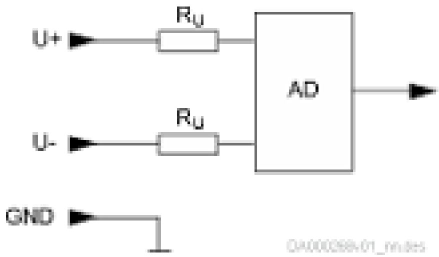


Fig. 113: Analog voltage input
AD: Analog/digital converter

Table 254: Data

Data	Unit	min.	typ.	max.
Allowed input voltage	V	-30		+30
Workspace input voltage U_{ein_work}	V	-10		+10
Input resistance R_u	kΩ	150		300
Input bandwidth (-3 dB)	kHz		1.3	
Common-mode range	V	-30		+30
Common-mode rejection	dB	50		
Relative measuring error at 90% U_{ein_work}	%	-1		+1
Resolution	Bit		14	
Cables		Only use **shielded** cables for cable lengths > 30 m.		

11.5.4 Analog current input, XG38

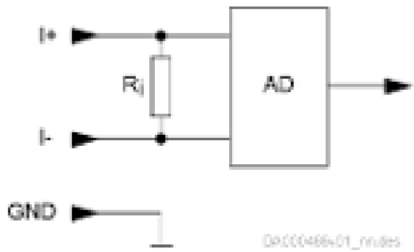


Fig. 114: Analog current input
AD: Analog/digital converter

Table 255: Data

Data	Unit	min.	max.
Input current measuring range[1)]	mA	-20 / 4	+20
Input current minimum value monitoring[2)]	mA	+2	+3
Input current maximum value monitoring[3)]	mA	+21	+22
Input resistance R_i	Ω	280	
Input bandwidth (-3 dB)	kHz	1.3	
Relative measuring error at 18 mA	%	-1	+1
Resolution	-	13bit (12bit + 4-fold oversampling)	
Overload protection[4)]		included	
Cables		Only use **shielded** cables for cable lengths **> 30 m**.	

1) Measuring range (-20 ... 20 or 4 ... 20) can be set using a parameter. With a measuring range 4 ... 20, the minimum value monitoring (wire break) is automatically active.

2) Only possible with a measuring range 4 ... 20

3) Monitoring switched off at approx. ±35 mA

4) In the case of input currents greater than the maximum value, an error is signaled and the input is switched at high resistance

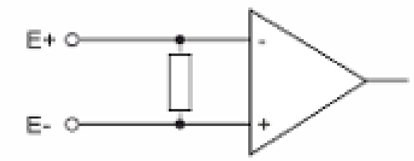
11.5.5 Analog output, XG38

Table 256: Data

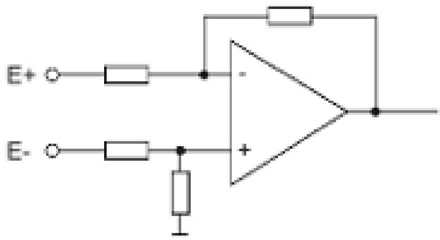
Data	Unit	min.	typ.	max.
Output voltage	V	-10		+10
Output load, ohmic	kΩ	2		
Output load, capacitive	nF			100
Resolution	Bit		10	
Conversion time (incl. response time)	µs			250
Output clock		Position controller clock		
Precision (in relation to the measuring range)		±0.5% with load ≥ 10 kΩ ±1% with load ≥ 2 kΩ		
Short circuit protection		included		
Overload protection		included		

11.6 Encoder evaluation (EC)

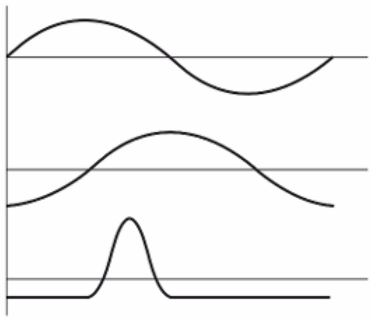
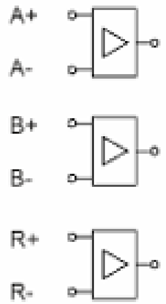
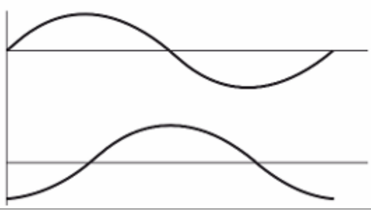
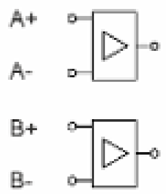
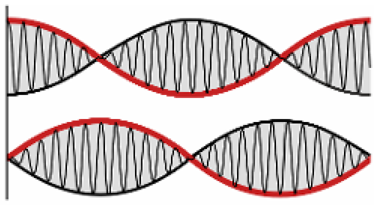
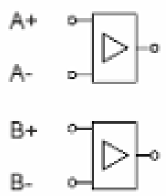
11.6.1 Sine signals

Input circuit	Differential input sine signals				
Sine signals A+, A-, B+, B-, R+, R-	Data	Unit	min.	typ.	max.
	Amplitude of encoder signal peak-peak	V	0.8	1.0	1.2
	Input resistance	Ω		120	
	Converter width A/D converter	Bit		12	
	Cutoff frequency (-3 dB)	kHz		400	

11.6.2 Resolver signals

Input circuit	Differential input resolver signals				
Resolver signals A+, A-, B+, B-	Data	Unit	min.	typ.	max.
	Amplitude encoder signal sine	V		5	6
	Input resistance	kΩ		12	
	Converter width A/D converter	Bit		12	

11.6.3 Signal assignment to the actual position value

Signal assignment [1)]	Signal designation	Signal shape	Actual position value (with standard setting)
		Sine (1 V_{pp}) Without absolute value	**Rotary motor:** Increasing actual position values with clockwise motor motion (when viewed from the front toward the A-side shaft end) **Linear Rexroth motor:** Increasing actual position values with motor motion in the direction of cable outlet
		Sine (1 V_{pp}) With absolute value (e.g., EnDat)	
 Amplitude-modulated signal		Resolver	
			1) see following note

The encoder signal assignment to the inputs is based on clockwise rotation (front view toward motor shaft).

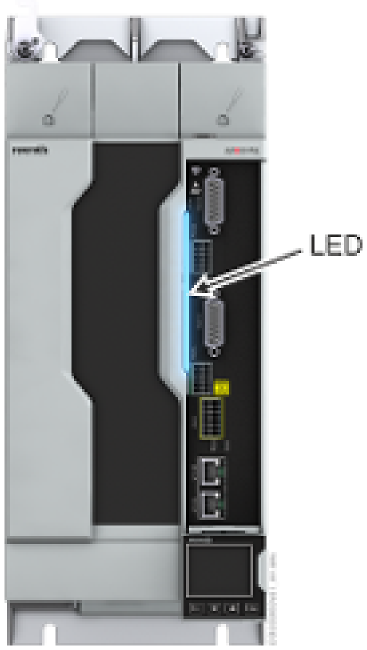
- Track A (A+, A-; "cos") advances track B (B+, B-, "sin") 90° electrically.
- The actual position value increases (prerequisite: negation of the encoder signals was not parameterized).
- If available, the reference track R (R+, R-) provides the reference mark pulse at positive signals of track A and track B (in the so-called "0-th" quadrant).

Standard setting: See Functional Description of firmware.

12 Diagnostic display

12.1 PF01 LED (Device State)

PF01 LED



By means of different colors and flashing patterns, the LED shows the device state and the state of the optional internal control.

Description of colors and flashing patterns:

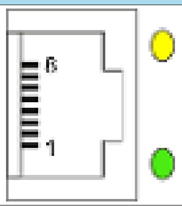
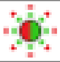
See documentation on ctrlX DRIVE firmware:

- Diagnostic Messages of Runtime AXS-V-02VRS (R911383776)
- Diagnostic Messages of Runtime AXS-V-03VRS (R911409808)
- Diagnostic Messages of Runtime AXS-V-04VRS (R911421277)
- Diagnostic Messages of Runtime AXS-V-05VRS (R911422251)

12.2 Sercos/EtherCAT/PROFINET IO

12.2.1 Display elements

Table 257: Display elements

LED	Significance
	Port LED, 1 × yellow, 1 × green
	Diagnostic LED, multicolor

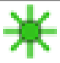
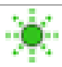
The LED display depends on the field bus system.

12.2.2 Port LED

EtherCAT

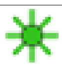
EtherCAT only has one active LED per port.

Table 258: Port LED

LED: Color / flashing pattern	Significance
 off	No connection
 Permanently lit green	Connection to network available, but no telegram exchange (EtherCat bus inactive)
 Flashing green	Connection to the network available with telegram exchange (EtherCat bus active)

Sercos

Table 259: Port LED

LED: Color / flashing pattern	Significance
 off	No connection No data transfer
 Permanently lit yellow	Data transfer is active
 Permanently lit green	Connection to network available

PROFINET IO

Table 260: Port LED

LED: Color / flashing pattern	Significance
off	No connection No data transfer
Permanently lit yellow	Data transfer is active
Permanently lit green	Connection to network available

12.2.3 Diagnostic LED

EtherCAT

Table 261: Diagnostic LED

LED: Color / flashing pattern 1)	Significance	Description
-- off	Status INIT	• Cyclic process data and acyclic data channel are not transmitted • no error
GN -- Flashing green	Status PRE-OPERATIONAL	Acyclic data channel is transmitted
GN -- -- -- -- -- Green, single flashing	Status SAFE-OPERATIONAL	Acyclic data channel is transmitted
GN Permanently lit green	Status OPERATIONAL	Cyclic process data and acyclic data channel are transmitted
RD -- Flashing red	Configuration error	General EtherCAT configuration error
RD -- -- -- -- -- Red, single flashing	Synchronization error	• The drive controller has not been synchronized to the EtherCAT master • Communication error of the drive controller
RD -- RD -- -- -- -- -- Red, double flashing	Timeout - watchdog	• Timeout during monitoring of the cyclic process data • Watchdog of EtherCAT master

1) Flashing pattern: One square corresponds to a duration of 200 ms; the arrow marks the end of a cycle

GN = LED permanently lit green

RD = LED permanently lit red

-- = LED is off

Sercos

Table 262: Diagnostic LED

LED: Color / flashing pattern 1)	Description	Prio 2)
-- off	NRT mode (no Sercos communication) 3)	6
OG Permanently lit orange	CP0 (communication phase 0 active)	6
GN OG OG OG OG OG OG OG OG OG OG OG ↺ Flashing orange/green	CP1 (communication phase 1 active)	6
GN OG GN OG OG OG OG OG OG OG OG OG ↺ Flashing orange/green	CP2 (communication phase 2 active)	6
GN OG GN OG GN OG OG OG OG OG OG OG ↺ Flashing orange/green	CP3 (communication phase 3 active)	6
GN Permanently lit green	CP4 (communication phase 4 active)	6
OG GN OG GN OG GN OG GN OG GN OG GN ↺ Flashing orange/green	HP0 (hot-plug phase 0 active)	6
OG GN GN GN GN GN GN GN GN GN GN GN ↺ Flashing orange/green	HP1 (hot-plug phase 1 active)	6
OG GN OG GN GN GN GN GN GN GN GN GN ↺ Flashing orange/green	HP2 (hot-plug phase 2 active)	6
GN -- GN -- GN -- GN -- GN -- GN -- ↺ Flashing green	Transition from Fast forward to Loopback	5
RD OG RD OG RD OG RD OG RD OG RD OG ↺ Flashing red/orange	Application error (sub-device/device error [C1D])	4
RD GN RD GN RD GN RD GN RD GN RD GN ↺ Flashing red/green	MST warning 4) (S-0-1045, Sercos: Device Status [S-Dev], bit15)	3
RD Permanently lit red	Communication error (sub-device/device error [C1D])	2
OG -- OG -- OG -- OG -- OG -- OG -- ↺ Flashing orange	Identification (S-0-1044, Sercos: Device Control [C-Dev], bit15)	1
RD -- RD -- RD -- RD -- RD -- RD -- ↺ Flashing red	Internal watchdog	0

1) Flashing pattern: One square corresponds to a duration of 250 ms; the arrow marks the end of a cycle; abbreviations on the squares: GN = LED permanently lit green, OG = LED permanently lit orange, RD = LED permanently lit red, -- = LED is off

2) Display priority; the state of the highest priority is displayed

3) NRT = Non Real Time

4) MST = Master Synchronization Telegram

Diagnostic display

PROFINET IO

Table 263: Diagnostic LED

LED: Color / flashing pattern 1)	Description
off	Invalid IP address
Flashing green	No cyclic connection
Permanently lit green	Connection error-free
Flashing red	Connection interrupted (e.g., watchdog)
Permanently lit red	IP address already exists (Duplicate IP address check)
Flashing red-green	Device running up and self test
1) Flashing pattern: One square corresponds to a duration of 200 ms; the arrow marks the end of a cycle GN = LED permanently lit green RD = LED permanently lit red -- = LED is off	

12.3 DRIVElink

12.3.1 Display elements

Table 264: Display elements

LED	Significance
	Port LED, bicolor (green/orange)
	Diagnostic LED (multicolor)

12.3.2 Port LED

Table 265: Port LED

LED: Color / flashing pattern	Significance
off	No connection No data transfer
Permanently lit green	Connection available
Flashing green/orange	Connection available and data transfer

12.3.3 Diagnostic LED

See diagnostic LED Sercos.

➦ Chapter Sercos on page 391

13 Accessories

13.1 Connector set

Designation		Mat. no.	[mm²]	ctrlX DRIVE					
				≤ 0036*	0054/70*	0090	0100/120	0150/180	≥ 0210
RLS0200 Motor (XZ03)	RLS0200/K01	R911390370	1.0	✓	-	-	-	-	-
	RLS0200/K02	R911390372	1.5	✓	-	-	-	-	-
	RLS0200/K03	R911390373	2.5	✓	-	-	-	-	-
	RLS0200/K04	R911402183	4.0	✓	-	-	-	-	-
	RLS0200/K06	R911402182	6.0	✓	-	-	-	-	-
	RLS0200/K10	R911402180	10.0	✓	-	-	-	-	-
RLS0201 Motor (XD03 + XG03)	RLS0201/K03	R911390374	2.5	-	✓	-	-	-	-
	RLS0201/K04	R911390375	4.0	-	✓	-	-	-	-
	RLS0201/K06	R911390376	6.0	-	✓	-	-	-	-
	RLS0201/K10	R911390371	10.0	-	✓	-	-	-	-
RGS0010 Encoder (XG21)	RGS0010/CUB1	R911379695	-	✓	✓	✓	✓	✓	✓
RBS0026 FireWire (XG20)	RBS0026/L01	R911384843	-	✓	✓	✓	✓	✓	✓

* Table also applies to double-axis devices

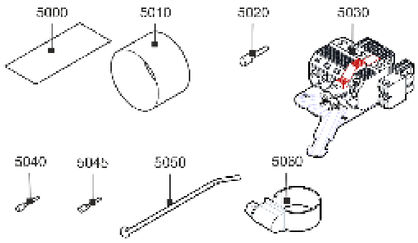
rexroth
A Bosch Company

Connector
RLS0200_K06

Product Insert

RA83183987
AA 2020-02

Content



Bill of material

Item Number	Component number	Object description	Comp. Qty (CUn)	Component unit
5000	R911277668	ADHESIVE TAPE KUPFER 25MM	0,002	PC
5010	R911309905	SHRINKABLE TUBE SL25.4-08, 10K-ROLL-0&	0,015	M
5020	R911213431	END SPLICE AF06,00-06,00BK20,0	4	PC
5030	R911384438	PUSH-WIRE TERMINAL KM07,62F-FK-BVF_H-P1&	1	PC
5040	R911335050	END SPLICE AF01,00-01,00YE16,0	2	PC
5045	R911322720	END SPLICE AF01,50-01,50RD16,4	2	PC
5050	R911210976	CABLE FASTENER D01,6-B2,4-C085-N050-&	1	PC
5060	R911274471	CLAMP SCHL-S012*022-B12-ZN&	1	PC

RA83183987, AA 2020-02, Bosch Rexroth AG

Fig. 115: Example: RLS0200/K06

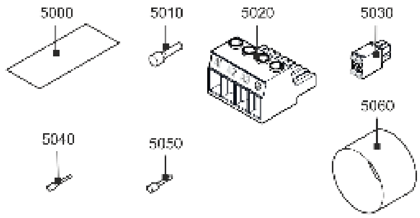
The Drive & Control Company
Rexroth
Bosch Group

Connector
RLS0201_K06

Product Insert

RA69360241
AA 2018-04

Content



Bill of material

Item Number	Component number	Object description	Comp. Qty (CUn)	Component unit
5000	R911277868	ADHESIVE TAPE KUPFER 25MM	0,002	PC
5010	R911213431	END SPLICE AE06,00-06,00BK20,0	4	PC
5020	R911381525	PUSH-WIRE TERMINAL KL10,16F-_-PC___-_1&	1	PC
5030	R911384638	PUSH-WIRE TERMINAL KL03.50F-FK-DFMC_-_0&	1	PC
5040	R911339050	END SPLICE AE01,00-01,00YE16,0	2	PC
5050	R911322720	END SPLICE AE01,50-01,50RD16,4	2	PC
5060	R911289886	SHRINKABLE TUBE SL19,0-06,0BK-ROLL-BA	0,025	M

RA69360241, AA 2018-04, Bosch Rexroth AG

Fig. 116: Example: RLS0201/K06

The Drive & Control Company Rexroth Bosch Group

Connector
RGS0010/CUB1

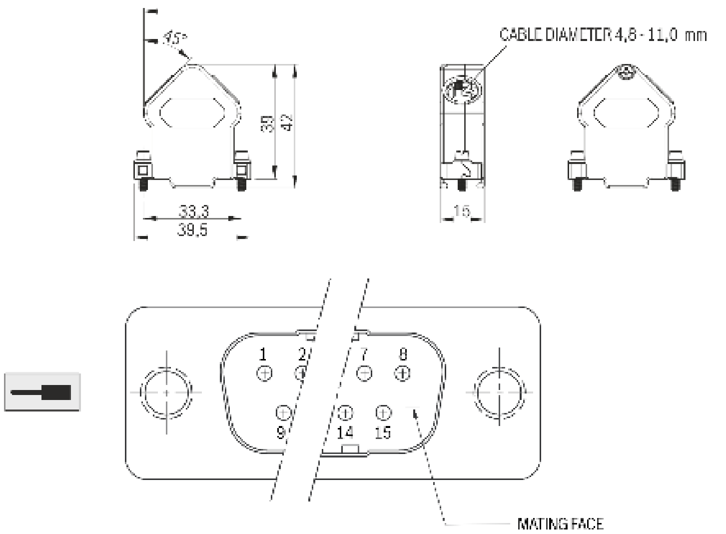
Product Insert

RA59581696
AA 2016/10

Bill of material

Item Number	Component number	Object description	Comp. Qty (CUn)	Component unit
0010	R911296424	CONNECTOR ACCESSORIES Z-DSUB01-GEHAEUSE 15-VS3-11,0	1	PC
0020	R911278184	STECK-DSUB02 CR 15-2M GER5 ** D ****	1	PC
0030	R911235723	CONTAKT KON-EM-0,20/0,50-14,50-AU-D-A	15	PC

Poles / Dimensions



RA59581696, AA 2016/10, Bosch Rexroth AG

RELEASED / freigegeben RA59581696_001 | RGS0010 DSUB | AA.1 | 1

Fig. 117: Example: RGS0010/CUB1

13.2 XAS2, shield connection

13.2.1 Type code

Table 266: XAS2, type code

<table>
<tr><td rowspan="2">Short type designation</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>4</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td></tr>
<tr><td>Example:</td><td>X</td><td>A</td><td>S</td><td>2</td><td>-</td><td>0</td><td>0</td><td>1</td><td>-</td><td>0</td><td>0</td><td>1</td><td>-</td><td>N</td><td>N</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="4">①</td><td></td><td colspan="3">②</td><td></td><td colspan="3">③</td><td></td><td colspan="2">④</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>①</td><td colspan="40">Product:
XAS2 = ctrlX DRIVE accessories, shield connection</td></tr>
<tr><td>②</td><td colspan="40">Device assignment:
001 = XMD*-W5454, 7070
XMD*-C5454, 7070
002 = XCS*-W0100, 120
003 = XMS*-W0100, 120
004 = XCS*-W0210, 250, 280, 330, 375
XMS*-W0210, 250, 280, 330, 375
005 = XMS*-W0054, 70, 90
XMS*-C0054, 70, 90
006 = XCS*-W0054, 70
XCS*-C0054, 70
007 = XMS*-W0150, 180
008 = XCS*-W0150, 180
009 = XCS*-W0090</td></tr>
<tr><td>③</td><td colspan="40">Cable outlet:
001 = Downwards (only with device assignment = 004, 007, 008)
002 = Backwards (only with device assignment = 004, 007, 008)
003 = Downwards, backwards (only with device assignment = 001, 002, 003, 005, 006, 009)
With Coldplate devices and with 003, only the cable outlet facing downwards is possible.</td></tr>
<tr><td>④</td><td colspan="40">Other design:
NN = None</td></tr>
</table>

Accessories

13.2.2 Shield connection

XAS2-001-003-NN

rexroth
A Bosch Company

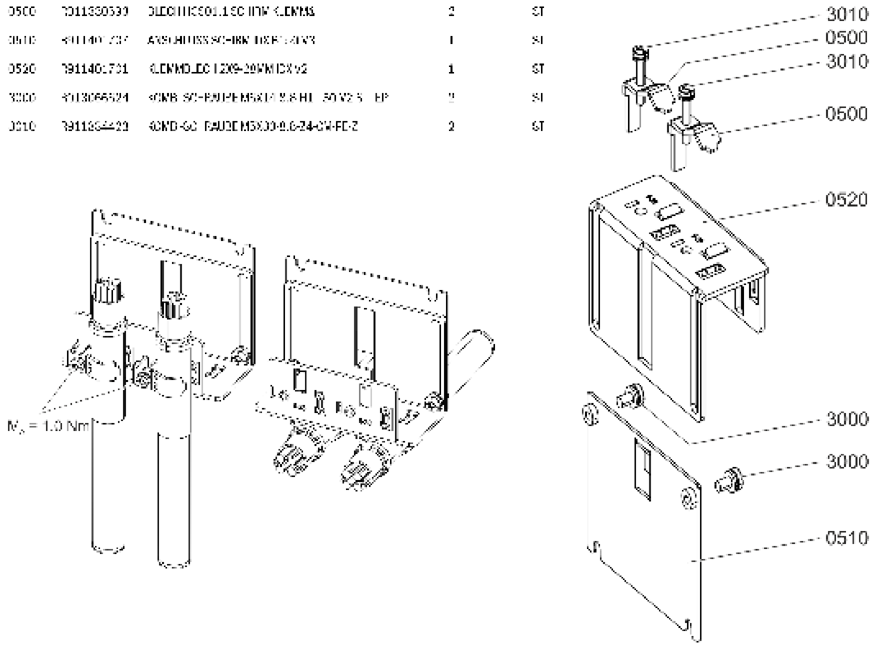
XAS2-001-003-NN

Beipackzettel

R911401714
AA 2020-01

R911401709

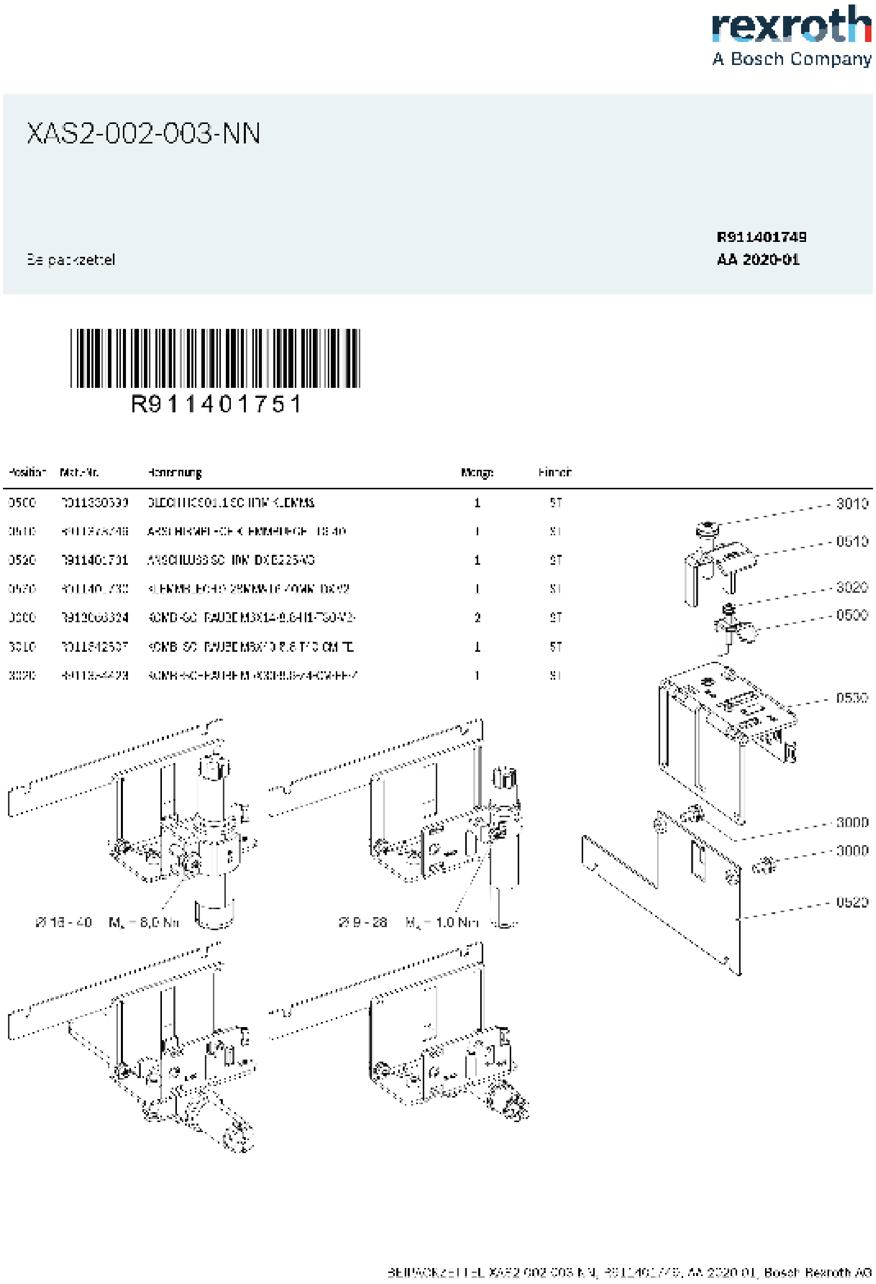
Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	[illegible]	[illegible]	2	ST
0510	[illegible]	[illegible]	1	ST
0520	[illegible]	[illegible]	1	ST
3000	[illegible]	[illegible]	2	ST
3010	[illegible]	[illegible]	2	ST



BEIPACKZETTEL XAS2 001 003 NN, R91140171_4, AA 2020 01, Bosch Rexroth AG

Fig. 118: Product insert XAS2-001-003-NN

XAS2-002-003-NN



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A Bosch Company

XAS2-002-003-NN

Beipackzettel

R911401749
AA 2020-01

R911401751

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	[illegible]	[illegible]	1	ST
0510	[illegible]	[illegible]	1	ST
0520	[illegible]	[illegible]	1	ST
0530	[illegible]	[illegible]	1	ST
3000	[illegible]	[illegible]	2	ST
3010	[illegible]	[illegible]	1	ST
3020	[illegible]	[illegible]	1	ST

Fig. 119: Product insert XAS2-002-003-NN

XAS2-003-003-NN

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A Bosch Company

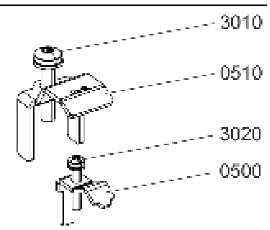
XAS2-003-003-NN

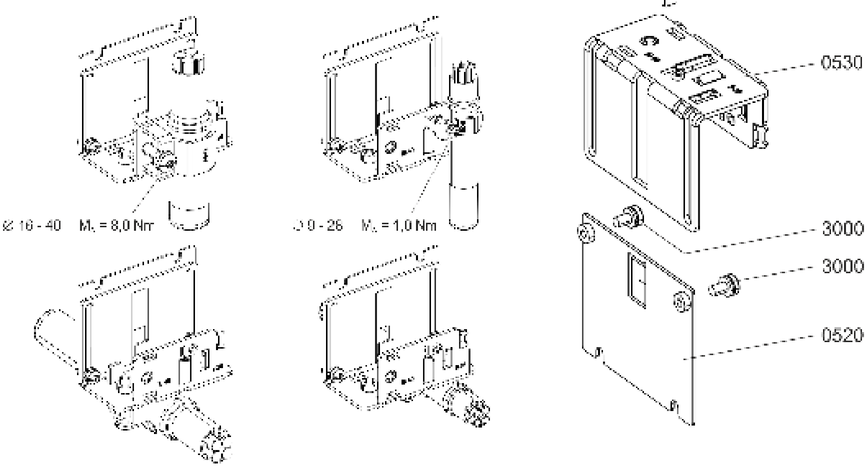
Beipackzettel

R911401750
AA 2020-01

R911401752

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	[illegible]	[illegible]	1	ST
0510	[illegible]	[illegible]	1	ST
0520	R911401702	[illegible]	1	ST
0530	[illegible]	[illegible]	1	ST
3000	[illegible]	[illegible]	2	ST
3010	[illegible]	[illegible]	1	ST
3020	[illegible]	[illegible]	1	ST

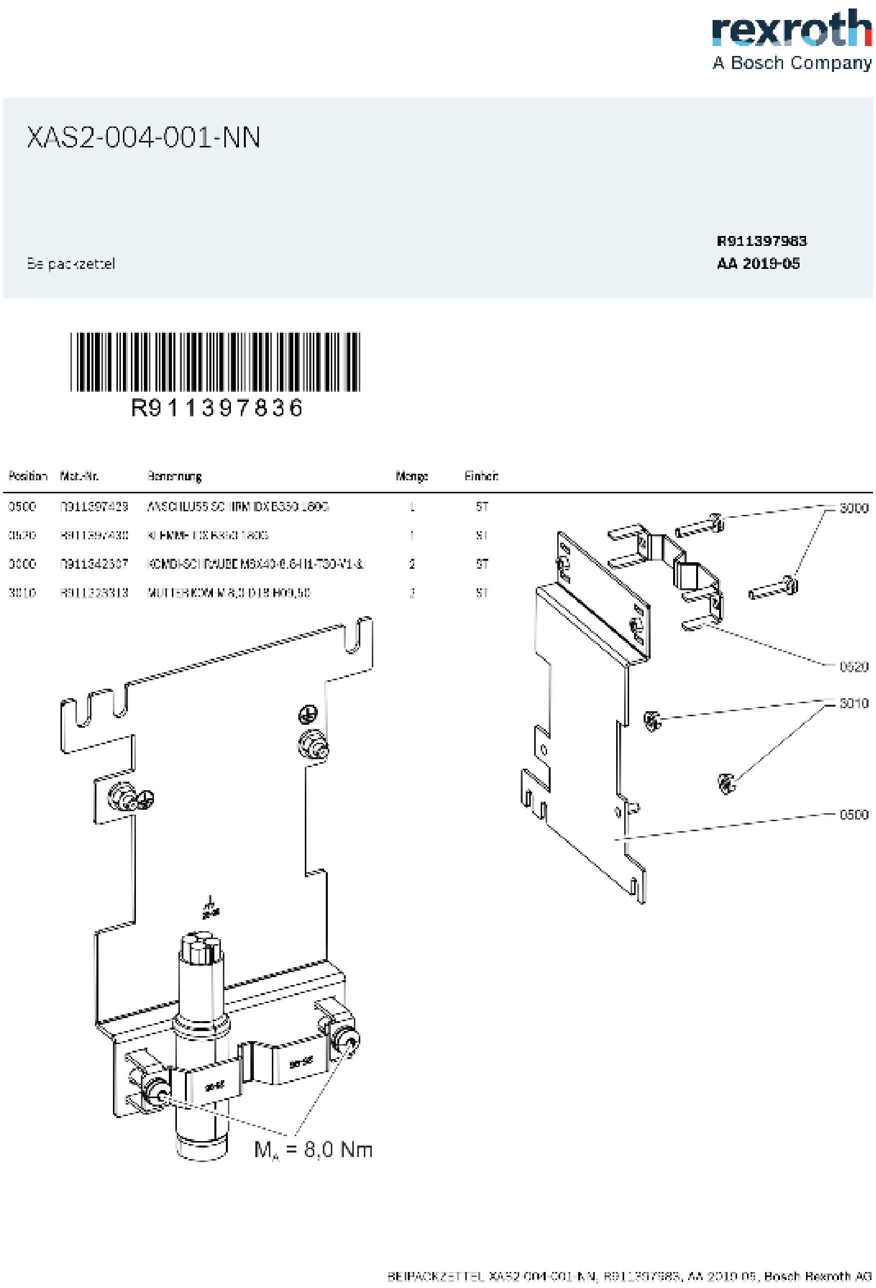




BEIPACKZETTEL XAS2-003-003-NN, R911401750, AA 2020-01, Bosch Rexroth AG

Fig. 120: Product insert XAS2-003-003-NN

XAS2-004-001-NN


XAS2-004-001-NN

Beipackzettel

R911397983
AA 2019-05

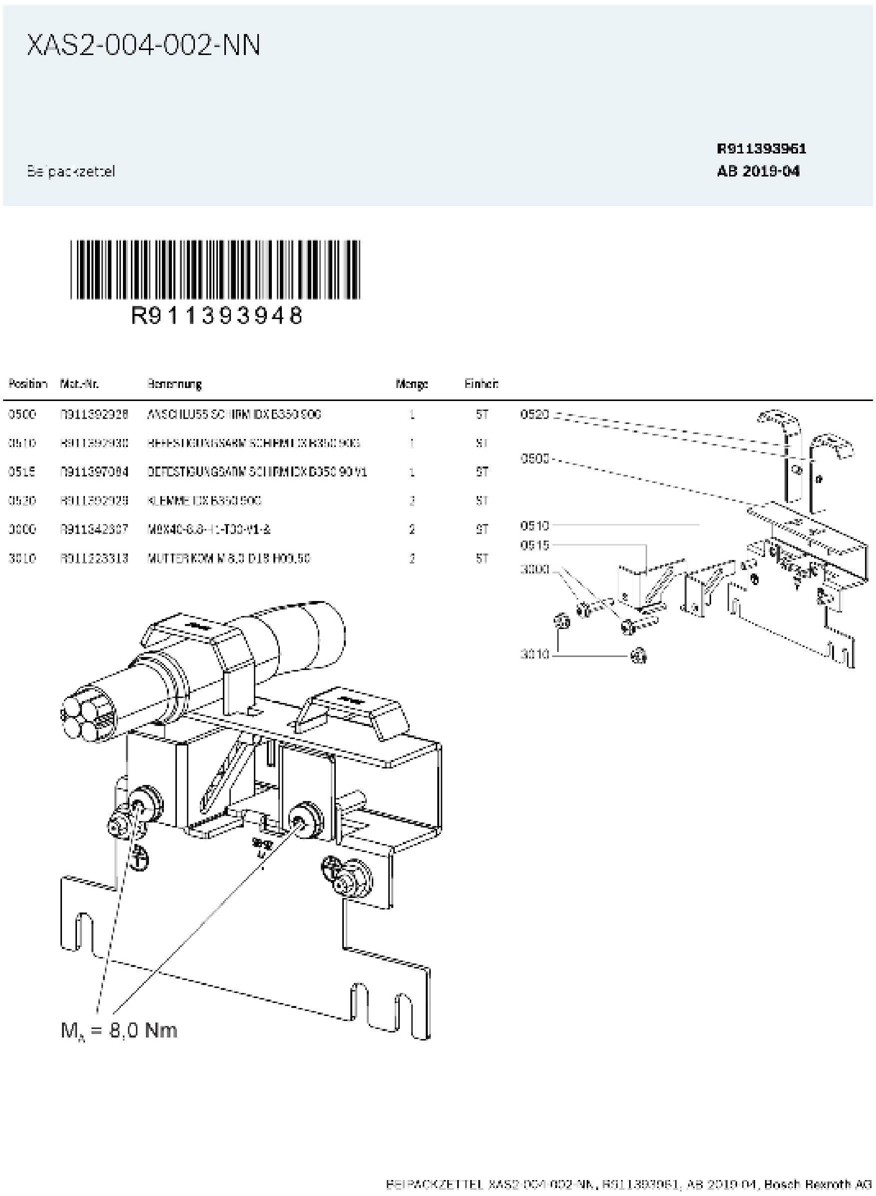
R911397836

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R911397429	ANSCHLUSS SCHIRM IDX B350 180G	1	ST
0520	R911397430	KLEMME IDX B350 180G	1	ST
3000	R911342307	KOMBI-SCHRAUBE M8X40-8.8-H1-T30-V1-&	2	ST
3010	R911323313	MUTTER KOM M 8,0 D18 H00,50	2	ST

