Product catalogue of frequency inverters

- MX eco 4V
- MX pro 4V
- MX pro 6V
- MX multi-eco
- MX multi-pro

Schneider Electric

With MX frequency inverters you make the right choice quickly !

The catalogue in hand supports you with this by means of:

- **Product overview** for a fast selection of the suitable product range
- **Application tips** in order to prevent difficulties
- Clear **technical data**

As one of the leading providers of frequency inverters and motors, quality is top priority.

Our quality management system fulfils therefore all guidelines of the DIN ISO 9001 standard (identical with EN 29 001 and ISO 9001).

General remarks

The following symbols should assist you in handling the instructions:

Advice, tip !

General information, note exactly !

The requirements for successful commissioning are correct selection of the device, proper planning and installation. If you have any further questions, please contact the supplier of the device.

Specifications in this document

We are always anxious to improve our products and adapt them to the latest state of the art. Therefore, we reserve the right to modify the specifications given in this document at any time, particular those referring to weights and dimensions. All planning recommendations and connection examples are non-binding suggestions for which we cannot assume liability, particularly because the regulations to be complied depend on the type and place of installation and on the use of the devices.

All foreign-language translations result from the German or English version. Please consider those in case of unclarity.

Basis of contract

The specifications in text and drawings of this document are no subject of contract in the legal sense without explicit confirmation.

Regulations

The user is responsible to ensure that the device and its components are used in compliance with the applicable regulations. It is not permitted to use these devices in residential environments without special measures to suppress radio frequency interferences.

Trademark rights

Please note that we do not guarantee that the connections, devices and processes described herein are free from patent or trademark rights of third parties.

Copyright

Product catalogue of frequency inverters
MX eco & pro

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8 P01 002 EN.08/08

Schneider Electric Power Drives

Schneider Electric Power Drives a new powerful company name, MX a long established powerful frequency inverter product with the most modern technology, industrial design and utmost user-friendliness.

With more than 30 years experience in the area of electronic drive engineering and as competence centre for drive engineering in the former ELIN concern we are now, as Schneider Electric Power Drives, the drives specialists in the global concern Schneider Electric. Schneider Electric is a group with more than 100,000 employees worldwide and a business volume of €13 billion, a byword for industrial continuity and technological progress.

Our sales team comprises of a network of specialists in order to solve your complex drive demands right up to the high power ranges and above.

A close interconnection between user and development guarantees innovation with uncompromising targets at customer’s benefits. A flexible production line and a coordinating logistics system guarantees the on schedule availability of the MX frequency inverters.

With MX frequency inverters you always make the right choice.

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MX eco	MX pro
	
Product range	
Frequency inverter for the speed control of three-phase asynchronous motors	
Brief description	
New generation of frequency inverters with numerous option possibilities and an extensive list of functions as built-in unit or for wall-mounting	
Applications	
Pumps, fans, compressors and screw conveyors in buildings, communities and facilities	All drives with high performance in industry, machine building and automation
Power ranges	
MX eco 4V: 0.75...630 kW	MX pro 4V: 0.75...500/630 kW MX pro 6V: 2.2/3.0…630/800 kW
Voltage ranges	
3 AC 380...440 V; 50 Hz 3 AC 380...480 V; 60 Hz	MX pro 4V: 3 AC 380...440 V; 50 / 60 Hz MX pro 6V: 3 AC 500...690 V; 50 / 60 Hz
Interfaces	
Consistent interfaces at all MX devices from 0.75 to 2,400 kW Removable matrix operating panel, extensible terminals, RS 485 / Modbus, Profibus DP, CANopen	
Protection degree	
Built-in units: IP31 / IP20 Wall-mounting devices: IP31	Built-in units: IP31 / IP20 Wall-mounting devices: IP31

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MX multi-eco	MX multi-pro
	

Product range

Frequency inverter in cubicle design for speed control of three-phase drives

Brief description

High-quality frequency inverters in cubicle design for performance up to 2.4 MW,
alternatively with liquid cooling

Applications

Drives with high-performance in industry, machine building and automation as well as standard applications for fans, pumps and compressors.

Power ranges

MX multi-eco 4V: 22 … 630 kW	MX multi-pro 4V & 4C: 22...1400 kW MX multi-pro 5V & 5C: 18...1800 kW MX multi-pro 6V & 6C: 22...2400 kW

Voltage ranges

MX multi-eco: 3 AC 400 (380, 415) V; 50/60 Hz	MX multi-pro 4V & 4C: 3 AC 400 (380, 415) V; 50/60 Hz MX multi-pro 5V & 5C: 3 AC 500 (525) V; 50/60 Hz MX multi-pro 6V & 6C: 3 AC 690 V; 50/60 Hz

Interfaces

Consistent interfaces at all MX devices from 0.75 to 2,400 kW
Removable matrix operating panel, extensible terminals,
RS 485 / Modbus, Profibus DP, CANopen

Protection degree

Cubicle units: IP23, IP54 (alternatively with separated air flow) or
IP55 (in liquid cooled design)

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MX pro 4L & 6L	AFE
	
Product range	
Water-cooled frequency inverter for speed control of three-phase drives	Active Front End
Brief description	
The MX pro 4L & 6L is equipped with a corrosion-resistant cooling circuit which is suitable for industrial water and a mixture of water and glycol	Option for MX eco/pro to return excess energy to the mains as well as to reduce the mains current harmonics
Applications	
The main fields of application are mining and machine building	Mains-supply and -regenerating unit and use as "Low harmonic drive"
Power ranges	
MX pro 4L: 90 …630 kW MX pro 6L: 110...800 kW	AFE 4V: 120...675 kW AFE 6V: 145...860 kW
Voltage ranges	
3 AC 380...480 V; 50 / 60 Hz 3 AC 500...690 V; 50 / 60 Hz	3 AC 380...480 V; 50 / 60 Hz 3 AC 500...690 V; 50 / 60 Hz
Interfaces	
Consistent interfaces at all MX devices from 0.75 to 2,400 kW Removable matrix operating panel, extensible terminals, RS 485 / Modbus, Profibus DP, CANopen	
Protection degree	
Built-in units: IP00	Built-in units: IP00

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Drive systems

Our range of products
Drive systems
Brief description
The whole drive strand consisting of transformer, frequency inverter and motor. With wiring on request.
Applications
Projects for facilities and industry
Power ranges
Low voltage up to 2,400 kW motor shaft power Medium voltage up to 11,000 kW motor shaft power
Voltage ranges
Low voltage: 400 ... 690 V Medium voltage: 3.3 kV
Services
Application consulting, engineering, commissioning, maintenance and service

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MX eco Products

For standard drives in buildings, communities and industry

With the MX eco you decide in favour for a simple, robust frequency inverter which covers a very wide range of applications by means of its option possibilities.

The standard built-in LED keypad, the exceedingly user-friendly Matrix operating panel or the PC software Matrix 3 can be selected for operation.

In addition to the standard terminals, two additional terminal extension cards and various fieldbus options are available for control.

When installing the inverter the standard built-in unit can be extended to a well-protected wall-mounting device by means of a simple terminal box.

To install the inverter, various options are available for a safe integration in the electrical energy flow without interfering reactions.

Optimised device features suitable for your application range:

Application	Device features
Pump drives in industry, residential environment and communities, from 0.75 to 630 kW	– Cascade control for up to 4 pumps in different circuit variations – Integrated PID controller for pressure, flow, quantity or filling level – An energy saving mode ensures highest efficiency of the whole drive also in partial load range
Fan drives for air conditioning, combustion, flue gas hood, tunnel ventilation and many more	– Separate operation mode "Emergency operation" can be selected to protect people in case of fire – Automatic motor recognition enables the safe operation of the service switch – Excellent braking action of the drive without additional components
Compressors, screw conveyors, stirrer drives and many more for use e.g. in waste water treatment plants	– Varnished printed circuit boards offer the best protection against environmental influences – Integrated logic modules for varied control tasks in the system – Built-in RFI filter for 1st environment "Residential environments" and 2nd environment "Industrial environments" up to 630 kW

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MX eco 4V

General technical data	
Mains voltage	3-phase 380…440 V -15 +10 %; 50 Hz ±5 % 3-phase 380…480 V -15 +10 %; 60 Hz ±5 %
Maximum current	120 % for 60 s per 10 minutes, 135 % for 2 seconds
Design	Built in unit with protection degree IP20, from 90 kW IP20 / IP00 Wall-mounting device with protection degree IP41 / IP21, from 90 kW IP31
Operating temperature	-10...+50°C (+45°C from 110 kW), up to +60°C with derating
Interfaces	Removable Matrix operating panel, extensible terminals, RS 485 / Modbus, Profibus DP, CANopen
Special functions	RFI filter built-in for 1st "residential environment", from 5.5 kW built-in for 2nd "industrial environment" function "Safe Standstill" according to EN 954-1 / ISO 13849-1 category 3
Standards	CE, UL, CSA, GOST, ATEX

	Motor output	Output current	Dimensions W x H x D	Order code 1.)
MX eco 4V0,75	0.75 kW	2.3 A	130 x 230 x 175 mm	ELNME4U07AAA
MX eco 4V1,5	1.5 kW	4.1 A	130 x 230 x 175 mm	ELNME4U15AAA
MX eco 4V2,2	2.2 kW	5.8 A	130 x 230 x 175 mm	ELNME4U22AAA
MX eco 4V3,0	3.0 kW	7.8 A	155 x 260 x 187 mm	ELNME4U30AAA
MX eco 4V4,0	4.0 kW	10.5 A	155 x 260 x 187 mm	ELNME4U40AAA
MX eco 4V5,5	5.5 kW	14.3 A	175 x 295 x 187 mm	ELNME4U55AAA
MX eco 4V7,5	7.5 kW	17.6 A	175 x 295 x 187 mm	ELNME4U75AAA
MX eco 4V11	11 kW	27.7 A	210 x 295 x 213 mm	ELNME4D11AAA
MX eco 4V15	15 kW	33 A	230 x 400 x 213 mm	ELNME4D15AAA
MX eco 4V18	18.5 kW	41 A	230 x 400 x 213 mm	ELNME4D18AAA
MX eco 4V22	22 kW	48 A	240 x 420 x 236 mm	ELNME4D22AAA
MX eco 4V30	30 kW	66 A	240 x 550 x 266 mm	ELNME4D30AAA
MX eco 4V37	37 kW	79 A	240 x 550 x 266 mm	ELNME4D37AAA
MX eco 4V45	45 kW	94 A	320 x 630 x 290 mm	ELNME4D45AAA
MX eco 4V55	55 kW	116 A	320 x 630 x 290 mm	ELNME4D55AAA
MX eco 4V75	75 kW	160 A	320 x 630 x 290 mm	ELNME4D75AAA
MX eco 4V90	90 kW	179 A	310 x 680 x 377 mm	ELNME4D90DAA 2.)
MX eco 4V110	110 kW	215 A	310 x 680 x 377 mm	ELNME4C11DAA 2.)
MX eco 4V132	132 kW	259 A	350 x 782 x 377 mm	ELNME4C13DAA 2.)
MX eco 4V160	160 kW	314 A	330 x 950 x 377 mm	ELNME4C16DAA 2.)
MX eco 4V200	200 kW	387 A	430 x 950 x 377 mm	ELNME4C20DAA 2.)
MX eco 4V250	250 kW	481 A	585 x 950 x 377 mm	ELNME4C25DAA 2.)
MX eco 4V315	315 kW	616 A	585 x 950 x 377 mm	ELNME4C31DAA 2.)
MX eco 4V355	355 kW	671 A	880 x 1150 x 377 mm	ELNME4C35DAA 2.)
MX eco 4V400	400 kW	759 A	880 x 1150 x 377 mm	ELNME4C40DAA 2.)
MX eco 4V500	500 kW	941 A	880 x 1150 x 377 mm	ELNME4C50DAA 2.)
MX eco 4V630	630 kW	1188 A	1110 x 1150 x 377 mm	ELNME4C63DAA 2.)

1.) The Matrix operating panel BE11 is to be ordered separately.

2.) The order code for inverters without DCL box is ELNME4xxxAAA.

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MX pro Products

For all drives with high performance in industry, machine building and automation

With the MX pro you decide in favour for an utmost multifunctional frequency inverter which covers a very wide range of applications by means of its option possibilities and numerous functions.

The standard built-in LED keypad, the exceedingly user-friendly Matrix operating panel or the PC software Matrix 3 can be selected for operation.

In addition to the standard terminals, two different terminal extension cards, various fieldbus options and the possibility of the speed feedback are available to control.

In addition to the classical use as a built-in unit or wall-mounting device the solution "Flange mounting" can be selected for mounting of the inverter.

To install the inverter, various options are available for a safe integration in the electrical energy flow without interfering reactions.

Optimised device features suitable for your application range:

Application	Device features
Coupled drives system such as sheet metal processing machines	– Master/Slave control for balanced load distribution with group drives – Simple possibility of coupling the DC link provides an optimum balance of energy – Safety function "Safe Standstill" also with coupled drives
Drives with energy regeneration to the mains or to braking resistors such as e.g. crane hoisting and carriages	– Extremely efficient braking option up to 630 kW with 50% overload, built-in braking unit as standard up to 200 kW – Extended crane functions increase the safety and accelerate the operating cycle – Set of motor data and parameter sets which an be switched separately
Intelligent drive solutions with functions for control and monitoring directly in the drive	– Integrated logic modules for varied control tasks – Positioning functionality and position switch evaluation for quick production plants – Free configurable alarm categories increase the safety and availability of the system
Synchronous motors	– Standard starting torque without speed feedback – High starting torque with speed feedback (MX pro ...-SY with another order code)
Medium voltage motors	– Motors up to 6000 V with step-up transformer (MX pro ...-MV with another order code)

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MX pro 4V

General technical data	
Mains voltage	3-phase 380…440 V -15 +10 %; 50 Hz ±5 % 3-phase 380…480 V -15 +10 %; 60 Hz ±5 %
Maximum current	150 % for 60 s per 10 minutes, 165 % for 2 seconds at power 1 120 % for 60 s or 135 % for 2 s at power 2 from 110 kW
Design	Built in unit with protection degree IP20, from 90 kW IP20 / IP00 Wall-mounting device with protection degree IP41 / IP21, from 90 kW IP31
Operating temperature	-10...+50°C (+45°C from 110 kW at power 2), up to +60°C with derating
Interfaces	Removable matrix operating panel, extensible terminals, speed feedback, RS 485 / Modbus, Profibus DP, CANopen
Special functions	RFI filter built-in for 1st "residential environment", from 5.5 kW built-in for 2nd "industrial environment" braking unit built-in up to 200 kW, above as option function "Safe Standstill" according to EN 954-1 / ISO 13849-1 category 3
Standards	CE, UL, CSA, GOST, ATEX

	Motor output	Output current	Dimensions W x H x D	Order code 1.)
MX pro 4V0,75	0.75 kW	2.3 A	130 x 230 x 175 mm	ELNMP4U07AAB
MX pro 4V1,5	1.5 kW	4.1 A	130 x 230 x 175 mm	ELNMP4U15AAB
MX pro 4V2,2	2.2 kW	5.8 A	130 x 230 x 175 mm	ELNMP4U22AAB
MX pro 4V3,0	3.0 kW	7.8 A	155 x 260 x 187 mm	ELNMP4U30AAB
MX pro 4V4,0	4.0 kW	10.5 A	155 x 260 x 187 mm	ELNMP4U40AAB
MX pro 4V5,5	5.5 kW	14.3 A	175 x 295 x 187 mm	ELNMP4U55AAB
MX pro 4V7,5	7.5 kW	17.6 A	175 x 295 x 187 mm	ELNMP4U75AAB
MX pro 4V11	11 kW	27.7 A	210 x 295 x 213 mm	ELNMP4D11AAB
MX pro 4V15	15 kW	33 A	230 x 400 x 213 mm	ELNMP4D15AAB
MX pro 4V18	18.5 kW	41 A	230 x 400 x 213 mm	ELNMP4D18AAB
MX pro 4V22	22 kW	48 A	240 x 420 x 236 mm	ELNMP4D22AAB
MX pro 4V30	30 kW	66 A	240 x 550 x 266 mm	ELNMP4D30AAB
MX pro 4V37	37 kW	79 A	240 x 550 x 266 mm	ELNMP4D37AAB
MX pro 4V45	45 kW	94 A	320 x 630 x 290 mm	ELNMP4D45AAB
MX pro 4V55	55 kW	116 A	320 x 630 x 290 mm	ELNMP4D55AAB
MX pro 4V75	75 kW	160 A	320 x 630 x 290 mm	ELNMP4D75AAB
MX pro 4V90/110	90/110 kW	179/215 A	310 x 680 x 377 mm	ELNMP4D90DAB 2.)
MX pro 4V110/132	110/132 kW	215/259 A	350 x 782 x 377 mm	ELNMP4C11DAB 2.)
MX pro 4V132/160	132/160 kW	259/314 A	330 x 950 x 377 mm	ELNMP4C13DAB 2.)
MX pro 4V160/200	160/200 kW	314/387 A	430 x 950 x 377 mm	ELNMP4C16DAB 2.)
MX pro 4V200/250	200/250 kW	387/481 A	585 x 950 x 377 mm	ELNMP4C20DAA 2.) 3.)
MX pro 4V250/315	250/315 kW	481/616 A	585 x 950 x 377 mm	ELNMP4C25DAA 2.) 3.)
MX pro 4V315/400	315/400 kW	616/759 A	880 x 1150 x 377 mm	ELNMP4C31DAA 2.) 3.)
MX pro 4V400/500	400/500 kW	759/941 A	880 x 1150 x 377 mm	ELNMP4C40DAA 2.) 3.)
MX pro 4V500/630	500/630 kW	941/1188 A	1110 x 1150 x 377 mm	ELNMP4C50DAA 2.) 3.)

1.) The Matrix operating panel BE11 is to be ordered separately.
In case of drives with synchronous motors or step-up transformers another order code is required.

2.) The order code for inverters without DCL box is ELNMP4xxxAAx.

3.) The braking option is an optional component.

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MX pro 6V

General technical data	
Mains voltage	3-phase 500V -15% … 690V+10%; 50/60Hz+/-5%
Maximum current	P1: 150 % for 60 s per 10 minutes, 165 % for 2 seconds P2: 120 % for 60 s per 10 minutes, 135 % for 2 seconds
Design	Built in unit with protection degree IP20, from 90/110 kW IP20 / IP00 Wall-mounting device with protection degree IP41/IP21, from 90/110 kW IP31
Operating temperature	P1: -10...+50°C, up to +60°C with derating P2: -10...+45°C, up to +55°C with derating
Interfaces	Removable matrix operating panel, extensible terminals, speed feedback, RS 485 / Modbus, Profibus DP, CANopen
Special functions	RFI filter built-in for 2nd "industrial environment" category C3 braking unit built-in up to 160/200 kW, above as option function "Safe Standstill" according to EN 954-1 / ISO 13849-1 category 3
Standards	CE, UL, CSA, GOST, ATEX

	Motor output (500 V P1/P2) 690 V P1/P2	Output current (500 V P1/P2) 690 V P1/P2	Dimensions W x H x D [mm]	Order code 1.)
MX pro 6V2,2/3,0	(1.5/2.2) 2.2/3.0 kW	(3.2/4.5) 4.0/4.5 A	240 x 420 x 236	ELNMP6U22AAB
MX pro 6V3,0/4,0	(2.2/3.0) 3.0/4.0 kW	(4.5/5.8) 4.5/5.5 A	240 x 420 x 236	ELNMP6U30AAB
MX pro 6V4,0/5,5	(3.0/4.0) 4.0/5.5 kW	(5.8/7.5) 5.5/7.5 A	240 x 420 x 236	ELNMP6U40AAB
MX pro 6V5,5/7,5	(4.0/5.5) 5.5/7.5 kW	(7.5/10) 7.5/10 A	240 x 420 x 236	ELNMP6U55AAB
MX pro 6V7,5/11	(5.5/7.5) 7.5/11 kW	(10/13.5) 10/13.5 A	240 x 420 x 236	ELNMP6U75AAB
MX pro 6V11/15	(7.5/11) 11/15 kW	(13.5/18.5) 13.5/18.5 A	240 x 420 x 236	ELNMP6D11AAB
MX pro 6V15/18	(11/15) 15/18 kW	(18.5/24) 18.5/24 A	240 x 420 x 236	ELNMP6D15AAB
MX pro 6V18/22	(15/18) 18/22 kW	(24/29) 24/27 A	240 x 420 x 236	ELNMP6D18AAB
MX pro 6V22/30	(18/22) 22/30 kW	(29/35) 27/35 A	240 x 420 x 236	ELNMP6D22AAB
MX pro 6V30/37	(22/30) 30/37 kW	(35/47) 35/43 A	320 x 630 x 290	ELNMP6D30AAB
MX pro 6V37/45	(30/37) 37/45 kW	(47/59) 43/54 A	320 x 630 x 290	ELNMP6D37AAB
MX pro 6V45/55	(37/45) 45/55 kW	(59/68) 54/62 A	320 x 630 x 290	ELNMP6D45AAB
MX pro 6V55/75	(45/55) 55/75 kW	(68/85) 62/84 A	320 x 630 x 290	ELNMP6D55AAB
MX pro 6V75/90	(55/75) 75/90 kW	(85/110) 84/104 A	320 x 630 x 290	ELNMP6D75AAB
MX pro 6V90/110	(75/90) 90/110 kW	(110/136) 104/125 A	330 x 950 x 377	ELNMP6D90TAB [2.)]
MX pro 6V110/132	(90/110) 110/132 kW	(136/165) 125/150 A	330 x 950 x 377	ELNMP6C11TAB [2.)]
MX pro 6V132/160	(110/132) 132/160 kW	(165/200) 150/180 A	330 x 950 x 377	ELNMP6C13TAB [2.)]
MX pro 6V160/200	(132/160) 160/200 kW	(200/240) 180/220 A	330 x 950 x 377	ELNMP6C16TAB [2.)]
MX pro 6V200/250	(160/200) 200/250 kW	(240/312) 220/290 A	585 x 950 x 377	ELNMP6C20TAA [2.) 3.)]
MX pro 6V250/315	(200/250) 250/315 kW	(312/390) 290/355 A	585 x 950 x 377	ELNMP6C25TAA [2.) 3.)]
MX pro 6V315/400	(250/315) 315/400 kW	(390/462) 355/420 A	585 x 950 x 377	ELNMP6C31TAA [2.) 3.)]
MX pro 6V400/500	(315/400) 400/500 kW	(462/590) 420/543 A	1110 x 1150 x 377	ELNMP6C40TAA [2.) 3.)]
MX pro 6V500/630	(400/500) 500/630 kW	(590/740) 543/675 A	1110 x 1150 x 377	ELNMP6C50TAA [2.) 3.)]
MX pro 6V630/800	(500/630) 630/800 kW	(740/900) 675/840 A	1110 x 1150 x 377	ELNMP6C63TAA [2.) 3.)]

1.) The Matrix operating panel BE11 is to be ordered separately.
In case of drives with synchronous motors or step-up transformers another order code is required.

2.) The order code for inverters without TRAFO-BOX is ELNMP6xxxAAx.

3.) The braking option is an optional component.

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MX pro 4L & 6L Products - "Liquid cooled"

With the MX pro you decide in favour for an utmost multifunctional frequency inverter which covers a very wide range of applications by means of its option possibilities and numerous functions.

The frequency inverters MX pro 4L & 6L are designed for liquid cooling of the power electronics. Due to the continuously use of corrosion-resistant steel (stainless steel SS) in the cooling circuit it is possible to use industrial water, clean water with or without corrosion protection or a water-glycol-mixture for cooling. As the design of the cooling element is especially robust, the inverter can be operated in closed cooling systems as well as in open cooling systems.

The standard built-in LED keypad, the exceedingly user-friendly Matrix operating panel or the PC software Matrix 3 can be selected for operation.

In addition to the standard terminals, two terminal extension cards, fieldbus options and the possibility of the speed feedback are available to control.

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Optimised device features suitable for your application range:

Application	Device features
Liquid cooling for reduction of the lost heat in the electrical room	When several inverters with high power are installed in an electrical room, the heat dissipation is often problematic. At the devices of type MX pro 4L & 6L the losses of the power electronics are dissipated by the cooling liquid. Only the remaining losses of the inverter are exhausted by the device-internal fans. Thus prevents an increase of temperature inside the enclosure and the installation of an external air conditioning unit can be avoided.
Liquid cooling to increase the protection degree of the enclosure	Due to the ambient conditions there are often enclosures with higher protection degree required. That can be realized for air-cooled inverters of high power only with extraordinary expenses. At the devices of type MX pro 4L & 6L the losses of the power electronics are directly dissipated by the cooling liquid. The remaining losses are exhausted from the enclosure via an air-water-heat exchanger. Usually the air-water-heat exchanger is dimensioned in such a way that it also covers the losses of the other components (NDU, AMF, ...) of the cubicle.
Coupled drive systems	– Master/Slave control for balanced load distribution with group drives – Simple possibility of coupling the DC link provides an optimum balance of energy – Safety function "Safe Standstill" also with coupled drives
Intelligent drive solutions with functions for control and monitoring directly in the drive	– Integrated logic modules for varied control tasks – Positioning functionality and position switch evaluation for quick production plants – Free configurable alarm categories increase the safety and availability of the system

MX pro 4L

General technical data	
Mains voltage	3-phase 380…440 V -15 +10 %; 50 Hz ±5 % 3-phase 380…480 V -15 +10 %; 60 Hz ±5 %
Maximum current	P1: 150 % for 60 s per 10 minutes, 165 % for 2 seconds P2: 120 % for 60 s per 10 minutes, 135 % for 2 seconds
Design	Built in unit with protection degree IP20 / IP00 with liquid cooling of the power electronics
Interfaces	Removable matrix operating panel, extensible terminals, speed feedback, RS 485 / Modbus, Profibus DP, CANopen
Special functions	RFI filter built-in for 2nd "industrial environment" braking unit built-in up to 132/160 kW, above as option function "Safe Standstill" according to EN 954-1 / ISO 13849-1 category 3
Standards	CE (UL, CSA, GOST, ATEX in preparation)

	Motor output	Output current	Dimensions W x H x D	Order code 1.)
MX pro 4L90/110	90/110 kW	179/215 A	330 x 950 x 377 mm	ELNMP4D90LDB
MX pro 4L110/132	110/132 kW	215/259 A	330 x 950 x 377 mm	ELNMP4C11LDB
MX pro 4L132/160	132/160 kW	259/314 A	330 x 950 x 377 mm	ELNMP4C13LDB
MX pro 4L160/200	160/200 kW	314/387 A	585 x 950 x 377 mm	ELNMP4C16LDA 2.)
MX pro 4L200/250	200/250 kW	387/481 A	585 x 950 x 377 mm	ELNMP4C20LDA 2.)
MX pro 4L250/315	250/315 kW	481/616 A	585 x 950 x 377 mm	ELNMP4C25LDA 2.)
MX pro 4L315/400	315/400 kW	616/759 A	1110 x 1150 x 377 mm	ELNMP4C31LDA 2.)
MX pro 4L400/500	400/500 kW	759/941 A	1110 x 1150 x 377 mm	ELNMP4C40LDA 2.)
MX pro 4L500/630	500/630 kW	941/1188 A	1110 x 1150 x 377 mm	ELNMP4C50LDA 2.)

1.) The Matrix operating panel BE11 is to be ordered separately.

2.) The braking option is an optional component.

Detailed information about the frequency inverters MX pro 4L & 6L is given in the "Mounting instructions MX pro 4L & 6L", order number 8 P01 344 EN.

MX pro 6L

General technical data	
Mains voltage	3-phase 500V -15% … 690V+10%; 50/60Hz+/-5%
Maximum current	P1: 150 % for 60 s per 10 minutes, 165 % for 2 seconds P2: 120 % for 60 s per 10 minutes, 135 % for 2 seconds
Design	Built in unit with protection degree IP20 / IP00 with liquid cooling of the power electronics
Interfaces	Removable matrix operating panel, extensible terminals, speed feedback, RS 485 / Modbus, Profibus DP, CANopen
Special functions	RFI filter built-in for 2nd "industrial environment" category C3 braking unit built-in up to 160/200 kW, above as option function "Safe Standstill" according to EN 954-1 / ISO 13849-1 category 3
Standards	CE (UL, CSA, GOST, ATEX in preparation)

	Motor output (500 V P1/P2) 690 V P1/P2	Output current (500 V P1/P2) 690 V P1/P2	Dimensions W x H x D [mm]	Order code 1.)
MX pro 6L110/132	(90/110) 110/132 kW	(136/165) 125/150 A	330 x 950 x 377	ELNMP6C11LDB
MX pro 6L132/160	(110/132) 132/160 kW	(165/200) 150/180 A	330 x 950 x 377	ELNMP6C13LDB
MX pro 6L160/200	(132/160) 160/200 kW	(200/240) 180/220 A	330 x 950 x 377	ELNMP6C16LDB
MX pro 6L200/250	(160/200) 200/250 kW	(240/312) 220/290 A	585 x 950 x 377	ELNMP6C20LDA 2.)
MX pro 6L250/315	(200/250) 250/315 kW	(312/390) 290/355 A	585 x 950 x 377	ELNMP6C25LDA 2.)
MX pro 6L315/400	(250/315) 315/400 kW	(390/462) 355/420 A	585 x 950 x 377	ELNMP6C31LDA 2.)
MX pro 6L400/500	(315/400) 400/500 kW	(462/590) 420/543 A	1110 x 1150 x 377	ELNMP6C40LDA 2.)
MX pro 6L500/630	(400/500) 500/630 kW	(590/740) 543/675 A	1110 x 1150 x 377	ELNMP6C50LDA 2.)
MX pro 6L630/800	(500/630) 630/800 kW	(740/900) 675/840 A	1110 x 1150 x 377	ELNMP6C63LDA 2.)

1.) The Matrix operating panel BE11 is to be ordered separately.
2.) The braking option is an optional component.

Detailed information about the frequency inverters MX pro 4L & 6L is given in the "Mounting instructions MX pro 4L & 6L", order number 8 P01 344 EN.

Product line Active Front End AFE

Mains-supply and -regenerating unit as well as use as "Low harmonic drive"

The Active Front End is an option for the frequency inverter to return energy to the mains. It provides 4-quadrant operation and thus it is well qualified for all applications with generator operating mode.

Additionally the Active Front End has excellent properties for drives with low mains current harmonics. State-of-the-art components, a new control concept as well as a top-quality filter module reduce the total current distortion factor THD(i) to a value less than 4 %.

Optimised device features suitable for your application range:

Application	Device features
Supply and regenerating unit	– Power factor cos Phi 1 independent of the load situation and the energy direction – No converter transformer required – Mains voltage drops up to 40 % without interruption of operation – Wide mains frequency range permitted – Adjustable regenerating power e.g. for operation with diesel generator
"Low harmonic drive"	– THD(i) less than 4 % – Integrated radio frequency interference filter according to EN 61800-3 category C3 – Mains short circuit power up to 100kA permitted – No damping resistors with heavy losses required and thus it is especially robust in respect to heavily distorted mains voltages – Reduction of transformer losses, wiring and switching devices

Detailed information about the product line AFE is given in the "Configuration guide - AFE", order number 8 P01 335 EN.

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Applications / capabilities / design

The Active Front End with quite simple construction is quickly set up. All control connections are pre-assembled and clearly marked. Usually it is sufficient to adjust the existing mains voltage for parameterization of the whole Active Front End.

The Active Front End is connected upstream to the standard frequency inverter and consists of three components:

- Active Infeed Converter
- Line Filter Module (EMC filter, line contactor and charging circuit)
- Line Filter Choke (3 parts)

General technical data		
Voltage / frequency	380...400 V / 440 V / 480 V ±10 %: 500...525 V ±10 %: 575...600 V / 690 V ±10 %:	50/60 Hz ±5 % (30...70 Hz for short periods) 50 Hz ±5 % 50/60 Hz ±5 % (30...70 Hz for short periods)
Overvoltage class	Category III	
Power range	120...860 kW	
Overload	+20 % for 60 seconds per 10 minutes	
Operating temperature	-10...+45 °C (+60 °C with derating)	
Protection degree	IP00	
Control concept	Controllable via terminals, CANopen bus or Modbus built-in, other field busses via option cards	
Standards	Devices are designed, built and tested on the basis of EN 61800-5-1	
Approvals	CE, UL, CSA	

Inverter MX		Active Front End Type	AIC	LFM	LFC
up to MX eco 4V110	up to MX pro 4V90/110	400V 120kW	VW3A7250	VW3A7260	VW3A7265
MX eco 4V132	MX pro 4V110/132	400V 145kW	VW3A7251	VW3A7261	VW3A7266
MX eco 4V160	MX pro 4V132/160	400V 175kW	VW3A7252	VW3A7261	VW3A7266
MX eco 4V200	MX pro 4V160/200	400V 240kW	VW3A7253	VW3A7262	VW3A7267
MX eco 4V250	MX pro 4V200/250	400V 275kW	VW3A7254	VW3A7262	VW3A7267
MX eco 4V315	MX pro 4V250/315	400V 340kW	VW3A7255	VW3A7262	VW3A7267
MX eco 4V355...4V400	MX pro 4V315/400	400V 430kW	VW3A7256	2xVW3A7262	2xVW3A7267
MX eco 4V500	MX pro 4V400/500	400V 540kW	VW3A7257	2xVW3A7262	2xVW3A7267
MX eco 4V630	MX pro 4V500/630	400V 675kW	VW3A7258	2xVW3A7262	2xVW3A7267
up to MX eco 4V110	up to MX pro 4V90/110	480V 120kW	VW3A7250	VW3A7260	VW3A7265
MX eco 4V132	MX pro 4V110/132	480V 145kW	VW3A7251	VW3A7261	VW3A7266
-	MX pro 4V132/160	480V 175kW	VW3A7252	VW3A7261	VW3A7266
MX eco 4V160...4V200	MX pro 4V160/200	480V 240kW	VW3A7283	VW3A7262	VW3A7267
MX eco 4V250	MX pro 4V200/250	480V 275kW	VW3A7254	VW3A7262	VW3A7267
MX eco 4V315	MX pro 4V250/315	480V 340kW	VW3A7255	VW3A7262	VW3A7267
MX eco 4V355...4V400	MX pro 4V315/400	480V 430kW	VW3A7286	2xVW3A7262	2xVW3A7267
MX eco 4V500	MX pro 4V400/500	480V 540kW	VW3A7287	2xVW3A7262	2xVW3A7267
MX eco 4V630	MX pro 4V500/630	480V 675kW	VW3A7258	2xVW3A7262	2xVW3A7267
-	MX pro 6V90/110 & 6V110/132	690V 145kW	VW3A7270	VW3A7263	VW3A7268
-	MX pro 6V132/160	690V 175kW	VW3A7271	VW3A7263	VW3A7268
-	MX pro 6V160/200	690V 220kW	VW3A7272	VW3A7263	VW3A7268
-	MX pro 6V200/250	690V 275kW	VW3A7273	VW3A7264	VW3A7269
-	MX pro 6V250/315	690V 340kW	VW3A7274	VW3A7264	VW3A7269
-	MX pro 6V315/400	690V 430kW	VW3A7275	VW3A7264	VW3A7269
-	MX pro 6V400/500	690V 540kW	VW3A7276	2xVW3A7264	2xVW3A7269
-	MX pro 6V500/630	690V 675kW	VW3A7277	2xVW3A7264	2xVW3A7269
-	MX pro 6V630/800	690V 860kW	VW3A7278	2xVW3A7264	2xVW3A7269

MX multi cubicle design

High-performance drives in a cubicle design for industry, machine building and automation

Frequency inverter standard cubicle

The concept of the MX multi offers standard cubicles ready to connect. The modular construction makes it possible to adapt the cubicle to the individual requests. The economic cubicle version makes the planning easy and ensures a quick installation and commissioning of the drive.

Basic equipment of the MX multi

The MX multi is an extension to the frequency inverter offer. The basic equipment contains a frequency inverter MX eco or MX pro, main fuses, main switch, a choke to reduce the harmonics and terminals. The design is based of the standard cubicle system Rittal TS8 with the Matrix operation panel built-in into the door.

The control is located on a spacious swing frame. That ensures compact dimensions, nevertheless it is enough space for additional extensions and accessibility in case of maintenance.

Optimized cubicle designs that fit your range of applications:

Device features	
Cubicle system	The Rittal TS8 cubicle system with additional internal reinforcement elements and slide bars for easy installation and removal of the inverter devices and other power components can be added to any existing cubicle systems.
Operation / parameterization	For safe control, clear parameterization and fast diagnosis, the matrix operating panel is installed in the cubicle door at an ideal height. A transparent protective cover and an adjustable locking code prevent the unintended parameter adjustments.
Displays on the cubicle	The following status displays are permanently present: "Ready" / "Run" / "Trip". 3 analog actual values can be parameterized for the display of current, voltage, power, load, speed, operating hours meter, and much more and thus provide information on the relevant drive data at any time.
Connection	Generous space is provided to connect the power cables. The extensibility and accessibility of the control terminals is also taken into consideration. In the standard design, the cables are to be connected at the bottom of the inverter.
Extensibility	All cubicle units are equipped with a large, swivelling control panel that permits subsequent extensions.

Detailed information about the cubicle devices is given in the product catalogue "Frequency inverters in cubicle design", order number 8 P01 004 EN.

MX multi-eco   400 V

General technical data	
Mains voltage	400 (380, 415) V ±10%, 50/60 Hz for TT, TN-C or IT mains
Maximum current	120 % for 60 s per 10 minutes, 135 % for 2 seconds
Operating temperature	0...+40°C, up to +50°C with derating possible
Standards	CE, RFI filter for 2nd “industrial environment” C3 integrated
General design	Cubicle system Rittal TS8 in RAL 7035 Controls in the cubicle door with additional protective cover, Cable entry from below, cubicle depth of 600 mm (622 mm incl. door handle)
Interfaces	Control terminals directly on the inverter or alternatively in the cubicle, control terminals can be extended, fieldbus connection via Modbus and CANopen or optionally Profibus DP

Design	
MX multi-eco 4V	
IP23	Air flow through grid in cubicle door and mounted air guidance hood, Cubicle height of 2155 mm
IP54	Air flow through filter mats in cubicle door and a top mounted fan, Cubicle height of 2260 mm
IP54 with separated air flow	Air flow through cubicle plinth and mounted air guidance hood, cooling of the control part by means of filter fans in the cubicle door, cubicle height of 2355 mm (incl. 200 mm plinth)
Standard equipment	Frequency inverter MX eco, main switch, mains fuses, AC or DC choke, motor terminals, control panel and matrix operating panel in the door
Options	Line contactor, AMF (output motor filter, partially with additional field), terminal extensions, fieldbus, emergency stop button, safe standstill (control category 3 according to EN 954-1 / ISO 13849-1 for "Safe Standstill" (stop category 0 or 1)), cubicle lighting, cubicle heating, and much more.

Type	Motor output [kW]	Output current [A]	Dimensions [mm] Width	Depth	Height
MX multi-eco 4V					
4V22-S	22	48	600	600	IP23: 2155 mm IP54: 2260 mm
4V30-S	30	66	600	600	
4V37-S	37	79	600	600	
4V45-S	45	94	600	600	
4V55-S	55	116	600	600	
4V75-S	75	160	600	600	
4V90-S	90	179	600	600	IP23: 2155 mm IP54: 2260 (2355) mm
4V110-S	110	215	600	600	
4V132-S	132	259	600	600	
4V160-S	160	314	600	600	
4V200-S	200	387	600	600	
4V250-S	250	481	800	600	
4V315-S	315	616	800	600	
4V355-S	355	671	1000 (1400)	600	
4V400-S	400	759	1000 (1400)	600	
4V500-S	500	941	1000 (1400)	600	
4V630-S	630	1188	1200 (1600)	600	

( ) Values in brackets for IP54 with separated air flow

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MX multi-pro 400 V

General technical data	
Mains voltage	400 (380, 415) V ±10%, 50/60 Hz for TT, TN-C or IT mains
Maximum current	Power 1: 150 % for 60 s per 10 minutes, 165 % for 2 seconds Power 2: 120 % for 60 s, 135 % for 2 s (from MX multi-pro 4V90/110-S)
Operating temperature	0...+40°C, up to +50°C with derating possible
Standards	CE, RFI filter for 2nd “industrial environment” C3 integrated
General design	Cubicle system Rittal TS8 in RAL 7035 Controls in the cubicle door with additional protective cover, Cable entry from below, cubicle depth of 600 mm (622 mm incl. door handle)
Interfaces	Control terminals directly on the inverter or alternatively in the cubicle, control terminals can be extended, fieldbus connection via Modbus and CANopen or optionally Profibus DP

Design	
MX multi-pro 4V	
IP23	Air flow through grid in cubicle door and mounted air guidance hood, Cubicle height of 2155 mm
IP54	Air flow through filter mats in cubicle door and a top mounted fan, Cubicle height of 2260 mm
IP54 with separated air flow	Air flow through cubicle plinth and mounted air guidance hood, cooling of the control part by means of filter fans in the cubicle door, cubicle height of 2355 mm (incl. 200 mm plinth)
Standard equipment	MX pro frequency inverter, main switch, mains fuses, AC or DC choke, motor terminals, control panel, terminals for an external braking resistor (only MX multi-pro 4V22-S...4V160/200-S) and matrix operating panel in the door
Options	Line contactor, braking unit (from MX multi-pro 4V200/250-S, partially with additional field), AMF (output motor filter, partially with additional field), terminal extensions, fieldbus, emergency stop button, safe standstill (control category 3 according to EN 954-1 / ISO 13849-1 for "Safe Standstill" (stop category 0 or 1)), cubicle lighting, cubicle heating, and much more
MX multi-pro 4C	
IP23 with internal cooling circuit	Internal cooling circuit for cooling of the power part with heat exchange in a separate cooling cubicle, additional fans in the cubicle door for incoming and outgoing cubicle, cubicle height 2000 mm
IP54 with internal cooling circuit	Internal cooling circuit for cooling of the power part with heat exchange in a separate cooling cubicle, additional filter fans in the cubicle door for incoming and outgoing cubicle, cubicle height 2000 mm
Standard equipment	Frequency inverter MX pro, main switch, mains fuses, motor terminals, control panel and matrix operating panel in the door
Options	Line contactor, line reactor, motor choke, terminal extensions, fieldbus, emergency stop button, safe standstill (control category 3 according to EN 954-1 / ISO 13849-1 for "Safe Standstill" (stop category 0 or 1)), cubicle lighting, cubicle heating, and much more

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Type	Motor output	Output current	Dimensions [mm]		
	P1 / P2 [kW]	I1 / I2 [A]	Width	Depth	Height
MX multi-pro 4V					
4V22-S	22	48	600	600	IP23: 2155 mm IP54: 2260 mm
4V30-S	30	66	600	600	
4V37-S	37	79	600	600	
4V45-S	45	94	600	600	
4V55-S	55	116	600	600	
4V75-S	75	160	600	600	
4V90/110-S	90 / 110	179 / 215	600	600	IP23: 2155 mm IP54: 2260 (2355) mm
4V110/132-S	110 / 132	215 / 259	600	600	
4V132/160-S	132 / 160	259 / 314	600	600	
4V160/200-S	160 / 200	314 / 387	600	600	
4V200/250-S	200 / 250	387 / 481	600	600	
4V250/315-S	250 / 315	481 / 616	800	600	
4V315/400-S	315 / 400	616 / 759	1000 (1400)	600	
4V400/500-S	400 / 500	759 / 941	1000 (1400)	600	
4V500/630-S	500 / 630	941 / 1188	1200 (1600)	600	
MX multi-pro 4C					
4C500/630-S	500 / 630	920 / 1100	1800	600	2000
4C630/710-S	630 / 710	1100 / 1230	1800	600	2000
4C710/900-S	710 / 900	1260 / 1580	3400	600	2000
4C900/1100-S	900 / 1100	1580 / 1860	3400	600	2000
4C1100/1300-S	1100 / 1300	1860 / 2200	3400	600	2000
4C1300/1400-S	1300 / 1400	2200 / 2430	3400	600	2000

( ) Values in brackets for IP54 with separated air flow

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General technical data	
Mains voltage	500 (525) V ±10% 50/60 Hz, for TT, TN-C or IT mains
Maximum current	Power 1: 150 % for 60 s per 10 minutes, 165 % for 2 seconds Power 2: 120 % for 60 s, 135 % for 2 seconds
Operating temperature	0...+40°C, up to +50°C with derating possible
Standards	CE, RFI filter for IT mains (C4) integrated
General design	Cubicle system Rittal TS8 in RAL 7035 Controls in the cubicle door with additional protective cover, Cable entry from below, cubicle depth of 600 mm (622 mm incl. door handle)
Interfaces	Control terminals directly on the inverter or alternatively in the cubicle, control terminals can be extended, fieldbus connection via Modbus and CANopen or optionally Profibus DP

Design	
MX multi-pro 5V	
IP23	Air flow through grid in cubicle door and mounted air guidance hood, Cubicle height of 2155 mm
IP54	Air flow through filter mats in cubicle door and a top mounted fan, Cubicle height of 2260 mm
IP54 with separated air flow	Air flow through cubicle plinth and mounted air guidance hood, cooling of the control part by means of filter fans in the cubicle door, cubicle height of 2355 mm (incl. 200 mm plinth)
Standard equipment	MX pro frequency inverter, main switch, mains fuses, AC or DC choke, motor terminals, control panel, terminals for an external braking resistor (only MX multi-pro 5V22/30-S...5V132/160-S) and matrix operating panel in the door
Options	Line contactor, braking unit (from MX multi-pro 5V160/200-S, partially with additional field), AMF (output motor filter, partially with additional field), terminal extensions, fieldbus, emergency stop button, safe standstill (control category 3 according to EN 954-1 / ISO 13849-1 for "Safe Standstill" (stop category 0 or 1)), cubicle lighting, cubicle heating, and much more
MX multi-pro 5C	
IP23 with internal cooling circuit	Internal cooling circuit for cooling of the power part with heat exchange in a separate cooling cubicle, additional fans in the cubicle door for incoming and outgoing cubicle, cubicle height 2000 mm
IP54 with internal cooling circuit	Internal cooling circuit for cooling of the power part with heat exchange in a separate cooling cubicle, additional filter fans in the cubicle door for incoming and outgoing cubicle, cubicle height 2000 mm
Standard equipment	Frequency inverter MX pro, main switch, mains fuses, motor terminals, control panel and matrix operating panel in the door
Options	Line contactor, line reactor, motor choke, terminal extensions, fieldbus, emergency stop button, safe standstill (control category 3 according to EN 954-1 / ISO 13849-1 for "Safe Standstill" (stop category 0 or 1)), cubicle lighting, cubicle heating, and much more

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Type	Motor output P1 / P2 [kW]	Output current I1 / I2 [A]	Dimensions [mm] Width	 Depth	 Height
MX multi-pro 5V					
5V15/18-S	15 / 18.5	24 / 29	600	600	IP23: 2155 mm IP54: 2260 mm
5V18/22-S	18.5 / 22	29 / 35	600	600	
5V22/30-S	22 / 30	35 / 47	600	600	
5V30/37-S	30 / 37	47 / 59	600	600	
5V37/45-S	37 / 45	59 / 68	600	600	
5V45/55-S	45 / 55	68 / 85	600	600	
5V55/75-S	55 / 75	85 / 110	600	600	
5V75/90-S	75 / 90	110 / 136	600 (1000)	600	IP23: 2155 mm IP54: 2260 (2355) mm
5V90/110-S	90 / 110	136 / 165	600 (1000)	600	
5V110/132-S	110 / 132	165 / 200	600 (1000)	600	
5V132/160-S	132 / 160	200 / 240	600 (1000)	600	
5V160/200-S	160 / 200	240 / 312	800 (1200)	600	
5V200/250-S	200 / 250	312 / 390	800 (1200)	600	
5V250/315-S	250 / 315	390 / 462	800 (1200)	600	
5V315/400-S	315 / 400	462 / 590	1200 (1600)	600	
5V400/500-S	400 / 500	590 / 740	1200 (1600)	600	
5V500/630-S	500 / 630	740 / 900	1200 (1600)	600	
MX multi-pro 5C					
5C500/630-S	500 / 630	740 / 920	1800	600	2000
5C630/800-S	630 / 800	920 / 1100	1800	600	2000
5C800/900-S	800 / 900	1100 / 1230	1800	600	2000
5C900/1100-S	900 / 1100	1260 / 1580	3400	600	2000
5C1100/1300-S	1100 / 1300	1580 / 1860	3400	600	2000
5C1300/1500-S	1300 / 1500	1860 / 2140	3400	600	2000
5C1500/1800-S	1500 / 1800	2020 / 2430	3400	600	2000

( ) Values in brackets for IP54 with separated air flow

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MX multi-pro 690 V

General technical data	
Mains voltage	690 V ±10% 50/60 Hz, for TT, TN-C or IT mains
Maximum current	Power 1: 150 % for 60 s per 10 minutes, 165 % for 2 seconds Power 2: 120 % for 60 s, 135 % for 2 seconds
Operating temperature	0...+40°C, up to +50°C with derating possible
Standards	CE, RFI filter for 2nd “industrial environment” C3 integrated
General design	Cubicle system Rittal TS8 in RAL 7035 Controls in the cubicle door with additional protective cover, Cable entry from below, cubicle depth of 600 mm (622 mm incl. door handle)
Interfaces	Control terminals directly on the inverter or alternatively in the cubicle, control terminals can be extended, fieldbus connection via Modbus and CANopen or optionally Profibus DP

Design	
MX multi-pro 6V	
IP23	Air flow through grid in cubicle door and mounted air guidance hood, Cubicle height of 2155 mm
IP54	Air flow through filter mats in cubicle door and a top mounted fan, Cubicle height of 2260 mm
IP54 with separated air flow	Air flow through cubicle plinth and mounted air guidance hood, cooling of the control part by means of filter fans in the cubicle door, cubicle height of 2355 mm (incl. 200 mm plinth)
Standard equipment	MX pro frequency inverter, main switch, mains fuses, AC or DC choke, motor terminals, control panel, terminals for an external braking resistor (only MX multi-pro 6V22/30-S...6V160/200-S) and matrix operating panel in the door
Options	Line contactor, braking unit (from MX multi-pro 6V200/250-S, partially with additional field), AMF (output motor filter, partially with additional field), terminal extensions, fieldbus, emergency stop button, safe standstill (control category 3 according to EN 954-1 / ISO 13849-1 for "Safe Standstill" (stop category 0 or 1)), cubicle lighting, cubicle heating, and much more
MX multi-pro 6C	
IP23 with internal cooling circuit	Internal cooling circuit for cooling of the power part with heat exchange in a separate cooling cubicle, additional fans in the cubicle door for incoming and outgoing cubicle, cubicle height 2000 mm
IP54 with internal cooling circuit	Internal cooling circuit for cooling of the power part with heat exchange in a separate cooling cubicle, additional filter fans in the cubicle door for incoming and outgoing cubicle, cubicle height 2000 mm
Standard equipment	Frequency inverter MX pro, main switch, mains fuses, motor terminals, control panel and matrix operating panel in the door
Options	Line contactor, line reactor, motor choke, terminal extensions, fieldbus, emergency stop button, safe standstill (control category 3 according to EN 954-1 / ISO 13849-1 for "Safe Standstill" (stop category 0 or 1)), cubicle lighting, cubicle heating, and much more

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Type	Motor output P1 / P2 [kW]	Output current I1 / I2 [A]	Dimensions [mm] Width	Depth	Height
MX multi-pro 6V					
6V18/22-S	18 / 22	24 / 27	600	600	IP23: 2155 mm IP54: 2260 mm
6V22/30-S	22 / 30	27 / 35	600	600	
6V30/37-S	30 / 37	35 / 43	600	600	
6V37/45-S	37 / 45	43 / 54	600	600	
6V45/55-S	45 / 55	54 / 62	600	600	
6V55/75-S	55 / 75	62 / 84	600	600	
6V75/90-S	75 / 90	84 / 104	600	600	
6V90/110-S	90 / 110	104 / 125	600 (1000)	600	IP23: 2155 mm IP54: 2260 (2355) mm
6V110/132-S	110 / 132	125 / 150	600 (1000)	600	
6V132/160-S	132 / 160	150 / 180	600 (1000)	600	
6V160/200-S	160 / 200	180 / 220	600 (1000)	600	
6V200/250-S	200 / 250	220 / 290	800 (1200)	600	
6V250/315-S	250 / 315	290 / 355	800 (1200)	600	
6V315/400-S	315 / 400	355 / 420	800 (1200)	600	
6V400/500-S	400 / 500	420 / 543	1200 (1600)	600	
6V500/630-S	500 / 630	543 / 675	1200 (1600)	600	
6V630/800-S	630 / 800	675 / 840	1200 (1600)	600	
MX multi-pro 6C					
6C630/800-S	630 / 800	675 / 840	1800	600	2000
6C800/1000-S	800 / 1000	840 / 1050	1800	600	2000
6C1000/1200-S	1000 / 1200	1010 / 1230	1800	600	2000
6C1200/1500-S	1200 / 1500	1260 / 1580	3400	600	2000
6C1500/1800-S	1500 / 1800	1580 / 1860	3400	600	2000
6C1800/2100-S	1800 / 2100	1860 / 2140	3400	600	2000
6C2000/2400-S	2000 / 2400	2020 / 2430	3400	600	2000

( ) Values in brackets for IP54 with separated air flow

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Operation of the MX eco & pro inverters

Matrix operating panel

Due to our many years of experience in the field of frequency inverter development, we can offer you a device which you will be extremely familiar within a very short time.

The programming of the MX eco & pro frequency inverters does not call for special requirements and is geared towards utmost ease of use. In this way you have a full overview of the device in each situation.

The keypad of the MX eco & pro combines function and design and therefore fulfills several tasks:

- Display function:
  A good readable, large LCD window displays the latest status of the inverter in plain text, three selectable actual values and the just active control variant.
  All displayed texts are changed according to the selected language.
- Manual operation:
  The function button F1 enables the shock free switch-over to manual operation. The control is carried out via 4 buttons and the practical Matrix wheel presets the desired reference value.
  Manual operation can also be locked, if it is not permitted for safety reasons.
- Parameterization:
  The navigation inside the parameter matrix, which contains the available parameters, can be reached by selecting the function button F2 "MATRIX". With the Matrix wheel, its push button and the ESC command (function button F3) the desired settings are carried out in a very short time. No illogical program steps and intricate dependences disturb the operation.

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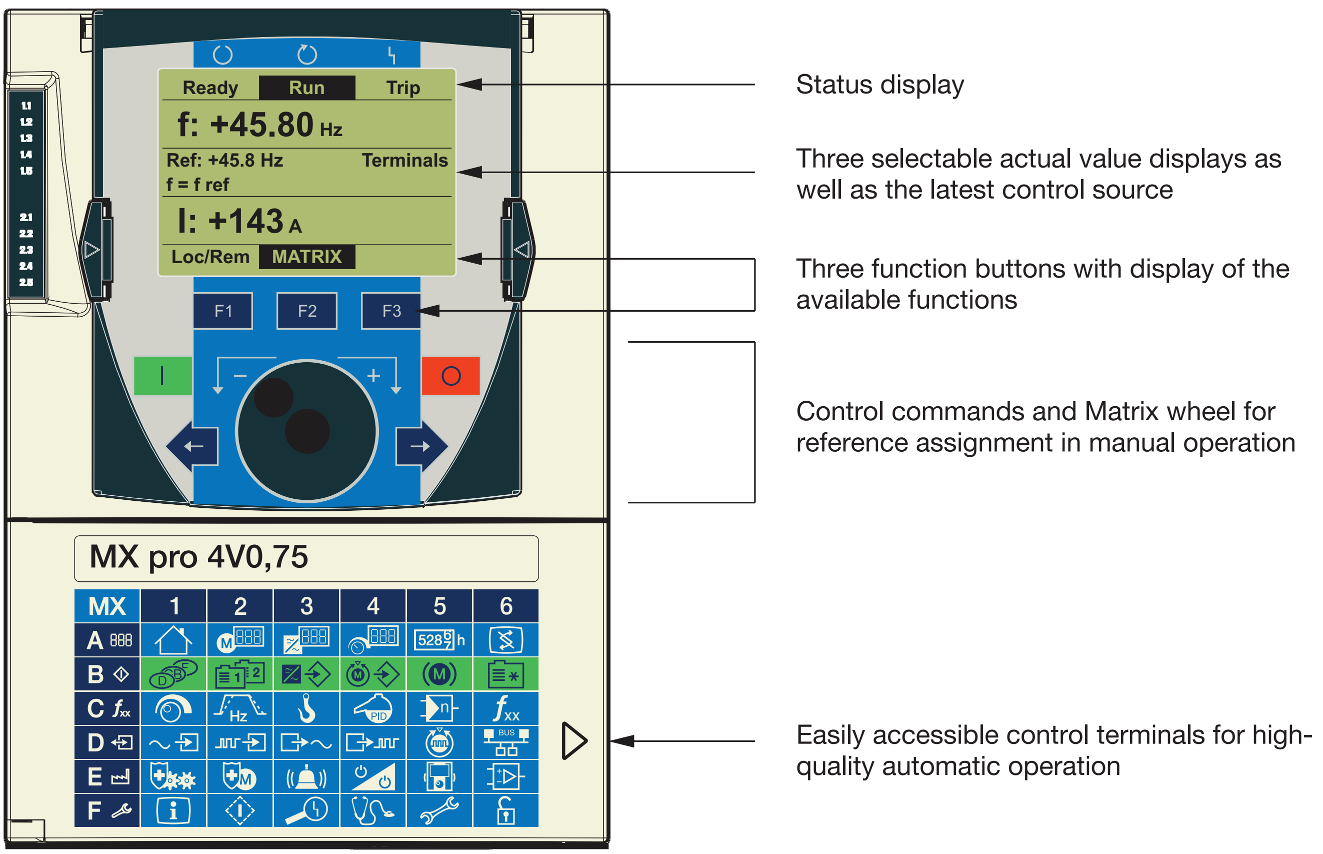
Display function of the keypad in automatic and in manual operation

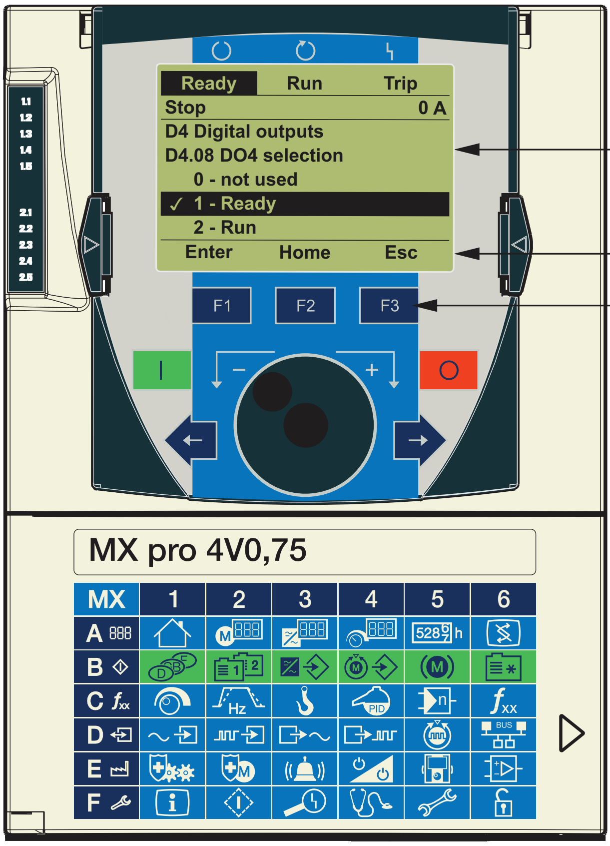


The keypad at parameterization

The MX eco & pro inverters are unique and especially practical to parameterize.

The desired functions and device characteristics can be set quickly and without any problems due to the well-structured Matrix surface and the parameter descriptions in clear text which are displayed at the same time. In no time you optimize the drive performance of your machine.

The parameterization is easily started with the "MATRIX" function button and can be abort at any time with just one press of the F2 function button "HOME".



The display adapts itself extremely well to the situation and therefore remains always clearly arranged.

The three function buttons optimize the functionality of parameterization.

Only few impulses on the Matrix wheel are necessary in order to set the desired parameter values.

The MX eco & pro Matrix enables quick locating of the desired parameters.

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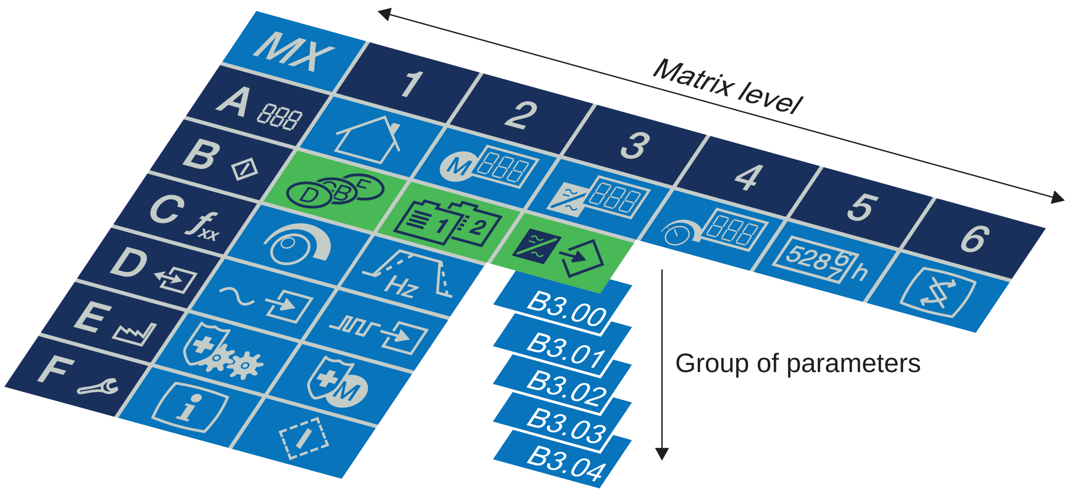
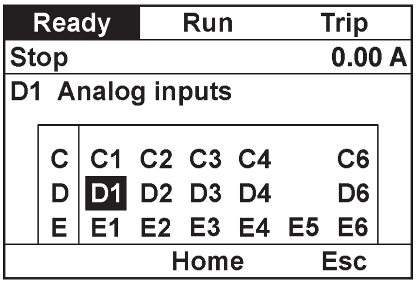
Matrix philosophy

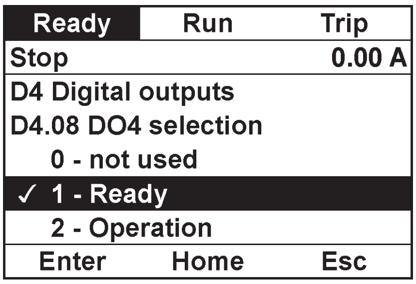
The secret of the simple and quick parameterization of the MX eco & pro devices is not an endlessly long list or a many-branched tree structure but a clear Matrix with easy-to-recognize symbols.

The parameters themselves are therefore arranged in the third dimension.





Within the Matrix level first the desired Matrix line and then the function can be selected with the Matrix wheel (e.g. field D1). Subsequently the relevant parameter can be selected and adapted by pressing the Matrix wheel again.



With the arrow keys the position, which is to be changed, is selected and can be set with the Matrix wheel. Pressing of the Matrix wheel once more saves the changed value.

With the ESC function button F3 you can go back step-by-step to select the next parameter.

To abort parameterization immediately just one push of the functions button F2 "HOME" is necessary.

Further advantages of the Matrix philosophy of the MX eco & pro inverters:

- The recognizing, assigning and accurate call-up of all functions and setting variances are made easier by the clear and easily identifiable pictograms.
- All parameters have a clear letter/number-code as well as a parameter name in several languages.
- The setting possibilities of the list parameters have in addition a numerical value in order to guarantee even quicker setting and checking.
- On request only each parameters, whose respective function is active, are displayed (e.g. motor protection) or whose respective option is plugged-in (e.g. terminal extension).

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Presettings

Our MX eco & pro inverters are provided with sophisticated parameter presettings for all standard applications to ensure quick start-up. However, expert users cherish the possibility to store their own settings as a backup.

MX eco & pro include 4 preset application macros and one backup memory:

Macro M1

Parameter pre-settings are optimized for standard drives with conventional control via the terminals (factory setting)

Macro M2

MX eco:

Preset parameters for the use of the integrated PID controller and conventional control (typical for pumps, fans and compressors)

MX pro:

Preset parameters for crane drives with braking unit

Macro M3

MX eco:

Parameter pre-setting for drives in cascade connection and with PID controller

MX pro:

Parameter presetting for speed-controlled drives in Master/Slave connection

Macro M4

Preset parameters for the control of the drive via fieldbus "Profibus DP"

Backup memory

The latest application parameters can be saved in the backup memory and recalled at any point in time. Alternatively this memory area, which is switchable externally, can be used as a second parameter set for all application parameters.

When selecting a macro, the appropriate functions are automatically activated, the parameters are optimized and the terminals are configured. At the same time a "Short menu" is provided in which the most important parameters are listed.

This short menu can be altered at any time and can remain accessible for an intentional limited parameter access while the other settings are certainly locked (see function "Parameter lock", page 304).

Software functions

The MX eco & pro inverters include extensive standard functions for varied tasks as well as numerous special functions for specific adaptation of the drive.

A listing of the most important functions is given in chapter "Functions", page 255.

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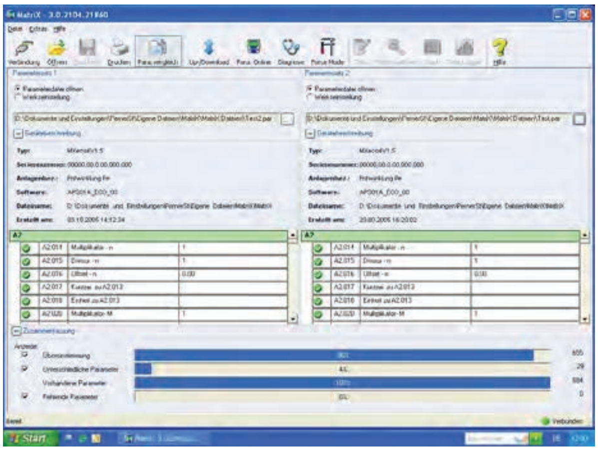
PC software Matrix 3

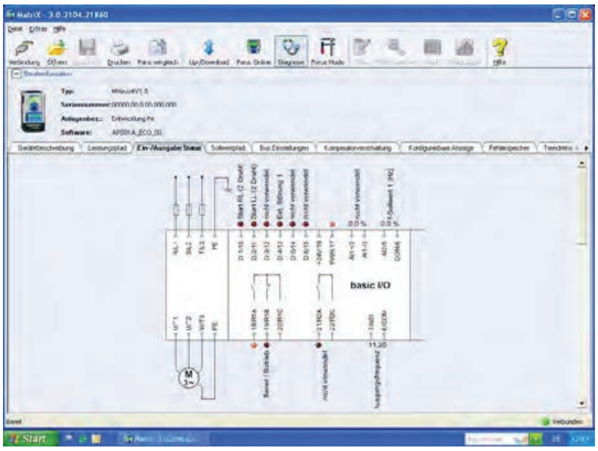
The easy to operate and powerful PC software Matrix 3 makes a further step towards the improvement of the user-friendliness of the MX eco & pro devices. Based on the familiar Windows-surface and well proven functions, it offers numerous tools for considerable quicker commissioning and for the safe archiving of the settings. Special attention was paid to the clearly arranged display and the comparability of drive parameters.

The numerous representations of the control inputs and outputs as well as the whole drive chain are especially advantageous for the commissioning and trouble-shooting.



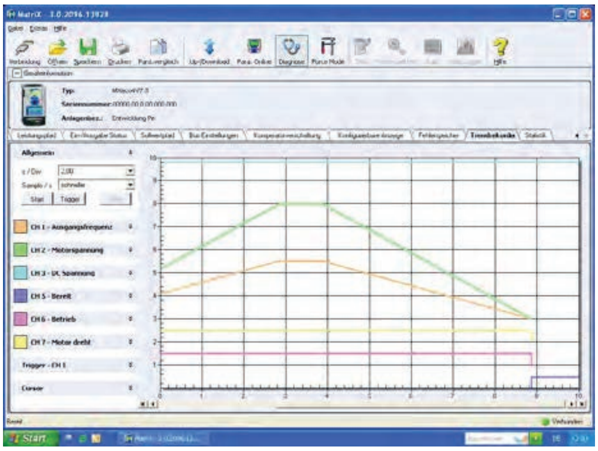
Our concise user interface is also available on the screen of your PC. All parameters can be queried online and changed if necessary. The display of the setting possibility and limits of each parameter make the adjustment easier. A detailed description of the function is available with F1

By means of the Parameter-Upload and Download, the device settings can be archived or printed out as lists. For a quick recognition of the specific setting values, the parameter list can be compared with the factory setting or with other parameter lists.



The extensive setting possibilities are clearly presented in schematic diagrams which are created online. In this way you quickly obtain an overview of the active functions and control signals.

You also receive intelligent support in the event of a fault: MX eco & pro inverters create a detailed record for each problem. With Matrix 3 the fault memory is evaluated and archived problem-free.



The built-in actual value recorder is the right tool for commissioning. In real time mode freely selectable analog and digital states can be recorded during operation and therefore analysed at a later point in time. The built-in trigger is invaluable especially for the analysis of unplanned incidents.

The reading of the values from the "Data logger" (the records of three selectable sizes which are saved in the inverter) provides further possibilities for the analysis of the drive or the whole process (see function "Data-Logger", page 264).

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General specification

MX eco & pro frequency inverters use modern components and solutions for the control of asynchronous three-phase motors and synchronous three-phase motors. This enables an extremely compact design and userfriendly device features.

Our high degree of quality awareness ranges from the basic requests in the product specification over the development of the cooling system, of the mechanical design, of the electrical circuit diagram and the individual functions up to the production of the device. This quality level is also long-term guaranteed by means of the corresponding quality assurance systems in the individual business processes and is certified every year by independent authorities according to DIN EN ISO 9001:2000 and ISO 14001:2004.

The MX eco frequency inverters are suitable for the motor operation of motors in both rotational directions. The function "motor braking" is available for a quick shut-down of the drive, which enables a quick deceleration without additional components.

MX pro frequency inverters are suitable for the motor and dynamic operation of motors in both rotational directions and both energy directions. They can eliminate the accumulating braking energy via an external braking resistor or they feed the energy back into the mains by connecting a supply/regenerating unit "Active Front End AFE" in series.

MX eco & pro frequency inverters are independent working devices with internal supply of the control and forced ventilation. They have a built-in LED-keypad and an extensive control terminal. The removable Matrix operating panel offers an optimum ease of operation with the large LCD display and a Matrix wheel.

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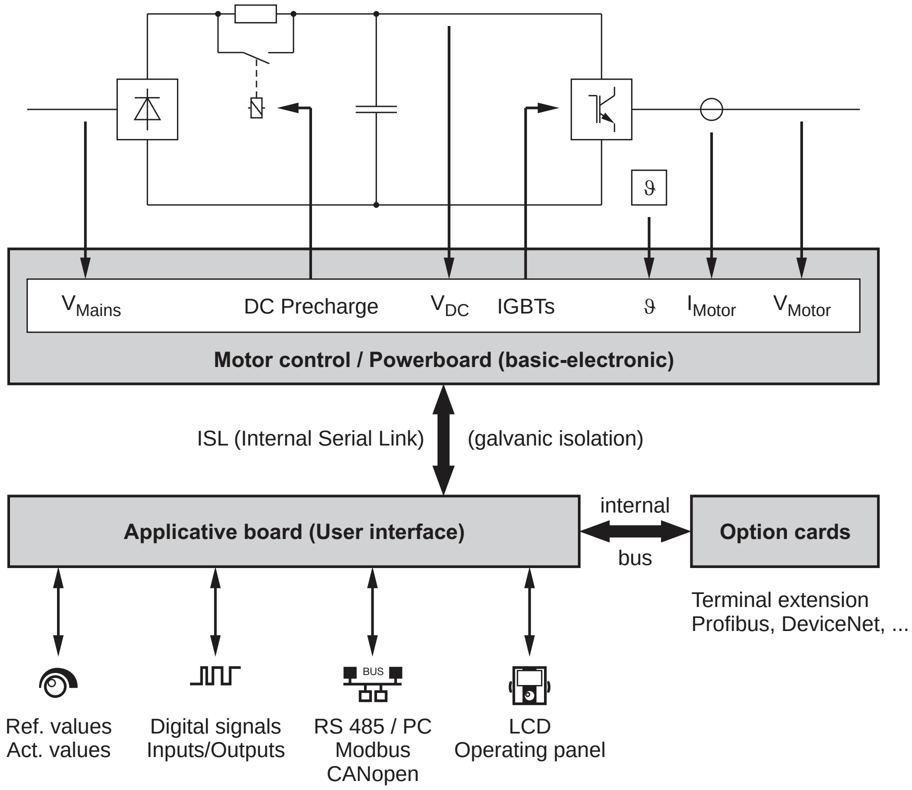


Depending on the local conditions and the requests on the drive the basic device can or must be supplemented by options. Options for the power path, options for control and operation as well as mechanical options are available.

MX eco & pro frequency inverters fulfil the relevant international standards and regulations of the EN-standard, IEC-standards up to UL and CSA regulations.

Quality

CE Marking

All devices and drives of the electric drive engineering may cause electromagnetic interferences and otherwise they may be influenced by such interferences. Therefore, they are subject to the **EMC directive 2004/108/EEC** since 1.1.1996.

The frequency inverters have an operating voltage which is clearly in the range of 50...1000 V AC or 75...1500 V DC. Therefore, they are also subject to the **Low-voltage directive 2006/95/EEC** since 1.1.1997.

Because of the radio frequency interference filters which are built into the frequency inverters they are in conformity with **EN 61800-3** and **EN 61800-5-1**.

Frequency inverters are not considered as machines with at least one mechanically moving part. Therefore, they are not subject to the Machine directive 2006/42/EEC.

Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

The frequency inverters have a CE marking on the rating plate. However, it is necessary to observe the installation regulations to achieve the corresponding limits.

Installation regulations

- The MX eco & pro frequency inverters include a RFI filter for industrial environment as standard (MX eco 4V & pro 4V for residential environment up to 4.0 kW). In case of long motor cables and for the use in residential environment the implementation of an additional external filter is necessary to reduce the current harmonics on the mains caused by the DC link.
- Installation on a well-grounded metallic mounting plate with good HF connection between motor cable screen and filter
- Use of screened motor cables, proper connection of the motor cables on both ends or proper laying in a metallic, closed and interconnected cable conduit
- Use of an output motor filter in case of high motor cable lengths
- Use and proper connection of screened control cables
- Grounding of the frequency inverter for human protection with at least 10 mm^2
- Consider the protective separation when preparing control lines and coupling relays
- Laying of the motor cables separated from other cables, especially from the control wiring

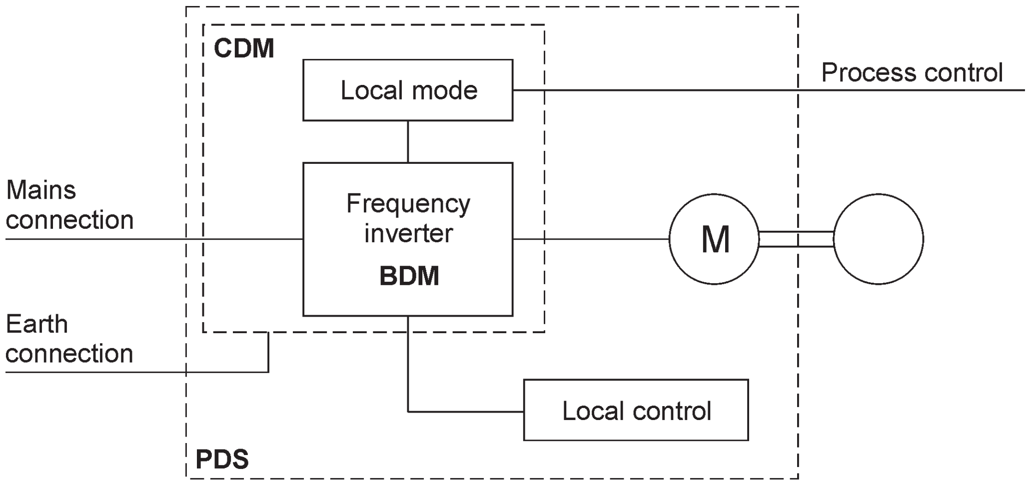
EMC product standard for PDS (Power Drive Systems) EN 61800-3

For frequency inverter drives the product standard EN/IEC 61800-3 edition 2 appeared. It has first priority over the existing general standards (generic standards). If a drive is installed into another device for which a separate EMC product standard exists, then this standard applies.

The aim of the EMC directive **2004/108/EC** is the ability of electric and electronic installations to operate satisfactorily in their electromagnetic environment without influencing the environment or other loads therein.

Therefore, the PDS product standard contains both limits for admissible interferences and requirements for the necessary interference resistance.

The power drive standard EN 61800-3 covers the complete drive from the mains supply to the motor shaft.



BDM:	Base-Drive-Module	Basic drive consisting of the power part and the control electronics (e.g. frequency inverter - built-in unit)
CDM:	Complete-Drive-Module	Drive modules consisting of BDM (basic drive) and extensions, if existing (e.g. cubicle including RFI filter, AMF, line contactor, ...)
PDS:	Power-Drive-System	Drive system consisting of CDM (drive module) and motor, motor cable, local control, power transformer, ... (e.g. the complete electric drive of a machine)

The differentiation in respect of the sales method and the range of use is essential for the handling of frequency inverters.

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Use in residential environment

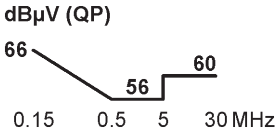
Drives which are connected without an intermediate transformer to the power supply network which also supplies residential areas. The standard refers to these application areas as "first environment".

The valid limits for interferences are very low and can only be observed by compliance with all installation instructions.

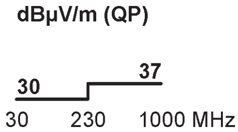
Category C1

Use in residential environments with general sales (unrestricted to every person)

Conducted interferences



Radiation

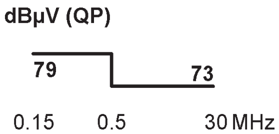


The admissible limits for interferences comply with the applied standard EN 55011 class B; i.e. 66-56/56/60 dB(µV) quasi-peak and 30/37 dB(µV/m) at a distance of 10 m (33 ft).

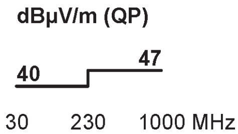
Category C2

Use in residential environments with restricted sales (only EMC qualified resellers)

Conducted interferences



Radiation



All drives must comply with the limits of interferences of the former class A group 1.

i.e. 79/73/73 dB(µV) quasi-peak and 40/47 dB(µV/m) at a distance of 10 m (33 ft)

Use in industrial environment

The standard refers to these application areas as "second environment". These are areas which are separated from the public network by means of an own transformer.

The use must ensure that the suppression components recommended by the manufacturer are used and that the introductions of the manufacturer are observed. Moreover, the user must ensure that strong interferences do not couple into neighbouring low-voltage networks.

If the neighbouring network is a public network with residential areas, the limits 66-56/56/60 dB(µV) quasi-peak apply. In case of industrial networks the higher limits 79/73/73 dB(µV) quasi-peak can be used.

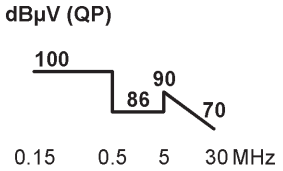
Furthermore, it is necessary to enhance the suppression of interferences if other devices are influenced. The operator of the plant is responsible for this improvement.

The limits for immunity are much stricter because they are based on a generally higher level of interferences.

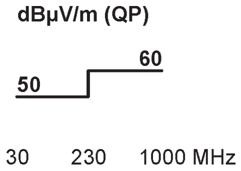
Category C3

Use in industrial environments

Conducted interferences
drive ≤ 100 A

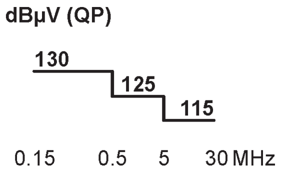


Radiation

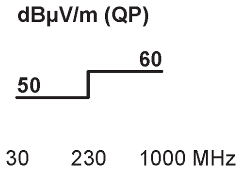


For drives with a size ≤ 100 A the admissible limits for interferences are 100/86/90-70 dB(µV) quasi-peak and 50/60 dB(µV/m) at a distance of 10 m (33 ft) (class A group 2).

Conducted interferences
drive > 100 A



Radiation



For drives with a size > 100 A the admissible limits for interferences are 130/125/115 dB(µV) quasi-peak and 50/60 dB(µV/m) at a distance of 10 m (33 ft) (class A group 2).

Category C4

Use in industrial environments for drives > 1000 V or > 400 A

For this drives are no limits defined. An EMC concept has to be compiled within project planning.

In case of non-grounded mains it is usually not possible to keep the limits. Filter capacitors make detection of insulation faults difficult and thus they interfere with the concept of a floating power supply. However, filters which are developed especially for IT mains can be used because they also cause a high reduction of the conducted interferences in non-grounded mains.

The basic requirements for compliance with the relevant limits are the observance and compliance of the installation requirements and the use of the recommended options.

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Mains conditions

Mains voltage

The MX eco & pro devices are designed for the following mains voltages:

3 AC 380 V -15 % up to 440 V +10 %, 50 Hz ± 5 %
3 AC 380 V -15 % up to 480 V +10 %, 60 Hz ± 5 %

The MX pro 6V inverters are designed for the following mains voltages:

3 AC 500 V -15 % to 690 V +10 %, 50/60 Hz ± 5 %

The existing nominal mains voltage must be set at the inverter by means of a parameter. Thereby an optimal adjustment of the undervoltage protective function takes place.

Fan supply

The inverters MX pro 6V90/110…6V630/800 – order code ELNMP6xxxAAx contain AC fans for cooling. These fans have to be supplied by the voltage

3 AC 400 V -10 % to 440 V +10 %, 50 Hz ± 5 %
3 AC 400 V -10 % to 480 V +10 %, 60 Hz ± 5 %

The inverters MX pro 6V90/110…6V630/800 – order code ELNMP6xxxTAx are equipped with a TRAFO-BOX in order to create the fan supply voltage from the mains voltage.

Fuses

The MX eco & pro frequency inverters do not contain any input fuses. These must be provided externally (see chapter "Fuses and cable cross sections") to protect the power cables from overload and to protect the input rectifier in the event of an internal short circuit.

It is recommended to use super fast (semiconductor) fuses. Standard fast fuses or circuit breakers can also be used but the rectifier could be damaged in case of an internal fault.

Braking unit / Braking resistor

The MX pro frequency inverters have parameters to monitor the braking power.

If the braking resistor does not match the overload characteristic to be used or the local regulations require an additional protective device, a thermal relay should be integrated into the mains disconnection mechanism.

The correct setting of the braking parameters is essential for the protection of the braking resistor in normal operation. In case of malfunction of the internal braking transistor or of the external braking unit, the braking resistor can be only protected by mains disconnection. Therefrom, a line contactor is necessary when using the braking function. Furthermore, the use of the function "Line contactor control" is recommended..

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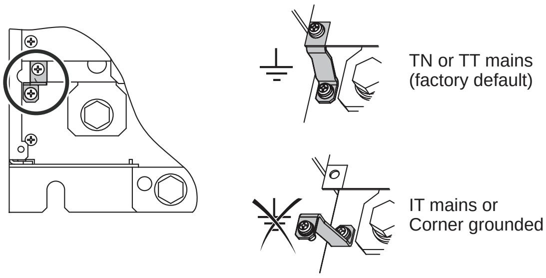
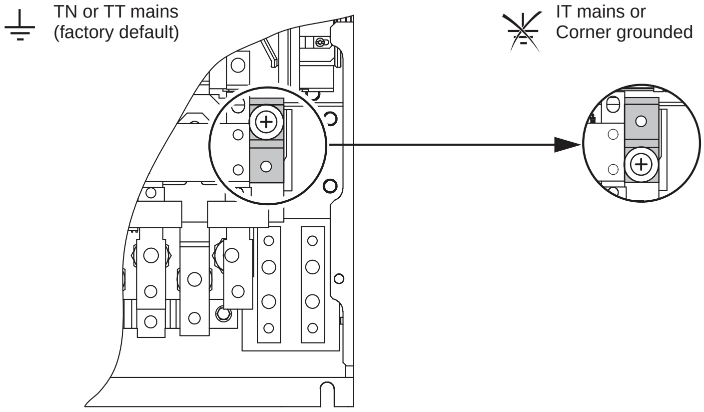
Nongrounded mains

The use of the MX eco & pro frequency inverters is basically in all mains variants permitted. But MX pro 6V devices must not be operated in "Corner Grounded Networks".

Basic principle:





The built-in EMC filter can be adapted to the respective mains by means of switch-over/reconnection.

In case of nongrounded mains a single earth fault in the supplying mains has no effect to the function of the inverter. If the earth fault occurs in the motor or the motor cables, the inverter is switched off. But the recognition heavily depends on the earth capacitance of the mains.

Due to human protection, in IT mains only the use of special RFI filters with very low leakage current is permitted (increase of earth capacitance).

The filter option RFI is not qualified for the use in IT mains !

Radio interferences

The MX inverters include a radio frequency interference filter as standard. Depending on the device size, those filters comply with the requirements for categories C2 or C3 according to EN/IEC 61800-3.

Device	Category
MX eco & pro 4V0,75 ... 4V4,0	C2 residential environment – EMC-versed user (in the past: EN 55011 class A group 1)
MX eco & pro from 4V5,5 MX pro 6V	C3 industrial environment (in the past: EN 55011 class A group 2)

For using inverters of higher power in residential environment and in case of longer motor cables, additional filters option MX RFI must be used.

Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

Mains current harmonics / Mains voltage distortion

Because of using a diode rectifier on the input of the inverter harmonics occur in the mains current which lead to a voltage distortion of the supplying mains.

There are several possibilities to reduce this current harmonics and to decrease the total mains current:

– Use of a DC choke option MX DCL

  This external option is available for the MX eco & pro 4V0,75...4V75 devices in protection degree IP20. For devices from 90 kW the DCL box with protection degree IP31 is available as device variant ELNMx4xxxDAx.

– Use of a three-phase choke option MX NDU in the mains lines

  For all devices MX eco & pro from 4V15 (MX pro 6V from 2,2/3,0) a well-adapted line reactor is available as an external option.

– 12-pulse-connection

  The supply results from a separate transformer with two out-of-phase secondary windings.
  The following devices are prepared for 12-pulse-supply as standard:

  MX eco 4V500...4V630
  MX pro 4V400/500...4V500/630
  MX pro 6V400/500…6V630/800

– Using the Active Front End AFE

  AFE 4V: 120...675 kW

  AFE 6V: 145...860 kW

12-pulse supply

The following inverters are standard equipped with two parallel input rectifiers and therefore are suitable for a 12-pulse rectification:

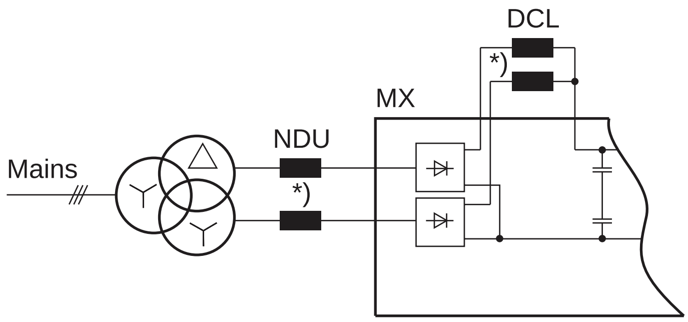
MX eco 4V500...4V630

MX pro 4V400/500...4V500/630

MX pro 6V400/500...6V630/800

The supply results from a separate transformer with two out-of-phase secondary windings (e.g. superimposing transformer Yy6 Yd5).

On the main side of the transformer the 5th and 7th current harmonics are practically non-existent as they have been cancelled by the shifted transformer windings.



*) Line chokes (or alternatively DC chokes) are only necessary if a transformer is used for several inverters or if the transformer power is notedly larger than the inverter power (see chapter "Mains impedance / Short-circuit current", page 41).

The transformer must keep to the following tolerances in order to guarantee a constant current sharing:

Tolerance of the secondary voltages to each other: 0.3 % of V_{NOM}

Tolerance of the relative short circuit voltage: ± 5.0 % of v_{SC_NOM}

The nominal output voltage of a transformer is specified at no load operation. Therefore this value has to be approx. 5 % higher than the rated voltage of the drive.

In case of 12-pulse supply the radio frequency interference filters, which are built into the MX eco & pro as standard, must be reconnected onto setting "IT mains".

Mains impedance / Short-circuit current

The MX eco & pro frequency inverters are designed considering a maximal permitted mains short-circuit current of the supply (values see technical data of the respective frequency inverter).

By means of using chokes (option MX DCL or option MX NDU) considerably higher mains short-circuit powers are possible without any effect to the operating safety of the inverter.

Power factor correction systems

Frequency inverters cause current harmonics in the supplying mains. When a power factor correction system is used, their capacitors are additionally stressed by means of the harmonics.

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Switching rate

The MX eco & pro inverters can be directly switched on and off by means of the line contactor which can be easy controlled via a relay output of the inverters.

In case of frequent start/stop commands it is recommended to realize them by means of the digital control inputs (or via a serial bus) directly to the electronics of the inverter.

By means of the certificated control input "PWR" a "Safe Standstill" of the drive is guaranteed considering the safety category according to EN 954-1 / ISO 13849-1 (and IEC/EN 61800-5-2). Thus a line or motor contactor can be saved.

Further information is given in the function "safe standstill".

Inverter control	Switching rate
The inverter is controlled by means of connecting and disconnecting the mains voltage.	max. 60 switching operations per hour (safety category 1, stop category 0)
Disconnection of the motor by means of a motor contactor	depending on the motor contactor (safety category 1, stop category 0)
Electronic start/stop commands by means of the digital inputs of the inverter	arbitrary
Electronic lock of the inverter by means of the control input PWR "Safe Standstill"	arbitrary (safety category 3, stop category 0 or 1)

The device fans are automatically controlled depending on the start command and a temperature-sensitive delay of stop (see function "Fan control", parameter B3.41).

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Protection of the plant

Responsibility

The users are responsible to integrate the frequency inverters into the protection and safety concept of the plant or machine.

All stated connection recommendations and planning remarks are to be taken merely as suggestions which must be adapted to the local conditions and regulations concerning installation and usage.

This applies especially to the safety regulations for machines, the EMC regulations and the general regulations for human protection.

Frequencies > 60 Hz

For operating the motors and drives with frequencies higher than 60 Hz check all used components if they are also qualified.

You should ask the manufacturer of the motor and the machine on principle. Typically, 4- to 8-pole motors are qualified for operation up to 100 Hz.

Overvoltage protective circuit

All inductivities like relays, contactors, magnetic brakes, etc. have to be equipped with an overvoltage protective circuit. That prevents malfunctions of the conventional device control as well as of the fieldbus.

A free-wheel diode has to be provided for DC control circuits.

For AC control circuits an R/C circuit is favored over a circuit with varistors because with the R/C circuit not only the peak overvoltage is reduced but also the rise-time.

The protective circuit must be qualified for inverter operation !

Earth leakage circuit breaker

Frequency inverters, especially those with additional EMC filters and screened motor cables, lead an increased leakage current against earth.

The leakage current depends on:

- the length of the motor cable
- the type of laying and whether the motor cable is screened or not
- the set pulse frequency
- the use of an additional radio frequency interference filter
- the grounding of the motor at its installation place (grounded or nongrounded)

Particularly because of the capacitors of the filter, an unintentional triggering of an earth leakage circuit breaker may occur at the moment of switching on. As well, the earth capacitances may cause an incorrect triggering during operation.

On the other hand, it is possible that the triggering is blocked by means of DC components which are caused by the mains rectification at the input of the inverter.

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Therefrom, you should observe following:

- Only use short-time delayed and pulse current sensitive earth leakage circuit breakers with considerably higher tripping current.
- Protect the other loads by means of a separate earth leakage circuit breaker.
- Earth leakage circuit breakers in front of an inverter do not provide absolutely reliable protection in case of direct contact !! So they should be always used in combination with other protective measures.
- The frequency inverters have no current-limiting effect (in case of earth leakage currents) and therefore they do not violate the protective multiple earthing.

Depending on the conditions, the leakage current of plants with high cable lengths can be absolutely higher than 100 mA !!

The built-in earth leakage detection has no current-limiting effect. It only protects the drive and is no human protection.

Automatic restarting

The internal function "automatic restart" switches the inverter automatically on after each mains switch-on or mains recurrence without the power failure having to be confirmed. This is an important and valuable function for the increase in availability, especially for drives which are not integrated into the plant control via a fieldbus system.

The automatic restart takes place in case of:

- Switch-on of the mains voltage (only in case of 2-wire control and dependent on the selected undervoltage behaviour)
- after a mains failure (only in case of 2-wire control and dependent on the selected undervoltage behaviour)
- completion of the standby-mode
- after each trip confirmation (only in case of 2-wire control – level rated)
- after a fast stop or emergency stop (only in case of 2-wire control – level rated)

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Locking of the frequency inverter

The MX eco & pro devices include the standard protective function "Safe Standstill" (Power Removal, certificate no. 72148-2 /2006), which prevents any unintended start-up of the motor. This function fulfills, when correctly wired, the machine standard EN 954-1 / ISO 13849-1 safety category 3, the IEC/EN 61508 SIL2 standard for functional safety and the power drive system standard IEC/EN 61800-5-2.

Further information about this protective function is given in chapter "Safe standstill", page 308.

Connecting and disconnecting the motor

Alternatively to the use of the control terminal PWR "Safe Standstill" a safety switch or a motor contactor can be installed to connect and disconnect the motor. Because the inverter recognizes the respective switching state, there is no risk of demolition or fault switch-off.

After connection the motor restarts by means of the function "Catch on the fly".

Further information is given in chapter "Motor contactor control", page 298.

Operation of ATEX motors in explosive atmospheres

The variable speed drives MX eco and MX pro integrate the "Power Removal" safety function which prohibits unintended equipment operation. The motor no longer produces torque. The use of the "Power Removal" safety function allows the drive to be installed as a part of the safety-related electrical, electronic and programmable electronic control systems, dedicated to the safety of a machine or an industrial process. This safety function complies with the standard for safety of machinery EN 954-1 / ISO 13849-1, category 3. It complies also with the standard for functional safety IEC/EN 61508 and with the power drive systems product standard IEC/EN 61800-5-2, SIL2 capability.

The use of the "Power Removal" safety function also allows the MX eco and MX pro variable speed drives to control and command motors installed in explosive atmospheres (ATEX).

More information about the operation of the frequency inverter in combination with ATEX-motors can be found in the "ATEX Installation guide" 8 P01 036.

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MX eco 4V

For standard drives in buildings, communities and industry

The market for speed-controlled standard drives requires simple and robust units.

This need is well covered by the MX eco. The range of uses stretch from internal waterworks, irrigation plants, industrial pump and blower drives with variable torque to compressors, water-lifting works and extruder drives with constant torque.

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Extensive standard fitting and multi-functional use

Feature	Advantages	Reference
RFI filter built-in	No additional space required and reduced mounting costs	Page 165
Digital input PWR "Safe Standstill"	Prevents an unwanted starting of the motor and guarantees the safety of the machine and plant personnel.	Page 308
Extensive option possibilities	Standard solutions for the adaptation of the MX eco to many applications, numerous add-on options and options capable for integration reduce the required space as well as the mounting costs.	from page 197
Wall-mounting in IP21 / IP31	Compact wall-mounting device with terminal box as a cheap alternative to the cubicle installation	Page 246
Flange mounting	The power part of the inverter, designed with IP54 protection degree, is located outside the cubicle by which the additional temperature rise is minimized.	Page 249
Optimized for cubicle installation	MX eco are suitable for each type of customer-specific cubicles. Standard components are available for the realization of thermal optimized cubicles with IP54 protection degree.	Page 158

User interfaces

Feature	Advantages	Reference
Parameter matrix	No endlessly long list or a multiple branched tree structure but a clear arrangement of parameters in Matrix form with logical organization according to their function.	Page 29
Matrix user interface	Simple and quick commissioning and parameterization by means of navigation with the Matrix wheel inside the parameter matrix on the graphical, removable Matrix operating panel	Page 27
PC software	Free PC program Matrix 3 for commissioning, programming, documentation and analysis	Page 31
Connection and communication possibilities	Inputs and outputs for practically all demands. Integrated Modbus and CANopen interface as standard. Option cards for all usual fieldbus systems.	Page 208
Extensive software functions	Flexible adapting to the application demands. No external components like relays, PLC and monitoring instruments and reduced mounting costs	Page 255

Industry-fulfilled design

Feature	Advantages	Reference
Wide power and voltage range	A product range for all applications. In this way standardized interfaces, reduced training costs and simple spares inventories are guaranteed.	Page 38
Robust design of power part and control part	High reliability also with rough ambient conditions. The power part is designed in IP54, the cooling air of control part and power part are completely separated, the circuit boards are varnished.	Page 147
Intelligent limitation and protection concepts	High availability and less process interruptions. Inverter, motor and application are optimally protected.	Page 326
Fan control	The fans of the inverter are automatically switched-off when cooling is not necessary. In this way the life of the fans is increased as well as the energy consumption and noise load being reduced.	Page 282
Indirect coupled control terminals	Safe and reliable operation according to EN 50178 PELV	Page 185
Internationally approved	A product range which complies with the most important approvals such as CE, UL and CSA and which can be used internationally.	Page 147

Useful functions

Cascade control, motor brake, quick catch on the fly and 44 further functions belong to the performance scope of the MX eco inverter range. They are described clearly in chapter "Functions", from page 255.

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Specification

Technical data

The frequency inverters of the MX eco range are designed for high continuous load at a simultaneously good dynamic overload capacity

The power rating is according to the nominal power of the IEC motor range.

Example MX eco 4V 315

- 315 — Nominal power: 315 kW; Overload: 120% for 60 s in 10 min, 135% for 2 s in 30 s
- 4V — 380...480 V mains voltage
- eco — Product line MX eco
- MX — Product family MX

Input	
Voltage	380 V -15% up to 480 V +10% for TT, TN or IT mains *)
Frequency	50 / 60 Hz ±5 % *)
Overvoltage class	Class III according to EN 61800-5-1
Power factor	Fundamental (displacement factor): > 0.98 Total (λ) at full load: 0.93...0.95 (with AC or DC choke) Total (λ) at no load: approx. 0.7 (with AC or DC choke)
Output	
Control method	Sensorless Vector Control, V/f characteristic
Voltage	3 AC 0...100% mains voltage, dynamic voltage stabilization
Overload	20 % for 60 seconds per 10 minutes, 35 % for 2 seconds
Pulse frequency	MX eco 4V0,75...4V75: 4 kHz, adjustable from 2...16 kHz MX eco 4V90...4V630: 2.5 kHz, adjustable from 2...8 kHz
Frequency / Base frequency	0...300 Hz / 25...300 Hz, adjustable
Short circuit protection	All-pole protected against short circuit and earth fault by means of overcurrent switch-off
Design	Built-in unit for vertical mounting
Cooling	forced
Frequency resolution, digital	0.01 Hz / 50 Hz, frequency stability: ±0.01 % / 50 Hz
Speed accuracy	V/f mode: slip frequency VC without feedback: 0.3 x slip frequency
Mechanical strength	
Mechanical vibration	According to IEC/EN 60068-2-6 MX eco 4V0,75...4V75: 1.5 mm at 3...13 Hz, 1 g at 13...200 Hz (3M3 according to IEC/EN 60721-3-3) MX eco 4V90...4V630: 1.5 mm at 3...10 Hz, 0.6 g at 10...200 Hz (3M3 according to IEC/EN 60721-3-3)
Shock	According to IEC/EN 60068-2-27 MX eco 4V0,75...4V75: 15 g for 11 ms (3M3 according to IEC/EN 60721-3-3) MX eco 4V90...4V160: 7 g for 11 ms (3M3 according to IEC/EN 60721-3-3) MX eco 4V200...4V630: 4 g for 11 ms (3M2 according to IEC/EN 60721-3-3)

*) Technical data and remarks for mains voltages are given in chapter "Mains conditions", page 38.

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Ambient conditions	
Operating temperature	MX eco 4V0,75...4V90: -10...+50°C MX eco 4V110...4V630: -10...+45°C (3K3 according to IEC/EN 60721-3-3) up to +60°C with derating
Storage / Transport temperature	-25...+70°C
Protection degree	MX eco 4V0,75...4V75: bottom, sideways, front IP21 top IP41 (IP20 without protective cover) MX eco 4V90...4V630: sideways, front IP31 top IP20 (IP31 with DC box) bottom IP00 (IP31 with terminal box)
Environmental class / Humidity	Class 3K3 in accordance with IEC/EN 60721-3-3 / no condensation, max. 95 % relative humidity
Altitude	Up to 1000 m, beyond power decrease of 1 % per 100 m up to 3000 m
Allowed pollution	Pollution degree 2 according to EN 61800-5-1 MX eco 4V0,75...4V75: 3C1 and 3S2 according to EN 60721-3-3 MX eco 4V90...4V630: 3C2 and 3S2 according to EN 60721-3-3
Protection class	Class 1 according to EN 61800-5-1
Safety functions and ATEX – applications	
Safety of the drive	The safety function "safe standstill" (Power Removal) allows a controlled shut-down as well as switch-off of the power supply when standstill. It also prevents any unintended start of the motor according to EN 954-1 / ISO 13849-1, category 3 and IEC/EN 61800-5-2.
Protection of the machine	The safety function "safe standstill" (Power Removal) allows a controlled shut-down as well as switch-off of the power supply when standstill. It also prevents any unintended start of the motor according to IEC/EN 61508, SIL2 capability and IEC/EN 61800-5-2.
Safety of the ATEX motor	The thermal sensor of the ATEX motor is integrated to the safety function "safe standstill" (PWR input) of the inverter by a safety switching device.
Response time	≤ 100 ms in STO (Safe Torque Off)
Standards	
Basic standard	The devices are designed, built and tested on the basis of EN 61800-5-1.
EMC immunity	According to EN 61800-3, 1st and 2nd environment (IEC 1000-4-2; IEC 1000-4-3; IEC 1000-4-4; IEC 1000-4-5; IEC 1000-4-6)
EMC emission	in accordance with product standard EN 61800-3, 1st and 2nd environment, category C1, C2, C3
Insulation	Galvanic insulation from the control electronics in accordance with EN 61800-5-1 PELV (Protective Extra Low Voltage)
Approvals	CE, UL, CSA, GOST, ATEX

⚠ Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

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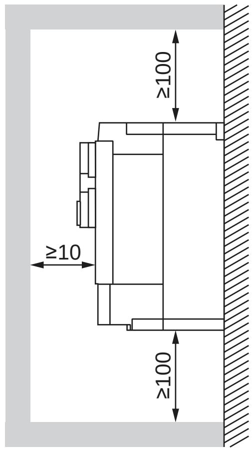
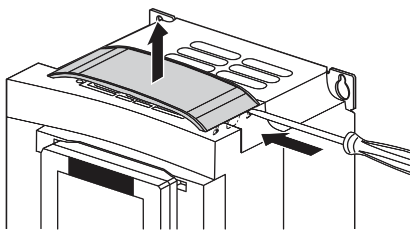
MX eco	4V0,75	4V1,5	4V2,2	4V3,0	4V4,0
Nominal data					
Motor rating					
P_N [kW]	0.75	1.5	2.2	3.0	4.0
P_N [hp]	1	2	3	–	5
Continuous output power					
$S_{N\,400}$ [kVA] V_N = 400 V	1.6	2.8	4.0	5.4	7.3
$S_{N\,460}$ [kVA] V_N = 460 V	1.8	3.3	4.6	6.2	8.4
Continuous output current					
$I_{N\,400}$ [A] V_N = 400 V	2.3	4.1	5.8	7.8	10.5
$I_{N\,460}$ [A] V_N = 460 V	2.3	4.1	5.8	7.8	10.5
Maximum current for 60 s per 10 minutes					
I_{MAX} [A]	2.8	4.9	7.0	9.4	12.6
Input current (without choke)					
$I_{IN\,400}$ [A] V_N = 400 V	3.7	5.8	8.2	10.7	14.1
$I_{IN\,460}$ [A] V_N = 460 V	3.0	5.3	7.1	9	11.5
Characteristics					
Efficiency [%]	> 94.5	> 95.5	> 96.0	> 96.0	> 96.5
Losses [W] at I_N	44	64	87	115	145
Weight approx. [kg]	3	3	3	4	4
Ambient conditions					
Volume cooling air [m³/h]	17	17	17	55	55
Sound pressure [dB(A)]	43	43	55	55	55
Mains short circuit c. [kA]	5	5	5	5	5
Dimensions					
Dimension A1 [mm]	230	230	230	260	260
Dimension A2 [mm]	220	220	220	249	249
Dimension A3 [mm]	5	5	5	7	7
Dimension B1 [mm]	130	130	130	155	155
Dimension B2 [mm]	113.5	113.5	113.5	138	138
Dimension C1 [mm]	152	152	152	164	164
Dimension C2 [mm]	175	175	175	187	187
Dimension C3 [mm]	174	174	174	186	186
Dimension C4 [mm]	197	197	197	209	209
Dimension C5 [mm]	196	196	196	208	208
Dimension C6 [mm]	219	219	219	231	231
Fixing D1 [mm]	4x ∅4.5	4x ∅4.5	4x ∅4.5	4x ∅4.5	4x ∅4.5

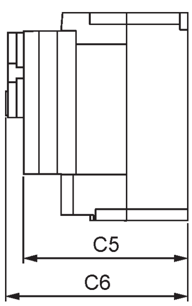


For installation keep a minimum distance of 50 mm between the units and the side wall.

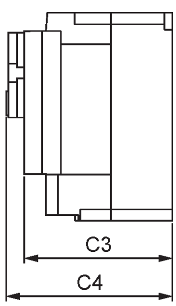


When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 62.

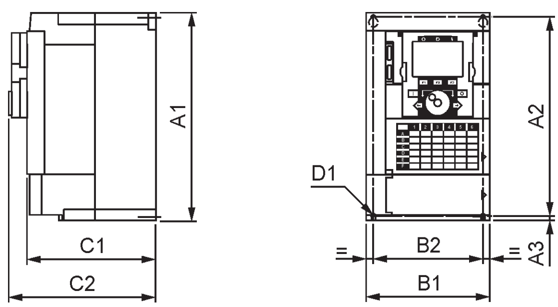
with 2 option cards



with 1 option card



Basic device without option card



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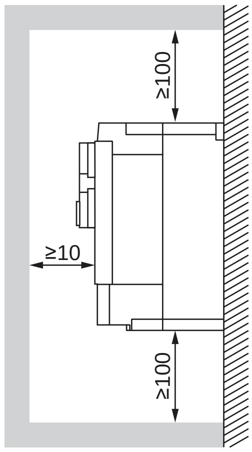
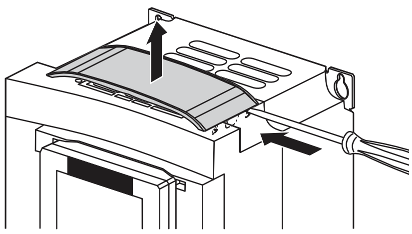
MX eco	4V5,5	4V7,5	4V11	4V15	4V18
Nominal data					
Motor rating					
P_N [kW]	5.5	7.5	11	15	18.5
P_N [hp]	7.5	10	15	20	25
Continuous output power					
$S_{N\,400}$ [kVA] V_N = 400 V	9.9	12.2	19.2	23	28
$S_{N\,460}$ [kVA] V_N = 460 V	11.4	14	22	26	33
Continuous output current					
$I_{N\,400}$ [A] V_N = 400 V	14.3	17.6	27.7	33	41
$I_{N\,460}$ [A] V_N = 460 V	14.3	17.6	27.7	33	41
Maximum current for 60 s per 10 minutes					
I_{MAX} [A]	17.2	21	33	40	49
Input current (without choke)					
$I_{IN\,400}$ [A] V_N = 400 V	20.3	27.0	36.6	48	46
$I_{IN\,460}$ [A] V_N = 460 V	17.0	22.2	30.0	39	38
Characteristics					
Efficiency [%]	> 96.5	> 97.0	> 97.0	> 97.0	> 97.0
Losses [W] at I_N	180	220	320	390	485
Weight approx. [kg]	5.5	5.5	7	9	9
Ambient conditions					
Volume cooling air [m^3/h]	110	110	160	250	250
Sound pressure [dB(A)]	56	56	57	60	60
Mains short circuit c. [kA]	5	5	5	5	22
Dimensions					
Dimension A1 [mm]	295	295	295	400	400
Dimension A2 [mm]	283	283	283	386	386
Dimension A3 [mm]	6	6	6	8	8
Dimension B1 [mm]	175	175	210	230	230
Dimension B2 [mm]	158	158	190	210	210
Dimension C1 [mm]	164	164	190	190	190
Dimension C2 [mm]	187	187	213	213	213
Dimension C3 [mm]	186	186	212	212	212
Dimension C4 [mm]	209	209	235	235	235
Dimension C5 [mm]	208	208	234	234	234
Dimension C6 [mm]	231	231	257	257	257
Fixing D1 [mm]	4x ∅5.5	4x ∅5.5	4x ∅5.5	4x ∅5.5	4x ∅5.5

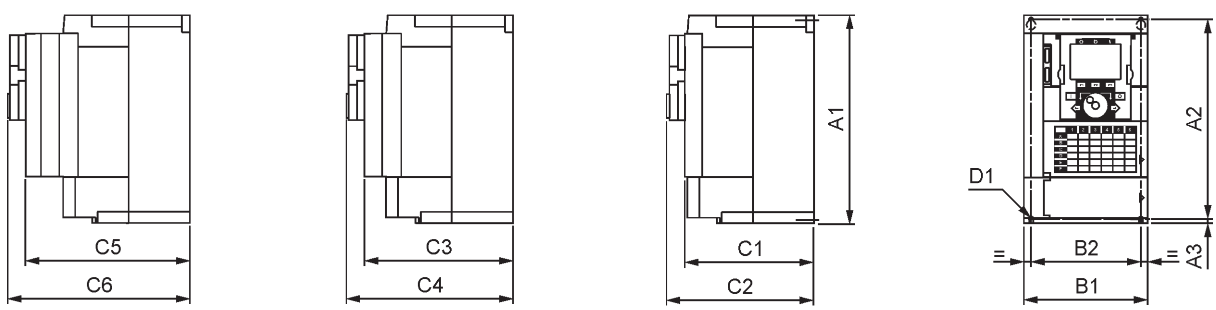


For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 62.

with 2 option cards   with 1 option card   Basic device without option card



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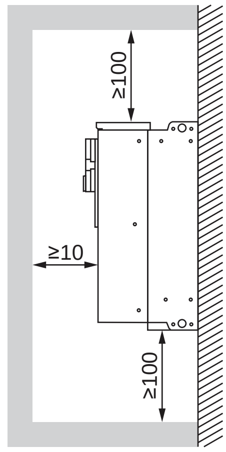
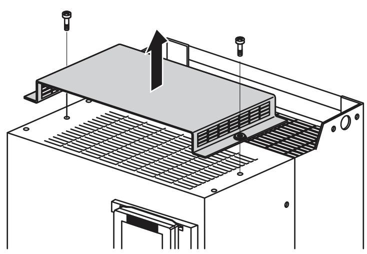
MX eco	4V22	4V30	4V37
Nominal data			
Motor rating			
P_N [kW]	22	30	37
P_N [hp]	30	40	50
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	33	46	55
$S_{N\,460}$ [kVA] V_N = 460 V	38	53	63
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	48	66	79
$I_{N\,460}$ [A] V_N = 460 V	48	66	79
Maximum current for 60 s per 10 minutes			
I_{MAX} [A]	58	79	95
Input current (without choke)			
$I_{IN\,400}$ [A] V_N = 400 V	50	66	84
$I_{IN\,460}$ [A] V_N = 460 V	42	56	69
Characteristics			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at I_N	720	980	1180
Weight approx. [kg]	19	26	26
Ambient conditions			
Volume cooling air [m^3/h]	200	200	200
Sound pressure [dB(A)]	60	64	64
Mains short circuit c. [kA]	22	22	22
Dimensions			
Dimension A1 [mm]	420	550	550
Dimension A2 [mm]	403	529	529
Dimension A3 [mm]	8.5	11	11
Dimension B1 [mm]	240	240	240
Dimension B2 [mm]	206	206	206
Dimension C1 [mm]	213	243	243
Dimension C2 [mm]	236	266	266
Dimension C3 [mm]	235	265	265
Dimension C4 [mm]	258	288	288
Dimension C5 [mm]	257	287	287
Dimension C6 [mm]	280	310	310
Fixing D1 [mm]	4 x ∅ 5.5	4 x ∅ 5.5	4 x ∅ 5.5

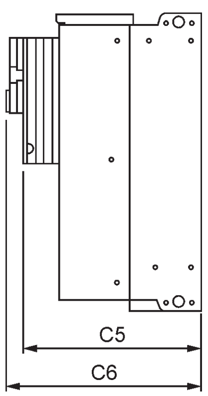


For installation keep a minimum distance of 50 mm between the units and the side wall.

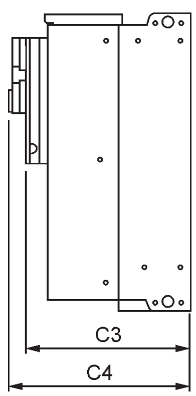


When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 62.

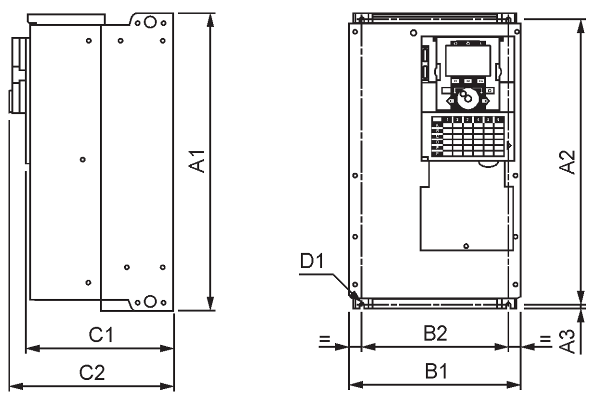
with 2 option cards



with 1 option card



Basic device without option card



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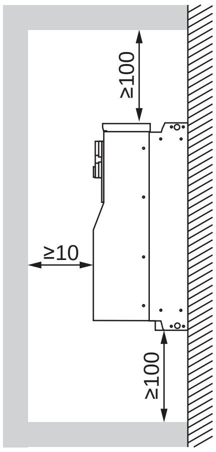
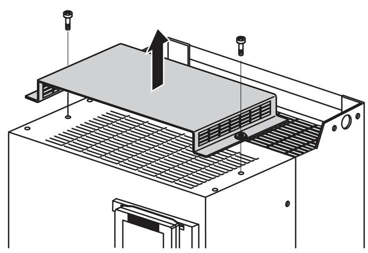
MX eco	4V45	4V55	4V75
Nominal data			
Motor rating			
P_N [kW]	45	55	75
P_N [hp]	60	75	100
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	65	80	111
$S_{N\,460}$ [kVA] V_N = 460 V	75	92	128
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	94	116	160
$I_{N\,460}$ [A] V_N = 460 V	94	116	160
Maximum current for 60 s per 10 minutes			
I_{MAX} [A]	113	139	192
Input current (without choke)			
$I_{IN\,400}$ [A] V_N = 400 V	104	120	167
$I_{IN\,460}$ [A] V_N = 460 V	85	101	137
Characteristics			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at I_N	1360	1560	2320
Weight approx. [kg]	44	44	44
Ambient conditions			
Volume cooling air [m³/h]	400	400	400
Sound pressure [dB(A)]	64	64	64
Mains short circuit c. [kA]	22	22	22
Dimensions			
Dimension A1 [mm]	630	630	630
Dimension A2 [mm]	604.5	604.5	604.5
Dimension A3 [mm]	15.5	15.5	15.5
Dimension B1 [mm]	320	320	320
Dimension B2 [mm]	280	280	280
Dimension C1 [mm]	290	290	290
Dimension C3 [mm]	290	290	290
Dimension C4 [mm]	312	312	312
Dimension C5 [mm]	311	311	311
Dimension C6 [mm]	334	334	334
Fixing D1 [mm]	4 x ∅ 9	4 x ∅ 9	4 x ∅ 9



For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 62.

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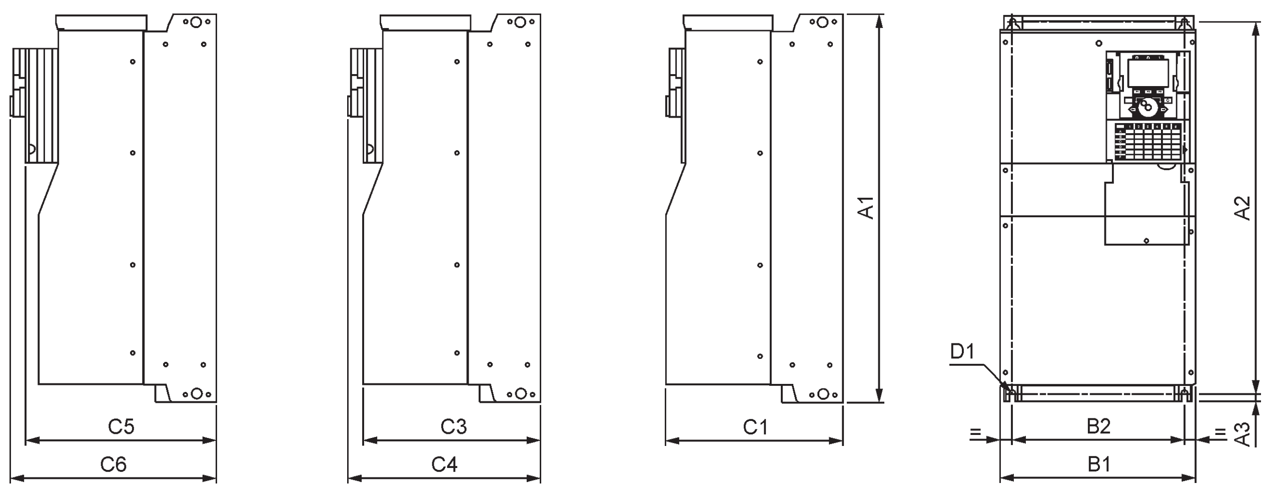
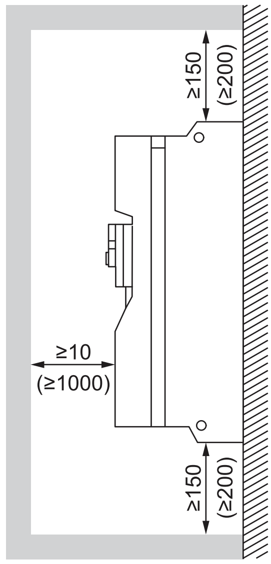
with 2 option cards   with 1 option card   Basic device without option card



MX eco	4V90	4V110	4V132	4V160
Nominal data				
Motor rating				
P_N [kW]	90	110	132	160
P_N [hp]	125	150	200	250
Continuous output power				
$S_{N\,400}$ [kVA] V_N = 400 V	124	149	179	218
$S_{N\,460}$ [kVA] V_N = 460 V	143	171	206	250
Continuous output current				
$I_{N\,400}$ [A] V_N = 400 V	179	215	259	314
$I_{N\,460}$ [A] V_N = 460 V	179	215	259	314
Maximum current for 60 s per 10 minutes				
I_{MAX} [A]	215	258	311	377
Input current (with DCL-BOX)				
$I_{IN\,400}$ [A] V_N = 400 V	158	188	226	271
$I_{IN\,460}$ [A] V_N = 460 V	143	168	224	275
Characteristics				
Efficiency [%]	> 97.5	> 97.5	> 97.5	> 97.6
Losses [W] at I_N	2210	2810	3330	3710
Weight approx. [kg]	60	60	74	80
Ambient conditions				
Volume of cooling air [m³/h]	400	400	600	600
Sound pressure level [dB(A)]	61	61	69	71
Mains short circuit curr. [kA]	50 [1.)]	50 [1.)]	50 [1.)]	50 [1.)]
Dimensions				
Dimension A1 [mm]	680	680	782	950
Dimension A2 [mm]	650	650	758	920
Dimension A3 [mm]	15	15	12	15
Dimension B1 [mm]	310	310	350	330
Dimension B2 [mm]	250	250	298	285
Dimension C1 [mm]	377	377	377	377
Dimension C3 [mm]	377	377	377	377
Dimension C4 [mm]	392	392	392	392
Fixing D1 [mm]	4x ∅11.5	4x ∅11.5	4x ∅11.5	4x ∅11.5



If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

[1.)] in device variant with DCL-BOX

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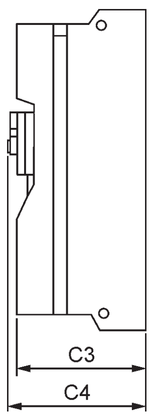
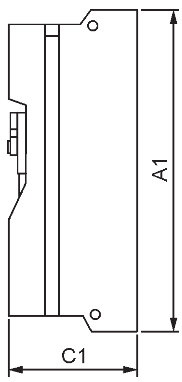
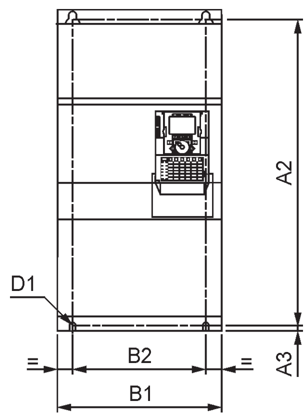
with 2 option cards

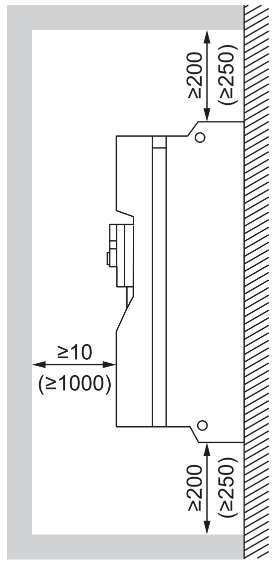


Basic device (without DCL-BOX) without or with 1 option card





MX eco	4V200	4V250	4V315
Nominal data			
Motor rating			
P_N [kW]	200	250	315
P_N [hp]	300	400	500
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	268	333	427
$S_{N\,460}$ [kVA] V_N = 460 V	308	383	491
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	387	481	616
$I_{N\,460}$ [A] V_N = 460 V	387	481	616
Maximum current for 60 s per 10 minutes			
I_{MAX} [A]	464	577	739
Input current (with MX DCL-BOX)			
$I_{IN\,400}$ [A] V_N = 400 V	338	418	527
$I_{IN\,460}$ [A] V_N = 460 V	331	435	544
Characteristics			
Efficiency [%]	> 97.7	> 97.7	> 97.7
Losses [W] at I_N	4450	5890	7250
Weight approx. [kg]	110	140	140
Ambient conditions			
Volume of cooling air [m^3/h]	800	1200	1200
Sound pressure level [dB(A)]	72	73	73
Mains short circuit curr. [kA]	50 [1.)]	50 [1.)]	50 [1.)]
Dimensions			
Dimension A1 [mm]	950	950	950
Dimension A2 [mm]	920	920	920
Dimension A3 [mm]	15	15	15
Dimension B1 [mm]	430	585	585
Dimension B2 [mm]	350	540	540
Dimension C1 [mm]	377	377	377
Dimension C3 [mm]	377	377	377
Dimension C4 [mm]	392	392	392
Fixing D1 [mm]	4x ∅11.5	4x ∅11.5	4x ∅11.5



If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

1.) in device variant with DCL-BOX

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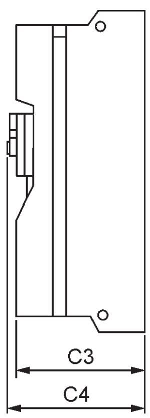
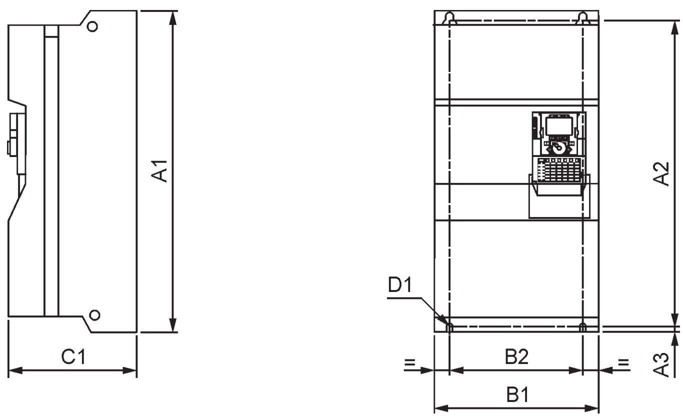
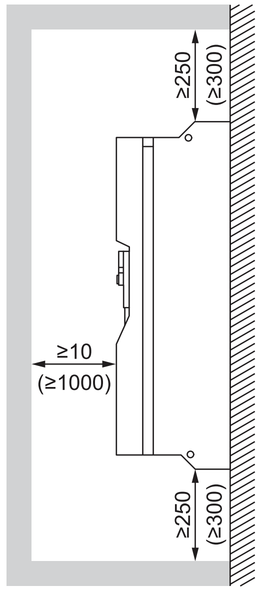
with 2 option cards



Basic device (without DCL-BOX) without or with 1 option card



MX eco	4V355	4V400	4V500	4V630
Nominal data				
Motor rating				
P_N [kW]	355	400	500	630
P_N [hp]	550	600	700	900
Continuous output power				
$S_{N\,400}$ [kVA] V_N = 400 V	465	526	652	823
$S_{N\,460}$ [kVA] V_N = 460 V	535	605	750	947
Continuous output current				
$I_{N\,400}$ [A] V_N = 400 V	671	759	941	1188
$I_{N\,460}$ [A] V_N = 460 V	671	759	941	1080
Maximum current for 60 s per 10 minutes				
I_{MAX} [A]	805	911	1129	1426
Input current (with MX DCL-BOX)				
$I_{IN\,400}$ [A] V_N = 400 V	592	660	834	1037
$I_{IN\,460}$ [A] V_N = 460 V	597	644	760	964
Characteristics				
Efficiency [%]	> 97.8	> 97.8	> 97.8	> 97.8
Losses [W] at I_N	7660	8810	11150	13830
Weight approx. [kg]	215	215	225	300
Ambient conditions				
Volume of cooling air [m^3/h]	1800	1800	1800	2400
Sound pressure level [dB(A)]	75	75	75	75
Mains short circuit curr. [kA]	50 [1.)]	50 [1.)]	50 [1.)]	50 [1.)]
Dimensions				
Dimension A1 [mm]	1150	1150	1150	1150
Dimension A2 [mm]	1120	1120	1120	1120
Dimension A3 [mm]	15	15	15	15
Dimension B1 [mm]	880	880	880	1110
Dimension B2 [mm]	417.5	417.5	417.5	532.5
Dimension C1 [mm]	377	377	377	377
Dimension C3 [mm]	377	377	377	377
Dimension C4 [mm]	392	392	392	392
Fixing D1 [mm]	5x ∅11.5	5x ∅11.5	5x ∅11.5	6x ∅11.5

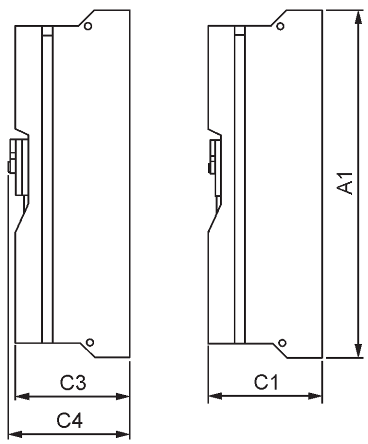


If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

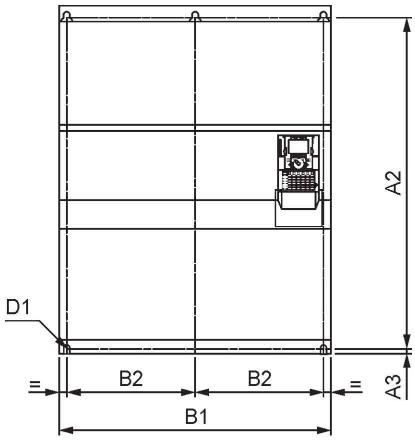
In either case avoid air short circuits.