BEIPACKZETTEL XAS2-004-001-NN, R911397983, AA 2019-05, Bosch Rexroth AG

Fig. 121: Product insert XAS2-004-001-NN

XAS2-004-002-NN



XAS2-004-002-NN

Beipackzettel

R911393961
AB 2019-04

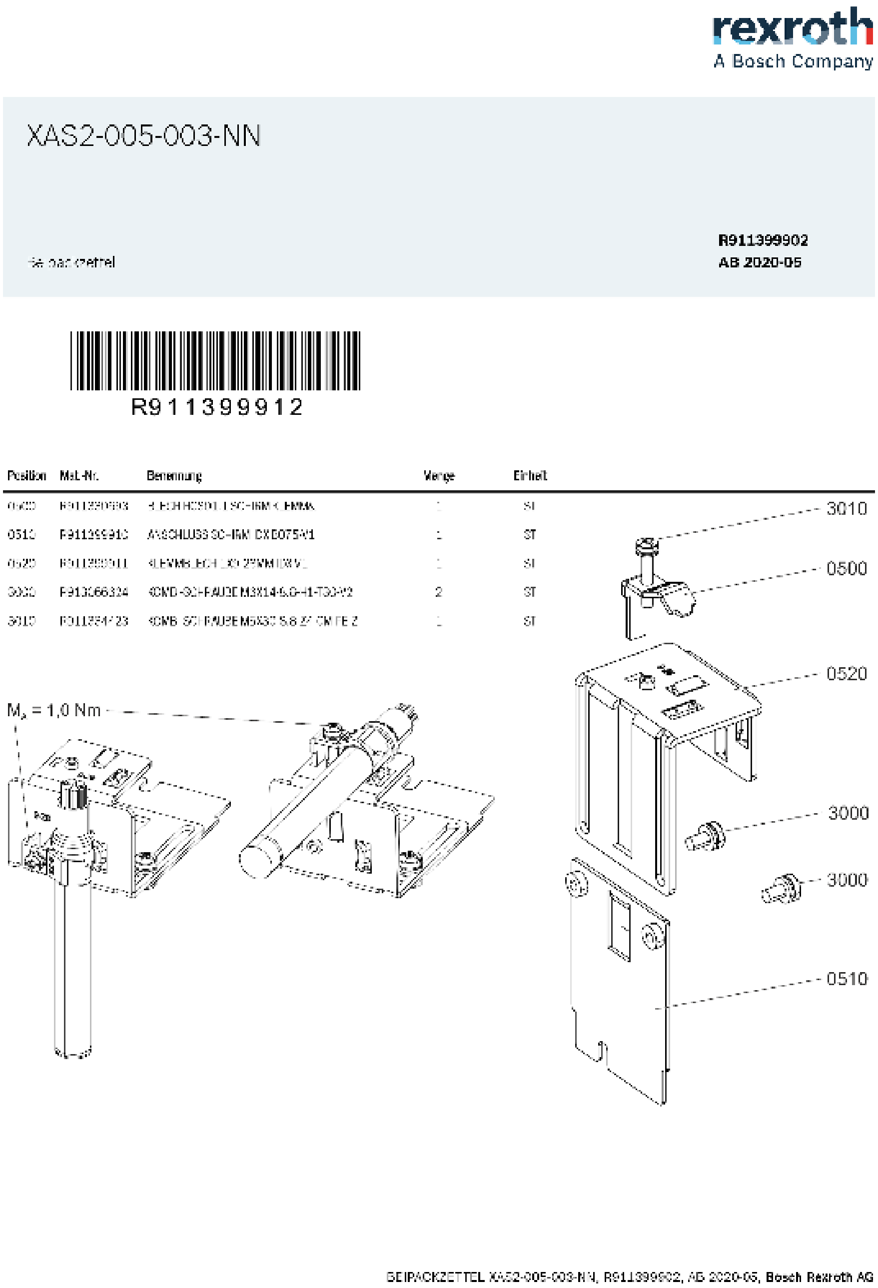
R911393948

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R911392928	ANSCHLUSS SCHIRM IDX B350 90G	1	ST
0510	R911392930	BEFESTIGUNGSARM SCHIRM IDX B350 90G	1	ST
0515	R911397084	BEFESTIGUNGSARM SCHIRM IDX B350 90 V1	1	ST
0520	R911392929	KLEMME IDX B350 90G	2	ST
3000	R911342307	M8X40-8.8-H1-T30-V1-2	2	ST
3010	R911223313	MUTTER KOM M 8,0 D18 H00,50	2	ST

BEIPACKZETTEL XAS2-004-002-NN, R911393961, AB 2019-04, Bosch Rexroth AG

Fig. 122: Product insert XAS2-004-002-NN

XAS2-005-003-NN


rexroth
A Bosch Company

XAS2-005-003-NN

Beipackzettel

R911399902
AB 2020-05

R911399912

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R91139990[illegible]	BLECH [illegible] SC-IBM KLEMMA	1	ST
0510	R911399910	ANSCHLUSS SC-IBM DXD075-V1	1	ST
0520	R911399911	KLEMMBLECH DXD 2[illegible]MM DX V1	1	ST
3000	R913066324	KOMB-SCHRAUBE M3X14-8.8-H1-T30-V2	2	ST
3010	R91135[illegible]	KOMB-SCHRAUBE M5X30 8.8 [illegible] FE Z	1	ST

BEIPACKZETTEL XAS2-005-003-NN, R911399902, AB 2020-05, Bosch Rexroth AG

Fig. 123: Product insert XAS2-005-003-NN

XAS2-006-003-NN

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A Bosch Company

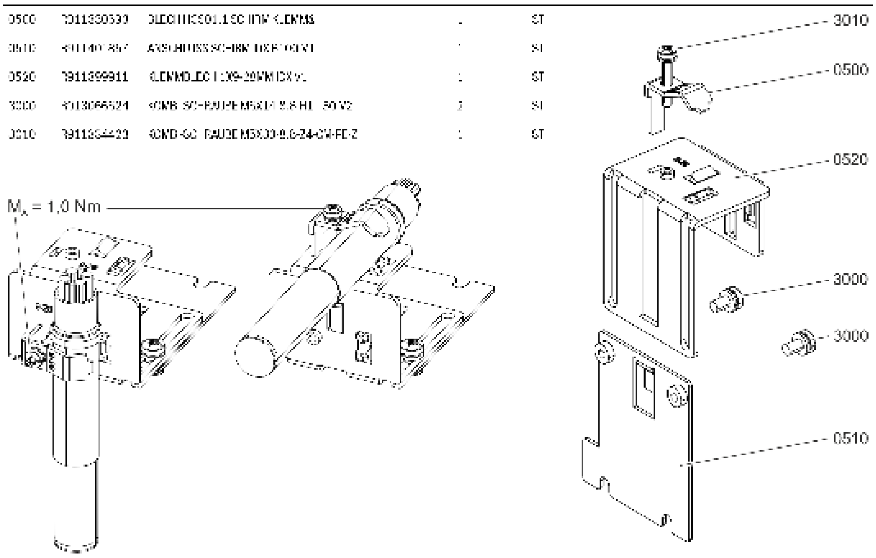
XAS2-006-003-NN

Beipackzettel

R911401855
AA 2020-01

R911401855

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	[illegible]	[illegible]	1	ST
0510	[illegible]	[illegible]	1	ST
0520	R911399911	[illegible]	1	ST
3000	[illegible]	[illegible]	2	ST
3010	[illegible]	[illegible]	1	ST



BEIPACKZETTEL XAS2-006-003-NN, R911401855, AA 2020-01, Bosch Rexroth AG

Fig. 124: Product insert XAS2-006-003-NN

XAS2-007-001-NN

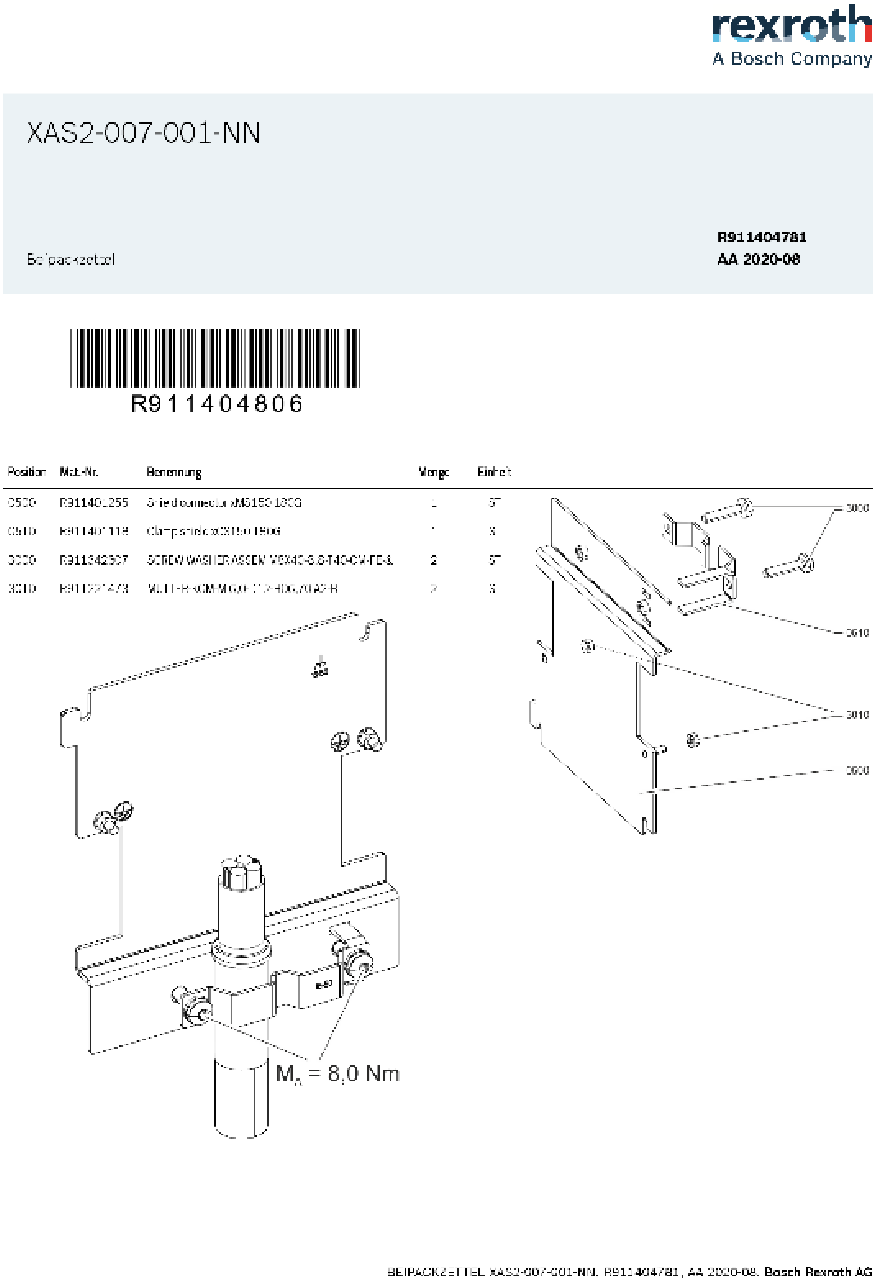


Fig. 125: Product insert XAS2-007-001-NN

XAS2-007-002-NN

rexroth
A Bosch Company

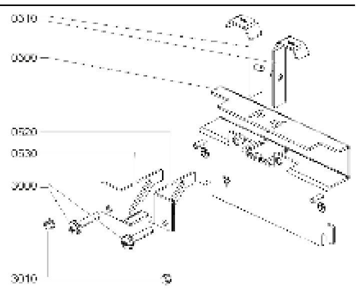
XAS2-007-002-NN

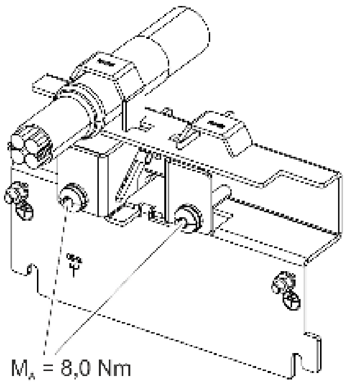
Beipackzettel

R911404782
AA 2020-08

R911404807

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R911401253	Shield connector XMS150-90G	1	ST
0510	R911401254	Clamp shield XCS150-90G	2	ST
0520	R911392930	MOUNTING ARM SCHIRM IDX E350 90G	1	ST
0530	R911397084	MOUNTING ARM SCHIRM IDX E350 90 V1	1	ST
3000	R911342907	SCREW WASHER ASSEM M6X40-G.8-T40-CM-FE-A	2	ST
3010	R911221773	MUTTER 4CM M 6,0 C12 406,70 A2 B	2	ST

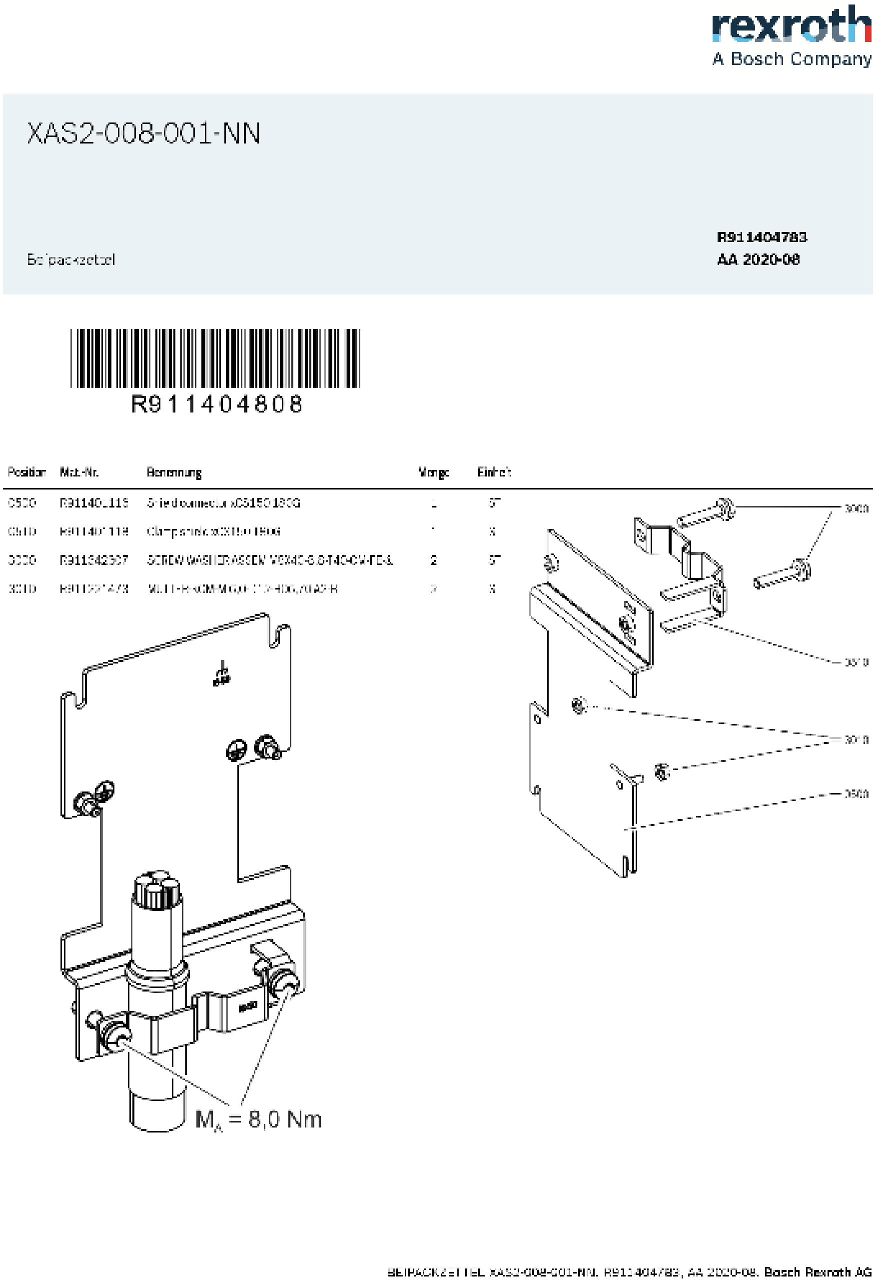




BEIPACKZETTEL XAS2-007-002-NN, R911404782, AA 2020-08, Bosch Rexroth AG

Fig. 126: Product insert XAS2-007-002-NN

XAS2-008-001-NN


rexroth
A Bosch Company

XAS2-008-001-NN

Beipackzettel

R911404783
AA 2020-08

R911404808

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R911401119	[illegible]	1	ST
0510	[illegible]	[illegible]	1	[illegible]
3000	R911342507	SCREW WASHER ASSEM M5X40-8.8-T40-CM-FE-3	2	ST
3010	[illegible]	[illegible]	[illegible]	[illegible]

BEIPACKZETTEL XAS2-008-001-NN, R911404783, AA 2020-08, Bosch Rexroth AG

Fig. 127: Product insert XAS2-008-001-NN

XAS2-008-002-NN

rexroth
A Bosch Company

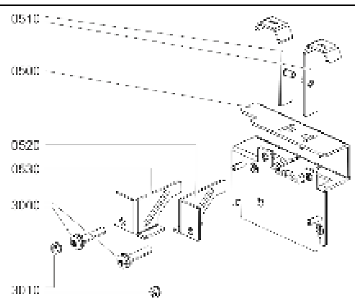
XAS2-008-002-NN

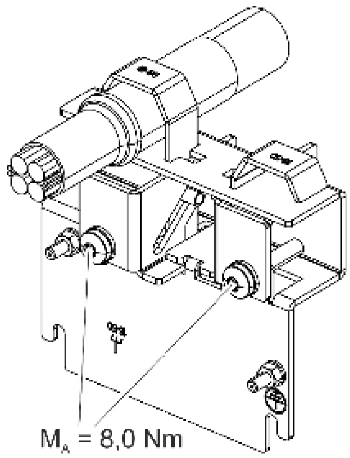
Beipackzettel

R911404784
AA 2020-08

R911404809

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R911401117	Shield connector XCS150 90G	1	ST
0510	R911401254	Clamp shield XCS150 90G	2	ST
0520	R911392900	MOUNTING ARM SCHIRM IDX E350 90G	1	ST
0530	R911397084	MOUNTING ARM SCHIRM IDX E3[illegible] V1	1	ST
3000	R911342907	SCREW WASHER ASSEM M6X40-8.8-T40-CM-FE-A	2	ST
3010	R911221773	MUTTER [illegible] M 6,0 [illegible]	2	ST





BEIPACKZETTEL XAS2-008-002-NN, R911404784, AA 2020-08, Bosch Rexroth AG

Fig. 128: Product insert XAS2-008-002-NN

XAS2-009-003-NN

rexroth
A Bosch Company

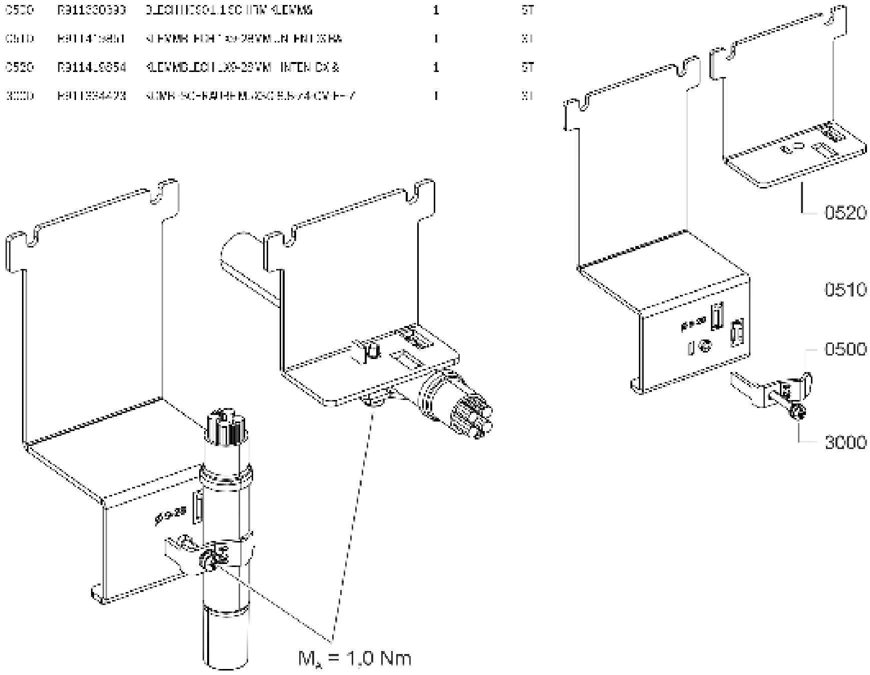
XAS2-009-003-NN

Beipackzettel

R911419839
AA 2023-01

R911419881

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R911330390	[illegible]	1	ST
0510	[illegible]	[illegible]	1	ST
0520	R911419854	[illegible]	1	ST
3000	[illegible]	[illegible]	1	ST



BEIPACKZETTEL XAS2-009-003-NN, R911419839, AA 2023-01, Bosch Rexroth AG

Fig. 129: Product insert XAS2-009-003-NN

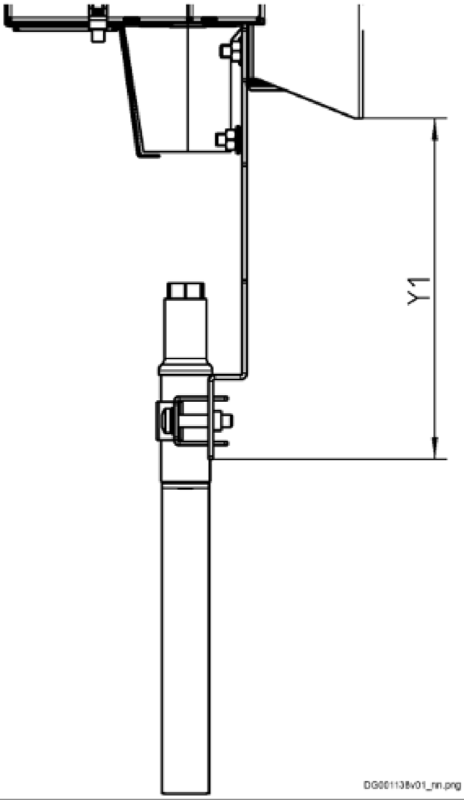
13.2.3 Clamping plate (XAS2-xxx-001-NN)

Distance between cable and drive controller

Use the values of the table below to determine the distance between the cable and the drive controller and to plan the control cabinet ducts.

The values apply to Rexroth cables and the maximum cable diameter.

Table 267: Distance between cable and drive controller

Device	XAS2-xxx-001-NN
	Cable outlet downwards
	
XCS*-W0210/250/280/330/375	Y1: 223
XMS*-W0210/250/280/330/375	Y1: 223
XCS*-W0150/180	Y1: 176.5
XMS*-W0150/180	Y1: 176.5
Y1: Distance between clamping plate and drive controller	

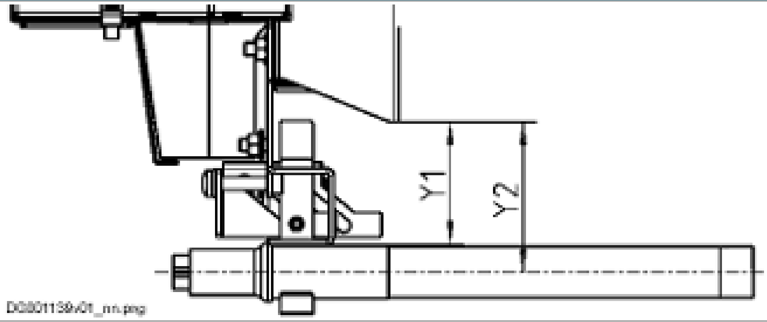
13.2.4 Clamping plate (XAS2-xxx-002-NN)

Distance between cable and drive controller

Use the values of the table below to determine the distance between the cable and the drive controller and to plan the control cabinet ducts.

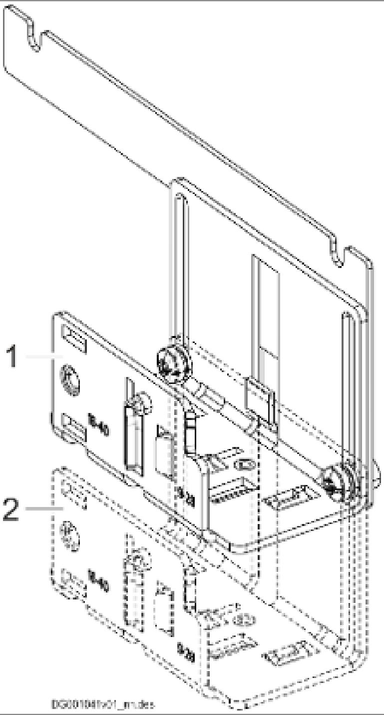
The values apply to Rexroth cables and the maximum cable diameter.

Table 268: Distance between cable and drive controller

Device	XAS2-xxx-002-NN
	Cable outlet backwards
	
XCS*-W0210/250/280/330/375	Y1: 74
XMS*-W0210/250/280/330/375	Y1: 74
XCS*-W0150/180	Y1: 66.5
XMS*-W0150/180	Y1: 66.5
	Y1: Distance between clamping plate and drive controller **Y2:** Y2 = Y1 + (0.5 × cable diameter)

13.2.5 Clamping plate (XAS2-xxx-003-NN)

Positions

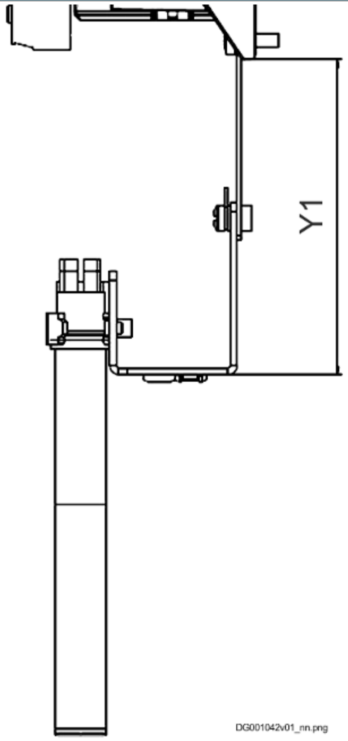
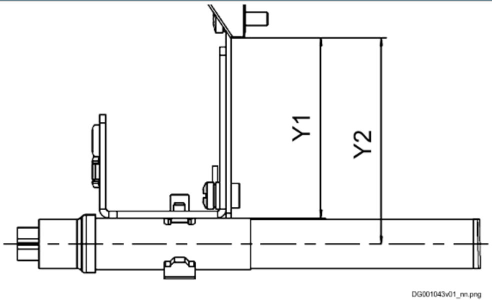
	When using XAS2-xxx-003 accessories, mount the cable with the cable outlet facing backwards or with the cable outlet facing downwards. Clamping plate positions: 1) Position with cable outlet facing backwards 2) Position with cable outlet facing downwards With Coldplate devices, only the cable outlet facing downwards is possible.

Distance between cable and drive controller

Use the values of the table below to determine the distance between the cable and the drive controller and to plan the control cabinet ducts.

The values apply to Rexroth cables and the maximum cable diameter.

Table 269: Distance between cable and drive controller

Device	XAS2-xxx-003-NN	
	Cable outlet downwards	Cable outlet backwards[1)]
		
XMD*-W5454/7070	Y1: 141	Y1: 81
XCS*-W0100/120	Y1: 141	Y1: 81
XMS*-W0100/120	Y1: 136	Y1: 75.5
XMS*-W0054/70/90	Y1: 144	Y1: 79
XCS*-W0054/70	Y1: 144	Y1: 79
XCS*-W0090	Y1: 167.5	Y1: 68.5

Y1: Distance between clamping plate and drive controller

Y2: Y2 = Y1 + (0.5 × cable diameter)

1) With **Coldplate devices**, only the cable outlet facing **downwards** is possible.

13.3 XAS4, DC bus adapter

13.3.1 XAS4 - Purpose, type code, assignment, cable cross sections

Note the information in ➦ Chapter Multiple-line arrangement of devices on page 158.

Purpose

The accessory is used for DC bus connection of devices that have not been mounted side by side (e.g., for multiline device arrangement in the control cabinet).

Type code

Table 270: XAS4, type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	A	S	4	-	W	M	-	U	0	0	5	-	N	N																									
	①					②	③		④	⑤				⑥																										

①	**Product:** XAS4 = ctrlX DRIVE accessory, DC bus adapter
②	**Connection compatibility 01:** W = Air-cooled devices C = Coldplate devices
③	**Connection compatibility 02:** M = Device height 309 mm L = Device height 340 mm
④	**Mounting position:** U = Independent (left and right)
⑤	**Cable outlet direction:** 005 = Downwards and upwards
⑥	**Other design:** NN = None

Assignment

Table 271: Air-cooled devices (W)

Air-cooled devices (W)		XAS4-WM-U005-NN R911408730	XAS4-WL-U005-NN R911408739
XVE	≤ XVE*-W0030	✓	-
	≥ XVE*-W0075	-	✓
XVR	≤ XVR*-W0019	✓	-
	≥ XVR*-W0048	-	✓
XCS	≤ XCS*-W0120	✓	-
	≥ XCS*-W0150	-	✓
XCD	≤ XCD*-W2323	✓	-
XMS	≤ XMS*-W0120	✓	-
	≥ XMS*-W0150	-	✓
XMD	≤ XMD*-W7070	✓	-
XLC	XLC*-W01M2-A-0750-NN	✓	-

Table 272: Coldplate devices (C)

Coldplate devices (C)		XAS4-CM-U005-NN R911408735	XAS4-CL-U005-NN R911408746
XCS	≤ XCS*-C0120	✓	-
	≥ XCS*-C0150	-	✓
XMS	≤ XMS*-C0120	✓	-
	≥ XMS*-C0150	-	✓
XMD	≤ XMD*-C7070	✓	-

Cable cross sections

Table 273: Cable cross sections

Permissible cross section, stranded wire	Unit	XAS4-*M-U005-NN	XAS4-*L-U005-NN
1 ring cable lug M6 1)	mm²	1 × 6	-
		1 × 10	-
		1 × 16	-
		1 × 25	-
		1 × 35	1 × 35
		1 × 50	1 × 50
		-	1 × 70
	AWG	1 × 10	-
		1 × 8	-
		1 × 6	-
		1 × 4	-
		1 × 3	-
		1 × 2	1 × 2
		1 × 1	1 × 1
		1 × 1/0	1 × 1/0
		-	1 × 2/0
2 ring cable lugs M6 2)	mm²	-	2 × 35
		-	2 × 50
		-	2 × 70
	AWG	-	2 × 1/0
		-	2 × 2/0
1) Recommendation: Ring cable lugs according to DIN 46234 2) To comply with the degree of protection IP20, use ring cable lugs according to DIN 46234.			

13.3.2 XAS4-WM-U005-NN, DC bus adapter

Product insert

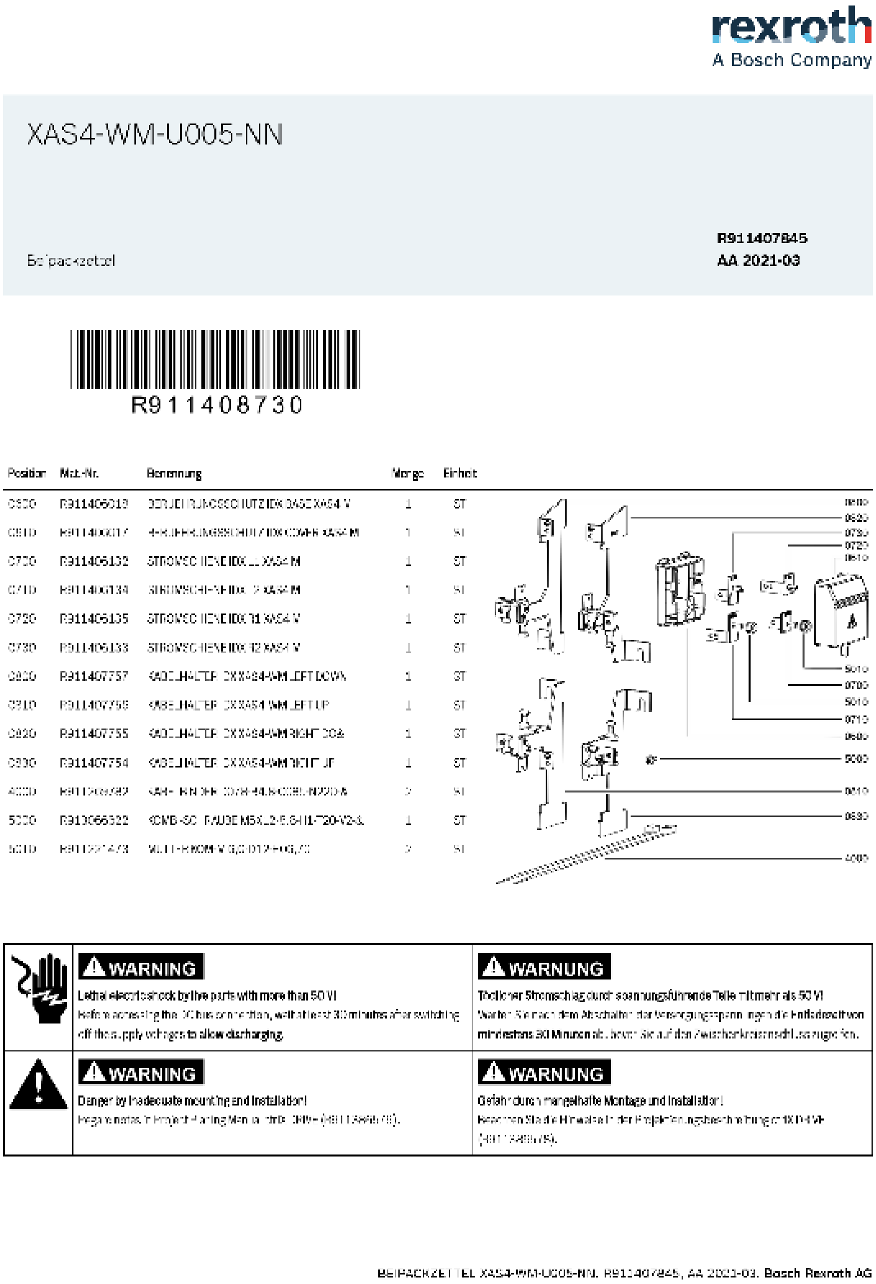


Fig. 130: Product insert

Dimensions

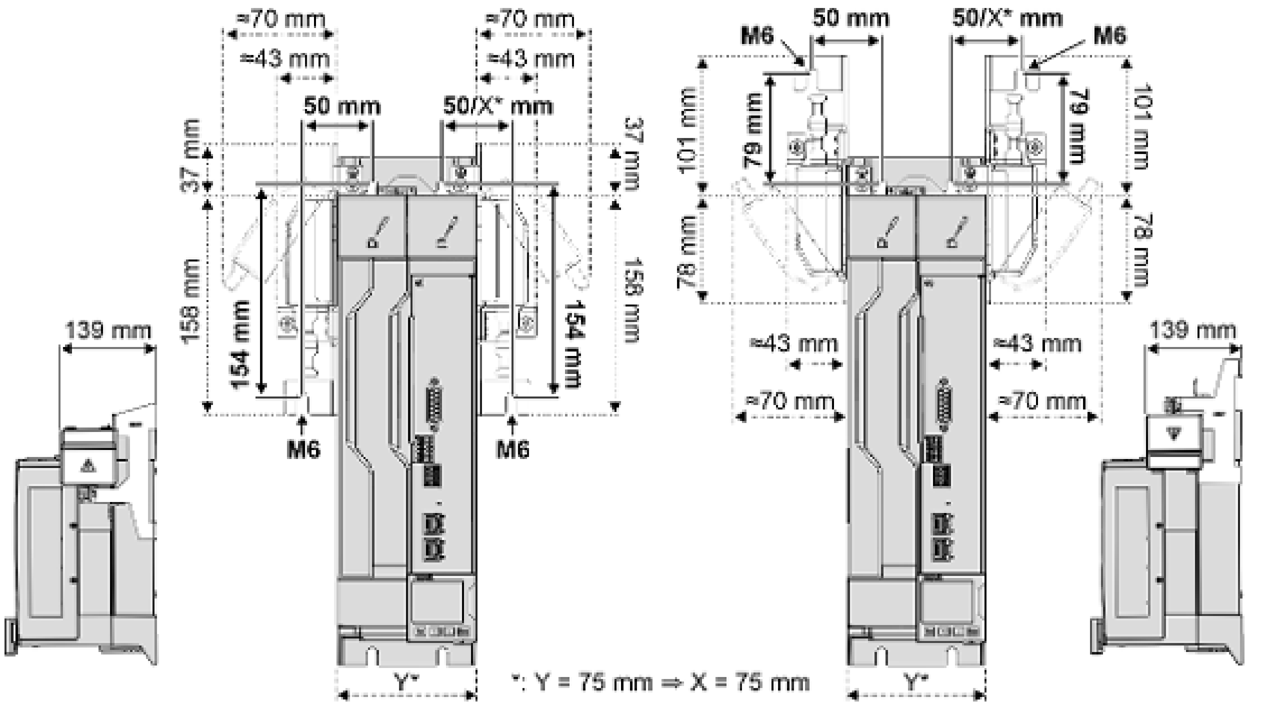


Fig. 131: Dimensions

50/X* mm, 79/154 mm	Position of mounting screw (M6) is relative to the position of the mounting screw of the device
X*/Y*	In case of devices with a width of 75 mm, the horizontal distance of the mounting screw (M6) is 75 mm to the right.

Comply with the minimum bending radius of the used cable. Additional installation space above the cable outlet may be required.