[1.)] in device variant with DCL-BOX

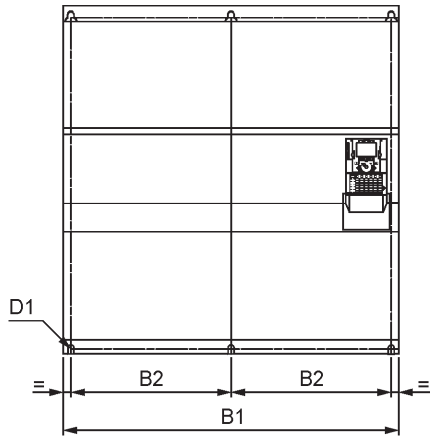
2 option cards 0/1 option card



MX eco 4V400...4V500
(without DCL-BOX)



MX eco 4V630
(without DCL-BOX)



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Mounting place and mounting position

As it is usual with electronic built-in devices, the MX eco frequency inverters are also designed in compliance with the pollution degree 2 according to 50178. If the environment does not correspond to these conditions then the necessary transition of the pollution degree must be provided e.g. by means of a cubicle.

Because of convection the devices are designed for vertical wall mounting. Install the device on a non-combustible vertical wall which does not transmit any vibrations.

Keep the allowed minimum distances between the devices and from other equipment (see chapter "Technical data", as from page 49).

⚠ The mounting place should be well ventilated and without direct solar radiation.

Avoid environmental effects like high temperatures and high humidity as well as dust, dirt and aggressive gases. Condensation must be prevented by all means.

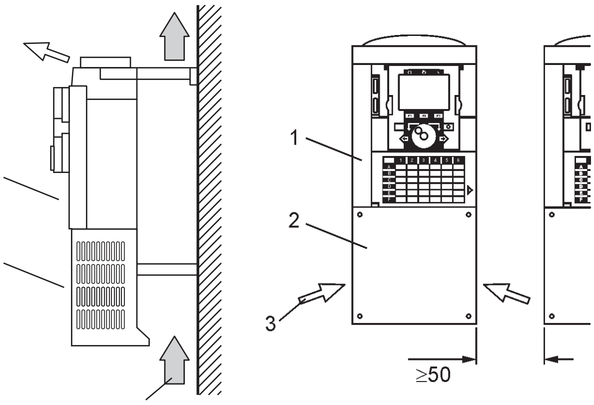
⚠ Do not install the device near heat generating equipment.

Wall-mounting

The MX eco is designed for installation on the wall or in an electrical room. When using the option MX TER-BOX the devices comply with protection degree IP21/31.

For devices up to 75 kW observe a distance of 50 mm sideways, from 90 kW on observe a distance of 10 mm sideways. Additionally provide sufficient free space above and below all devices to ensure unimpeded intake and blow of the cooling air.

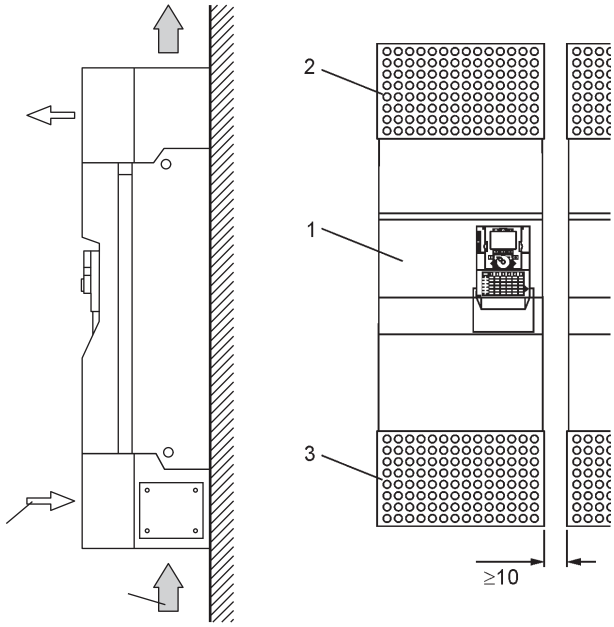
Wall-mounting with option terminal box for frequency inverters up to 75 kW



1 MX eco 4V0,75 … 4V75
2 Option MX TER-BOX 130...320
3 Cooling air for control part
4 Cooling air for power part

Protection degree: above IP41, all around IP21
Ambient temperature: -10...+45°C

Wall-mounting with option DCL box and option terminal box for frequency inverters from 90 kW on



1 MX eco from 90 kW
2 MX DCL-BOX
3 Option MX TER-BOX
4 Cooling air for control part
5 Cooling air for power part

Protection degree: IP31
Ambient temperature: -10...+45°C

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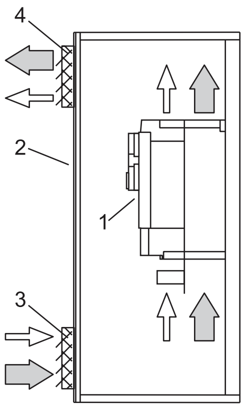
Cubicle installation IP23

The stated losses and minimum cross sections for air inlet are related to the inverter. Further heat sources like DCL, NDU, AMF, fuses and contactors must be considered additionally. The power part fan which is inside the device provides the exhaust of the cubicle. The air flow must not be constrained by means of fixtures or filter mats. Provide a separation of the power part air for devices from 90 kW to avoid internal air short-cuts. Furthermore take care of an exhaust of the control part.

Cubicle installation protection degree IP23
for frequency inverters up to 75 kW

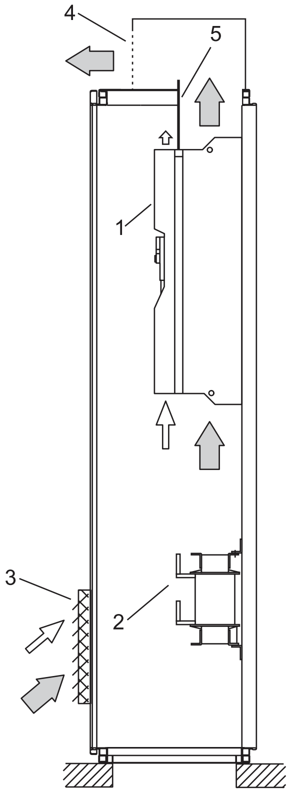


1 MX eco 4V0,75...4V75
2 Cubicle
3 Air inlet grid (without filter mat) for control part and power part
4 Air outlet grid (without filter mat) for control part and power part

Protection degree: IP23

Ambient temperature: -10...+40°C

Cubicle installation protection degree IP23
for frequency inverters from 90 kW



1 MX eco from 90 kW
2 Line choke option NDU
3 Air inlet grid (without filter mat) for control part and power part
4 Metal cover with splash water protection
5 Separation wall to avoid internal air short-cuts

Protection degree: IP23

Ambient temperature: -10...+40°C

For RITTAL TS8 cubicles an optional installation kit is available.

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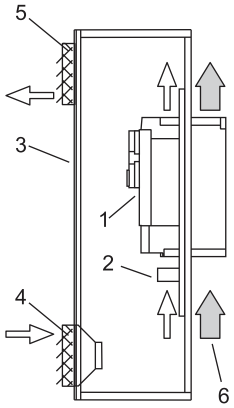
Cubicle installation IP54

Cubicle installation IP54 with separated air flow or flange mounting:

The power part of all devices is designed in IP54 and is sealed from the control electronics. In case of cubicle installation a basement is necessary for separated air flow. The power part fan which is inside the device exhausts the losses of the power part (external). The losses of the control part must be exhausted by means of filter fans or a correspondingly large cubicle surface. The stated values for losses and volume of cooling air refer to the inverter for devices up to 75 kW, from 90 kW they refer to the inverter including a MX DCL-box. Further heat sources like DCL, NDU, AMF, fuses and contactors must be considered additionally.

In the power range from 22 kW a completely designed and tested cubicle design is available. Prices and technical data on request.

Cubicle installation protection degree IP54
for frequency inverters up to 75 kW

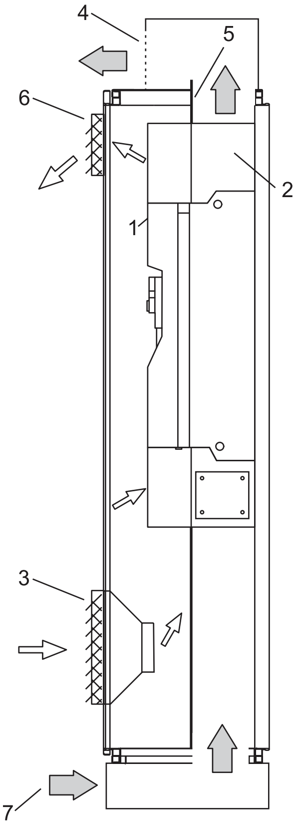


1 MX eco 4V0,75...4V75
2 DCL
3 Cubicle
4 Air inlet grid (with filter fan) for control part
5 Air outlet grid (with filter mat) for control part
6 Cooling air for power part

Protection degree: IP54

Ambient temperature: -10...+40°C

Cubicle installation protection degree IP54
for frequency inverters from 90 kW



1 MX eco from 90 kW
2 DCL-BOX
3 Air inlet grid (with filter fan) for control part
4 Metal cover with splash water protection
5 Separation wall to avoid internal air short-cuts
6 Air outlet (with filter mat) for control part
7 Cooling air for power part

Protection degree: IP54

Ambient temperature: -10...+40°C

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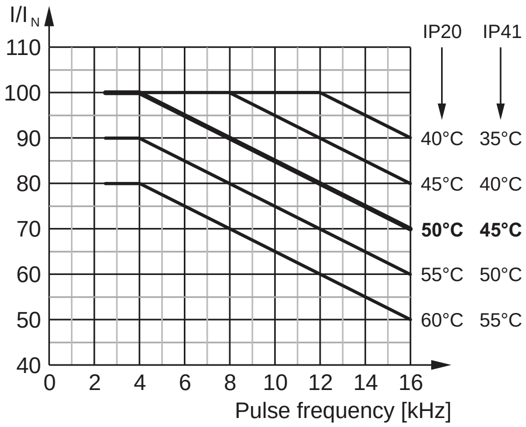
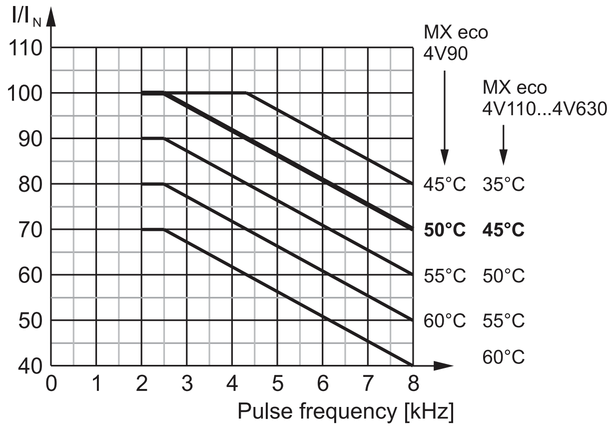
Power decrease

Depending on the chosen pulse frequency and the maximum ambient temperature a power increase is possible or a power reduction is necessary. This can be determined by means of the following diagrams.

MX eco 4V0,75...4V75



MX eco 4V90...4V630



IP20...upper protective cover removed

IP41...device with upper protective cover

Please observe the following guidelines to guarantee trouble-free operation of the drive:

- At higher pulse frequencies the allowed motor cable length is reduced (see chapter "Motor cable lengths", page 70).
- Select a motor which is at most one type bigger.

The DCL box and the terminal box do not have any effect on the cooling and from there also the power increase or reduction of the frequency inverter is independent from their use.

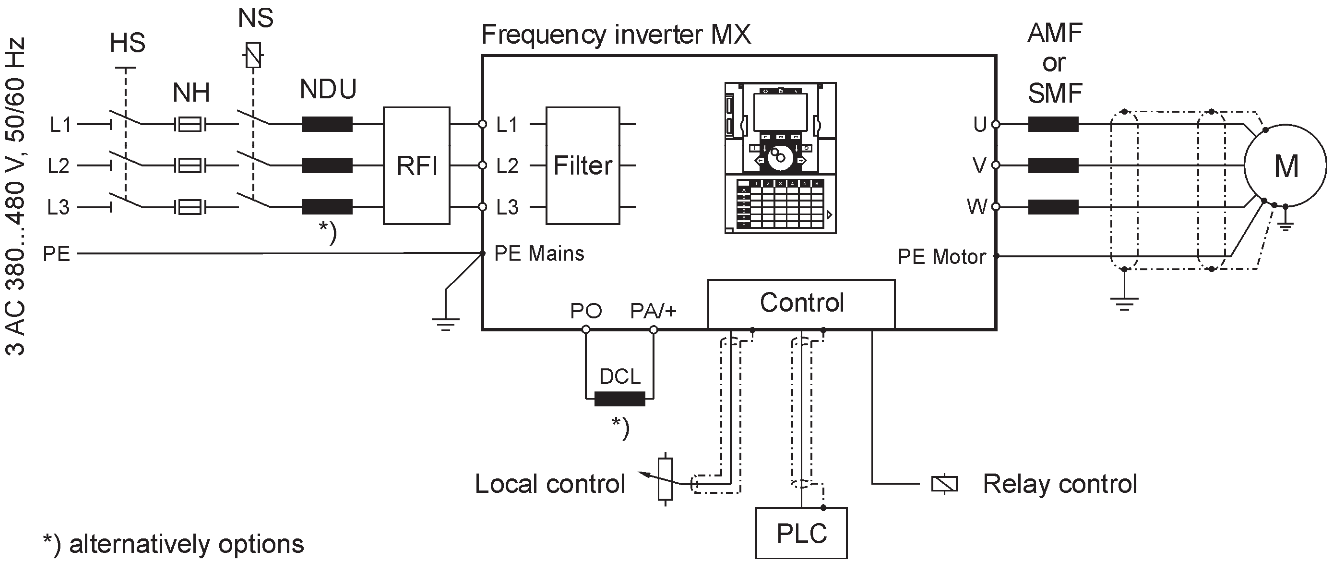
If the heat sink temperature is too high, the pulse frequency is automatically reduced to prevent an overload of the inverter.

Wiring and connection

Wiring diagram

The following diagrams show the typical wiring of the frequency inverters including the options which may be required for protection of the plant or the device, depending on the application.

MX eco 4V0,75...4V400



*) alternatively options

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HS .... Main switch (to be used if required according to the local regulations)

NH......................... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

MX NDU................ Option line reactor to reduce the current harmonics on the mains caused by the DC link, use as an alternative to MX DCL

RFI .... Radio frequency interference filter to use the inverter considering category C1 or C2 according to EN 61800-3 "Use in 1st environment - residential environment"

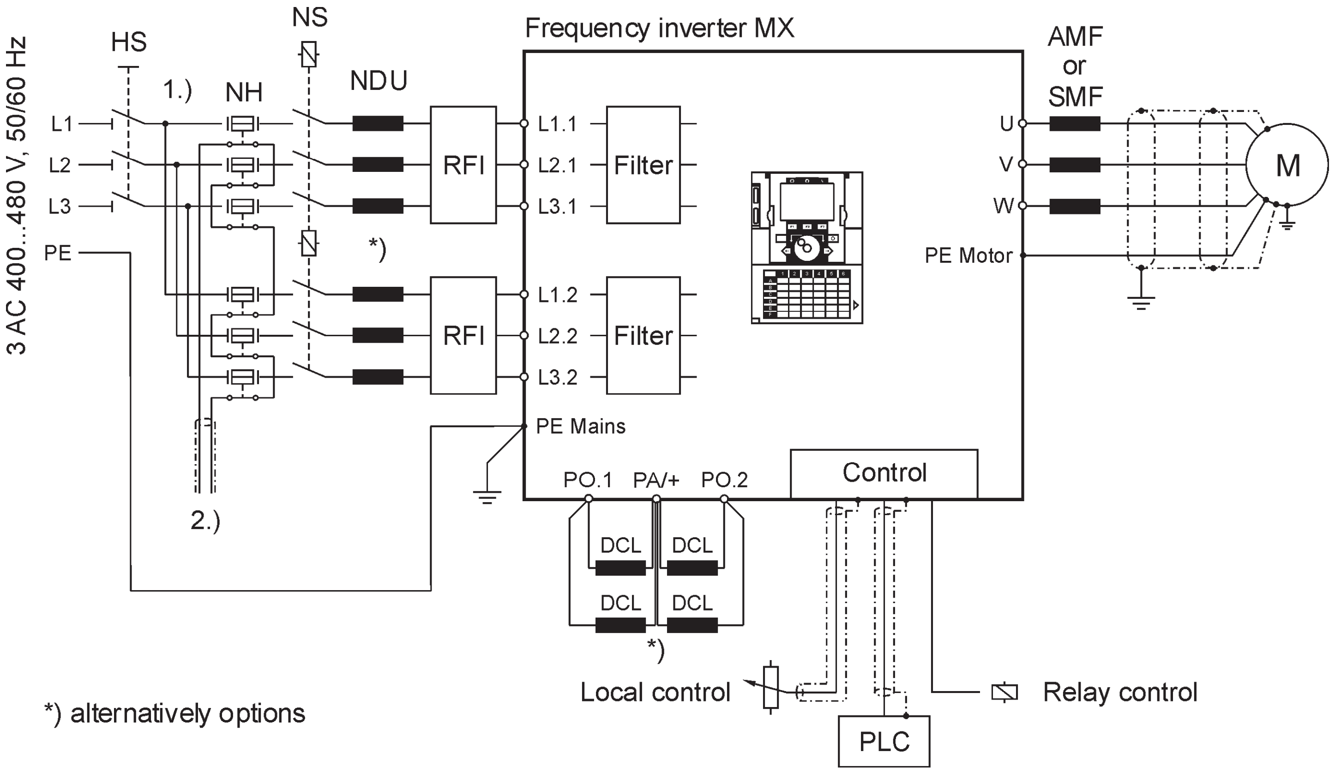
internal filter .... Radio interference filter built-in as standard; considering category C3 according to EN 61800-3 "Use in industrial environments" (category C2 up to MX eco 4V4,0)

AMF .... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF .... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

MX DCL .... Option DC choke to reduce the current harmonics, use as an alternative to the option MX NDU.
For MX eco 4V0,75...4V75 as an external option, above as device variant available.

MX eco 4V500...4V630



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HS ....Main switch (to be used if required according to the local regulations)

NH.........................Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS ....Mains contactor (to be used if required according to the local regulations)

MX NDU ....Option line reactor to reduce the current harmonics on the mains caused by the DC link, use as an alternative to MX DCL

internal filter ....Radio frequency interference filter built-in as standard considering category C3 according to EN 61800-3 "Use in industrial environments"

AMF.......................Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF.......................Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

MX DCL.................DC choke to reduce the current harmonics, use as an alternative to the option MX NDU. The DC choke is available as inverter device variant.

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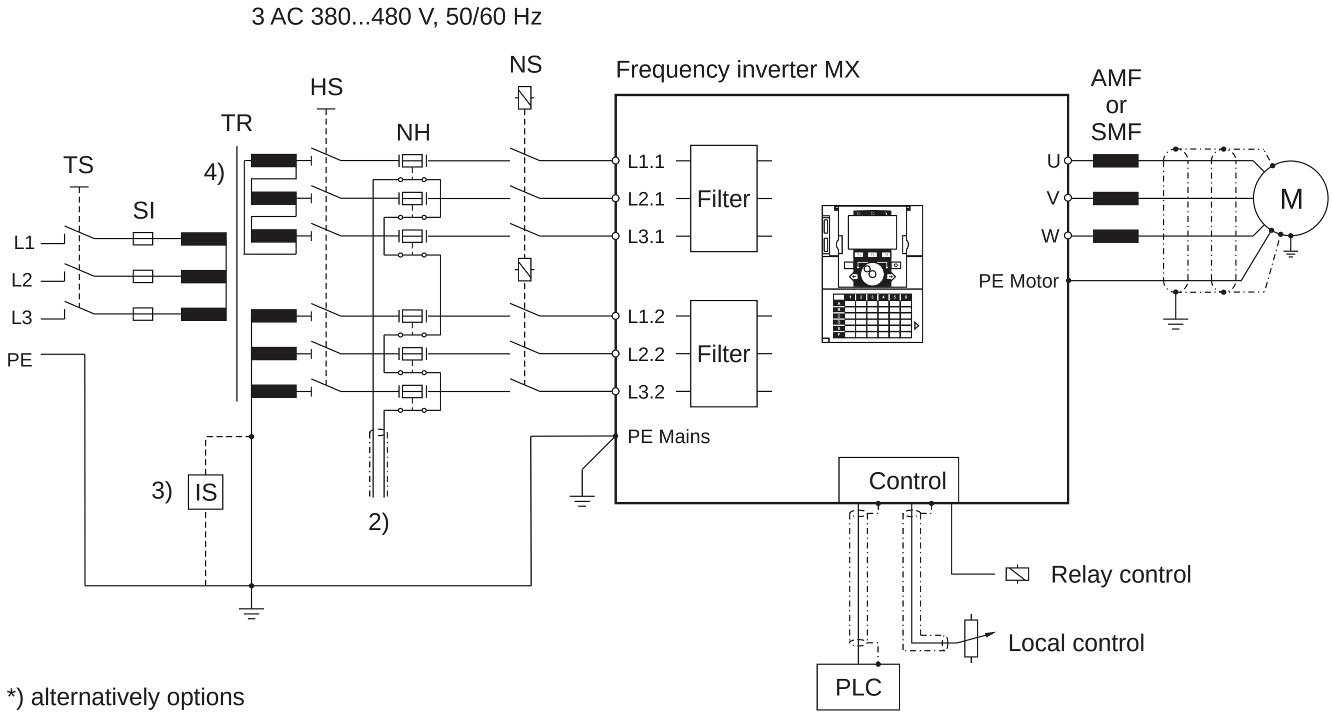
1. The inverter supply must be split up in front of the line reactors, if they are used.
2. The monitoring of the fuses is used to protect the inverter against unbalanced load. It must act on mains contactor or pulse inhibit (e.g. digital input "External fault"). This is not obligatory, because the inverter monitors the mains voltage. Therefor set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).

MX eco 4V500...4V630

12-pulse rectification



*) alternatively options

HS .... Main switch (to be used if required according to the local regulations)

NH......................... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

TR .... Transformer with two out-of-phase secondary windings (e.g. Yy6 d5)

TS.......................... Disconnecting switch (to be used according to the local regulations)

internal filter .... Radio frequency interference filter built-in as standard
considering category C3 according to EN 61800-3 "Use in industrial environments"

AMF .... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF .... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

2. The monitoring of the fuses is used to protect the inverter against unbalanced load. It must act on mains contactor or pulse inhibit (e.g. digital input "External fault"). This is not obligatory, because the inverter monitors the mains voltage. Therefor set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).
3. In case of supply by means of a three-winding-transformer the neutral point can be grounded or alternatively an insulation monitoring relay can be used.
4. The transformer must keep to the following tolerances in order to guarantee a constant current sharing:
Tolerance of the secondary voltages to each other: 0.3 % of V_{NOM}
Tolerance of the relative short circuit voltage: ± 5.0 % of v_{SC_NOM}
The nominal output voltage of a transformer is specified at no load operation. Therefore this value has to be appr. 5 % higher than the rated voltage of the drive.

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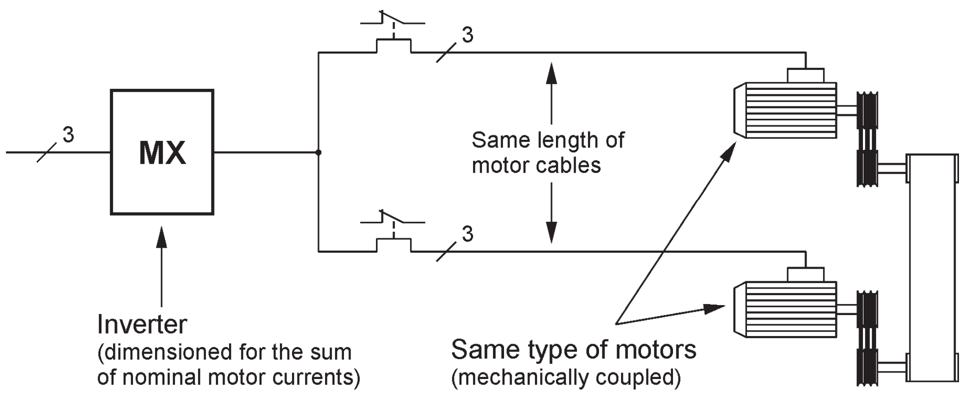
Multi-motor operation

It is basically possible to operate several motors with a MX eco frequency inverter.

For pumps (centrifugal pumps) and fan applications, however, observe the following:

- The sum of the nominal currents must be less than the nominal current of the inverter.
- A different speed regulation is not possible.
- The total motor cable length must be taken into consideration.
- No high starting torque is available.
- The inverter does not provide individual motor overload protection.
- Autotuning is not possible (but also not necessary).
- Activation is only permitted if the starting current surge remains less than the maximum inverter current.

For applications with a higher starting torque (e.g. travel drives, conveyors, lifting gear, etc.), only the parallel connection of several mechanically coupled motors is possible. In order to execute autotuning, the motors must be of the same type and the motor cables must have the same length preferably.



If thermal relays or motor circuit breakers are used, they must be set to about 110 % of the nominal current of the motor !

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Fuses and cable cross sections

The MX eco frequency inverters do not contain any input fuses. They have to be provided externally for the case that the electronic protective mechanism of the inverters fails. So they are a secondary protection of the inverter to protect the power cables against overload and to protect the input rectifier against an internal short-circuit.

The mentioned diameters for 3-wire cables are recommended values for laying the cable in air at max. 40°C ambient temperature, based on the regulations ÖVN EN 1 and VDE 0100.

The lines in the cubicles are dimensioned according to the specification for single conductors XLPE/EPR copper 90°C.

The motor cables are dimensioned for the maximum continuous current. They apply to 0...100 Hz (up to 300 Hz the cable losses increase about 25 % because of the Skin-effect).

In case of other ambient conditions and different regulations the cable diameters must be adjusted.

Mains supply				Frequency inverter			Motor output
Pre- or conduit fuses [1.)]	Cu cable mm^2	Mains fuse "inverter protection" "sf	Lines in the cubicle mm^2 (per phase)	MX eco	Max. cont. current	Max. connec- tion	Motor cable mm^2 [3.)]
10 A	3 x 1.5	10 A (sf)	1.5	4V0,75	2.3 A	6 mm^2	3 x 1.5
10 A	3 x 1.5	10 A (sf)	1.5	4V1,5	4.1 A	6 mm^2	3 x 1.5
10 [16] A	3 x 1.5 [2.5]	10 [16] A (sf)	1.5 [2.5]	4V2,2	5.8 A	6 mm^2	3 x 1.5
16 [20] A	3 x 2.5	16 [20] A (sf)	2.5	4V3,0	7.8 A	6 mm^2	3 x 1.5
20 [25] A	3 x 2.5 [4]	16 [25] A (sf)	2.5 [4]	4V4,0	10.5 A	6 mm^2	3 x 1.5
25 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V5,5	14.3 A	6 mm^2	3 x 2.5
32 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V7,5	17.6 A	6 mm^2	3 x 2.5
40 [63] A	3 x 6 [16]	40 [63] A (sf)	6 [10]	4V11	27.7 A	16 mm^2	3 x 4
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V15	33 A	35 mm^2	3 x 6
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V18	41 A	35 mm^2	3 x 10
63 [80] A	3 x 16 [25]	63 [80] A sf A	10 [16]	4V22	48 A	50 mm^2	3 x 10
80 [100] A	3 x 25 [35]	80 [100] A sf A	16 [25]	4V30	66 A	50 mm^2	3 x 16
100 [125] A	3 x 35 [50]	100 [125] A sf A	25 [35]	4V37	79 A	50 mm^2	3 x 25
125 [160] A	3 x 50 [70]	125 [160] A sf B	35 [50]	4V45	94 A	120 mm^2	3 x 35
160 [200] A	3 x 70 [95]	160 [200] A sf B	50 [70]	4V55	116 A	120 mm^2	3 x 50
200 [250] A	3 x 95 [120]	200 [250] A sf B	70 [95]	4V75	160 A	120 mm^2	3 x 70
250 A	3 x 120	250 A sf C	95	4V90	179 A	M10	3 x 95
250 A	3 x 120	250 A sf C	95	4V110	215 A	M10	3 x 120
315 A	3 x 185	315 A sf C	120	4V132	259 A	M10	3 x 150
400 A	2 x (3 x 120)	400 A sf D	185	4V160	314 A	M10	2 x (3 x 95)
500 A	2 x (3 x 150)	500 A sf D	2 x 120	4V200	387 A	M12	2 x (3 x 120)
630 A	2 x (3 x 185)	630 A sf E	2 x 150	4V250	481 A	M12	2 x (3 x 150)
800 A	3 x (3 x 185)	800 A sf F	3 x 150	4V315	616 A	M12	3 x (3 x 150)
1000 A	4 x (3 x 185)	800 A sf F	3 x 150	4V355	671 A	M12	3 x (3 x 150)
1000 A	4 x (3 x 185)	900 A sf F	3 x 185	4V400	759 A	M12	3 x (3 x 185)
1250 A	4 x (3 x 240)	2 x 630 A sf [2.)] E	2 x 2 x 150	4V500	941 A	M12	4 x (3 x 185)
1600 A	6 x (3 x 240)	2 x 800 A sf [2.)] F	2 x 3 x 150	4V630	1188 A	M12	5 x (3 x 185)

[1.)] Recommended pre-fuses suitable for DOL starting with bypass circuit.

[2.)] 2 x 3-pole fuses because of parallel supply

[3.)] In case of bypass operation the motor cable has to be dimensioned according to the pre- or conduit fuses !

[ ] If the inverters are used without the options MX DCL or MX NDU, consider the values in brackets.

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It is recommended to use super fast (semiconductor) fuses. Standard fast fuses or circuit breakers can also be used but the rectifier could be damaged in case of an internal fault.

To protect the rectifier in case of a short-circuit the used fuses should not exceed the following I^2t values (referring to 10 ms):

A	B	C	D	E	F
5.10^3 A^2s	50.10^3 A^2s	160.10^3 A^2s	320.10^3 A^2s	780.10^3 A^2s	1000.10^3 A^2s

If the mains fuses blow the inverter already has a primary defect. Therefore, exchanging the blown fuses and switching the inverter on again is not effective. Consequently, the use of circuit breakers is not advantageous and has additionally the disadvantage of a slower switch-off ad. A circuit breaker with motor drive has to be seen in fact as an alternative to the line contactor.

A low cost alternative to screened motor cables is the use of NYCY or NYCWY cables (power cables with concentric protective conductor).

Dimensioning according to UL/CSA

In order to meet the requirements of UL/CSA, copper cables with temperature class 60/75°C have to be used.

In addition to semiconductor fuses (with UL approval, nominal values in accordance with column Mains fuse "inverter protection" "sf") the use of class CC, class J and class T fuses according to the table below is permitted.
The below-mentioned cable cross sections correspond with the temperature class 75°C and an ambient temperature of 30°C.

	UL fuses 600V type Fast acting	Max. mains short-circuit current at 480V mains voltage according to UL listing			Cable cross section for mains- and motor cables (per phase)
		without choke	with DCL-choke	with line reactor	
MX eco 4V0,75	Class CC 6 A max.	5 kA	35 kA	100 kA	AWG 14
MX eco 4V1,5	Class CC 12 A max.	5 kA	35 kA	100 kA	AWG 14
MX eco 4V2,2	Class J 15 A max.	5 kA	35 kA	100 kA	AWG 14
MX eco 4V3,0	Class J 17.5 A max.	5 kA	35 kA	100 kA	AWG 14
MX eco 4V4,0	Class J 25 A max.	5 kA	35 kA	100 kA	AWG 12
MX eco 4V5,5	Class J 40A max.	5 kA	35 kA	100 kA	AWG 10
MX eco 4V7,5	Class J 40 A max.	5 kA	35 kA	100 kA	AWG 10
MX eco 4V11	Class J 60 A max.	5 kA	35 kA	100 kA	AWG 8
MX eco 4V15	Class J 70 A max.	5 kA	35 kA	100 kA	AWG 6
MX eco 4V18	Class J 70 A max.	5 kA	35 kA	100 kA	AWG 6
MX eco 4V22	Class J 80 A max.	5 kA	35 kA	100 kA	AWG 6
MX eco 4V30	Class J 90 A max.	5 kA	35 kA	100 kA	AWG 4
MX eco 4V37	Class J 110 A max.	5 kA	35 kA	100 kA	AWG 3
MX eco 4V45	Class J 150 A max.	10 kA	35 kA	100 kA	AWG 1
MX eco 4V55	Class J 175 A max.	10 kA	35 kA	100 kA	AWG 1/0
MX eco 4V75	Class J 225 A max.	10 kA	35 kA	100 kA	AWG 3/0
MX eco 4V90	Class J 250 A max.	(10 kA)	50 kA	100 kA	2x AWG 1/0
MX eco 4V110	Class J 300 A max.	(10 kA)	50 kA	100 kA	2x AWG 2/0
MX eco 4V132	Class J 350 A max.	(10 kA)	50 kA	100 kA	2x AWG 4/0
MX eco 4V160	Class J 400 A max.	(18 kA)	50 kA	100 kA	2x 250 MCM
MX eco 4V200	Class J 450 A max.	(18 kA)	50 kA	100 kA	2x 350 MCM
MX eco 4V250	Class J 600 A max.	(18 kA)	50 kA	100 kA	3x 250 MCM
MX eco 4V315	Class T 800 A max.	(30 kA)	50 kA	100 kA	3x 350 MCM
MX eco 4V355	Class T 800 A max.	(30 kA)	50 kA	100 kA	4x 350 MCM
MX eco 4V400	Semiconductor fuse 900 A max.	(30 kA)	50 kA	100 kA	4x 350 MCM
MX eco 4V500	Class J 2x600 A max.	(30 kA)	50 kA	100 kA	Mains: 2x (2x 500 MCM) Motor: 4x 500 MCM
MX eco 4V630	Class T 2x800 A max.	(30 kA)	50 kA	100 kA	Mains: 2x (3x 500 MCM) Motor: 5x 500 MCM

( ) Further information about the values in parentheses is given in chapter "DC choke DCL", page 218 and chapter "Line reactor NDU", page 223.

Motor cable lengths

Because of the permitted mains disturbances, the allowed overvoltages at the motor, the occurring bearing currents and the permitted losses the distance between inverter and motor(s) is limited. The maximum distance heavily depends on the type of motor cable (screened/unscreened) as well as from the used options.

Overvoltages at the motor

Overvoltages at the motor terminals result from reflection in the motor cable. In case of motor cables with more than 50 m length the used motors must feature increased voltage resistance. Thereby the motor load is nearly independent from the used inverter !

Mains voltage 400 V	Motor insulation for 1300 V phase-to-phase peak voltage and dv/dt resistance > 8 kV/µs
Mains voltage 460 V	Motor insulation for 1600 V phase-to-phase peak voltage and dv/dt resistance > 8 kV/µs

In order to use standard motors in this voltage range, the MX eco have a function to inhibit short output voltage pulses. The function can be activated by means of parameter B3.32 "Min. length of pulses", whereby the overvoltages caused by the reflection are reduced. The slew rate as well as the EMC load are not influenced by changing this parameter.

At even longer motor cables the use of a "dv/dt filter" is required. Combined with the cable capacitance the option AMF (output motor filter) affects like a filter and limits the voltage peaks at the motor as well as the slew rate of the output pulses.

If the specified motor cable lengths are observed the motor life time can be significantly extended.

Mains voltage 400 V	max. 1000 V phase-to-phase peak voltage and dv/dt < 500 V/µs
Mains voltage 460 V	max. 1300 V phase-to-phase peak voltage and dv/dt < 750 V/µs

Observing the specified length of motor cables is absolutely necessary to protect the motor !

EMC interferences

The mains rectifier as well as the IGBT inverter cause high-frequent interferences which drain off more and more stronger to the earth potential with increasing motor cable length. As a result the line-conducted interferences to the mains increase. The attenuation of the line reactors is not longer sufficient and the permitted interference limits are exceeded.

Observing the specified length of motor cables is also necessary for compliance with the EMC limits !

Bearing currents

Common mode bearing currents which even cannot be prevented by means of motors equipped with an insulated bearing are significantly reduced by use of the option AMF.

Especially in case of big motors with middle up to high motor cable lengths the option AMF is considerable to increase the availability of the motor.

Multiplication factors

The specified lengths of motor cables are recommended limits based on typical motor cables, laying in cable channels, default pulse frequency and maximal output frequency of 100 Hz.

In case of different conditions the recommended cable lengths must be converted by means of the following factors.

If several factors apply, please multiply them.

- The pulse frequency does not correspond to factory default:

MX eco 4V0,75...4V75:

at 8 kHz	multiply all values by 0.6
at 12 kHz	multiply all values by 0.4
at 16 kHz	multiply all values by 0.3

MX eco 4V90...4V630:

at 4 kHz	multiply all values by 0.7
at 8 kHz	multiply all values by 0.4

- In case of output frequencies higher than 100 Hz:

up to 200 Hz	multiply all values by 0.8
up to 300 Hz	multiply all values by 0.5

- Instead of two parallel cables one thicker cable is used: multiply all values by 1.5

- In case of 6-pole motor cabling (e.g. for star/delta starting circuit): multiply all values by 0.75

- In case of parallel motors with their centre near the inverter values must be converted in compliance with the number of motors. When an adjusted AMF is used for each motor, the following values in brackets apply.

at 2 motors	multiply all values by 0.40 (0.80)
at 3 motors	multiply all values by 0.25 (0.60)
at 4 motors	multiply all values by 0.15 (0.40)
at 5 motors	multiply all values by 0.10 (0.25)

- If the centre of the parallel motors is near the motors, following factors for conversion apply:

at 2 motors	multiply all values by 0.80
at 3 motors	multiply all values by 0.60
at 4 motors	multiply all values by 0.40
at 5 motors	multiply all values by 0.25

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Recommended maximum lengths of motor cables in 1st environment

options	4V0,75...4V4,0	4V5,5…4V45	4V55…4V630	Type of motor cable
C1 residential environment - unrestricted sales (EN 55011 - class B group 1)				
Option RFI	50 m	50 m	–	screened
C2 residential environment - EMC qualified user (EN 55011 - class A group 1)				
no options	10 m	–	–	screened
Option RFI *)	75 m	75 m	100 m	screened
Option RFI + AMF	80 m	80 m	120 m	screened
Option RFI + SMF	100 m	100 m	150 m	screened

Recommended maximum lengths of motor cables in 2nd environment (industrial environment)

options	4V0,75...4V4,0	4V5,5…4V45	4V55…4V630	Type of motor cable
C3 (EN 55011 - class A group 2)				
no options	20 m	20 m	50 m	screened
Option AMF	50 m	50 m	80 m	screened
Option RFI *)	80 m	80 m	100 m	screened
Option RFI + AMF	120 m	120 m (200 m)	200 m	screened
Option RFI + SMF	150 m	200 m	200 m	screened
Option SMF	20 m	20 m	–	unscreened
C4 (EMC concept)				
no options *)	50 m	50 m	80 m	screened
Option AMF	100 m (150 m)	120 m (200 m)	250 m	screened
2 x Option AMF serial	200 m (300 m)	250 m (400 m)	500 m	screened
Option SMF	150 m	150 m	200 m	screened
no options	100 m	100 m	100 m	unscreened
Option AMF	150 m (200 m)	200 m (300 m)	400 m	unscreened
2 x Option AMF serial	200 m (400 m)	300 m (600 m)	600 m	unscreened
Option SMF	300 m	300 m	400 m	unscreened

Values in brackets () … with option AMF 215-3 instead of AMF xx-1

*) To avoid overvoltages at the motor it is absolutely necessary to adjust parameters B3.32 "Min. length of pulses" optimized.

To reduce the voltage load and bearing currents in the motor, the use of the option AMF makes sense from motor cable lengths of 50 m.

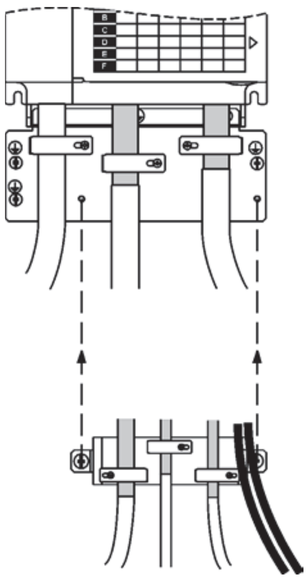
Wiring remarks for power and control cables

Take the control wiring separately from the mains cables, motor cables and any other power cables. The control wiring should be screened and should not exceed 20 m.

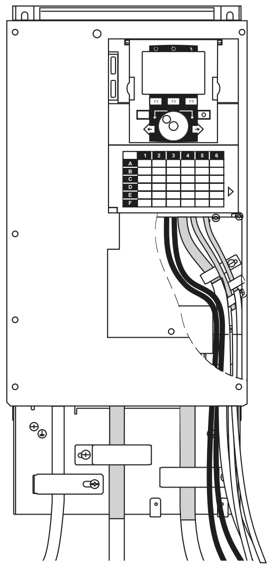
If crossings with power cables cannot be prevented, take them with 90° angle.

All MX eco & pro 4V0,75...4V75 and MX pro 6V2,2/3,0…6V75/90 inverters are delivered with an EMC plate including screws and suitable cable clamps. It is used to fix all cables to the inverter and presents an optimal connection between motor cable screen and radio interference filter. Moreover, all screens of the control wires can be connected to the EMC plate.

MX eco & pro 4V0,75…4V18



MX eco & pro 4V22...4V75
MX pro 6V2,2/3,0...6V75/90



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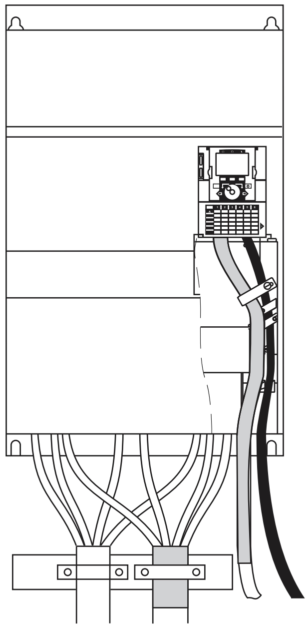
The total height of the inverter alters when using the EMC plate corresponding to this additional element.

Device	Height of the device
MX eco & pro 4V0,75…4V4,0	+83 mm
MX eco & pro 4V5,5…4V18	+95 mm
MX eco & pro 4V22...4V75 MX pro 6V2,2/3,0...6V75/90	+120 mm

For the leading-in of the control wires the MX eco & pro from 90kW have a separate cable tray which is insulated from the power part. Therein, the cable clamps for connecting the screens can be found just underneath the control terminals.



The connection between the motor cable screen and the radio interference filter inside the inverter or the option MX RFI is established via a well-conductive mounting plate. Alternatively the terminal box option MX TER-BOX can be used.

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Control terminals

The frequency inverters MX eco are equipped with extensive control terminals as standard. The use and the function of all inputs and outputs can be parameterized.

For extension the option cards IO11 and IO12 are available. The same option card can be plugged in only one time per unit.

The inverters MX eco can be equipped at most with 2 option cards (terminal extension and/or field bus).

Listing of all control terminals

Control terminals		Standard equip-ment	Option IO11	Option IO12	Max. equip-ment
Reference voltages	+10 V	x	–	–	x
	-10 V	–	x	x	x
	+24 V	x	x	x	x
Ext. buffer voltage	24 V DC	x	–	–	x
Inputs					
Analog inputs (limits and usage can be parameterized)	0...±10 V (differential)	1x	–	–	1x
	0(4)...20 mA (differential)	–	–	1x	1x
	alternatively 0...+10 V or 0(4)...20 mA	1x	–	1x	2x
Digital inputs (function can be parameterized)	DI (24 V, positive / negative logic)	5x	4x	4x	13x
	alternatively DI or thermistor	1x	–	–	1x
Thermistor inputs	Thermistor	–	1x	1x	2x
	alternatively DI or thermistor	1x	–	–	1x
Safety input	"Safe Standstill"	1x	–	–	1x
Digital ref. value	0...30 kHz	–	–	1x	1x
Outputs					
Analog outputs (selection of actual values can be parameterized)	alternatively 0...+10 V or 0(4)...20 mA	1x	–	–	1x
	alternatively ±10 V or 0(4)...20 mA	–	–	2x	2x
Digital outputs (function can be parameterized)	Open Collector 24 V DC	–	2x	2x	4x
Relay outputs (function can be parameterized)	N.O./N.C.	1x	1x	1x	3x
	N.O.	1x	–	–	1x

The ground (0 V) can float up to 35 V compared to PE. The connection 0 V – ground which is necessary to limit the voltage can therefore e.g. also occur far away in the PLC (if necessary by the analog output related to 0 V).

The analog input AI1 with differential amplifier (as well as AI3 of the option card IO12) enables the reference assignment decoupled from the ground.

Keep the maximum cable length of 15 m for the wiring of the safety input PWR "Safe standstill".

The device fulfills all requirements for protective separation between power and electronic connections according to EN 61800-5-1.

Also all connected circuits must fulfil the requirements for protective separation to guarantee protective separation.

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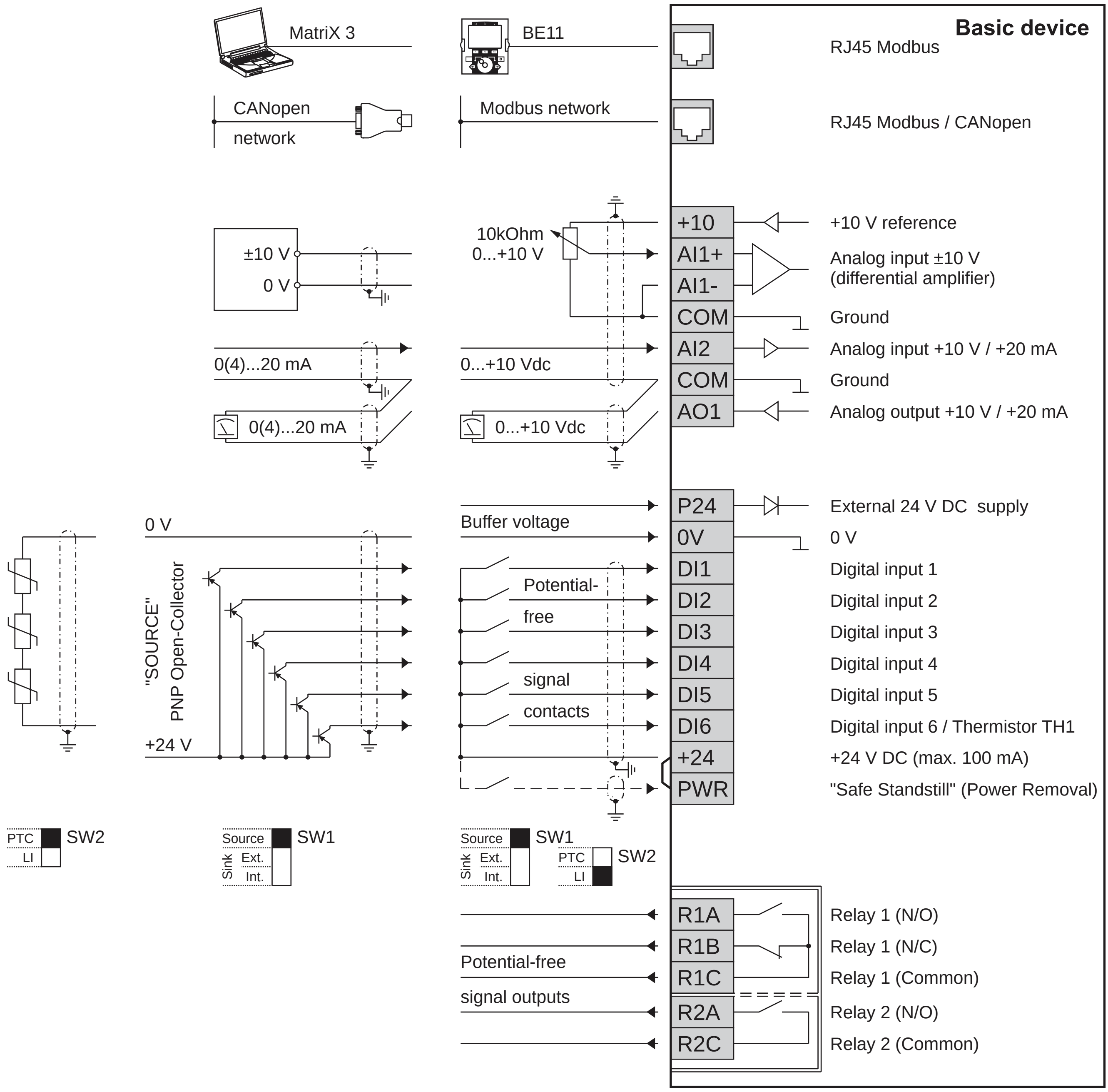
Standard control terminals of the frequency inverter



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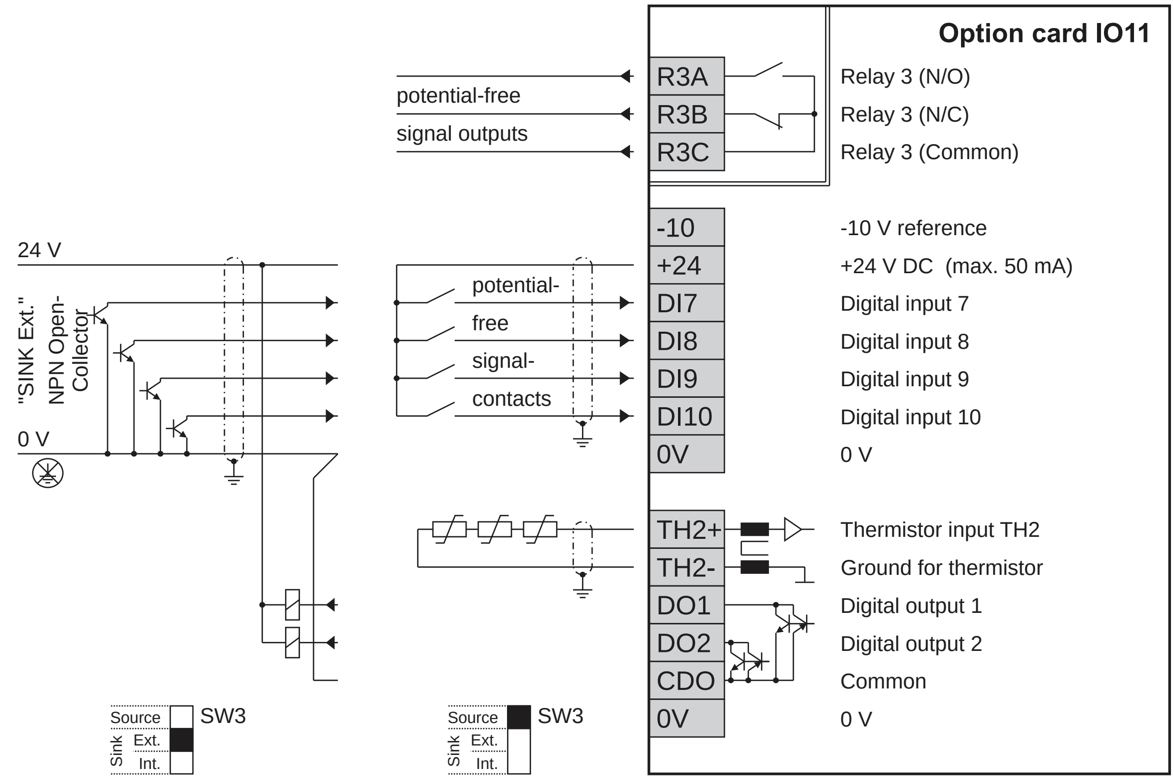
The use of the individual inputs and outputs as well as their limits can be adjusted by means of the device software. Only the alternative use of the digital input DI6 for motor thermistor monitoring and the selection of the switching method for all digital inputs has to be adjusted by means of the sliding switch.

The inverters MX eco are equipped with a built-in interface for control via Modbus. In addition to the external wiring (connection to the T-pieces in the bus line) only the adjustment of few parameters is necessary.

Alternatively, this interface can be also used for the CANopen bus. Therefore, an adapter is required for conversion of the RJ45 plug to SUB-D (CANopen standard CiA DRP 303-1). The bus wiring is taken by connection to the next device.

A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 209.

Control terminals of option card IO11



The terminal extension IO11 is a cost-effective solution with additional digital inputs and outputs, one relay output and one high-quality thermistor input. The card cannot be used twice.

The setting for positive or negative logic of the option card can be taken independent from the digital inputs of the basic device by means of the sliding switch SW3.

Parameters which belong to the inputs and outputs of the option cards are only available at the inverter when the card(s) are plugged. Thus, wrong parameterization of functions close to the terminals is extensively prevented.

A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 209.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

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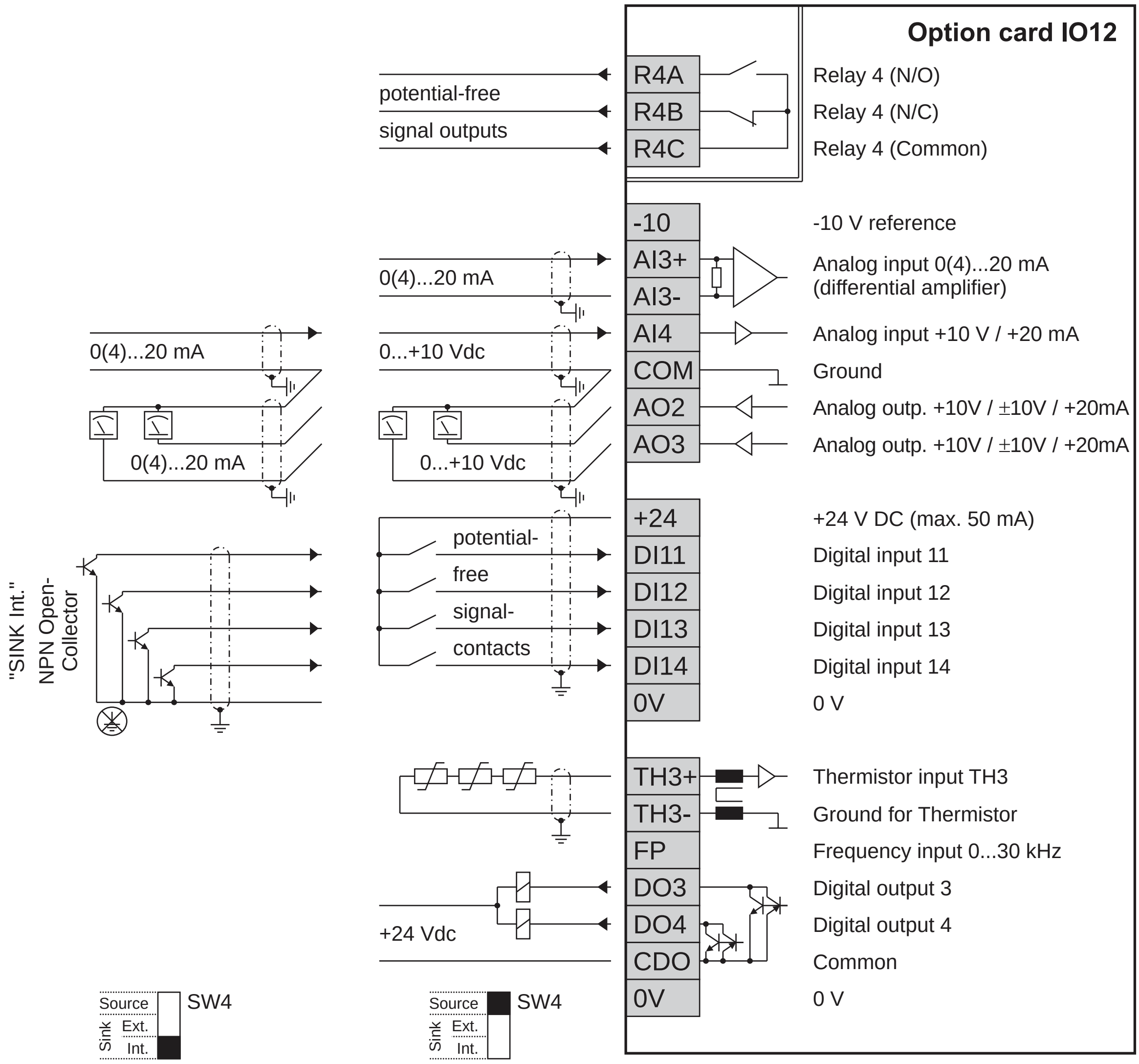
Control terminals of option card IO12



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The terminal extension IO12 can be plugged in addition or as an alternative to the option IO11. The card cannot be used twice.

The setting for positive or negative logic of the option card can be taken independent from the digital inputs of the basic device by means of the sliding switch SW4.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

Purchase order

The order code of the MX eco frequency inverter consists of 9 points of reference (characters and figures). The meaning of each point is illustrated in the following example.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*Ref. point*
ELN	M	E	4	C	2	0	A	A	A	**Example**

	Meaning
Point 9	Hardware configuration always "A"
Point 8	Specification of language always "A"
Point 7	Favored device variant "A" ... Standard "D" ... device variant DCL-BOX (from MX eco 4V90)
Points 4...6	Indication of device power U07...U75 for 0,75...7,5 kW D11...D90 for 11...90 kW C11...C63 for 110...630 kW
Point 3	"4" for devices with 380...480 V mains voltage
Point 2	"E" for product line MX eco
Point 1	"M" for product family MX

Options for the inverter device must be ordered additionally. The respective order numbers are given in chapter "Options", as from page 197.

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Documentation

The documentation of the MX eco frequency inverters is divided into different documents for better clarity:

- **Product leaflets** give an overview of the characteristics and functions of the devices
- **Product catalogue** for planning and ordering of the drives
- Printed copies of the **operating instructions** are enclosed with each device
- **Description of the functions** with detailed description of all functions and parameters
- **Operating instructions** for divers fieldbuses like Modbus, CANopen and Profibus
- **Mounting instructions** for professional mounting and connection of the inverters
- **Installation instructions** for the individual options

In addition to the operating instructions a CD-ROM is attached to each inverter (order number 8 P01 021). It contains all above-mentioned instructions as well as the PC-program Matrix 3 for perfect commissioning and diagnosis of the inverters.

Further reading

If you need instructions in printed form, you can ask for them by means of the below-mentioned order number.

Designation	Order number	Brief description
Product leaflet of MX eco & MX pro frequency inverters	8 P01 000 DE 8 P01 000 EN	Overview of the characteristics of the device, external design of the inverter and its most important functions
Product catalogue of MX eco & pro frequency inverters	8 P01 002 DE 8 P01 002 EN	General description of the device, technical data, valid standards, information about planning and ordering of the frequency inverters and its options
Product catalogue of MX multi-eco & MX multi-pro frequency inverters in cubicle design	8 P01 004 DE 8 P01 004 EN	General description of the device, technical data, valid standards, information about planning and ordering of the frequency inverters and its options
Operating instructions for MX eco & MX pro	8 P01 022	Unpacking, operating, mounting and trouble shooting as well as important remarks for handling and possible dangers
Description of functions for MX eco	8 P01 023 DE 8 P01 023 EN	Operating and parameterizing, complete parameter list, alarm and trip messages, description of the PC-program Matrix 3
Mounting instructions for MX eco	8 P01 025 DE 8 P01 025 EN	Technical data, valid standards, mounting, connection, ambient conditions
Operating instructions Modbus for MX eco	8 P01 033 DE 8 P01 033 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions CANopen for MX eco	8 P01 031 DE 8 P01 031 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions Profibus DP for MX eco	8 P01 027 DE 8 P01 027 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning

Further information can also be found on our homepage
www.schneider-electric-power-drives.com.

Available options for MX eco inverters

To enlarge the field of applications for the frequency inverters MX eco, various options are available concerning control and operation, extensions referring to the electric arrangement and to increase the protection degree.

General options

Designation	Order number	Brief description	Reference
Operating options			
MX BE11	ELN 8 P01 100 (8 P01 100/B)	Matrix operating panel affords optimal operating comfort by means of the matrix philosophy	Page 198
MX DMK11	ELN 8 P01 120	Door mounting kit for installing the operating panel BE11 in a cubicle door, up to 10 m away from the inverter	Page 200
MX DMK11-IP65	VW3 A1 103	Transparent IP65 cover for the door mounting kit of the operating panel BE11	
MX CABLE3-BE	VW3 A1 104R30	Connecting cable operating panel – inverter with 3 m length	
MX CABLE10-BE	VW3 A1 104 R100	Connecting cable operating panel – inverter with 10 m length	
Manual-CD MX eco & pro	8 P01 021	This CD-ROM provides the whole documentation of the inverter as well as the PC program Matrix 3	Page 31
MX CABLE3-PC	ELN 8 P01 124	Connecting cable inverter – PC with 3 m length, incl. RS232/485 interface converter on the computer side	
MX ADAP BLUE	VW3 A8 114	Bluetooth adapter	
MX RS232/485	Phönix Contact PSM-ME-RS232/RS485-P	RS232/485 interface converter with supply and active bus connection	
MX MATRIX REMOTE LINK	8 P01 128	Remote maintenance option for analog modem connection or Ethernet network.	
MX ADAP RJ45	VW3 A1 105	RJ45 F/F adapter is required for the connection of the operating panel BE11 to the connecting cable	
Control options			
MX IO11	ELN 8 P01 101	Terminal extension for additional digital inputs and outputs	Page 209
MX IO12	ELN 8 P01 102	Terminal extension for additional analog and digital inputs and outputs	
MX MODBUS T-ADAP 03	VW3 A8 306 TF03	Modbus T-adapter with 0.3 m connecting cable	Page 205
MX MODBUS T-ADAP 1	VW3 A8 306 TF10	Modbus T-adapter with 1 m connecting cable	
MX MODBUS RC	VW3 A8 306 RC	Bus termination RC	
MX MODBUS SPLITTER	LU9 GC3	Divides the Modbus signal into eight further channels	
MX MODBUS PLUG	Phönix Contact VS-08-RJ45-5-Q/IP20	RJ45 connector IP20 with quick-connecting technology	
MX ADAP CAN	VW3 CAN A71	RJ45/Sub-D adapter for the connection of the inverter to a CANopen fieldbus network	Page 207
MX CANOPEN PLUG	TSX CAN KCDF 180 T	Connecting plug for CANopen network	
MX CAN TAP2	VW3 CAN TAP 2	Passive CAN adapter with shiftable terminating resistor	
MX PBO11	ELN 8 P01 103	Option card for control of the inverter via Profibus DP	Page 208
MX PROFIBUS PLUG	Phönix Contact SUBCON-PLUS-PROFIB/AX/SC	Connecting plug for Profibus network	

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Options depending on the power

Designation	Order number	Brief description	Reference
Options depending on the power			
MX RFI	See following allocation table	Additional radio interference filter to reduce the high-frequency interferences for use in residential environment	Page 215
MX DCL		DC choke to reduce the mains current harmonics to THD I ≤ 45 %	Page 218
MX NDU		Three-phase choke to reduce the mains current harmonics to THD I ≤ 45 %	Page 223
MX AMF		Output motor filter enables the use of the inverter with long motor cables and limits the voltage peaks in the motor	Page 236
MX SMF		Sinus motor filter enables the use of the inverter with very long motor cables and prevents additional noises in the motor, necessary in case of step-up transformers	Page 240
MX TER-BOX		Terminal box which is attached at the bottom of the inverter for mechanical support and connection of the motor cable screen	Page 246
MX FLANGE		Flange mounting kit to install the inverter in flange mounting technology (heat sink outside the cubicle)	Page 249
MX CMK		Cubicle mounting kit for an optimal mounting of the frequency inverter in a Rittal TS8 cubicle	Page 252

Allocation table for options depending on the power

	Option RFI	Option DCL	Option NDU
MX eco 4V0,75	VW3 A4 401 (RFI 480/12-TN)	VW3 A4 501 (DCL 2)	VW3 A4 551
MX eco 4V1,5	VW3 A4 401 (RFI 480/12-TN)	VW3 A4 502 (DCL 4)	VW3 A4 551
MX eco 4V2,2	VW3 A4 401 (RFI 480/12-TN)	VW3 A4 503 (DCL 8)	VW3 A4 552
MX eco 4V3,0	VW3 A4 402 (RFI 480/26-TN)	VW3 A4 503 (DCL 8)	VW3 A4 552
MX eco 4V4,0	VW3 A4 402 (RFI 480/26-TN)	VW3 A4 504 (DCL 11)	VW3 A4 552
MX eco 4V5,5	VW3 A4 403 (RFI 480/35-TN)	VW3 A4 505 (DCL 14)	VW3 A4 553
MX eco 4V7,5	VW3 A4 403 (RFI 480/35-TN)	VW3 A4 506 (DCL 19)	VW3 A4 553
MX eco 4V11	VW3 A4 404 (RFI 480/46-TN)	VW3 A4 507 (DCL 27)	VW3 A4 554
MX eco 4V15	VW3 A4 405 (RFI 480/72-TN)	VW3 A4 508 (DCL 44)	VW3 A4 554
MX eco 4V18	VW3 A4 405 (RFI 480/72-TN)	VW3 A4 508 (DCL 44)	VW3 A4 555
MX eco 4V22	VW3 A4 406 (RFI 480/90-TN)	VW3 A4 510 (DCL 85)	VW3 A4 555
MX eco 4V30	VW3 A4 407 (RFI 480/92-TN)	VW3 A4 510 (DCL 85)	VW3 A4 556
MX eco 4V37	VW3 A4 407 (RFI 480/92-TN)	VW3 A4 510 (DCL 85)	VW3 A4 556
MX eco 4V45	VW3 A4 408 (RFI 480/180-TN)	VW3 A4 511 (DCL 171)	VW3 A4 556
MX eco 4V55	VW3 A4 408 (RFI 480/180-TN)	VW3 A4 511 (DCL 171)	VW3 A4 570 (NDU 160)
MX eco 4V75	VW3 A4 408 (RFI 480/180-TN)	VW3 A4 511 (DCL 171)	VW3 A4 570 (NDU 160)
MX eco 4V90	VW3 A4 410 (RFI 480/300-TN)	ELNME4D90DAA (MX eco incl. MX DCL-BOX 240)	VW3 A4 558 (NDU 195)
MX eco 4V110	VW3 A4 410 (RFI 480/300-TN)	ELNME4C11DAA (MX eco incl. MX DCL-BOX 240)	VW3 A4 559 (NDU 235)
MX eco 4V132	VW3 A4 410 (RFI 480/300-TN)	ELNME4C13DAA (MX eco incl. MX DCL-BOX 290)	VW3 A4 560 (NDU 280)
MX eco 4V160	VW3 A4 410 (RFI 480/300-TN)	ELNME4C16DAA (MX eco incl. MX DCL-BOX 350)	VW3 A4 568 (NDU 315)
MX eco 4V200	VW3 A4 411 (RFI 480/600-TN)	ELNME4C20DAA (MX eco incl. MX DCL-BOX 490)	VW3 A4 561 (NDU 365)
MX eco 4V250	VW3 A4 411 (RFI 480/600-TN)	ELNME4C25DAA (MX eco incl. MX DCL-BOX 570)	VW3 A4 569 (NDU 475)
MX eco 4V315	VW3 A4 411 (RFI 480/600-TN)	ELNME4C31DAA (MX eco incl. MX DCL-BOX 700)	VW3 A4 564 (NDU 650)
MX eco 4V355	VW3 A4 412 (RFI 480/800-TN)	ELNME4C35DAA (MX eco incl. MX DCL-BOX 860)	VW3 A4 565 (NDU 760)
MX eco 4V400	VW3 A4 412 (RFI 480/800-TN)	ELNME4C40DAA (MX eco incl. MX DCL-BOX 860)	VW3 A4 565 (NDU 760)
MX eco 4V500	2 x VW3 A4 411 (2 x RFI 480/600-TN)	ELNME4C50DAA (MX eco incl. MX DCL-BOX 1160)	2 x VW3 A4 563 (2 x NDU 540)
MX eco 4V630	2 x VW3 A4 411 (2 x RFI 480/600-TN)	ELNME4C63DAA (MX eco incl. MX DCL-BOX 1400)	2 x VW3 A4 573 (2 x NDU 620)

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	Option AMF	Option SMF	Option TER-BOX	Option FLANGE
MX eco 4V0,75	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 101 (TER-BOX 130)	VW3 A9 501 (FLANGE 130 x 230)
MX eco 4V1,5	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 101 (TER-BOX 130)	VW3 A9 501 (FLANGE 130 x 230)
MX eco 4V2,2	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 101 (TER-BOX 130)	VW3 A9 501 (FLANGE 130 x 230)
MX eco 4V3,0	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 102 (TER-BOX 155)	VW3 A9 502 (FLANGE 155 x 260)
MX eco 4V4,0	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 102 (TER-BOX 155)	VW3 A9 502 (FLANGE 155 x 260)
MX eco 4V5,5	VW3 A5 102 (AMF 48-1)	VW3 A5 202 (SMF 480/16)	VW3 A9 103 (TER-BOX 175)	VW3 A9 503 (FLANGE 175 x 295)
MX eco 4V7,5	VW3 A5 102 (AMF 48-1)	VW3 A5 203 (SMF 480/33)	VW3 A9 103 (TER-BOX 175)	VW3 A9 503 (FLANGE 175 x 295)
MX eco 4V11	VW3 A5 102 (AMF 48-1)	VW3 A5 203 (SMF 480/33)	VW3 A9 104 (TER-BOX 210)	VW3 A9 504 (FLANGE 210 x 295)
MX eco 4V15	VW3 A5 102 (AMF 48-1)	VW3 A5 203 (SMF 480/33)	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX eco 4V18	VW3 A5 102 (AMF 48-1)	VW3 A5 204 (SMF 480/66)	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX eco 4V22	VW3 A5 102 (AMF 48-1)	VW3 A5 204 (SMF 480/66)	VW3 A9 106 (TER-BOX 240)	VW3 A9 506 (FLANGE 240 x 420)
MX eco 4V30	VW3 A5 103 (AMF 90-1)	VW3 A5 204 (SMF 480/66)	VW3 A9 107 (TER-BOX 241)	VW3 A9 507 (FLANGE 240 x 550)
MX eco 4V37	VW3 A5 103 (AMF 90-1)	VW3 A5 205 (SMF 480/95)	VW3 A9 107 (TER-BOX 241)	VW3 A9 507 (FLANGE 240 x 550)
MX eco 4V45	VW3 A5 103 (AMF 90-1)	VW3 A5 205 (SMF 480/95)	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX eco 4V55	VW3 A5 104 (AMF 215-3)	VW3 A5 206 (SMF 480/180)	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX eco 4V75	VW3 A5 104 (AMF 215-3)	VW3 A5 206 (SMF 480/180)	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX eco 4V90	VW3 A5 104 (AMF 215-3)	VW3 A5 206 (SMF 480/180)	VW3 A9 109 (TER-BOX 310)	VW3 A9 510 (FLANGE 310 x 680)
MX eco 4V110	VW3 A5 104 (AMF 215-3)	VW3 A5 207 (SMF 480/200)	VW3 A9 109 (TER-BOX 310)	VW3 A9 510 (FLANGE 310 x 680)
MX eco 4V132	VW3 A5 105 (AMF 320-3)	VW3 A5 208 (SMF 480/300)	VW3 A9 110 (TER-BOX 350)	VW3 A9 511 (FLANGE 350 x 780)
MX eco 4V160	VW3 A5 105 (AMF 320-3)	VW3 A5 209 (SMF 480/400)	VW3 A9 111 (TER-BOX 330)	VW3 A9 509 (FLANGE 330 x 950)
MX eco 4V200	VW3 A5 106 (AMF 480-3)	(SMF 480/400) VW3 A5 209	VW3 A9 112 (TER-BOX 430)	VW3 A9 511 (FLANGE 430 x 950)
MX eco 4V250	VW3 A5 106 (AMF 480-3)	VW3 A5 210 (SMF 480/600)	VW3 A9 113 (TER-BOX 585)	VW3 A9 513 (FLANGE 585 x 950)
MX eco 4V315	VW3 A5 107 (AMF 760-3)	VW3 A5 210 (SMF 480/600)	VW3 A9 113 (TER-BOX 585)	VW3 A9 513 (FLANGE 585 x 950)
MX eco 4V355	VW3 A5 107 (AMF 760-3)	VW3 A5 211 (SMF 480/1200)	VW3 A9 115 (TER-BOX 880)	-
MX eco 4V400	VW3 A5 107 (AMF 760-3)	VW3 A5 211 (SMF 480/1200)	VW3 A9 115 (TER-BOX 880)	-
MX eco 4V500	VW3 A5 108 (AMF 1190-3)	VW3 A5 211 (SMF 480/1200)	VW3 A9 115 (TER-BOX 880)	-
MX eco 4V630	VW3 A5 108 (AMF 1190-3)	VW3 A5 211 (SMF 480/1200)	VW3 A9 116 (TER-BOX 1100)	-

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	Option CMK-IP23	Option CMK-IP54FL	Option CMK-IP54GL
MX eco 4V0,75	–	–	–
MX eco 4V1,5	–	–	–
MX eco 4V2,2	–	–	–
MX eco 4V3,0	–	–	–
MX eco 4V4,0	–	–	–
MX eco 4V5,5	–	–	–
MX eco 4V7,5	–	–	–
MX eco 4V11	–	–	–
MX eco 4V15	–	–	–
MX eco 4V18	–	–	–
MX eco 4V22	–	–	–
MX eco 4V30	–	–	–
MX eco 4V37	–	–	–
MX eco 4V45	–	–	–
MX eco 4V55	–	–	–
MX eco 4V75	–	–	–
MX eco 4V90	CMK 9-23 8 P02 003	CMK 9-54FL 8 P02 023	CMK 9-54GL 8 P02 043
MX eco 4V110	CMK 9-23 8 P02 003	CMK 9-54FL 8 P02 023	CMK 9-54GL 8 P02 043
MX eco 4V132	CMK 10-23 8 P02 004	CMK 10-54FL 8 P02 024	CMK 10-54GL 8 P02 044
MX eco 4V160	CMK 11-23 8 P02 005	CMK 11-54FL 8 P02 025	CMK 11-54GL 8 P02 045
MX eco 4V200	CMK 12-23 8 P02 006	CMK 12-54FL 8 P02 026	CMK 12-54GL 8 P02 046
MX eco 4V250	CMK 13-23 8 P02 007	CMK 13-54FL 8 P02 027	CMK 13-54GL 8 P02 047
MX eco 4V315	CMK 13-23 8 P02 007	CMK 13-54FL 8 P02 027	CMK 13-54GL 8 P02 047
MX eco 4V355	CMK 14-23 8 P02 008	CMK 14-54FL 8 P02 028	CMK 14-54GL 8 P02 048
MX eco 4V400	CMK 14-23 8 P02 008	CMK 14-54FL 8 P02 028	CMK 14-54GL 8 P02 048
MX eco 4V500	CMK 14-23 8 P02 008	CMK 14-54FL 8 P02 028	CMK 14-54GL 8 P02 048
MX eco 4V630	CMK 15-23 8 P02 009	CMK 15-54FL 8 P02 029	CMK 15-54GL 8 P02 049

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MX pro 4V

For all drives with high-performance in industry, machine building and automation

The MX pro adds even more numerous functions to the well-known and extremely well-proven features of the MX range. It presents itself to the user as being even more robust with improved operation and having a clearly wider range of user possibilities.

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Extensive standard fitting and multi-functional use

Feature	Advantages	Reference
RFI filter built-in	No additional space required and reduced mounting costs	Page 165
Digital input PWR "Safe Standstill"	Prevents an unwanted starting of the motor and guarantees the safety of the machine and plant personnel.	Page 308
Extensive option possibilities	Standard solutions for the adaptation of the MX pro to many applications, numerous add-on options and options capable for integration reduce the required space as well as the mounting costs.	from page 197
Wall-mounting in IP21 / IP31	Compact wall-mounting device with terminal box as a cheap alternative to the cubicle installation	Page 246
Flange mounting	The power part of the inverter, designed with IP54 protection degree, is located outside the cubicle by which the additional temperature rise is minimized.	Page 249
Optimized for cubicle installation	MX pro are suitable for each type of customer-specific cubicles. Standard components are available for the realization of thermal optimized cubicles with IP54 protection degree.	Page 158

User interfaces

Feature	Advantages	Reference
Parameter matrix	No endlessly long list or a multiple branched tree structure but a clear arrangement of parameters in Matrix form with logical organization according to their function.	Page 29
Matrix user interface	Simple and quick commissioning and parameterization by means of navigation with the Matrix wheel inside the parameter matrix on the graphical, removable Matrix operating panel	Page 27
PC software	Free PC program Matrix 3 for commissioning, programming, documentation and analysis	Page 31
Connection and communication possibilities	Inputs and outputs for practically all demands. Integrated Modbus and CANopen interface as standard. Option cards for all usual fieldbus systems.	Page 208
Extensive software functions	Flexible adapting to the application demands. No external components like relays, PLC and monitoring instruments and reduced mounting costs	Page 255

Industry-fulfilled design

Feature	Advantages	Reference
Wide power and voltage range	A product range for all applications. In this way standardized interfaces, reduced training costs and simple spares inventories are guaranteed.	Page 38
Robust design of power part and control part	High reliability also with rough ambient conditions. The power part is designed in IP54, the cooling air of control part and power part are completely separated, the circuit boards are varnished.	Page 147
Intelligent limitation and protection concepts	High availability and less process interruptions. Inverter, motor and application are optimally protected.	Page 326
Fan control	The fans of the inverter are automatically switched-off when cooling is not necessary. In this way the life of the fans is increased as well as the energy consumption and noise load being reduced.	Page 282
Indirect coupled control terminals	Safe and reliable operation according to EN 50178 PELV	Page 185
Internationally approved	A product range which complies with the most important approvals such as CE, UL and CSA and which can be used internationally.	Page 147

Useful functions

Crane control, speed control alternatively with feedback, torque control and further functions belong to the performance of the MX pro inverter range. They are described clearly in chapter "Functions", from page 255.

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Specification

Technical data

The frequency inverters are equipped with a dual rating function (exception: MX pro 4V0,75...4V75).

So the frequency inverter can be used either:

- with a high dynamic overload capability and nominal continuous power (setting "0 .. Power P1") or
- with high continuous load at a simultaneously reduced dynamic overload capacity (setting "1 .. Power P2").

The difference between the maximum permissible continuous output power of both settings is one step of IEC motor list.

Example MX pro 4V 315 / 400

- 400: Setting B3.16 = "1 .. Power P2"
  Nominal power: 400 kW
  Overload: 120 % for 60 s in 10 min
  135 % for 2 s in 30 s
- 315: Setting B3.16 = "0 .. Power P1"
  Nominal power: 315 kW
  Overload: 150 % for 60 s in 10 min
  165 % for 2 s in 30 s
- 4V: 4V, 4C: 380...480 V mains voltage
  6V, 6C: 500...690 V mains voltage
- pro: Product line MX pro
- MX: Product family MX

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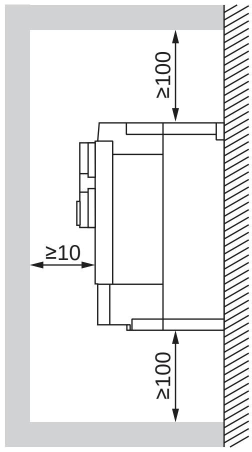
Input	
Voltage	380 V -15% up to 480 V +10% for TT, TN or IT mains *)
Frequency	50 / 60 Hz ±5 % *)
Overvoltage class	Class III according to EN 61800-5-1
Power factor	Fundamental (displacement factor): > 0.98 Total (λ) at full load: 0.93...0.95 (with AC or DC choke) Total (λ) at no load: approx. 0.7 (with AC or DC choke)
Output	
Control method	Sensorless Vector Control, Vector Control with speed feedback, V/f-characteristic, Synchronous motor without encoder, Synchronous motor with encoder (MX pro 4V...-SY devices with own order code for applications with high starting torque)
Voltage	3 AC 0...100% mains voltage, dynamic voltage stabilization
Overload	Power 1: 50 % for 60 s per 10 minutes, 65 % for 2 seconds Power 2: 20 % for 60 s or 35 % for 2 s (from 110 kW)
Pulse frequency	MX pro *4V0,75...4V75:* 4 kHz, adjustable from 2...16 kHz MX pro *4V90/110...4V500/630:* 2.5 kHz, adjustable from 2...8 kHz
Frequency / Base frequency	0...300 Hz / 25...300 Hz, adjustable
Short circuit protection	All-pole protected against short circuit and earth fault by means of overcurrent switch-off
Design	Built-in unit for vertical mounting
Cooling	forced
Frequency resolution, digital	0.01 Hz / 50 Hz, frequency stability: ±0.01 % / 50 Hz
Speed accuracy	V/f mode: Slip frequency VC without feedback: 0.3 x slip frequency VC with feedback: 0.01% of maximum frequency (parameter C2.02)
Torque accuracy	5% at VC (3 … 300 Hz)
Torque response time	Depending on the setting of the speed controller up to 2 ms
Mechanical strength	
Mechanical vibration	According to IEC/EN 60068-2-6 MX pro *4V0,75...4V75:* 1.5 mm at 3...13 Hz, 1 g at 13...200 Hz (3M3 according to IEC/EN 60721-3-3) MX pro *4V90/110...4V500/630:* 1.5 mm at 3...10 Hz, 0.6 g at 10...200 Hz (3M3 according to IEC/EN 60721-3-3)
Shock	According to IEC/EN 60068-2-27 MX pro *4V0,75...4V75:* 15 g for 11 ms (3M3 according to IEC/EN 60721-3-3) MX pro *4V90/110...4V132/160:* 7 g for 11 ms (3M3 according to IEC/EN 60721-3-3) MX pro *4V160/200...4V500/630:* 4 g for 11 ms (3M2 according to IEC/EN 60721-3-3)

*) Technical data and remarks for mains voltages are given in chapter "Mains conditions", page 38.

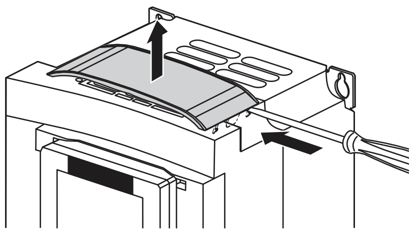
Ambient conditions	
Operating temperature	in case of dimensioning for high overload (Power 1): -10...+50°C in case of increased output power (Power 2, from 4V90/110): -10...+45°C (3K3 according to IEC/EN 60721-3-3) up to +60°C with derating
Storage / Transport temperature	-25...+70°C
Protection degree	*MX pro 4V0,75...4V75:* bottom, sideways, front IP21 top IP41 (IP20 without protective cover) MX pro *4V90/110...4V500/630:* sideways, front IP31 top IP20 (IP31 with DC box) bottom IP00 (IP31 with terminal box)
Environmental class / Humidity	Class 3K3 in accordance with IEC/EN 60721-3-3 / no condensation, max. 95 % relative humidity
Altitude	Up to 1000 m, beyond power decrease of 1 % per 100 m up to 3000 m
Allowed pollution	Pollution degree 2 according to EN 61800-5-1 MX pro *4V0,75...4V75:* 3C1 and 3S2 according to EN 60721-3-3 MX pro *4V90/110...4V500/630:* 3C2 and 3S2 according to EN 60721-3-3
Protection class	Class 1 according to EN 61800-5-1
Safety functions and ATEX – applications	
Safety of the drive	The safety function "safe standstill" (Power Removal) allows a controlled shut-down as well as switch-off of the power supply when standstill. It also prevents any unintended start of the motor according to EN 954-1 / ISO 13849-1, category 3 and IEC/EN 61800-5-2.
Protection of the machine	The safety function "safe standstill" (Power Removal) allows a controlled shut-down as well as switch-off of the power supply when standstill. It also prevents any unintended start of the motor according to IEC/EN 61508, SIL2 capability and IEC/EN 61800-5-2.
Safety of the ATEX motor	The thermal sensor of the ATEX motor is integrated to the safety function "safe standstill" (PWR input) of the inverter by a safety switching device.
Response time	≤ 100 ms in STO (Safe Torque Off)
Standards	
Basic standard	The devices are designed, built and tested on the basis of EN 61800-5-1.
EMC immunity	According to EN 61800-3, 1^{st} and 2^{nd} environment (IEC 1000-4-2; IEC 1000-4-3; IEC 1000-4-4; IEC 1000-4-5; IEC 1000-4-6)
EMC emission	in accordance with product standard EN 61800-3, 1^{st} and 2^{nd} environment, category C1, C2, C3
Insulation	Galvanic insulation from the control electronics in accordance with EN 61800-5-1 PELV (Protective Extra Low Voltage)
Approvals	CE, UL, CSA, GOST, ATEX

Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

MX pro	4V0,75	4V1,5	4V2,2	4V3,0	4V4,0
Nominal data					
Motor rating					
P_N [kW] - Power 1	0.75	1.5	2.2	3.0	4.0
P_N [hp] - Power 1	1	2	3	–	5
Continuous output power					
$S_{N\,400}$ [kVA] V_N = 400 V	1.6	2.8	4.0	5.4	7.3
$S_{N\,460}$ [kVA] V_N = 460 V	1.8	3.3	4.6	6.2	8.4
Continuous output current					
$I_{N\,400}$ [A] V_N = 400 V	2.3	4.1	5.8	7.8	10.5
$I_{N\,460}$ [A] V_N = 460 V	2.3	4.1	5.8	7.8	10.5
Maximum current for 60 s per 10 minutes					
I_{MAX} [A] - Power 1	3.5	6.2	8.7	11.7	15.8
Input current (without choke)					
$I_{IN\,400}$ [A] V_N = 400 V	3.7	5.8	8.2	10.7	14.1
$I_{IN\,460}$ [A] V_N = 460 V	3.0	5.3	7.1	9	11.5
Braking unit					
P_{CONT} [kW]	0.75	1.5	2.2	3.0	4.0
P_{MAX} for 60 s [kW]	1.1	2.3	3.3	4.5	6.0
R_{MIN} / R_{MAX} [Ω]	56/500	56/250	56/175	34/125	34/100
Characteristics					
Efficiency [%]	> 94.5	> 95.5	> 96.0	> 96.0	> 96.5
Losses [W] at I_N	44	64	87	115	145
Weight approx. [kg]	3	3	3	4	4
Ambient conditions					
Volume cooling air [m^3/h]	17	17	17	55	55
Sound pressure [dB(A)]	43	43	55	55	55
Mains short circuit c. [kA]	5	5	5	5	5
Dimensions					
Dimension A1 [mm]	230	230	230	260	260
Dimension A2 [mm]	220	220	220	249	249
Dimension A3 [mm]	5	5	5	7	7
Dimension B1 [mm]	130	130	130	155	155
Dimension B2 [mm]	113.5	113.5	113.5	138	138
Dimension C1 [mm]	152	152	152	164	164
Dimension C2 [mm]	175	175	175	187	187
Dimension C3 [mm]	174	174	174	186	186
Dimension C4 [mm]	197	197	197	209	209
Dimension C5 [mm]	196	196	196	208	208
Dimension C6 [mm]	219	219	219	231	231
Fixing D1 [mm]	4x ∅4.5	4x ∅4.5	4x ∅4.5	4x ∅4.5	4x ∅4.5



For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 103.

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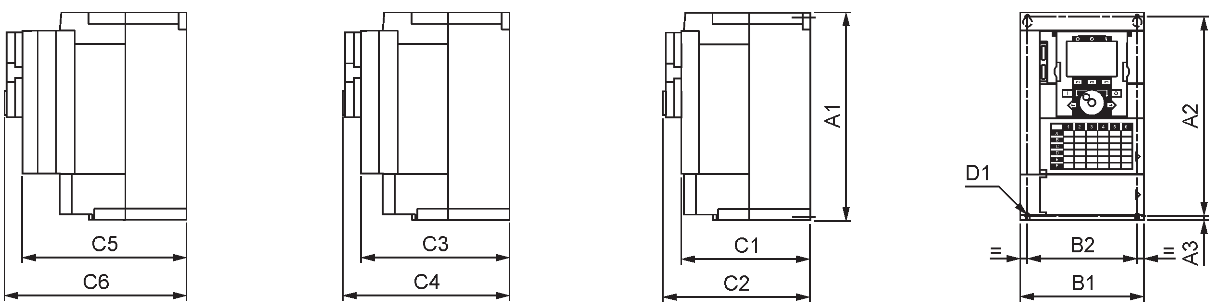
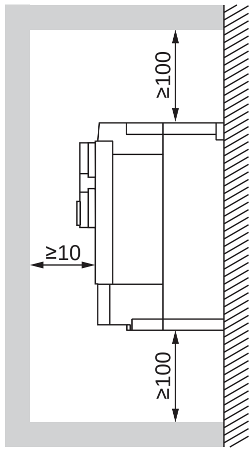
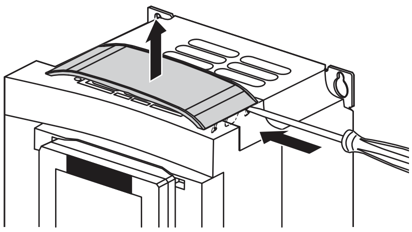
with 2 option cards with 1 option card Basic device without option card



MX pro	4V5,5	4V7,5	4V11	4V15	4V18
Nominal data					
Motor rating					
P_N [kW] - Power 1	5.5	7.5	11	15	18.5
P_N [hp] - Power 1	7.5	10	15	20	25
Continuous output power					
$S_{N\,400}$ [kVA] V_N = 400 V	9.9	12.2	19.2	23	28
$S_{N\,460}$ [kVA] V_N = 460 V	11.4	14	22	26	33
Continuous output current					
$I_{N\,400}$ [A] V_N = 400 V	14.3	17.6	27.7	33	41
$I_{N\,460}$ [A] V_N = 460 V	14.3	17.6	27.7	33	41
Maximum current for 60 s per 10 minutes					
I_{MAX} [A] - Power 1	21.5	26.4	42	50	62
Input current (without choke)					
$I_{IN\,400}$ [A] V_N = 400 V	20.3	27.0	36.6	48	46
$I_{IN\,460}$ [A] V_N = 460 V	17.0	22.2	30.0	39	38
Braking unit					
P_{CONT} [kW]	5.5	7.5	11	15	18.5
P_{MAX} for 60 s [kW]	8.3	11	17	23	28
R_{MIN} / R_{MAX} [Ω]	25/75	20/55	15/38	14/28	14/24
Characteristics					
Efficiency [%]	> 96.5	> 97.0	> 97.0	> 97.0	> 97.0
Losses [W] at I_N	180	220	320	390	485
Weight approx. [kg]	5.5	5.5	7	9	9
Ambient conditions					
Volume cooling air [m^3/h]	110	110	160	250	250
Sound pressure [dB(A)]	56	56	57	60	60
Mains short circuit c. [kA]	5	5	5	5	22
Dimensions					
Dimension A1 [mm]	295	295	295	400	400
Dimension A2 [mm]	283	283	283	386	386
Dimension A3 [mm]	6	6	6	8	8
Dimension B1 [mm]	175	175	210	230	230
Dimension B2 [mm]	158	158	190	210	210
Dimension C1 [mm]	164	164	190	190	190
Dimension C2 [mm]	187	187	213	213	213
Dimension C3 [mm]	186	186	212	212	212
Dimension C4 [mm]	209	209	235	235	235
Dimension C5 [mm]	208	208	234	234	234
Dimension C6 [mm]	231	231	257	257	257
Fixing D1 [mm]	4x ∅5.5	4x ∅5.5	4x ∅5.5	4x ∅5.5	4x ∅5.5



For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 103.

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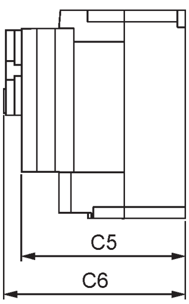
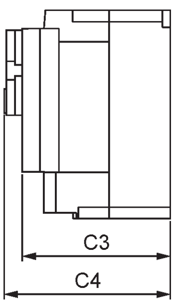
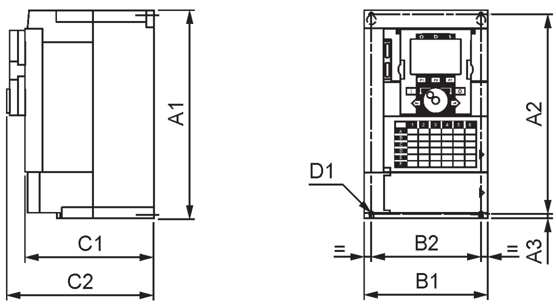
with 2 option cards



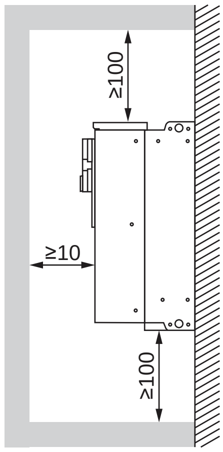
with 1 option card



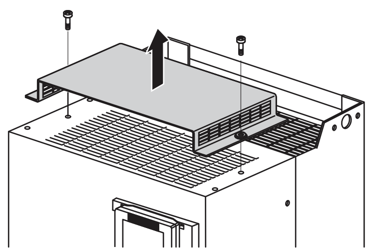
Basic device without option card



MX pro	4V22	4V30	4V37
Nominal data			
Motor rating			
P_N [kW] - Power 1	22	30	37
P_N [hp] - Power 1	30	40	50
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	33	46	55
$S_{N\,460}$ [kVA] V_N = 460 V	38	53	63
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	48	66	79
$I_{N\,460}$ [A] V_N = 460 V	48	66	79
Maximum current for 60 s per 10 minutes			
I_{MAX} [A] - Power 1	72	99	119
Input current (without choke)			
$I_{IN\,400}$ [A] V_N = 400 V	50	66	84
$I_{IN\,460}$ [A] V_N = 460 V	42	56	69
Braking unit			
P_{CONT} [kW]	22	30	37
P_{MAX} for 60 s [kW]	33	45	56
R_{MIN} / R_{MAX} [Ω]	14/20	10/15	7/12
Characteristics			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at I_N	720	980	1180
Weight approx. [kg]	19	26	26
Ambient conditions			
Volume cooling air [m³/h]	200	200	200
Sound pressure [dB(A)]	60	64	64
Mains short circuit c. [kA]	22	22	22
Dimensions			
Dimension A1 [mm]	420	550	550
Dimension A2 [mm]	403	529	529
Dimension A3 [mm]	8.5	11	11
Dimension B1 [mm]	240	240	240
Dimension B2 [mm]	206	206	206
Dimension C1 [mm]	213	243	243
Dimension C2 [mm]	236	266	266
Dimension C3 [mm]	235	265	265
Dimension C4 [mm]	258	288	288
Dimension C5 [mm]	257	287	287
Dimension C6 [mm]	280	310	310
Fixing D1 [mm]	4 x ∅ 5.5	4 x ∅ 5.5	4 x ∅ 5.5

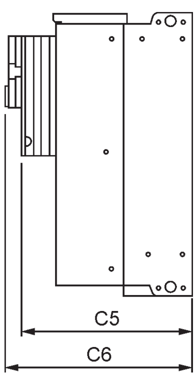


For installation keep a minimum distance of 50 mm between the units and the side wall.

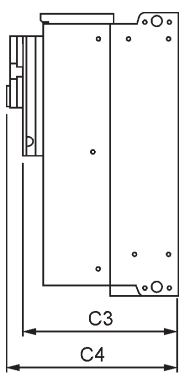


When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 103.

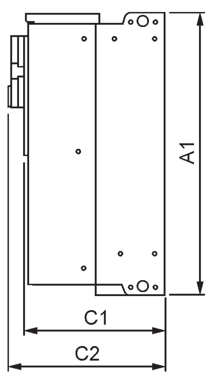
with 2 option cards

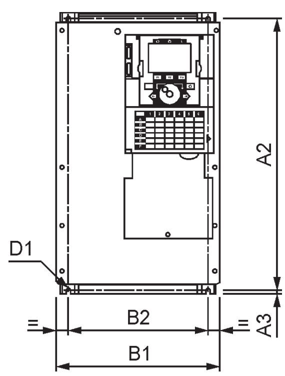


with 1 option card



Basic device without option card





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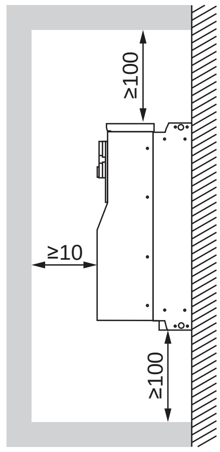
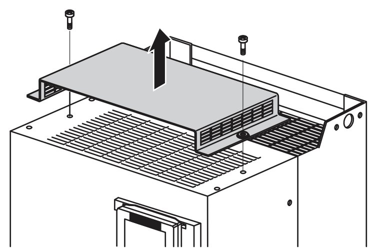
MX pro	4V45	4V55	4V75
Nominal data			
Motor rating			
P_N [kW] - Power 1	45	55	75
P_N [hp] - Power 1	60	75	100
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	65	80	111
$S_{N\,460}$ [kVA] V_N = 460 V	75	92	128
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	94	116	160
$I_{N\,460}$ [A] V_N = 460 V	94	116	160
Maximum current for 60 s per 10 minutes			
I_{MAX} [A] - Power 1	141	174	240
Input current (without choke)			
$I_{IN\,400}$ [A] V_N = 400 V	104	120	167
$I_{IN\,460}$ [A] V_N = 460 V	85	101	137
Braking unit			
P_{CONT} [kW]	45	55	75
P_{MAX} for 60 s [kW]	68	83	113
R_{MIN} / R_{MAX} [Ω]	5/10	4/8	3.3/6
Characteristics			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at I_N	1360	1560	2320
Weight approx. [kg]	44	44	44
Ambient conditions			
Volume cooling air [m^3/h]	400	400	400
Sound pressure [dB(A)]	64	64	64
Mains short circuit c. [kA]	22	22	22
Dimensions			
Dimension A1 [mm]	630	630	630
Dimension A2 [mm]	604.5	604.5	604.5
Dimension A3 [mm]	15.5	15.5	15.5
Dimension B1 [mm]	320	320	320
Dimension B2 [mm]	280	280	280
Dimension C1 [mm]	290	290	290
Dimension C3 [mm]	290	290	290
Dimension C4 [mm]	312	312	312
Dimension C5 [mm]	311	311	311
Dimension C6 [mm]	334	334	334
Fixing D1 [mm]	4 x ∅ 9	4 x ∅ 9	4 x ∅ 9

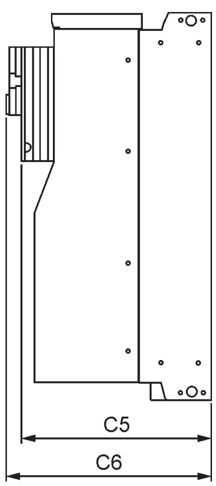


For installation keep a minimum distance of 50 mm between the units and the side wall.

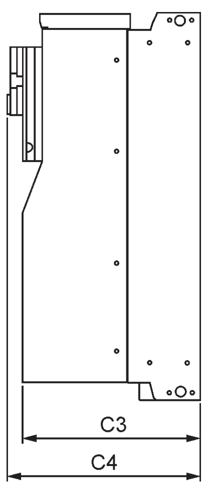


When you remove the IP41 protective cover the units can be mounted without any distance sideways.
See also chapter "Power decrease", page 103.

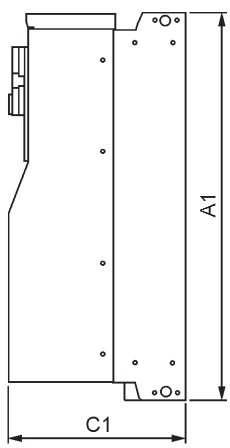
with 2 option cards

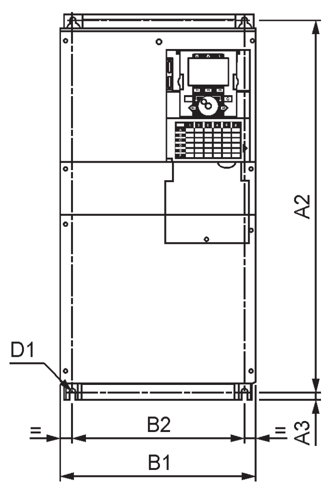


with 1 option card



Basic device without option card





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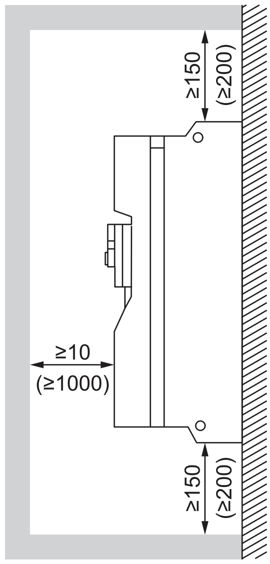
MX pro	4V90/110	4V110/132	4V132/160
Nominal data			
Motor rating			
P_N [kW] - Power 1/2	90/110	110/132	132/160
P_N [hp] - Power 1/2	125/150	150/200	200/250
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	124/149	149/179	179/218
$S_{N\,460}$ [kVA] V_N = 460 V	143/171	171/206	206/250
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	179/215	215/259	259/314
$I_{N\,460}$ [A] V_N = 460 V	179/215	215/259	259/314
Maximum current for 60 s per 10 minutes			
I_{MAX} [A] - Power 1/2	269 / 258	323 / 311	389 / 377
Input current (with MX DCL-BOX)			
$I_{IN\,400}$ [A] V_N = 400 V	159/188	194/226	229/271
$I_{IN\,460}$ [A] V_N = 460 V	143/168	173/224	225/275
Braking unit			
P_{CONT} [kW]	70	85	100
P_{MAX} for 10 s [kW]	135	165	200
R_{MIN} / R_{MAX} [Ω]	2.5/5.0	2.1/4.0	1.75/3.5
Characteristics			
Efficiency [%]	> 97.5	> 97.5	> 97.6
Losses [W] at I_N	2210/2810	2520/3330	2950/3710
Weight approx. [kg]	60	74	80
Ambient conditions			
Volume of cooling air [m^3/h]	400	600	600
Sound pressure level [dB(A)]	61	69	71
Mains short circuit curr. [kA]	50 [1.)]	50 [1.)]	50 [1.)]
Dimensions			
Dimension A1 [mm]	680	782	950
Dimension A2 [mm]	650	758	920
Dimension A3 [mm]	15	12	15
Dimension B1 [mm]	310	350	330
Dimension B2 [mm]	250	298	285
Dimension C1 [mm]	377	377	377
Dimension C3 [mm]	377	377	377
Dimension C4 [mm]	392	392	392
Fixing D1 [mm]	4x ∅11.5	4x ∅11.5	4x ∅11.5



If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

1.) in device variant with DCL-BOX

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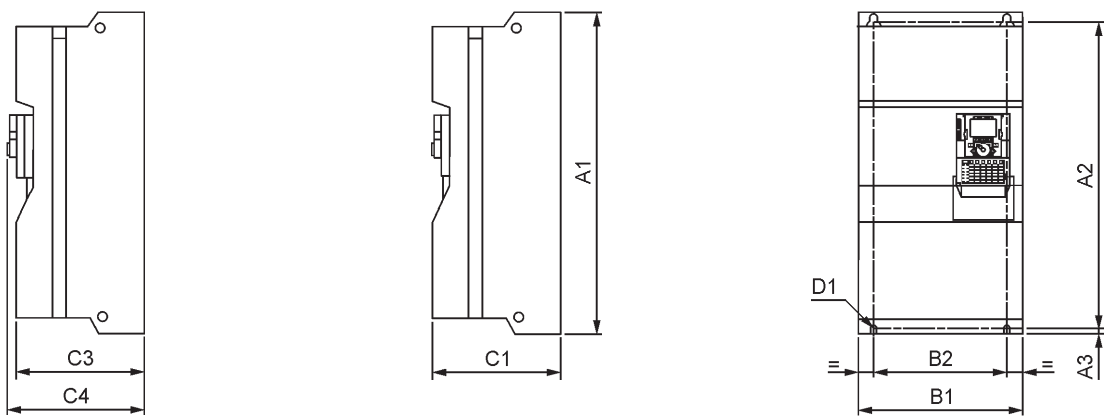
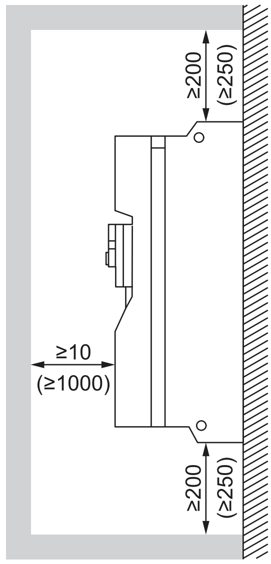
with 2 option cards

Basic device (without DCL-BOX) without or with 1 option card



MX pro	4V160/200	4V200/250	4V250/315
Nominal data			
Motor rating			
P_N [kW] - Power 1/2	160/200	200/250	250/315
P_N [hp] - Power 1/2	250/300	300/400	400/500
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	218/268	268/333	333/427
$S_{N\,460}$ [kVA] V_N = 460 V	250/308	308/383	383/491
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	314/387	387/481	481/616
$I_{N\,460}$ [A] V_N = 460 V	314/387	387/481	481/616
Maximum current for 60 s per 10 minutes			
I_{MAX} [A] - Power 1/2	471 / 464	581 / 577	722 / 739
Input current (with MX DCL-BOX)			
$I_{IN\,400}$ [A] V_N = 400 V	277/338	340/418	424/527
$I_{IN\,460}$ [A] V_N = 460 V	281/331	333/435	442/544
Braking unit			
P_{CONT} [kW]	120	200 [2.)]	200 [2.)]
P_{MAX} for 10 s [kW]	240	300	375
R_{MIN} / R_{MAX} [Ω]	1.75/2.75	1.05/2.2	1.05/1.75
Characteristics			
Efficiency [%]	> 97.7	> 97.7	> 97.7
Losses [W] at I_N	3490/4450	4560/5890	5430/7250
Weight approx. [kg]	110	140	140
Ambient conditions			
Volume of cooling air [m^3/h]	800	1200	1200
Sound pressure level [dB(A)]	72	73	73
Mains short circuit curr. [kA]	50 [1.)]	50 [1.)]	50 [1.)]
Dimensions			
Dimension A1 [mm]	950	950	950
Dimension A2 [mm]	920	920	920
Dimension A3 [mm]	15	15	15
Dimension B1 [mm]	430	585	585
Dimension B2 [mm]	350	540	540
Dimension C1 [mm]	377	377	377
Dimension C3 [mm]	377	377	377
Dimension C4 [mm]	392	392	392
Fixing D1 [mm]	4x ∅11.5	4x ∅11.5	4x ∅11.5



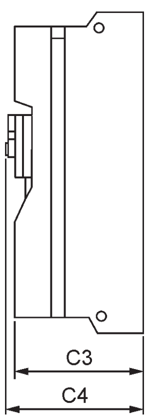
If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

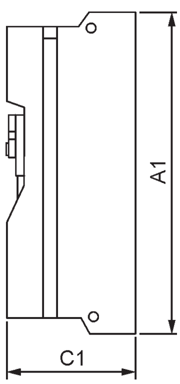
1.) in device variant with DCL-BOX

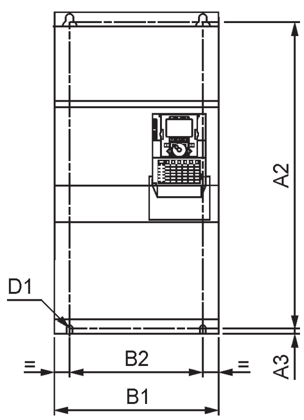
2.) External braking unit

with 2 option cards



Basic device (without DCL-BOX) without or with 1 option card





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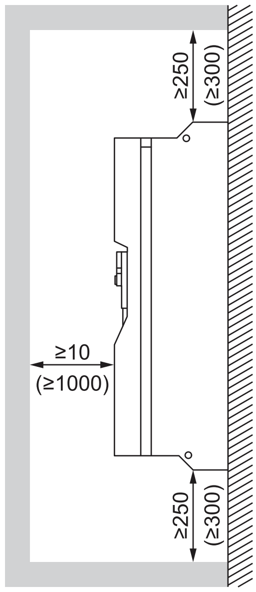
MX pro	4V315/400	4V400/500	4V500/630
Nominal data			
Motor rating			
P_N [kW] - Power 1/2	315/400	400/500	500/630
P_N [hp] - Power 1/2	500/600	600/700	700/900
Continuous output power			
$S_{N\,400}$ [kVA] V_N = 400 V	427/526	526/652	652/823
$S_{N\,460}$ [kVA] V_N = 460 V	491/605	605/750	750/861
Continuous output current			
$I_{N\,400}$ [A] V_N = 400 V	616/759	759/941	941/1188
$I_{N\,460}$ [A] V_N = 460 V	616/759	759/941	941/1080
Maximum current for 60 s per 10 minutes			
I_{MAX} [A] - Power 1/2	924 / 911	1139 / 1129	1412 / 1426
Input current (with MX DCL-BOX)			
$I_{IN\,400}$ [A] V_N = 400 V	529/660	675/834	834/1037
$I_{IN\,460}$ [A] V_N = 460 V	547/644	660/760	761/964
Braking unit			
P_{CONT} [kW]	400 [2.)]	400 [2.)]	400 [2.)]
P_{MAX} for 10 s [kW]	475	600	750
R_{MIN} / R_{MAX} [Ω]	0.7/1.4	0.7/1.1	0.7/0.85
Characteristics			
Efficiency [%]	> 97.8	> 97.8	> 97.8
Losses [W] at I_N	6880/8810	8630/11150	10530/13830
Weight approx. [kg]	215	225	300
Ambient conditions			
Volume of cooling air [m^3/h]	1800	1800	2400
Sound pressure level [dB(A)]	75	75	75
Mains short circuit curr. [kA]	50 [1.)]	50 [1.)]	50 [1.)]
Dimensions			
Dimension A1 [mm]	1150	1150	1150
Dimension A2 [mm]	1120	1120	1120
Dimension A3 [mm]	15	15	15
Dimension B1 [mm]	880	880	1110
Dimension B2 [mm]	417.5	417.5	532.5
Dimension C1 [mm]	377	377	377
Dimension C3 [mm]	377	377	377
Dimension C4 [mm]	392	392	392
Fixing D1 [mm]	5x ∅11.5	5x ∅11.5	6x ∅11.5



If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

[1.)] in device variant with DCL-BOX

[2.)] External braking unit

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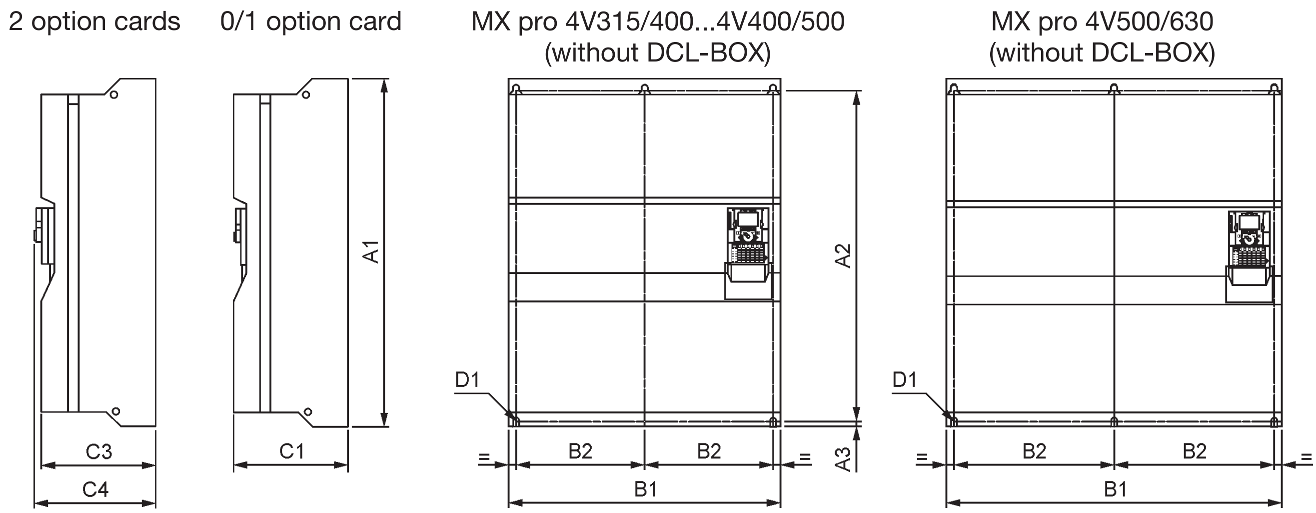

Mounting place and mounting position

As it is usual with electronic built-in devices, the MX pro frequency inverters are also designed in compliance with the pollution degree 2 according to 50178. If the environment does not correspond to these conditions then the necessary transition of the pollution degree must be provided e.g. by means of a cubicle.

Because of convection the devices are designed for vertical wall mounting. Install the device on a non-combustible vertical wall which does not transmit any vibrations.

Keep the allowed minimum distances between the devices and from other equipment (see chapter "Technical data", as from page 89).

The mounting place should be well ventilated and without direct solar radiation.

Avoid environmental effects like high temperatures and high humidity as well as dust, dirt and aggressive gases. Condensation must be prevented by all means.

Do not install the device near heat generating equipment.

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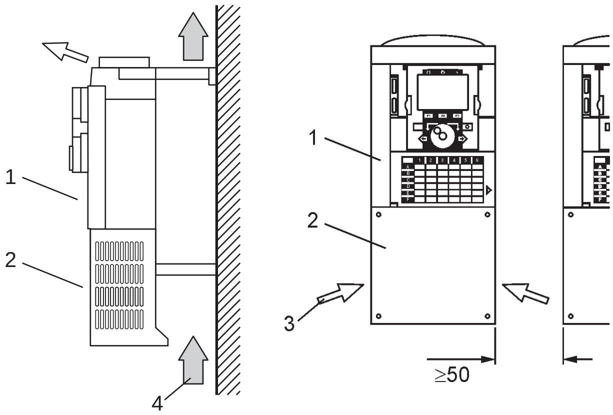
Wall-mounting

The MX eco is designed for installation on the wall or in an electrical room. When using the option MX TER-BOX the devices comply with protection degree IP21/31.

For devices up to 75 kW observe a distance of 50 mm sideways, from 90 kW on observe a distance of 10 mm sideways. Additionally provide sufficient free space above and below all devices to ensure unimpeded intake and blow of the cooling air.

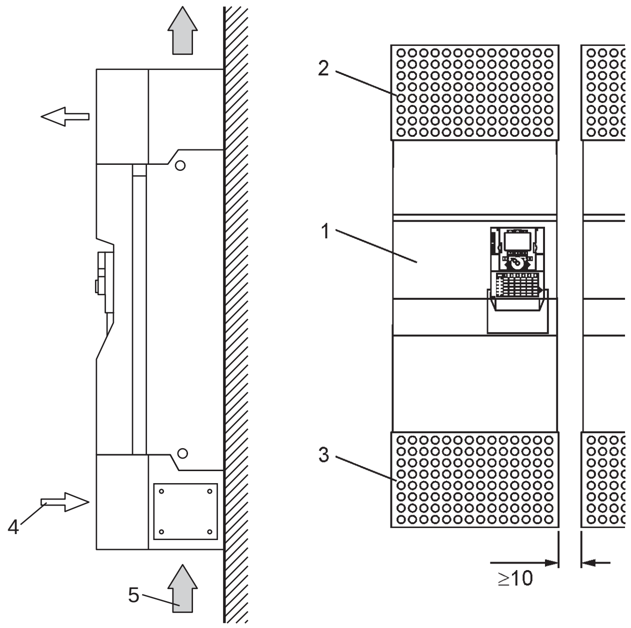
Wall-mounting with option terminal box for frequency inverters up to 75 kW



1 MX eco 4V0,75 … 4V75
2 Option MX TER-BOX 130...320
3 Cooling air for control part
4 Cooling air for power part

Protection degree: above IP41, all around IP21
Ambient temperature: -10...+45°C

Wall-mounting with option DCL box and option terminal box for frequency inverters from 90 kW on



1 MX eco from 90 kW
2 MX DCL-BOX
3 Option MX TER-BOX
4 Cooling air for control part
5 Cooling air for power part

Protection degree: IP31
Ambient temperature: -10...+45°C

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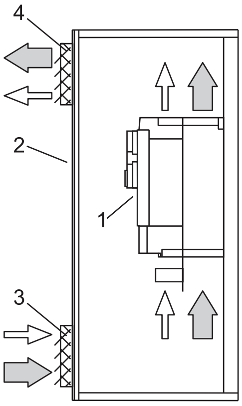
Cubicle installation IP23

The stated losses and minimum cross sections for air inlet are related to the inverter. Further heat sources like DCL, NDU, AMF, fuses and contactors must be considered additionally. The power part fan which is inside the device provides the exhaust of the cubicle. The air flow must not be constrained by means of fixtures or filter mats. Provide a separation of the power part air for devices from 90 kW to avoid internal air short-cuts. Furthermore take care of an exhaust of the control part.

Cubicle installation protection degree IP23
for frequency inverters up to 75 kW

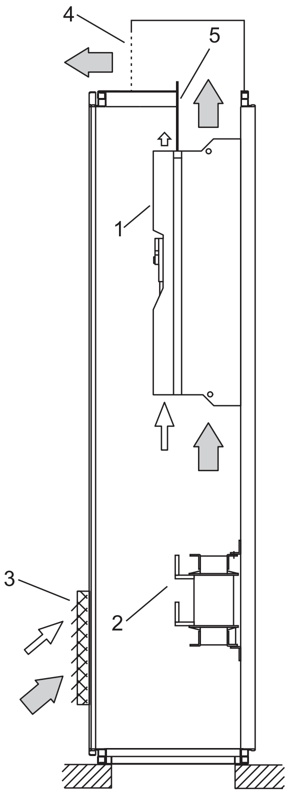


1 MX pro 4V0,75...4V75
2 Cubicle
3 Air inlet grid (without filter mat) for control part and power part
4 Air outlet grid (without filter mat) for control part and power part

Protection degree: IP23

Ambient temperature: -10...+40°C

Cubicle installation protection degree IP23
for frequency inverters from 90 kW



1 MX pro from 90 kW
2 Line choke option NDU
3 Air inlet grid (without filter mat) for control part and power part
4 Metal cover with splash water protection
5 Separation wall to avoid internal air short-cuts

Protection degree: IP23

Ambient temperature: -10...+40°C

For RITTAL TS8 cubicles an optional installation kit is available.

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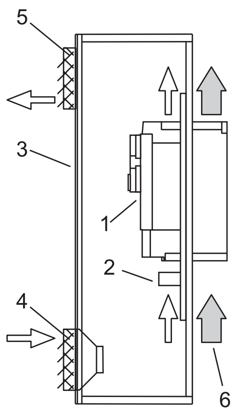
Cubicle installation IP54

Cubicle installation IP54 with separated air flow or flange mounting:

The power part of all devices is designed in IP54 and is sealed from the control electronics. In case of cubicle installation a basement is necessary for separated air flow. The power part fan which is inside the device exhausts the losses of the power part (external). The losses of the control part must be exhausted by means of filter fans or a correspondingly large cubicle surface. The stated values for losses and volume of cooling air refer to the inverter for devices up to 75 kW, from 90 kW they refer to the inverter including a MX DCL-box. Further heat sources like DCL, NDU, AMF, fuses and contactors must be considered additionally.

In the power range from 22 kW a completely designed and tested cubicle design is available. Prices and technical data on request.