Mounting

Selecting individual parts

Two conditions have to be considered when selecting individual parts:

- Direction of cable outlet: downwards or upwards
- Position of cable outlet: right or left of the device

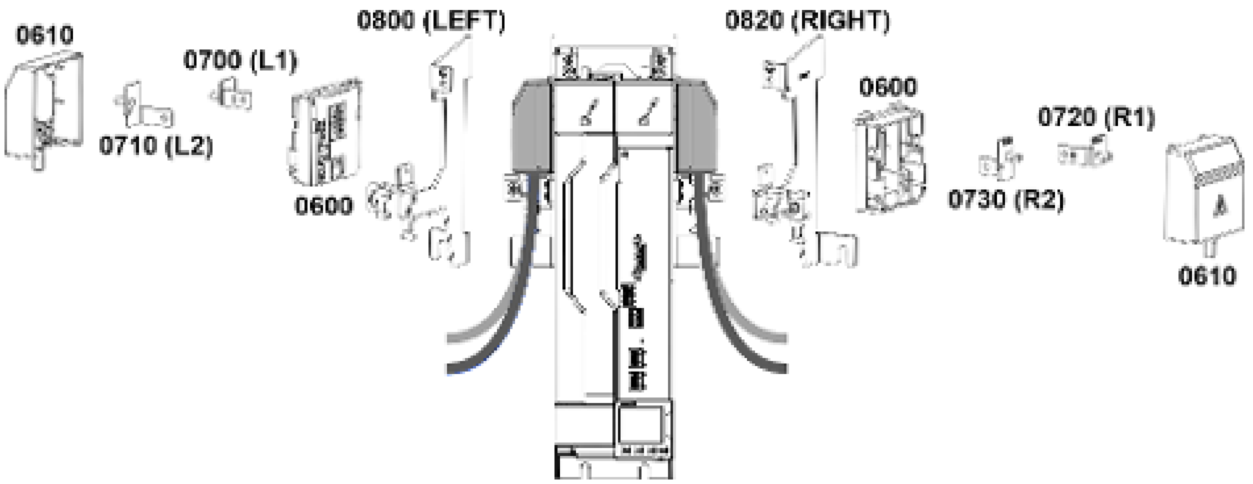


Fig. 132: Cable outlet downwards

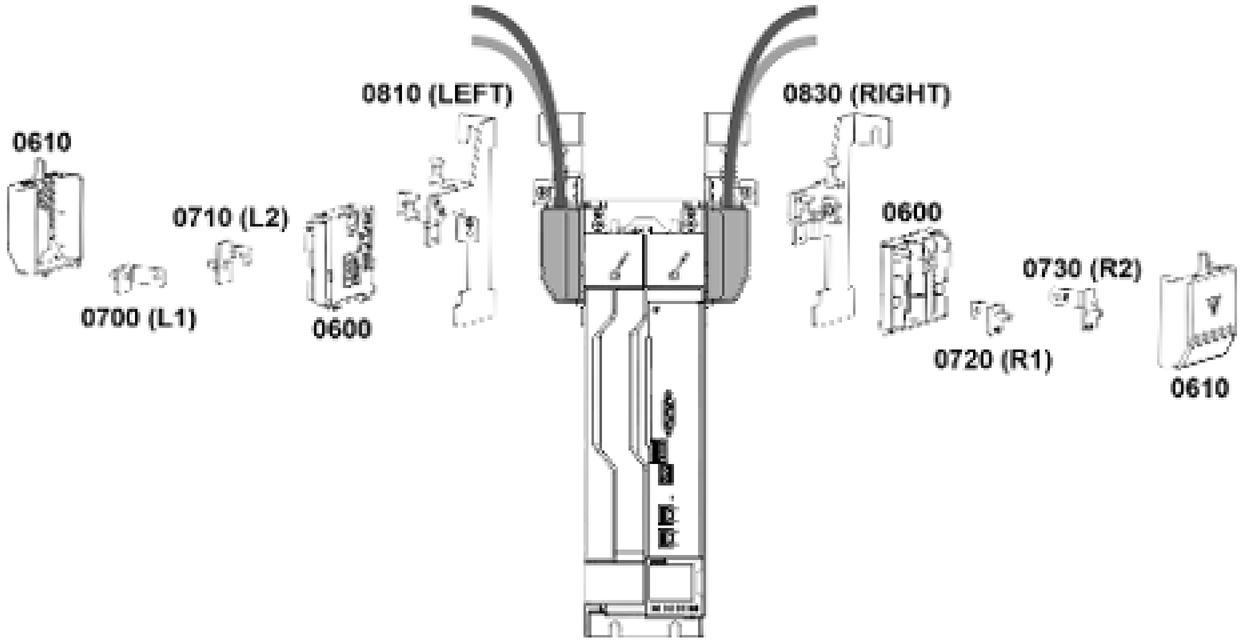
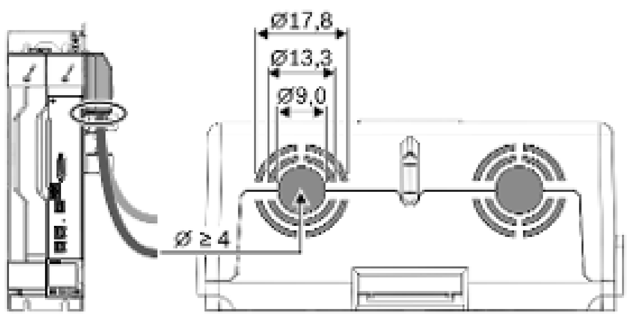


Fig. 133: Cable outlet upwards

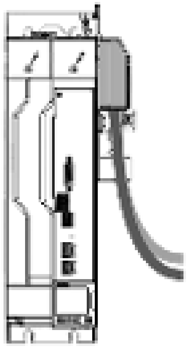
Cable

Table 274: Cable

Length	≤ 20 m
Outer diameter	≥ 4.0 mm
Cable feedthrough at touch guard (data in mm): 	Only enlarge cable feedthrough at touch guard if the cable diameter is too big for the existing cable feedthrough. Remove any sharp edges after having enlarged the cable feedthrough. **Cable feedthrough ↔ cable:** • **Ø9.0 mm** ≈ 1 × 6 ... 16 mm² • **Ø13.3 mm** ≈ 1 × 25 ... 35 mm² • **Ø17.8 mm** ≈ 1 × 50 mm²

Mounting accessories

Example: Cable outlet facing downwards and to the right side of the device

<table>
<tr>
<td></td>
<td>Parts list:

Parts of the accessories XAS4:

Touch guard (0600; 1×)
Touch guard cover (0610; 1×)
Conductor rail R1 (0720; 1×)
Conductor rail R2 (0730; 1×)
Cable support RIGHT DOWN (0820; 1×)
Screw nut M6 (5010; 2×)
Screw M5 (5000; 1×)
Cable connector (4000; 2×)

Parts to be provided by you:

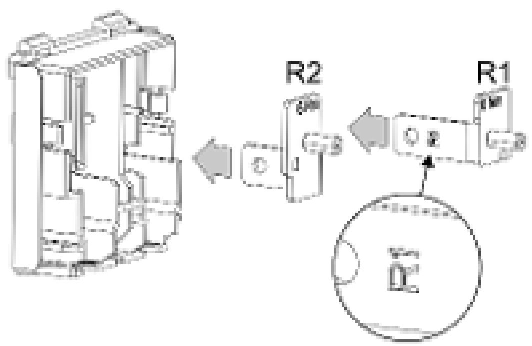
Cable (with terminal end M6; with insulated heat shrink sleeves; 2x)
Screw M6 (for mounting of accessory in the cabinet; 1×)

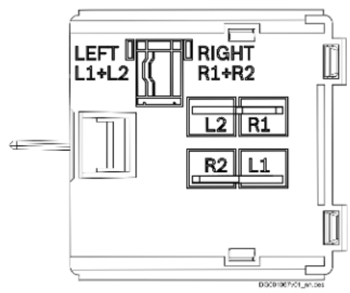
Parts that should already be available:

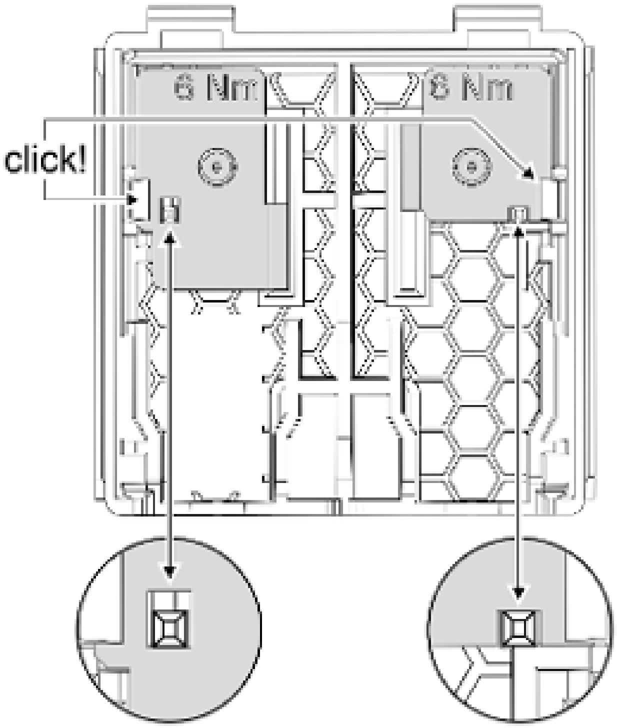
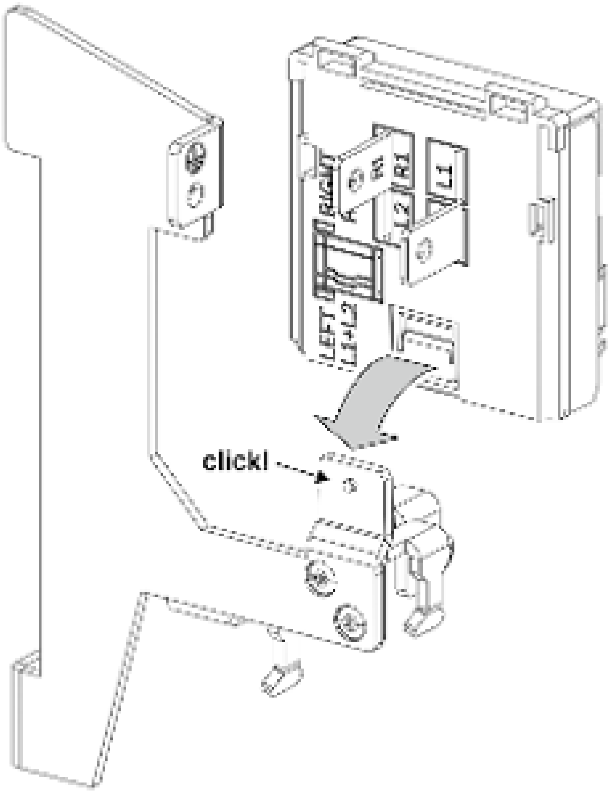
Screw M5 (3×; two screws for the DC bus connection; one screw for the equipment grounding connection; these screws are already available at the device upon delivery)

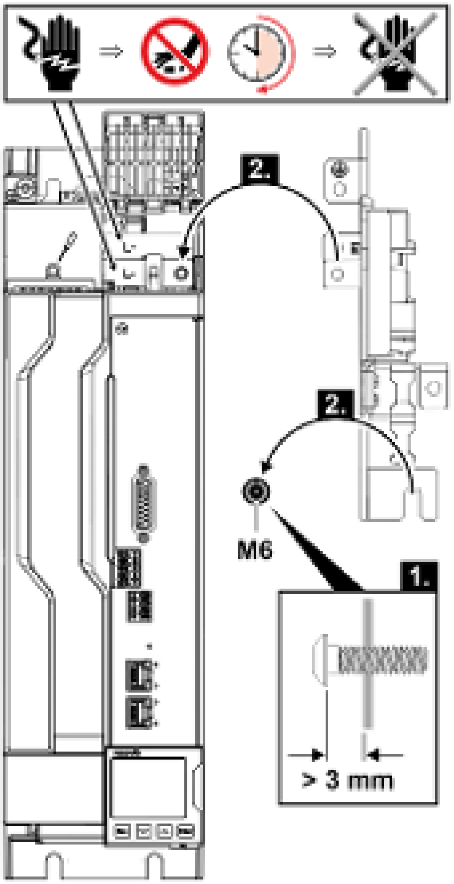
</td>
</tr>
</table>

Table 275: Mounting the parts

<table>
<tr>
<td>
</td>
<td>Insert contact bars.

The assignment of the contact bars is pictured on the back side of the touch guard:

</td>
</tr>
</table>

	Put contact bars in position and click engagement hooks into place.
	Push touch guard onto holder and click it into place.

<table>
<tr><td></td><td>

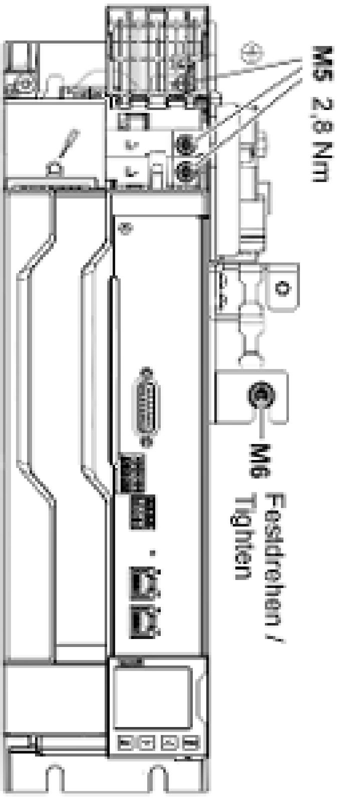
WARNING

Fatal electric shock due to live parts with more than 50 V!

Before accessing the DC bus connection, wait at least **30 minutes after switching off the supply voltages to allow discharging**.

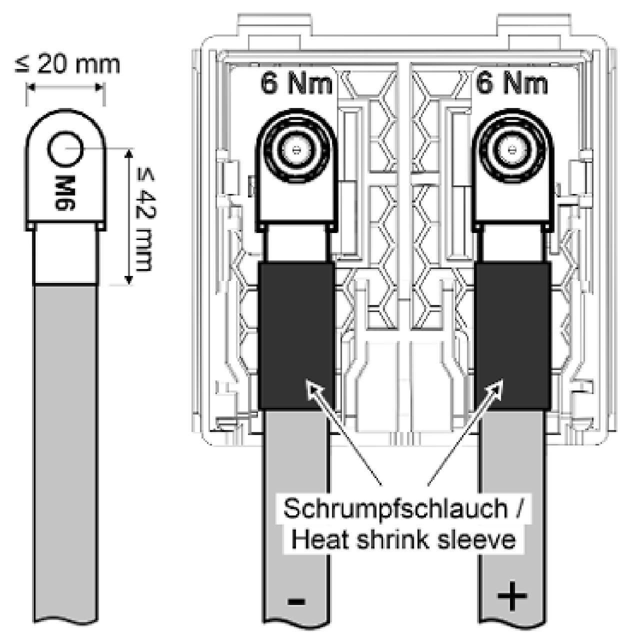
Flush mount accessories.

- **M6:** Preassemble screw to mounting plate.
- Open touch guard flap of the DC bus connection at the device and put accessory in position.

</td></tr>
<tr><td></td><td>

- **M5:** Tighten screws with 2.8 Nm.
- **M6:** Tighten screw at mounting plate.

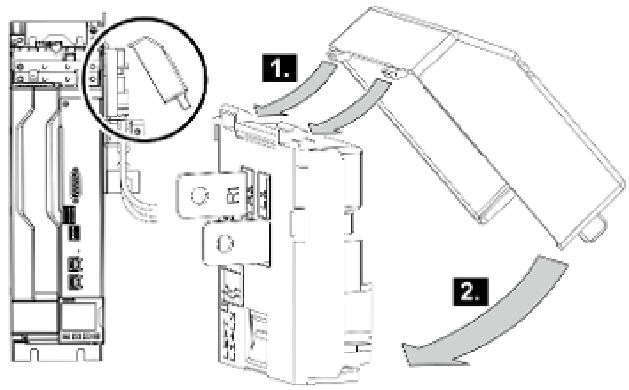
</td></tr>
</table>

<table>
<tr>
<td>
</td>
<td>Ring cable lug:

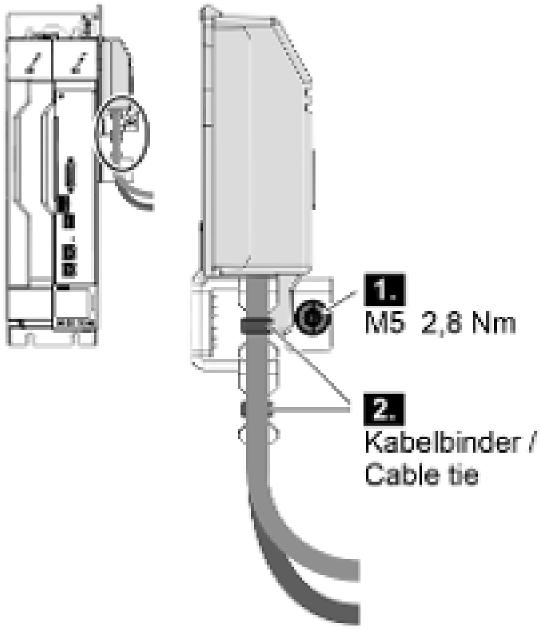
M6
Width: ≤ 20 mm
Length: ≤ 42 mm
Tightening torque: 6 Nm
Recommendation:
Recommendation: Ring cable lugs according to DIN 46234

Connecting the cables

Insulate ring cable lugs and connection cables with heat shrink sleeve.
Make sure the heat shrink sleeve overlaps sufficiently with the cable jacket so that finger protection IP20 is achieved.
Strip the insulation of the contact surface of the ring cable lug.
Put cable onto the contact bar and tighten nut with 6 Nm.

Do not yet use cable ties. Only use cable ties after mounting the cover.
Recommendation: Mark the assigned polarity with "+" and "-" on each cable.</td>
</tr>
<tr>
<td>
</td>
<td>Mount cover

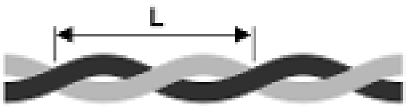
Place cover into the eyelets.
Carefully move the cover into place.
When moving cover into place make sure not to damage the engagement hooks of the contact bars.
</td>
</tr>
</table>



- Put screw (M5) into holder and tighten it with 2.8 Nm.
  The screw is used as a limit stop for the cover and must not squeeze the cover.
- Fasten cables with cable tie at the holder.
  Make sure the cables do not exert force to the cover.

Before connecting the cables to the other components of the DC bus group:

- Mount strain relief for cables.
  The accessory must not be mechanically stressed.
- Twist the cables
  Allowed length of lay:
  - ≤ 10 mm²: L ≤ 60 mm
  - 10 mm² < ... ≤ 25 mm²: L ≤ 90 mm
  - ≥ 35 mm²: L ≤ 120 mm



13.3.3 XAS4-CM-U005-NN, DC bus adapter

Product insert

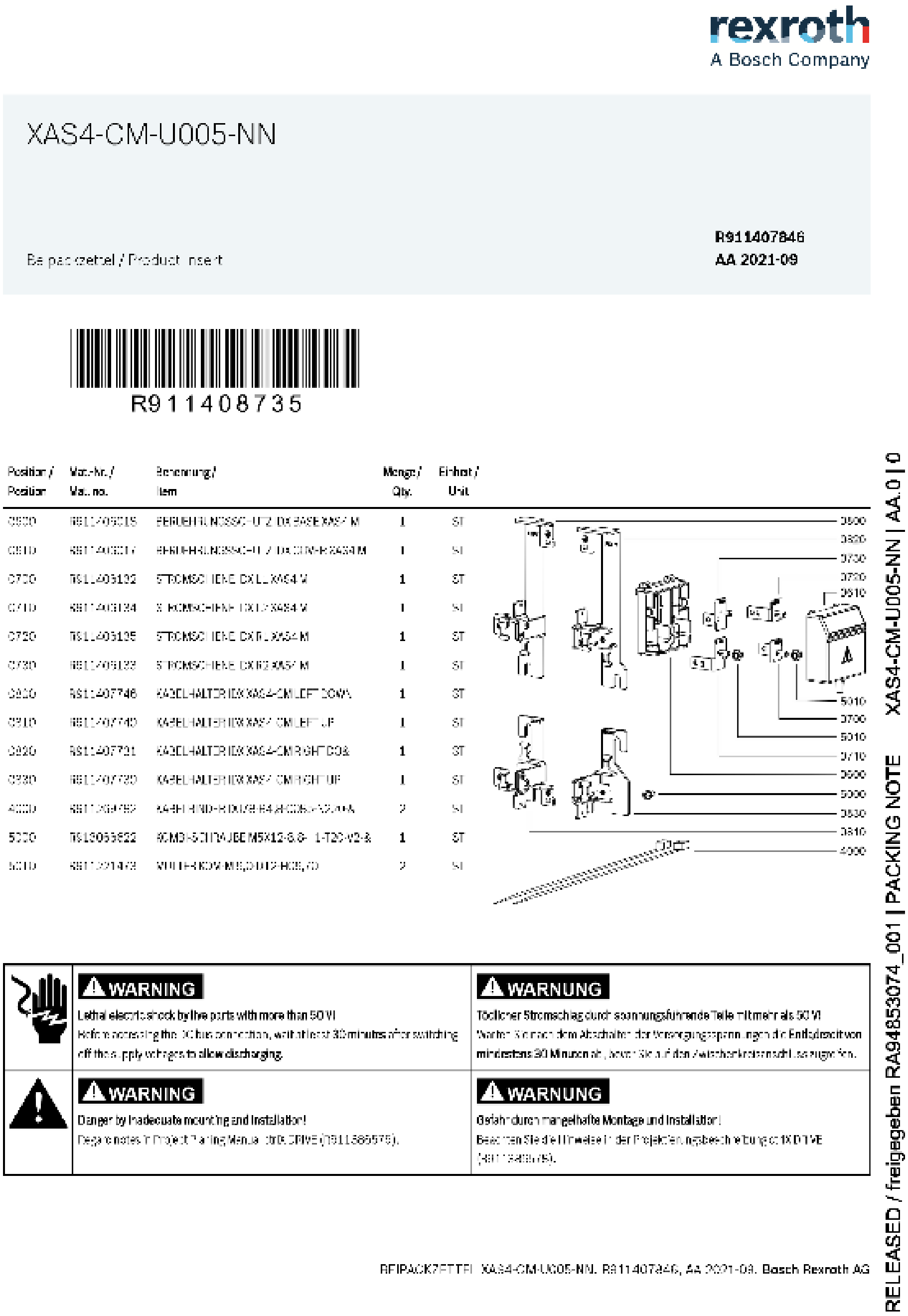


Fig. 134: Product insert

Dimensions

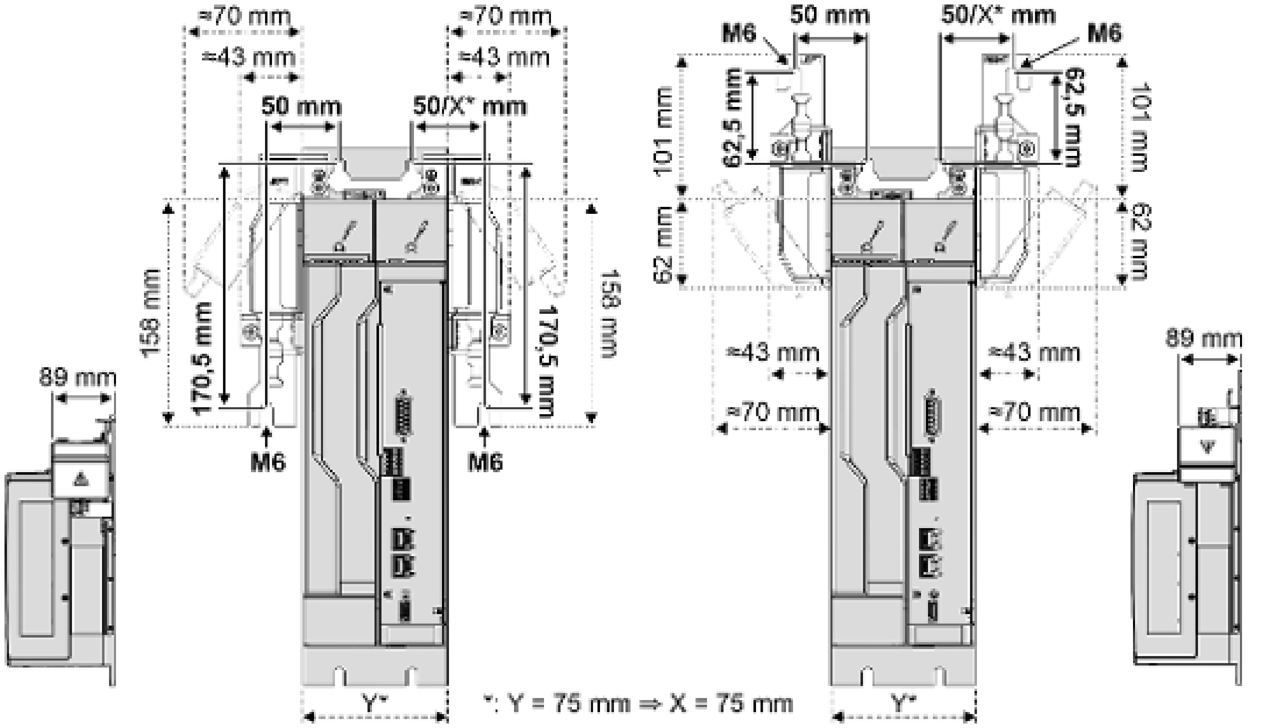


Fig. 135: Dimensions

50/X* mm, 62.5/170.5 mm: Position of mounting screw (M6) is relative to the position of the mounting screw of the device

X*/Y*: For devices of a width of 75 mm, the horizontal distance of the mounting screw (M6) to the right is 75 mm.

Observe the minimum bending radiuses of the cables used. Especially with a cable outlet facing upwards, more mounting clearance might be required.

Mounting

Selecting individual parts

Two conditions have to be considered when selecting individual parts:

- Direction of cable outlet: downwards or upwards
- Position of cable outlet: to the right or left side of the device

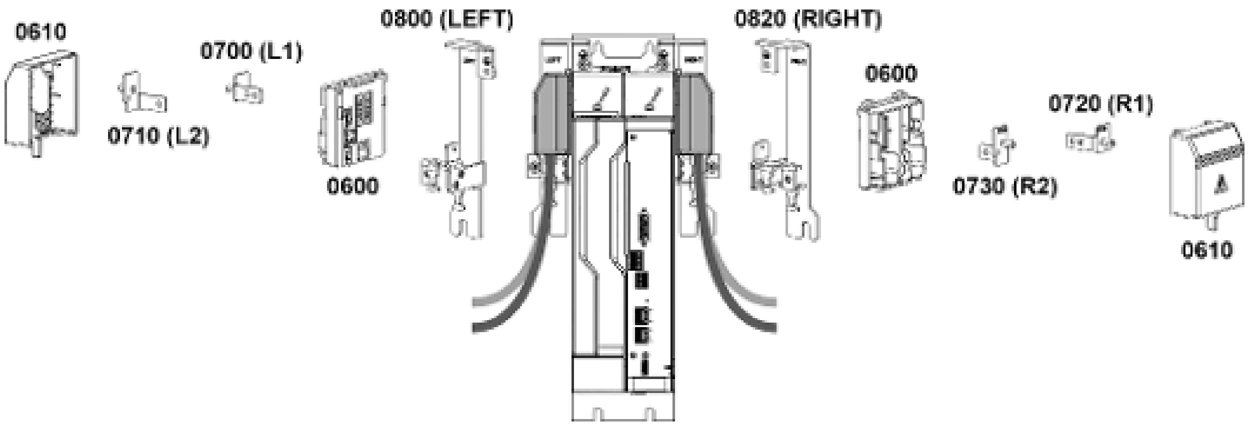


Fig. 136: Cable outlet downwards

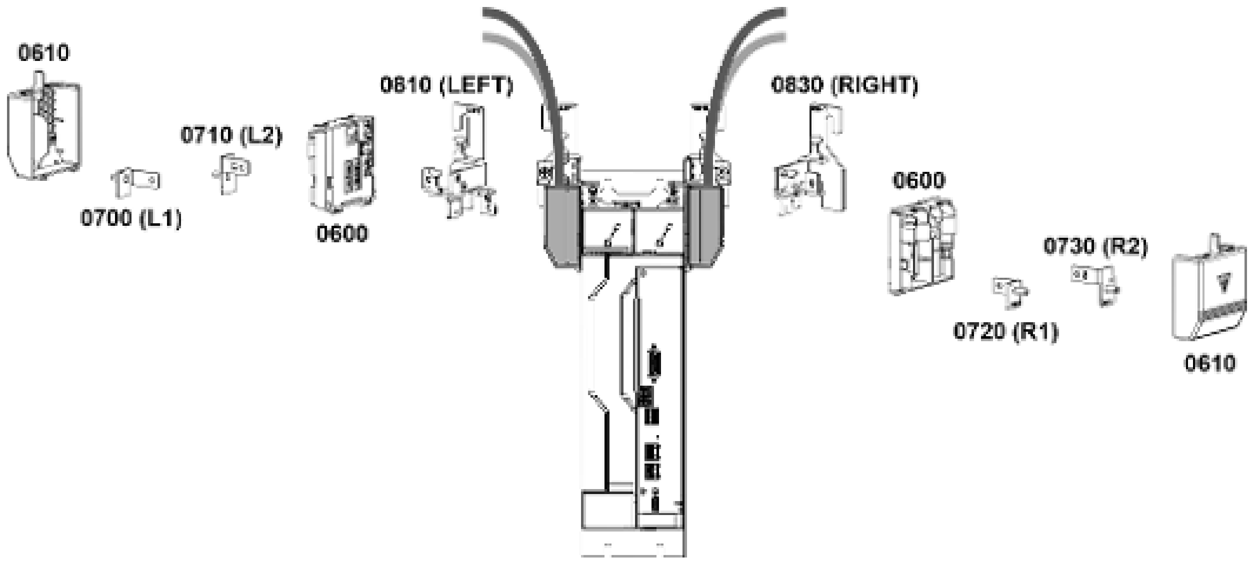
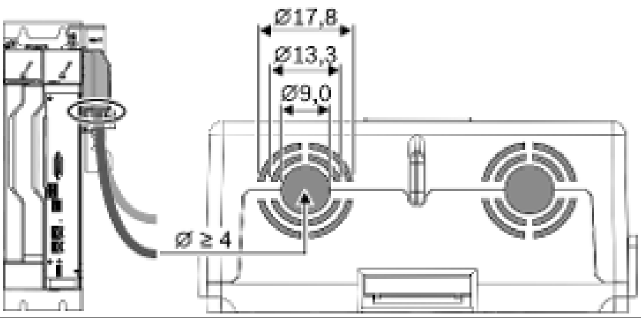


Fig. 137: Cable outlet upwards

Cable

Table 276: Cable

Length	≤ 20 m
Outer diameter	≥ 4.0 mm
Cable feedthrough at touch guard (data in mm):  	Only enlarge cable feedthrough at touch guard if the cable diameter is too big for the existing cable feedthrough. Remove any sharp edges after having enlarged the cable feedthrough. **Cable feedthrough ↔ cable:** • **Ø9.0 mm** ≈ 1 × 6 ... 16 mm² • **Ø13.3 mm** ≈ 1 × 25 ... 35 mm² • **Ø17.8 mm** ≈ 1 × 50 mm²

Mounting accessories

Example: Cable outlet facing downwards and to the right side of the device

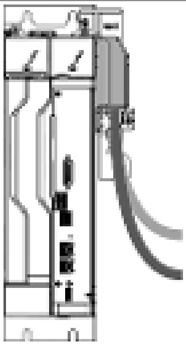
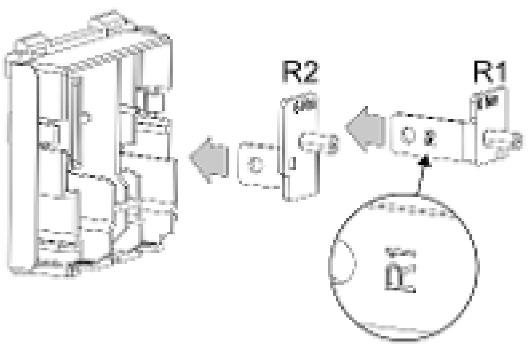
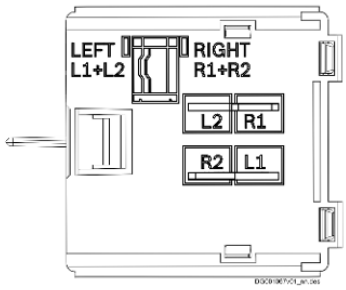
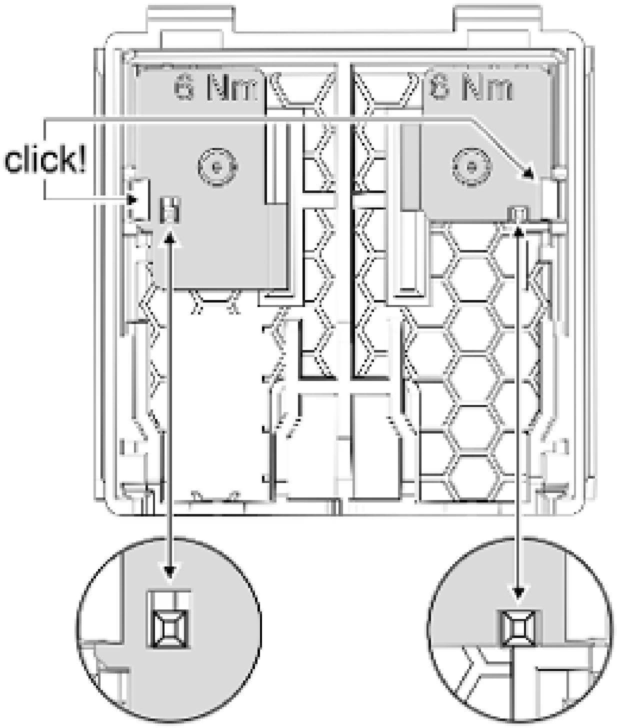
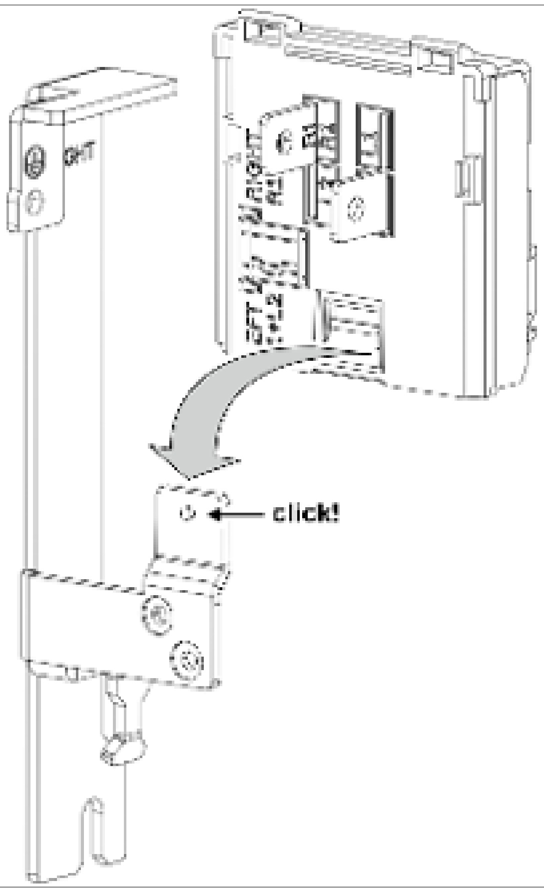
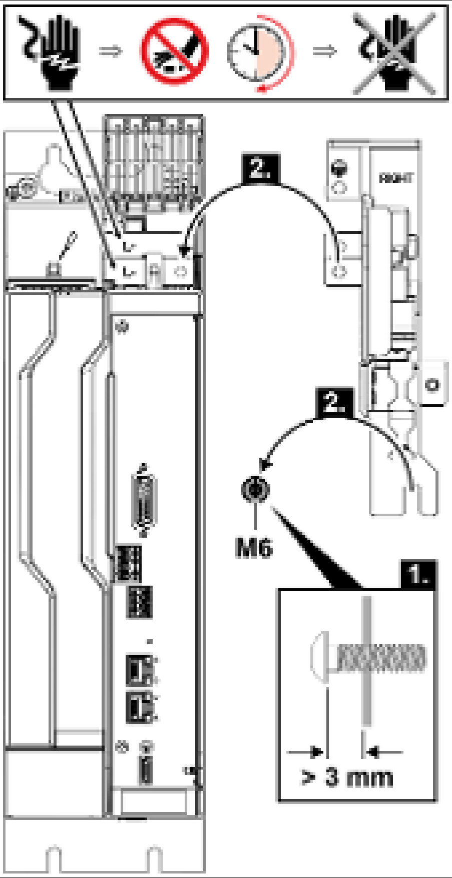
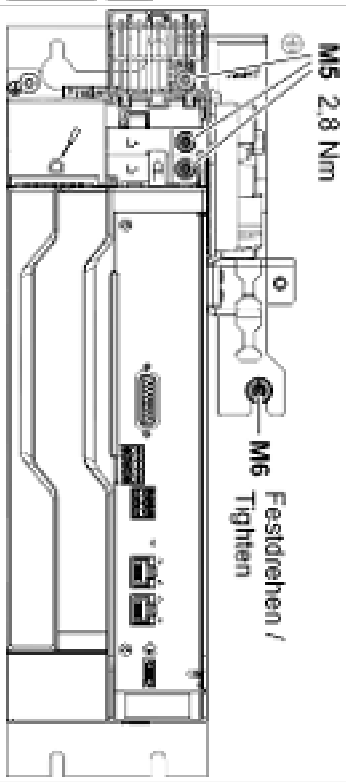
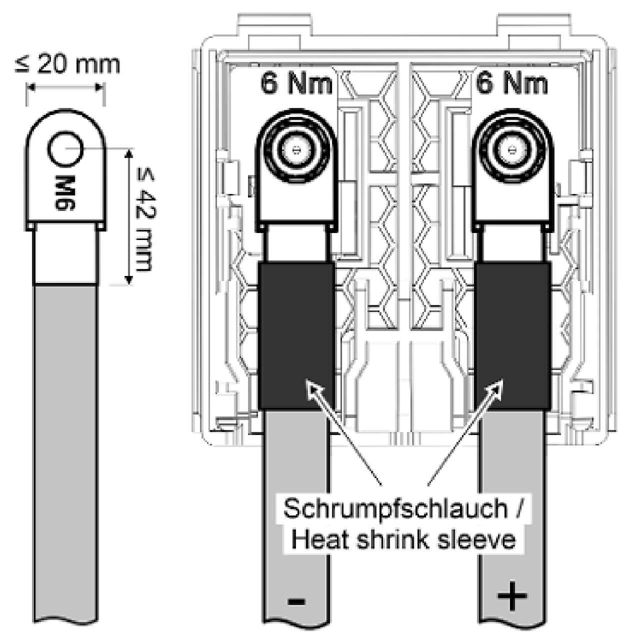
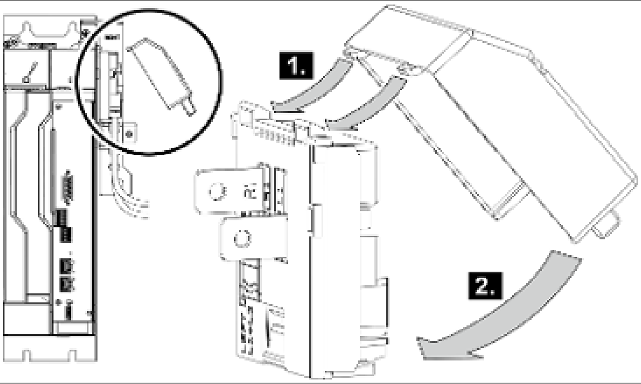
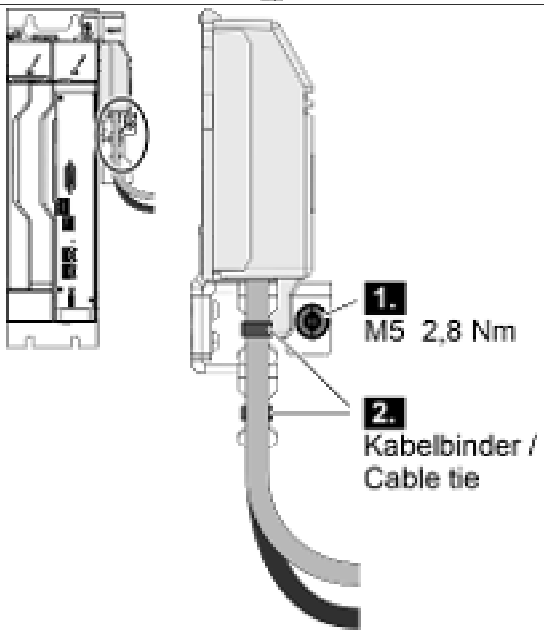
	Parts list: ● **Parts of the XAS4 accessory:** – Touch guard (0600; 1×) – Touch guard cover (0610; 1×) – Contact bar R1 (0720; 1×) – Contact bar R2 (0730; 1×) – Cable support RIGHT DOWN (0820; 1×) – Nut M6 (5010; 2×) – Screw M5 (5000; 1×) – Cable tie (4000; 2×) ● **Parts to be provided by you:** – Cable (with ring cable lug M6; insulated with heat shrink sleeve; 2×) – Screw M6 (for mounting the accessory in the control cabinet; 1×) ● **Parts that should already be available:** – Screw M5 (3×; two screws for the DC bus connection; one screw for the equipment grounding connection; these screws are already available at the device upon delivery)

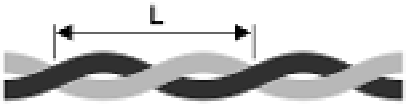
Table 277: Mounting the parts

	Insert contact bars. The assignment of the contact bars is pictured on the back side of the touch guard: 

	Put contact bars in position and click engagement hooks into place.
	Push touch guard onto holder and click it into place.