Cubicle installation protection degree IP54
for frequency inverters up to 75 kW

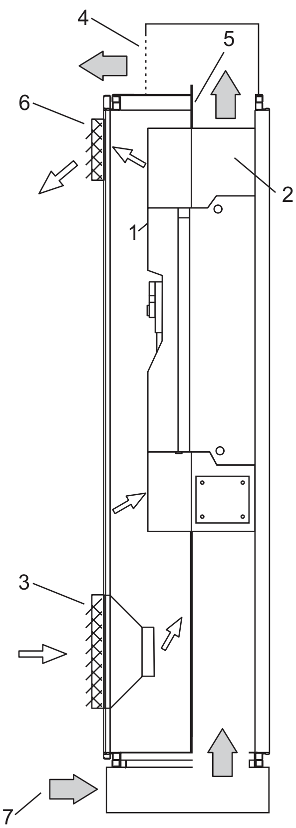


1 MX pro 4V0,75...4V75
2 DCL
3 Cubicle
4 Air inlet grid (with filter fan) for control part
5 Air outlet grid (with filter mat) for control part
6 Cooling air for power part

Protection degree: IP54

Ambient temperature: -10...+40°C

Cubicle installation protection degree IP54
for frequency inverters from 90 kW



1 MX pro from 90 kW
2 DCL-BOX
3 Air inlet grid (with filter fan) for control part
4 Metal cover with splash water protection
5 Separation wall to avoid internal air short-cuts
6 Air outlet (with filter mat) for control part
7 Cooling air for power part

Protection degree: IP54

Ambient temperature: -10...+40°C

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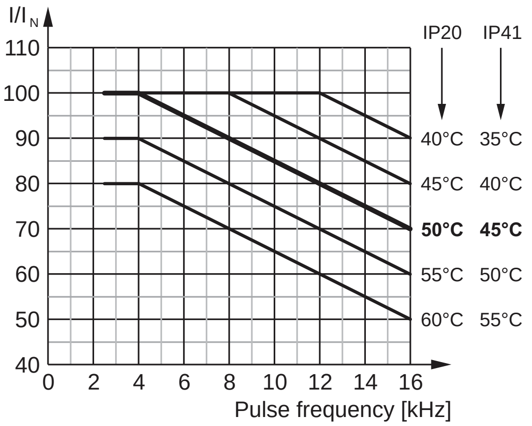
Power decrease

Depending on the chosen pulse frequency and the maximum ambient temperature a power increase is possible or a power reduction is necessary. This can be determined by means of the following diagrams.

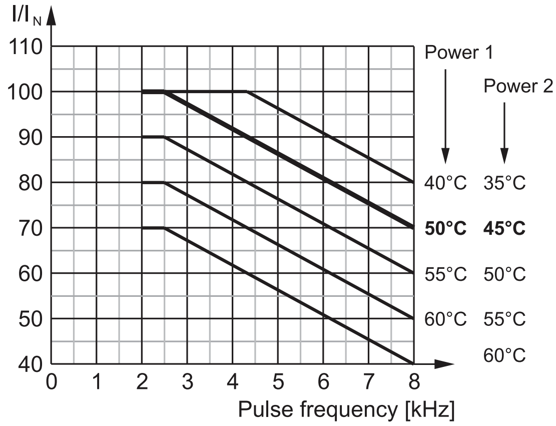
MX pro 4V0,75...4V75



IP20...Top protective cover removed

IP41...Device with top protective cover

MX pro 4V90/100...4V500/630



Power 1...Dimensioned for high overload

Power 2...Increased output power

Please observe the following guidelines to guarantee trouble-free operation of the drive:

- At higher pulse frequencies the allowed motor cable length is reduced (see chapter "Motor cable lengths", page 126).
- Select a motor which is at most one type bigger.

The DCL box and the terminal box do not have any effect on the cooling and from there also the power increase or reduction of the frequency inverter is independent from their use.

If the heat sink temperature is too high, the pulse frequency is automatically reduced to prevent an overload of the inverter.

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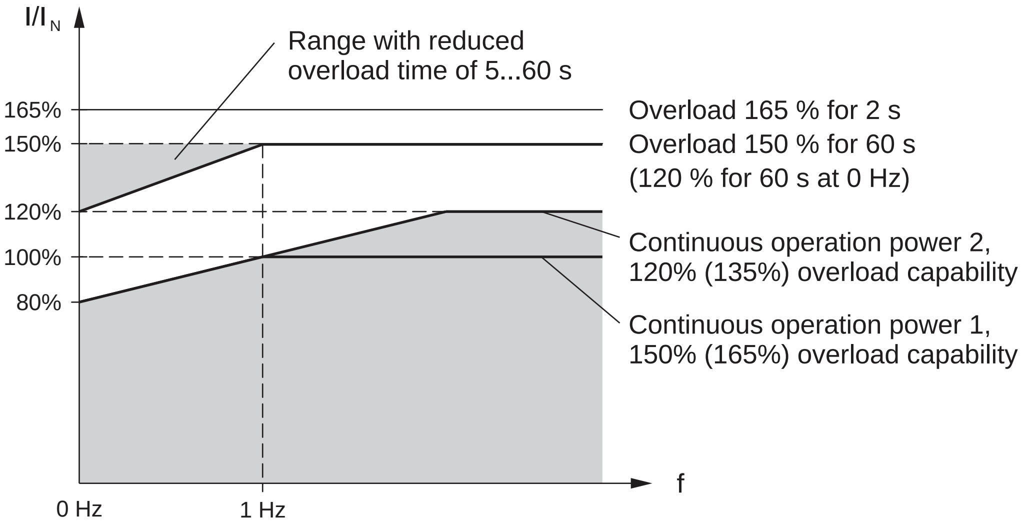
Continuous current at output frequencies < 1 Hz

For the complete protection of the power semiconductors (IGBTs) against thermal overloads, the carrier frequency will be reduced automatically near 0 Hz operation. If the overload takes too long the drive will trip.



During the operation of the frequency inverter at output frequencies < 1 Hz, the overload time is lower than 60 s at high overload up to 150%.

It amounts to the following:	of 0.0 Hz	only 5 s
	at 0.5 Hz	approx. 32 s
	from 1.0 Hz	60 s

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The limitation of the overload time is only to be taken into consideration for drives that work in continuous operation near 0 Hz.

There is practically no effect on the start of a drive since even 500 kW motors already have a nominal slip of 0.3 Hz and thus an overload time of approx. 22 s is possible.

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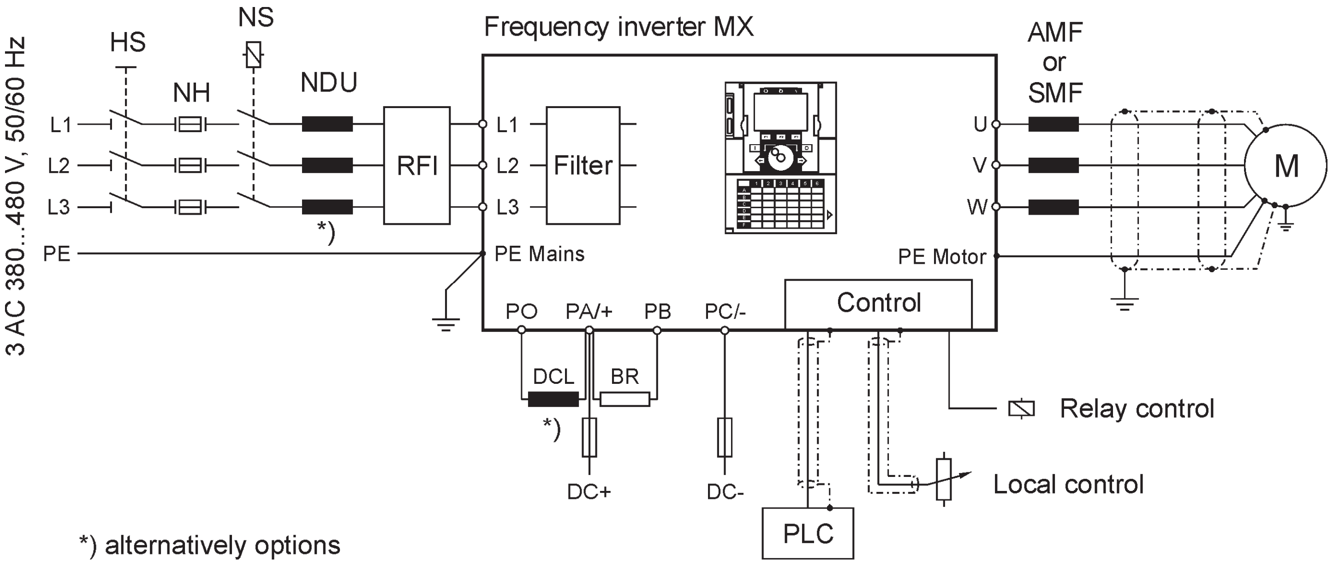
Wiring and connection

Wiring diagram

The following diagrams show the typical wiring of the frequency inverters including the options which may be required for protection of the plant or the device, depending on the application.

MX pro 4V0,75...4V160/200



*) alternatively options

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HS .... Main switch (to be used if required according to the local regulations)

NH......................... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

MX NDU................ Option line reactor to reduce the current harmonics on the mains caused by the DC link, use as an alternative to MX DCL

RFI .... Radio frequency interference filter to use the inverter considering category C1 or C2 according to EN 61800-3 "Use in 1st environment - residential environment"

internal filter .... Radio interference filter built-in as standard; considering category C3 according to EN 61800-3 "Use in industrial environments" (category C2 up to MX pro 4V4,0)

AMF .... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

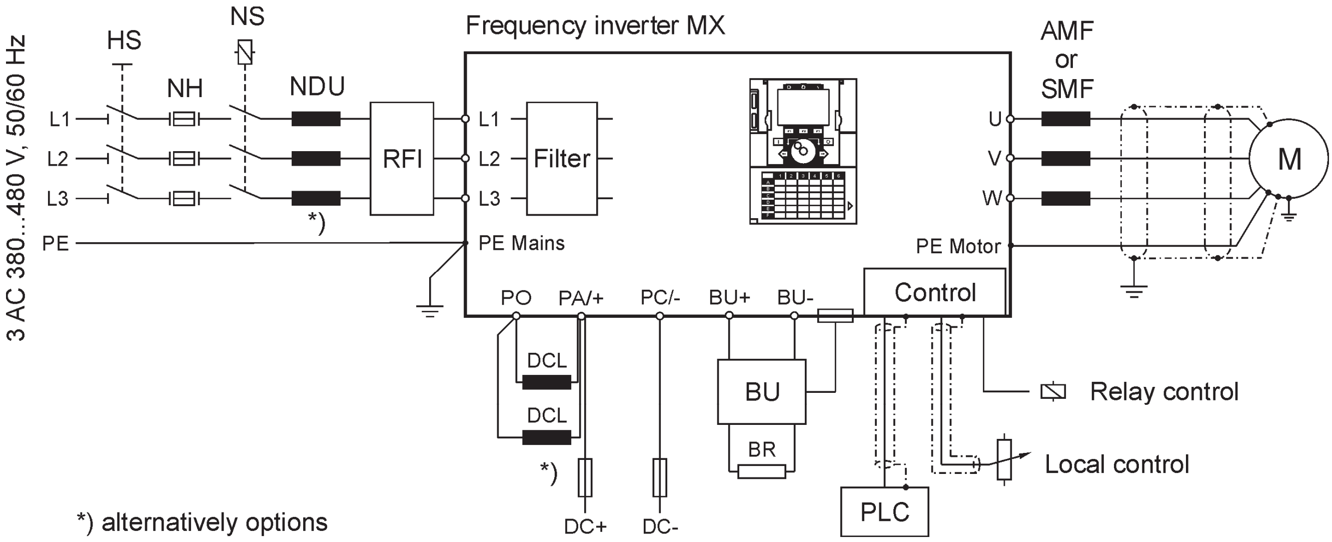
SMF .... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

MX DCL .... Option DC choke to reduce the current harmonics, use as an alternative to the option MX NDU.
For MX pro 4V0,75...4V75 as an external option, above as device variant available.

BR.......................... Option braking resistor for short deceleration time or short-time dynamic loads

DC+ / DC-............. Power supply from a DC-bar; alternatively to 3AC mains supply.

MX pro 4V200/250...4V315/400



HS .... Main switch (to be used if required according to the local regulations)

NH......................... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

MX NDU .... Option line reactor to reduce the current harmonics on the mains caused by the DC link, use as an alternative to MX DCL

RFI......................... Option radio frequency interference filter to use the inverter considering category C2 according to EN 61800-3 "Use in 1st environment - residential environment"

internal filter .... Radio frequency interference filter built-in as standard considering category C3 according to EN 61800-3 "Use in industrial environments"

AMF....................... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF....................... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

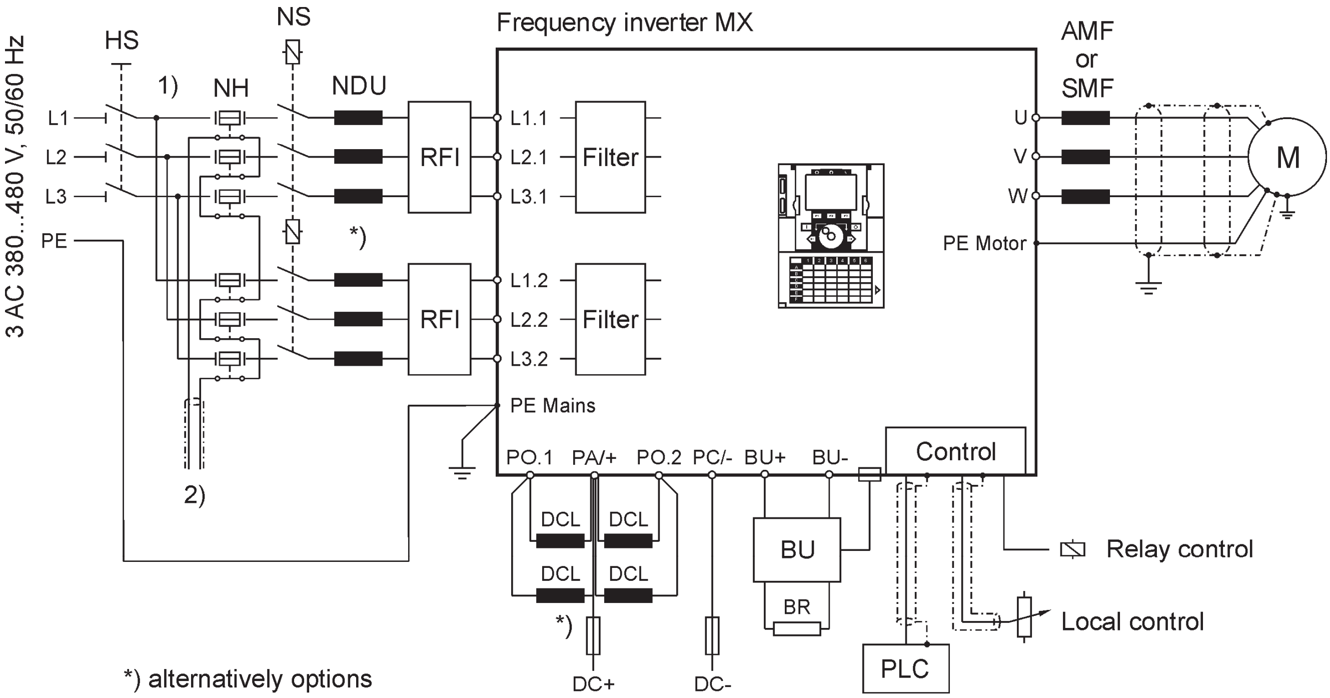
MX DCL................. DC choke to reduce the current harmonics, use as an alternative to the option MX NDU. The DC choke is available as inverter device variant.

BU .... External braking unit option for MX pro 4V200/250 … 4V500/630

BR......................... Option braking resistor for short deceleration time or short-time dynamic loads

DC+ / DC- .... Power supply from a DC-bar; alternatively to 3AC mains supply.

MX pro 4V400/500...4V500/630



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HS .... Main switch (to be used if required according to the local regulations)

NH......................... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

MX NDU................ Option line reactor to reduce the current harmonics on the mains caused by the DC link, use as an alternative to MX DCL

RFI .... Option radio frequency interference filter to use the inverter considering category C2 according to EN 61800-3 "Use in 1st environment - residential environment"

internal filter .... Radio frequency interference filter built-in as standard considering category C3 according to EN 61800-3 "Use in industrial environments"

AMF .... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF .... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

MX DCL .... DC choke to reduce the current harmonics, use as an alternative to the option MX NDU. The DC choke is available as inverter device variant.

BU......................... External braking unit option for MX pro 4V200/250 … 4V500/630

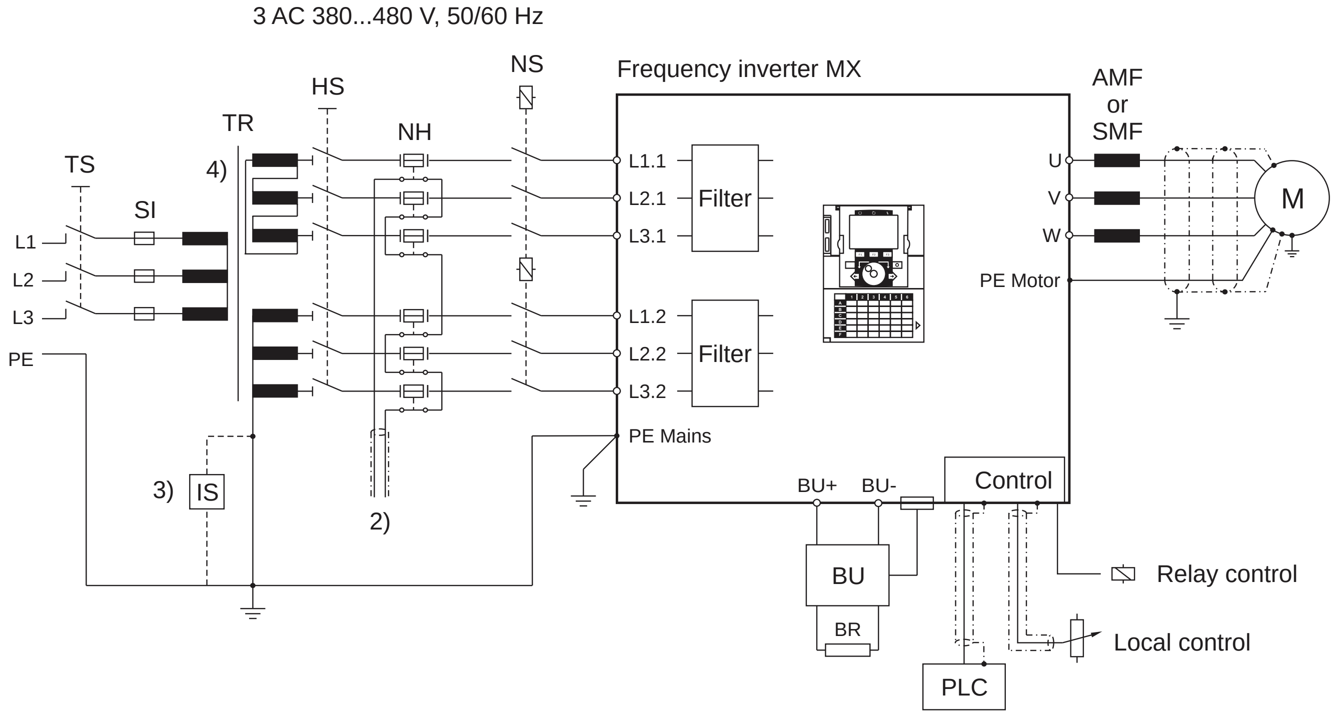
BR......................... Option braking resistor for short deceleration time or short-time dynamic loads

DC+ / DC-............. Power supply from a DC-bar; alternatively to 3AC mains supply.

1. The inverter supply must be split up in front of the line reactors, if they are used.
2. The monitoring of the fuses is used to protect the inverter against unbalanced load. It must act on mains contactor or pulse inhibit (e.g. digital input "External fault"). This is not obligatory, because the inverter monitors the mains voltage. Therefor set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).

MX pro 4V400/500...4V500/630

12-pulse rectification



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HS .... Main switch (to be used if required according to the local regulations)

NH .... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

TR.......................... Transformer with two out-of-phase secondary windings (e.g. Yy6 d5)

TS.......................... Disconnecting switch (to be used according to the local regulations)

internal filter .... Radio frequency interference filter built-in as standard considering category C3 according to EN 61800-3 "Use in industrial environments"

AMF....................... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF....................... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

BU .... External braking unit option for MX pro 4V200/250 … 4V500/630

BR .... Option braking resistor for short deceleration time or short-time dynamic loads

2. The monitoring of the fuses is used to protect the inverter against unbalanced load. It must act on mains contactor or pulse inhibit (e.g. digital input "External fault"). This is not obligatory, because the inverter monitors the mains voltage. Therefor set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).
3. In case of supply by means of a three-winding-transformer the neutral point can be grounded or alternatively an insulation monitoring relay can be used.
4. The transformer must keep to the following tolerances in order to guarantee a constant current sharing:
   Tolerance of the secondary voltages to each other: 0.3 % of V_{NOM}
   Tolerance of the relative short circuit voltage: ± 5.0 % of v_{SC_NOM}
   The nominal output voltage of a transformer is specified at no load operation. Therefore this value has to be appr. 5 % higher than the rated voltage of the drive.

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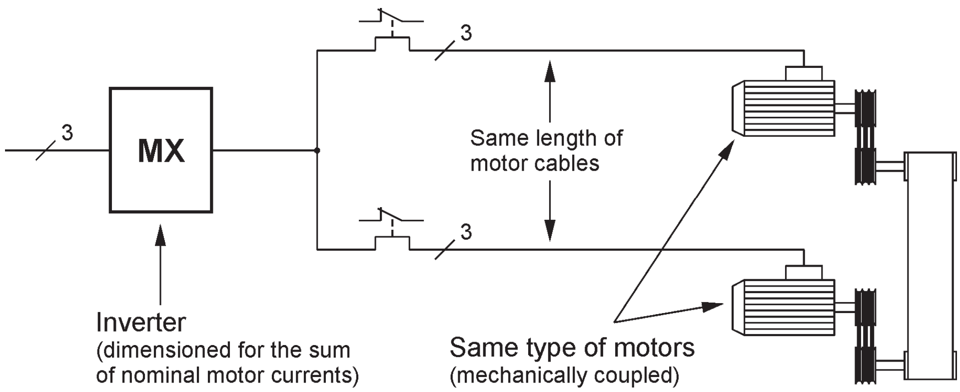
Multi-motor operation

It is basically possible to operate several motors with a MX pro frequency inverter.

For pumps (centrifugal pumps) and fan applications, however, observe the following:

- The sum of the nominal currents must be less than the nominal current of the inverter.
- A different speed regulation is not possible.
- The total motor cable length must be taken into consideration.
- No high starting torque is available.
- The inverter does not provide individual motor overload protection.
- Autotuning is not possible (but also not necessary).
- Activation is only permitted if the starting current surge remains less than the maximum inverter current.

For applications with a higher starting torque (e.g. travel drives, conveyors, lifting gear, etc.), only the parallel connection of several mechanically coupled motors is possible. In order to execute autotuning, the motors must be of the same type and the motor cables must have the same length preferably.



If thermal relays or motor circuit breakers are used, they must be set to about 110 % of the nominal current of the motor !

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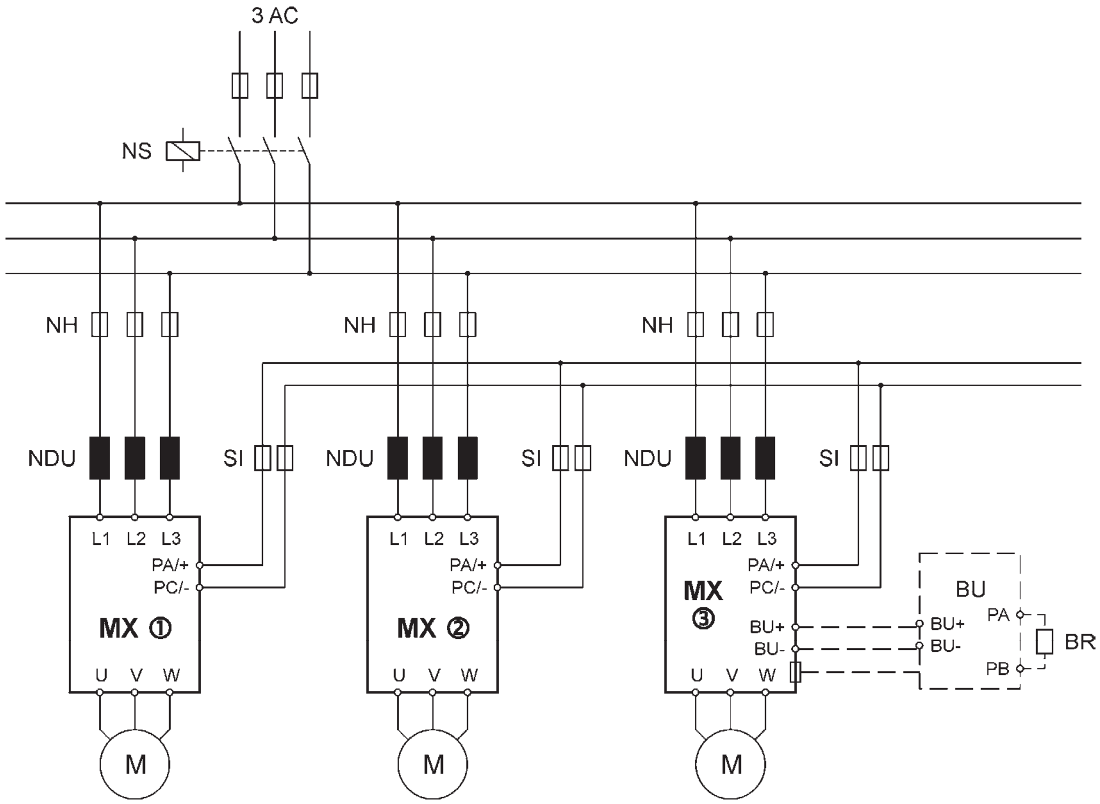
DC coupling

DC-coupling of several MX pro with a line contactor

It is advisable to couple the DC links in case of applications which have to perform full motor power on the one hand and which should act also in generator operation due to the energy exchange over the DC link on the other hand (e.g. roller conveyors, conveyer belts,...).



NS ....Line contactor
Because of the installation of a common line contactor, the charging circuits of the individual inverters act in parallel when the mains is switched on and thus they cannot be overloaded.

NH.........................Device protection on the main side
In order to protect each rectifier against overload, keep the recommended fuses in chapter "Fuses and cable cross sections", page 112. Consequential damages of the charging circuit during mains switch-on can be avoided by using a fuse monitoring which acts on the digital input "Ext. fault 1", "Ext. fault 2" or on the line contactor.

SI...........................Fuse in the DC link according to table in chapter "Fuses for DC-coupled inverters", page 115

①, ②, ③ ....MX eco and/or MX pro frequency inverters in standard design
Basically, the number of devices and their size is arbitrary, but between the biggest and smallest device only three power ratings are possible.

NDU ....The option line reactor NDU or the DC choke DCL is absolutely necessary !

BU / BR.................Braking unit and braking resistor for short-time reduction of the generator power
For example, if all drives should be shut down at the same time, the resulting energy will be relieved in the braking resistor.
The use of a braking unit is not obligatory.

MX pro 4V frequency inverters can be operated at the same DC bus. However, some parameters have to be adjusted appropriate (see Description of functions).

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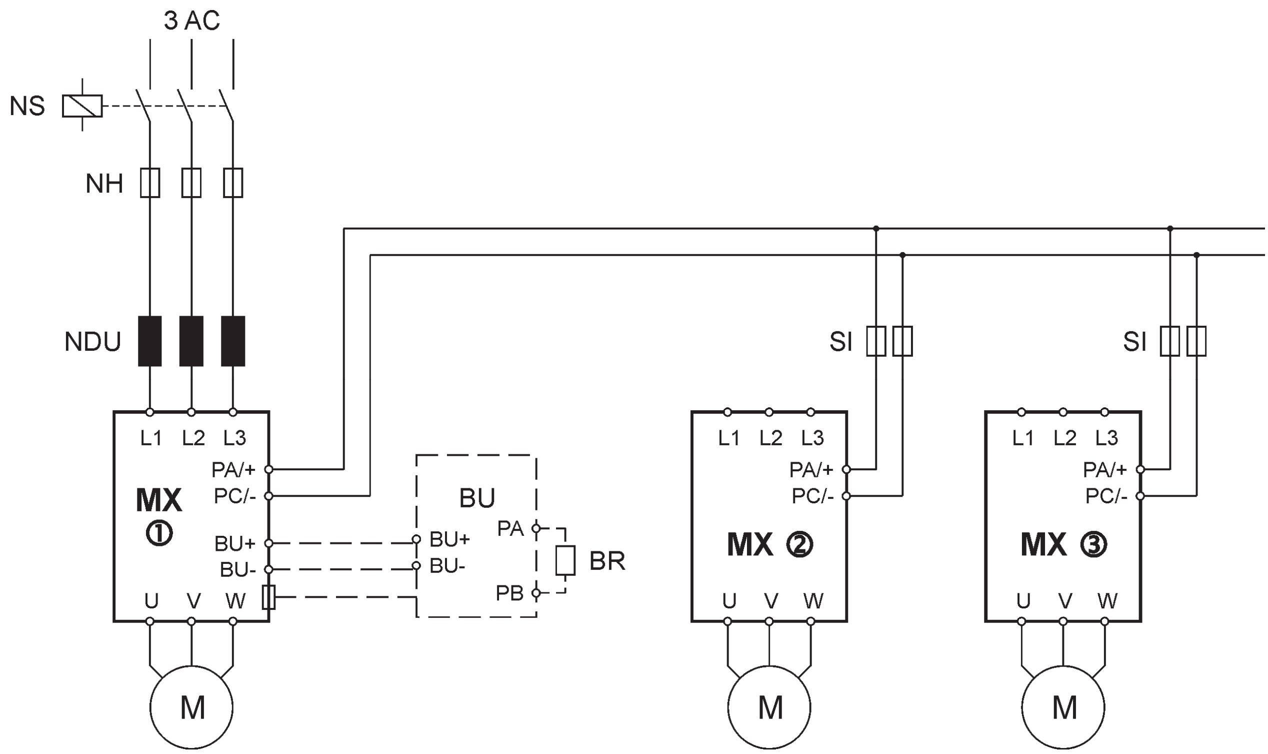
MX pro master drive with slave(s) at the DC link

Applications, which include drives which operate as generator (during braking operation) as well as one or several drives which operate as motor, can act very economic in case of a DC supply (e.g. re-/unwinder, straighteners, motor test benches, roller conveyors, hoisting applications,...).

However, at any time there must not be needed more motor power than power which is required for the rectifier of the main drive (e.g. 250 kW + 20 % for 60 s for MX pro 4V 200/250).

DC supplied drives must not be connected during operation !



①........................... MX pro frequency inverter in standard design (main drive)
This inverter defines the maximum possible motor power of the whole drive group. It is able to charge three similar devices (or several smaller devices with same total power).

②, ③ .... DC supplied inverters MX eco and/or MX pro (slaves)

NDU .... The option line reactor NDU or the DC choke DCL is absolutely necessary !

SI........................... Semiconductor fuse according to the table in chapter "Fuses for DC-coupled inverters", page 115
It does not makes sense to install switching devices in the DC circuit because closing the switching device would lead unintended triggering of the fuses as a result of the high charging current.

BU / BR................. Braking unit and braking resistor for short-time reduction of the generator power
For example, if all drives should be shut down at the same time, the resulting energy will be relieved in the braking resistor.
The use of a braking unit is not obligatory.

At the main drive the braking function has to be activated. The slave(s) have to be parameterized for operation with an external braking unit.

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Fuses and cable cross sections

The MX pro frequency inverters do not contain any input fuses. They have to be provided externally for the case that the electronic protective mechanism of the inverters fails. So they are a secondary protection of the inverter to protect the power cables against overload and to protect the input rectifier against an internal short-circuit.

The mentioned diameters for 3-wire cables are recommended values for laying the cable in air at max. 40°C ambient temperature, based on the regulations ÖVN EN 1 and VDE 0100.

The lines in the cubicles are dimensioned according to the specification for single conductors XLPE/EPR copper 90°C.

The motor cables are dimensioned for the maximum continuous current. They apply to 0...100 Hz (up to 300 Hz the cable losses increase about 25 % because of the Skin-effect).

In case of other ambient conditions and different regulations the cable diameters must be adjusted.

Mains supply				Frequency inverter			Motor output
Pre- or conduit fuses 1.)	Cu cable mm²	Mains fuse "inverter protection" "sf"	Lines in the cubicle mm² (per phase)	MX pro	Max. cont. current	Max. connec-tion	Motor cable mm² 3.)
10 A	3 x 1.5	10 A (sf)	1.5	4V0,75	2.3 A	6 mm²	3 x 1.5
10 A	3 x 1.5	10 A (sf)	1.5	4V1,5	4.1 A	6 mm²	3 x 1.5
10 [16] A	3 x 1.5 [2.5]	10 [16] A (sf)	1.5 [2.5]	4V2,2	5.8 A	6 mm²	3 x 1.5
16 [20] A	3 x 2.5	16 [20] A (sf)	2.5	4V3,0	7.8 A	6 mm²	3 x 1.5
20 [25] A	3 x 2.5 [4]	16 [25] A (sf)	2.5 [4]	4V4,0	10.5 A	6 mm²	3 x 1.5
25 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V5,5	14.3 A	6 mm²	3 x 2.5
32 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V7,5	17.6 A	6 mm²	3 x 2.5
40 [63] A	3 x 6 [16]	40 [63] A (sf)	6 [10]	4V11	27.7 A	16 mm²	3 x 4
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V15	33 A	35 mm²	3 x 6
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V18	41 A	35 mm²	3 x 10
63 [80] A	3 x 16 [25]	63 [80] A sf A	10 [16]	4V22	48 A	50 mm²	3 x 10
80 [100] A	3 x 25 [35]	80 [100] A sf A	16 [25]	4V30	66 A	50 mm²	3 x 16
100 [125] A	3 x 35 [50]	100 [125] A sf A	25 [35]	4V37	79 A	50 mm²	3 x 25
125 [160] A	3 x 50 [70]	125 [160] A sf B	35 [50]	4V45	94 A	120 mm²	3 x 35
160 [200] A	3 x 70 [95]	160 [200] A sf B	50 [70]	4V55	116 A	120 mm²	3 x 50
200 [250] A	3 x 95 [120]	200 [250] A sf B	70 [95]	4V75	160 A	120 mm²	3 x 70
Power 1 – high overload							
250 A	3 x 120	250 A sf C	95	4V**90**/110	179 A	M10	3 x 95
315 A	3 x 185	315 A sf C	120	4V**110**/132	215 A	M10	3 x 120
400 A	2 x (3 x 120)	350 A sf D	150	4V**132**/160	259 A	M10	3 x 150
400 A	2 x (3 x 120)	400 A sf D	185	4V**160**/200	314 A	M12	2 x (3 x 95)
500 A	2 x (3 x 150)	500 A sf E	2 x 120	4V**200**/250	387 A	M12	2 x (3 x 120)
630 A	2 x (3 x 185)	630 A sf F	2 x 150	4V**250**/315	481 A	M12	2 x (3 x 150)
800 A	3 x (3 x 185)	800 A sf F	3 x 150	4V**315**/400	616 A	M12	3 x (3 x 150)
1000 A	4 x (3 x 185)	2 x 500 A sf 2.) E	2 x 2 x 120	4V**400**/500	759 A	M12	3 x (3 x 185)
1250 A	4 x (3 x 240)	2 x 630 A sf 2.) F	2 x 2 x 150	4V**500**/630	941 A	M12	4 x (3 x 185)

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Mains supply				Frequency inverter			Motor output
Pre- or conduit fuses [1.)]	Cu cable mm^2	Mains fuse "inverter protection" "sf"	Lines in the cubicle mm^2 (per phase)	MX pro	Max. cont. current	Max. connec-tion	Motor cable mm^2 [3.)]
Power 2 – high continuous load							
250 A	3 x 120	250 A sf C	95	4V90/**110**	215 A	M10	3 x 120
315 A	3 x 185	315 A sf C	120	4V110/**132**	259 A	M10	3 x 150
400 A	2 x (3 x 120)	400 A sf D	185	4V132/**160**	314 A	M10	2 x (3 x 95)
500 A	2 x (3 x 150)	500 A sf D	2 x 120	4V160/**200**	387 A	M12	2 x (3 x 120)
630 A	2 x (3 x 185)	630 A sf E	2 x 150	4V200/**250**	481 A	M12	2 x (3 x 150)
800 A	3 x (3 x 185)	800 A sf F	3 x 150	4V250/**315**	616 A	M12	3 x (3 x 150)
1000 A	4 x (3 x 185)	900 A sf F	3 x 185	4V315/**400**	759 A	M12	3 x (3 x 185)
1250 A	4 x (3 x 240)	2 x 630 A sf [2.)] E	2 x 2 x 150	4V400/**500**	941 A	M12	4 x (3 x 185)
1600 A	6 x (3 x 240)	2 x 800 A sf [2.)] F	2 x 3 x 150	4V500/**630**	1188 A	M12	5 x (3 x 185)

1.) Recommended pre-fuses suitable for DOL starting with bypass circuit.

2.) 2 x 3-pole fuses because of parallel supply

3.) In case of bypass operation the motor cable has to be dimensioned according to the pre- or conduit fuses !

[ ] If the inverters are used without the options MX DCL or MX NDU, consider the values in brackets.

It is recommended to use super fast (semiconductor) fuses. Standard fast fuses or circuit breakers can also be used but the rectifier could be damaged in case of an internal fault.

To protect the rectifier in case of a short-circuit the used fuses should not exceed the following I^2t values (referring to 10 ms):

A	B	C	D	E	F
5.10^3 A^2s	50.10^3 A^2s	160.10^3 A^2s	320.10^3 A^2s	780.10^3 A^2s	1000.10^3 A^2s

If the mains fuses blow the inverter already has a primary defect. Therefore, exchanging the blown fuses and switching the inverter on again is not effective. Consequently, the use of circuit breakers is not advantageous and has additionally the disadvantage of a slower switch-off ad. A circuit breaker with motor drive has to be seen in fact as an alternative to the line contactor.

A low cost alternative to screened motor cables is the use of NYCY or NYCWY cables (power cables with concentric protective conductor).

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Dimensioning according to UL/CSA

In order to meet the requirements of UL/CSA, copper cables with temperature class 60/75°C have to be used.

In addition to semiconductor fuses (with UL approval, nominal values in accordance with column Mains fuse "inverter protection" "sf") the use of class CC, class J and class T fuses according to the table below is permitted.
The below-mentioned cable cross sections correspond with the temperature class 75°C and an ambient temperature of 30°C.

	UL fuses 600V type Fast acting	Max. mains short-circuit current at 480V mains voltage according to UL listing			Cable cross section for mains- and motor cables (per phase)
		without choke	with DCL-choke	with line reactor	
MX pro 4V0,75	Class CC 6 A max.	5 kA	35 kA	100 kA	AWG 14
MX pro 4V1,5	Class CC 12 A max.	5 kA	35 kA	100 kA	AWG 14
MX pro 4V2.2	Class J 15 A max.	5 kA	35 kA	100 kA	AWG 14
MX pro 4V3,0	Class J 17.5 A max.	5 kA	35 kA	100 kA	AWG 14
MX pro 4V4,0	Class J 25 A max.	5 kA	35 kA	100 kA	AWG 12
MX pro 4V5,5	Class J 40A max.	5 kA	35 kA	100 kA	AWG 10
MX pro 4V7,5	Class J 40 A max.	5 kA	35 kA	100 kA	AWG 10
MX pro 4V11	Class J 60 A max.	5 kA	35 kA	100 kA	AWG 8
MX pro 4V15	Class J 70 A max.	5 kA	35 kA	100 kA	AWG 6
MX pro 4V18	Class J 70 A max.	5 kA	35 kA	100 kA	AWG 6
MX pro 4V22	Class J 80 A max.	5 kA	35 kA	100 kA	AWG 6
MX pro 4V30	Class J 90 A max.	5 kA	35 kA	100 kA	AWG 4
MX pro 4V37	Class J 110 A max.	5 kA	35 kA	100 kA	AWG 3
MX pro 4V45	Class J 150 A max.	10 kA	35 kA	100 kA	AWG 1
MX pro 4V55	Class J 175 A max.	10 kA	35 kA	100 kA	AWG 1/0
MX pro 4V75	Class J 225 A max.	10 kA	35 kA	100 kA	AWG 3/0
MX pro 4V90/110	Class J 300 A max.	(10 kA)	50 kA	100 kA	2x AWG 2/0
MX pro 4V110/132	Class J 350 A max.	(10 kA)	50 kA	100 kA	2x AWG 4/0
MX pro 4V132/160	Class J 400 A max.	(18 kA)	50 kA	100 kA	2x 250 MCM
MX pro 4V160/200	Class J 450 A max.	(18 kA)	50 kA	100 kA	2x 350 MCM
MX pro 4V200/250	Class J 600 A max.	(18 kA)	50 kA	100 kA	3x 250 MCM
MX pro 4V250/315	Class T 800 A max.	(30 kA)	50 kA	100 kA	3x 350 MCM
MX pro 4V315/400	Semiconductor fuse 900 A max.	(30 kA)	50 kA	100 kA	4x 350 MCM
MX pro 4V400/500	Class J 2x600 A max.	(30 kA)	50 kA	100 kA	Mains: 2x (2x 500 MCM) Motor: 4x 500 MCM
MX pro 4V500/630	Class T 2x800 A max.	(30 kA)	50 kA	100 kA	Mains: 2x (3x 500 MCM) Motor: 5x 500 MCM

( ) Further information about the values in parentheses is given in chapter "DC choke DCL", page 218 and chapter "Line reactor NDU", page 223.

Fuses for DC-coupled inverters

Only semiconductor fuses are suitable for DC applications. Due to their construction they can switch off at DC voltages as well as AC voltages.

DC mains supply	400 V	440 V	460 V
Nominal voltage Voltage range Overvoltage shut-down	560 V DC 405...650 V DC 1.50 x V_{N-DC}	620 V DC 450...685 V DC 1.35 x V_{N-DC}	680 V DC 490...745 V DC 1.25 x V_{N-DC}
Nominal current DC (approx.)	1.15 x I_{MOTOR}	1.15 x I_{MOTOR}	1.15 x I_{MOTOR}
Type of fuse, Nominal voltage	690 V sf	690 V sf	690 V sf

Frequency inverter		Mains fuse "inverter protection" "sf"	Lines in the cubicle (per phase)
MX eco 4V0,75	MX pro 4V0,75	16 A	2.5 mm^2
MX eco 4V1,5	MX pro 4V1,5	16 A	2.5 mm^2
MX eco 4V2,2	MX pro 4V2,2	16 A	2.5 mm^2
MX eco 4V3,0	MX pro 4V3,0	16 A	2.5 mm^2
MX eco 4V4,0	MX pro 4V4,0	20 A	4 mm^2
MX eco 4V5,5	MX pro 4V5,5	25 A	4 mm^2
MX eco 4V7,5	MX pro 4V7,5	32 A	6 mm^2
MX eco 4V11	MX pro 4V11	40 A	6 mm^2
MX eco 4V15	MX pro 4V15	63 A	10 mm^2
MX eco 4V18	MX pro 4V18	63 A	10 mm^2
MX eco 4V22	MX pro 4V22	80 A	16 mm^2
MX eco 4V30	MX pro 4V30	100 A	25 mm^2
MX eco 4V37	MX pro 4V37	125 A	35 mm^2
MX eco 4V45	MX pro 4V45	160 A	50 mm^2
MX eco 4V55	MX pro 4V55	200 A	70 mm^2
MX eco 4V75	MX pro 4V75	250 A	95 mm^2
MX eco 4V90		315 A	120 mm^2
MX eco 4V110	MX pro 4V90/110	315 A	120 mm^2
MX eco 4V132	MX pro 4V110/132	400 A	185 mm^2
MX eco 4V160	MX pro 4V132/160	500 A	2 x 120 mm^2
MX eco 4V200	MX pro 4V160/200	630 A	2 x 150 mm^2
MX eco 4V250	MX pro 4V200/250	700 A	3 x 120 mm^2
MX eco 4V315	MX pro 4V250/315	900 A	3 x 150 mm^2
MX eco 4V355		1000 A	3 x 185 mm^2
MX eco 4V400	MX pro 4V315/400	1250 A	4 x 150 mm^2
MX eco 4V500	MX pro 4V400/500	1400 A	6 x 120 mm^2
MX eco 4V630	MX pro 4V500/630	1600 A	6 x 150 mm^2

Braking unit BU

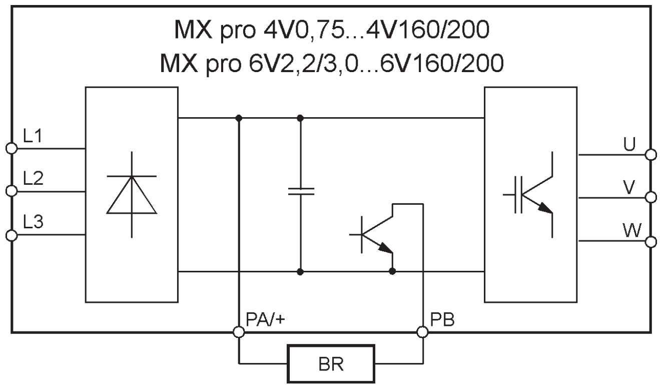
When a motor is braked on the deceleration ramp, the motor acts as a generator. Since voltage DC link inverters cannot return energy to the mains as standard, the DC link voltage increases in case of generator operation.

If more power is returned to the DC link during the braking procedure than the losses in the motor and inverter amount to, the DC link voltage increases and a shut-down with overvoltage results.

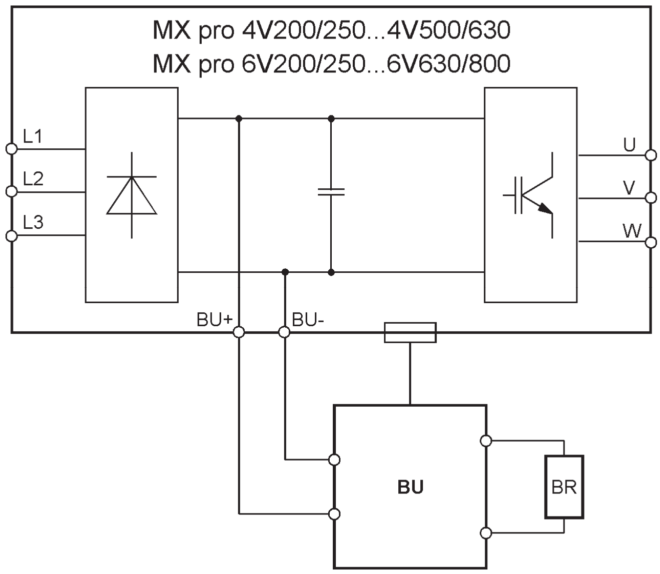
The generator power depends on the moment of inertia of the load and the set deceleration time, among other things.

The MX pro inverter counteracts the shut-down through an automatic extension of the deceleration ramp. If shorter braking times must be observed, a braking resistor should be connected to the inverter (or to the braking unit BU).

MX pro with an internal braking transistor



MX pro with an external braking unit BU



If the DC link voltage exceeds an adjustable value due to a braking procedure, the external braking resistor is switched into the DC link as a consumer. The braking resistor BR converts the energy incurred into heat and thus prevents a further rising of the DC link voltage.

The connection of a braking resistor BR enables the use of the frequency inverter *M*X pro for 4-quadrant-operation. Depending on the selected combination inverter / (braking unit) / braking resistor, a high peak braking power, a high continuous braking power or both can be optimized.

The resistors should be selected according to the respective allocation tables. In the process, the permissible braking power and braking time should be taken into consideration.

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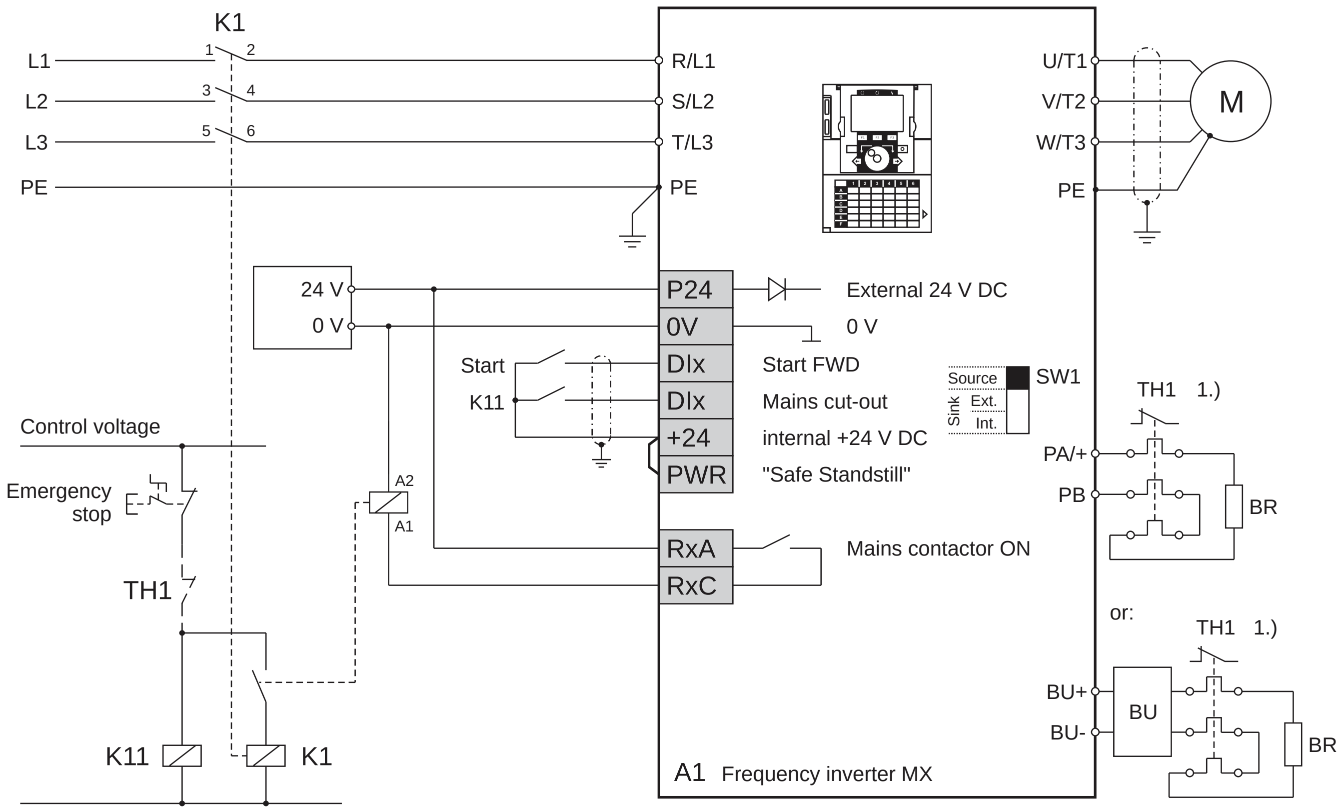
The MX pro frequency inverters have parameters to monitor the braking power.

If the braking resistor does not match the overload characteristic to be used or the local regulations require an additional protective device, a thermal relay should be integrated into the mains disconnection mechanism.

The correct setting of the braking parameters is essential for the protection of the braking resistor in normal operation. In case of malfunction of the internal braking transistor or of the external braking unit, the braking resistor can be only protected by mains disconnection. Therefrom, a line contactor is necessary when using the braking function. Furthermore, the use of the function "Line contactor control" is recommended..

By using the function "Line contactor control" the frequency inverter is itself able to connect and disconnect the mains by means of a contactor upstream. Therefore, a selectable digital output is activated with each start command (via keypad, terminals or bus) through which the line contactor is activated. The termination of the line contactor occurs with a stop command after a deceleration process has taken place, in the case of an occurring fault or if a lock signal is given, the line contactor releases immediately.



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1.) When using an additional thermal relay, the auxiliary contact has to be integrated into the circuit of the line contactor.

An external 24 V buffer voltage is required for the supply of the inverter electronics.

In order to guarantee a safe switching-off of the line contactor when using an emergency STOP control, a digital input with the function "Mains cut-off" must be integrated.

Minimum resistance value of the braking resistor

In the technical data, R_{MIN} indicates the nominal value of the braking resistor that may not fall short due to the protection of the braking transistor (see chapter "Technical data" of the respective inverter). In the data, a resistor tolerance of -10% has been taken into consideration.

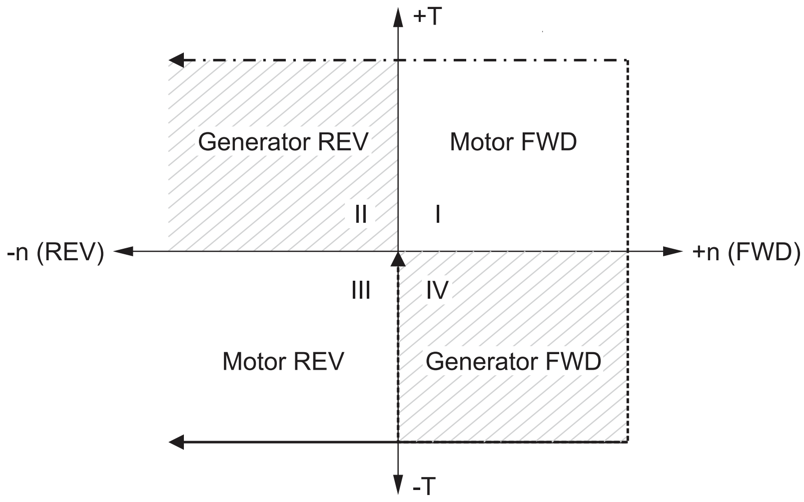
Maximum resistance value of the braking resistor

In the technical data, R_{MAX} indicates the nominal resistance value at which a peak braking power of 150% of the nominal inverter power can still be reached (see chapter "Technical data" of the respective inverter). In the data, a resistor tolerance of +20% (incl. heating) has been taken into consideration. If a braking resistor with a higher resistance value is used, the deceleration ramp must be extended depending on the accumulating peak braking power (this can also take place using the function "S-ramp") to prevent a fault shutdown with overvoltage.

Principle and calculation of the braking sequence

To obtain a quantitative statement regarding the drive and braking power, the torque and speed at the respective operating point must be known.

If both these variables are compared graphically, the diagram for the four load quadrants results.



------ braking of a motor to n=0 with constant torque

– · – transition from raising to sinking of a hoist

—— braking and reversing of a motor with constant torque

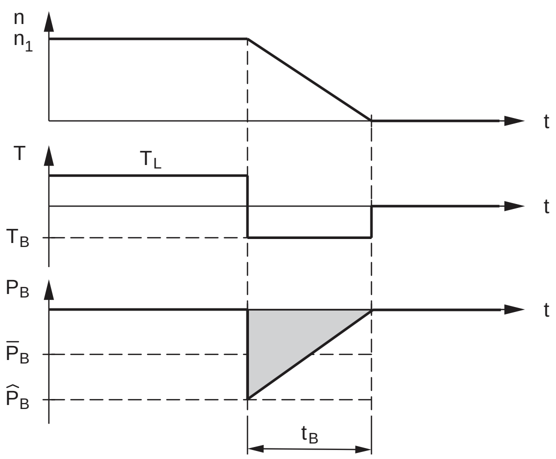
For the power, the following generally applies: $\boxed{P = \frac{T \cdot n}{9.55}}$

Motor power (+P) thus results in quadrants I (+T, +n) and III (-T, -n).

Generator power (-P) results in quadrants II (+T, -n) and IV (-T, +n).

The generator load cases are principally divided into the following groups:

1. Evenly delayed braking



n_1 ...Starting speed

T_L ...Load torque (motor)

T_B ...Braking torque (generator)

$\hat{P}_B$ ...Peak braking power

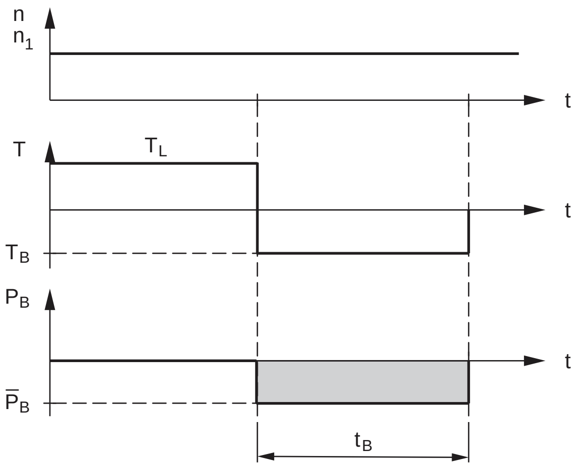
$\overline{P}_B$ ...Average over braking power during t_B

t_B ...Braking time

The characteristic of the braking power curve is the peak braking power $\hat{P}_B$ and the average of the braking power that corresponds to $\hat{P}_B/2$ when braking to zero (triangular area).

Example: Shut-down of processing machines, centrifuges, long-travels, reversing of the rotational speed, etc.

2. Braking at constant speed

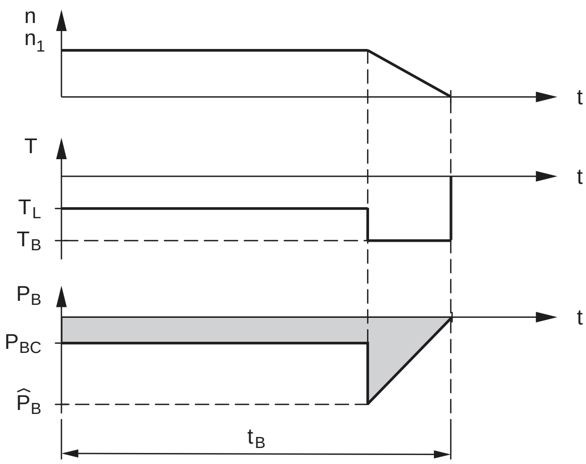


n_1 ...Starting speed
T_L ...Load torque (motor)
T_B ...Braking torque (generator)
$\overline{P}_B$ ...Average over braking power during t_B
t_B ...Braking time

When braking is performed at constant speed, the braking power accumulating during the braking time is constant.

Example: Motor and gear test benches, ...

3. Braking with constant speed and subsequent delay



n_1 ... Starting speed
T_L ... Load torque (motor)
T_B ... Braking torque (generator)
P_{BC} ... Continuous braking power
$\hat{P}_B$ ... Peak braking power
t_B ... Braking time

In this case, braking takes place at constant speed and constant braking power. After that, a dynamic delay takes place, whereby the peak braking power may amount to about two or three times the continuous braking power due to the centrifugal mass being braked.

Example: Hoist during lowering procedure

Calculation of the braking power

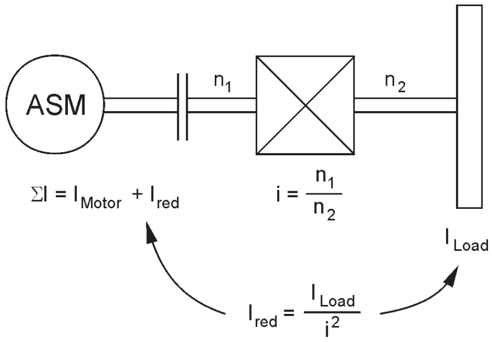
1. **Braking of the centrifugal mass with constant delay**

$$\boxed{T_B = \frac{\sum I \cdot (n_1 - n_2)}{9.55 \cdot t_B}}$$

$$\boxed{P = T \cdot \varpi} \quad \boxed{\omega = \frac{2\pi \cdot n}{60}}$$

T_B ... Braking torque of the motor [Nm]
ΣI ... Sum of the moments of inertia related to the motor shaft [kgm^2]
n_1 ... Speed before braking [rpm]
n_2 ... Speed after braking [rpm]
t_B ... Braking time [t]

Calculation of the moment of inertia



2. **Braking of transversal movements (e.g. long-travels) with constant delay**

$$\boxed{W_{kin} = \frac{m \cdot v^2}{2}}$$

$$\boxed{\overline{P}_B = \frac{W_{kin}}{t_B}}$$

$$\boxed{\hat{P}_B = P_B \cdot 2}$$

W_{kin} ... Kinetic energy [Joule]
m ... Weight [kg]
v ... Speed [m/s]
t_B ... Braking time [s]
$\hat{P}_B$ ... Peak braking power [W]
$\overline{P}_B$ ... Average over braking power during t_B [W]

3. **Braking of active, driving of loads (e.g. test bench)**

$$\boxed{\overline{P}_B = \frac{T_B \cdot n}{9.55}}$$

$\overline{P}_B$ ... Average over braking power during t_B [W]
T_B ... Braking torque [Nm]
n ... Braking speed [rpm]

4. **Braking of hoistings during lowering**

$$\boxed{\overline{P}_B = m \cdot g \cdot v}$$

$$\boxed{\hat{P}_B = m \cdot (g + a) \cdot v + \frac{I \cdot \omega^2}{t_B}}$$

$$\boxed{\omega = \frac{2\pi \cdot n}{60}}$$

$\overline{P}_B$ ... Average over braking power during t_B [W]
$\hat{P}_B$ ... Peak braking power [W]
m ... Weight [kg]
g ... Acceleration of gravity 9.81 m/s^2
a ... Braking delay [m/s^2]
v ... Lowering speed [m/s]
I ... Moment of inertia [kgm^2]
ω ... Angular velocity [rad/s]
t_B ... Braking time [s]
n ... Motor speed during lowering operation [rpm]

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All previously calculated braking powers apply only under the assumption that there are no system losses (i.e. $\eta=1$) or motor load torques.

Since both parts reduce the arising braking power, they must be observed precisely:

1. System losses

The losses occurring during motor operation must not only be applied during the braking procedure (generator operation, quadrants II and IV), they also actively help during the braking procedure. Thus the efficiency is to be included squared in the calculation of the braking power.

2. Load torques

Any existing load torques (as they are not taken into consideration in the overall efficiency), such as friction, wind force, quadratic load torque of fans, air resistance, and so on, reduce the braking power. The load torques or power is to be subtracted during the calculation of the braking power.