	**WARNING** **Lethal electric shock from live parts with more than 50 V!** Before accessing the DC bus connection, wait at least **30 minutes after switching off the supply voltages to allow discharging**. Mount the accessory as near as possible to the device. ● **M6:** Preassemble screw to mounting plate. ● Open touch guard flap of the DC bus connection at the device and put accessory in position.
	● **M5:** Tighten screws with 2.8 Nm. ● **M6:** Tighten screw at mounting plate.

	Ring cable lug: ● M6 ● Width: ≤ 20 mm ● Length: ≤ 42 mm ● Tightening torque: 6 Nm ● Recommendation: Ring cable lugs according to DIN 46234 Connecting the cables ● Insulate ring cable lugs and connection cables with **heat shrink sleeve**. Make sure the heat shrink sleeve overlaps sufficiently with the cable jacket so that finger protection **IP20** is achieved. ● Strip the insulation of the contact surfaces of the ring cable lug. ● Put cable onto the contact bar and tighten nut with **6 Nm**. Do **not** yet use cable ties. Only use cable ties after mounting the cover. Recommendation: Mark the assigned polarity with "+" and "-" on each cable.
	Mounting the cover ● Put cover into the eyelets. ● Carefully move the cover into place. When moving cover into place make sure not to damage the engagement hooks of the contact bars.
	● Put **screw (M5)** into holder and tighten it with 2.8 Nm. The screw is used as a limit stop for the cover and must not squeeze the cover. ● Fasten cables with **cable tie** at the holder. Make sure the cables do not exert force to the cover. Before connecting the cables to the other components of the DC bus group: ● Mount **strain relief** for cables. The accessory must not be mechanically stressed. ● **Twist the cables** Allowed length of lay: – ≤ 10 mm²: L ≤ 60 mm – 10 mm² < ... ≤ 25 mm²: L ≤ 90 mm – ≥ 35 mm²: L ≤ 120 mm

13.3.4 XAS4-WL-U005-NN, DC bus adapter

Product insert

rexroth
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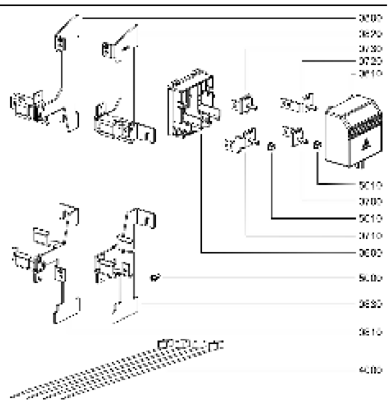
XAS4-WL-U005-NN

Beipackzettel

R911407847
AA 2021-03

R911408739

Position	Mat.-Nr.	Benennung	Menge	Einheit
0600	R911406011	BERUEHRUNGSSCHUTZ IDX BASE XAS4 L	1	ST
0610	R911406013	BERUEHRUNGSSCHUTZ IDX COVER XAS4 L	1	ST
0700	R911406014	STROMSCHIENE IDX L1 XAS4 L	1	ST
0710	R911406012	STROMSCHIENE IDX L2 XAS4 L	1	ST
0720	R911406015	STROMSCHIENE IDX R1 XAS4 L	1	ST
0730	R911406016	STROMSCHIENE IDX R2 XAS4 L	1	ST
0800	R911407788	KABELHALTER DXXAS4-WL LEFT DOWN	1	ST
0810	R911407789	KABELHALTER DXXAS4-WL LEFT UP	1	ST
0820	R911407790	KABELHALTER DXXAS4-WL RIGHT DOWN	1	ST
0830	R911407791	KABELHALTER DXXAS4-WL RIGHT UP	1	ST
4000	[illegible]	[illegible]	4	ST
5000	R913066322	KOMBI-SCHRAUBE M5X12-[illegible]	1	ST
5010	[illegible]	[illegible]	2	ST



	WARNING	WARNUNG
	Lethal electric shock by live parts with more than 50 V! Before accessing the DC bus connection, wait at least 30 minutes after switching off the supply voltages to allow discharging.	**Tödlicher Stromschlag durch spannungsführende Teile mit mehr als 50 V!** Warten Sie nach dem Abschalten der Versorgungsspannungen die Entladezeit von mindestens 30 Minuten ab, bevor Sie auf den Zwischenkreisanschluss zugreifen.
	Danger by inadequate mounting and installation! Regard notes in Project Planning Manual ctrlX DRIVE (R911385575).	**Gefahr durch mangelhafte Montage und Installation!** Beachten Sie die Hinweise in der Projektierungsbeschreibung ctrlX DRIVE (R911385575).

BEIPACKZETTEL XAS4-WL-U005-NN, R911407847, AA 2021-03, Bosch Rexroth AG

Fig. 138: Product insert

Dimensions

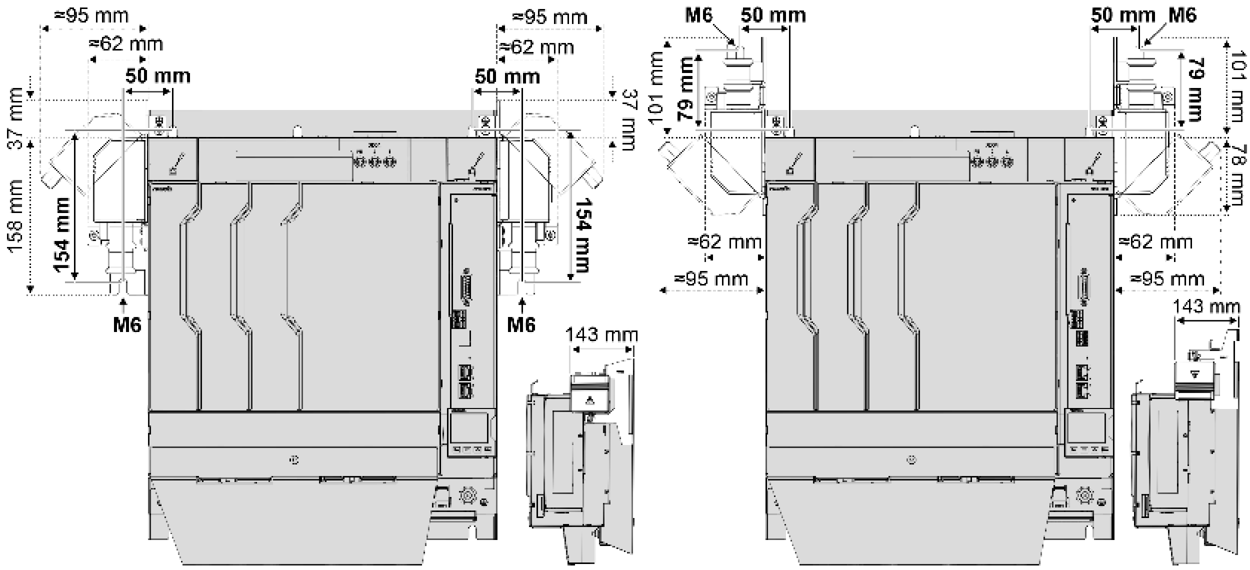


Fig. 139: Dimensions

50 mm, 79/154 mm	**Position of mounting screw (M6)** is relative to the position of the mounting screw of the device
37/101 mm	Height of the accessory

Comply with the minimum bending radius of the used cable. Additional installation space above the cable outlet may be required.

Mounting

Selecting individual parts

Two conditions have to be considered when selecting individual parts:

- Direction of cable outlet: downwards or upwards
- Position of cable outlet: right or left of the device

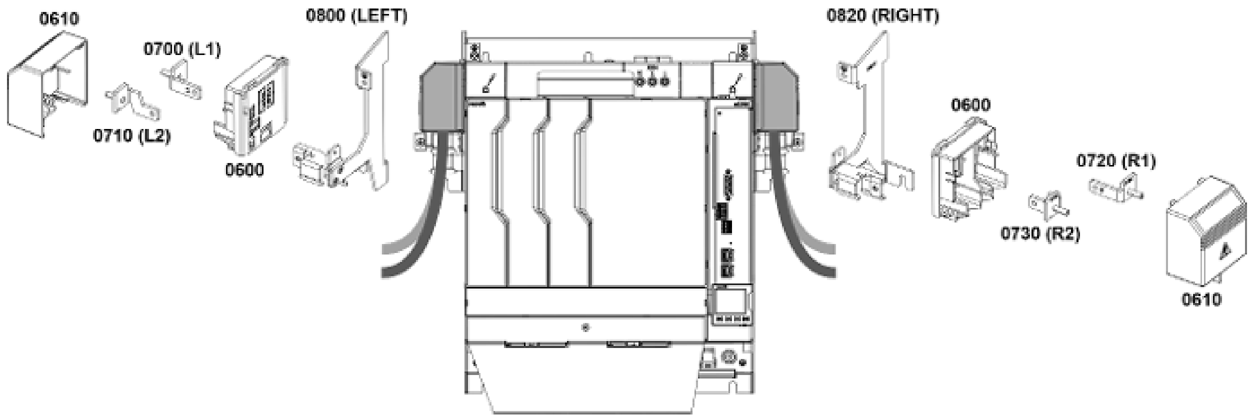


Fig. 140: Cable outlet downwards

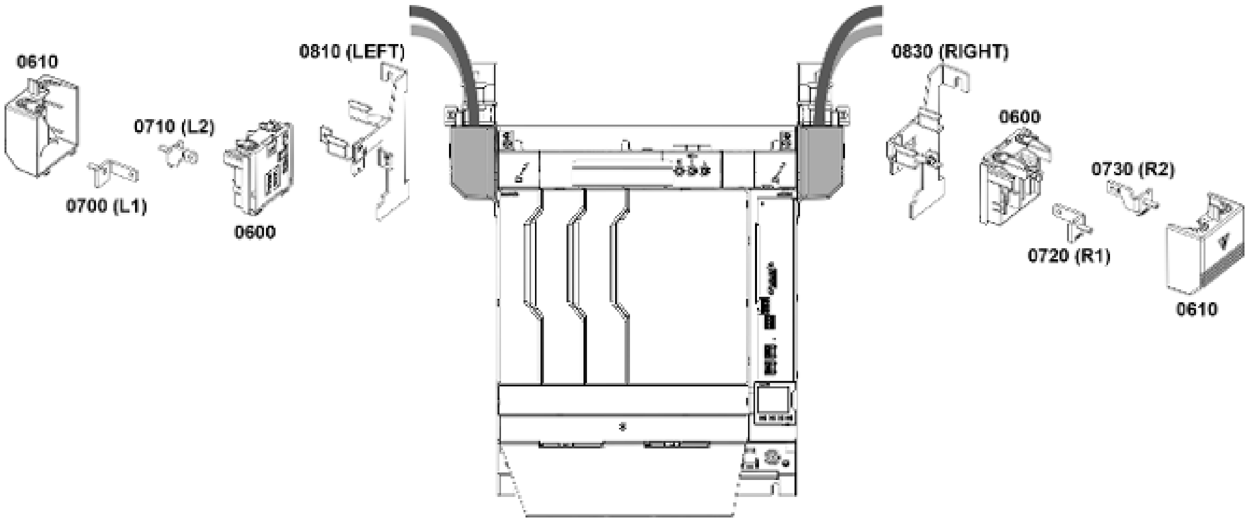
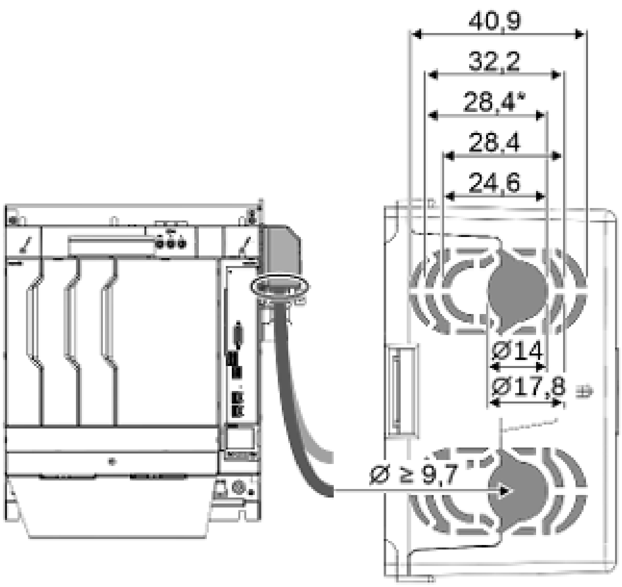


Fig. 141: Cable outlet upwards

Cable

Table 278: Cable

Length	≤ 20 m
Outer diameter	≥ 9.7 mm
Cable feedthrough at touch guard (data in mm):  	Only enlarge cable feedthrough at touch guard if the cable diameter is too big for the existing cable feedthrough. Remove any sharp edges after having enlarged the cable feedthrough. **Cable feedthrough ↔ cable:** • **Ø14.0 mm ≈** 1 × 35 mm² Outer diameter of cable: ≥ 9.7 mm • **Ø17.8 mm ≈** – 1 × 50 mm² Outer diameter: ≥ 1 × 11.5 mm – 1 × 70 mm² Outer diameter: ≥ 1 × 13.5 mm • **24.6 mm ≈** – 2 × 35 mm² Outer diameter of cables: ≥ 2 × 9.7 mm – 2 × 50 mm² Outer diameter of cables: ≥ 2 × 11.5 mm • **28.4 mm ≈** – 2 × 50 mm² Outer diameter of cables: ≥ 2 × 11.5 mm – 2 × 70 mm² Outer diameter of cables: ≥ 2 × 13.5 mm • **28.4* mm ≈** – 2 × 70 mm² Outer diameter of cables: ≥ 2 × 13.5 mm • **32.2 mm ≈** 2 × 70 mm²

	Outer diameter of cables: ≥ 2 × 13.5 mm

Mounting accessories

Example: Cable outlet facing downwards and to the right side of the device

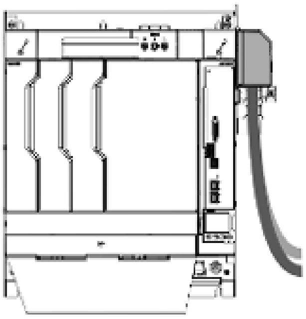
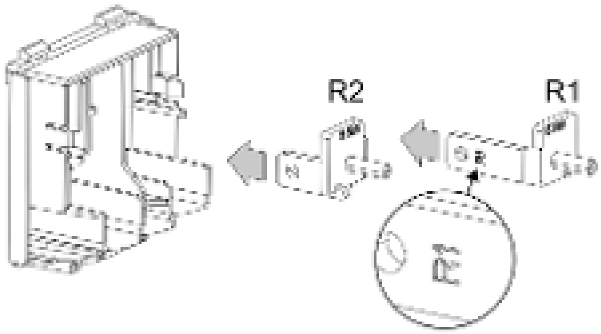
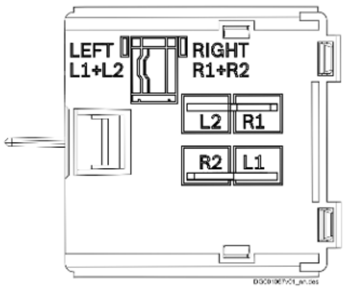
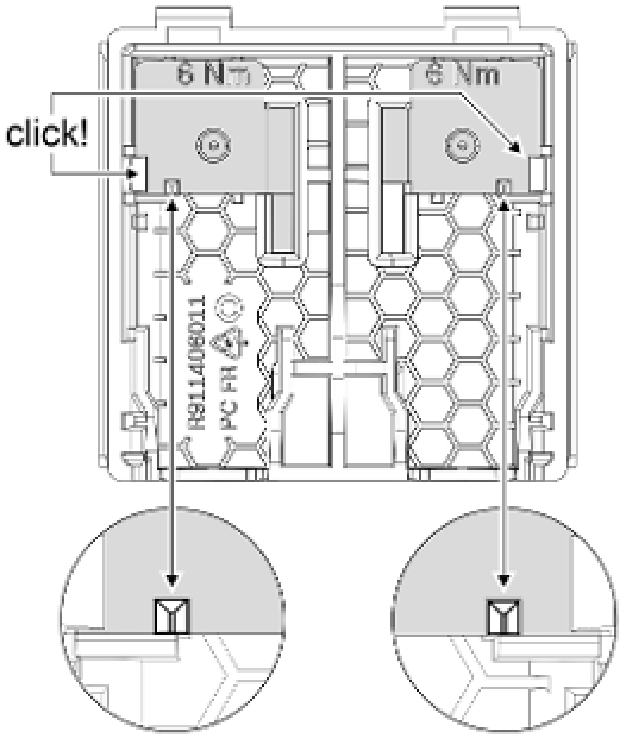
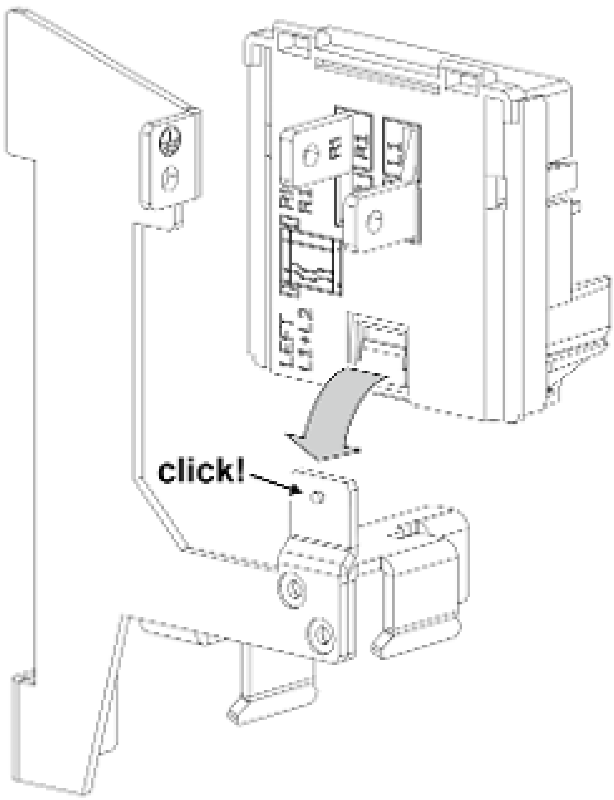
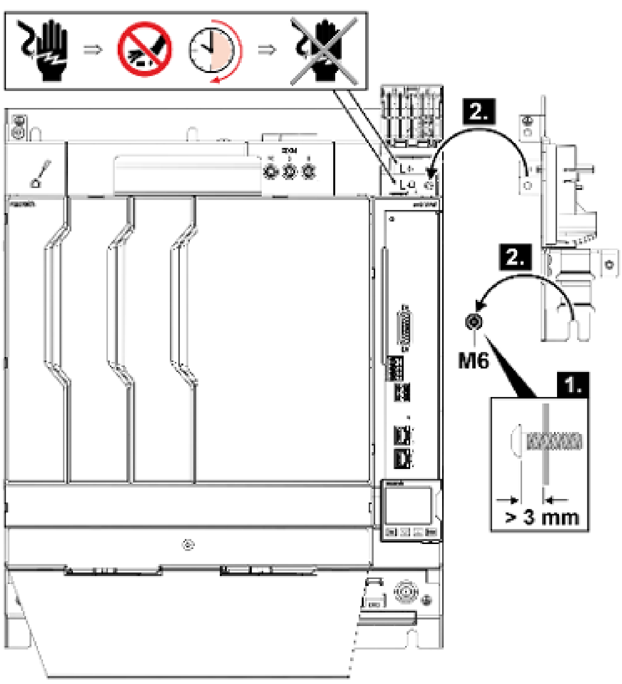
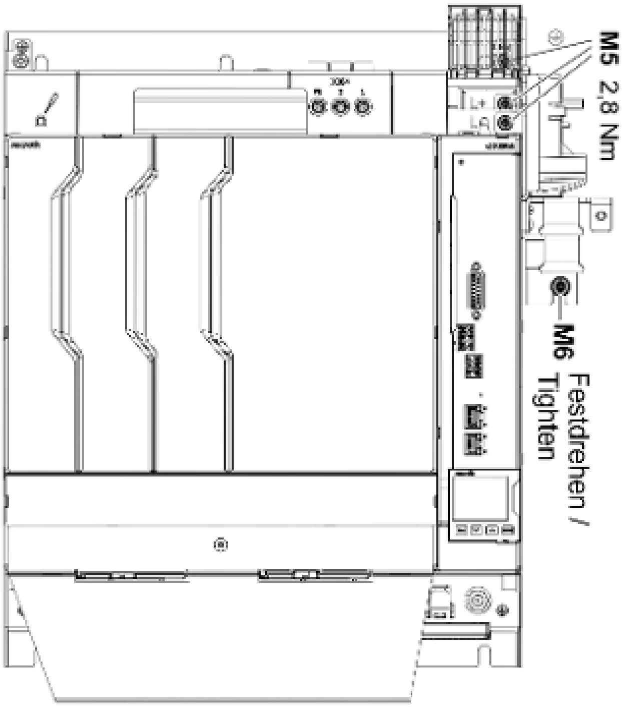
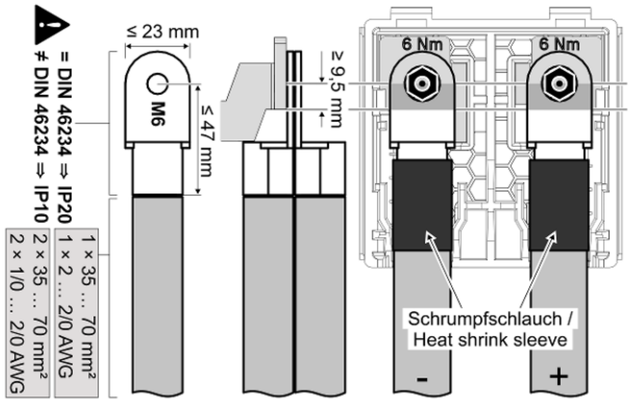
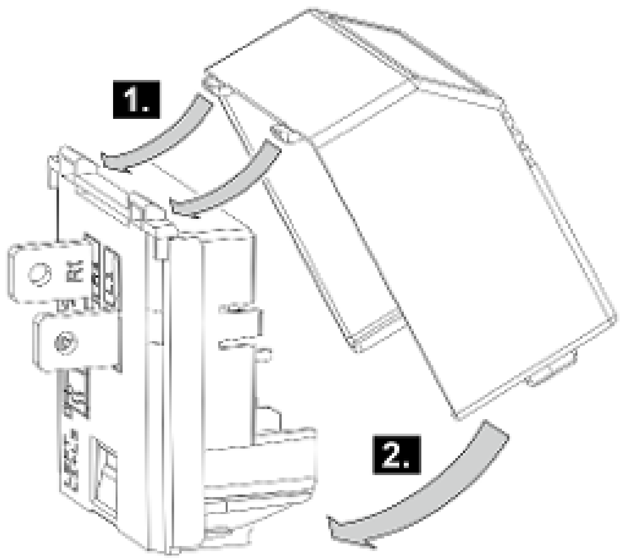
	Parts list: ● Parts of the accessories XAS4: – Touch guard (0600; 1×) – Touch guard cover (0610; 1×) – Conductor rail R1 (0720; 1×) – Conductor rail R2 (0730; 1×) – Cable support RIGHT DOWN (0820; 1×) – Screw nut M6 (5010; 2×) – Screw M5 (5000; 1×) – Cable tie (4000; 4×) ● Parts to be provided by you: – Cable (with ring cable lug M6; insulated with heat shrink sleeve; 2× or 4×) – Screw M6 (for mounting of accessory in the cabinet; 1×) ● Parts that should already be available: – Screw M5 (3×; two screws for the DC bus connection; one screw for the equipment grounding connection; these screws are already available at the device upon delivery)

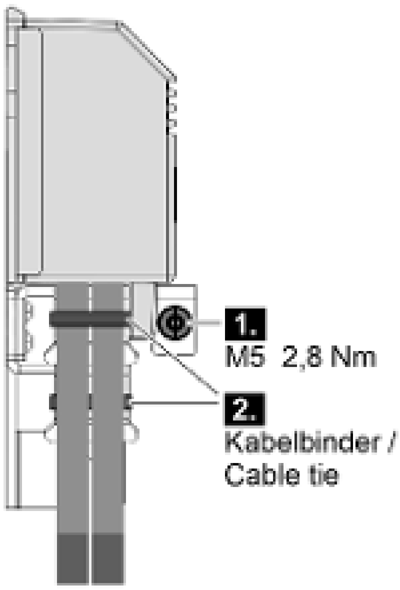
Table 279: Mounting the parts

	Insert contact bars. The assignment of the contact bars is pictured on the back side of the touch guard: 

	Put contact bars in position and click engagement hooks into place.
	Push touch guard onto holder and click it into place.

	**WARNUNG** **Fatal electric shock due to live parts with more than 50 V!** Before accessing the DC bus connection, wait at least **30 minutes after switching off the supply voltages to allow discharging.** Flush mount accessories. ● **M6:** Preassemble screw to mounting plate. ● Open touch guard flap of the DC bus connection at the device and put accessory in position.
	**M5:** Tighten screws with 2.8 Nm. **M6:** Tighten screw at mounting plate.

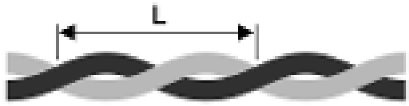
	Ring cable lug: ● M6: = DIN 46234 ⇒ IP20 ≠ DIN 46234 ⇒ IP10 ● Width: ≤ 23 mm ● Length: ≤ 47 mm ● If 2 ring cable lugs are used per contact bar: See picture: The lower ring cable lug must have even contact with the contact bar, at least for the specified area (≥ 9.5 mm). ● Tightening torque: 6 Nm Connecting the cables ● Make sure the heat shrink sleeve overlaps sufficiently with the cable jacket so that finger protection IP20 is achieved. ● Strip the insulation of the contact surface of the ring cable lug. ● Put cable onto the contact bar and tighten nut with 6 Nm. Do **not** yet use cable ties. Only use cable ties after mounting the cover. Recommendation: Mark the assigned polarity with "+" and "-" on each cable.
	Mount cover ● Place cover into the eyelets. ● Carefully move the cover into place. When moving cover into place make sure not to damage the engagement hooks of the contact bars.



- Put **screw (M5)** into holder and tighten it with 2.8 Nm.
  The screw is used as a limit stop for the cover and must not squeeze the cover.
- Fasten cables with **cable tie** at the holder.
  Make sure the cables do not exert force to the cover.

Before connecting the cables to the other components of the DC bus group:

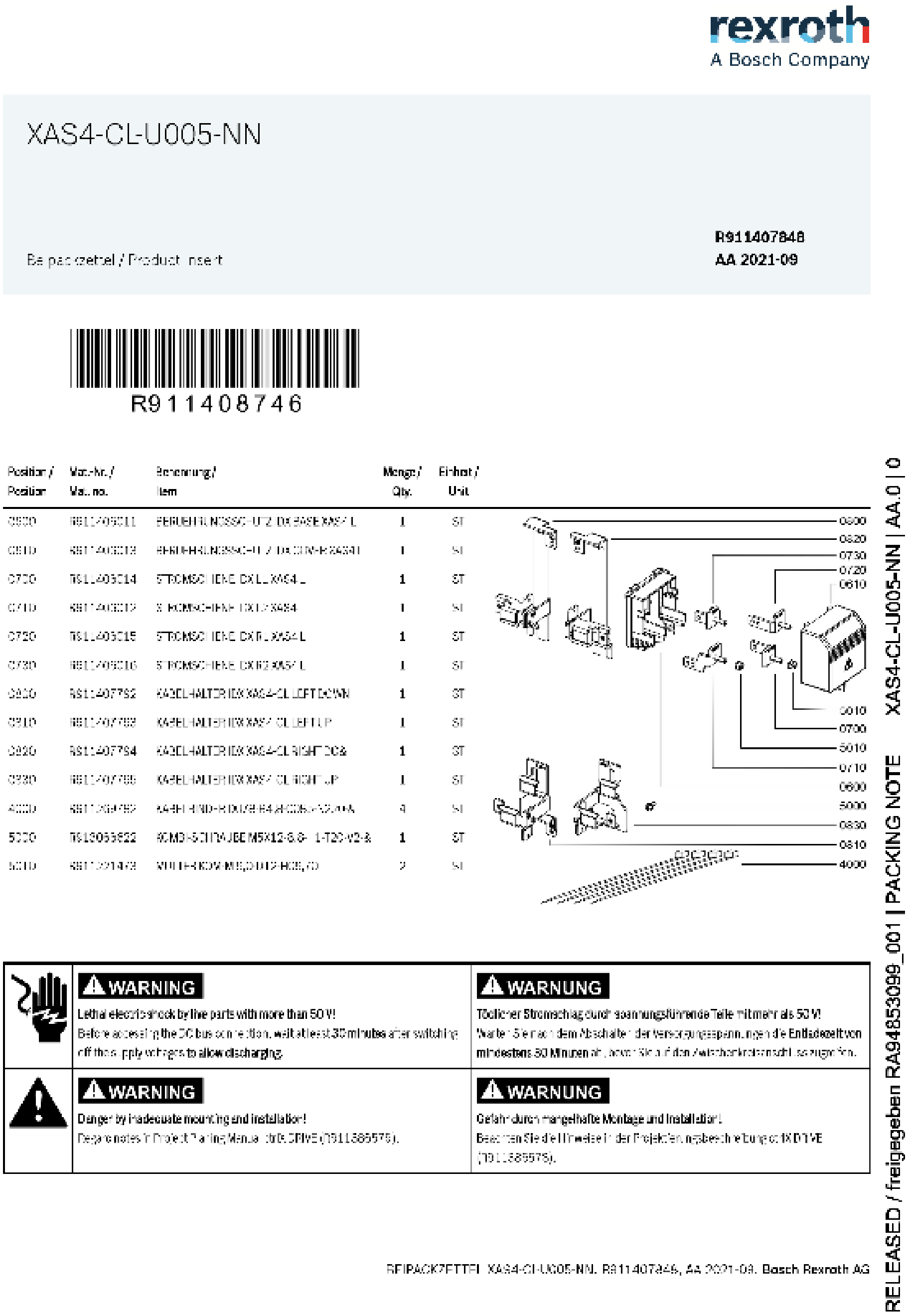
- Mount **strain relief** for cables.
  The accessory must not be mechanically stressed.
- **Twist the cables**
  Allowed length of lay: L ≤ 120 mm



- **Twist the cable pairs**

13.3.5 XAS4-CL-U005-NN, DC bus adapter

Product insert



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XAS4-CL-U005-NN

Beipackzettel / Product insert

R911407848
AA 2021-09

R911408746

Position / Position	Mat.-Nr. / Mat. no.	Benennung / Item	Menge / Qty.	Einheit / Unit
0600	R9114090[illegible]	BERUEHRUNGSSCHUTZ DC BASE XAS4 L	1	ST
0610	R9114090[illegible]	BERUEHRUNGSSCHUTZ DC COVER XAS4 L	1	ST
0700	R911409014	STROMSCHIENE DC L1 XAS4 L	1	ST
0710	R9114090[illegible]	STROMSCHIENE DC L2 XAS4	1	ST
0720	R911409015	STROMSCHIENE DC R1 XAS4 L	1	ST
0730	R9114090[illegible]	STROMSCHIENE DC R2 XAS4 L	1	ST
0800	R911407792	KABELHALTER IDX XAS4-CL LEFT DOWN	1	ST
0810	R9114077[illegible]	KABELHALTER IDX XAS4-CL LEFT UP	1	ST
0820	R911407794	KABELHALTER IDX XAS4-CL RIGHT DO[illegible]	1	ST
0830	R9114077[illegible]	KABELHALTER IDX XAS4-CL RIGHT UP	1	ST
4000	[illegible]	[illegible]	4	ST
5000	[illegible]	KOMBI-SCHRAUBE M5X12-8.8-[illegible]	1	ST
5010	[illegible]	[illegible]	2	ST

	WARNING	WARNUNG
	Lethal electric shock by live parts with more than 50 V! Before accessing the DC bus connection, wait at least 30 minutes after switching off the supply voltages to allow discharging.	Tödlicher Stromschlag durch spannungsführende Teile mit mehr als 50 V! Warten Sie nach dem Abschalten der Versorgungsspannungen die Entladezeit von mindestens 30 Minuten ab, bevor Sie auf den Zwischenkreisanschluss zugreifen.
	Danger by inadequate mounting and installation! Regard notes in Project Planning Manual ctrlX DRIVE (R911385575).	Gefahr durch mangelhafte Montage und Installation! Beachten Sie die Hinweise in der Projektierungsbeschreibung ctrlX DRIVE (R911385575).

BEIPACKZETTEL XAS4-CL-U005-NN, R911407846, AA 2021-09, Bosch Rexroth AG

RELEASED / freigegeben RA94853099_001 | PACKING NOTE XAS4-CL-U005-NN | AA.0 | 0

Fig. 142: Product insert

Dimensions

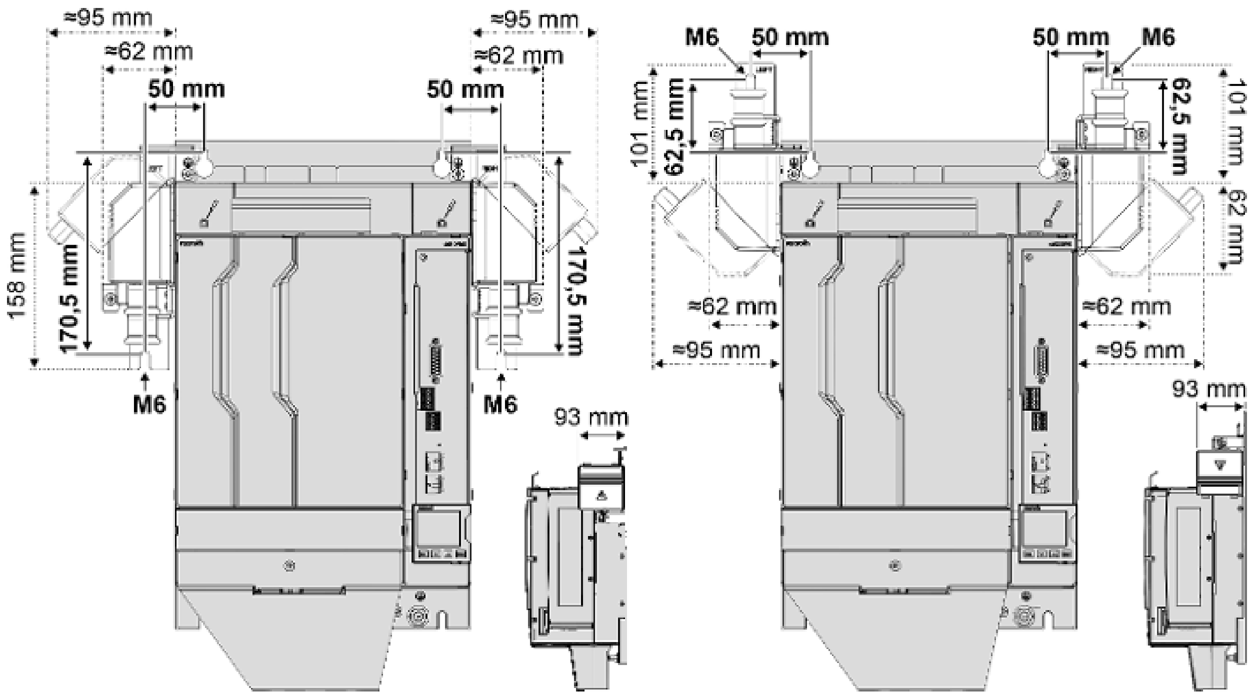


Fig. 143: Dimensions

50 mm, 62.5/170.5 mm: Position of mounting screw (M6) is relative to the position of the mounting screw of the device

Observe the minimum bending radiuses of the cables used. Especially with a cable outlet facing upwards, more mounting clearance might be required.

Mounting

Selecting individual parts

Two conditions have to be considered when selecting individual parts:

- Direction of cable outlet: downwards or upwards
- Position of cable outlet: to the right or left side of the device

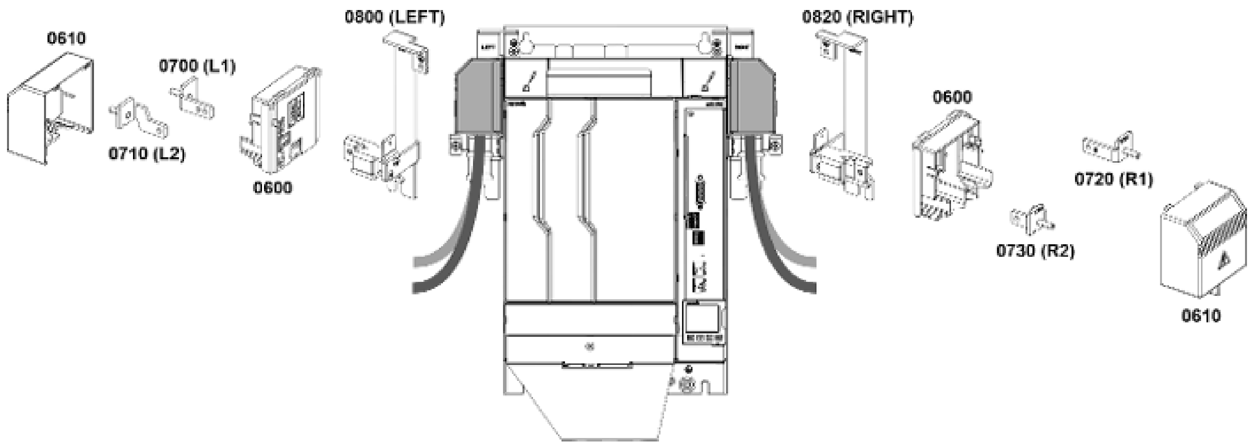


Fig. 144: Cable outlet downwards

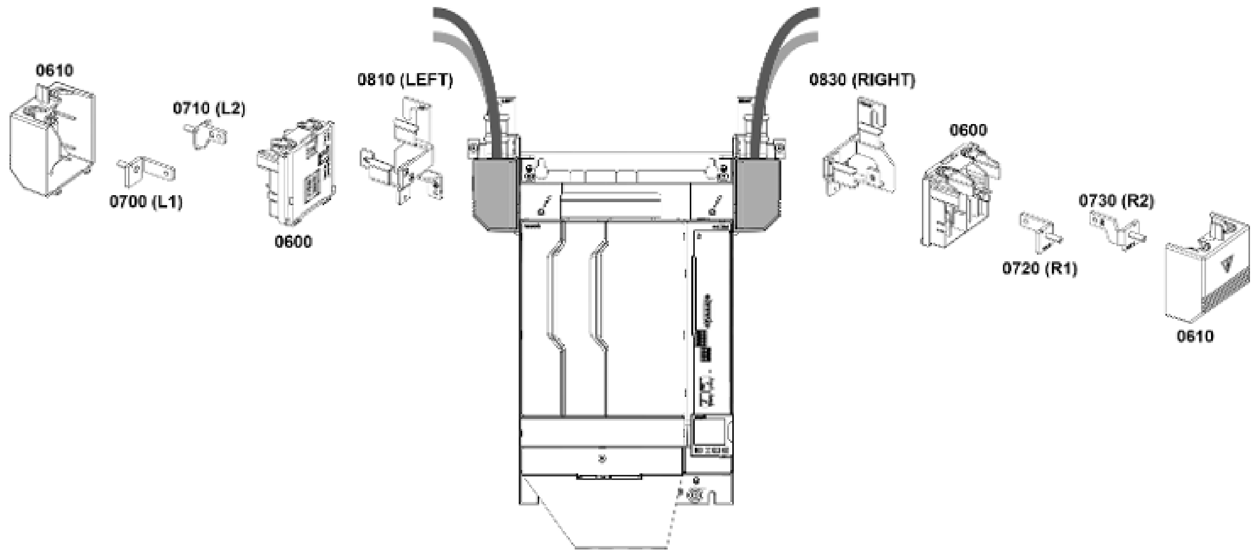
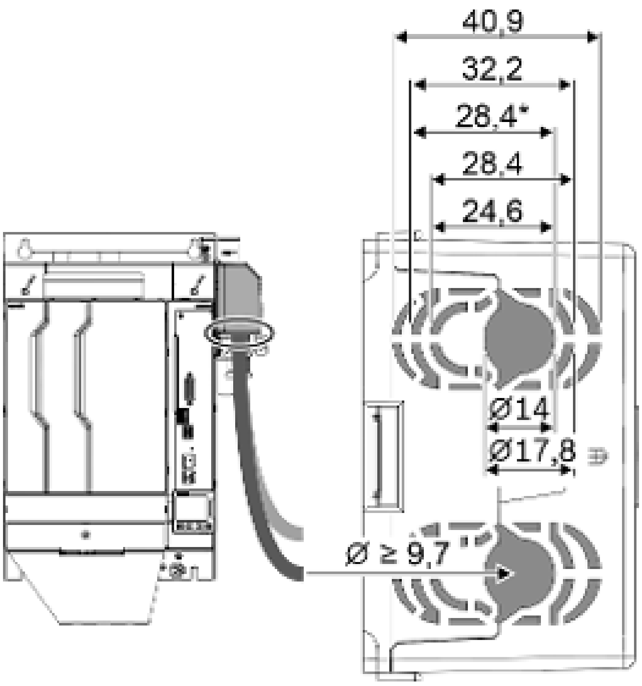


Fig. 145: Cable outlet upwards

Cable

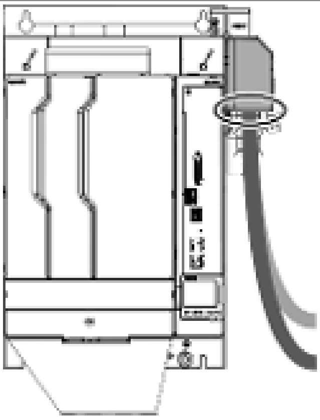
Table 280: Cable

Length	≤ 20 m
Outer diameter	≥ 9.7 mm
Cable feedthrough at touch guard (data in mm): 	Only enlarge cable feedthrough at touch guard if the cable diameter is too big for the existing cable feedthrough. Remove any sharp edges after having enlarged the cable feedthrough. **Cable feedthrough ↔ cable:** ● **Ø14.0 mm ≈** 1 × 35 mm² Outer diameter of cable: ≥ 9.7 mm ● **Ø17.8 mm ≈** – 1 × 50 mm² Outer diameter: ≥ 1 × 11.5 mm – 1 × 70 mm² Outer diameter: ≥ 1 × 13.5 mm ● **24.6 mm ≈** – 2 × 35 mm² Outer diameter of cables: ≥ 2 × 9.7 mm – 2 × 50 mm² Outer diameter of cables: ≥ 2 × 11.5 mm ● **28.4 mm ≈** – 2 × 50 mm² Outer diameter of cables: ≥ 2 × 11.5 mm – 2 × 70 mm² Outer diameter of cables: ≥ 2 × 13.5 mm ● **28.4* mm ≈** – 2 × 70 mm² Outer diameter of cables: ≥ 2 × 13.5 mm ● **32.2 mm ≈**

	2 × 70 mm² Outer diameter of cables: ≥ 2 × 13.5 mm

Mounting accessories

Example: Cable outlet facing downwards and to the right side of the device

<table>
<tr>
<td></td>
<td>Parts list:

Parts of the XAS4 accessory:

Touch guard (0600; 1×)
Touch guard cover (0610; 1×)
Contact bar R1 (0720; 1×)
Contact bar R2 (0730; 1×)
Cable support RIGHT DOWN (0820; 1×)
Nut M6 (5010; 2×)
Screw M5 (5000; 1×)
Cable tie (4000; 4×)

Parts to be provided by you:

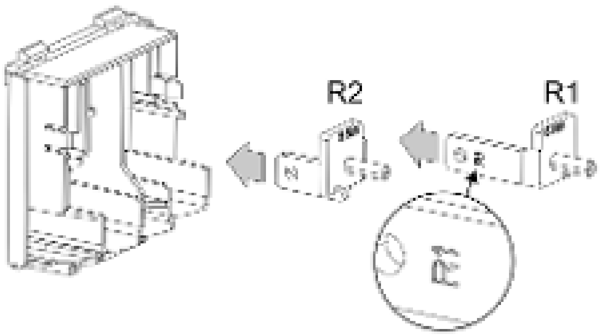
Cable (with ring cable lug M6; insulated with heat shrink sleeve; 2× or 4×)
Screw M6 (for mounting the accessory in the control cabinet; 1×)

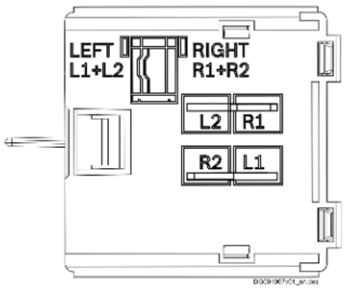
Parts that should already be available:

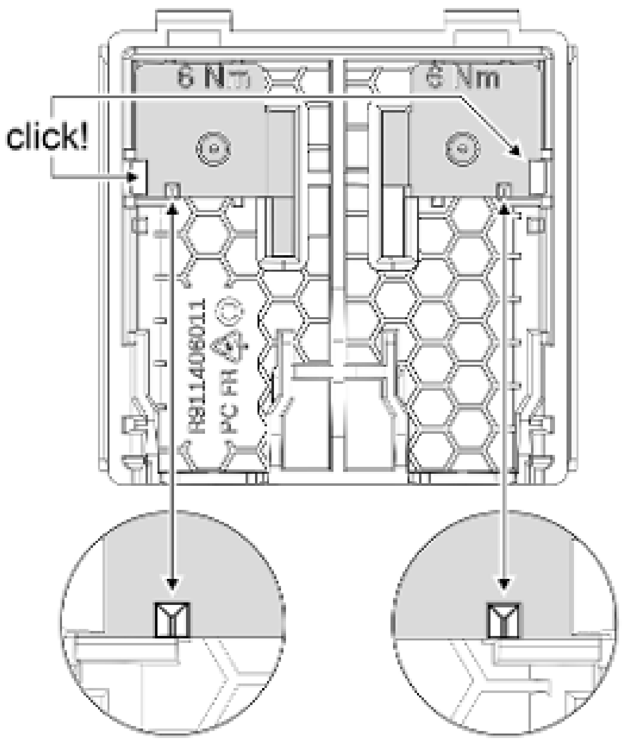
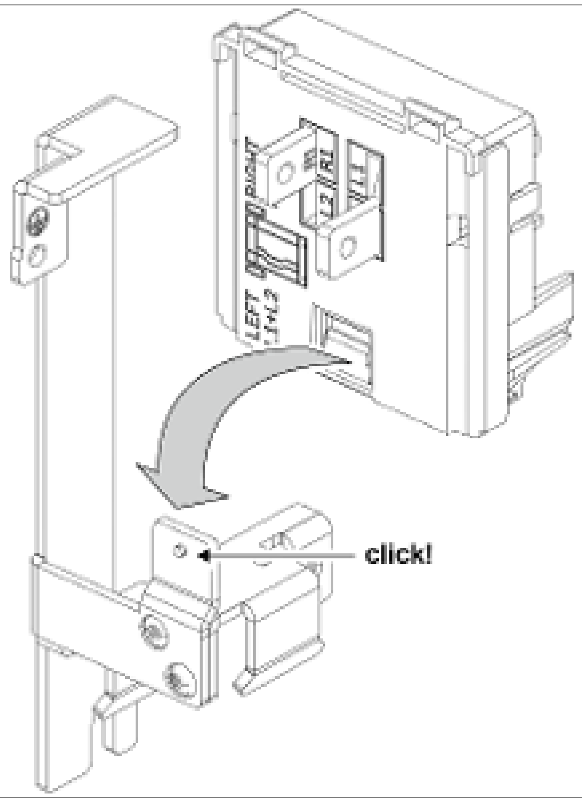
Screw M5 (3×; two screws for the DC bus connection; one screw for the equipment grounding connection; these screws are already available at the device upon delivery)

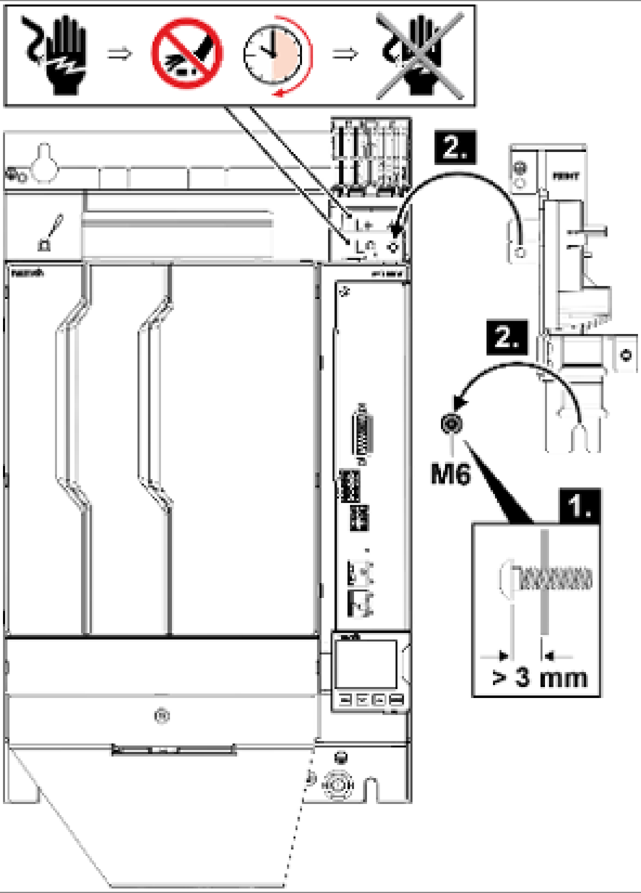
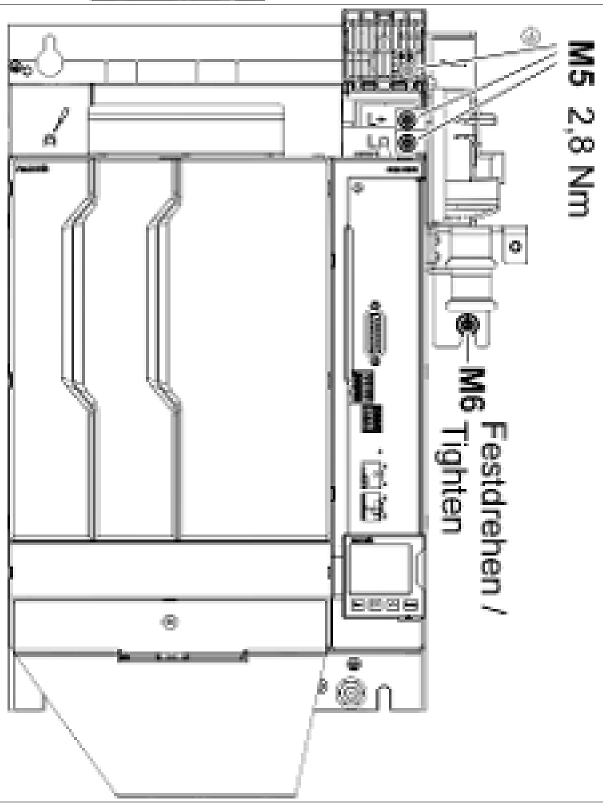
</td>
</tr>
</table>

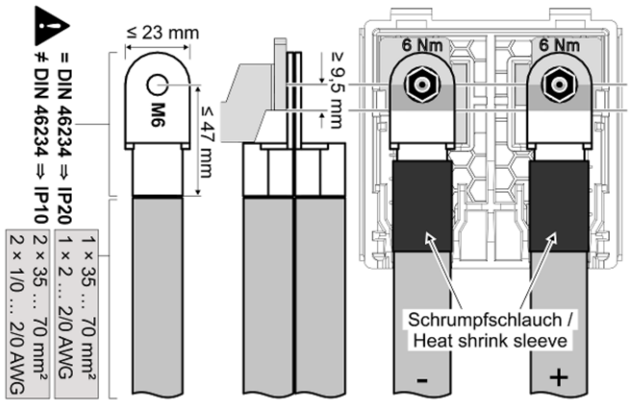
Table 281: Mounting the parts

<table>
<tr>
<td>
</td>
<td>Insert contact bars.

The assignment of the contact bars is pictured on the back side of the touch guard:

</td>
</tr>
</table>

	Put contact bars in position and click engagement hooks into place.
	Push touch guard onto holder and click it into place.

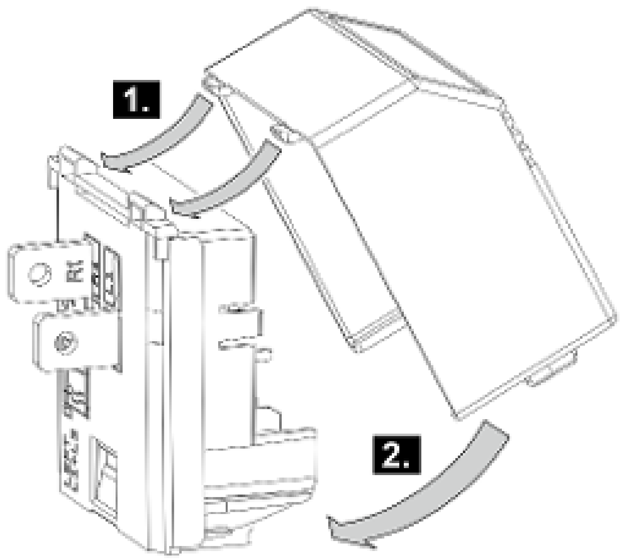
	**⚠ WARNUNG** **Lethal electric shock from live parts with more than 50 V!** Before accessing the DC bus connection, wait at least **30 minutes after switching off the supply voltages to allow discharging.** Mount the accessory as near as possible to the device. ● **M6:** Preassemble screw to mounting plate. ● Open touch guard flap of the DC bus connection at the device and put accessory in position.
	**M5:** Tighten screws with 2.8 Nm. **M6:** Tighten screw at mounting plate.

<table>
<tr>
<td>
</td>
<td>Ring cable lug:

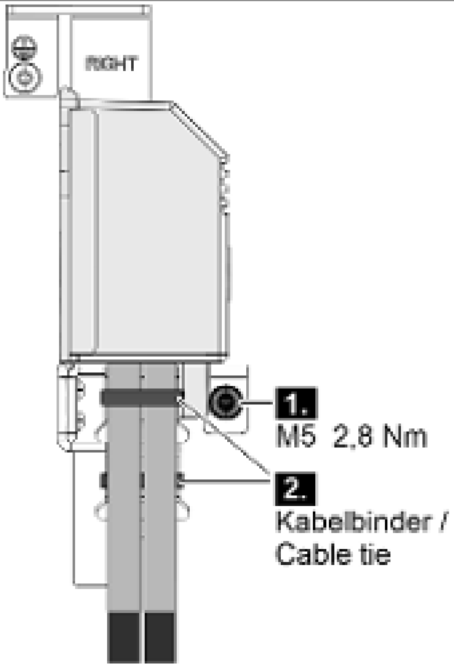
M6:
= DIN 46234 ⇒ IP20
≠ DIN 46234 ⇒ IP10
Width: ≤ 23 mm
Length: ≤ 47 mm
If 2 ring cable lugs are used per contact bar:
See picture: The lower ring cable lug must have even contact with the contact bar, at least for the specified area (≥ 9.5 mm).
Tightening torque: 6 Nm

Connecting the cables

Make sure the heat shrink sleeve overlaps sufficiently with the cable jacket so that finger protection IP20 is achieved.
Strip the insulation of the contact surfaces of the ring cable lug.
Put cable onto the contact bar and tighten nut with 6 Nm.

Do not yet use cable ties. Only use cable ties after mounting the cover.
Recommendation: Mark the assigned polarity with "+" and "-" on each cable.</td>
</tr>
<tr>
<td>
</td>
<td>Mounting the cover

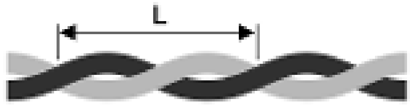
Put cover into the eyelets.
Carefully move the cover into place.
When moving cover into place make sure not to damage the engagement hooks of the contact bars.
</td>
</tr>
</table>



- Put **screw (M5)** into holder and tighten it with 2.8 Nm.
  The screw is used as a limit stop for the cover and must not squeeze the cover.
- Fasten cables with **cable tie** at the holder.
  Make sure the cables do not exert force to the cover.

Before connecting the cables to the other components of the DC bus group:

- Mount **strain relief** for cables.
  The accessory must not be mechanically stressed.
- **Twist the cables**
  Allowed length of lay: L ≤ 120 mm



- **Twist the cable pairs**

13.4 XAS6, touch guard

13.4.1 Type code

Table 282: XAS6, type code

Short type designation	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	X	A	S	6	-	F	0	A	-	N	N																													
	①					②				③																														
①	**Product:** XAS6 = ctrlX DRIVE accessories, touch guard																																							
②	**Device assignment:** F0A = XNF1-xx-xxxxx-E0140; XNF1-xx-xxxxx-E0180																																							
③	**Other design:** NN = None																																							

13.4.2 XAS6-F0A-NN

The accessory increases the degree of protection of the assigned device from IP00 to IP20.

rexroth
A Bosch Company

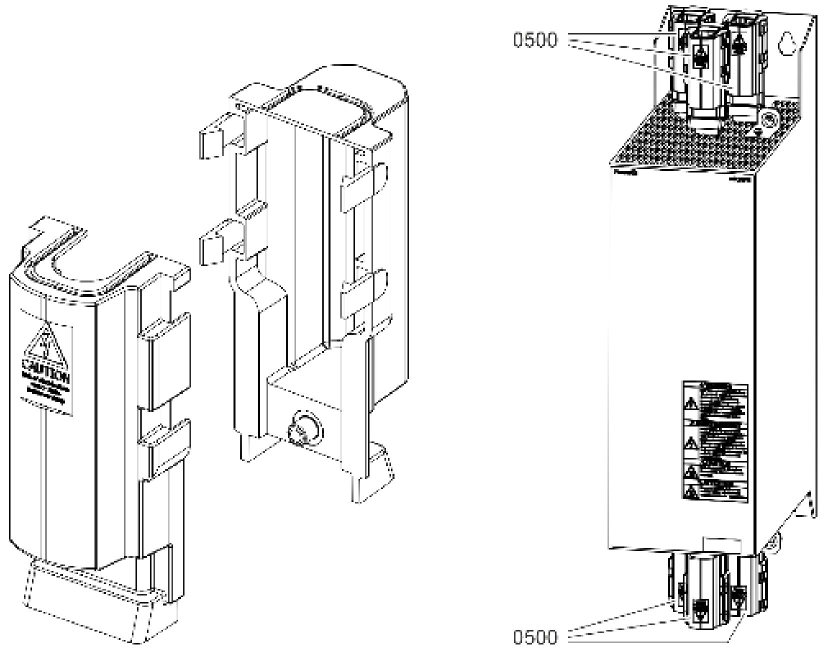
XAS6-F0A-NN

Beipackzettel

R911402623
AB 2022-10

R911402610

Position	Mat.-Nr.	Benennung	Menge	Einheit
0500	R913077313	PROTECTIVE COVER 03 20x5	6	ST



BEIPACKZETTEL XAS6-F0A-NN, R911402623 , AB 2022-10, Bosch Rexroth AG

Fig. 146: XAS6-F0A-NN

14 Additional components

14.1 XNF mains filter

14.1.1 Type code

Table 283: XNF1, type code

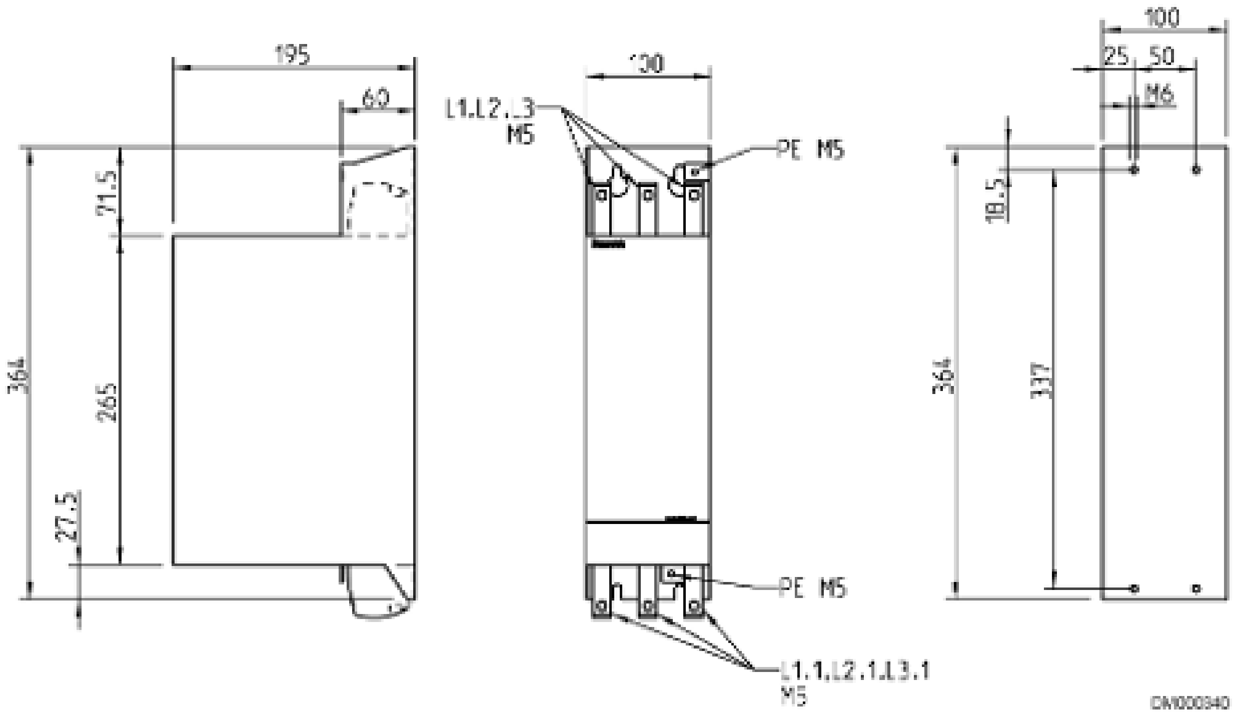
										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	N	F	1	-	1	A	-	0	1	0	0	N	-	E	0	0	8	0	-	A	-	A	4	-	N	N	N	N	-	N	N								
	①					②	③		④						⑤	⑥					⑦		⑧			⑨					⑩									

①	**Product:** XNF1 = Mains filter
②	**Design:** 1 = 1
③	**EMC area:** A = Category C3 in accordance with DIN EN 61800-3 C = Category C2 in accordance with DIN EN 61800-3
④	**Leakage capacitance:** 0100N = 100 nF (example)
⑤	**Supply system:** E = For XCS/XCD and XVE
⑥	**Rated current:** 0080 = 80 A 0140 = 140 A 0185 = 185 A
⑦	**Degree of protection:** A = IP20 1) N = IP00 2)
⑧	**Input voltage:** A4 = 3 × AC 200 ... 480 V, +10% -15%V
⑨	**Other option:** NNNN = None
⑩	**Other design:** NNNN = None
	1) ⑥ = 0080 2) ⑥ = 0140, 0185

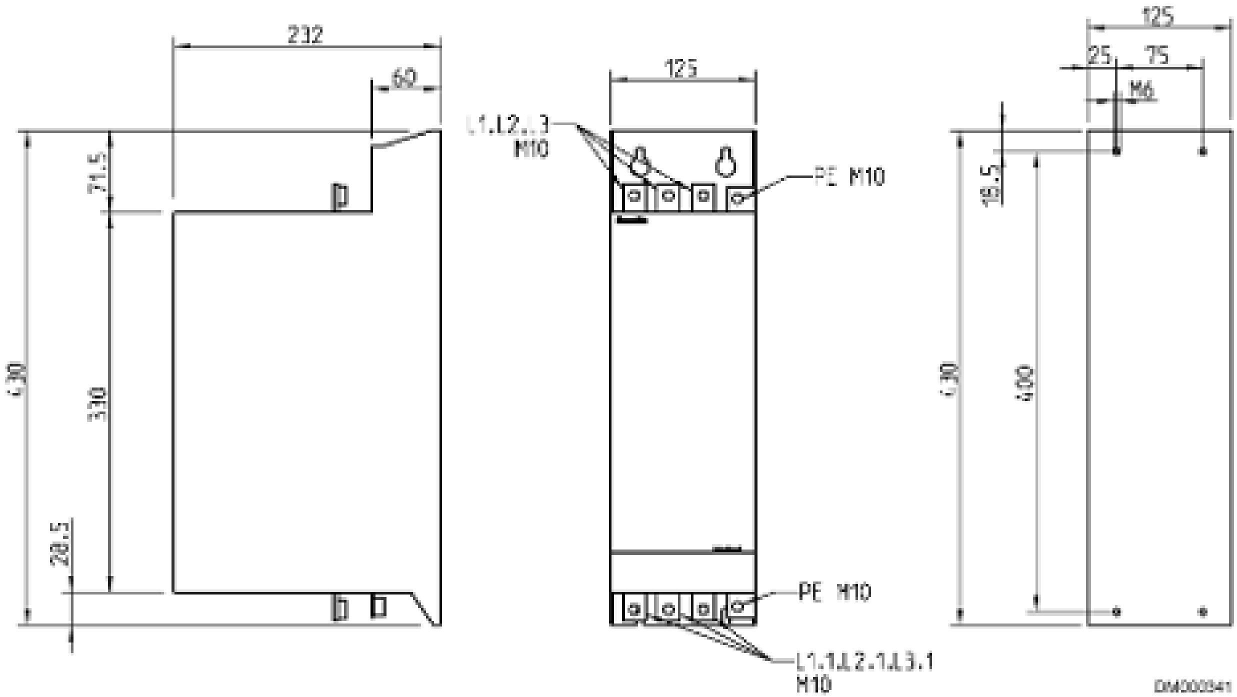
14.1.2 Mechanical data XNF

Dimensions

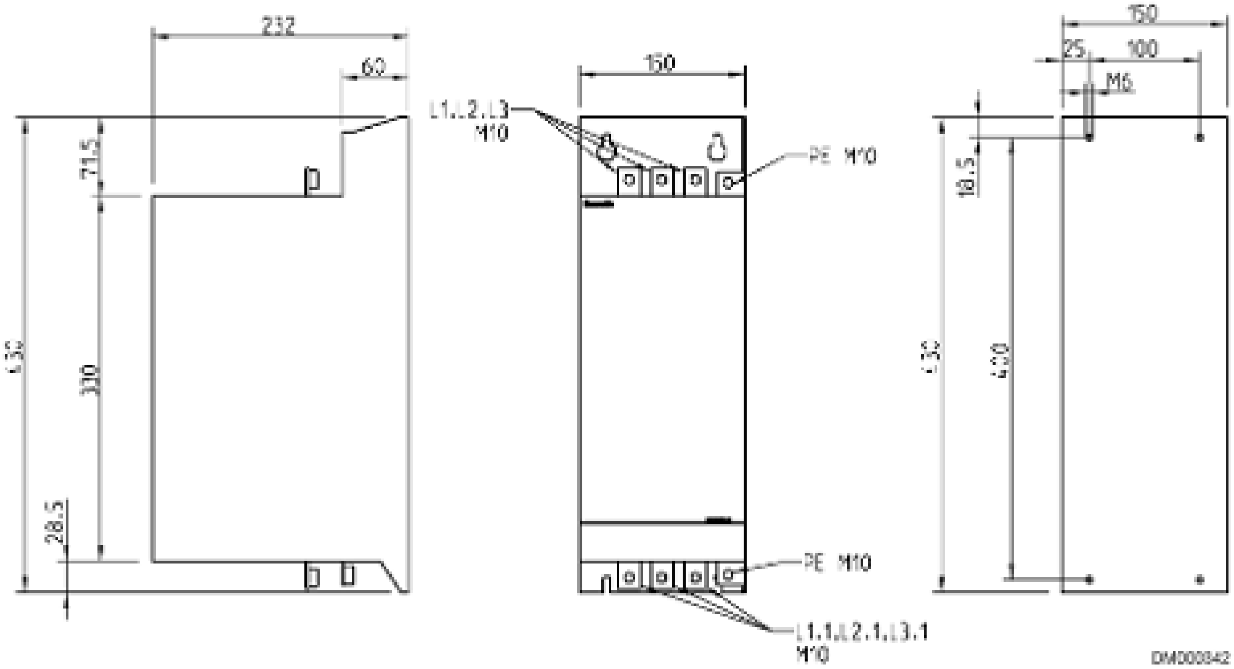
XNF1-1*-0100N-E0080, dimensions



XNF1-1*-0150N-E0140, dimensions



XNF1-1*-0240N-E0185, dimensions



Connection

Table 284: Connection points

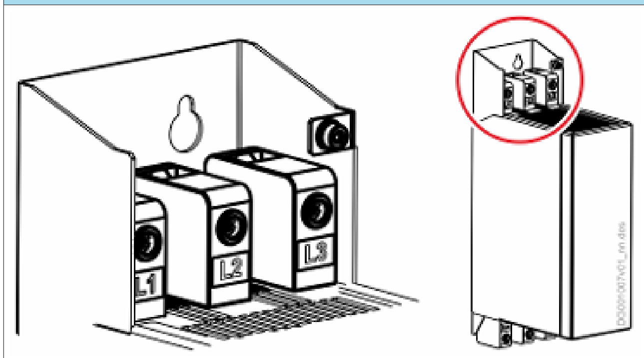
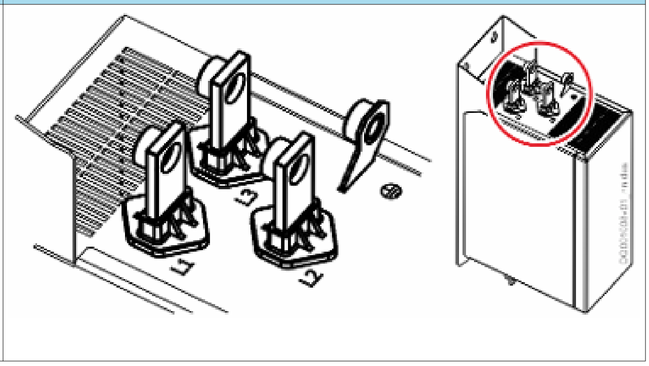
XNF1-1*-0100N-E0080	XNF1-1*-0150N-E0140 XNF1-1*-0240N-E0185
	

Table 285: XNF, connection

Mains filter	L1, L2, L3 L1.1, L2.1, L3.1			PE	
	[mm²]	[AWG]	[Nm]	Thread	[Nm]
XNF1-1*-0100N-E0080	Flexible: 6 ... 25 Rigid: 6 ... 35	Flexible: 10 ... 2	4.0 ... 4.5	M5	2.0 ... 2.2
XNF1-1*-0150N-E0140 XNF1-1*-0240N-E0185	Thread: M10		15 ... 17	M10	15 ... 17

14.1.3 Electrical data XNF

With the XNF1-1C mains filter, the drive system complies with the EMC category C2 according to EN61800-3.

For **line-based** noise emission the allowed category C2 limit values are as follows:

Table 286: Limit values for category C2

Frequency range [MHz]	Limit value [dBµV]
0.15 ... 0.5	79
0.5 – 30	73

With the **XNF1-1A** mains filter, the drive system complies with the EMC category **C3** according to EN61800-3.

For **line-based** noise emission the allowed category C3 limit values are as follows:

Table 287: Limit values for category C3

Size	Frequency range [MHz]	Limit value [dB (µV)]
I ≤ 100 A	0.15 ≤ f < 0.5	100[1]
	0.5 ≤ f ≤ 5	86[1]
	5 < f < 30	90[1]
I > 100 A	0.15 ≤ f < 0.5	130
	0.5 ≤ f < 5	125
	5 ≤ f < 30	115
1) Decreasing with the logarithm of the frequency to 73		

- Complying with limit values of radiated noise emission depends on the EMC-compliant control cabinet design, as well as on the arrangement, grounding and installation of the components.
- As a standard, the ctrlX DRIVE drive system complies with the category C3 according to EN 61800-3 (considering the EMC measures defined in the Project Planning Manual).
- The category C2 (radiated) according to EN 61800-3 can be complied with by the appropriate drive-external additional measures (e.g., additionally filtering all connected lines, additionally shielding the housing or the control cabinet, additional grounding, ...).

Table 288: Technical data - currents, voltages, power

Designation	Symbol	Unit	XNF1-1*-0100N-E0080	XNF1-1*-0150N-E0140	XNF1-1*-0240N-E0185
Degree of protection according to IEC60529	---		IP20	IP00	
Listing according to UL standard			UL1283		UL 60939-3
Listing according to CSA standard			C22.2 No. 8		
Mass	m	kg	XNF1-1A: 5.4 XNF1-1C: 6.4	XNF1-1A: 9.3 XNF1-1C: 12	XNF1-1A: 12 XNF1-1C: 16.5
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 480		
Mains voltage, three-phase at Corner-grounded-Delta mains [1]	U_{LN}	V	Not allowed		

Designation	Symbol	Unit	XNF1-1*-0100N-E0080	XNF1-1*-0150N-E0140	XNF1-1*-0240N-E0185
Mains voltage, three-phase at IT mains	U_{LN}	V	Not allowed		
Tolerance U_{LN}		%	-15 / +10	±10	
Mains frequency	f_{LN}	Hz	50 ... 60		
Tolerance input frequency		Hz	±2		
Rated input current	I_{LN}	A	80	140	185
Maximum allowed peak current (without XNL mains choke)	$I_{L\_max\_wo}$	A	120	250	370
Maximum allowed peak current (with XNL mains choke)	$I_{L\_max\_w}$	A	XNF1-1A: 120 XNF1-1C: 160	280	370
Power dissipation at continuous current and continuous DC bus power respectively	P_{Diss_cont}	W	XNF1-1A: 43 XNF1-1C: 64	XNF1-1A: 45 XNF1-1C: 67	XNF1-1A: 65 XNF1-1C: 95
Insulation resistance at DC 500 V	R_{is}	MΩ	1.7 2)		
Required wire size in accordance with NFPA79 and UL 508A (internal wiring) 1)	A_{LN}	AWG	3	2/0	250 kcmil
Allowed leakage capacitance at 500 V and 4 kHz chopper frequency **with** mains choke	C_{ab}	nF	100	150	240
Allowed leakage capacitance at 500 V and 4 kHz chopper frequency **without** mains choke	C_{ab}	nF	100	150	240
Maximum allowed Y-capacitance	C_Y	nF	2 × 2550		

1) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; Ta ≤ 40 °C

2) Due to discharging resistors

14.1.4 Other mains filters

Other mains filters:

See documentation "Rexroth IndraDrive, Additional Components and Accessories, Project Planning Manual, ➦R911306140".