The braking power that is actually required can thus be calculated as follows:

$$\hat{P}_{BReal} = \left(\hat{P} - P_{Load}\right)\cdot\eta_{total}$$

$$\bar{P}_{BReal} = \left(\bar{P} - P_{Load}\right)\cdot\eta_{total}$$

$$\eta_{total} = \eta_{mech}\cdot\eta_{mot}\cdot 0.98$$

$\hat{P}_{BReal}$ ... Actual peak braking power [W]

$\bar{P}_{BReal}$ ... Actual continuous braking power [W]

η_{total} ... Total efficiency

P_{Load} ... Braking power of the load shares [W]

Selection of the braking option

The necessary braking option is primarily selected according to the necessary braking power ($\hat{P}_b, \bar{P}_b$), but also the following aspects may play a role in the selection of the braking option:

- Mounting type and protection degree of the braking resistors
- Amount of wiring
- Problems with the accumulating thermal energy (air conditioning)
- Price and possibility for amortisation due to reduced energy costs

In case of operating with braking unit, the braking resistor is selected under consideration of the required powers by means of the braking time/cycle diagram and the selection tables in these instructions.

In general, the following applies:

$$\hat{P}_{max} = \frac{V_d^2}{R}$$

$$P_{Cont.} = I^2\cdot R$$

$\hat{P}_{max}$ ... Maximum braking power [W]

$P_{Cont.}$ ... Thermal continuous braking power [W]

V_d ... Braking unit activation level [V]

I ... Thermal continuous current limit of the braking resistor (see set value TH) [A]

R ... Resistance value of the braking resistor [Ω]

P_{Cycle} ... See the characteristic curve in the cycle diagram.

The MX pro frequency inverters have parameters to monitor the braking power. If the braking resistor does not match the overload characteristic to be used or the local regulations require an additional protective device, a thermal relay must be integrated into the mains disconnection mechanism.

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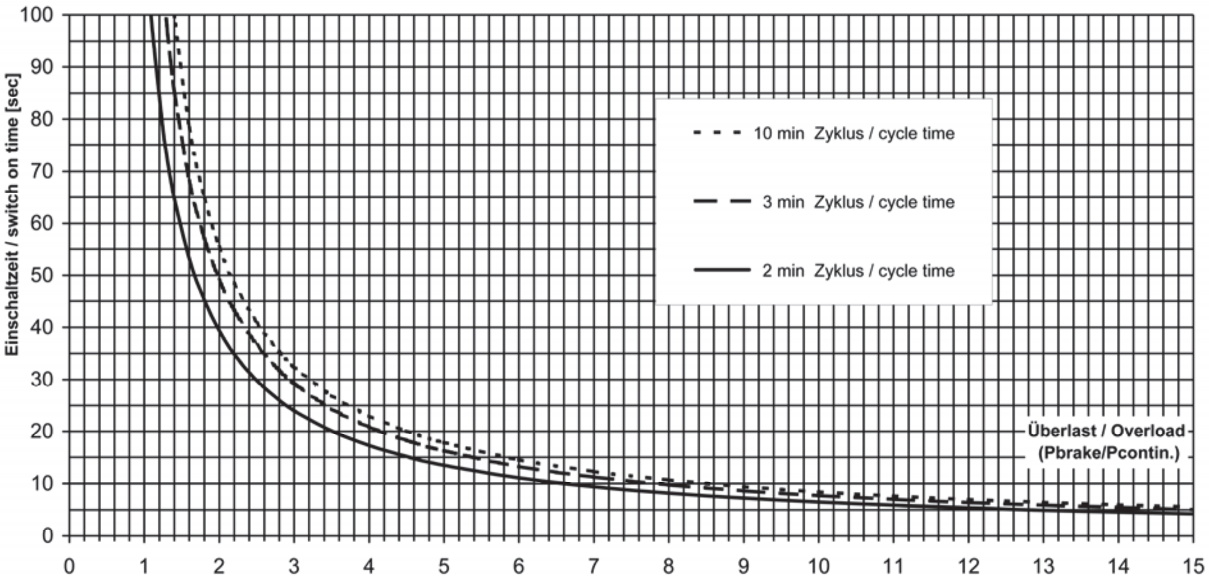
Tripping characteristics for dimensioning and monitoring of the braking resistors

The characteristic curves show the allowed load of the braking resistors depending on the cycle time. They are mapped in the inverter as a calculation model and thus represent an optimum protection of the braking resistor. If this load is exceeded, the inverter triggers with the message "BR Overload" (alarm or fault).

For this purpose, the proper parameterization of parameters B5.05...B5.09 is necessary:

- B5.05 Set "BR overload activation" to setting "1 .. Active" (activates the resistor monitoring).
- B5.06 "BR overload response" sets the desired reaction in case of BR overload. When "1 .. -Δt-alarm" is set, however, an external reaction for the protection of the braking resistor BR must occur!
- B5.07 "Time Δt" for process-related adaptation of the reaction of B5.06
- B5.08 Set "BR continuous power" according to the installed braking resistor (sum of the braking resistors)
- B5.09 Set "BR Ohm value" according to the installed braking resistor (total resistance of all braking resistors)



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Allocation table for typical crane applications

Typical dimensioning for hoist applications

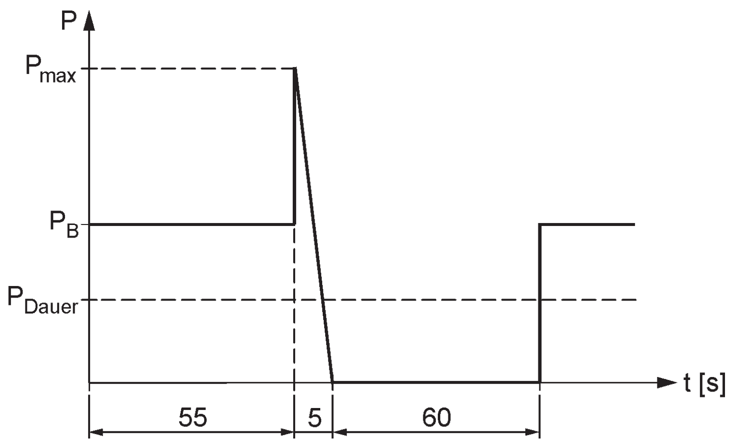
Typ. motor rating	Inverter	Braking unit	Braking resistor	P_{max} @ 785 V	P_B	P_{CONT}
0.75 kW	MX pro 4V0,75	internal	1 x VW3 A7 801	1.1 kW	0.5 kW	1.6 kW
1.5 kW	MX pro 4V1,5	internal	1 x VW3 A7 801	2.3 kW	1.1 kW	1.6 kW
2.2 kW	MX pro 4V2,2	internal	1 x VW3 A7 801	3.3 kW	1.5 kW	1.6 kW
3.0 kW	MX pro 4V3,0	internal	1 x VW3 A7 801	4.5 kW	2.1 kW	1.6 kW
4.0 kW	MX pro 4V4,0	internal	1 x VW3 A7 802	6.0 kW	3.0 kW	5.6 kW
5.5 kW	MX pro 4V5,5	internal	1 x VW3 A7 802	8.3 kW	4.1 kW	5.6 kW
7.5 kW	MX pro 4V7,5	internal	1 x VW3 A7 803	11 kW	5.6 kW	9.8 kW
11 kW	MX pro 4V11	internal	1 x VW3 A7 803	17 kW	8.3 kW	9.8 kW
15 kW	MX pro 4V15	internal	1 x VW3 A7 804	23 kW	12 kW	22 kW
18.5 kW	MX pro 4V18	internal	1 x VW3 A7 804	28 kW	15 kW	22 kW
22 kW	MX pro 4V22	internal	1 x VW3 A7 804	33 kW	18 kW	22 kW
30 kW	MX pro 4V30	internal	1 x VW3 A7 804	45 kW	24 kW	22 kW
37 kW	MX pro 4V37	internal	1 x VW3 A7 805	56 kW	30 kW	44 kW
45 kW	MX pro 4V45	internal	1 x VW3 A7 805	68 kW	36 kW	44 kW
55 kW	MX pro 4V55	internal	1 x VW3 A7 806	83 kW	44 kW	62 kW
75 kW	MX pro 4V75	internal	1 x VW3 A7 806	113 kW	60 kW	62 kW
90 kW	MX pro 4V90/110	internal	1 x VW3 A7 811	135 kW	79 kW	56 kW
110 kW	MX pro 4V110/132	internal	1 x VW3 A7 811	165 kW	97 kW	56 kW
132 kW	MX pro 4V132/160	internal	1 x VW3 A7 812	198 kW	116 kW	75 kW
160 kW	MX pro 4V160/200	internal	1 x VW3 A7 812	240 kW	141 kW	75 kW
200 kW	MX pro 4V200/250	VW3 A7 101	2 x VW3 A7 811 [1]	300 kW	176 kW	112 kW
250 kW	MX pro 4V250/315	VW3 A7 101	2 x VW3 A7 811 [1]	375 kW	220 kW	112 kW
315 kW	MX pro 4V315/400	VW3 A7 102	2 x VW3 A7 812 [1]	473 kW	277 kW	150 kW
400 kW	MX pro 4V400/500	VW3 A7 102	3 x VW3 A7 811 [1]	600 kW	352 kW	168 kW
500 kW	MX pro 4V500/630	VW3 A7 102	3 x VW3 A7 812 [1]	750 kW	440 kW	225 kW

[1)] Resistors in parallel

Typical braking power and cycles for hoist applications

P_{max}......Maximum braking power
P_B ....Braking power at lowering the load
$P_{Cont.........}$Continuous braking power

max. cycle time: 120 s



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Typical dimensioning for long travel applications

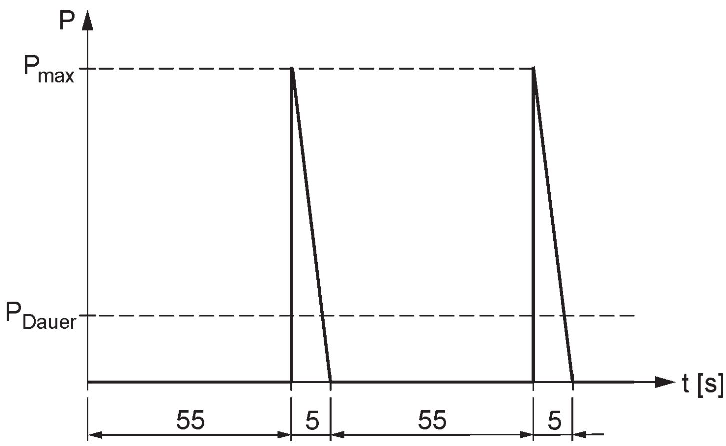
Typ. motor rating	Inverter	Braking unit	Braking resistor	P_{max} @ 785 V	P_{CONT}
0.75 kW	MX pro 4V0,75	internal	1 x VW3 A7 801	1.1 kW	1.6 kW
1.5 kW	MX pro 4V1,5	internal	1 x VW3 A7 801	2.3 kW	1.6 kW
2.2 kW	MX pro 4V2,2	internal	1 x VW3 A7 801	3.3 kW	1.6 kW
3.0 kW	MX pro 4V3,0	internal	1 x VW3 A7 801	4.5 kW	1.6 kW
4.0 kW	MX pro 4V4,0	internal	1 x VW3 A7 802	6.0 kW	5.6 kW
5.5 kW	MX pro 4V5,5	internal	1 x VW3 A7 802	8.3 kW	5.6 kW
7.5 kW	MX pro 4V7,5	internal	1 x VW3 A7 803	11 kW	9.8 kW
11 kW	MX pro 4V11	internal	1 x VW3 A7 803	17 kW	9.8 kW
15 kW	MX pro 4V15	internal	1 x VW3 A7 803	23 kW	9.8 kW
18.5 kW	MX pro 4V18	internal	1 x VW3 A7 804	28 kW	22 kW
22 kW	MX pro 4V22	internal	1 x VW3 A7 804	33 kW	22 kW
30 kW	MX pro 4V30	internal	1 x VW3 A7 804	45 kW	22 kW
37 kW	MX pro 4V37	internal	1 x VW3 A7 805	56 kW	44 kW
45 kW	MX pro 4V45	internal	1 x VW3 A7 805	68 kW	44 kW
55 kW	MX pro 4V55	internal	1 x VW3 A7 806	83 kW	62 kW
75 kW	MX pro 4V75	internal	1 x VW3 A7 806	113 kW	62 kW
90 kW	MX pro 4V90/110	internal	1 x VW3 A7 710	135 kW	25 kW
110 kW	MX pro 4V110/132	internal	1 x VW3 A7 710	165 kW	25 kW
132 kW	MX pro 4V132/160	internal	1 x VW3 A7 710	198 kW	25 kW
160 kW	MX pro 4V160/200	internal	1 x VW3 A7 711	240 kW	37 kW
200 kW	MX pro 4V200/250	VW3 A7 101	1 x VW3 A7 712	300 kW	44 kW
250 kW	MX pro 4V250/315	VW3 A7 101	1 x VW3 A7 715	375 kW	56 kW
315 kW	MX pro 4V315/400	VW3 A7 102	1 x VW3 A7 716	473 kW	75 kW
400 kW	MX pro 4V400/500	VW3 A7 102	3 x VW3 A7 711 [1]	600 kW	111 kW
500 kW	MX pro 4V500/630	VW3 A7 102	3 x VW3 A7 711 [1]	750 kW	111 kW

1) Resistors in parallel

Typical braking power and cycles for long travel applications

P_{max} ..... Maximum braking power
$P_{Cont.}$ .... Continuous braking power

max. cycle time: 120 s



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Motor cable lengths

Because of the permitted mains disturbances, the allowed overvoltages at the motor, the occurring bearing currents and the permitted losses the distance between inverter and motor(s) is limited. The maximum distance heavily depends on the type of motor cable (screened/unscreened) as well as from the used options.

Overvoltages at the motor

Overvoltages at the motor terminals result from reflection in the motor cable. In case of motor cables with more than 50 m length the used motors must feature increased voltage resistance. Thereby the motor load is nearly independent from the used inverter !

Mains voltage 400 V	Motor insulation for 1300 V phase-to-phase peak voltage and dv/dt resistance > 8 kV/µs
Mains voltage 460 V	Motor insulation for 1600 V phase-to-phase peak voltage and dv/dt resistance > 8 kV/µs

In order to use standard motors in this voltage range, the MX pro have a function to inhibit short output voltage pulses. The function can be activated by means of parameter B3.32 "Min. length of pulses", whereby the overvoltages caused by the reflection are reduced. The slew rate as well as the EMC load are not influenced by changing this parameter.

At even longer motor cables the use of a "dv/dt filter" is required. Combined with the cable capacitance the option AMF (output motor filter) affects like a filter and limits the voltage peaks at the motor as well as the slew rate of the output pulses.

If the specified motor cable lengths are observed the motor life time can be significantly extended.

Mains voltage 400 V	max. 1000 V phase-to-phase peak voltage and dv/dt < 500 V/µs
Mains voltage 460 V	max. 1300 V phase-to-phase peak voltage and dv/dt < 750 V/µs

Observing the specified length of motor cables is absolutely necessary to protect the motor !

EMC interferences

The mains rectifier as well as the IGBT inverter cause high-frequent interferences which drain off more and more stronger to the earth potential with increasing motor cable length. As a result the line-conducted interferences to the mains increase. The attenuation of the line reactors is not longer sufficient and the permitted interference limits are exceeded.

Observing the specified length of motor cables is also necessary for compliance with the EMC limits !

Bearing currents

Common mode bearing currents which even cannot be prevented by means of motors equipped with an insulated bearing are significantly reduced by use of the option AMF.

Especially in case of big motors with middle up to high motor cable lengths the option AMF is considerable to increase the availability of the motor.

Multiplication factors

The specified lengths of motor cables are recommended limits based on typical motor cables, laying in cable channels, default pulse frequency and maximal output frequency of 100 Hz.

In case of different conditions the recommended cable lengths must be converted by means of the following factors.

If several factors apply, please multiply them.

- The pulse frequency does not correspond to factory default:

  MX pro 4V0,75...4V75:

at 8 kHz	multiply all values by 0.6
at 12 kHz	multiply all values by 0.4
at 16 kHz	multiply all values by 0.3

  MX pro 4V90/110...4V500/630:

at 4 kHz	multiply all values by 0.7
at 8 kHz	multiply all values by 0.4

- In case of output frequencies higher than 100 Hz:

up to 200 Hz	multiply all values by 0.8
up to 300 Hz	multiply all values by 0.5

- Instead of two parallel cables one thicker cable is used: multiply all values by 1.5

- In case of 6-pole motor cabling (e.g. for star/delta starting circuit): multiply all values by 0.75

- In case of parallel motors with their centre near the inverter values must be converted in compliance with the number of motors. When an adjusted AMF is used for each motor, the following values in brackets apply.

at 2 motors	multiply all values by 0.40 (0.80)
at 3 motors	multiply all values by 0.25 (0.60)
at 4 motors	multiply all values by 0.15 (0.40)
at 5 motors	multiply all values by 0.10 (0.25)

- If the centre of the parallel motors is near the motors, following factors for conversion apply:

at 2 motors	multiply all values by 0.80
at 3 motors	multiply all values by 0.60
at 4 motors	multiply all values by 0.40
at 5 motors	multiply all values by 0.25

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Recommended maximum lengths of motor cables in 1st environment

options	4V0,75...4V4,0	4V5,5…4V45	4V55…4V500/630	Type of motor cable
C1 residential environment - unrestricted sales (EN 55011 - class B group 1)				
Option RFI	50 m	50 m	–	screened
C2 residential environment - EMC qualified user (EN 55011 - class A group 1)				
no options	10 m	–	–	screened
Option RFI *)	75 m	75 m	100 m	screened
Option RFI + AMF	80 m	80 m	120 m	screened
Option RFI + SMF	100 m	100 m	150 m	screened

Recommended maximum lengths of motor cables in 2nd environment (industrial environment)

options	4V0,75...4V4,0	4V5,5…4V45	4V55…4V500/630	Type of motor cable
C3 (EN 55011 - class A group 2)				
no options	20 m	20 m	50 m	screened
Option AMF	50 m	50 m	80 m	screened
Option RFI *)	80 m	80 m	100 m	screened
Option RFI + AMF	120 m	120 m (200 m)	200 m	screened
Option RFI + SMF	150 m	200 m	200 m	screened
Option SMF	20 m	20 m	–	unscreened
C4 (EMC concept)				
no options *)	50 m	50 m	80 m	screened
Option AMF	100 m (150 m)	120 m (200 m)	250 m	screened
2 x Option AMF serial	200 m (300 m)	250 m (400 m)	500 m	screened
Option SMF	150 m	150 m	200 m	screened
no options	100 m	100 m	100 m	unscreened
Option AMF	150 m (200 m)	200 m (300 m)	400 m	unscreened
2 x Option AMF serial	200 m (400 m)	300 m (600 m)	600 m	unscreened
Option SMF	300 m	300 m	400 m	unscreened

Values in brackets () … with option AMF 215-3 instead of AMF xx-1

*) To avoid overvoltages at the motor it is absolutely necessary to adjust parameters B3.32 "Min. length of pulses" optimized.

To reduce the voltage load and bearing currents in the motor, the use of the option AMF makes sense from motor cable lengths of 50 m.

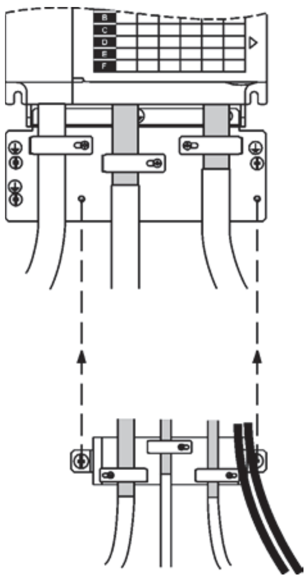
Wiring remarks for power and control cables

Take the control wiring separately from the mains cables, motor cables and any other power cables. The control wiring should be screened and should not exceed 20 m.

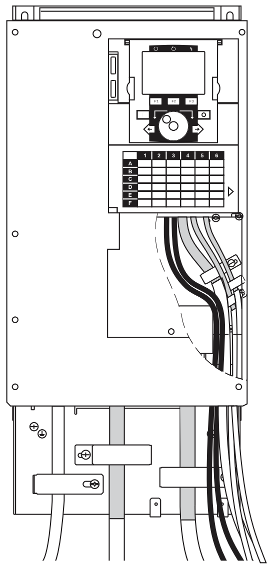
If crossings with power cables cannot be prevented, take them with 90° angle.

All MX eco & pro 4V0,75...4V75 and MX pro 6V2,2/3,0…6V75/90 inverters are delivered with an EMC plate including screws and suitable cable clamps. It is used to fix all cables to the inverter and presents an optimal connection between motor cable screen and radio interference filter. Moreover, all screens of the control wires can be connected to the EMC plate.

MX eco & pro 4V0,75…4V18



MX eco & pro 4V22...4V75
MX pro 6V2,2/3,0...6V75/90



The total height of the inverter alters when using the EMC plate corresponding to this additional element.

Device	Height of the device
MX eco & pro 4V0,75…4V4,0	+83 mm
MX eco & pro 4V5,5…4V18	+95 mm
MX eco & pro 4V22...4V75 MX pro 6V2,2/3,0...6V75/90	+120 mm

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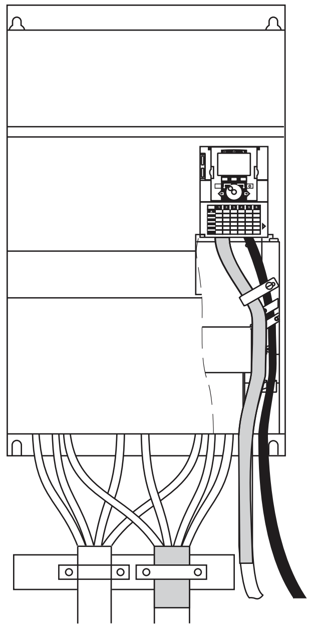
For the leading-in of the control wires the MX eco & pro from 90kW have a separate cable tray which is insulated from the power part. Therein, the cable clamps for connecting the screens can be found just underneath the control terminals.



The connection between the motor cable screen and the radio interference filter inside the inverter or the option MX RFI is established via a well-conductive mounting plate. Alternatively the terminal box option MX TER-BOX can be used.

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Control terminals

The frequency inverters MX pro are equipped with extensive control terminals as standard. The use and the function of all inputs and outputs can be parameterized.

For extension the option cards IO11 and IO12 are available. The same option card can be plugged in only one time per unit.

The inverters MX pro can be equipped at most with 2 option cards (terminal extension and/or field bus).

Listing of all control terminals

Control terminals		Standard equipment	Option IO11	Option IO12	Max. equipment
Reference voltages	+10 V	x	–	–	x
	-10 V	–	x	x	x
	+24 V	x	x	x	x
Ext. buffer voltage	24 V DC	x	–	–	x
Inputs					
Analog inputs (limits and usage can be parameterized)	0...±10 V (differential)	1x	–	–	1x
	0(4)...20 mA (differential)	–	–	1x	1x
	alternatively 0...+10 V or 0(4)...20 mA	1x	–	1x	2x
Digital inputs (function can be parameterized)	DI (24 V, positive / negative logic)	5x	4x	4x	13x
	alternatively DI or thermistor	1x	–	–	1x
Thermistor inputs	Thermistor	–	1x	1x	2x
	alternatively DI or thermistor	1x	–	–	1x
Safety input	"Safe Standstill"	1x	–	–	1x
Digital ref. value	0...30 kHz	–	–	1x	1x
Outputs					
Analog outputs (selection of actual values can be parameterized)	alternatively 0...+10 V or 0(4)...20 mA	1x	–	–	1x
	alternatively ±10 V or 0(4)...20 mA	–	–	2x	2x
Digital outputs (function can be parameterized)	Open Collector 24 V DC	–	2x	2x	4x
Relay outputs (function can be parameterized)	N.O./N.C.	1x	1x	1x	3x
	N.O.	1x	–	–	1x

The ground (0 V) can float up to 35 V compared to PE. The connection 0 V – ground which is necessary to limit the voltage can therefore e.g. also occur far away in the PLC (if necessary by the analog output related to 0 V).

The analog input AI1 with differential amplifier (as well as AI3 of the option card IO12) enables the reference assignment decoupled from the ground.

Keep the maximum cable length of 15 m for the wiring of the safety input PWR "Safe standstill".

The device fulfills all requirements for protective separation between power and electronic connections according to EN 61800-5-1.

Also all connected circuits must fulfil the requirements for protective separation to guarantee protective separation.

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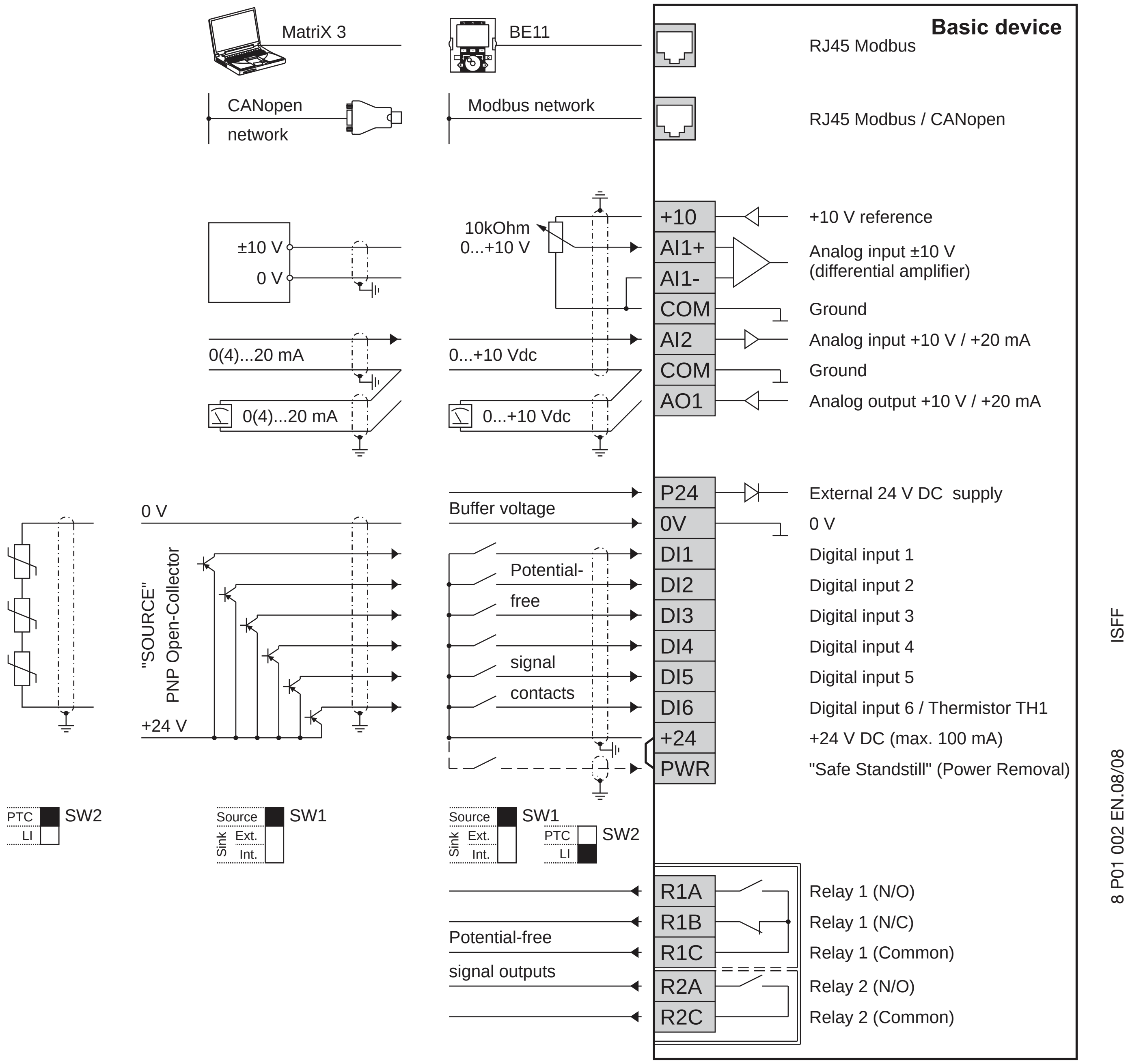
Standard control terminals of the frequency inverter



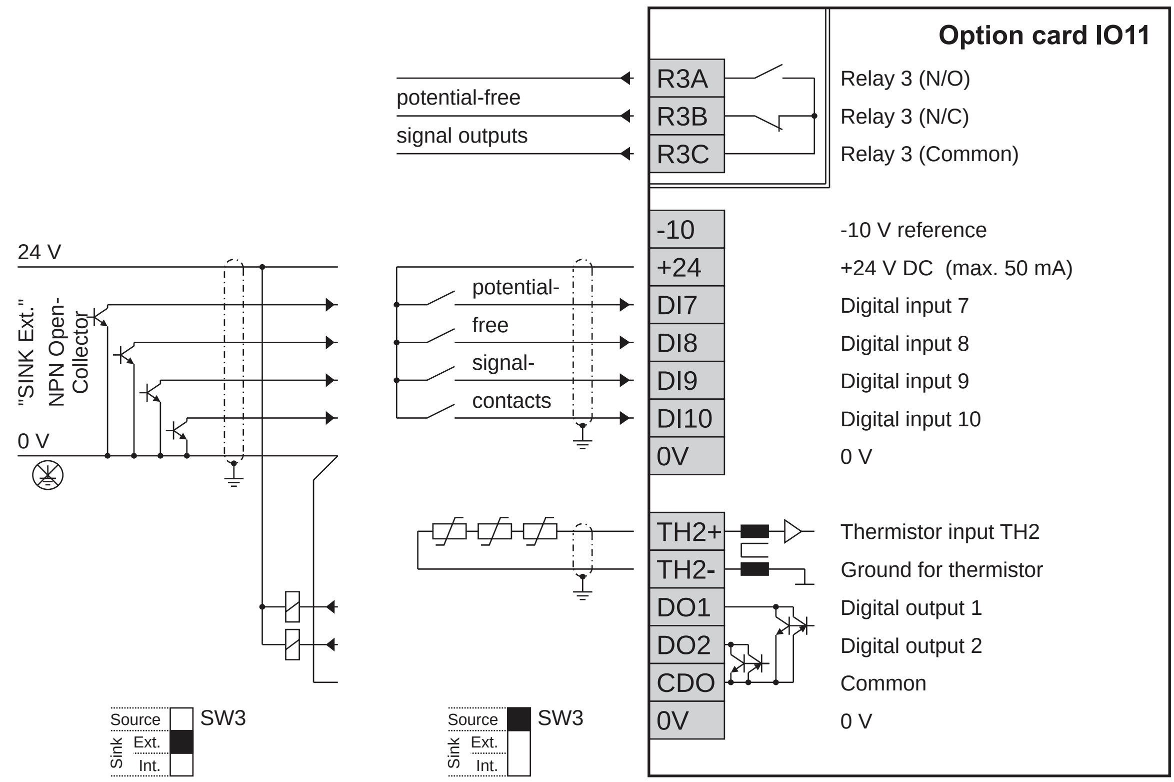
The use of the individual inputs and outputs as well as their limits can be adjusted by means of the device software. Only the alternative use of the digital input DI6 for motor thermistor monitoring and the selection of the switching method for all digital inputs has to be adjusted by means of the sliding switch.

The inverters MX pro are equipped with a built-in interface for control via Modbus. In addition to the external wiring (connection to the T-pieces in the bus line) only the adjustment of few parameters is necessary.

Alternatively, this interface can be also used for the CANopen bus. Therefore, an adapter is required for conversion of the RJ45 plug to SUB-D (CANopen standard CiA DRP 303-1). The bus wiring is taken by connection to the next device.

A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 209.

Control terminals of option card IO11



The terminal extension IO11 is a cost-effective solution with additional digital inputs and outputs, one relay output and one high-quality thermistor input. The card cannot be used twice.

The setting for positive or negative logic of the option card can be taken independent from the digital inputs of the basic device by means of the sliding switch SW3.

Parameters which belong to the inputs and outputs of the option cards are only available at the inverter when the card(s) are plugged. Thus, wrong parameterization of functions close to the terminals is extensively prevented.

A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 209.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

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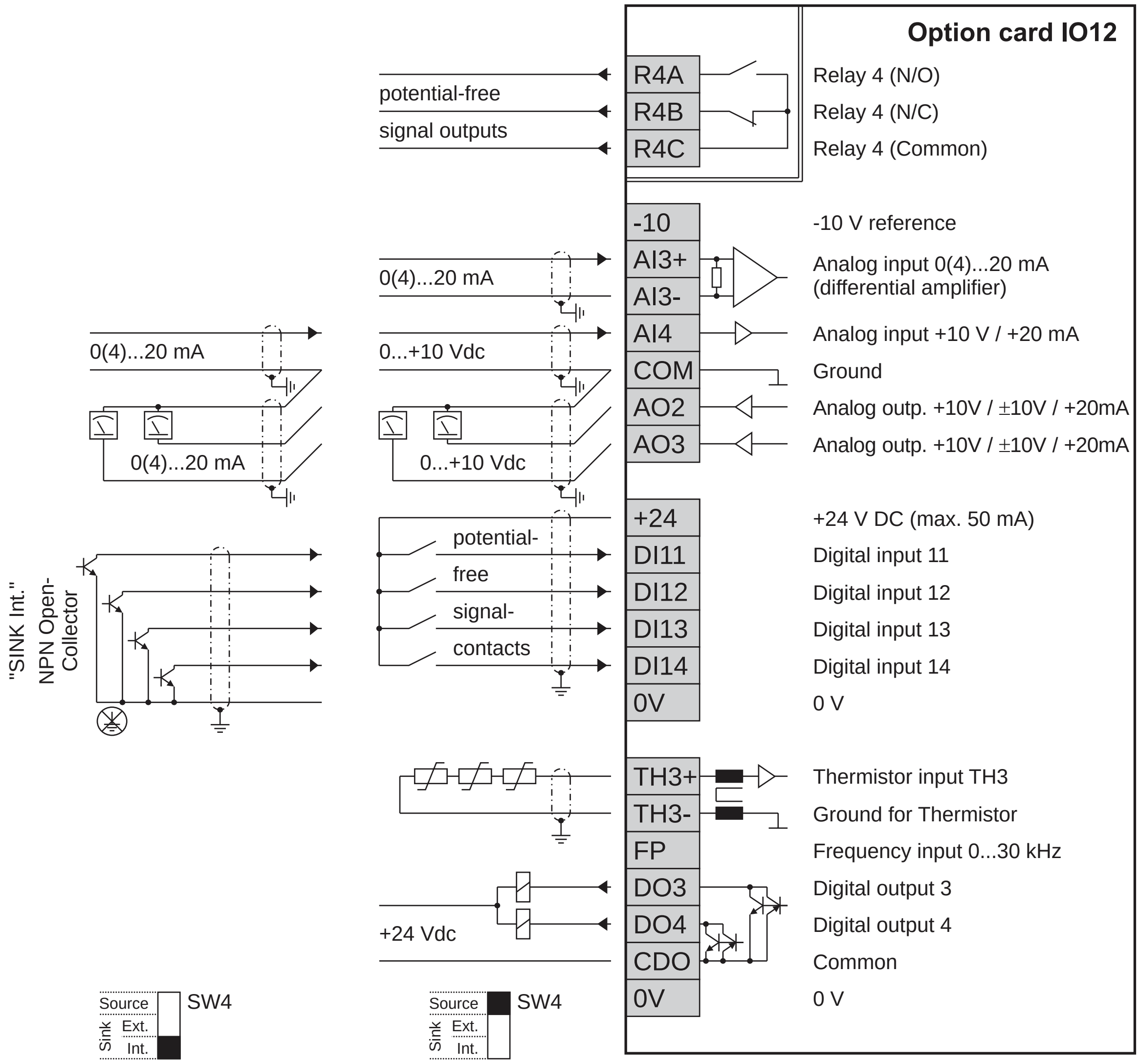
Control terminals of option card IO12



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The terminal extension IO12 can be plugged in addition or as an alternative to the option IO11. The card cannot be used twice.

The setting for positive or negative logic of the option card can be taken independent from the digital inputs of the basic device by means of the sliding switch SW4.

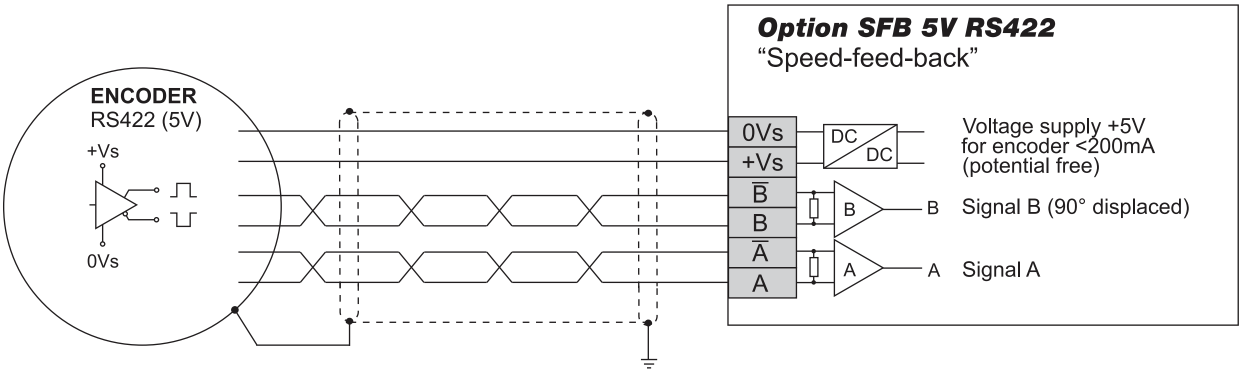
All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

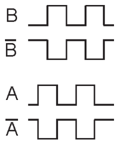
Control terminals of the option cards SFB

The option cards SFB are used to evaluate the pulses of an encoder which is attached to the motor.

Three option cards with different supply voltages for the encoder and with different types of signals are available.

SFB 5V RS422

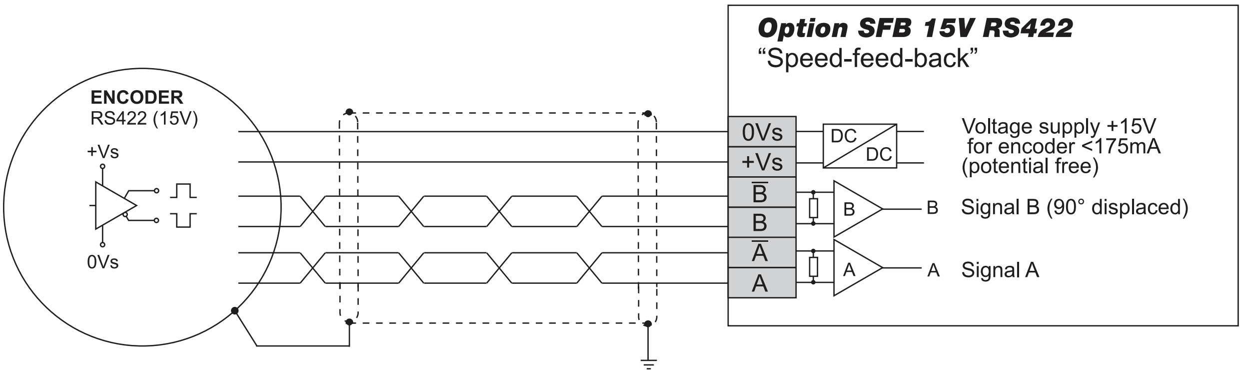


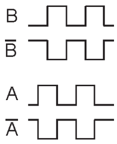


Recommended minimum cable cross section:

up to 25 m: 0.5 mm^2
up to 50 m: 0.75 mm^2
up to 100 m: 1.5 mm^2

SFB 15V RS422

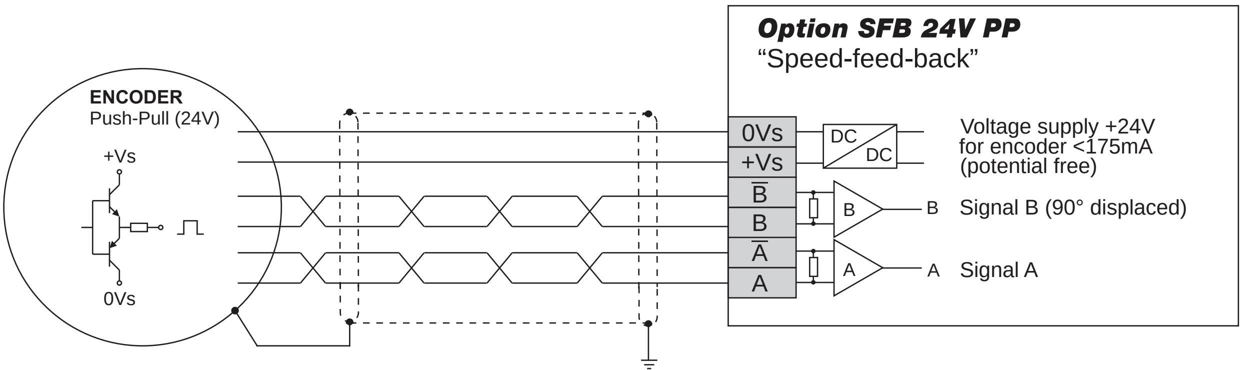


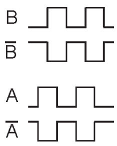


Recommended minimum cable cross section:

up to 25 m: 0.2 mm^2
up to 100 m: 0.5 mm^2
up to 600 m: 1.0 mm^2

SFB 24V PP





Recommended minimum cable cross section:

up to 600 m: 0.2 mm^2

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Purchase order

The order code of the MX pro frequency inverter consists of 9 points of reference (characters and figures). The meaning of each point is illustrated in the following example.

	1	2	3	4	5	6	7	8	9	*Ref. point*
ELN	M	P	4	C	1	6	A	A	A	**Example**

	Meaning
Point 9	Hardware configuration "A" ... without built-in braking unit (from MX pro 4V200/250) "B" ... with built-in braking unit (up to MX pro 4V160/200)
Point 8	Specification of language / Software "A" ... standard "S" ... applications with synchronous motor "T" ... applications with step-up transformer "D" ... liquid-cooled inverter
Point 7	Favored device variant "A" ... standard (up to MX pro 4V75) "D" ... device variant DCL-BOX (from MX pro 4V90/110) "L" ... liquid-cooled inverter
Points 4...6	Indication of device power (with high overload) U07...U75 for MX pro 4V0,75...4V7,5 D11...D90 for MX pro 4V11...4V90/110 C11...C50 for MX pro 4V110/132...500/630
Point 3	"4" for devices with 380...480 V mains voltage
Point 2	"P" for product line MX pro
Point 1	"M" for product family MX

Options for the inverter device must be ordered additionally. The respective order numbers are given in chapter "Options", as from page 197.

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Documentation

The documentation of the MX pro frequency inverters is divided into different documents for better clarity:

- **Product leaflets** give an overview of the characteristics and functions of the devices
- **Product catalogue** for planning and ordering of the drives
- Printed copies of the **operating instructions** are enclosed with each device
- **Description of the functions** with detailed description of all functions and parameters
- **Operating instructions** for divers fieldbuses like Modbus, CANopen and Profibus
- **Mounting instructions** for professional mounting and connection of the inverters
- **Installation instructions** for the individual options

In addition to the operating instructions a CD-ROM is attached to each inverter (order number 8 P01 021). It contains all above-mentioned instructions as well as the PC-program Matrix 3 for perfect commissioning and diagnosis of the inverters.

Further reading

If you need instructions in printed form, you can ask for them by means of the below-mentioned order number.

Designation	Order number	Brief description
Product leaflet of MX eco & MX pro frequency inverters	8 P01 000 DE 8 P01 000 EN	Overview of the characteristics of the device, external design of the inverter and its most important functions
Product catalogue of MX eco & MX pro frequency inverters	8 P01 002 DE 8 P01 002 EN	General description of the device, technical data, valid standards, information about planning and ordering of the frequency inverters and its options
Product catalogue of MX multi-eco & MX multi-pro frequency inverters in cubicle design	8 P01 004 DE 8 P01 004 EN	General description of the device, technical data, valid standards, information about planning and ordering of the frequency inverters and its options
Operating instructions for MX eco & MX pro	8 P01 022	Unpacking, operating, mounting and trouble shooting as well as important remarks for handling and possible dangers
Description of functions for MX pro	8 P01 323 DE 8 P01 323 EN	Operating and parameterizing, complete parameter list, alarm and trip messages, description of the PC-program Matrix 3
Mounting instructions for MX pro 4V	8 P01 325 DE 8 P01 325 EN	Technical data, valid standards, mounting, connection, ambient conditions
Mounting instructions for MX pro 6V	8 P01 329 DE 8 P01 329 EN	Technical data, valid standards, mounting, connection, ambient conditions
Mounting instructions for MX pro 4L & 6L	8 P01 344 DE 8 P01 344 EN	Technical data, valid standards, mounting, connection, ambient conditions
Operating instructions Modbus for MX pro	8 P01 333 DE 8 P01 333 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions CANopen for MX pro	8 P01 331 DE 8 P01 331 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions Profibus DP for MX pro	8 P01 327 DE 8 P01 327 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Projecting guide medium voltage motors for MX pro	8 P01 037 DE 8 P01 037 EN	Dimensioning and parameterization of drives for medium voltage motors

Further information can also be found on our homepage www.schneider-electric-power-drives.com.

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Available options for MX pro 4V inverters

To enlarge the field of applications for the frequency inverters MX pro, various options are available concerning control and operation, extensions referring to the electric arrangement and to increase the protection degree.

General options

Designation	Order number	Brief description	Reference
Operating options			
MX BE11	ELN 8 P01 100 (8 P01 100/B)	Matrix operating panel affords optimal operating comfort by means of the matrix philosophy	Page 198
MX DMK11	ELN 8 P01 120	Door mounting kit for installing the operating panel BE11 in a cubicle door, up to 10 m away from the inverter	Page 200
MX DMK11-IP65	VW3 A1 103	Transparent IP65 cover for the door mounting kit of the operating panel BE11	
MX CABLE3-BE	VW3 A1 104R30	Connecting cable operating panel – inverter with 3 m length	
MX CABLE10-BE	VW3 A1 104 R100	Connecting cable operating panel – inverter with 10 m length	
Manual-CD MX eco & pro	8 P01 021	This CD-ROM provides the whole documentation of the inverter as well as the PC program Matrix 3	Page 31
MX CABLE3-PC	ELN 8 P01 124	Connecting cable inverter – PC with 3 m length, incl. RS232/485 interface converter on the computer side	
MX ADAP BLUE	VW3 A8 114	Bluetooth adapter	
MX RS232/485	Phönix Contact PSM-ME-RS232/RS485-P	RS232/485 interface converter with supply and active bus connection	
MX MATRIX REMOTE LINK	8 P01 128	Remote maintenance option for analog modem connection or Ethernet network.	
MX ADAP RJ45	VW3 A1 105	RJ45 F/F adapter is required for the connection of the operating panel BE11 to the connecting cable	
Control options			
MX IO11	ELN 8 P01 101	Terminal extension for additional digital inputs and outputs	Page 209
MX IO12	ELN 8 P01 102	Terminal extension for additional analog and digital inputs and outputs	
MX SFB 5V RS422	VW3 A3 401	Extension card for encoder feedback. Supply voltage 5 V / RS422	Page 213
MX SFB 15V RS422	VW3 A3 402	Extension card for encoder feedback. Supply voltage 15 V / RS422	
MX SFB 24V PP	VW3 A3 407	Extension card for encoder feedback. Supply voltage 24 V / push-pull	
MX MODBUS T-ADAP 03	VW3 A8 306 TF03	Modbus T-adapter with 0.3 m connecting cable	Page 205
MX MODBUS T-ADAP 1	VW3 A8 306 TF10	Modbus T-adapter with 1 m connecting cable	
MX MODBUS RC	VW3 A8 306 RC	Bus termination RC	
MX MODBUS SPLITTER	LU9 GC3	Divides the Modbus signal into eight further channels	
MX MODBUS PLUG	Phönix Contact VS-08-RJ45-5-Q/IP20	RJ45 connector IP20 with quick-connecting technology	
MX ADAP CAN	VW3 CAN A71	RJ45/Sub-D adapter for the connection of the inverter to a CANopen fieldbus network	Page 207
MX CANOPEN PLUG	TSX CAN KCDF 180 T	Connecting plug for CANopen network	
MX CAN TAP2	VW3 CAN TAP 2	Passive CAN adapter with shiftable terminating resistor	
MX PBO11	ELN 8 P01 103	Option card for control of the inverter via Profibus DP	Page 208
MX PROFIBUS PLUG	Phönix Contact SUBCON-PLUS-PROFIB/AX/SC	Connecting plug for Profibus network	

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Options depending on the power

Designation	Order number	Brief description	Reference
Options depending on the power			
MX RFI	See following allocation table	Additional radio interference filter to reduce the high-frequency interferences for use in residential environment	Page 215
MX DCL		DC choke to reduce the mains current harmonics to THD I ≤ 45 %	Page 218
MX NDU		Three-phase choke to reduce the mains current harmonics to THD I ≤ 45 % (alternatively to DCL)	Page 223
MX BU		External braking unit for MX pro 4V200/250 to 4V500/630	Page 228
MX BR		Braking resistor for short deceleration time or short-time dynamic loads	Page 232
MX AMF		Output motor filter enables the use of the inverter with long motor cables and limits the voltage peaks in the motor	Page 236
MX SMF		Sinus motor filter enables the use of the inverter with very long motor cables and prevents additional noises in the motor, necessary in case of step-up transformers	Page 240
MX TER-BOX		Terminal box which is attached at the bottom of the inverter for mechanical support and connection of the motor cable screen	Page 246
MX FLANGE		Flange mounting kit to install the inverter in flange mounting technology (heat sink outside the cubicle)	Page 249
MX CMK		Cubicle mounting kit for an optimal mounting of the frequency inverter in a Rittal TS8 cubicle	Page 252

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Allocation table for options depending on the power

	Option RFI	Option DCL	Option NDU
MX pro 4V0,75	VW3 A4 401 (RFI 480/12-TN)	VW3 A4 501 (DCL 2)	VW3 A4 551
MX pro 4V1,5	VW3 A4 401 (RFI 480/12-TN)	VW3 A4 502 (DCL 4)	VW3 A4 551
MX pro 4V2,2	VW3 A4 401 (RFI 480/12-TN)	VW3 A4 503 (DCL 8)	VW3 A4 552
MX pro 4V3,0	VW3 A4 402 (RFI 480/26-TN)	VW3 A4 503 (DCL 8)	VW3 A4 552
MX pro 4V4,0	VW3 A4 402 (RFI 480/26-TN)	VW3 A4 504 (DCL 11)	VW3 A4 552
MX pro 4V5,5	VW3 A4 403 (RFI 480/35-TN)	VW3 A4 505 (DCL 14)	VW3 A4 553
MX pro 4V7,5	VW3 A4 403 (RFI 480/35-TN)	VW3 A4 506 (DCL 19)	VW3 A4 553
MX pro 4V11	VW3 A4 404 (RFI 480/46-TN)	VW3 A4 507 (DCL 27)	VW3 A4 554
MX pro 4V15	VW3 A4 405 (RFI 480/72-TN)	VW3 A4 508 (DCL 44)	VW3 A4 554
MX pro 4V18	VW3 A4 405 (RFI 480/72-TN)	VW3 A4 508 (DCL 44)	VW3 A4 555
MX pro 4V22	VW3 A4 406 (RFI 480/90-TN)	VW3 A4 510 (DCL 85)	VW3 A4 555
MX pro 4V30	VW3 A4 407 (RFI 480/92-TN)	VW3 A4 510 (DCL 85)	VW3 A4 556
MX pro 4V37	VW3 A4 407 (RFI 480/92-TN)	VW3 A4 510 (DCL 85)	VW3 A4 556
MX pro 4V45	VW3 A4 408 (RFI 480/180-TN)	VW3 A4 511 (DCL 171)	VW3 A4 556
MX pro 4V55	VW3 A4 408 (RFI 480/180-TN)	VW3 A4 511 (DCL 171)	VW3 A4 570 (NDU 160)
MX pro 4V75	VW3 A4 408 (RFI 480/180-TN)	VW3 A4 511 (DCL 171)	VW3 A4 570 (NDU 160)
MX pro 4V90/110	VW3 A4 410 (RFI 480/300-TN)	ELNMP4D90DAB (MX pro incl. MX DCL-BOX 240)	VW3 A4 559 (NDU 235)
MX pro 4V110/132	VW3 A4 410 (RFI 480/300-TN)	ELNMP4C11DAB (MX pro incl. MX DCL-BOX 290)	VW3 A4 560 (NDU 280)
MX pro 4V132/160	VW3 A4 410 (RFI 480/300-TN)	ELNMP4C13DAB (MX pro incl. MX DCL-BOX 350)	VW3 A4 568 (NDU 315)
MX pro 4V160/200	VW3 A4 411 (RFI 480/600-TN)	ELNMP4C16DAB (MX pro incl. MX DCL-BOX 490)	VW3 A4 561 (NDU 365)
MX pro 4V200/250	VW3 A4 411 (RFI 480/600-TN)	ELNMP4C20DAA (MX pro incl. MX DCL-BOX 570)	VW3 A4 569 (NDU 475)
MX pro 4V250/315	VW3 A4 411 (RFI 480/600-TN)	ELNMP4C25DAA (MX pro incl. MX DCL-BOX 700)	VW3 A4 564 (NDU 650)
MX pro 4V315/400	VW3 A4 412 (RFI 480/800-TN)	ELNMP4C31DAA (MX pro incl. MX DCL-BOX 860)	VW3 A4 565 (NDU 760)
MX pro 4V400/500	2 x VW3 A4 411 (2 x RFI 480/600-TN)	ELNMP4C40DAA (MX pro incl. MX DCL-BOX 1160)	2 x VW3 A4 563 (2 x NDU 540)
MX pro 4V500/630	2 x VW3 A4 411 (2 x RFI 480/600-TN)	ELNMP4C50DAA (MX pro incl. MX DCL-BOX 1400)	2 x VW3 A4 573 (2 x NDU 620)

	Option BU	Option BR Hoist	Option BR Long-travel
MX pro 4V0,75	Integrated braking unit	1 x VW3 A7 801	1 x VW3 A7 801
MX pro 4V1,5	Integrated braking unit	1 x VW3 A7 801	1 x VW3 A7 801
MX pro 4V2,2	Integrated braking unit	1 x VW3 A7 801	1 x VW3 A7 801
MX pro 4V3,0	Integrated braking unit	1 x VW3 A7 801	1 x VW3 A7 801
MX pro 4V4,0	Integrated braking unit	1 x VW3 A7 802	1 x VW3 A7 802
MX pro 4V5,5	Integrated braking unit	1 x VW3 A7 802	1 x VW3 A7 802
MX pro 4V7,5	Integrated braking unit	1 x VW3 A7 803	1 x VW3 A7 803
MX pro 4V11	Integrated braking unit	1 x VW3 A7 803	1 x VW3 A7 803
MX pro 4V15	Integrated braking unit	1 x VW3 A7 804	1 x VW3 A7 803
MX pro 4V18	Integrated braking unit	1 x VW3 A7 804	1 x VW3 A7 804
MX pro 4V22	Integrated braking unit	1 x VW3 A7 804	1 x VW3 A7 804
MX pro 4V30	Integrated braking unit	1 x VW3 A7 804	1 x VW3 A7 804
MX pro 4V37	Integrated braking unit	1 x VW3 A7 805	1 x VW3 A7 805
MX pro 4V45	Integrated braking unit	1 x VW3 A7 805	1 x VW3 A7 805
MX pro 4V55	Integrated braking unit	1 x VW3 A7 806	1 x VW3 A7 806
MX pro 4V75	Integrated braking unit	1 x VW3 A7 806	1 x VW3 A7 806
MX pro 4V90/110	Integrated braking unit	1 x VW3 A7 811	1 x VW3 A7 710
MX pro 4V110/132	Integrated braking unit	1 x VW3 A7 811	1 x VW3 A7 710
MX pro 4V132/160	Integrated braking unit	1 x VW3 A7 812	1 x VW3 A7 710
MX pro 4V160/200	Integrated braking unit	1 x VW3 A7 812	1 x VW3 A7 711
MX pro 4V200/250	VW3 A7 101 (BU 4V420)	2 x VW3 A7 811 [1)]	1 x VW3 A7 712
MX pro 4V250/315	VW3 A7 101 (BU 4V420)	2 x VW3 A7 811 [1]	1 x VW3 A7 715
MX pro 4V315/400	VW3 A7 102 (BU 4V750)	2 x VW3 A7 812 [1]	1 x VW3 A7 716
MX pro 4V400/500	VW3 A7 102 (BU 4V750)	3 x VW3 A7 811 [1]	3 x VW3 A7 711 [1]
MX pro 4V500/630	VW3 A7 102 (BU 4V750)	3 x VW3 A7 812 [1]	3 x VW3 A7 711 [1]

1) Resistors in parallel

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	Option MX AMF	Option MX SMF	Option MX TER-BOX	Option MX FLANGE
MX pro 4V0,75	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 101 (TER-BOX 130)	VW3 A9 501 (FLANGE 130 x 230)
MX pro 4V1,5	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 101 (TER-BOX 130)	VW3 A9 501 (FLANGE 130 x 230)
MX pro 4V2,2	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 101 (TER-BOX 130)	VW3 A9 501 (FLANGE 130 x 230)
MX pro 4V3,0	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 102 (TER-BOX 155)	VW3 A9 502 (FLANGE 155 x 260)
MX pro 4V4,0	VW3 A5 101 (AMF 12-1)	VW3 A5 201 (SMF 480/11)	VW3 A9 102 (TER-BOX 155)	VW3 A9 502 (FLANGE 155 x 260)
MX pro 4V5,5	VW3 A5 102 (AMF 48-1)	VW3 A5 202 (SMF 480/16)	VW3 A9 103 (TER-BOX 175)	VW3 A9 503 (FLANGE 175 x 295)
MX pro 4V7,5	VW3 A5 102 (AMF 48-1)	VW3 A5 203 (SMF 480/33)	VW3 A9 103 (TER-BOX 175)	VW3 A9 503 (FLANGE 175 x 295)
MX pro 4V11	VW3 A5 102 (AMF 48-1)	VW3 A5 203 (SMF 480/33)	VW3 A9 104 (TER-BOX 210)	VW3 A9 504 (FLANGE 210 x 295)
MX pro 4V15	VW3 A5 102 (AMF 48-1)	VW3 A5 203 (SMF 480/33)	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 4V18	VW3 A5 102 (AMF 48-1)	VW3 A5 204 (SMF 480/66)	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 4V22	VW3 A5 102 (AMF 48-1)	VW3 A5 204 (SMF 480/66)	VW3 A9 106 (TER-BOX 240)	VW3 A9 506 (FLANGE 240 x 420)
MX pro 4V30	VW3 A5 103 (AMF 90-1)	VW3 A5 204 (SMF 480/66)	VW3 A9 107 (TER-BOX 241)	VW3 A9 507 (FLANGE 240 x 550)
MX pro 4V37	VW3 A5 103 (AMF 90-1)	VW3 A5 205 (SMF 480/95)	VW3 A9 107 (TER-BOX 241)	VW3 A9 507 (FLANGE 240 x 550)
MX pro 4V45	VW3 A5 103 (AMF 90-1)	VW3 A5 205 (SMF 480/95)	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 4V55	VW3 A5 104 (AMF 215-3)	VW3 A5 206 (SMF 480/180)	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 4V75	VW3 A5 104 (AMF 215-3)	VW3 A5 206 (SMF 480/180)	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 4V90/110	VW3 A5 104 (AMF 215-3)	VW3 A5 207 (SMF 480/200)	VW3 A9 109 (TER-BOX 310)	VW3 A9 510 (FLANGE 310 x 680)
MX pro 4V110/132	VW3 A5 105 (AMF 320-3)	VW3 A5 208 (SMF 480/300)	VW3 A9 110 (TER-BOX 350)	VW3 A9 511 (FLANGE 350 x 780)
MX pro 4V132/160	VW3 A5 105 (AMF 320-3)	VW3 A5 209 (SMF 480/400)	VW3 A9 111 (TER-BOX 330)	VW3 A9 509 (FLANGE 330 x 950)
MX pro 4V160/200	VW3 A5 106 (AMF 480-3)	VW3 A5 209 (SMF 480/400)	VW3 A9 112 (TER-BOX 430)	VW3 A9 511 (FLANGE 430 x 950)
MX pro 4V200/250	VW3 A5 106 (AMF 480-3)	VW3 A5 210 (SMF 480/600)	VW3 A9 113 (TER-BOX 585)	VW3 A9 513 *) (FLANGE 585 x 950)
MX pro 4V250/315	VW3 A5 107 (AMF 760-3)	VW3 A5 210 (SMF 480/600)	VW3 A9 113 (TER-BOX 585)	VW3 A9 513 *) (FLANGE 585 x 950)
MX pro 4V315/400	VW3 A5 107 (AMF 760-3)	VW3 A5 211 (SMF 480/1200)	VW3 A9 115 (TER-BOX 880)	-
MX pro 4V400/500	VW3 A5 108 (AMF 1190-3)	VW3 A5 211 (SMF 480/1200)	VW3 A9 115 (TER-BOX 880)	-
MX pro 4V500/630	VW3 A5 108 (AMF 1190-3)	VW3 A5 211 (SMF 480/1200)	VW3 A9 116 (TER-BOX 1100)	-

*) When using a VW3 A7 101 (BU 4V420) the option VW3 A9 515 (MX FLANGE 660 x 950) is necessary!