14.2 XNL mains choke

14.2.1 Type code

Table 289: XNL1, type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	N	L	1	-	1	E	-	0	3	6	2	-	N	0	0	8	0	-	B	-	5	0	0	-	N	N	N	N	-	N	N								
	①					②	③		④					⑤	⑥					⑦		⑧				⑨					⑩									

①	**Product:** XNL1 = power choke
②	**Design:** 1 = 1
③	**Supply system:** E = Feeding
④	**Nominal inductance:** 0362 = 362 µH (example)
⑤	**Additional option:** N = none
⑥	**Rated current:** 0080 = 80 A 0146 = 146 A 0185 = 185 A
⑦	**Degree of protection:** B = IP10
⑧	**Mains supply voltage:** 500 = 3 × AC 520 V
⑨	**Other option:** NNNN = none
⑩	**Other design:** NN = None

14.2.2 Type plate

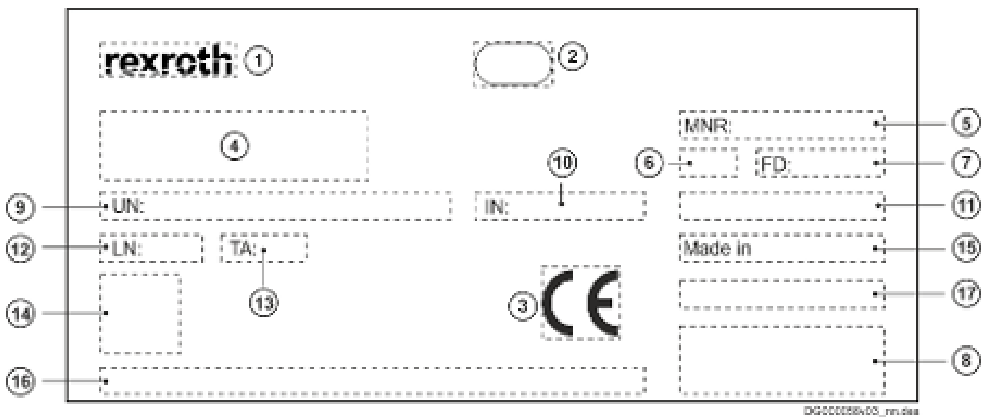


Fig. 147: Type plate

1 Word mark
2 Area/factory number
3 CE label

4 Type designation (two lines, 20 characters each)
5 Material number
6 Change status
7 Manufacturing date (YYWww)
8 Certification mark
9 Rated input voltage / frequency
10 Rated current
11 Product number
12 Nominal inductance:
13 Temperature
14 2D bar code
15 Designation of origin
16 Serial number
17 Manufacturer

14.2.3 Mechanical data XNL

Allowed mounting positions

Each mounting position is allowed.

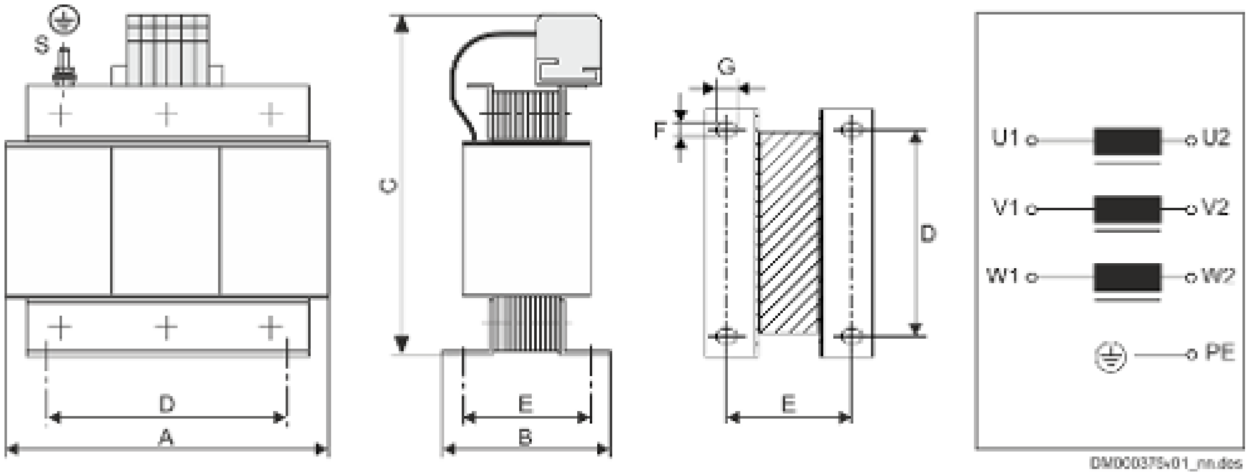


Fig. 148: Dimensions

Table 290: Dimensions, weight

Mains choke	Dimensions [mm]								Weight [kg]
	A	B	C	D	E	F	G	S	
XNL1-1E-0362-N0080-B-500	210	142	250	175	106	11	18	M6	12.2
XNL1-1E-0170-N0146-B-500	250	134	341	215	120	11	15	M8	20
XNL1-1E-0135-N0185-B-500	270	163	310	240	135	11	18	M8	19.5

Table 291: Connection cross section, tightening torque

Mains choke	Maximum connection cross section [mm²]	Tightening torque [Nm]
XNL1-1E-0362-N0080-B-500	35	Please refer to the information printed on the component.
XNL1-1E-0170-N0146-B-500	95	
XNL1-1E-0135-N0185-B-500	120	

14.2.4 Electrical data XNL

Table 292: Electrical data

Mains choke	U_N [V]	I_N [A]	L_N [µH]	P_V [W]	I_{max} [A]	L_{min} at I_{max}	IP
XNL1-1E-0362-N0080-B-500	520	80	362	< 210	160	50% of L_N	IP10
XNL1-1E-0170-N0146-B-500	520	146	170	< 325	292		
XNL1-1E-0135-N0185-B-500	520	185	135	< 460	370		

14.3 HLR01 braking resistor

HLR01.1N-xxxx-Nxxx-A-007-NNNN braking resistors convert generated kinetic energy into thermal energy.

⚠ CAUTION	**Connection cables** Size the electric strength of the connection cables according to the switch-on threshold of the braking resistor.

Table 293: DC bus resistor units HLR

Type	Use
HLR01.1N	Type of construction N (version for free assembly): Braking resistors for free assembly

Types of design:

- Fixed resistor IP 20 **type A**
  Cement-coated, wire-wound, tube-type fixed resistors; screwed on side walls; perforated cover; connections in terminal box with PG glands
- Steel-grid fixed resistor IP 20 **type B**
  Fixed resistor in steel-grid design; connection depending on type

Basically, all HLR01.1 types can be used that comply with the requirements on the minimum resistance, the continuous power and peak power, as well as the regenerative power to be absorbed (see technical data of the component (chapter "External braking resistor/integrated braking transistor").

Selecting an HLR01 braking resistor:

HLR01.1N-XXXX-NYYY-A-007-NNNN

- XXXX continous power (e.g. 07K0 = 7 kW)
- YYY resistance value (e.g. 14R0 = 14 ohm)

See documentation "Rexroth IndraDrive, Additional Components and Accessories, Project Planning Manual, R911306140" for selecting an HLR01 braking resistor.

14.4 XLI mains connection module

14.4.1 Components

The mains connection module is used to operate regenerative supply units and contains the following components:

- Mains filter
- Mains choke
- Mains contactor
- Electronics

The mains connection module communicates with the supply unit via the XLI bus.

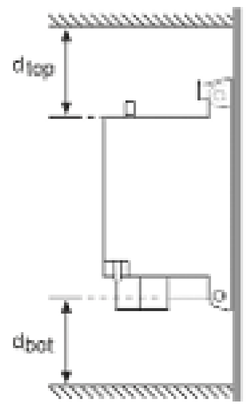
14.4.2 Type code

Table 294: XLI1, type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	L	I	1	-	1	R	-	W	0	0	4	8	N	-	A	-	F	A	1	1	0	0	N	-	N	N	N	N	-	N	N								
		①				③	②		④					⑥		⑦		⑧	⑨			⑩					⑪				⑫									

①	**Product:** XLI1 = Mains connection module (X: ctrlX DRIVE; L: Line; I: Interface; 1: 1st generation)
②	**Design:** 1 = 1
③	**Supply system:** R = Regenerative
④	**Cooling type:** W = Internal air cooling
⑤	**Rated power:** 0019 = 19 kW 0048 = 48 kW 0072 = 72 kW 0100 = 100 kW
⑥	**Additional option:** N = None
⑦	**Degree of protection, input voltage:** A = IP20; 3 × AC 380 ... 480 V
⑧	**Characteristics:** F = Integrated mains filter
⑨	**EMC area:** A = Cat. C3 according to DIN EN 61800-3
⑩	**Maximum leakage capacitance:** 1100N = 1100 nF
⑪	**Other option:** NNNN = None
⑫	**Other design:** NN = None

14.4.3 Dimensions

Observe minimum upwards and downwards distances! In the control cabinet, the space below the air intake (d_{bot}) and above the air outlet (d_{top}) has to be clear: d_{bot}, d_{top}: 80 mm	 Example: XLI1-1R-W0048/72/100

XLI1-1R-W0019

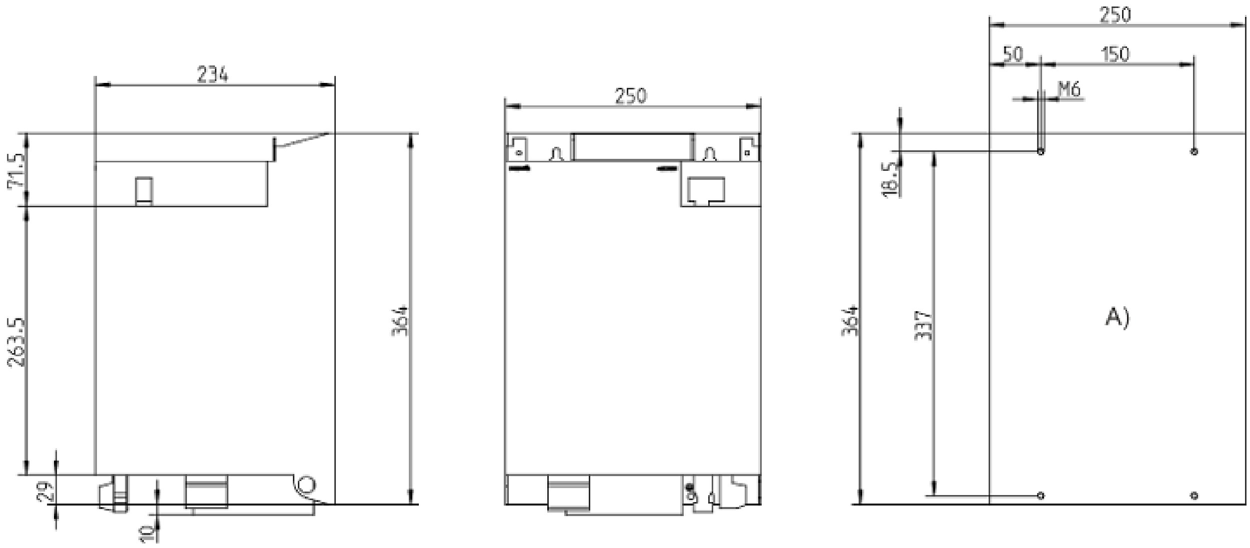


Fig. 149: XLI1-1R-W0019 dimensions
A) Drilling pattern

XLI1-1R-W0048

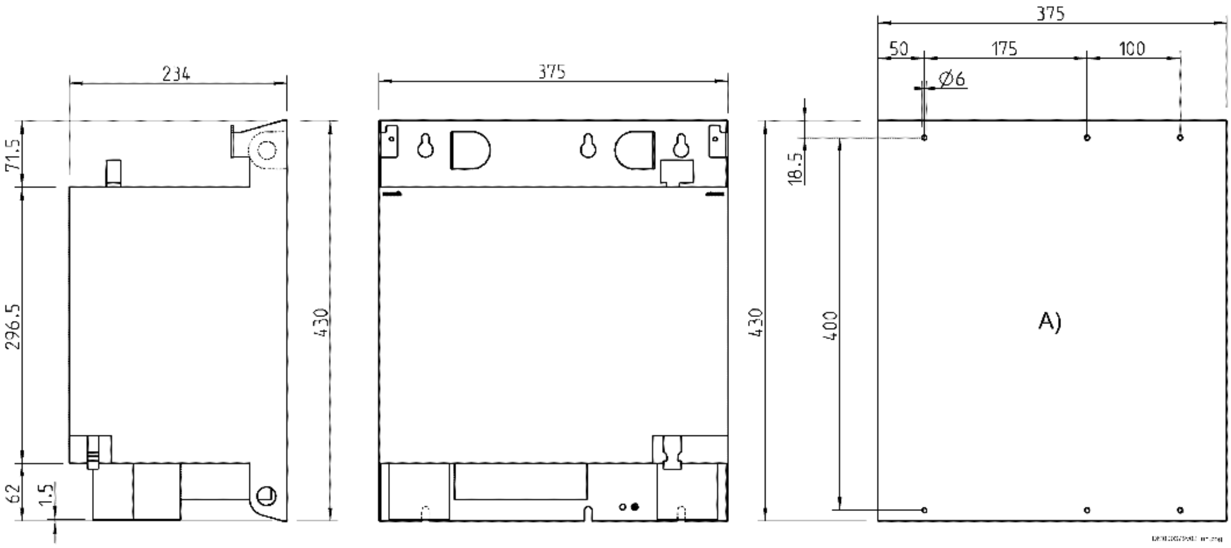


Fig. 150: XLI1-1R-W0048 dimensions
A) Drilling pattern

XLI1-1R-W0072

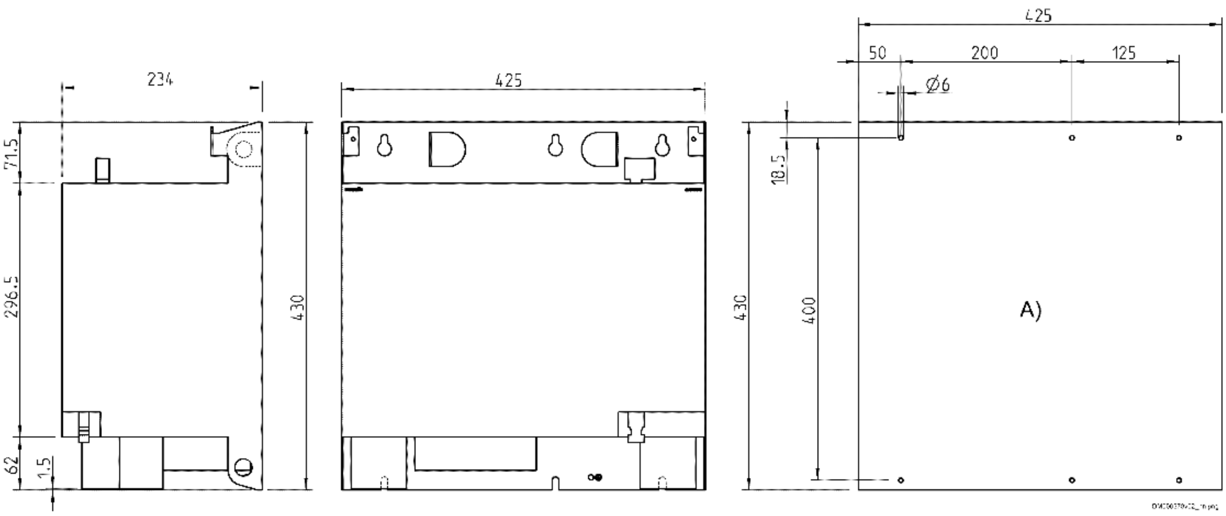


Fig. 151: XLI1-1R-W0072 dimensions
A) Drilling pattern

XLI1-1R-W0100

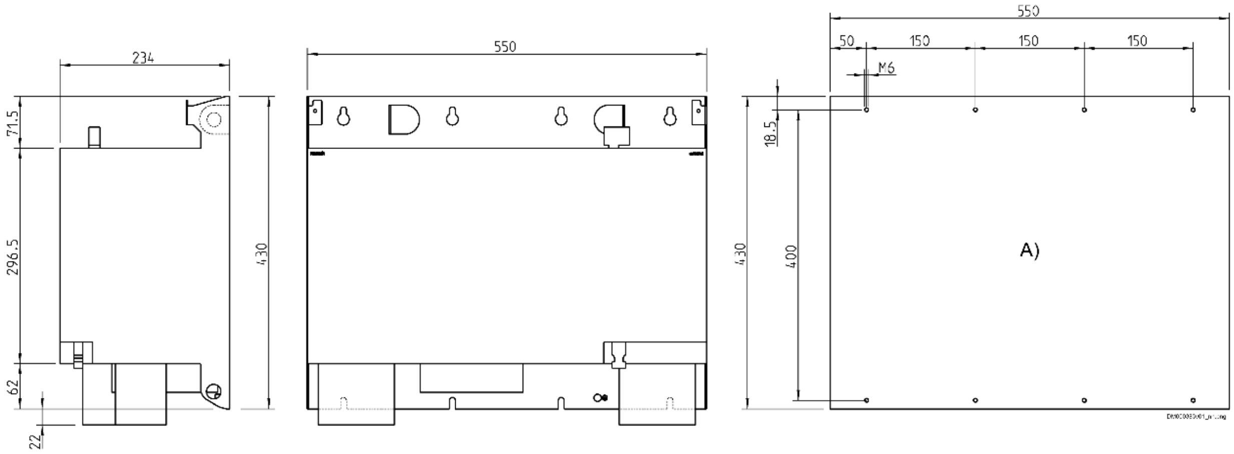


Fig. 152: XLI1-1R-W0100 dimensions
A) Drilling pattern

14.4.4 Mounting

Single-line mounting

Arranging the devices: XLI to the left, XVR to the right

The supplied cable (RG2-500AAB) has been designed for this arrangement.

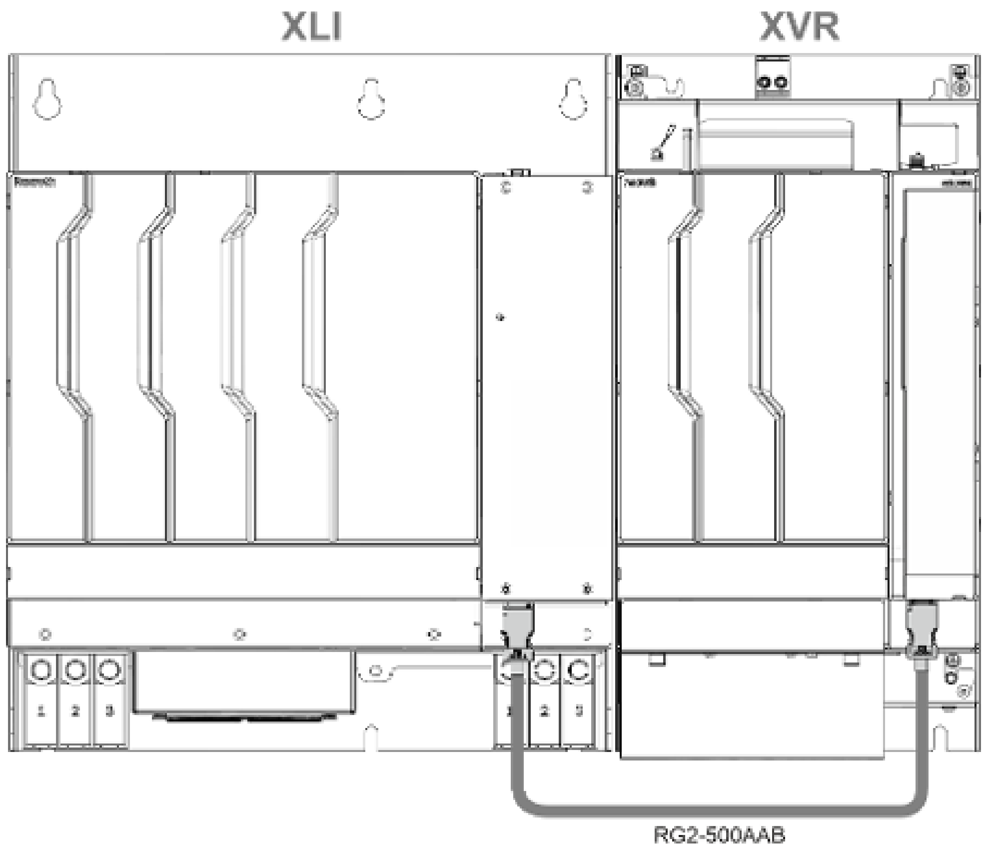


Fig. 153: Single-line arrangement of devices

Double-line mounting

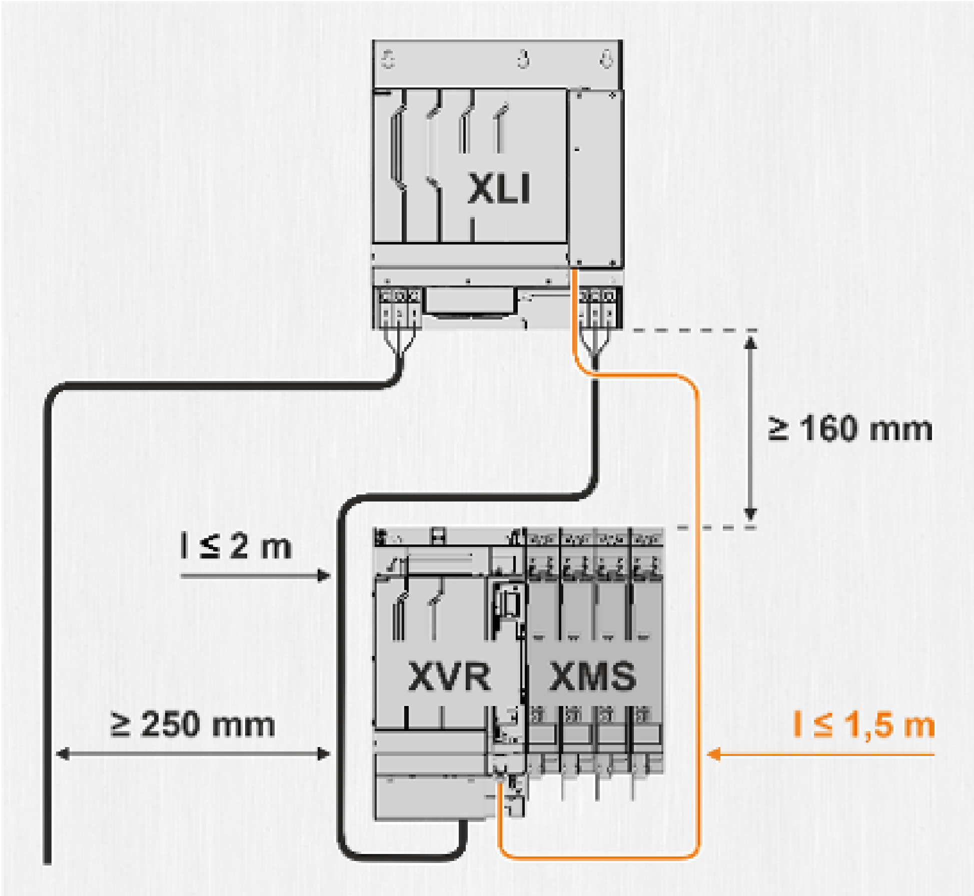


Fig. 154: Double-line arrangement of devices

Requirements:

- Cable lengths
  - Mains XLI-XVR: ≤ 2 m
  - XLI bus (RG2-500AAB-NN): ≤ 1.5 m
- Distance and routing between mains supply line and XLI/XVR line
  - Distance with parallel line routing between mains supply line and XLI/XVR line ≥ 250 mm
  - No parallel routing of XLI bus and mains XLI-XVR
- Distance between XLI and XVR: ≥ 160 mm
- XLI and XVR/XMS mounted on a joint conductive mounting plate

14.4.5 Lifting eyes

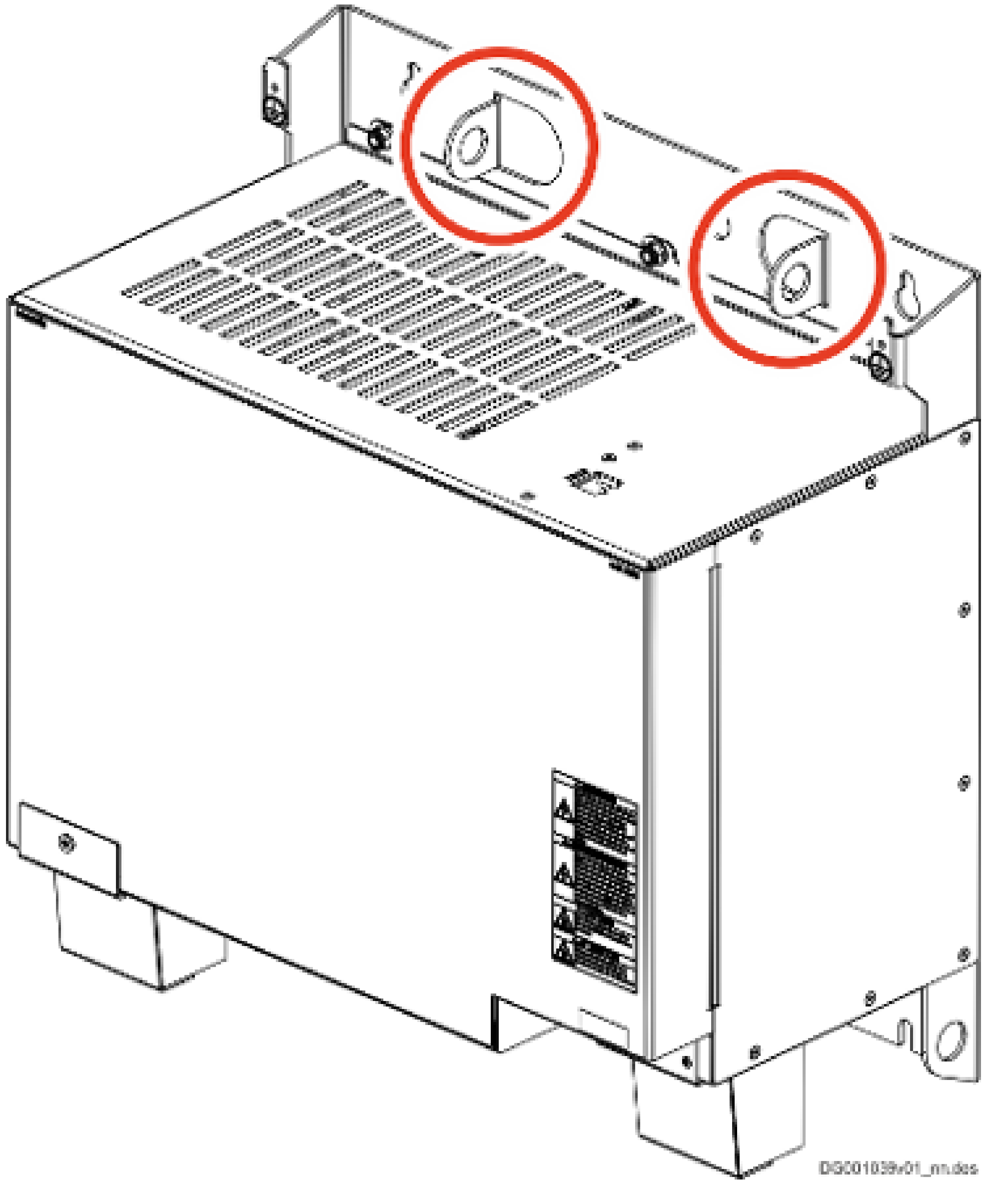


Fig. 155: Lifting eyes

14.4.6 Technical data XLI

Using mains filters in mains grounded via outer conductor

When using mains filters in **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Table 295: Technical data

Description	Symbol	Unit	XLI1-1R-W0019	XLI1-1R-W0048	XLI1-1R-W0072	XLI1-1R-W0100
Degree of protection according to IEC 60529	IP		IP20			
Listing according to UL standard			tbd	UL 508		
Listing according to CSA standard			tbd	C22.2 No. 14-M91		
Mass	m	kg	25	40	57	80
Allowed mounting position			G1			
Average sound pressure level (accuracy class 2) at P_{DC_cont} 5)	L_P	db (A)	< 80			
Mains voltage, three-phase at TN-S, TN-C, TT mains	U_{LN}	V	3 × AC 380 ... 480			
Mains voltage, three-phase at Corner-grounded-Delta mains1)	U_{LN}	V	Not allowed			
Mains voltage, three-phase at IT mains2)	U_{LN}	V	Not allowed			
Tolerance U_{LN}		%	±10			
Mains frequency	f_{LN}	Hz	50 ... 60			
Tolerance input frequency		Hz	±2			
Rated current	I_{LN}	A	30.7	76	109	150
Maximum allowed peak current	I_{L_max}	A	92	190	272	375
Maximum power dissipation at continuous current and continuous DC bus power respectively	P_{Diss_cont}	W	360	530	580	1250
Inductance of the integrated choke	L_N	µH	1760	749	509	360
Insulation resistance4)	R_{is}	Mohm	1.3			
Required wire size in accordance with UL 508 A3)	A_{LN}	AWG	8	3	1/0	3/0
Maximum allowed capacitance from DC bus against ground	C_{Y_limit}	nF	2 × 4100			
Maximum allowed leakage capacitance at 4 KHz switching frequency of the drives	C_{leak_limit}	nF	1100			
Control voltage input	U_{N3}	V	24 ±20%			
Rated power consumption control voltage input at U_{N3}	P_{N3}	W	28.8 ±20%			
Current pulse when switching on the internal mains contactor	I_{N3_pulse}	A	6 (60 ms)			

1) 2) Mains voltage > U_{LN}: Use a transformer with grounded neutral point, do not use autotransformers!

3) According to NFPA70 table 310.15 at $T_a \leq 40$ °C and 75 °C cable (copper wire; PVC-insulation)

4) Due to discharging resistors

5) According to DIN EN ISO 11205; comparative value at 1 m distance, out of cabinet

14.4.7 Circuit diagram

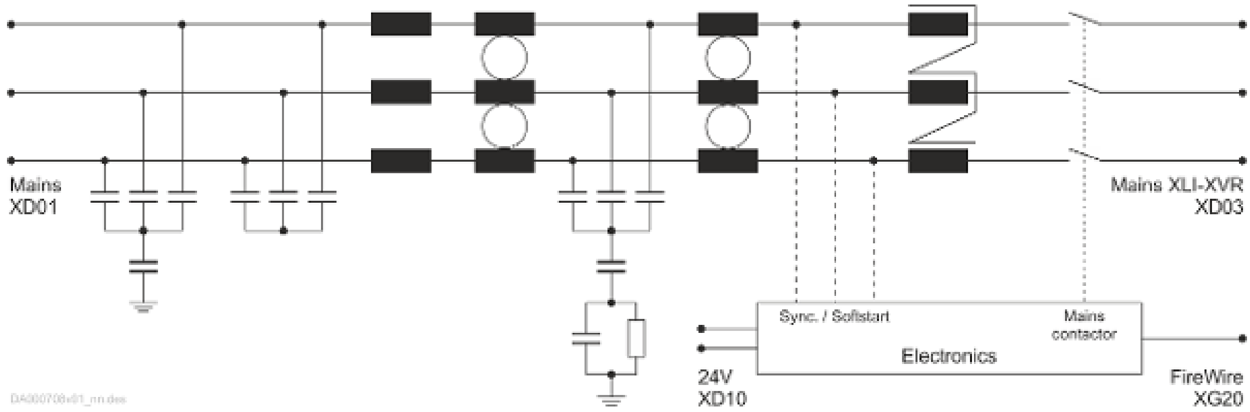


Fig. 156: XLI circuit diagram

14.4.8 Connection diagram

XVR*-W0019

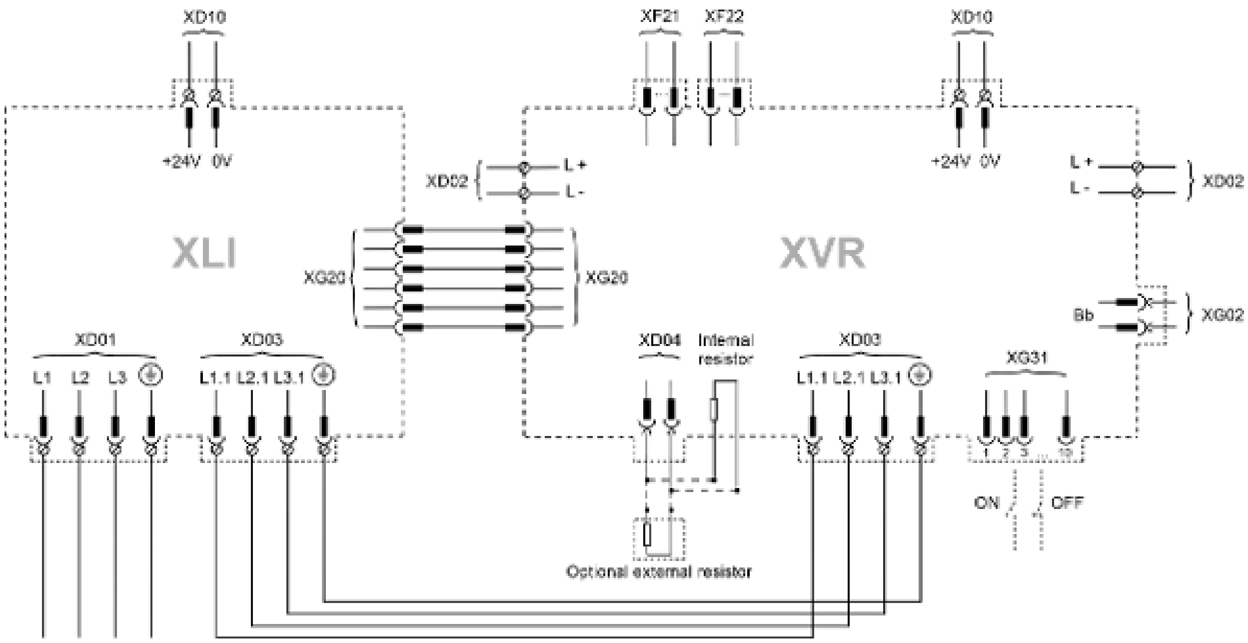


Fig. 157: Connection diagram XVR*-W0019

XVR*-W0048/72/100

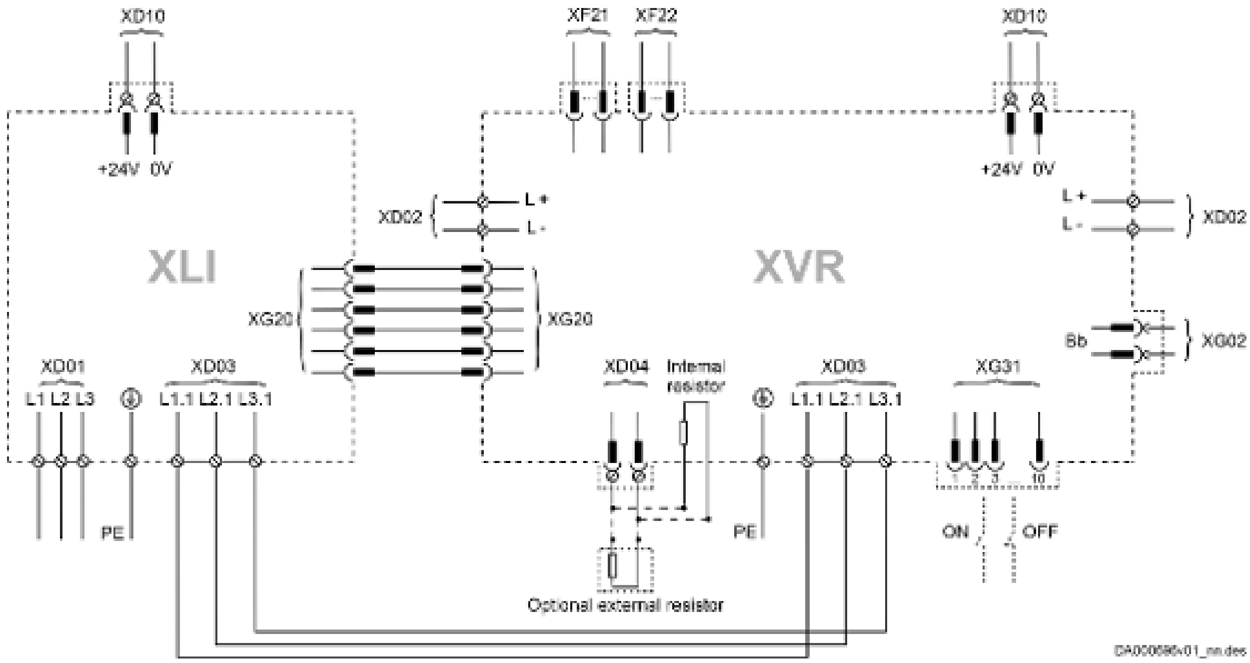


Fig. 158: Connection diagram XVR*-W0048/72/100

14.4.9 Connection points

Overview

Table 296: Connection points (XLI1-1R-W0019)

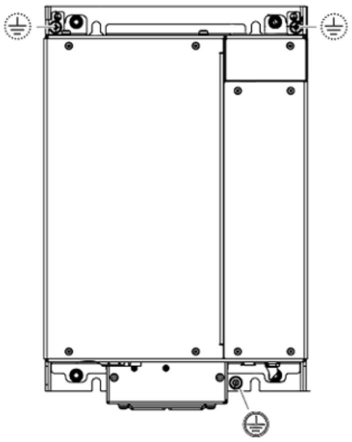
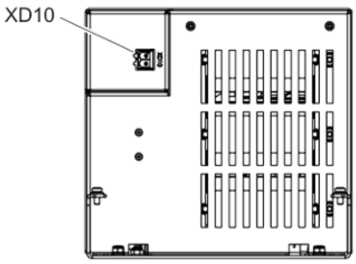
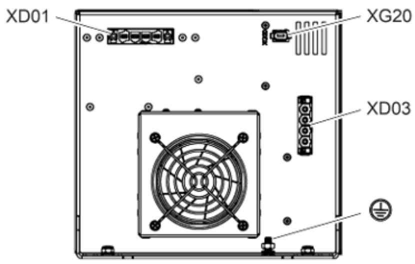
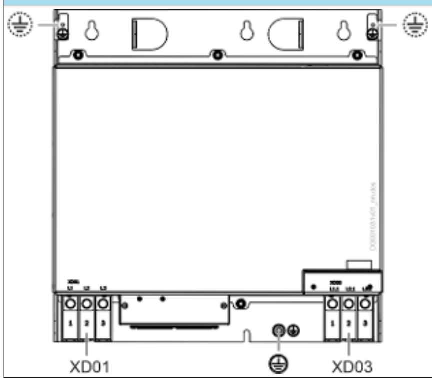
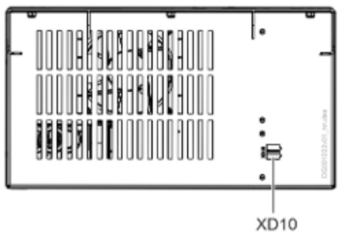
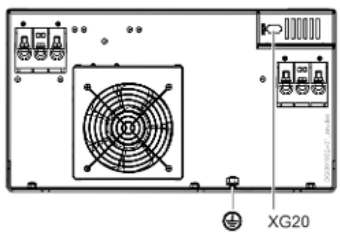
Front	Top	Bottom
		
⏚: Equipment grounding conductor (required; M6) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD10: Control voltage	XD01: Mains XD03: Mains XLI-XVR XG20: XLI bus ⏚: Equipment grounding conductor (required; M6)

Table 297: Connection points (XLI1-1R-W0048/72/100)

Front	Top	Bottom
		
XD01: Mains XD03: Mains XLI-XVR ⏚: Equipment grounding conductor (required) ⏚ Equipment grounding conductor (optional; connection to the left or right)	XD10: Control voltage	XG20: XLI bus ⏚: Equipment grounding conductor (required)

Equipment grounding conductor

⚠ WARNING	High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!
	– Prior to commissioning the components, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points. – Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA. – Establish an equipment grounding connection with a copper wire of a cross section of at least 10 mm². Additionally run a second equipment grounding conductor of the same cross section as the original equipment grounding conductor.