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	Option CMK-IP23	Option CMK-IP54FL	Option CMK-IP54GL
MX pro 4V0,75	–	–	–
MX pro 4V1,5	–	–	–
MX pro 4V2,2	–	–	–
MX pro 4V3,0	–	–	–
MX pro 4V4,0	–	–	–
MX pro 4V5,5	–	–	–
MX pro 4V7,5	–	–	–
MX pro 4V11	–	–	–
MX pro 4V15	–	–	–
MX pro 4V18	–	–	–
MX pro 4V22	–	–	–
MX pro 4V30	–	–	–
MX pro 4V37	–	–	–
MX pro 4V45	–	–	–
MX pro 4V55	–	–	–
MX pro 4V75	–	–	–
MX pro 4V90/110	CMK 9-23 8 P02 003	CMK 9-54FL 8 P02 023	CMK 9-54GL 8 P02 043
MX pro 4V110/132	CMK 10-23 8 P02 004	CMK 10-54FL 8 P02 024	CMK 10-54GL 8 P02 044
MX pro 4V132/160	CMK 11-23 8 P02 005	CMK 11-54FL 8 P02 025	CMK 11-54GL 8 P02 045
MX pro 4V160/200	CMK 12-23 8 P02 006	CMK 12-54FL 8 P02 026	CMK 12-54GL 8 P02 046
MX pro 4V200/250	CMK 13-23 8 P02 007	CMK 13-54FL 8 P02 027	CMK 13-54GL 8 P02 047
MX pro 4V250/315	CMK 13-23 8 P02 007	CMK 13-54FL 8 P02 027	CMK 13-54GL 8 P02 047
MX pro 4V315/400	CMK 14-23 8 P02 008	CMK 14-54FL 8 P02 028	CMK 14-54GL 8 P02 048
MX pro 4V400/500	CMK 14-23 8 P02 008	CMK 14-54FL 8 P02 028	CMK 14-54GL 8 P02 048
MX pro 4V500/630	CMK 15-23 8 P02 009	CMK 15-54FL 8 P02 029	CMK 15-54GL 8 P02 049

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MX pro 6V

For all drives with high-performance in industry for mains supply of 500 to 690 V

The MX pro 6V adds even more numerous functions to the well-known and extremely well-proven features of the MX range. It presents itself to the user as being even more robust with improved operation and having a clearly wider range of user possibilities.

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Extensive standard fitting and multi-functional use

Feature	Advantages	Reference
RFI filter built-in	No additional space required and reduced mounting costs	Page 165
Digital input PWR "Safe Standstill"	Prevents an unwanted starting of the motor and guarantees the safety of the machine and plant personnel.	Page 308
Extensive option possibilities	Standard solutions for the adaptation of the MX pro to many applications, numerous add-on options and options capable for integration reduce the required space as well as the mounting costs.	from page 197
Wall-mounting in IP21 / IP31	Compact wall-mounting device with terminal box as a cheap alternative to the cubicle installation	Page 246
Flange mounting	The power part of the inverter, designed with IP54 protection degree, is located outside the cubicle by which the additional temperature rise is minimized.	Page 249
Optimized for cubicle installation	MX pro are suitable for each type of customer-specific cubicles. Standard components are available for the realization of thermal optimized cubicles with IP54 protection degree.	Page 158

User interfaces

Feature	Advantages	Reference
Parameter matrix	No endlessly long list or a multiple branched tree structure but a clear arrangement of parameters in Matrix form with logical organization according to their function.	Page 29
Matrix user interface	Simple and quick commissioning and parameterization by means of navigation with the Matrix wheel inside the parameter matrix on the graphical, removable Matrix operating panel	Page 27
PC software	Free PC program Matrix 3 for commissioning, programming, documentation and analysis	Page 31
Connection and communication possibilities	Inputs and outputs for practically all demands. Integrated Modbus and CANopen interface as standard. Option cards for all usual fieldbus systems.	Page 208
Extensive software functions	Flexible adapting to the application demands. No external components like relays, PLC and monitoring instruments and reduced mounting costs	Page 255

Industry-fulfilled design

Feature	Advantages	Reference
Wide power and voltage range	A product range for all applications. In this way standardized interfaces, reduced training costs and simple spares inventories are guaranteed.	Page 38
Robust design of power part and control part	High reliability also with rough ambient conditions. The power part is designed in IP54, the cooling air of control part and power part are completely separated, the circuit boards are varnished.	Page 147
Intelligent limitation and protection concepts	High availability and less process interruptions. Inverter, motor and application are optimally protected.	Page 326
Fan control	The fans of the inverter are automatically switched-off when cooling is not necessary. In this way the life of the fans is increased as well as the energy consumption and noise load being reduced.	Page 282
Indirect coupled control terminals	Safe and reliable operation according to EN 50178 PELV	Page 185
Internationally approved	A product range which complies with the most important approvals such as CE, UL and CSA and which can be used internationally.	Page 147

Useful functions

Crane control, speed control alternatively with feedback, torque control and further functions belong to the performance of the MX pro inverter range. They are described clearly in chapter "Functions", from page 255.

Specification

Technical data

The frequency inverters are equipped with a dual rating function (exception: MX pro 4V0,75...4V75).

So the frequency inverter can be used either:

– with a high dynamic overload capability and nominal continuous power (setting "0 .. Power P1") or
– with high continuous load at a simultaneously reduced dynamic overload capacity (setting "1 .. Power P2").

The difference between the maximum permissible continuous output power of both settings is one step of IEC motor list.

Example MX pro 4V 315 / 400

- 400: Setting B3.16 = "1 .. Power P2"
  Nominal power: 400 kW
  Overload: 120 % for 60 s in 10 min
  135 % for 2 s in 30 s
- 315: Setting B3.16 = "0 .. Power P1"
  Nominal power: 315 kW
  Overload: 150 % for 60 s in 10 min
  165 % for 2 s in 30 s
- 4V: 4V, 4C: 380...480 V mains voltage
  6V, 6C: 500...690 V mains voltage
- pro: Product line MX pro
- MX: Product family MX

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Input	
Voltage	500 V -15% up to 690 V +10% for TT, TN or IT mains *) (not for corner grounded mains supply)
Frequency	50 / 60 Hz ±5 % *)
Auxiliary voltage for fan supply (MX pro 6V90/110 … 6V630/800 only)	3AC 400…440V ±10% 50 Hz ±5% 3AC 400…480V ±10% 60 Hz ±5%
Overvoltage class	Class III according to EN 61800-5-1
Power factor	Fundamental (displacement factor): > 0.98 Total (λ) at full load: 0.93...0.95 (with AC or DC choke) Total (λ) at no load: approx. 0.7 (with AC or DC choke)
Leakage current	Setting TN: < 450 mA max.; < 30 mA continuously Setting IT: < 450 mA max.; < 6 mA continuously
Output	
Control method	Sensorless Vector Control, Vector Control with speed feedback, V/f-characteristic, Synchronous motor without encoder, Synchronous motor with encoder (MX pro 6V...-SY devices with own order code for applications with high starting torque)
Voltage	3 AC 0...100% mains voltage, dynamic voltage stabilization
Overload	Power 1: 50 % for 60 s per 10 minutes, 65 % for 2 seconds Power 2: 20 % for 60 s per 10 minutes, 35 % for 2 seconds
Pulse frequency	MX pro 6V2,2/3,0...6V22/30: 2.5 kHz, adjustable from 2...6 kHz MX pro 6V30/37...6V630/800: 2.5 kHz, adjustable from 2...4.9 kHz
Frequency / Base frequency	0...300 Hz / 25...300 Hz, adjustable
Short circuit protection	All-pole protected against short circuit and earth fault by means of overcurrent switch-off
Design	Built-in unit for vertical mounting
Cooling	forced
Frequency resolution, digital	0.01 Hz / 50 Hz, frequency stability: ±0.01 % / 50 Hz
Speed accuracy	V/f mode: Slip frequency VC without feedback: 0.3 x slip frequency VC with feedback: 0.01 % of maximum frequency (parameter C2.02)
Torque accuracy	5% at VC (3 … 300 Hz)
Torque response time	Depending on the setting of the speed controller up to 2 ms

*) Technical data and remarks for mains voltages are given in chapter "Mains conditions", page 38.

Mechanical strength		
Mechanical vibration	According to IEC/EN 60068-2-6	
	MX pro 6V2,2/3,0...6V75/90:	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz (3M3 according to IEC/EN 60721-3-3)
	MX pro 6V90/110...6V630/800:	1.5 mm at 3...10 Hz, 0.6 g at 10...200 Hz (3M3 according to IEC/EN 60721-3-3)
Shock	According to IEC/EN 60068-2-27	
	MX pro 6V2,2/3,0...6V75/90:	15 g for 11 ms (3M3 according to IEC/EN 60721-3-3)
	MX pro 6V90/110...6V160/200:	7 g for 11 ms (3M3 according to IEC/EN 60721-3-3)
	MX pro 6V200/250...6V630/800:	4 g for 11 ms (3M2 according to IEC/EN 60721-3-3)

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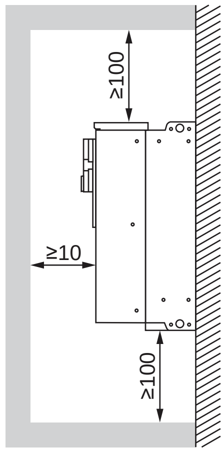
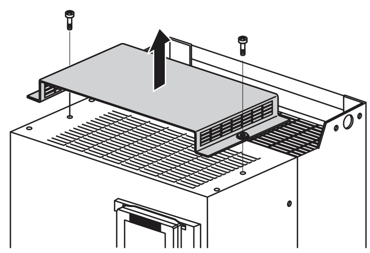
Ambient conditions	
Operating temperature	in case of high overload (Power 1): -10...+50°C in case of increased output power (Power 2): -10...+45°C (3K3 according to IEC/EN 60721-3-3) up to +60°C with derating
Storage / Transport temperature	-25...+70°C
Protection degree	MX pro 6V2,2/3,0...6V75/90: bottom, sideways, front IP21 top IP41 (IP20 without protective cover) MX pro 6V90/110...6V630/800: sideways, front IP31 top IP20 (IP31 with TRAFO-box) bottom IP00 (IP31 with terminal box)
Environmental class / Humidity	Class 3K3 in accordance with IEC/EN 60721-3-3 / no condensation, max. 95 % relative humidity
Altitude	Up to 1000 m, beyond power decrease of 1 % per 100 m up to 2400 m
Allowed pollution	Pollution degree 2 according to EN 61800-5-1 MX pro 6V2,2/3,0...6V75/90: 3C1 and 3S2 according to EN 60721-3-3 MX pro 6V90/110...6V630/800: 3C2 and 3S2 according to EN 60721-3-3
Protection class	Class 1 according to EN 61800-5-1
Safety functions and ATEX – applications	
Safety of the drive	The safety function "safe standstill" (Power Removal) allows a controlled shut-down as well as switch-off of the power supply when standstill. It also prevents any unintended start of the motor according to EN 954-1 / ISO 13849-1, category 3 and IEC/EN 61800-5-2.
Protection of the machine	The safety function "safe standstill" (Power Removal) allows a controlled shut-down as well as switch-off of the power supply when standstill. It also prevents any unintended start of the motor according to IEC/EN 61508, SIL2 capability and IEC/EN 61800-5-2.
Safety of the ATEX motor	The thermal sensor of the ATEX motor is integrated to the safety function "safe standstill" (PWR input) of the inverter by a safety switching device.
Response time	≤ 100 ms in STO (Safe Torque Off)
Standards	
Basic standard	The devices are designed, built and tested on the basis of EN 61800-5-1.
EMC immunity	According to EN 61800-3, 1st and 2nd environment (IEC 1000-4-2; IEC 1000-4-3; IEC 1000-4-4; IEC 1000-4-5; IEC 1000-4-6)
EMC emission	In accordance with product standard EN 61800-3, 2nd environment, category C3
Insulation	Galvanic insulation from the control electronics in accordance with EN 61800-5-1 PELV (Protective Extra Low Voltage)
Standards	CE, UL, CSA, GOST, ATEX

Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

MX pro	6V2,2/3,0	6V3,0/4,0	6V4,0/5,5
Nominal data			
Motor rating (P1/P2)			
P_N [kW] V_N = 500 V	1.5/2.2	2.2/3.0	3.0/4.0
P_N [hp] V_N = 600 V	2/3	3/(4)	(4)/5
P_N [kW] V_N = 690 V	2.2/3.0	3.0/4.0	4.0/5.5
Continuous output power (P1/P2)			
$S_{N\,500}$ [kVA] V_N = 500 V	2.8/3.9	3.9/5	5/6.5
$S_{N\,600}$ [kVA] V_N = 600 V	4.2/4.7	4.7/5.7	5.7/7.8
$S_{N\,690}$ [kVA] V_N = 690 V	4.8/5.4	5.4/6.6	6.6/9
Continuous output current (P1/P2)			
$I_{N\,500}$ [A] V_N = 500 V	3.2/4.5	4.5/5.8	5.8/7.5
$I_{N\,600}$ [A] V_N = 600 V	4.0/4.5	4.5/5.5	5.5/7.5
$I_{N\,690}$ [A] V_N = 690 V	4.0/4.5	4.5/5.5	5.5/7.5
Maximum current (P1/P2) for 60 s per 10 minutes			
I_{MAX} [A] V_N = 500 V	4.8/5.4	6.8/7	8.7/9
I_{MAX} [A] V_N = 600 V	6/5.4	6.8/6.6	8.3/9
I_{MAX} [A] V_N = 690 V	6/5.4	6.8/6.6	8.3/9
Input current (without external choke)			
$I_{IN\,500}$ [A] V_N = 500 V	3.8/5.2	5.2/6.8	6.8/8.6
$I_{IN\,600}$ [A] V_N = 600 V	3.2/4.4	4.4/5.7	5.7/7.2
$I_{IN\,690}$ [A] V_N = 690 V	4.0/5.2	5.2/6.6	6.6/8.6
Braking unit			
P_{CONT} [kW]	2.2	3.0	4.0
P_{MAX} for 60 s [kW]	3.3	4.5	6
R_{MIN} / R_{MAX} [Ω]	80/350	80/260	80/200
Characteristics			
Efficiency [%]	> 97	> 97	> 97
Losses [W] at I_N	115/120	120/140	140/160
Weight approx. [kg]	20	20	20
Ambient conditions			
Volume of cooling air [m³/h]	200	200	200
Sound pressure level [dB(A)]	60	60	60
Mains short circuit curr. [kA] *)	22	22	22



For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.

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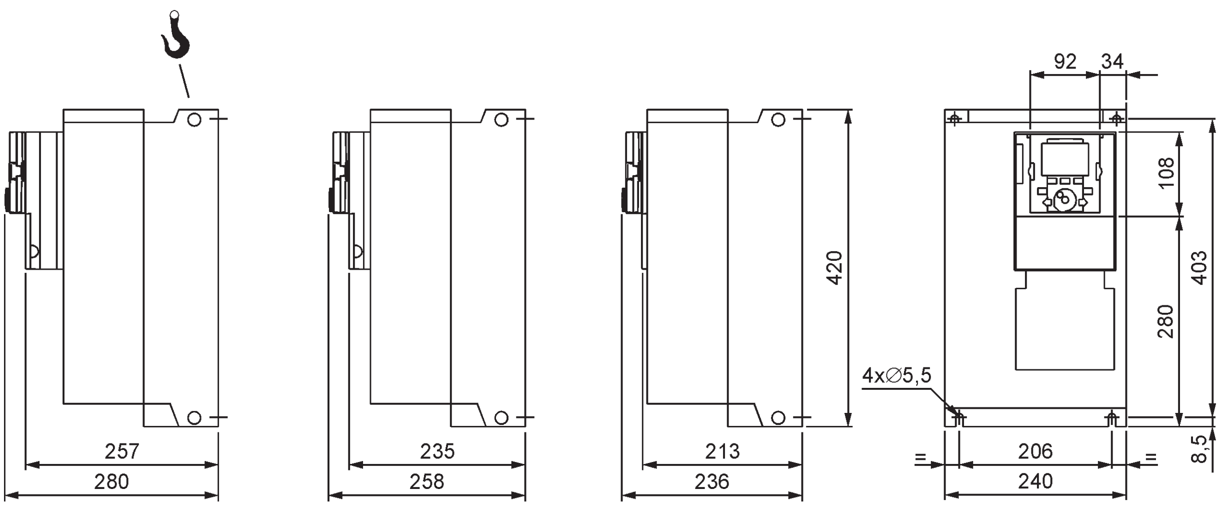
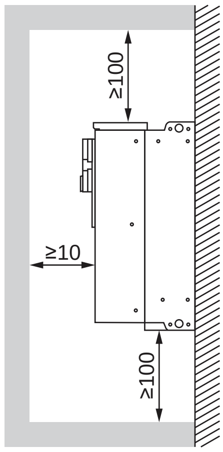
with 2 option cards

with 1 option card

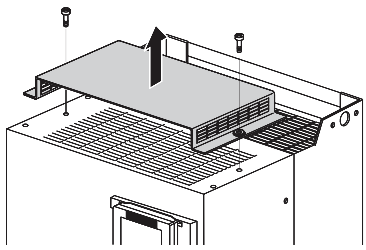
Basic device without option card



MX pro		6V5,5/7,5	6V7,5/11	6V11/15
Nominal data				
Motor rating (P1/P2)				
P_N [kW]	V_N = 500 V	4.0/5.5	5.5/7.5	7.5/11
P_N [hp]	V_N = 600 V	5/7.5	7.5/10	10/15
P_N [kW]	V_N = 690 V	5.5/7.5	7.5/11	11/15
Continuous output power (P1/P2)				
$S_{N\,500}$ [kVA]	V_N = 500 V	6.5/8.7	8.7/11.3	11.7/15.6
$S_{N\,600}$ [kVA]	V_N = 600 V	7.8/10.4	10.4/14.0	14.0/19.2
$S_{N\,690}$ [kVA]	V_N = 690 V	9/12	12/16	16/22
Continuous output current (P1/P2)				
$I_{N\,500}$ [A]	V_N = 500 V	7.5/10	10/13.5	13.5/18.5
$I_{N\,600}$ [A]	V_N = 600 V	7.5/10	10/13.5	13.5/18.5
$I_{N\,690}$ [A]	V_N = 690 V	7.5/10	10/13.5	13.5/18.5
Maximum current (P1/P2) for 60 s per 10 minutes				
I_{MAX} [A]	V_N = 500 V	11.3/12	15/16	20/22
I_{MAX} [A]	V_N = 600 V	11.3/12	15/16	20/22
I_{MAX} [A]	V_N = 690 V	11.3/12	15/16	20/22
Input current (without external choke)				
$I_{IN\,500}$ [A]	V_N = 500 V	8.6/11	11/15	15/20
$I_{IN\,600}$ [A]	V_N = 600 V	7.2/10	10/13	13/17
$I_{IN\,690}$ [A]	V_N = 690 V	8.6/11	11/16	16/20
Braking unit				
P_{CONT} [kW]		5.5	7.5	11
P_{MAX} for 60 s [kW]		8.3	11.3	17
R_{MIN} / R_{MAX} [Ω]		40/150	40/100	40/70
Characteristics				
Efficiency [%]		> 98	> 98	> 98
Losses [W]	at I_N	160/190	190/230	230/300
Weight approx. [kg]		20	20	20
Ambient conditions				
Volume of cooling air [m^3/h]		200	200	200
Sound pressure level [dB(A)]		60	60	60
Mains short circuit curr. [kA] *)		22	22	22

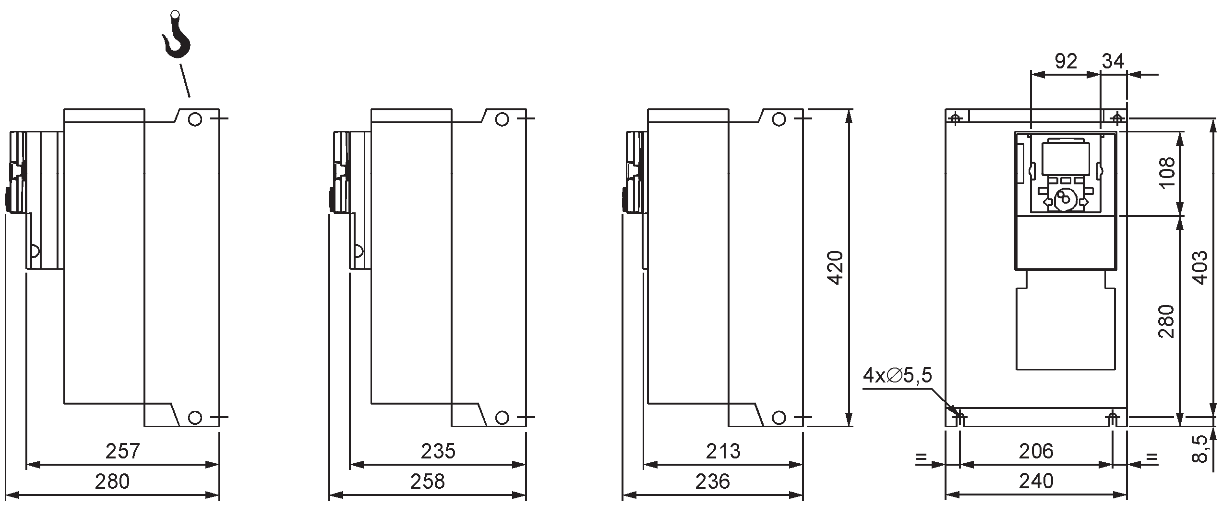


For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.

with 2 option cards　　with 1 option card　　Basic device without option card



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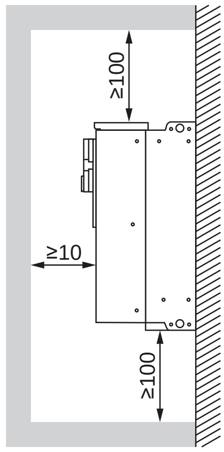
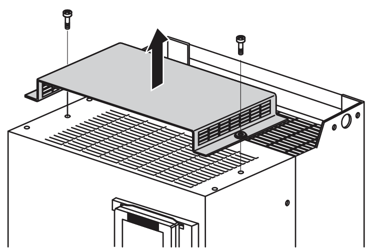
MX pro	6V15/18	6V18/22	6V22/30
Nominal data			
Motor rating (P1/P2)			
P_N [kW] V_N = 500 V	11/15	15/18.5	18.5/22
P_N [hp] V_N = 600 V	15/20	20/25	25/30
P_N [kW] V_N = 690 V	15/18.5	18.5/22	22/30
Continuous output power (P1/P2)			
$S_{N\,500}$ [kVA] V_N = 500 V	16/21	21/25	25/30
$S_{N\,600}$ [kVA] V_N = 600 V	19.2/25	25/28	28/36
$S_{N\,690}$ [kVA] V_N = 690 V	22/29	29/32	32/42
Continuous output current (P1/P2)			
$I_{N\,500}$ [A] V_N = 500 V	18.5/24	24/29	29/35
$I_{N\,600}$ [A] V_N = 600 V	18.5/24	24/27	27/35
$I_{N\,690}$ [A] V_N = 690 V	18.5/24	24/27	27/35
Maximum current (P1/P2) for 60 s per 10 minutes			
I_{MAX} [A] V_N = 500 V	28/29	36/35	44/42
I_{MAX} [A] V_N = 600 V	28/29	36/32	41/42
I_{MAX} [A] V_N = 690 V	28/29	36/32	41/42
Input current (without external choke)			
$I_{IN\,500}$ [A] V_N = 500 V	20/25	25/29	29/33
$I_{IN\,600}$ [A] V_N = 600 V	17/21	21/24	24/28
$I_{IN\,690}$ [A] V_N = 690 V	20/24	24/27	29/34
Braking unit			
P_{CONT} [kW]	15	18.5	22
P_{MAX} for 60 s [kW]	23	28	33
R_{MIN} / R_{MAX} [Ω]	24/50	20/45	20/37
Characteristics			
Efficiency [%]	> 98	> 98	> 98
Losses [W] at I_N	300/390	390/470	470/560
Weight approx. [kg]	20	20	20
Ambient conditions			
Volume of cooling air [m^3/h]	200	200	200
Sound pressure level [dB(A)]	60	60	60
Mains short circuit curr. [kA] *)	22	22	22



For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.

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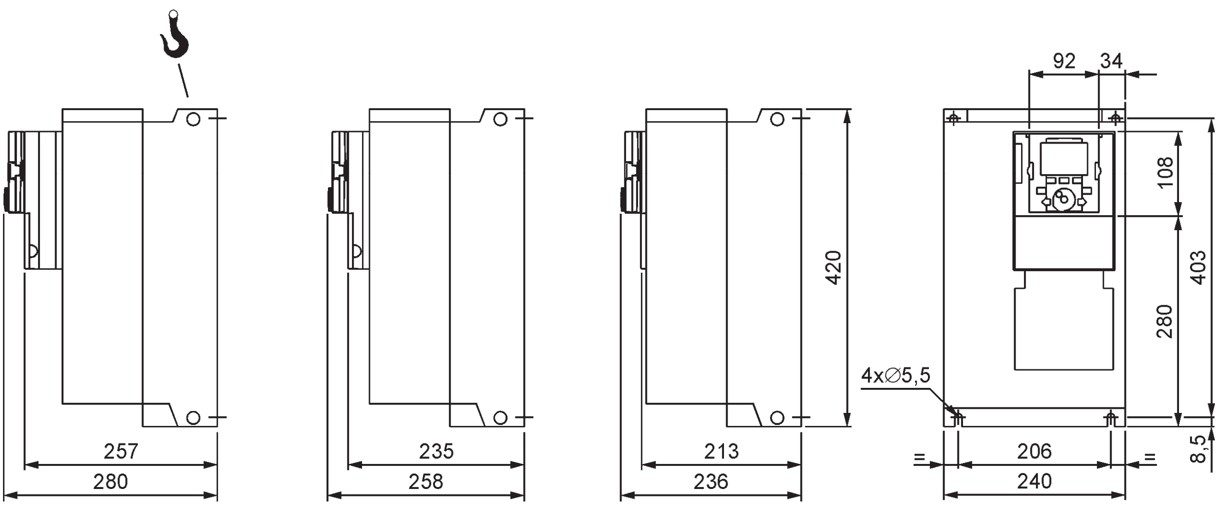
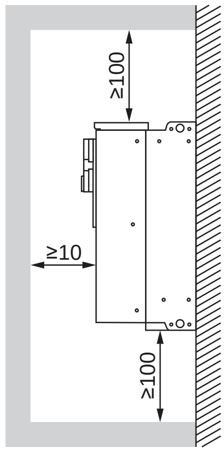
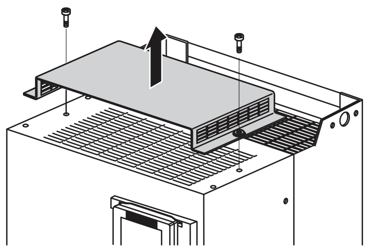
with 2 option cards | with 1 option card | Basic device without option card



MX pro		6V30/37	6V37/45	6V45/55
Nominal data				
Motor rating (P1/P2)				
P_N [kW]	V_N = 500 V	22/30	30/37	37/45
P_N [hp]	V_N = 600 V	30/40	40/50	50/60
P_N [kW]	V_N = 690 V	30/37	37/45	45/55
Continuous output power (P1/P2)				
$S_{N\ 500}$ [kVA]	V_N = 500 V	30/41	41/51	51/59
$S_{N\ 600}$ [kVA]	V_N = 600 V	36/45	45/56	56/64
$S_{N\ 690}$ [kVA]	V_N = 690 V	42/51	51/65	65/74
Continuous output current (P1/P2)				
$I_{N\ 500}$ [A]	V_N = 500 V	35/47	47/59	59/68
$I_{N\ 600}$ [A]	V_N = 600 V	35/43	43/54	54/62
$I_{N\ 690}$ [A]	V_N = 690 V	35/43	43/54	54/62
Maximum current (P1/P2) for 60 s per 10 minutes				
I_{MAX} [A]	V_N = 500 V	53/56	71/71	89/82
I_{MAX} [A]	V_N = 600 V	53/52	65/65	81/74
I_{MAX} [A]	V_N = 690 V	53/52	65/65	81/74
Input current (without external choke)				
$I_{IN\ 500}$ [A]	V_N = 500 V	38/48	48/62	62/68
$I_{IN\ 600}$ [A]	V_N = 600 V	32/41	41/51	51/57
$I_{IN\ 690}$ [A]	V_N = 690 V	39/47	47/55	55/63
Braking unit				
P_{CONT} [kW]		30	37	45
P_{MAX} for 60 s [kW]		45	56	68
R_{MIN} / R_{MAX} [Ω]		12/27	12/22	8/18
Characteristics				
Efficiency [%]		> 98	> 98	> 98
Losses [W]	at I_N	560/720	720/920	920/1100
Weight approx. [kg]		57	57	57
Ambient conditions				
Volume of cooling air [m^3/h]		400	400	400
Sound pressure level [dB(A)]		64	64	64
Mains short circuit curr. [kA] *)		22	22	22

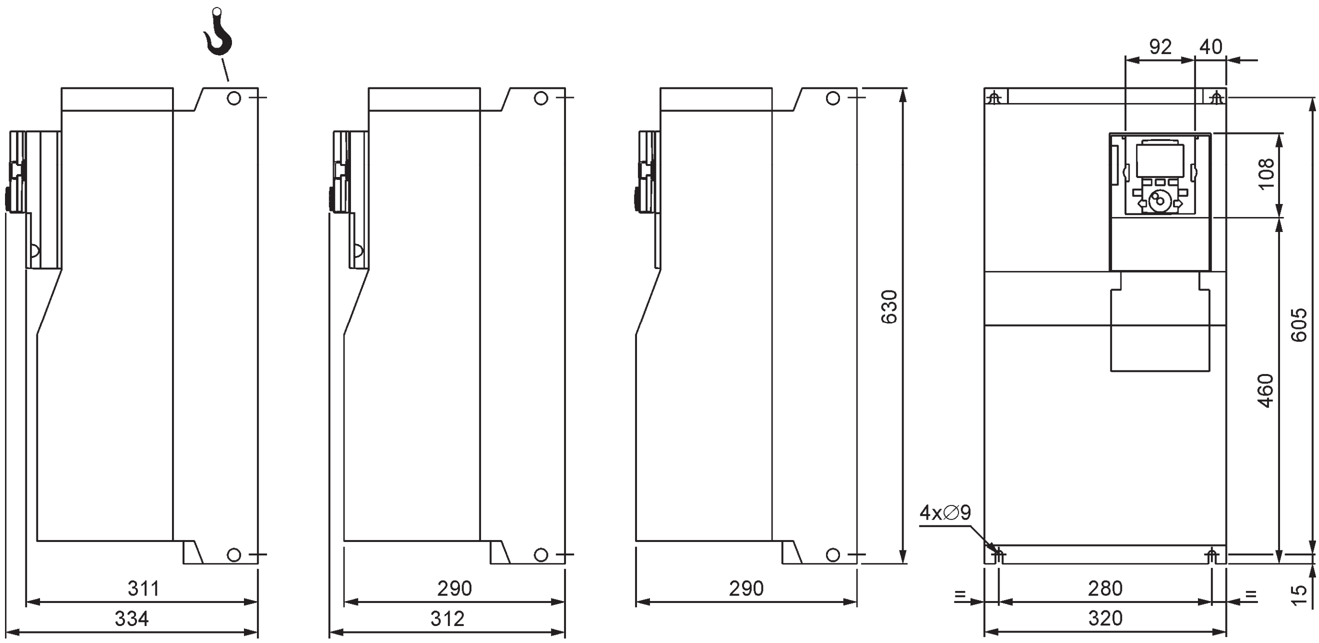


For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.

with 2 option cards with 1 option card Basic device without option card



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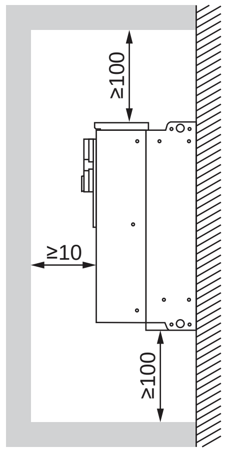
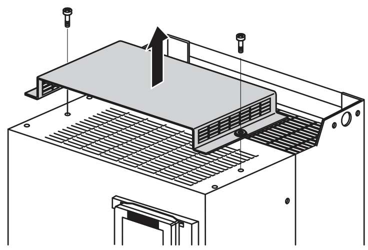
MX pro		6V55/75	6V75/90
Nominal data			
Motor rating (P1/P2)			
P_N [kW]	V_N = 500 V	45/55	55/75
P_N [hp]	V_N = 600 V	60/75	75/100
P_N [kW]	V_N = 690 V	55/75	75/90
Continuous output power (P1/P2)			
$S_{N\,500}$ [kVA]	V_N = 500 V	59/74	74/95
$S_{N\,600}$ [kVA]	V_N = 600 V	64/87	87/108
$S_{N\,690}$ [kVA]	V_N = 690 V	74/100	100/124
Continuous output current (P1/P2)			
$I_{N\,500}$ [A]	V_N = 500 V	68/85	85/110
$I_{N\,600}$ [A]	V_N = 600 V	62/84	84/104
$I_{N\,690}$ [A]	V_N = 690 V	62/84	84/104
Maximum current (P1/P2) for 60 s per 10 minutes			
I_{MAX} [A]	V_N = 500 V	102/102	128/132
I_{MAX} [A]	V_N = 600 V	93/101	126/125
I_{MAX} [A]	V_N = 690 V	93/101	126/125
Input current (without external choke)			
$I_{IN\,500}$ [A]	V_N = 500 V	68/84	84/110
$I_{IN\,600}$ [A]	V_N = 600 V	57/71	71/92
$I_{IN\,690}$ [A]	V_N = 690 V	63/88	88/101
Braking unit			
P_{CONT} [kW]		55	75
P_{MAX} for 60 s [kW]		83	113
R_{MIN} / R_{MAX} [Ω]		8/15	5/11
Characteristics			
Efficiency [%]		> 98	> 98
Losses [W]	at I_N	1100/1550	1550/1950
Weight approx. [kg]		57	57
Ambient conditions			
Volume of cooling air [m^3/h]		400	400
Sound pressure level [dB(A)]		64	64
Mains short circuit curr. [kA] *)		22	22



For installation keep a minimum distance of 50 mm between the units and the side wall.



When you remove the IP41 protective cover the units can be mounted without any distance sideways.

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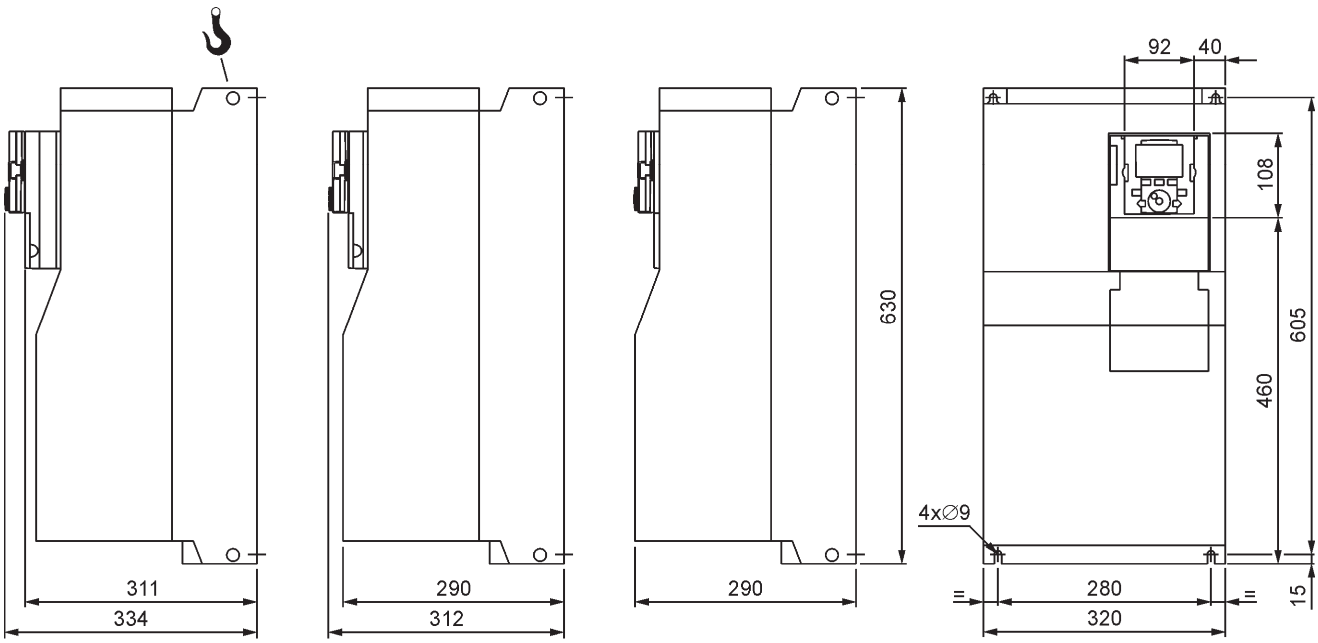
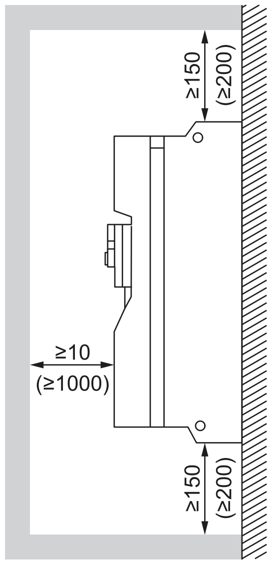
with 2 option cards | with 1 option card | Basic device without option card



MX pro		6V90/110	6V110/132	6V132/160	6V160/200
Nominal data					
Motor rating (P1/P2)					
P_N [kW]	V_N = 500 V	75/90	90/110	110/132	132/160
P_N [hp]	V_N = 600 V	100/125	125/150	150/(180)	(180)/200
P_N [kW]	V_N = 690 V	90/110	110/132	132/160	160/200
Continuous output power (P1/P2)					
$S_{N\,500}$ [kVA]	V_N = 500 V	95/118	118/143	143/173	173/208
$S_{N\,600}$ [kVA]	V_N = 600 V	108/130	130/156	156/187	187/228
$S_{N\,690}$ [kVA]	V_N = 690 V	124/149	149/179	179/215	215/263
Continuous output current (P1/P2)					
$I_{N\,500}$ [A]	V_N = 500 V	110/136	136/165	165/200	200/240
$I_{N\,600}$ [A]	V_N = 600 V	104/125	125/150	150/180	180/220
$I_{N\,690}$ [A]	V_N = 690 V	104/125	125/150	150/180	180/220
Maximum current (P1/P2) for 60 s per 10 minutes					
I_{MAX} [A]	V_N = 500 V	165/163	204/198	248/240	300/288
I_{MAX} [A]	V_N = 600 V	156/150	188/180	225/216	270/264
I_{MAX} [A]	V_N = 690 V	156/150	188/180	225/216	270/264
Input current					
$I_{IN\,500}$ [A]	V_N = 500 V	108/128	128/153	153/182	182/218
$I_{IN\,600}$ [A]	V_N = 600 V	94/113	113/133	133/159	159/197
$I_{IN\,690}$ [A]	V_N = 690 V	98/117	117/137	137/163	163/199
Braking unit					
P_{CONT} [kW]		90	110	132	160
P_{MAX} for 60 s [kW]		135	165	198	240
R_{MIN} / R_{MAX} [Ω]		4/9	4/7.3	4/6.1	4/5
Characteristics					
Efficiency [%]		> 97.9	> 97.9	> 97.9	> 97.9
Losses [W]	at I_N	1960/2320	2320/2750	2740/3290	3270/4030
Weight approx. [kg]		80	80	80	80
Ambient conditions					
Volume of cooling air [m³/h]		600	600	600	600
Sound pressure level [dB(A)]		71	71	71	71
Mains short circuit curr. [kA] *)		28	28	35	35
Fan supply					
Voltage [V]		400…480	400…480	400…480	400…480
Power [VA]		550	550	550	550

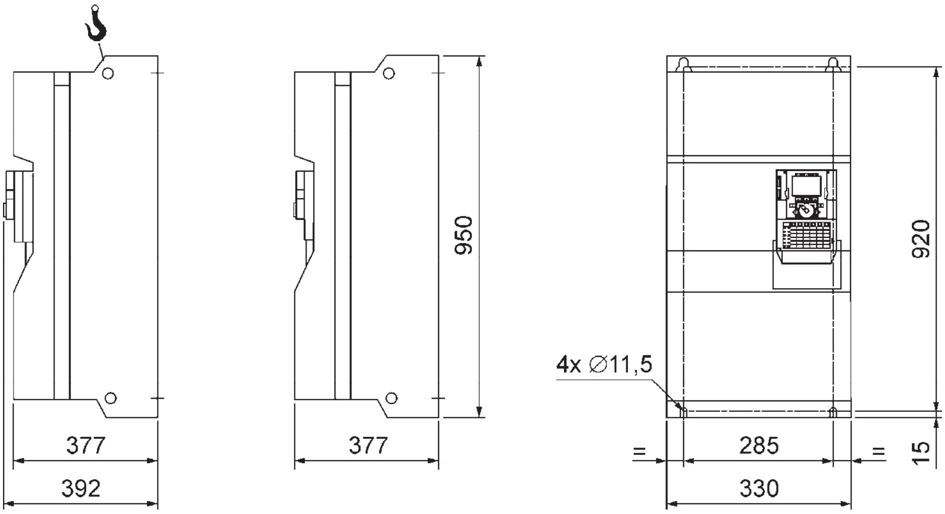


If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

with 2 option cards

Basic device (without TRAFO-BOX) without or with 1 option card



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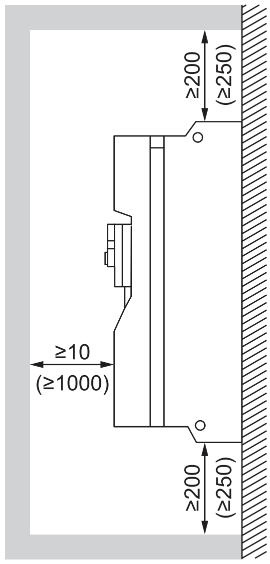
MX pro	6V200/250	6V250/315	6V315/400
Nominal data			
Motor rating (P1/P2)			
P_N [kW] V_N = 500 V	160/200	200/250	250/315
P_N [hp] V_N = 600 V	200/250	250/350	350/450
P_N [kW] V_N = 690 V	200/250	250/315	315/400
Continuous output power (P1/P2)			
$S_{N\,500}$ [kVA] V_N = 500 V	208/270	270/338	338/400
$S_{N\,600}$ [kVA] V_N = 600 V	228/301	301/368	368/436
$S_{N\,690}$ [kVA] V_N = 690 V	263/347	347/424	424/502
Continuous output current (P1/P2)			
$I_{N\,500}$ [A] V_N = 500 V	240/312	312/390	390/462
$I_{N\,600}$ [A] V_N = 600 V	220/290	290/355	355/420
$I_{N\,690}$ [A] V_N = 690 V	220/290	290/355	355/420
Maximum current (P1/P2) for 60 s per 10 minutes			
I_{MAX} [A] V_N = 500 V	360/374	468/468	585/554
I_{MAX} [A] V_N = 600 V	330/348	435/426	533/504
I_{MAX} [A] V_N = 690 V	330/348	435/426	533/504
Input current			
$I_{IN\,500}$ [A] V_N = 500 V	227/277	277/342	342/426
$I_{IN\,600}$ [A] V_N = 600 V	204/250	249/311	311/390
$I_{IN\,690}$ [A] V_N = 690 V	212/257	256/317	317/394
Braking unit			
P_{CONT} [kW]	200 [1.)]	250 [1.)]	315 [1.)]
P_{MAX} for 60 s [kW]	300	375	473
R_{MIN} / R_{MAX} [Ω]	2/4	2/3.2	2/2.6
Characteristics			
Efficiency [%]	> 98	> 98	> 98
Losses [W] at I_N	4010/5160	5140/6310	6290/7550
Weight approx. [kg]	140	140	140
Ambient conditions			
Volume of cooling air [m^3/h]	1200	1200	1200
Sound pressure level [dB(A)]	73	73	73
Mains short circuit curr. [kA] *)	35	35	42
Fan supply			
Voltage [V]	400…480	400…480	400…480
Power [VA]	1100 +550*)	1100 +550*)	1100 +550*)



If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

[1.)] External braking unit

*) 550 VA for braking unit

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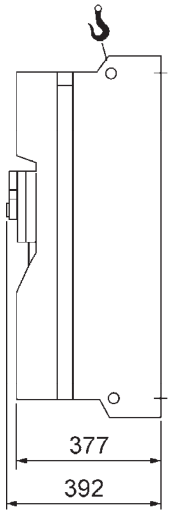
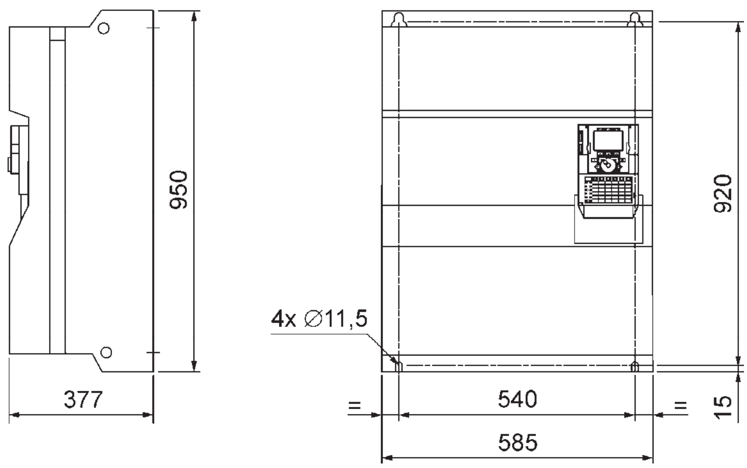
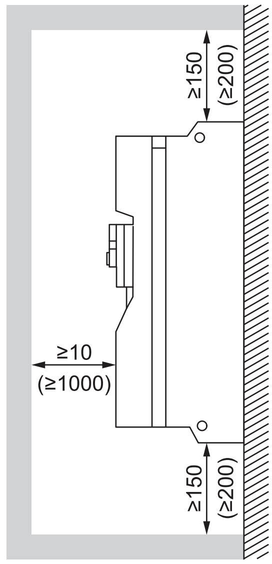
with 2 option cards



Basic device (without TRAFO-BOX) without or with 1 option card



MX pro	6V400/500	6V500/630	6V630/800
Nominal data			
Motor rating (P1/P2)			
P_N [kW] V_N = 500 V	315/400	400/500	500/630
P_N [hp] V_N = 600 V	450/550	550/700	700/800
P_N [kW] V_N = 690 V	400/500	500/630	630/800
Continuous output power (P1/P2)			
$S_{N\,500}$ [kVA] V_N = 500 V	400/511	511/641	641/779
$S_{N\,600}$ [kVA] V_N = 600 V	436/564	564/701	701/872
$S_{N\,690}$ [kVA] V_N = 690 V	502/649	649/807	807/1004
Continuous output current (P1/P2)			
$I_{N\,500}$ [A] V_N = 500 V	462/590	590/740	740/900
$I_{N\,600}$ [A] V_N = 600 V	420/543	543/675	675/840
$I_{N\,690}$ [A] V_N = 690 V	420/543	543/675	675/840
Maximum current (P1/P2) for 60 s per 10 minutes			
I_{MAX} [A] V_N = 500 V	693/708	885/888	1110/1080
I_{MAX} [A] V_N = 600 V	630/652	815/810	1013/1008
I_{MAX} [A] V_N = 690 V	630/652	815/810	1013/1008
Input current			
$I_{IN\,500}$ [A] V_N = 500 V	439/547	544/673	673/847
$I_{IN\,600}$ [A] V_N = 600 V	401/494	491/613	613/771
$I_{IN\,690}$ [A] V_N = 690 V	409/505	498/616	616/775
Braking unit			
P_{CONT} [kW]	400 [1.)]	500 [1.)]	630 [1.)]
P_{MAX} for 60 s [kW]	600	750	945
R_{MIN} / R_{MAX} [Ω]	1/2.02	1/1.61	1/1.28
Characteristics			
Efficiency [%]	> 98	> 98	> 98
Losses [W] at I_N	7600/9660	9610/11950	11920/14980
Weight approx. [kg]	300	300	300
Ambient conditions			
Volume of cooling air [m^3/h]	2400	2400	2400
Sound pressure level [dB(A)]	75	75	75
Mains short circuit curr. [kA] *)	42	42	42
Fan supply			
Voltage [V]	400…480	400…480	400…480
Power [VA]	2200 +550*)	2200 +550*)	2200 +550*)



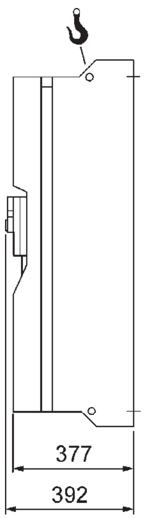
If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

In either case avoid air short circuits.

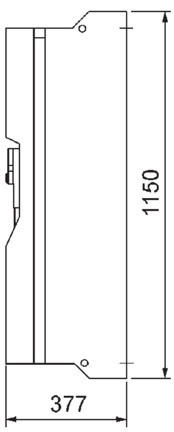
1.) External braking unit

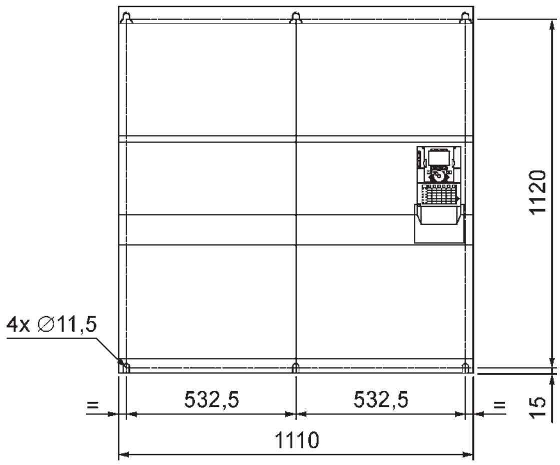
*) 550 VA for braking unit

with 2 option cards



Basic device (without TRAFO-BOX) without or with 1 option card





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Mounting place and mounting position

As it is usual with electronic built-in devices, the MX pro frequency inverters are also designed in compliance with the pollution degree 2 according to 50178. If the environment does not correspond to these conditions then the necessary transition of the pollution degree must be provided e.g. by means of a cubicle.

Because of convection the devices are designed for vertical wall mounting. Install the device on a non-combustible vertical wall which does not transmit any vibrations.

Keep the allowed minimum distances between the devices and from other equipment (see chapter "Technical data", as from page 147).

⚠ The mounting place should be well ventilated and without direct solar radiation.

Avoid environmental effects like high temperatures and high humidity as well as dust, dirt and aggressive gases. Condensation must be prevented by all means.

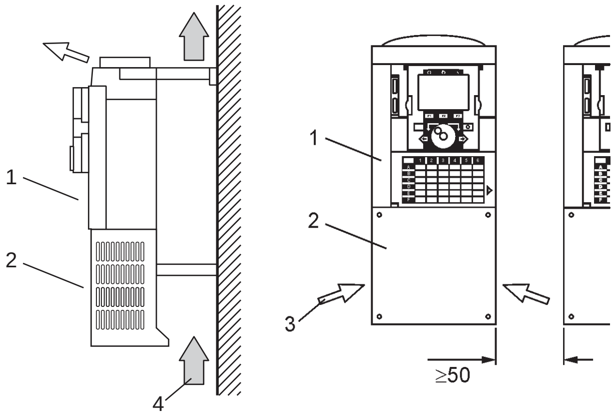
⚠ Do not install the device near heat generating equipment.

Wall-mounting

The MX pro 6V is designed for installation on the wall or in an electrical room. When using the inverter device variant TRAFO-BOX (for devices from 90/110 kW) and the option MX TER-BOX, the devices comply with protection degree IP21/31.

For devices up to 75/90 kW observe a distance of 50 mm sideways, from 90/110 kW on observe a distance of 10 mm sideways. Additionally provide sufficient free space above and below all devices to ensure unimpeded intake and blow of the cooling air.

Wall-mounting with option MX terminal box for frequency inverters up to 75/90 kW

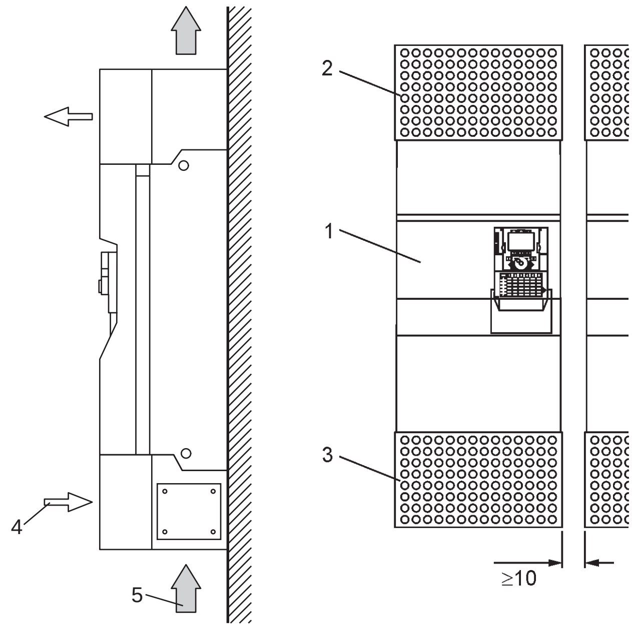


1 MX pro 6V2,2/3,0 … 6V75/90
2 Option MX TER-BOX 130...320
3 Cooling air for control part
4 Cooling air for power part

Protection degree: above IP41, all around IP21

Ambient temperature: -10...+45°C

Wall-mounting for device variant with TRAFO-BOX and option terminal box from 90/110 kW on



1 MX pro 6V from 90/110 kW
2 MX TRAFO-BOX
3 Option MX TER-BOX
4 Cooling air for control part
5 Cooling air for power part

Protection degree: IP31

Ambient temperature: -10...+45°C

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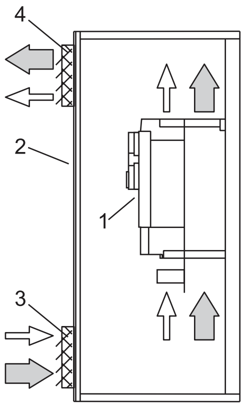
Cubicle installation IP23

The stated losses and minimum cross sections for air inlet are related to the inverter. Further heat sources like fan transformer (TRAFO-BOX), NDU, AMF, fuses and contactors must be considered additionally. The air flow must not be constrained by means of fixtures or filter mats. The air flow must not be constrained by means of fixtures or filter mats. Provide a separation of the power part air for devices from 90/110 kW to avoid internal air short-cuts. Furthermore take care of an exhaust of the control part.

Cubicle installation protection degree IP23
for frequency inverters up to 75/90 kW

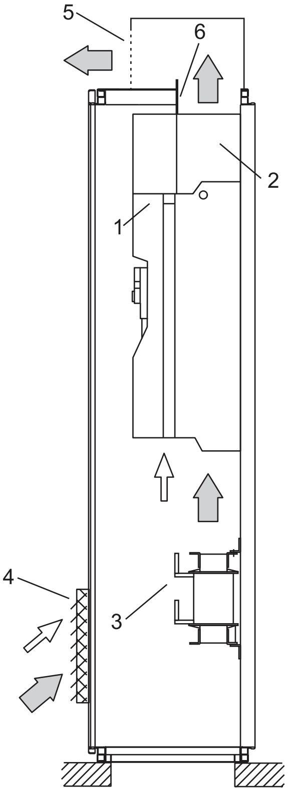


1 MX pro 6V2,2/3,0...6V75/90
2 Cubicle
3 Air inlet grid (without filter mat) for control part and power part
4 Air outlet grid (without filter mat) for control part and power part

Protection degree: IP23

Ambient temperature: -10...+40°C

Cubicle installation protection degree IP23
for frequency inverters from 90/110 kW



1 MX pro 6V from 90/110 kW
2 Transformer MX TRAFO-BOX
3 Line reactor option MX NDU
4 Air inlet grid (without filter mat) for control part and power part
5 Metal cover with splash water protection
6 Separation wall to avoid internal air short-cuts

Protection degree: IP23

Ambient temperature: -10...+40°C

For RITTAL TS8 cubicles an optional installation kit is available.

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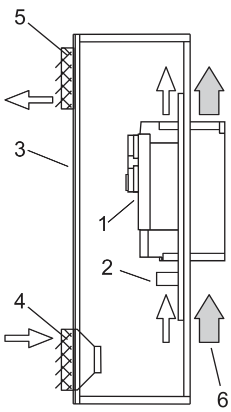
Cubicle installation IP54

Cubicle installation IP54 with separated air flow or flange mounting:

The power part of all devices is designed in IP54 and is sealed from the control electronics. In case of cubicle installation a basement is necessary for separated air flow. The power part fan which is inside the device exhausts the losses of the power part (external). The losses of the control part must be exhausted by means of filter fans or a correspondingly large cubicle surface. The stated values for losses and volume of cooling air refer to the inverter for devices up to 75/90 kW, from 90/110 kW they refer to the inverter including a TRAFO-BOX. Further heat sources like NDU, AMF, fuses and contactors must be considered additionally.

For the whole power range a completely designed and tested cubicle design is available. Prices and technical data on request.

Cubicle installation protection degree IP54 for frequency inverters up to 75/90 kW

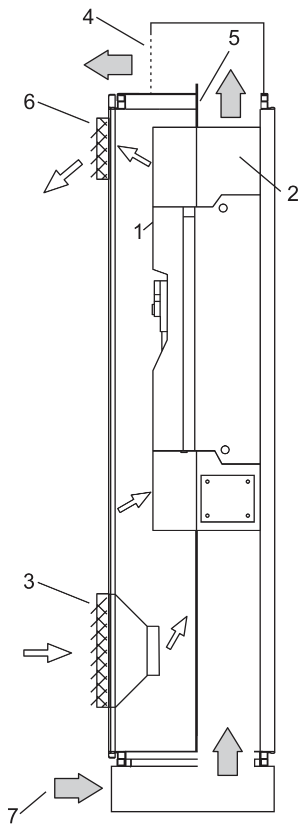


1 MX pro 6V2,2/3,0...6V75/90
2 MX NDU
3 Cubicle
4 Air inlet grid (with filter fan) for control part
5 Air outlet grid (without filter mat) for control part
6 Cooling air for power part

Protection degree: IP54

Ambient temperature: -10...+40°C

Cubicle installation protection degree IP54 for frequency inverters from 90/110 kW



1 MX pro 6V from 90/110 kW
2 Transformer MX TRAFO-BOX
3 Air inlet grid (with filter fan) for control part
4 Metal cover with splash water protection
5 Separation wall to avoid internal air short-cuts
6 Air outlet (with filter mat) for control part
7 Cooling air for power part

Protection degree: IP54

Ambient temperature: -10...+40°C

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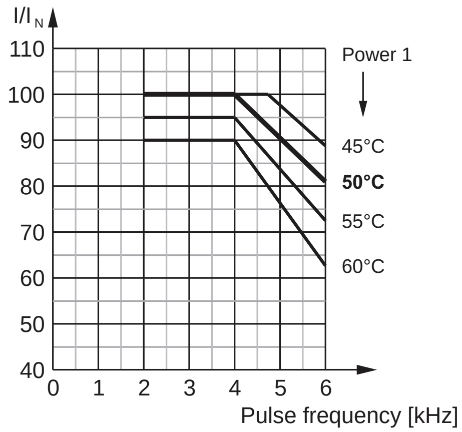
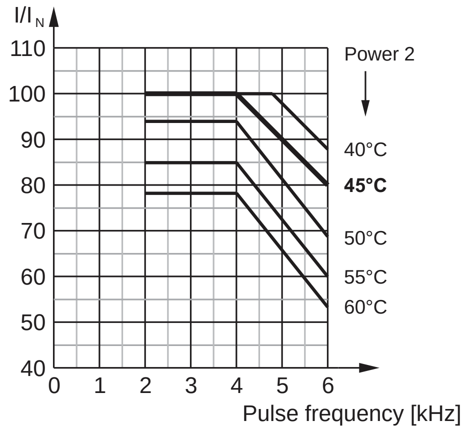
Power decrease

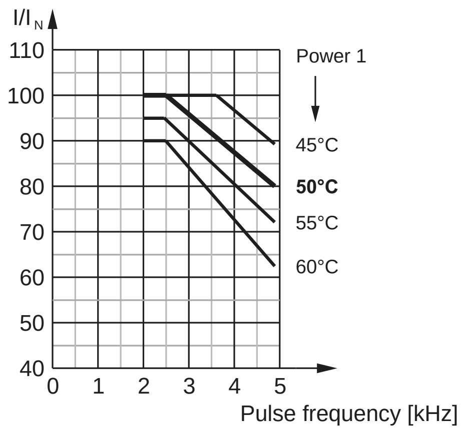
Depending on the chosen pulse frequency and the maximum ambient temperature a power increase is possible or a power reduction is necessary. This can be determined by means of the following diagrams.