⚠ WARNING	Lethal electric shock from live parts with more than 50 V!
	Only operate the device with connected equipment grounding conductor!

Equipment grounding conductor: Material and cross section

Use the same metal (e.g., copper) for the equipment grounding conductor as for the outer conductors.

When connecting the equipment grounding conductor connection point of the device to the equipment grounding system within the control cabinet, take into account that a sufficient cable cross section is required.

Cross section of equipment grounding connection:

For drive controllers **Xxxn-W/Cnnnn minimum 10 mm²**, but not smaller than cross section of supply feeder

Additionally mount the housing on a metallic, uncoated mounting plate. Also connect the mounting plate with at least the same cross-section to the protective conductor system in the control cabinet.

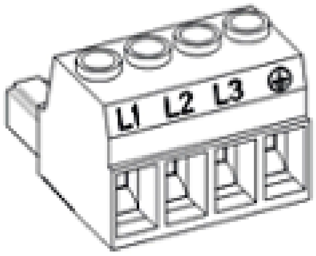
Installation

Connect ring cable lugs of equipment grounding conductors to device housing (⏚ symbol).

XLI1-1R-W0019 XLI1-1R-W0048 XLI1-1R-W0072	XLI1-1R-W0100
M6 5 Nm	M8 8 Nm

XD01, mains (XLI1-1R-W0019)

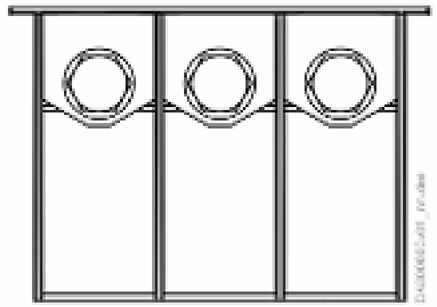
Table 298: Function, pin assignment, properties

View	Identifica-tion	Function
	L1	Connection to power grid (L1)
	L2	Connection to power grid (L2)
	L3	Connection to power grid (L3)
	⏚	Equipment grounding conductor connection

Screw connection at connector	**Unit**	**min.**	**max.**
Connection cable Cross section flexible	mm^2	0.5	16
	AWG	20	6
With ferrule with/without plastic sleeve	mm^2	0.25	16
	AWG	24	6
Cross section rigid	mm^2	0.2	16
	AWG	22	6
Stripped length	mm	12	
Tightening torque	Nm	1.2	2
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

XD01, mains (XLI1-1R-W0048)

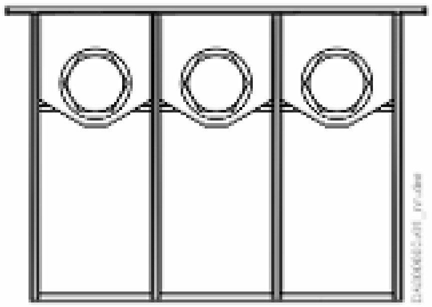
Table 299: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M6	
Tightening torque	Nm	4	5
Connection cable flexible with ring cable lug1)	mm^2	1×35 2×16	
	AWG	1×3	
Occurring current load and minimum required connection cross section	A	See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load	V	See technical data of device used (U_{LN} or U_{LN_nom})	

1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**

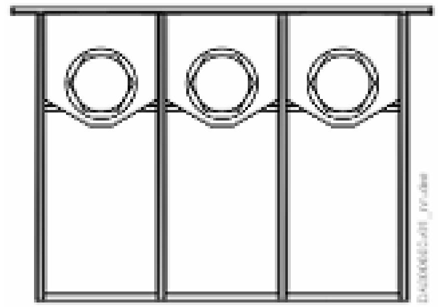
XD01, mains (XLI1-1R-W0072)

Table 300: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M6	
Tightening torque	Nm	4	5
Connection cable flexible with ring cable lug1)	mm^2	1×50 2×25	
	AWG	1×1/0	
Occurring current load and minimum required connection cross section	A	See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load	V	See technical data of device used (U_{LN} or U_{LN_nom})	
1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**; with a cable cross section of 50 mm^2, the ring cable lug may not exceed a maximum width of **18 mm** in the contact area (recommendation: use DIN 46234-6-50 ring cable lugs)			

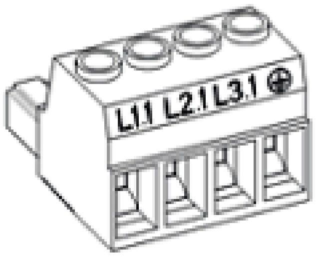
XD01, mains (XLI1-1R-W0100)

Table 301: Function, pin assignment, properties

<table>
<tr><th>View</th><th>Identification</th><th colspan="2">Function</th></tr>
<tr><td rowspan="3"></td><td>L1</td><td colspan="2">Connection to power grid (L1)</td></tr>
<tr><td>L2</td><td colspan="2">Connection to power grid (L2)</td></tr>
<tr><td>L3</td><td colspan="2">Connection to power grid (L3)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Terminal block</td><td>Unit</td><td>min.</td><td>max.</td></tr>
<tr><td>Screw thread</td><td></td><td colspan="2">M10</td></tr>
<tr><td>Tightening torque</td><td>Nm</td><td>16</td><td>20</td></tr>
<tr><td rowspan="2">Connection cable
flexible with ring cable lug[1)]</td><td>mm²</td><td>1×16, 2×16</td><td>1×120, 2×120</td></tr>
<tr><td>AWG</td><td>1×6, 2×4</td><td>1×4/0, 2×4/0</td></tr>
<tr><td>Occurring current load and minimum required connection cross section</td><td>A</td><td colspan="2">See technical data of device used (I_{LN} and A_{LN})</td></tr>
<tr><td>Occurring voltage load</td><td>V</td><td colspan="2">See technical data of device used (U_{LN} or U_{LN_nom})</td></tr>
<tr><td colspan="4">1) Maximum allowed length of ring cable lug: 38 mm; insulate ring cable lugs with heat shrink sleeves</td></tr>
</table>

XD03, mains XLI-XVR (XVR*-W0019, XLI1-1R-W0019)

The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

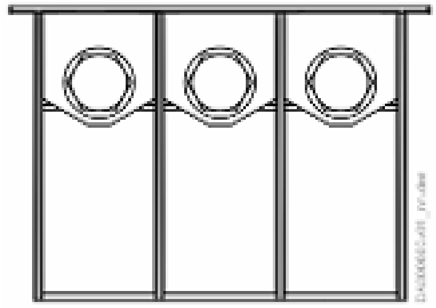
View	Identification	Function
	L1.1	Connection between supply unit and mains connection module
	L2.1	
	L3.1	
	⏚	

Screw connection at connector	**Unit**	**min.**	**max.**
Connection cable	mm²	0.75	16
Cross section flexible 1 conductor	AWG	18	6
with ferrule without plastic sleeve	mm²	0.5	16
	AWG	20	6
with ferrule with plastic sleeve	mm²	0.5	10
	AWG	20	8
Cross section flexible 2 conductors	mm²	0.75	6
	AWG	18	10
with ferrule without plastic sleeve	mm²	0.5	4
	AWG	20	12
with twin ferrule with plastic sleeve	mm²	0.5	6
	AWG	20	10
Cross section rigid 1 conductor	mm²	0.75	16
	AWG	18	6
Cross section rigid 2 conductors	mm²	0.75	6
	AWG	18	10
Stripped length	mm	12	
Tightening torque	Nm	1.7	1.8
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

XD03, mains XLI-XVR (XVR*-W0048, XLI1-1R-W0048)

The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

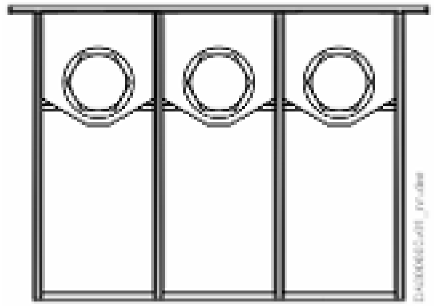
Table 302: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1.1	Connection between supply unit and mains connection module	
	L2.1		
	L3.1		
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M6	
Tightening torque	Nm	4	5
Connection cable flexible with ring cable lug1)	mm^2	1×35 2×16	
	AWG	1×3	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	
1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**			

XD03, mains XLI-XVR (XVR*-W0072, XLI*-1R-W0072)

The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

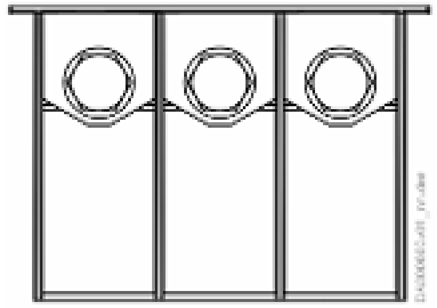
Table 303: Function, pin assignment, properties

View	Identifica-tion	Function	
	L1.1	Connection between supply unit and mains connection module	
	L2.1		
	L3.1		
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M6	
Tightening torque	Nm	4	5
Connection cable flexible with ring cable lug[1)]	mm^2	1×50 2×25	
	AWG	1×1/0	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	
1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**; with a cable cross section of 50 mm^2, the ring cable lug may not exceed a maximum width of **18 mm** in the contact area (recommendation: use DIN 46234-6-50 ring cable lugs)			

XD03, mains XLI-XVR (XVR*-W0100, XLI1-1R-W0100)

The connection point is used to connect a **regenerative** supply unit to the mains connection module XLI.

Table 304: Function, pin assignment, properties

View	Identification	Function	
	L1.1 L2.1 L3.1	Connection between supply unit and mains connection module	
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M10	
Tightening torque	Nm	16	20
Connection cable	mm²	1×16, 2×16	1×120, 2×120
flexible with ring cable lug1)	AWG	1×6, 2×4	1×4/0, 2×4/0
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	
1) Maximum allowed length of ring cable lug: **38 mm**; insulate ring cable lugs with **heat shrink sleeves**			

XD10, 24 V supply (control voltage)

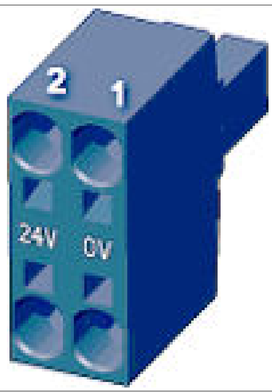
Function, pin assignment

Via the connection point, the 24 V supply is applied externally for

- the control section and power section of the drive controller
- the brake control
- the digital inputs and the digital output

Connectors included in scope of delivery.

Table 305: Function, pin assignment, properties

View	Connection	Signal name	Function
	1	0V	Reference potential for power supply
	2	+24V	Power supply
Spring terminal at connector	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.2	6
Cross section flexible 1 conductor	AWG	24	10
with ferrule without plastic sleeve	mm^2	0.25	6
	AWG	24	10
with ferrule with plastic sleeve	mm^2	0.25	4
	AWG	24	12
Cross section flexible 2 conductors	mm^2	0.25	1.5
with twin ferrule with plastic sleeve	AWG	24	16
Cross section rigid 1 conductor	mm^2	0.2	10
	AWG	24	8
Stripped length	mm	15	
Power consumption	W	P_{N3} (see control voltage data)	
Voltage load capacity	V	U_{N3} (see control voltage data)	
Current carrying capacity "looping through" from 0V to 0V, 24V to 24V	A	41	
Polarity reversal protection		Within the allowed voltage range by internal protective diode	
Insulation monitoring		Possible	

Installation instructions

Requirements on the connection for 24 V supply:

- Minimum cross section: 1 mm^2
- Maximum allowed inductance: 100 µH (2 twisted single strands, 75 m long)
- Parallel line routing where possible

Depending on the power consumption of the devices and the current carrying capacity of the connector, check the number of devices via which a line for 24 V supply can be looped through. If required, connect another device directly to the 24 V supply and then loop through the control voltage from this device to other devices.

XG20, XLI bus

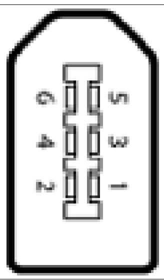
Function, pin assignment

The connection point is used to connect the supply unit to the mains connection module XLI.

Connection cable contained in XLI scope of supply:

- XLI1-1R-W0019/48/72
  RG2-500AAB-NN-000,5; length incl. connector: **0.5 m**; R911403093
- XLI1-1R-W0100
  RG2-500AAB-NN-000,8; length incl. connector: **0.8 m**; R911407458

Table 306: XG20, XLI bus

View	Connection	Function	
	1	Communication	
	2		
	3		
	4		
	5		
	6		
Properties	**Unit**	**min.**	**max.**
Connection cable Stranded wire	mm^2	0.25	0.8
Type		RG2-500AAB	

14.5 DC bus capacitor unit XLC

14.5.1 Type code

Table 307: XLC, type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	L	C	1	-	W	0	1	M	2	-	A	-	0	7	5	0	-	N	N																				
	①					②	③					④		⑤					⑥																					
①	**Product:** XLC1 = DC bus capacitor unit (X: ctrlX DRIVE; L: DC link component; C: capacitor; 1: 1st generation)																																							
②	**Connection compatibility:** W = Air-cooled devices																																							
③	**Nominal capacitance:** 01M2 = 1.2 mF																																							
④	**Degree of protection:** A = IP20																																							
⑤	**Nominal DC bus voltage:** 0750 = DC 750 V																																							
⑥	**Other design:** NN = None																																							

14.5.2 Dimensions

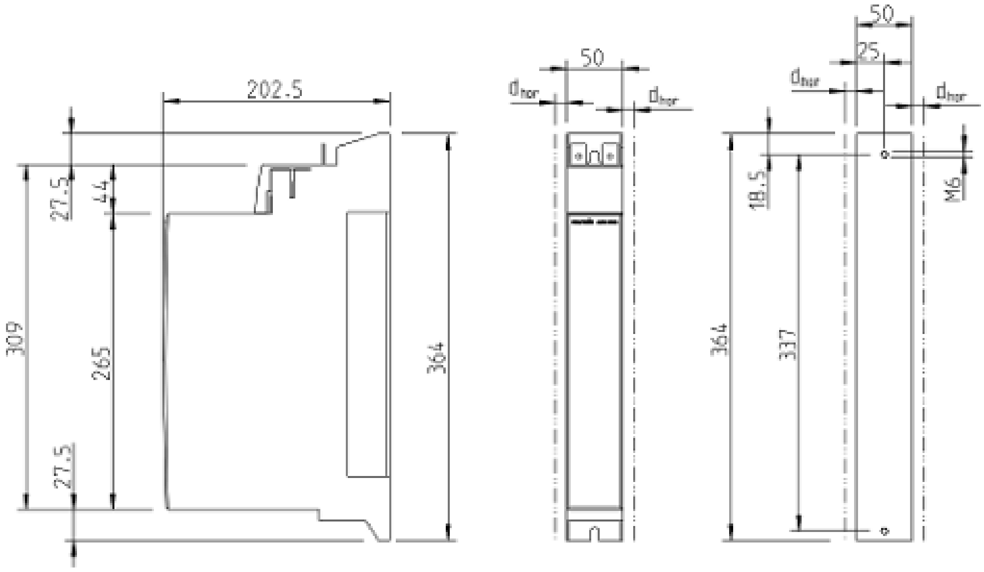


Fig. 159: XLC dimensions

Horizontal spacing at the device **d_{hor}**:

- 0 mm
  For devices of the ctrlX DRIVE product group in the DC bus group (central supply)
- 1,5 mm
  For devices of the ctrlX DRIVE product group outside of the DC bus group (individual supply)
- 10 mm
  For other devices

14.5.3 Technical data

Table 308: Data

Designation	Symbol	Unit	Type
			XLC1-W01M2
Degree of protection according to IEC60529	-	-	IP20
Mass	m	kg	3.2
Allowed mounting position			G1
Allowed input voltage	U_{DC}	V	DC 254 ... 750
Nominal DC bus capacitance	C_{DC}	mF	1.2 ±20%
Maximum discharging time from U_{DC} to 50 V	T	s	305
Maximum allowed input current at L+ L-	$I_{max(rms)}$	A	20
Power dissipation (at continuous power)	P_V	W	7
Insulation resistance	R_{is}	Mohm	> 10
Cooling			Natural convection

With an increasing mains supply voltage, the storable energy in the DC bus decreases, as the differential voltage between braking resistor threshold and DC bus voltage (peak value of the supply voltage) decreases.

Additional components

14.5.4 Connection points

General information

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** Before working with live parts: De-energize installation and secure power switch against unintentional or unauthorized reconnection. Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**. Make sure voltage has fallen below 50 V before touching live parts!

Overview

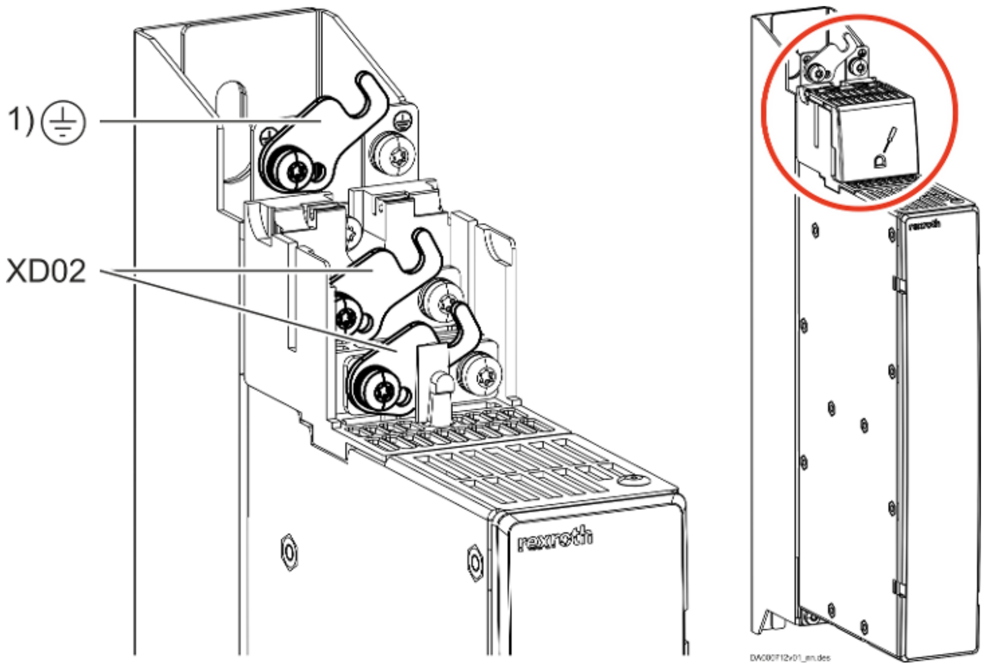


Fig. 160: Connection points

1) Equipment grounding conductor

XD02 DC bus

Equipment grounding conductor connection

⚠ **WARNING**	**High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!** – Prior to switching on and commissioning, ground or connect the electric drive and control system components to the equipment grounding conductor at the grounding points. – Connect the equipment grounding conductor of the electric drive and control system components permanently to the main power supply at all times. The leakage current is greater than 3.5 mA. – Establish an equipment grounding connection with a copper wire of a cross section of at least 10 mm² (8 AWG) or additionally run a second equipment grounding conductor of the same cross section as the original equipment grounding conductor.

⚠ **WARNING**	**Lethal electric shock from live parts with more than 50 V!** Only operate the device with connected equipment grounding conductor!

Connect the **claw bolt (tightening torque: 2.8 Nm)** with the neighboring device.

XD02, L+ L-, DC bus connection

⚠ **WARNING**	**Lethal electric shock from live parts with more than 50 V!** Before working with live parts: De-energize installation and secure power switch against unintentional or unauthorized reconnection. Before accessing the device, wait at least **30 minutes** after switching off the supply voltages to allow **discharging**. Make sure voltage has fallen below 50 V before touching live parts! **Always operate the device with a touch guard.**

Connect the **claw bolts (tightening torque: 2.8 Nm)** with the neighboring device.

Ground connection

The ground connection of the housing is used to provide functional safety of the devices and protection against contact in conjunction with the equipment grounding conductor.

Ground the device housings:

- Connect the uncoated, metallic rear panel of the device in conductive form to the mounting surface in the control cabinet. To do this, use the supplied mounting screws.
- Connect the mounting surface of the control cabinet in conductive form to the equipment grounding system.
- For the ground connection, observe the maximum allowed ground resistance.

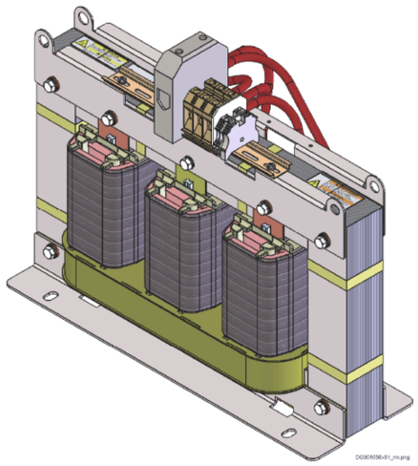
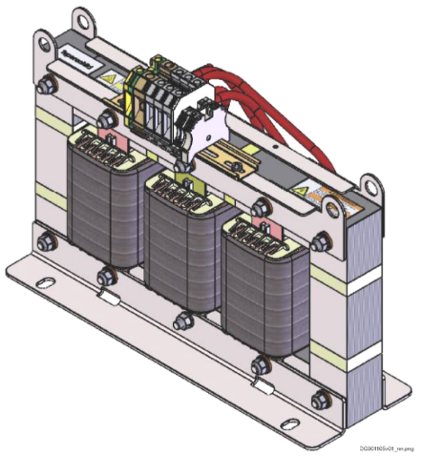
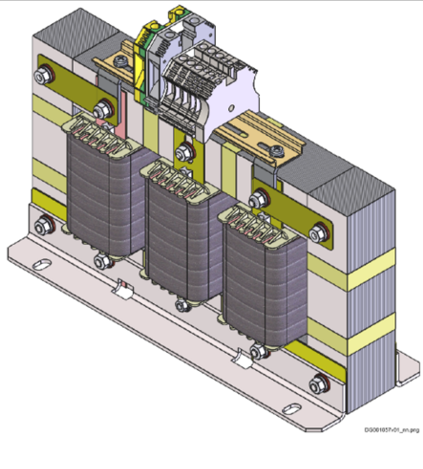
14.6 DC choke XLL

14.6.1 Type code

Table 309: XLL1, type code

										1										2										3										4
Short type designation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	L	L	1	-	1	N	G	4	0	1	M	0	G	-	0	0	5	0	N	N	N	N	N	-	N	N	N	N	N	N									
	①					②	③	④		⑤				⑥		⑦				⑧	⑨					⑩				⑪										

①	**Product:** XLL1 = DC choke (X: ctrlX DRIVE; L: DC bus or output component; L: inductance; 1: 1. generation)
②	**Design:** 1 = 1
③	**Cooling type:** N = None (natural convection) W = Air cooling
④	**Mounting position:** G4 = Bottom mounting
⑤	**Nominal inductance:** 01M0 = 1 mH 01M8 = 1.8 mH 02M0 = 2 mH
⑥	**Type:** G = Smoothing choke
⑦	**Rated current:** 0050 = 50 A 0080 = 80 A 0210 = 210 A
⑧	**Degree of protection:** N = IP00
⑨	**Maximum leakage capacitance:** NN = Not applicable
⑩	**Other option:** NNNN = None
⑪	**Other design:** NN = None

XLL1-1WG401M0G-0210	XLL1-1NG401M8G-0080	XLL1-1NG402M0G-0050
		

14.6.2 Dimensions

XLL1-1NG402M0G-0050

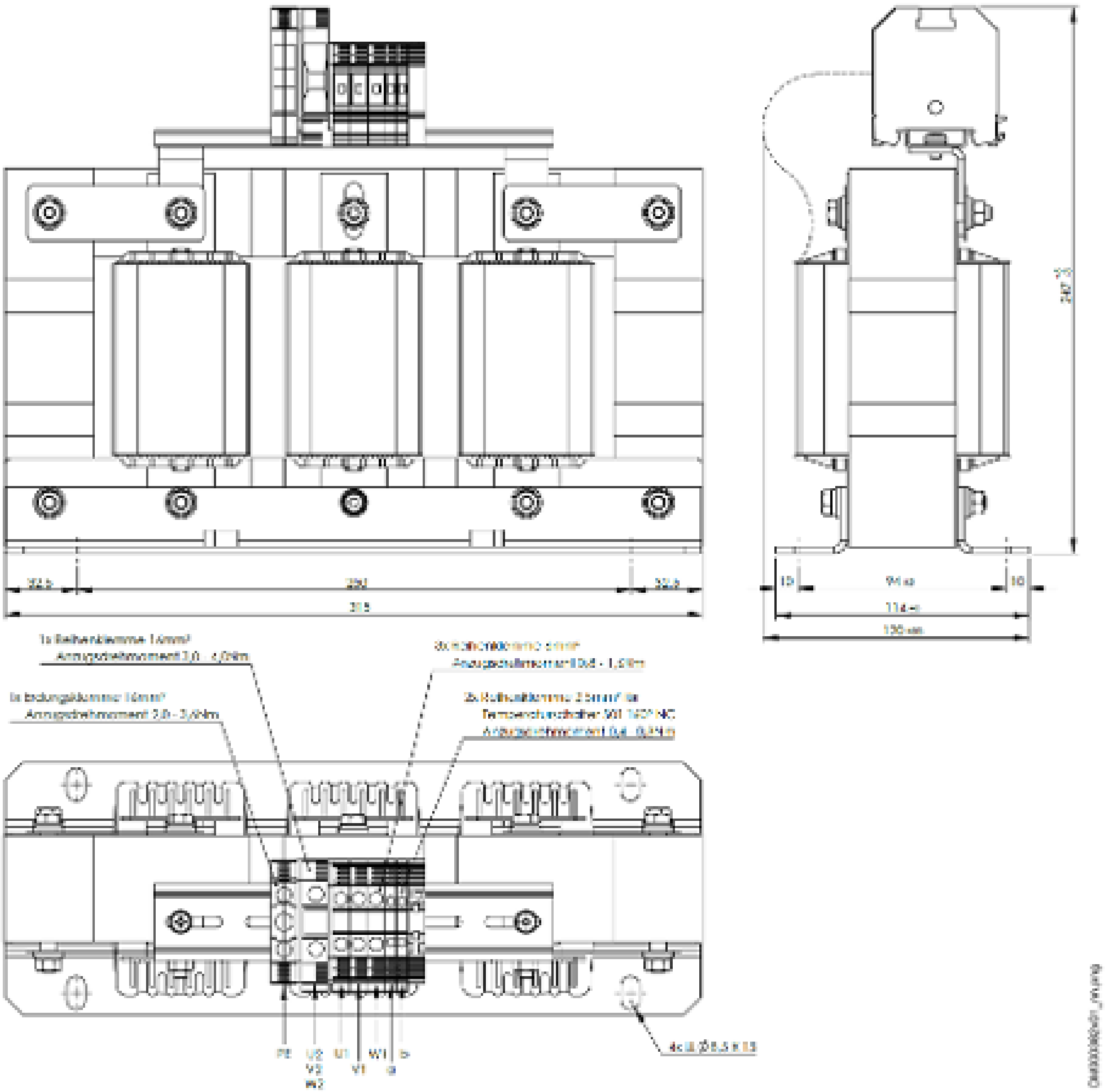


Fig. 161: XLL1-1NG402M0G-0050

XLL1-1WG401M8G-0080

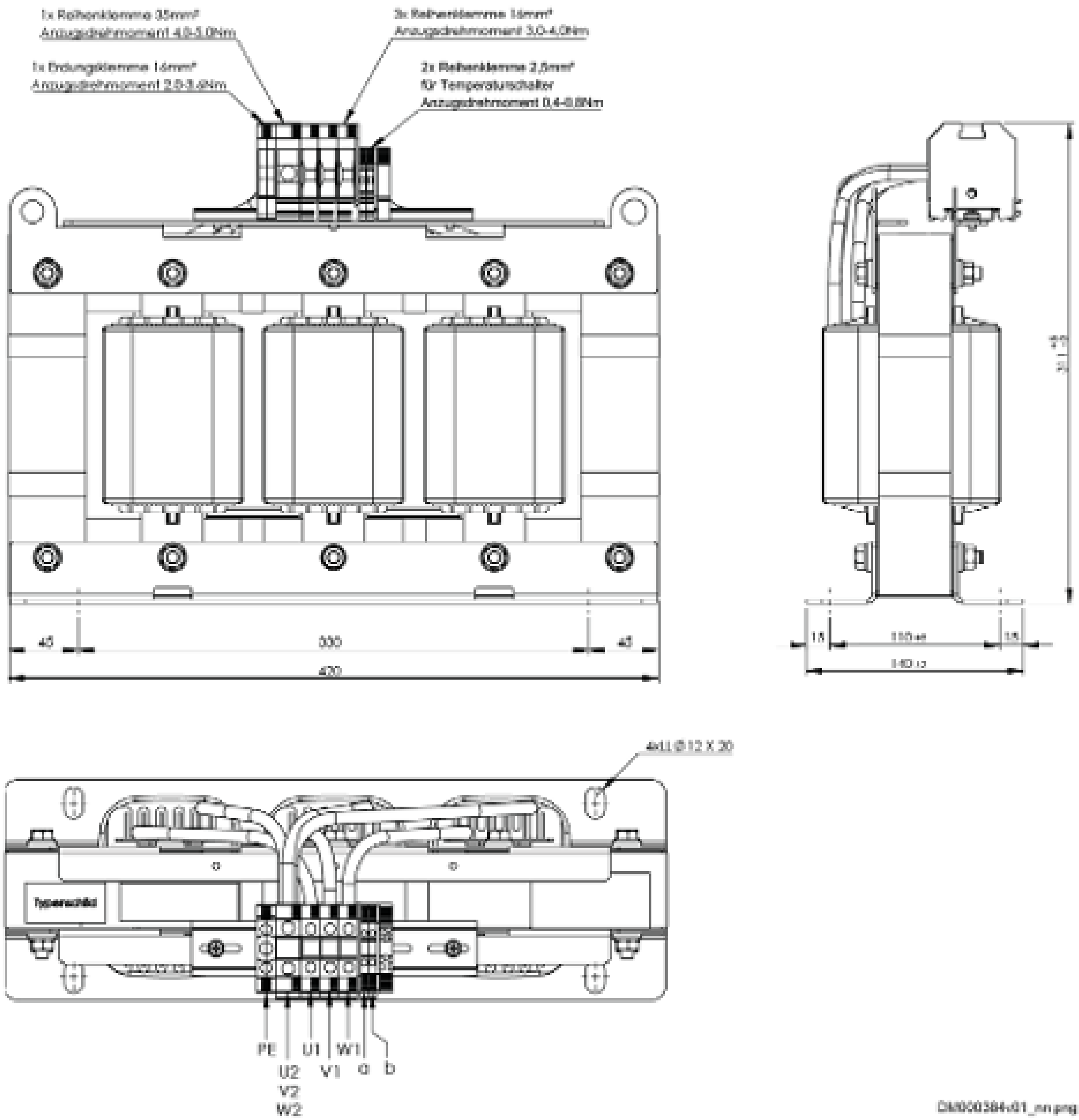


Fig. 162: XLL1-1WG401M8G-0080

XLL1-1WG401M0G-0210

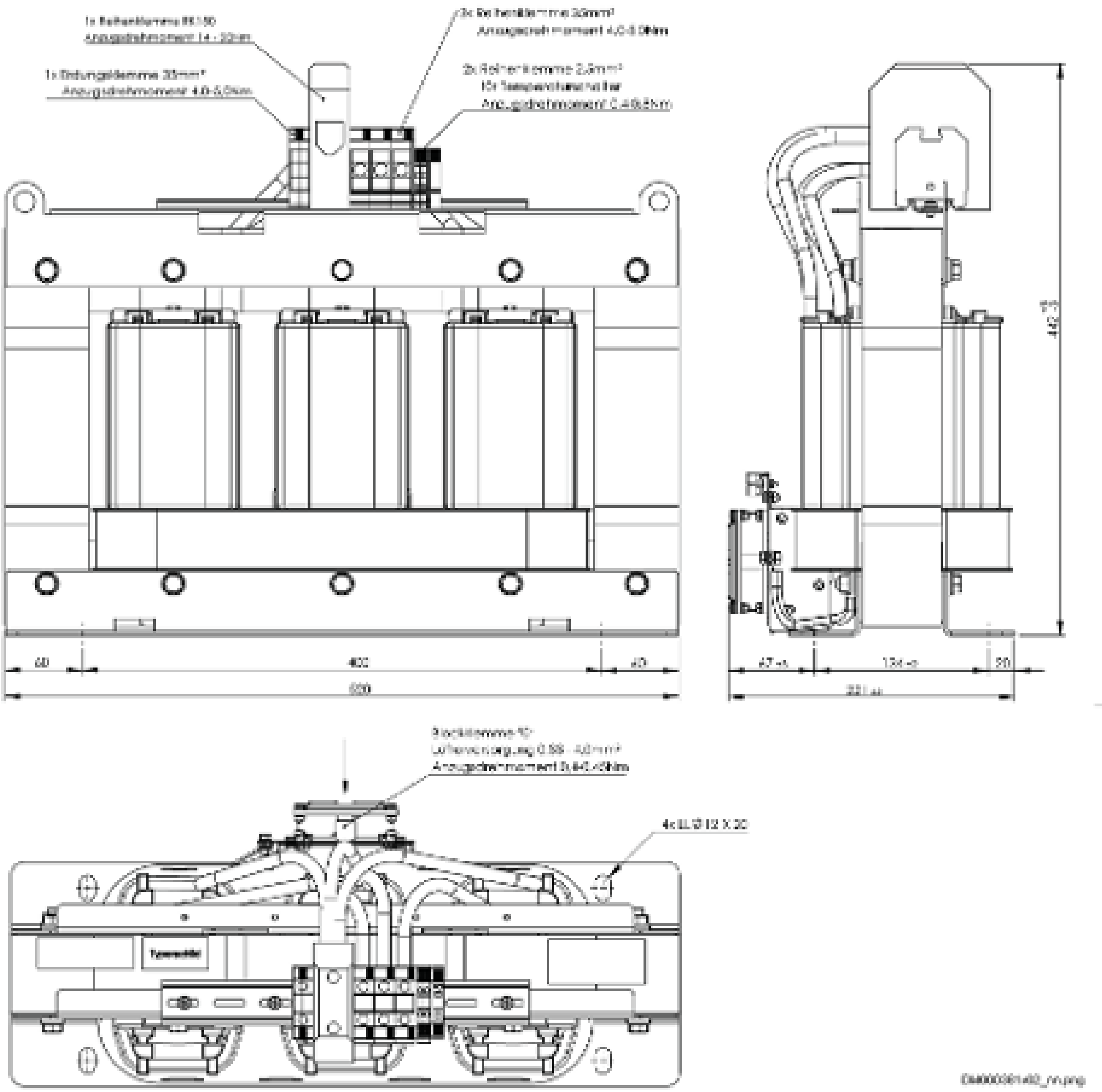


Fig. 163: XLL1-1WG401M0G-0210

14.6.3 Technical data

XLL1-1WG4	Inductance [mH]	Continuous current [A]	Rated voltage [V_{DC}]	Power dissipation 8/16 kHz [W]	Weight [kg]
02M0G-0050	2	50	750	300/270	approx. 20
01M8G-0080	1.8	80	750	380/340	approx. 35
01M0G-0210[1)]	1	210	750	1000/900	approx. 90
1) Fan: 24 VDC ±10%, ≤ 100 mA					

Temperature monitoring contact:

- Activation temperature: 160 °C
- N/C in one of the windings
- Electrical switching capacity:
  - 1 A
  - AC 250 V
  - DC 24 V

14.6.4 Mounting

Allowed mounting position: vertical

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!**
	Degree of protection of the component: **IP00**.
	Mount a **touch guard**!

The components are sized for operation in the control cabinet and can have a sound pressure level > 85 dBA.

Install appropriate noise control when mounting a component outside a closed control cabinet.

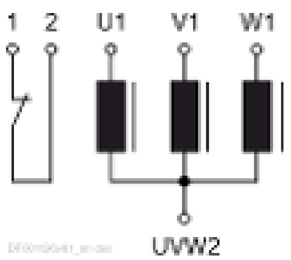
14.6.5 Connection

General information

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** Before working with live parts: De-energize installation and secure power switch against unintentional or unauthorized reconnection. **Make sure voltage has fallen below 50 V before touching live parts!** Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**. Mount a **touch guard**!

⚠ WARNING	**Risk of burns and damage by hot surfaces!** Chokes reach high temperatures during operation. Let the choke cool down before working with the choke. Wear safety gloves. When running cables, maintain sufficient distance to the choke. Cables must not touch the sheet metal frame of the choke.

⚠ CAUTION	**Danger by missing evaluation of the temperature switch!** Make sure the temperature switch is evaluated. If the temperature switch opens, the power output has to be stopped via the choke.

Circuit diagram	Symbol	Significance
	1 2	Temperature switch (N/C)
	U1 V1 W1	Power side
	UVW2	Load side

XLL1-1WG4	Connection points				
	Power side	Load side	Equipment grounding conductor	Temperature contact	Fan
02M0G-0050	3 × 6 mm² 0.8 ... 1.6 Nm	16 mm² 3.0 ... 4.0 Nm	16 mm² 2.0 ... 3.6 Nm	2.5 mm² 0.4 ... 0.8 Nm	-
01M8G-0080	3 × 16 mm² 3.0 ... 4.0 Nm	35 mm² 4.0 ... 5.0 Nm	16 mm² 2.0 ... 3.6 Nm	2.5 mm² 0.4 ... 0.8 Nm	-
01M0G-0210	3 × 35 mm² 4.0 ... 5.0 Nm	150 mm² 14 ... 20 Nm	35 mm² 4.0 ... 5.0 Nm	2.5 mm² 0.4 ... 0.8 Nm	0.33 ... 4.0 mm² 0.4 ... 0.45 Nm

15 ctrlX DRIVE panel

15.1 XDP1

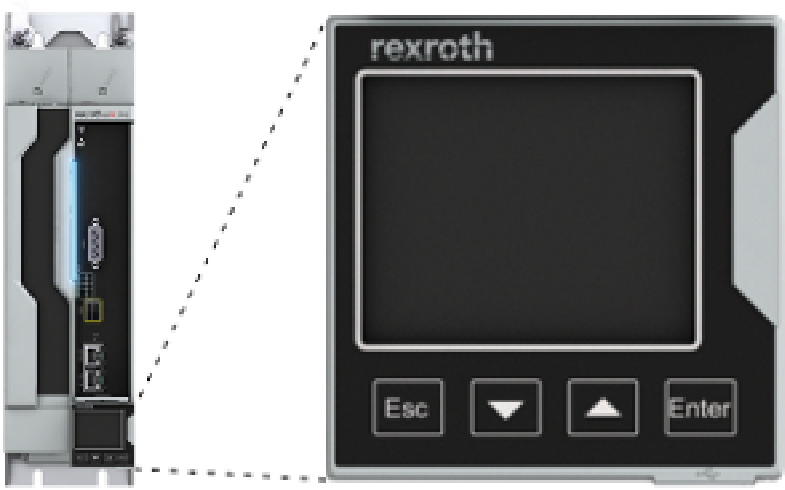


Fig. 164: Panel XDP1

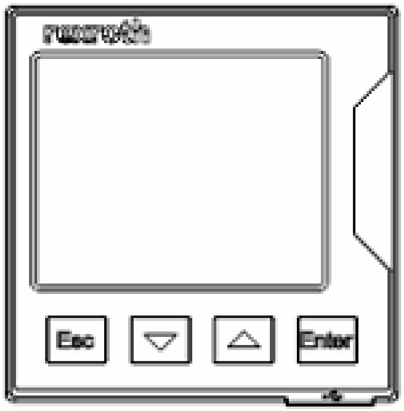
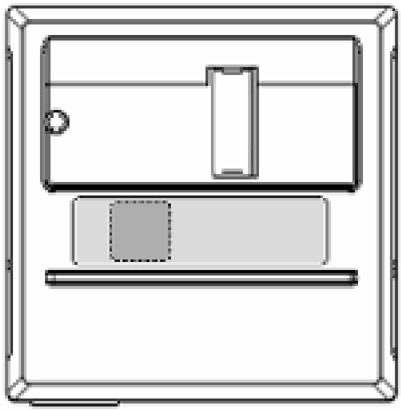
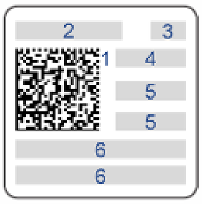
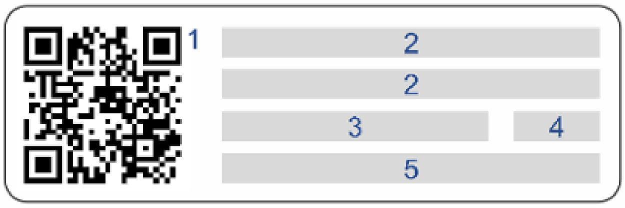
Table 310: Type code of panel

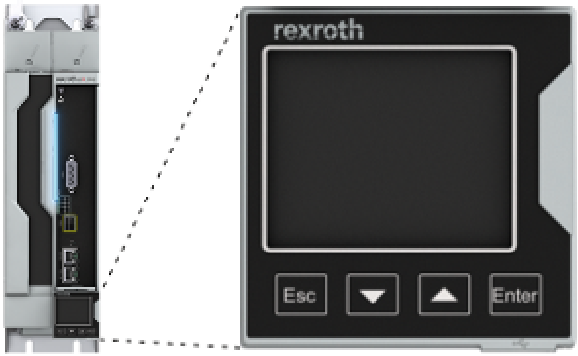
Short type designation										1										2										3										4
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
Example:	X	D	P	1	-	N	-	1	2	8	-	N	N	-	V	S	R	S	N	-	N	N																		
		①				②			③			④			⑤		⑥		⑦		⑧																			

①	**Product:** XDP1 = ctrlX DRIVE Panel
②	**Wireless data carrier:** N = Without
③	**Internal memory:** 128 = 128 MB
④	**Other designs:** NN = None
⑤	**Panel firmware version:** VS = current version
⑥	**Panel firmware release:** RS = Current release
⑦	**Export licenses required:** N = No
⑧	**Miscellaneous:** NN = None

15.2 Overview

Table 311: Panel

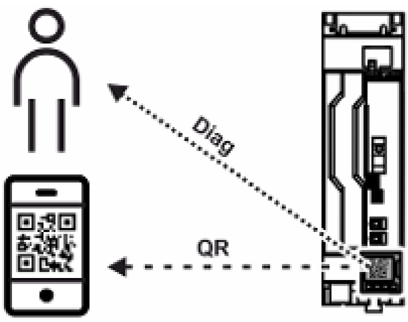
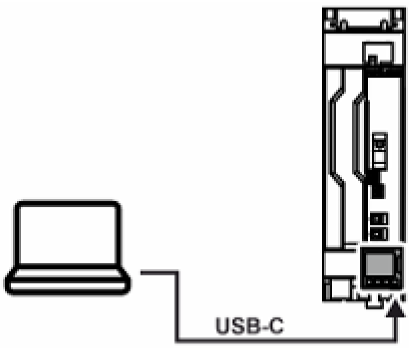
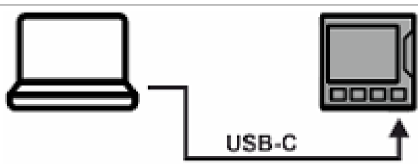
Engineering tool for devices ctrlX DRIVE		
Front		• TFT display • 4 keys: [Esc], [▼], [▲], [Enter] • hot-plug-compatible • dynamic QR code to display information on mobile end devices • USB interface • Flash memory (128 MB, FAT)
Back	 Type plates: • 10 × 10 mm: Panel ordered as component of the device (CP-XDP1) or • 32 × 12 mm Panel ordered as single component (XDP1-N-128-NN-VRSN-NN; R911403470)	 Type plate (10 × 10 mm): 1: 2D code 2: type 3: Hardware index 4: Production week (example: 20W38 indicates: year 2020, week 38) 5: Material number 6: Serial number  Type plate (32 × 12 mm): 1: QR code 2: type 3: Material number 4: Hardware index 5: Serial number

Engineering tool for devices ctrlX DRIVE	
	Panel plugged on a ctrlX DRIVE device

15.3 Operation modes

See also ➦ "Use Panel at ctrlX DRIVE"

Table 312: Operation modes

Operation mode [1)]		Description
Panel Engineering		Panel plugged on the ctrlX DRIVE device • Diagnostic display (at panel and via QR code at mobile end devices) • Menu options for ctrlX DRIVE devices and panel
USB Engineering		Panel plugged on the ctrlX DRIVE device and connected to a Windows PC via USB cable
USB storage medium		Panel is used as USB flash drive at a Windows PC (to save parameter sets, firmware downloads, diagnostic processes, etc.) • FAT file system • 128 MB
1) Parallel operation of operation modes is not possible.		

16 Environmental protection and disposal

16.1 Environmental protection

Production processes

The products are manufactured using production processes that are energy efficient and raw material-optimized. These processes facilitate recycling of waste products. In regular intervals, we strive to replace polluted raw material, auxiliary material and process material with environmentally sustainable alternatives.

No release of hazardous substances

Our products do not contains any hazardous material which could be released during intended use. There are usually no negative effects on the environment.

Basic components

Our products contains the following components:

Electronic devices

- Steel
- Aluminum
- Copper
- Plastics
- Electronic components

Motors

- Steel / stainless steel
- Aluminum
- Copper
- Brass
- Magnetic materials
- Electronic components

16.2 Disposal

Return

Products by Bosch Rexroth can be returned to us for disposal free of charge. However, this requires that the products are free from oil, grease or other dirt.

Furthermore, no inappropriate foreign material or components must be included in the return consignment.

Send the products to the following address, carriage free:

Bosch Rexroth AG

Electric Drives and Controls

Buergermeister-Dr.-Nebel-Strasse 2

97816 Lohr am Main, Germany

Packaging

The packaging consists of cardboard and plastic foils (PE, PU). The weight component of the plastic foil is less than 5% of the packaging unit. Therefore, the packaging may be disposed of as cardboard. For reasons of sustainability and to enable the foil to be recycled, the foil should be separated from the cardboard.

Due to ecological reasons, try to avoid return consignments.

Batteries and accumulators

Batteries and accumulators can be identified with this symbol.

The crossed-out waste bin symbol refers to collecting batteries separately.

End users in the EU are legally bound to return used batteries and accumulators. Outside the scope of the EU Directive 2006/66/EC, the applicable regulations have to be complied with.

Batteries and accumulators may contain hazardous substances which can harm the environment or human health when stored or disposed of improperly.

The batteries or accumulators contained in products by Bosch Rexroth must be returned to the country-specific collection systems for proper disposal.

Recycling

Most of the products can be recycled due to their high content of metal. In order to recycle the metal in the best possible way, the products must be disassembled into individual assemblies.

Metals contained in electric and electronic assemblies can also be recycled by means of special separation processes.

Plastic parts of the products may contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the applicable legal provisions.

17 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts provide you with advice and assistance. You can contact us **24/7**.

Service Germany

Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone:	+49 9352 40 5060
Fax:	+49 9352 18 4941
Email:	➦service.svc@boschrexroth.de
Internet:	➦http://www.boschrexroth.com

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide

Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

18 Appendix

18.1 Dimensioning of wire cross sections and fuses

18.1.1 Introduction

The dimensioning of wire cross sections refers to the **short circuit protection** of the devices, not the protection of the wire.

Dimensioning of wire cross sections and fuses in the feeder and feeding current to the drive system:

1. Determining the current in the feeder of the drive system and correcting the current using correction factors for ambient temperature and accumulation.
2. Determining the area of application ("internationally, except for USA/ Canada" or "USA/Canada")
3. Determining the installation type (e.g. B1 or B2)
4. Select the value from the table column "Current-carrying capacity" which is directly above the value determined in the first step.
5. Take the relevant fuse from the "Fuse" table column
6. Take the required cross section from the "Cross section A..." column

18.1.2 Internationally, except for USA/Canada; installation type B1

Table 313: Wire cross sections and fuses, B1 according to EN 60204-1:2006, table 6, from 150mm² DIN IEC 60364-5-52:2004, table B.52-10

Area of application: internationally except for USA/Canada				
Fuse I_N [A]			Current-carrying capacity (× 0,87) $I_{Z(40)}$ [A]	Cross section A [mm²] Installation type B1
1 ×	2 ×	3 ×		
2			1.6	1.5
4			3.3	1.5
6			5.0	1.5
10			8.6	1.5
16			10.3	1.5
16			13.5	1.5
20			18.27	2.5
35			24.36	4
35			31.32	6
50			43.50	10
80			59.16	16
100			77.43	25
125			95.70	35
160			116.58	50
200			148.77	70
200			180.09	95
250			207.93	120
250			227.94	150
315			257.52	185

Area of application: internationally except for USA/Canada				
Fuse I_N [A]			Current-carrying capacity (× 0,87) $I_{Z(40)}$ [A]	Cross section A [mm²] Installation type B1
1 ×	2 ×	3 ×		
355			301.02	240
400			342.78	300
	160		238.03	2 × 70
	160		288.14	2 × 95
	200		332.69	2 × 120
	200		364.70	2 × 150
	250		412.03	2 × 185
	315		481.63	2 × 240
	315		548.45	2 × 300
		125	312.42	3 × 70
		160	378.19	3 × 95
		160	436.65	3 × 120
		200	478.67	3 × 150
		200	540.79	3 × 185
		250	632.14	3 × 240
		315	719.84	3 × 300

18.1.3 Internationally, except for USA/Canada; installation type B2

Table 314: Wire cross sections and fuses, E according to EN 60204-1:2006, table 6, from 150mm² DIN IEC 60364-5-52:2004, table B.52-10

Area of application: internationally except for USA/Canada				
Fuse I_N [A]			Current-carrying capacity (× 0,87) $I_{Z(40)}$ [A]	Cross section A [mm²] Installation type B2
1 ×	2 ×	3 ×		
2			1.6	0.75
4			3.3	0.75
6			5.0	0.75
10			8.5	0.75
16			10.1	1.0
16			13.05	1.5
20			17.40	2.5
25			23.49	4
35			29.58	6
50			40.02	10
63			53.94	16
80			69.60	25
100			86.13	35
125			102.66	50
160			129.63	70
200			155.73	95
200			179.22	120
224			195.75	150
250			221.85	185
315			258.39	240
355			294.93	300
	125		207.41	2 × 70
	160		249.17	2 × 95
	160		286.75	2 × 120
	200		313.20	2 × 150
	200		354.96	2 × 185
	250		413.42	2 × 240
	315		471.89	2 × 300
		100	272.22	3 × 70
		125	327.03	3 × 95
		160	376.36	3 × 120
		160	411.08	3 × 150
		200	465.89	3 × 185
		200	542.62	3 × 240
		250	619.35	3 × 300

18.1.4 Internationally, except for USA/Canada; installation type E

Table 315: Wire cross sections and fuses, E according to EN 60204-1:2006, table 6, ab 150mm² DIN IEC 60364-5-52:2004, table B.52-10

Area of application: internationally except for USA/Canada				
Fuse I_N [A]			Current-carrying capacity (× 0,87) $I_{Z(40)}$ [A]	Cross section A [mm²] Installation type E
1 ×	2 ×	3 ×		
2			1.6	0.75
4			3.3	0.75
6			5.0	0.75
10			8.3	0.75
16			10.4	0.75
16			12.4	1
20			16.10	1.5
25			21.75	2.5
35			29.58	4
50			37.41	6
63			52.20	10
80			69.60	16
100			87.87	25
125			109.62	35
160			133.11	50
200			170.52	70
250			207.06	95
315			240.12	120
355			277.53	150
400			316.68	185
425			374.10	240
500			432.39	300
	160		272.83	2 × 70
	200		331.30	2 × 95
	250		384.19	2 × 120
	250		444.05	2 × 150
	315		506.69	2 × 185
	400		598.56	2 × 240
	400		691.82	2 × 300
		160	358.09	3 × 70
		200	434.83	3 × 95
		200	504.25	3 × 120
		250	582.81	3 × 150
		250	665.03	3 × 185
		315	785.61	3 × 240
		400	908.02	3 × 300

18.1.5 USA/Canada; installation type E

Table 316: Wire cross sections and fuses according to UL508A:2007, table 28.1

Area of application: USA/Canada					
Fuse I_N				Current-carrying capacity I_Z [A]	Cross section A Installation type E
1 ×	2 ×	3 ×	4 ×		
2				1.6	AWG 14
4				3.3	AWG 14
6				5	AWG 14
10				8.3	AWG 14
16				13	AWG 14
20				15	AWG 14
25				20	AWG 12
40				30	AWG 10
70				50	AWG 8
80				65	AWG 6
100				85	AWG 4
110				100	AWG 3
125				115	AWG 2
150				130	AWG 1
175				150	AWG 1/0
200				175	AWG 2/0
225				200	AWG 3/0
250				230	AWG 4/0
300				255	250 kcmil
300				285	300 kcmil
350				310	350 kcmil
350				335	400 kcmil
400				380	500 kcmil
450				420	600 kcmil
600				460	700 kcmil
600				475	750 kcmil
600				490	800 kcmil
600				520	900 kcmil
800				545	1000 kcmil
800				590	1250 kcmil
800				625	1500 kcmil
800				650	1750 kcmil
800				665	2000 kcmil
	200			300	2 × AWG 1/0
	225			350	2 × AWG 2/0
	250			400	2 × AWG 3/0
	300			460	2 × AWG 4/0
	300			510	2 × 250 kcmil
	350			570	2 × 300 kcmil
	350			620	2 × 350 kcmil

Area of application: USA/Canada					
Fuse I_N				Current-carrying capacity I_Z [A]	Cross section A Installation type E
1 ×	2 ×	3 ×	4 ×		
	400			670	2 × 400 kcmil
	450			760	2 × 500 kcmil
	600			840	2 × 600 kcmil
	600			920	2 × 700 kcmil
	600			950	2 × 750 kcmil
	600			980	2 × 800 kcmil
	800			1040	2 × 900 kcmil
	800			1090	2 × 1000 kcmil
		200		450	3 × AWG 1/0
		225		525	3 × AWG 2/0
		250		600	3 × AWG 3/0
		300		690	3 × AWG 4/0
		300		765	3 × 250 kcmil
		350		855	3 × 300 kcmil
		350		930	3 × 350 kcmil
		400		1005	3 × 400 kcmil
		450		1140	3 × 500 kcmil
			200	600	4 × AWG 1/0
			225	700	4 × AWG 2/0
			250	800	4 × AWG 3/0
			300	920	4 × AWG 4/0
			300	1020	4 × 250 kcmil
			350	1140	4 × 300 kcmil
			350	1240	4 × 350 kcmil
			400	1340	4 × 400 kcmil
			450	1520	4 × 500 kcmil

18.1.6 Rated values of the table values

- Ambient conditions T_A of the installed line ≤ 40 °C
- Temperature T_L at the conductor during rated current: 90 °C for UL-listed lines (USA/Canada) or 70 °C for PVC lines
- The rated current of the fuse is approx. 10-20% above the rated current I_{LN} of the converter/supply device or the determined current of the drive system.
- Installation types:
  – B1 according to IEC 60364-5-52, e.g. stranded single conductor installed in the cable channel
  – B2 according to IEC 60364-5-52, e.g. multi-conductor line installed in the cable channel
  – E according to EN 60204-1 e.g. multi-conductor line installed on an open cable rack
  – according to NFPA 79 (external wiring), UL508A (internal wiring), NEC, NFPA 70:
    - 1 cable with 3 lines, 1 neutral conductor and 1 equipment grounding conductor
    - surface mounting in a pipe
    internal wiring: Layout in the control cabinet or in devices
    external wiring: Layout outside the control cabinet
    field wiring: Specifications about cross section of terminals, wired by the user (in the field)
- Recommendation for the fuse design:
  – Internationally, except for USA/Canada:
    - Fuse element according to IEC 60269-1, utilization class gG (fusible cutout)
    - Circuit breaker according to IEC 60898-1/2, type B or C
    - Circuit breaker according to IEC 60947-2/6-2
  – USA/Canada:
    Use cUL-listed fuses (class J; 600 V AC). Can be used at mains supply circuits with max. 42000 A_{eff} symmetrical short-circuit current, max. 500 V. If time-inverted circuit breakers or a motor circuit type E are used instead of fuses, refer to UL61800-5-1, 5.2.3.6.2DV.4.1.3.

Correction factors

The relevant standards specify correction factors for deviating rated values.

In the following, the correction factors for ambient temperatures and number of installed cables and circuits. The determined current in the feeder has to be multiplied with these factors, if required.

Correction factor of ambient temperature

Table 317: Correction factor of ambient temperature according to EN 60204-1:2006 and NFPA 79:2007

Ambient temperature T_A / °C	30	35	40	45	50	55	60
Correction factor according to EN 60204-1:2006, table D.1	0.87	0.93	1.00	1.1	1.22	1.41	1.73
Correction factor according to NFPA 79:2007, table 12.5.5(a)	0.88	0.94	1.00	1.1	1.18	1.32	1.52

Correction factor in case of many lines (laying procedure B2 and E) and circuits (laying procedure B1[1)])

Table 318: Correction factor in case of many lines and circuits according to EN 60204-1:2006 and NFPA 79:2007

Number of lines	1	2	3	4	5
Correction factor according to EN 60204-1:2006, table D.2	1	1.25	1.43	1.54	1.67
Correction factor according to NFPA 79:2007, table 12.5.5(a)	1	1.25			
1) Three single conductors (L1, L2, L3) for power supply of a device are considered as one circuit.					

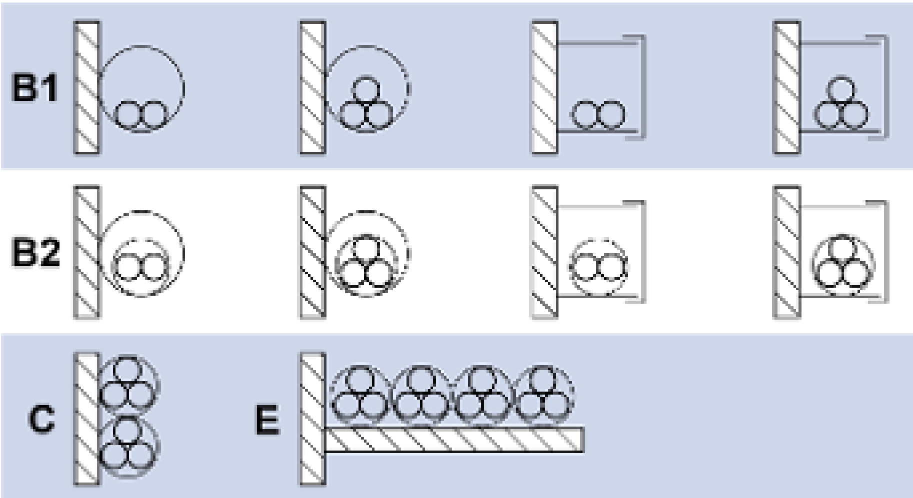


Fig. 165: Installation types (cf. IEC 60364-5-52; VDE 0298-4; EN 60204-1)
B1 Conductor in installation conduits and installation channels to be opened
B2 Channels or lines in installation conduits and installation channels to be opened
C Cables or lines on walls
E Cables or lines on open cable racks

18.2 Determining the leakage capacitance

The capacitances generating so-called earth current at the output of inverters are considered as leakage capacitance C_{ab}. Decisive parameters for the total value of the leakage capacitance C_{ab_g}:

- Capacitances of output filters
- Capacitances of power cables (capacitance per unit length against ground and ground wire)
- Capacitances of motors (winding capacitance against housing)

The leakage capacitance is composed of values of power cables and motors of all individual drives operated at the mains filter.

Calculation:

$C_{ab\_g} = C_{ab\_Mg} + C_{ab\_Kg}$

C_{ab_g}: Total value of leakage capacitance

C_{ab_Mg}: Total value of leakage capacitance of the motor

C_{ab_Kg}: Total value of leakage capacitance of the cable

The total capacitance C_{ab_Mg} is composed of the sum of the capacitances of the individual motors. These individual capacitances can be found in the motor documentation.

$C_{ab\_Mg} = C_{ab\ (Motor\_1)} + C_{ab\ (Motor\_2)} + \ldots + C_{ab\ (Motor\_n)}$

$C_{ab(Motor)}$: Leakage capacitance of a motor

$C_{ab\_Kg} = C_{Y\_K\ typ\ (K1)} + C_{Y\_K\ typ\ (K2)} + \ldots + C_{Y\_K\ typ\ (Kn)}$

$C_{Y\_K\ typ}$: Capacitance per unit length of cable

C_{ab_Kg}: Total leakage capacitance of cable

The total capacitance C_{ab_Kg} is composed of the sum of the capacitances of the individual power cables. The individual capacitances per unit lengths are listed in the technical data of the power cable.

Appendix

18.3 Replacing the fan

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** Before working with live parts: De-energize installation and secure power switch against unintentional or unauthorized reconnection. Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**. Make sure voltage has fallen below 50 V before touching live parts!

Ordering a new fan:

– Write down **serial number** of device for which the fan is to be replaced
– Contact Rexroth's **service team** and order a new fan with the serial number
  Mail: ➦service.svc@boschrexroth.de
  Tel.: +49 9352 40 5060

18.3.1 Fan (plug-in principle)

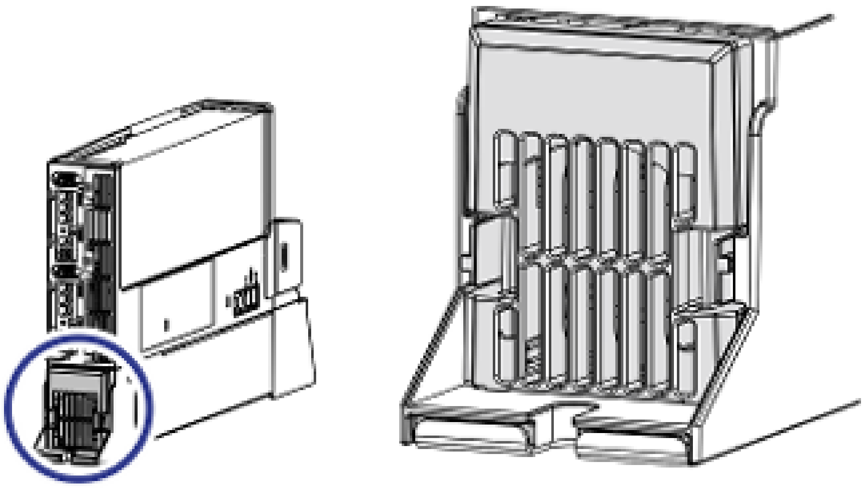
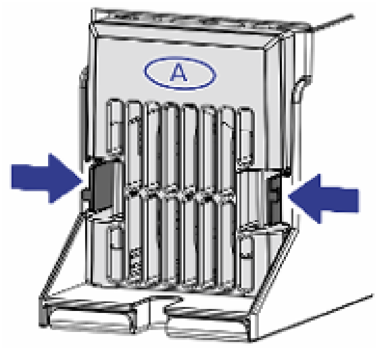
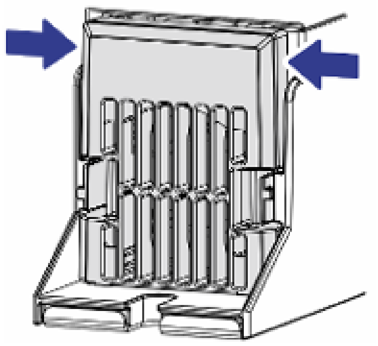
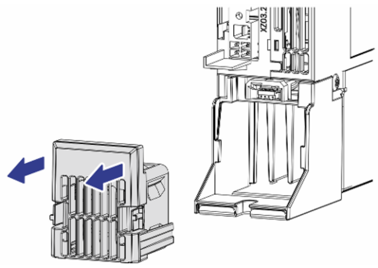
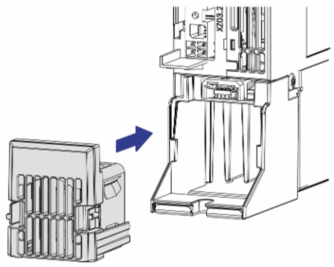


Fig. 166: Fan at device

Table 319: Replacing the fan

	Dismounting the fan in **2 steps**: **Step 1:** Press engagement hooks with your thumb and index finger and slightly pull the fan so that the fan unlatches. Fan now still is connected to the device in area **A**.
	**Step 2:** Grasp top of fan with your thumb and index finger and pull it from the device.
	**Installing the fan:** Push fan into the device until engagement hooks click into place.

18.3.2 Fan (swivel principle)

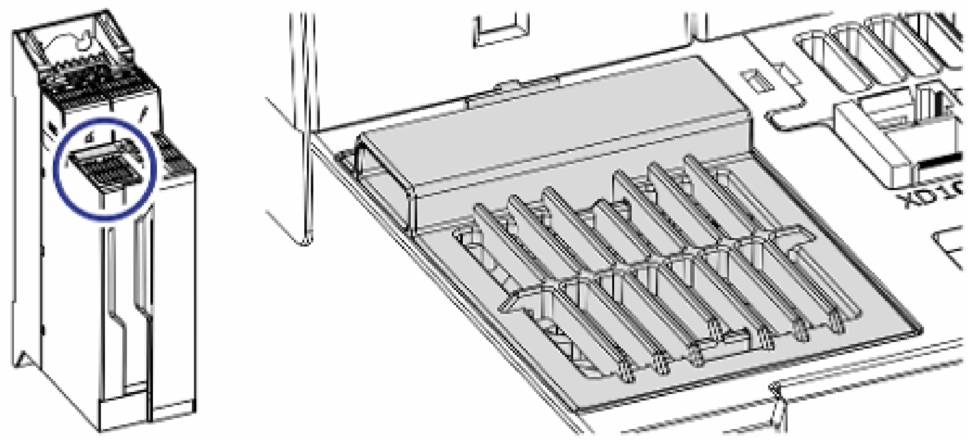
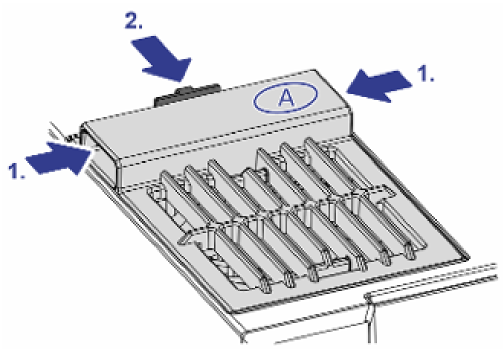
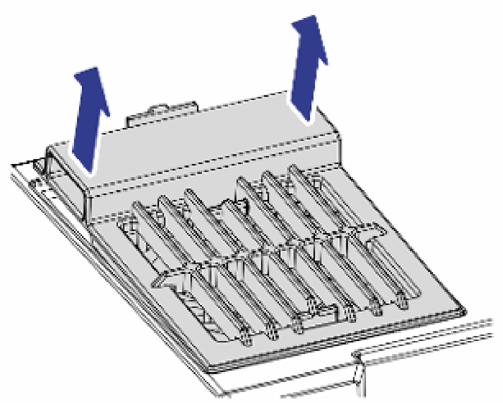
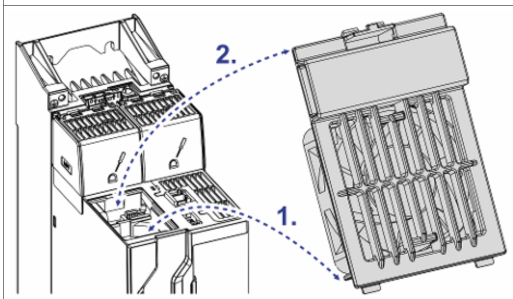


Fig. 167: Fan at device

Table 320: Replacing the fan

	1. Grasp fan with your thumb and middle finger. 2. With your index finger, press engagement hook and slightly pull the fan so that the fan unlatches. Fan now still is connected to the device in area A.
	Swivel fan upwards and take it from device.
	**Installing the fan:** 1. Insert the fan. 2. Swivel fan downwards until engagement hook clicks into place.

18.3.3 Fan (ctrlX CORE)

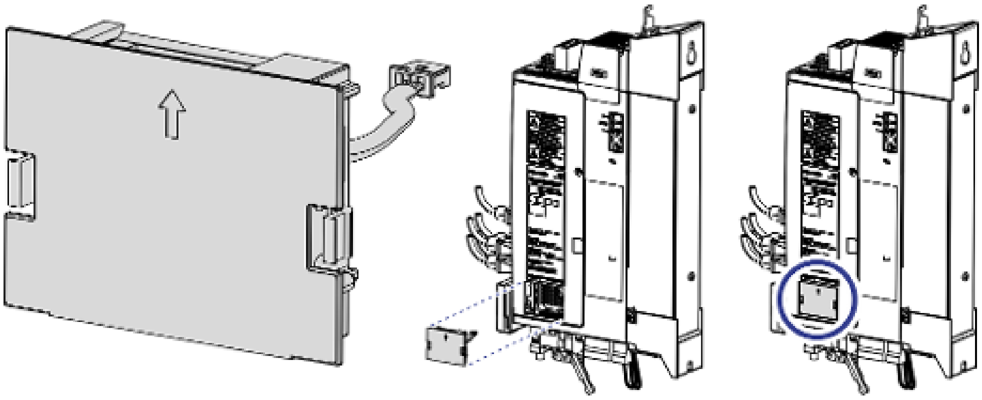
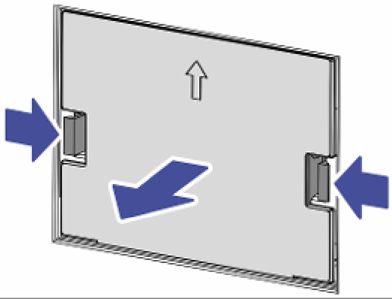
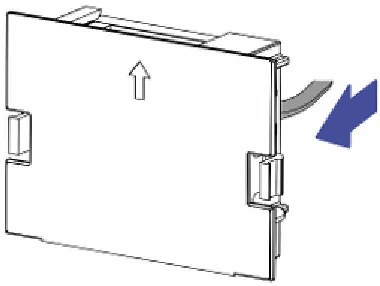
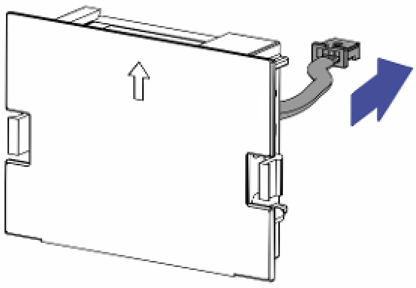
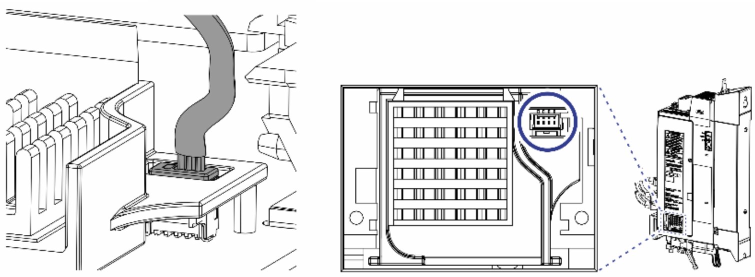
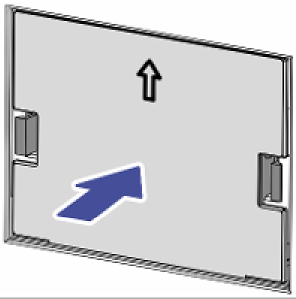


Fig. 168: Fan (ctrlX CORE)

Table 321: Replacing the fan

	Press engagement hooks with your thumb and index finger and slightly pull the fan so that the fan unlatches. Fan now still is connected to the device via a cable.
	Slightly pull the cable to disconnect fan from device.
	**Installing the fan:** Plug connector into device until connector sits flush with the plastic frame (if necessary, use an appropriate tool such as tweezers or pointed pliers): 

	Push fan (with the arrow pointing upwards) into the device until engagement hooks click into place.

18.4 RSC - Relative Short Circuit Power

RSC

RSC is the relation of the short circuit power S_{k_mains} at the connection point of the mains to the rated apparent power $S_{inverter}$ of the connected inverter, or the relation of the short circuit current I_{k_mains} at the connection point of the mains to the maximum current $I_{inverter}$ of the inverter.

$RSC = S_{k\_mains} \div S_{inverter}$

$RSC = I_{k\_mains} \div I_{inverter}$

The RSC has a strong impact on low-frequency mains pollution transmitted by the inverter.

The stronger the mains related to the converter load (RSC high), the lesser the harmonics produced by the inverter affect the shape of the mains voltage and thus other connected loads.

RSC > 50

"Strong mains": With the same load, the mains current has somewhat higher current harmonics. The current harmonics do not cause any noticeable voltage distortions at the low system impedance.

XVR can be operated without any problem.

Trouble-free operation of XVE or XCS is only possible with a mains choke. Operating XVE or XCS without mains choke is not recommended, since the rectifier current peaks might become too high.

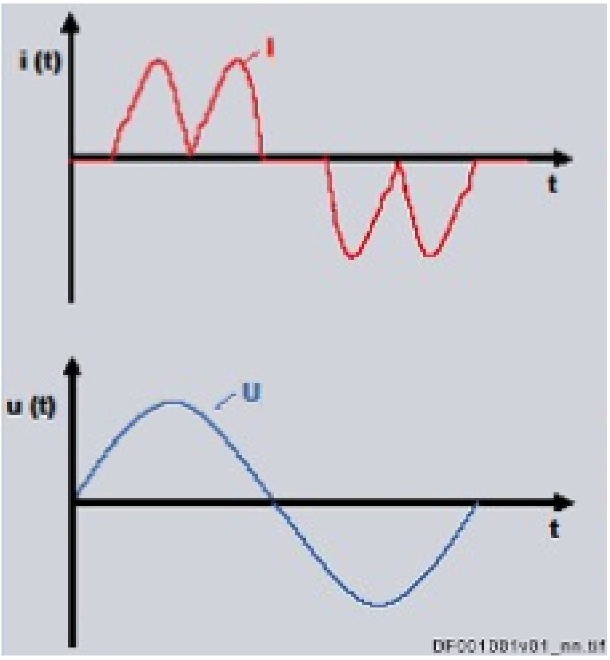


Fig. 169: Characteristic of mains current (I) and mains voltage (U) at RSC > 50

15 < RSC < 50

ctrlX DRIVE can be operated without any problem. The THD values worsen as the RSC is reduced.

5 < RSC < 15

"Weak mains": The current harmonics cause noticeable voltage distortions at the high system impedance.

Operating ctrlX DRIVE might be problematic:

- Mains voltage increased
- Control dynamics affected
- EMC limit values not complied with
- Overcurrent protection reduced

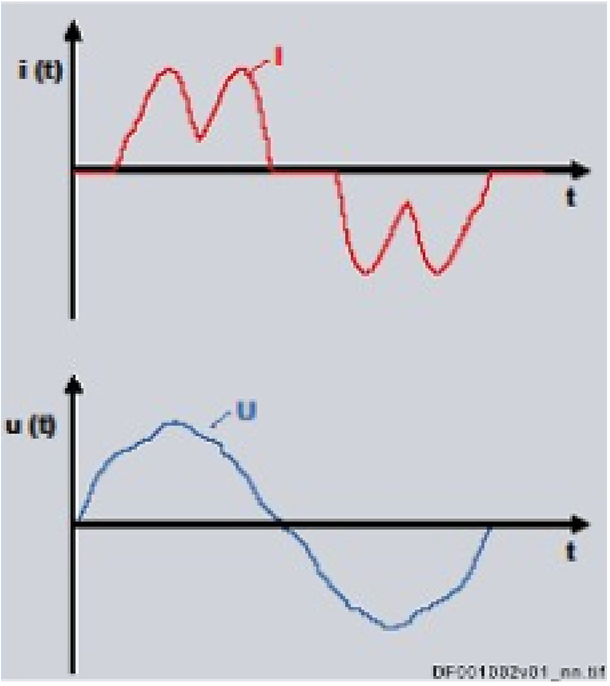


Fig. 170: Characteristic of mains current (I) and mains voltage (U) at RSC < 15

RSC < 5

It is not allowed to operate ctrlX DRIVE.

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