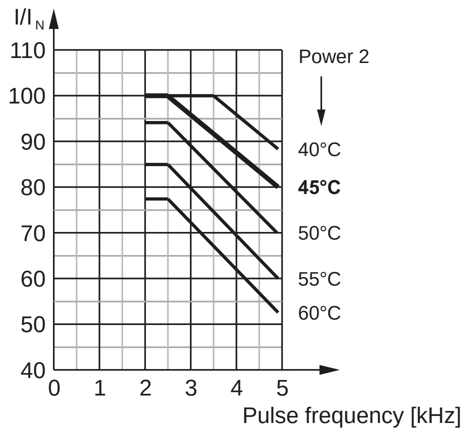
MX pro 6V2,2/3,0...6V22/30





MX pro 6V30/37...6V75/90





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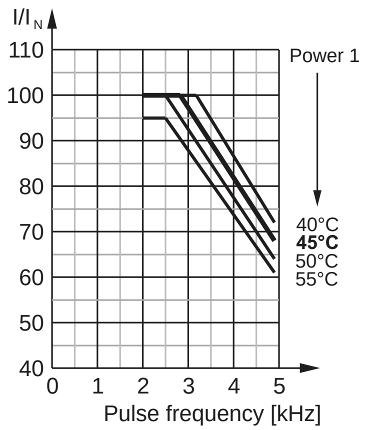
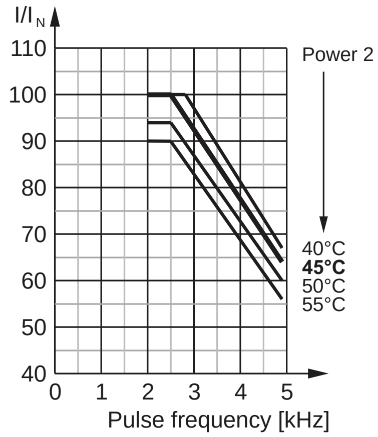
MX pro 6V90/110...6V630/800





Please observe the following guidelines to guarantee trouble-free operation of the drive:

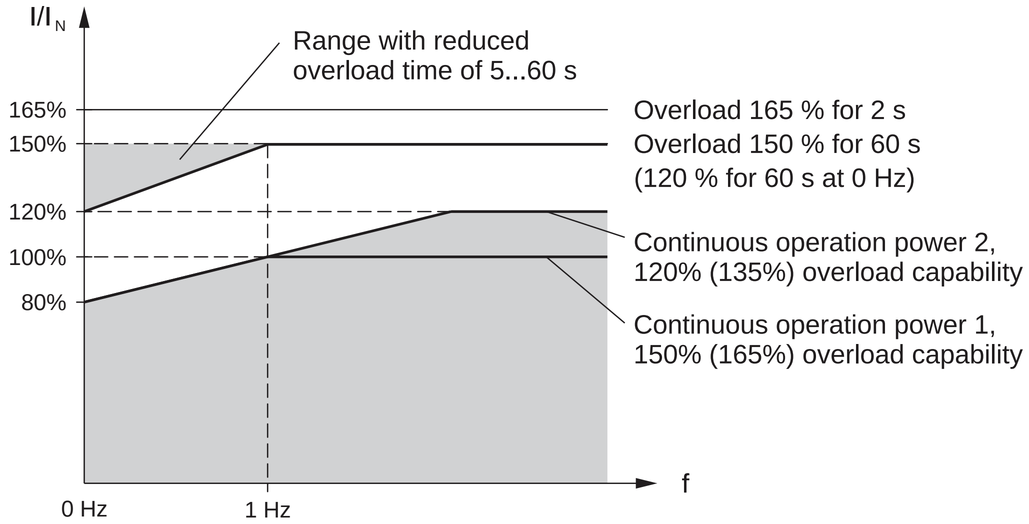
- At higher pulse frequencies the allowed motor cable length is reduced (see chapter "Motor cable lengths", page 180).
- Select a motor that is at most one type bigger.

The TRAFO-BOX and the terminal box do not have any effect on the cooling and from there also the power increase or reduction of the frequency inverter is independent from their use.

If the heat sink temperature is too high, the pulse frequency is automatically reduced to prevent an overload of the inverter.

Continuous current at output frequencies < 1 Hz

For the complete protection of the power semiconductors (IGBTs) against thermal overloads, the carrier frequency will be reduced automatically near 0 Hz operation. If the overload takes too long the drive will trip.



During the operation of the frequency inverter at output frequencies < 1 Hz, the overload time is lower than 60 s at high overload up to 150%.

It amounts to the following:	of 0.0 Hz	only 5 s
	at 0.5 Hz	approx. 32 s
	from 1.0 Hz	60 s

The limitation of the overload time is only to be taken into consideration for drives that work in continuous operation near 0 Hz.

There is practically no effect on the start of a drive since even 500 kW motors already have a nominal slip of 0.3 Hz and thus an overload time of approx. 22 s is possible.

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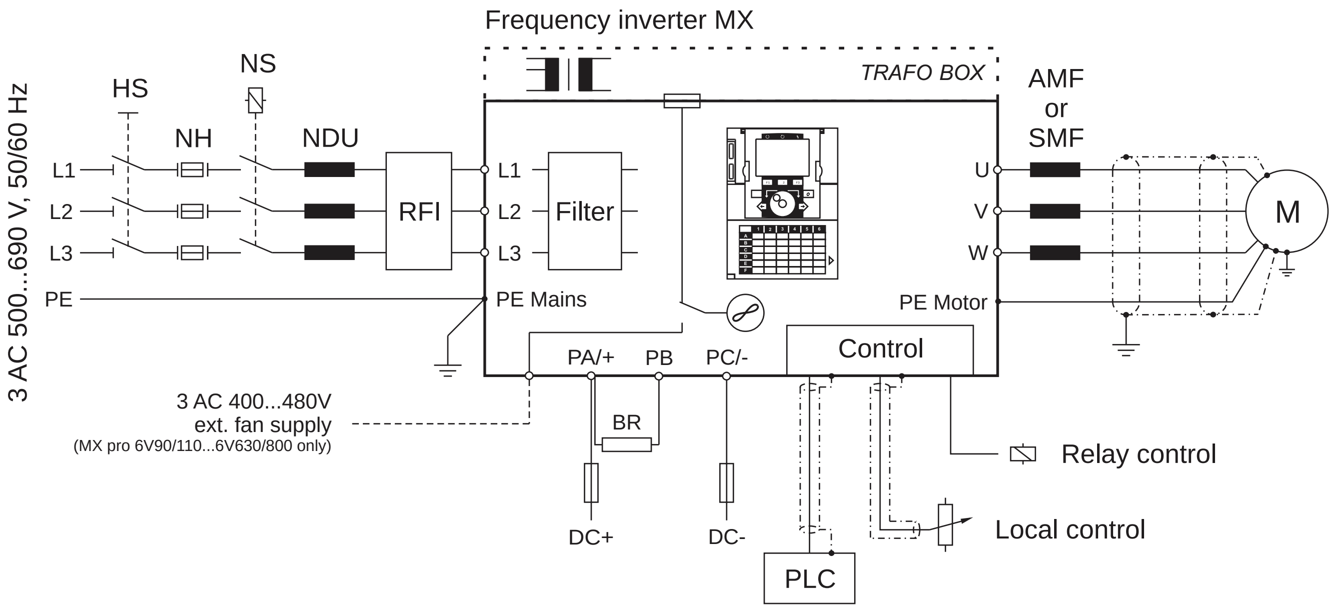
Wiring and connection

Wiring diagram

The following diagrams show the typical wiring of the frequency inverters including the options which may be required for protection of the plant or the device, depending on the application.

MX pro 6V2,2/3,0...6V160/200



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HS .... Main switch (to be used if required according to the local regulations)

NH......................... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

MX NDU .... Line reactor
Option to reduce the current harmonics on the mains caused by the DC link.

internal filter .... Radio frequency interference filter built-in as standard
considering category C3 according to EN 61800-3 "Use in industrial environments"

MX RFI .... Radio frequency interference filter to keep category C3 in case of long motor cables

AMF .... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

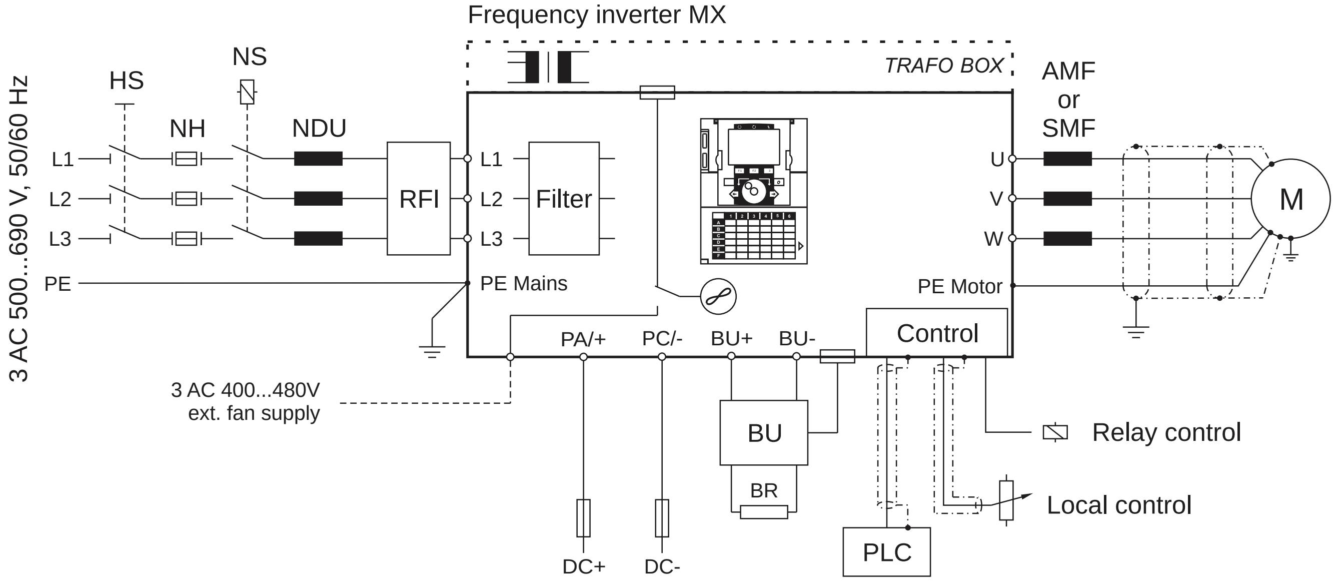
SMF .... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

BR......................... Option braking resistor for short deceleration time or short-time dynamic loads

DC+ / DC-............. Power supply from a DC-bar; alternatively to 3AC mains supply.

TRAFO-BOX .... Transformer box (only for MX pro 6V90/110…6V630/800)
The transformer box can be used instead of an external auxiliary voltage for fan supply, available as inverter device variant.

MX pro 6V200/250...6V315/400



HS .... Main switch (to be used if required according to the local regulations)

NH .... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

MX NDU .... Line reactor
Option to reduce the current harmonics on the mains caused by the DC link.

internal filter .... Radio frequency interference filter built-in as standard
considering category C3 according to EN 61800-3 "Use in industrial environments"

MX RFI .... Radio frequency interference filter to keep category C3 in case of long motor cables

AMF...................... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF...................... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

MX BU.................. Braking unit
External option for MX pro 6V200/250 … 6V630/800

BR .... Option braking resistor for short deceleration time or short-time dynamic loads

DC+ / DC- .... Power supply from a DC-bar; alternatively to 3AC mains supply.

TRAFO-BOX .... Transformer box (only for MX pro 6V90/110…6V630/800)
The transformer box can be used instead of an external auxiliary voltage for fan supply, available as inverter device variant.

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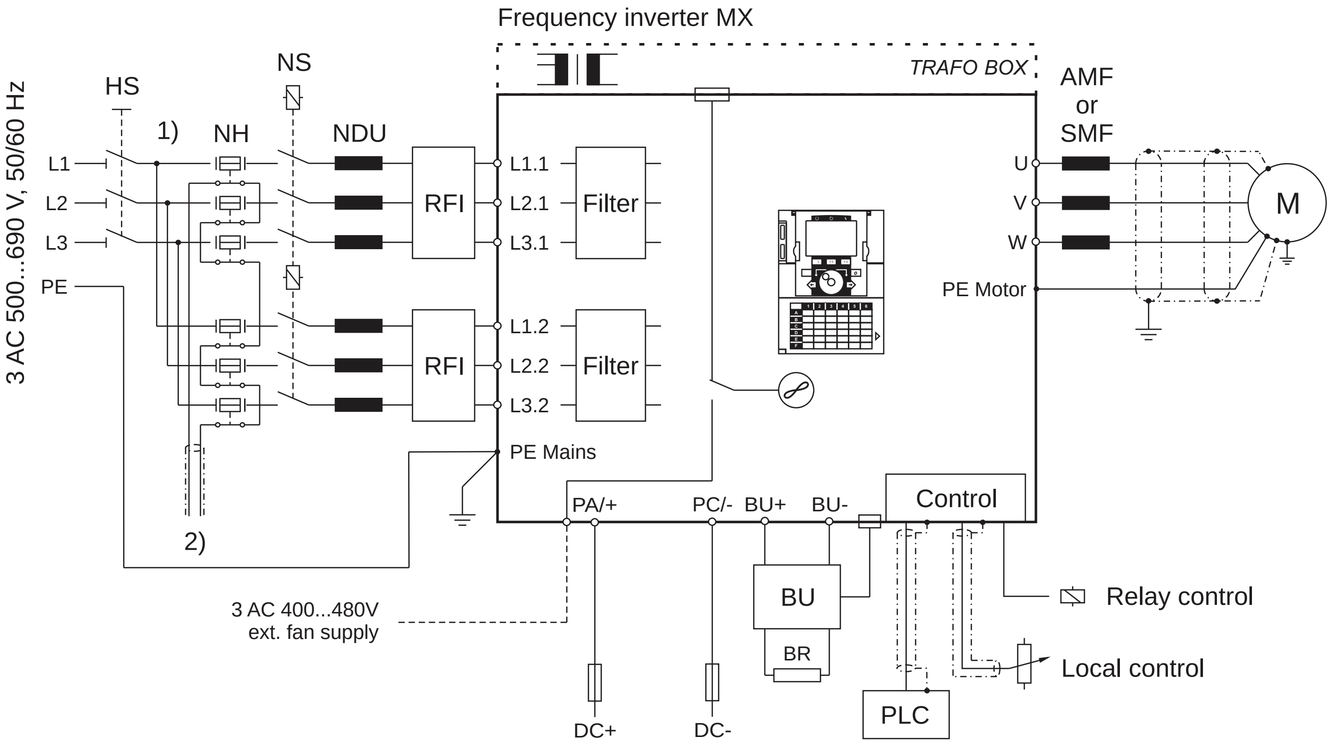
MX pro 6V400/500...6V630/800



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HS .... Main switch (to be used if required according to the local regulations)

NH......................... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

MX NDU .... Line reactor
Option to reduce the current harmonics on the mains caused by the DC link.

internal filter .... Radio frequency interference filter built-in as standard
considering category C3 according to EN 61800-3 "Use in industrial environments"

MX RFI .... Radio frequency interference filter to keep category C3 in case of long motor cables

AMF .... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF .... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

MX BU .... Braking unit
External option for MX pro 6V200/250 … 6V630/800

BR......................... Option braking resistor for short deceleration time or short-time dynamic loads

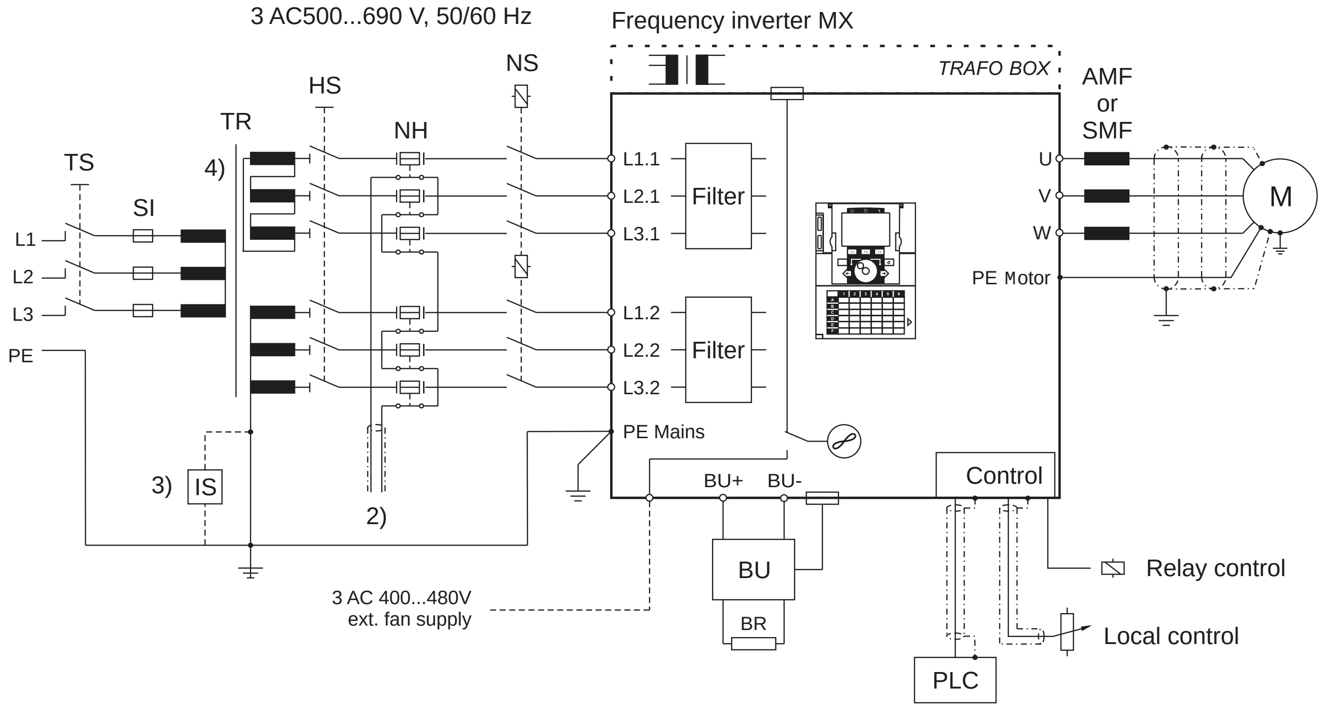
DC+ / DC- .... Power supply from a DC-bar; alternatively to 3AC mains supply.

TRAFO-BOX .... Transformer box (only for MX pro 6V90/110…6V630/800)
The transformer box can be used instead of an external auxiliary voltage for fan supply, available as inverter device variant.

1. The inverter supply must be split up in front of the line reactors, if they are used.
2. The monitoring of the fuses is used to protect the inverter against unbalanced load. It must act on mains contactor or pulse inhibit (e.g. digital input "External fault"). This is not obligatory, because the inverter monitors the mains voltage. Therefor set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).

MX pro 6V400/500...6V630/800

12-pulse rectification



HS .... Main switch (to be used if required according to the local regulations)

NH .... Mains fuses considering table "Fuses and cable cross sections" (absolutely necessary)

NS .... Mains contactor (to be used if required according to the local regulations)

TR.......................... Transformer with two out-of-phase secondary windings (e.g. Yy6 d5)

TS.......................... Disconnecting switch (to be used according to the local regulations)

internal filter .... Radio frequency interference filter built-in as standard
considering category C3 according to EN 61800-3 "Use in industrial environments"

AMF....................... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

SMF....................... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

MX BU................... Braking unit
External option for MX pro 6V200/250 … 6V630/800

BR .... Option braking resistor for short deceleration time or short-time dynamic loads

TRAFO-BOX .... Transformer box (only for MX pro 6V90/110…6V630/800)
The transformer box can be used instead of an external auxiliary voltage for fan supply, available as inverter device variant.

2. The monitoring of the fuses is used to protect the inverter against unbalanced load. It must act on mains contactor or pulse inhibit (e.g. digital input "External fault"). This is not obligatory, because the inverter monitors the mains voltage. Therefor set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).
3. In case of supply by means of a three-winding-transformer the neutral point can be grounded or alternatively an insulation monitoring relay can be used.
4. The transformer must keep to the following tolerances in order to guarantee a constant current sharing:
Tolerance of the secondary voltages to each other: 0.3 % of V_{NOM}
Tolerance of the relative short circuit voltage: ± 5.0 % of v_{SC_NOM}
The nominal output voltage of a transformer is specified at no load operation. Therefore this value has to be appr. 5 % higher than the rated voltage of the drive.

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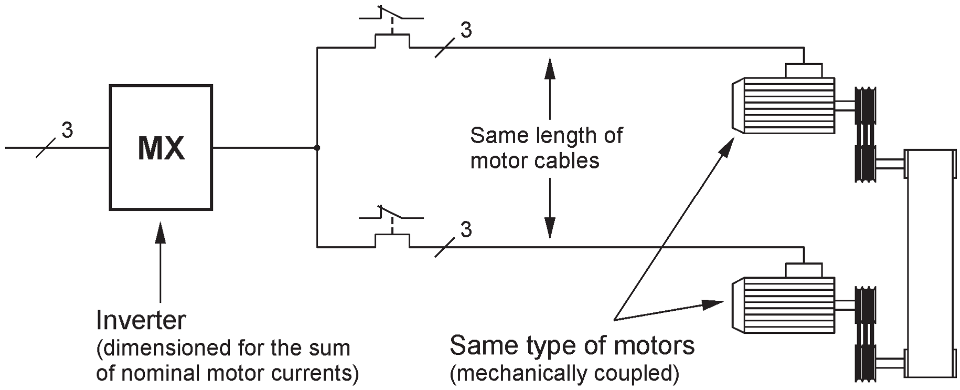
Multi-motor operation

It is basically possible to operate several motors with a MX pro frequency inverter.

For pumps (centrifugal pumps) and fan applications, however, observe the following:

- The sum of the nominal currents must be less than the nominal current of the inverter.
- A different speed regulation is not possible.
- The total motor cable length must be taken into consideration.
- No high starting torque is available.
- The inverter does not provide individual motor overload protection.
- Autotuning is not possible (but also not necessary).
- Activation is only permitted if the starting current surge remains less than the maximum inverter current.

For applications with a higher starting torque (e.g. travel drives, conveyors, lifting gear, etc.), only the parallel connection of several mechanically coupled motors is possible. In order to execute autotuning, the motors must be of the same type and the motor cables must have the same length preferably.



If thermal relays or motor circuit breakers are used, they must be set to about 110 % of the nominal current of the motor !

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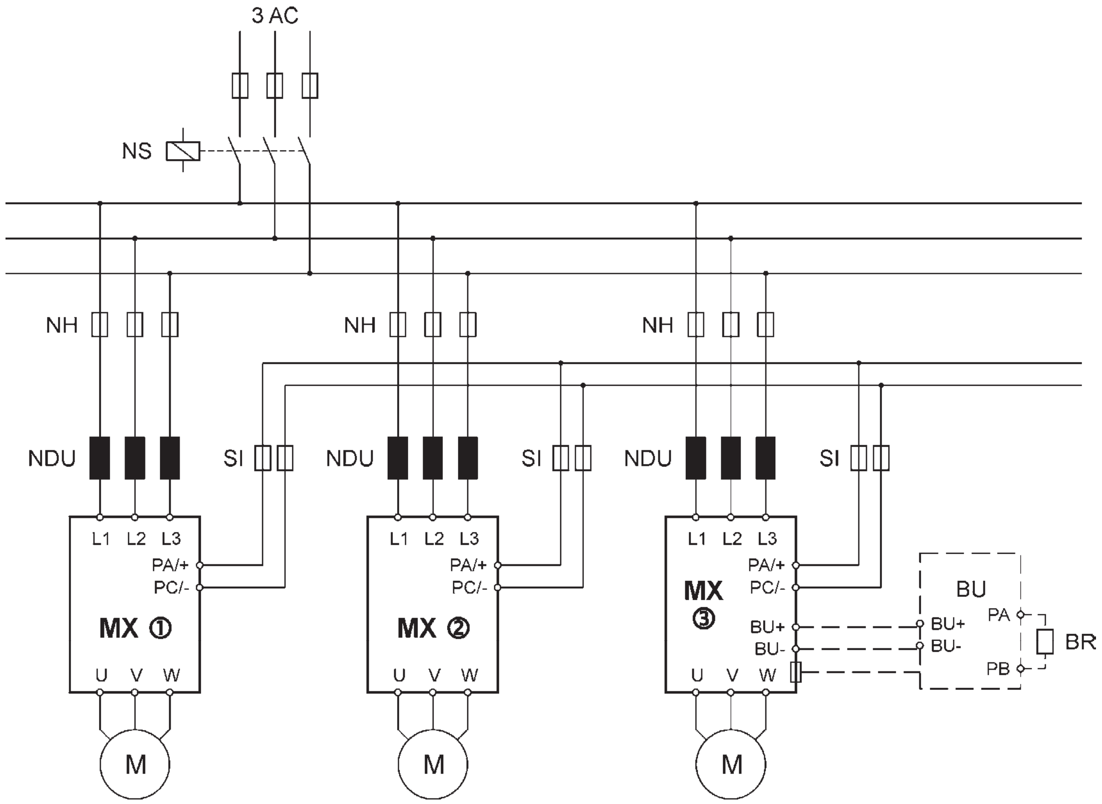
DC coupling

DC-coupling of several MX with a line contactor

It is advisable to couple the DC links in case of applications which have to perform full motor power on the one hand and which should act also in generator operation due to the energy exchange over the DC link on the other hand (e.g. roller conveyors, conveyer belts,...).



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NS ....Line contactor
Because of the installation of a common line contactor, the charging circuits of the individual inverters act in parallel when the mains is switched on and thus they cannot be overloaded.

NH ....Device protection on the main side
In order to protect each rectifier against overload, keep the recommended fuses in chapter "Fuses and cable cross sections", page 172. Consequential damages of the charging circuit during mains switch-on can be avoided by using a fuse monitoring which acts on the digital input "External fault 1", "External fault 2" or on the line contactor.

SI ....Fuse in the DC link according to table in chapter "Fuses for DC-coupled inverters", page 174

①, ②, ③ ....MX pro 6V frequency inverters in standard design
Basically, the number of devices and their size is arbitrary, but between the biggest and smallest device only three power ratings are possible.

NDU ....The option line reactor NDU is absolutely necessary !

BU / BR ....Braking unit and braking resistor for short-time reduction of the generator power
For example, if all drives should be shut down at the same time, the resulting energy will be relieved in the braking resistor.
The use of a braking unit is not obligatory.

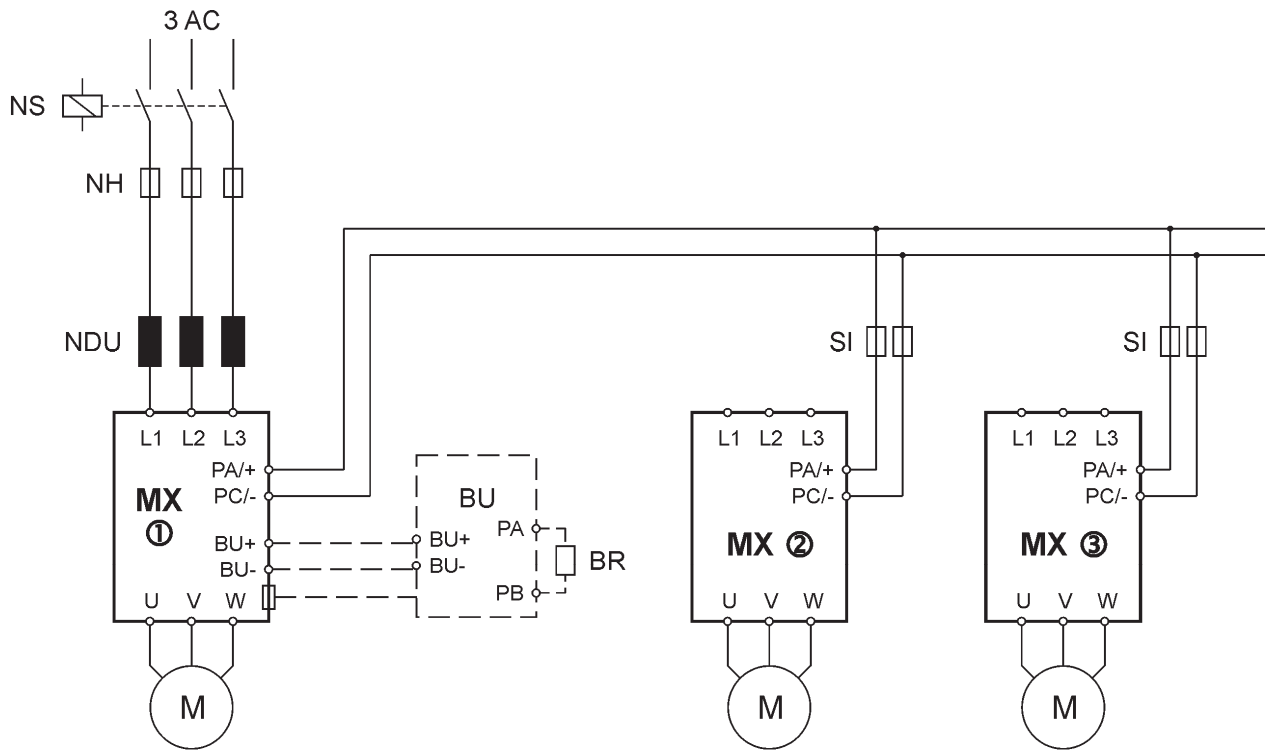
MX pro 6V frequency inverters can be operated at the same DC bus. However, some parameters have to be adjusted appropriate (see Description of functions).

MX pro main drive with slave(s) at the DC link

Applications, which include drives which operate as generator (during braking operation) as well as one or several drives which operate as motor, can act very economic in case of a DC supply (e.g. re-/unwinder, straighteners, motor test benches, roller conveyors, hoisting applications,...).

However, at any time there must not be needed more motor power than power which is required for the rectifier of the main drive (e.g. 250 kW + 20 % for 60 s for MX pro 6V 200/250).

DC supplied drives must not be connected during operation !



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①	MX pro 6V frequency inverter in standard design (main drive) This inverter defines the maximum possible motor power of the whole drive group. It is able to charge three similar devices (or several smaller devices with same total power).
②, ③	DC supplied inverters MX pro 6V (slaves)
NDU	The option line reactor NDU is absolutely necessary !
SI	Semiconductor fuse according to the table in chapter "Fuses for DC-coupled inverters", page 174 It does not makes sense to install switching devices in the DC circuit because closing the switching device would lead unintended triggering of the fuses as a result of the high charging current.
BU / BR	Braking unit and braking resistor for short-time reduction of the generator power For example, if all drives should be shut down at the same time, the resulting energy will be relieved in the braking resistor. The use of a braking unit is not obligatory.

At the main drive the braking function has to be activated. The slave(s) have to be parameterized for operation with an external braking unit.

Fuses and cable cross sections

The MX pro frequency inverters do not contain any input fuses. They have to be provided externally for the case that the electronic protective mechanism of the inverters fails. So they are a secondary protection of the inverter to protect the power cables against overload and to protect the input rectifier against an internal short-circuit.

The mentioned diameters for 3-wire cables are recommended values for laying the cable in air at max. 40°C ambient temperature, based on the regulations ÖVN EN 1 and VDE 0100.

The lines in the cubicles are dimensioned according to the specification for single conductors XLPE/EPR copper 90°C.

The motor cables are dimensioned for the maximum continuous current. They apply to 0...100 Hz (up to 300 Hz the cable losses increase about 25 % because of the Skin-effect).

In case of other ambient conditions and different regulations the cable diameters must be adjusted.

Mains supply					Frequency inverter			Motor output
Pre- or conduit fuses [1.)]	Cu cable mm^2	Mains fuse "inverter protection" "sf"		Lines in the cubicle mm^2 (per phase)	MX pro	Max. cont. current	Max. connec-tion	Motor cable mm^2 [1.)]
10 A	3x 1.5	10 A		1.5	6V2,2/3,0	4.5	10	3x 1.5
10 A	3x 1.5	10 A		1.5	6V3,0/4,0	5.8	10	3x 1.5
16 A	3x 2.5	16 A		2.5	6V4,0/5,5	7.5	10	3x 1.5
20 A	3x 2.5	20 A		2.5	6V5,5/7,5	10	10	3x 1.5
25 A	3x 4.0	25 A		4.0	6V7,5/11	13.5	10	3x 2.5
32 A	3x 6.0	32 A		6.0	6V11/15	18.5	10	3x 2.5
40 A	3x 10	40 A		6.0	6V15/18	24	50	3x 4.0
40 A	3x 10	40 A	A	6.0	6V18/22	29	50	3x 4.0
50 A	3x 10	50 A	A	10	6V22/30	35	50	3x 6.0
63 A	3x 16	63 A	A	10	6V30/37	47	120	3x 10
80 A	3x 25	80 A	A	16	6V37/45	59	120	3x 16
100 A	3x 35	100 A	A	25	6V45/55	68	120	3x 16
125 A	3x 50	125 A	A	35	6V55/75	85	120	3x 25
160 A	3x 70	160 A	B	50	6V75/90	110	120	3x 35
160 A	3x 70	160 A	C	50	6V90/110	136	M10	3x 70
200 A	3x 95	200 A	C	70	6V110/132	165	M10	3x 70
250 A	3x 120	250 A	C	95	6V132/160	200	M10	3x 95
315 A	3x 185	315 A	C	120	6V160/200	240	M10	3x 120
400 A	2x (3x 120)	400 A	D	185	6V200/250	312	M12	3x 185
500 A	2x (3x 150)	500 A	D	2x120	6V250/315	390	M12	2x (3x 120)
630 A	2x (3x 185)	630 A	D	2x150	6V315/400	462	M12	2x (3x 150)
800 A	3x (3x 185)	2x 400 A [2.)]	D	2x185	6V400/500	590	M12	3x (3x 150)
1000 A	4x (3x 185)	2x 500 A [2.)]	D	2x (2x 120)	6V500/630	740	M12	3x (3x 185)
1250 A	4x (3x 240)	2x 630 A [2.)]	D	2x (2x 150)	6V630/800	900	M12	4x (3x 185)

1.) In case of bypass operation the motor cable has to be dimensioned according to the pre- or conduit fuses !

2.) 2 x 3-pole fuses because of parallel supply

It is recommended to use super fast (semiconductor) fuses. Standard fast fuses or circuit breakers can also be used but the rectifier could be damaged in case of an internal fault.

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To protect the rectifier in case of a short-circuit the used fuses should not exceed the following I^2t values (referring to 10 ms):

A	B	C	D
$11.10^3\ A^2s$	$110.10^3\ A^2s$	$200.10^3\ A^2s$	$720.10^3\ A^2s$

If the mains fuses blow the inverter already has a primary defect. Therefore, exchanging the blown fuses and switching the inverter on again is not effective. Consequently, the use of circuit breakers is not advantageous and has additionally the disadvantage of a slower switch-off ad. A circuit breaker with motor drive has to be seen in fact as an alternative to the line contactor.

A low cost alternative to screened motor cables is the use of NYCY or NYCWY cables (power cables with concentric protective conductor).

Dimensioning according to UL/CSA

In order to meet the requirements of UL/CSA, copper cables with temperature class 60/75°C have to be used.

In addition to semiconductor fuses (with UL approval, nominal values in accordance with column: Mains fuses "inverter protection" "sf") the use of class J fuses according to the table below is permitted.
The specified cable cross sections correspond with temperature class 75°C and are calculated for an ambient temperature of 30°C.

MX	UL fuses 600V type Fast acting	Max. mains short-circuit current at 600V mains voltage according to UL listing		Cable cross section for mains- and motor cables (per phase)
		without choke	with line reactor	
MX pro 6V2,2/3,0	Class J 10A max.	22 kA	100 kA	AWG 14
MX pro 6V3,0/4,0	Class J 10A max.	22 kA	100 kA	AWG 14
MX pro 6V4,0/5,5	Class J 15A max.	22 kA	100 kA	AWG 14
MX pro 6V5,5/7,5	Class J 20A max.	22 kA	100 kA	AWG 14
MX pro 6V7,5/11	Class J 25A max.	22 kA	100 kA	AWG 12
MX pro 6V11/15	Class J 35A max.	22 kA	100 kA	AWG 10
MX pro 6V15/18	Class J 40A max.	22 kA	100 kA	AWG 10
MX pro 6V18/22	Class J 45A max.	22 kA	100 kA	AWG 8
MX pro 6V22/30	Class J 60A max.	22 kA	100 kA	AWG 8
MX pro 6V30/37	Class J 70A max.	22 kA	100 kA	AWG 6
MX pro 6V37/45	Class J 90A max.	22 kA	100 kA	AWG 4
MX pro 6V45/55	Class J 110A max.	22 kA	100 kA	AWG 4
MX pro 6V55/75	Class J 150A max.	22 kA	100 kA	AWG 3
MX pro 6V75/90	Class J 175A max.	22 kA	100 kA	AWG 1
MX pro 6V90/110	Class J 175A max.	–	100 kA	AWG 2/0
MX pro 6V110/132	Class J 200A max.	–	100 kA	AWG 3/0
MX pro 6V132/160	Class J 250A max.	–	100 kA	250 MCM
MX pro 6V160/200	Class J 300A max.	–	100 kA	300 MCM
MX pro 6V200/250	Class J 400A max.	–	100 kA	2 x 250 MCM
MX pro 6V250/315	Class J 500A max.	–	100 kA	2 x 350 MCM
MX pro 6V315/400	Class J 600A max.	–	100 kA	3 x 300 MCM
MX pro 6V400/500	Class J 2x 400A max.	–	100 kA	Mains: 2 x (2 x 300 MCM) Motor: 4 x 300
MX pro 6V500/630	Class J 2x 500A max.	–	100 kA	Mains: 2 x (2 x 400 MCM) Motor: 4 x 400
MX pro 6V630/800	Class J 2x 600A max.	–	100 kA	Mains: 2 x (2 x 500 MCM) Motor: 4 x 500 MCM

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Fuses for DC-coupled inverters

DC mains supply	500 V	600 V	690 V
Nominal voltage Voltage range Overvoltage shut-down	700 V DC 620...780 V DC 1.50 x $V_{N\text{-}DC}$	840 V DC 720...930 V DC 1.3 x $V_{N\text{-}DC}$	960 V DC 820...1070 V DC 1.15 x $V_{N\text{-}DC}$
Nominal current DC (approx.)	1.15 x I_{MOTOR}	1.15 x I_{MOTOR}	1.15 x I_{MOTOR}
Type of fuse, Nominal voltage	1100 V DC *)	1100 V DC *)	1100 V DC *)

*) 1100 V DC rated voltage at 10 ms L/R

MX frequency inverter	Mains fuses for DC-supply "inverter protection" ("Ferraz Protistor DC-fuse gR" or similar)	Lines in the cubicle (per phase)
MX pro 6V2,2/3,0	16 A (FD20GB100V16T)	2.5 mm^2
MX pro 6V3,0/4,0	16 A (FD20GB100V16T)	2.5 mm^2
MX pro 6V4,0/5,5	16 A (FD20GB100V16T)	2.5 mm^2
MX pro 6V5,5/7,5	20 A (FD20GB100V20T)	4 mm^2
MX pro 6V7,5/11	25 A (FD20GB100V25T)	4 mm^2
MX pro 6V11/15	32 A (FD20GB100V32T)	6 mm^2
MX pro 6V15/18	40 A (FD20GC100V40T)	6 mm^2
MX pro 6V18/22	50 A (D120GC75V50EF)	10 mm^2
MX pro 6V22/30	63 A (D120GC75V63EF)	10 mm^2
MX pro 6V30/37	80 A (D120GC75V80EF)	16 mm^2
MX pro 6V37/45	100 A (D120GC75V100EF)	25 mm^2
MX pro 6V45/55	125 A (D120GC75V125EF)	35 mm^2
MX pro 6V55/75	160 A (D120GC75V160EF)	50 mm^2
MX pro 6V75/90	160 A (D120GC75V160EF)	50 mm^2
MX pro 6V90/110	200 A (D121GC75V200EF)	70 mm^2
MX pro 6V110/132	250 A (D121GC75V250EF)	95 mm^2
MX pro 6V132/160	315 A (D122GC75V315EF)	120 mm^2
MX pro 6V160/200	350 A (D122GC75V350EF)	150 mm^2
MX pro 6V200/250	450 A (D122GD75V450EF)	2 x 95 mm^2
MX pro 6V250/315	630 A (D2122GC75V630TF) (or 2 x 315 A parallel)	2 x 150 mm^2
MX pro 6V315/400	800 A (D2122GC75V800TF) (or 2 x 400 A parallel)	3 x 150 mm^2
MX pro 6V400/500	900 A (D2122GD75V900TF) (or 2 x 450 A parallel)	3 x 150 mm^2
MX pro 6V500/630	1250 A (D2123GD75V12CTF) (or 2 x 630 A parallel)	4 x 150 mm^2
MX pro 6V630/800	1500 A (D2123GD75V1500TF) (or 2 x 750 A parallel)	6 x 150 mm^2

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Braking unit BU

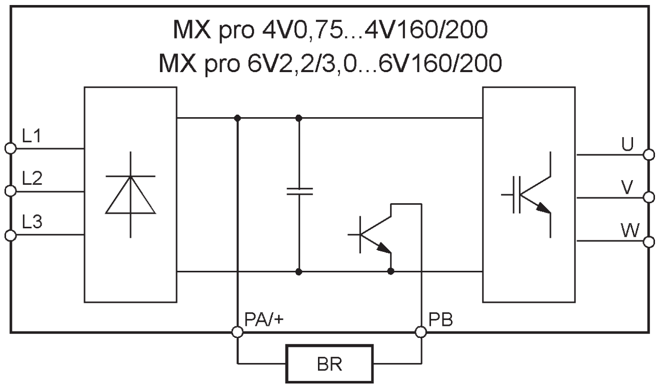
When a motor is braked on the deceleration ramp, the motor acts as a generator. Since voltage DC link inverters cannot return energy to the mains as standard, the DC link voltage increases in case of generator operation.

If more power is returned to the DC link during the braking procedure than the losses in the motor and inverter amount to, the DC link voltage increases and a shut-down with overvoltage results.

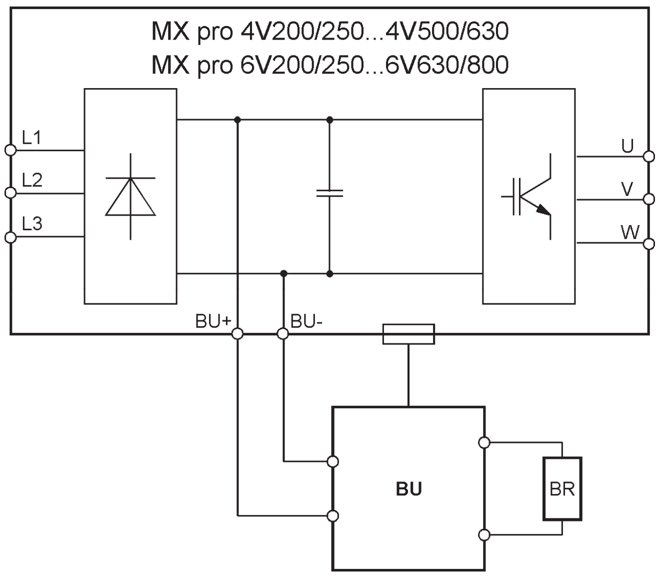
The generator power depends on the moment of inertia of the load and the set deceleration time, among other things.

The MX pro inverter counteracts the shut-down through an automatic extension of the deceleration ramp. If shorter braking times must be observed, a braking resistor should be connected to the inverter (or to the braking unit BU).

MX pro with an internal braking transistor



MX pro with an external braking unit BU



If the DC link voltage exceeds an adjustable value due to a braking procedure, the external braking resistor is switched into the DC link as a consumer. The braking resistor BR converts the energy incurred into heat and thus prevents a further rising of the DC link voltage.

The connection of a braking resistor BR enables the use of the frequency inverter *M*X pro for 4-quadrant-operation. Depending on the selected combination inverter / (braking unit) / braking resistor, a high peak braking power, a high continuous braking power or both can be optimized.

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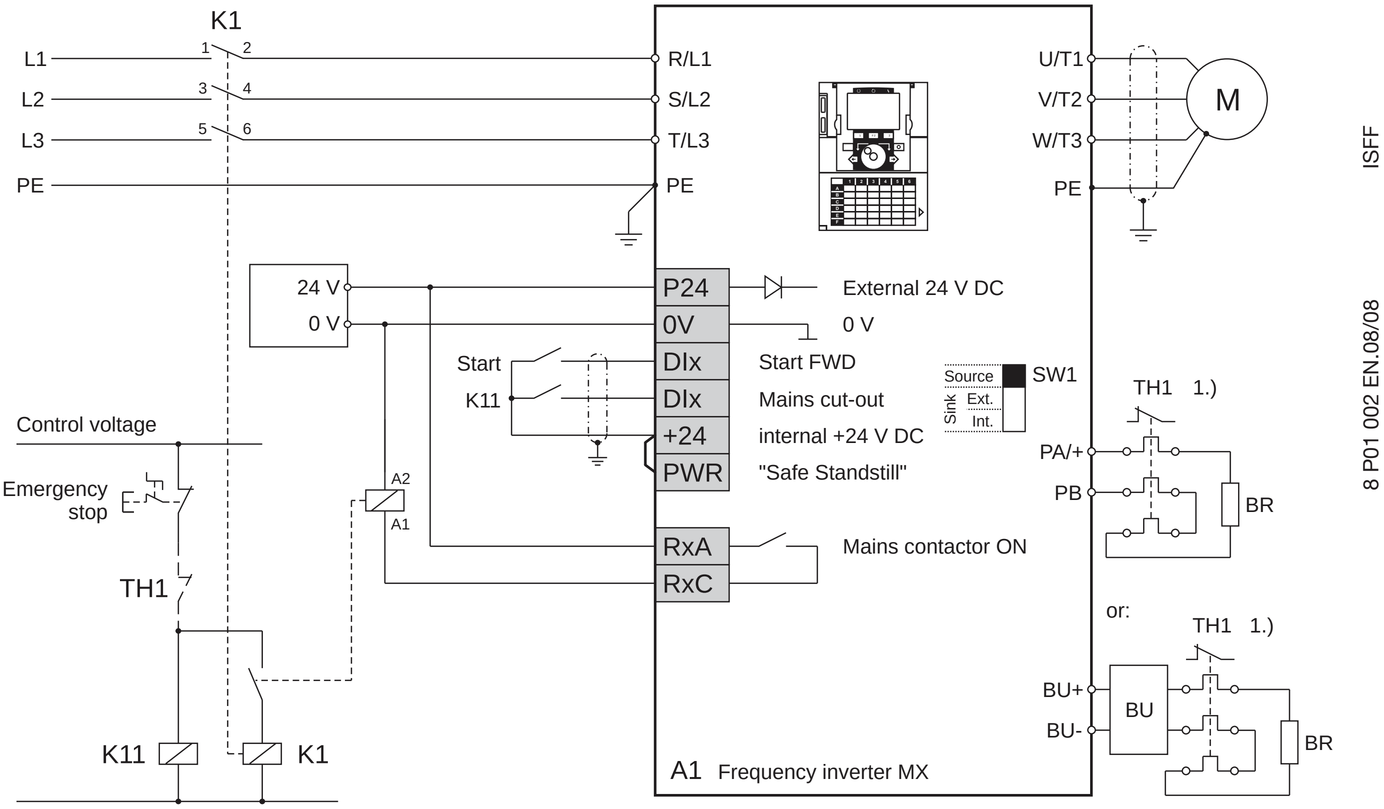
The resistors should be selected according to the respective allocation tables. In the process, the permissible braking power and braking time should be taken into consideration.

The MX pro frequency inverters have parameters to monitor the braking power.

If the braking resistor does not match the overload characteristic to be used or the local regulations require an additional protective device, a thermal relay should be integrated into the mains disconnection mechanism.

The correct setting of the braking parameters is essential for the protection of the braking resistor in normal operation. In case of malfunction of the internal braking transistor or of the external braking unit, the braking resistor can be only protected by mains disconnection. Therefrom, a line contactor is necessary when using the braking function. Furthermore, the use of the function "Line contactor control" is recommended..

By using the function "Line contactor control" the frequency inverter is itself able to connect and disconnect the mains by means of a contactor upstream. Therefore, a selectable digital output is activated with each start command (via keypad, terminals or bus) through which the line contactor is activated. The termination of the line contactor occurs with a stop command after a deceleration process has taken place, in the case of an occurring fault or if a lock signal is given, the line contactor releases immediately.



1.) When using an additional thermal relay, the auxiliary contact has to be integrated into the circuit of the line contactor.

An external 24 V buffer voltage is required for the supply of the inverter electronics.

In order to guarantee a safe switching-off of the line contactor when using an emergency STOP control, a digital input with the function "Mains cut-off" must be integrated.

Minimum resistance value of the braking resistor

In the technical data, R_{MIN} indicates the nominal value of the braking resistor that may not fall short due to the protection of the braking transistor (see chapter "Technical data" of the respective inverter). In the data, a resistor tolerance of -10% has been taken into consideration.

Maximum resistance value of the braking resistor

In the technical data, R_{MAX} indicates the nominal resistance value at which a peak braking power of 150% of the nominal inverter power can still be reached (see chapter "Technical data" of the respective inverter). In the data, a resistor tolerance of +20% (incl. heating) has been taken into consideration. If a braking resistor with a higher resistance value is used, the deceleration ramp must be extended depending on the accumulating peak braking power (this can also take place using the function "S-ramp") to prevent a fault shutdown with overvoltage.

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Allocation table for typical crane applications

Typical dimensioning for hoist applications

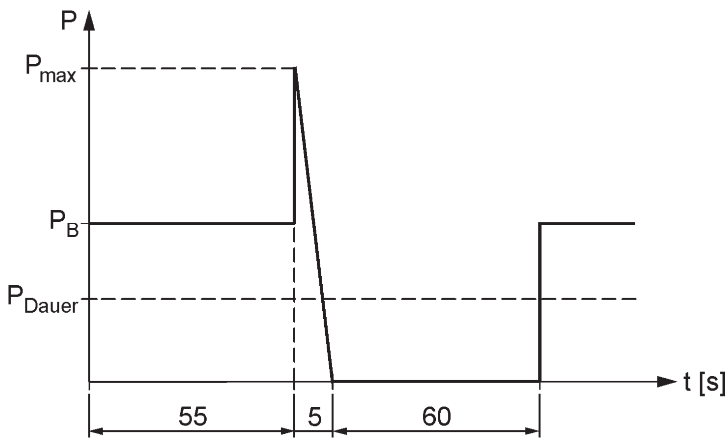
Typ. motor rating	Inverter	Braking unit	Braking resistor	P_{max} @ 1075 V	P_B	P_{CONT}
2.2	MX pro 6V2,2/3,0	internal	1 x VW3 A7 801	3.3 kW	1.5 kW	1.6 kW
3.0	MX pro 6V3,0/4,0	internal	1 x VW3 A7 801	4.5 kW	2.1 kW	1.6 kW
4.0	MX pro 6V4,0/5,5	internal	1 x VW3 A7 801	6.0 kW	2.8 kW	1.6 kW
5.5	MX pro 6V5,5/7,5	internal	1 x VW3 A7 802	8.3 kW	3.9 kW	5.6 kW
7.5	MX pro 6V7,5/11	internal	1 x VW3 A7 802	11 kW	5.3 kW	5.6 kW
11	MX pro 6V11/15	internal	1 x VW3 A7 802	17 kW	8.3 kW	5.6 kW
15	MX pro 6V15/18	internal	1 x VW3 A7 803	23 kW	12 kW	9.8 kW
18	MX pro 6V18/22	internal	1 x VW3 A7 803	27 kW	14 kW	9.8 kW
22	MX pro 6V22/30	internal	1 x VW3 A7 803	33 kW	18 kW	9.8 kW
30	MX pro 6V30/37	internal	1 x VW3 A7 804	45 kW	24 kW	22 kW
37	MX pro 6V37/45	internal	1 x VW3 A7 804	56 kW	30 kW	22 kW
45	MX pro 6V45/55	internal	1 x VW3 A7 804	68 kW	36 kW	22 kW
55	MX pro 6V55/75	internal	1 x VW3 A7 805	83 kW	44 kW	44 kW
75	MX pro 6V75/90	internal	1 x VW3 A7 805	113 kW	60 kW	44 kW
90	MX pro 6V90/110	internal	1 x VW3 A7 806	135 kW	79 kW	62 kW
110	MX pro 6V110/132	internal	1 x VW3 A7 806	165 kW	97 kW	62 kW
132	MX pro 6V132/160	internal	1 x VW3 A7 806	198 kW	116 kW	62 kW
160	MX pro 6V160/200	internal	1 x VW3 A7 806	240 kW	141 kW	62 kW
200	MX pro 6V200/250	VW3 A7 103	1 x VW3 A7 812	300 kW	176 kW	75 kW
250	MX pro 6V250/315	VW3 A7 103	2 x VW3 A7 806 [1)]	375 kW	220 kW	124 kW
315	MX pro 6V315/400	VW3 A7 103	2 x VW3 A7 806 [1)]	473 kW	277 kW	124 kW
400	MX pro 6V400/500	VW3 A7 104	3 x VW3 A7 806 [1)]	600 kW	352 kW	186 kW
500	MX pro 6V500/630	VW3 A7 104	4 x VW3 A7 806 [1)]	750 kW	440 kW	248 kW
630	MX pro 6V630/800	VW3 A7 104	4 x VW3 A7 806 [1)]	945 kW	554 kW	248 kW

[1)] Resistors in parallel

Typical braking power and cycles for hoist applications

P_{max}......Maximum braking power
P_B ....Braking power at lowering the load
$P_{Cont.........}$Continuous braking power

max. cycle time: 120 s



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Typical dimensioning for long travel applications

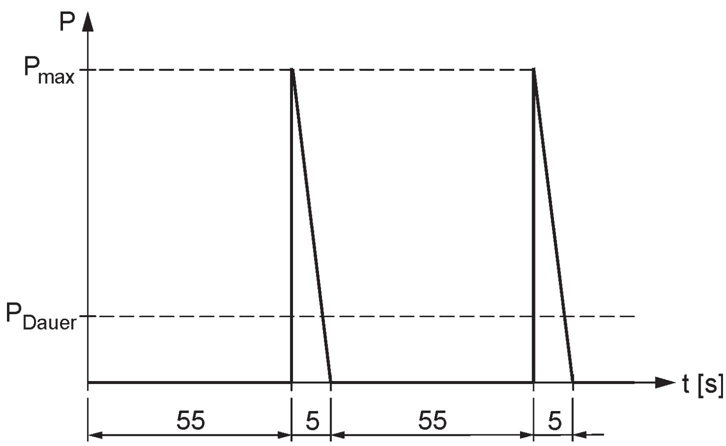
Typ. motor rating	Inverter	Braking unit	Braking resistor	P_{max} @ 1075 V	P_{CONT}
2.2	MX pro 6V2,2/3,0	internal	1 x VW3 A7 801	3.3 kW	1.6 kW
3.0	MX pro 6V3,0/4,0	internal	1 x VW3 A7 801	4.5 kW	1.6 kW
4.0	MX pro 6V4,0/5,5	internal	1 x VW3 A7 801	6.0 kW	1.6 kW
5.5	MX pro 6V5,5/7,5	internal	1 x VW3 A7 801	8.3 kW	1.6 kW
7.5	MX pro 6V7,5/11	internal	1 x VW3 A7 802	11 kW	5.6 kW
11	MX pro 6V11/15	internal	1 x VW3 A7 802	17 kW	5.6 kW
15	MX pro 6V15/18	internal	1 x VW3 A7 803	23 kW	9.8 kW
18	MX pro 6V18/22	internal	1 x VW3 A7 803	27 kW	9.8 kW
22	MX pro 6V22/30	internal	1 x VW3 A7 803	33 kW	9.8 kW
30	MX pro 6V30/37	internal	1 x VW3 A7 803	45 kW	9.8 kW
37	MX pro 6V37/45	internal	1 x VW3 A7 804	56 kW	22 kW
45	MX pro 6V45/55	internal	1 x VW3 A7 804	68 kW	22 kW
55	MX pro 6V55/75	internal	1 x VW3 A7 804	83 kW	22 kW
75	MX pro 6V75/90	internal	1 x VW3 A7 805	113 kW	44 kW
90	MX pro 6V90/110	internal	1 x VW3 A7 806	135 kW	62 kW
110	MX pro 6V110/132	internal	1 x VW3 A7 806	165 kW	62 kW
132	MX pro 6V132/160	internal	1 x VW3 A7 806	198 kW	62 kW
160	MX pro 6V160/200	internal	1 x VW3 A7 806	240 kW	62 kW
200	MX pro 6V200/250	VW3 A7 103	1 x VW3 A7 811	300 kW	56 kW
250	MX pro 6V250/315	VW3 A7 103	1 x VW3 A7 811	375 kW	56 kW
315	MX pro 6V315/400	VW3 A7 103	1 x VW3 A7 812	473 kW	75 kW
400	MX pro 6V400/500	VW3 A7 104	1 x VW3 A7 716	600 kW	75 kW
500	MX pro 6V500/630	VW3 A7 104	2 x VW3 A7 811 [1)]	750 kW	112 kW
630	MX pro 6V630/800	VW3 A7 104	2 x VW3 A7 812 [1)]	945 kW	150 kW

[1)] Resistors in parallel

Typical braking power and cycles for long travel applications

P_{max} ..... Maximum braking power
$P_{Cont.}$ .... Continuous braking power

max. cycle time: 120 s



Motor cable lengths

Because of the permitted mains disturbances, the allowed overvoltages at the motor, the occurring bearing currents and the permitted losses the distance between inverter and motor(s) is limited. The maximum distance heavily depends on the type of motor cable (screened/unscreened) as well as from the used options.

Overvoltages at the motor

Overvoltages at the motor terminals result from reflection in the motor cable. In case of motor cables with more than 10 m length the used motors must feature increased voltage resistance. Thereby the motor load is nearly independent from the used inverter !

Mains voltage 500 V	Motor insulation for 1600 V phase-to-phase peak voltage and dv/dt resistance > 8 kV/µs
Mains voltage 690 V	Motor insulation for 2000 V phase-to-phase peak voltage and dv/dt resistance > 8 kV/µs

In order to use standard motors in this voltage range, the MX pro have a function to inhibit short output voltage pulses. The function can be activated by means of parameter B3.32 "Min. length of pulses", whereby the overvoltages caused by the reflection are reduced. The slew rate as well as the EMC load are not influenced by changing this parameter.

At even longer motor cables the use of a "du/dt filter" is required. Combined with the cable capacitance the option MX AMF (output motor filter) affects like a filter and limits the voltage peaks at the motor as well as the slew rate of the output pulses.

When the specified motor cable lengths are observed the motor life time can be significantly extended.

Mains voltage 500 V	max. 1300 V phase-to-phase peak voltage and dv/dt < 750 V/µs
Mains voltage 690 V	max. 1600 V phase-to-phase peak voltage and dv/dt < 1000 V/µs

Observing the specified length of motor cables is absolutely necessary to protect the motor !

EMC interferences

The mains rectifier as well as the IGBT inverter cause high-frequent interferences which drain off more and more stronger to the earth potential with increasing motor cable length. As a result the line-conducted interferences to the mains increase. The attenuation of the line reactors is not longer sufficient and the permitted interference limits are exceeded.

Observing the specified length of motor cables is also necessary for compliance with the EMC limits !

Bearing currents

Common mode bearing currents which even cannot be prevented by means of motors equipped with an insulated bearing are significantly reduced by use of the option MX AMF.

Especially in case of big motors with middle up to high motor cable lengths the option MX AMF is considerable to increase the availability of the motor.

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Multiplication factors

The specified lengths of motor cables are recommended limits based on typical motor cables, laying in cable channels, default pulse frequency and maximal output frequency of 100 Hz.

In case of different conditions the recommended cable lengths must be converted by means of the following factors.

If several factors apply, please multiply them.

- The pulse frequency does not correspond to factory default:

MX pro 6V2,2/3,0...6V22/30:

at 4 kHz	multiply all values by 0.7
at 6 kHz	multiply all values by 0.6

MX pro 6V30/37...6V630/800:

at 4 kHz	multiply all values by 0.7

- In case of output frequencies higher than 100 Hz:

up to 200 Hz	multiply all values by 0.8
up to 300 Hz	multiply all values by 0.5

- Instead of two parallel cables one thicker cable is used: multiply all values by 1.5

- In case of 6-pole motor cabling (e.g. for star/delta starting circuit): multiply all values by 0.75

- In case of parallel motors with their centre near the inverter values must be converted in compliance with the number of motors. When an adjusted AMF is used for each motor, the following values in brackets apply.

at 2 motors	multiply all values by 0.40 (0.80)
at 3 motors	multiply all values by 0.25 (0.60)
at 4 motors	multiply all values by 0.15 (0.40)
at 5 motors	multiply all values by 0.10 (0.25)

- If the centre of the parallel motors is near the motors, following factors for conversion apply:

at 2 motors	multiply all values by 0.80
at 3 motors	multiply all values by 0.60
at 4 motors	multiply all values by 0.40
at 5 motors	multiply all values by 0.25

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Recommended maximum lengths of motor cables in 2nd environment (industrial environment)

MX options	MX pro 6V2,2/3,0…45/55	MX pro 6V55/75…630/800	Type of motor cable
C3 (EN 55011 - class A group 2)			
no options	10 m	15 m	screened
Option AMF	50 m	50 m	screened
Option RFI + AMF	75 (150) m	150 m	screened
Option RFI + SMF	150 m	150 m	screened
C4 (EMC concept)			
Option AMF	75 (150) m	150 m	screened
2 x Option AMF serial	150 (300) m	300 m	screened
Option SMF	200 m	200 m	screened
no options	20 m	30 m	unscreened
Option AMF	100 (250) m	250 m	unscreened
2 x Option AMF serial	180 (400) m	400 m	unscreened
Option SMF	300 m	300 m	unscreened

Values in brackets () … with option AMF 215-3 instead of AMF xx-1

To reduce the voltage load and bearing currents in the motor, the use of the option MX AMF makes sense from motor cable lengths of 10 m.

When an output motor filter MX AMF is used, a voltage stress of the motor occurs at 690 V mains voltage according to the following table:

Motor cable length	Voltage slew rate dv/dt	Peak voltage V_{PEAK}
10 m	1000 V/µs	1250 V
50 m	850 V/µs	1350 V
100 m	480 V/µs	1400 V
200 m	400 V/µs	1500 V
300 m	350 V/µs	1550 V
400 m	350 V/µs	1600 V
> 400 m	350 V/µs	max. 1800 V

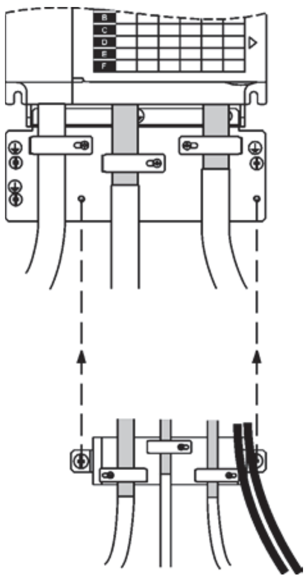
Wiring remarks for power and control cables

Take the control wiring separately from the mains cables, motor cables and any other power cables. The control wiring should be screened and should not exceed 20 m.

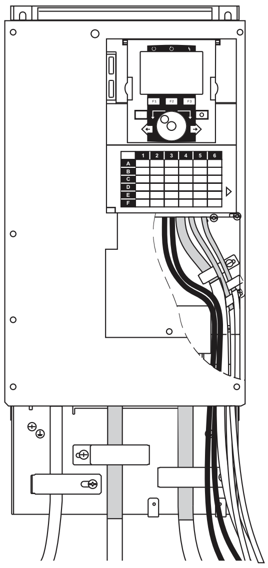
If crossings with power cables cannot be prevented, take them with 90° angle.

All MX eco & pro 4V0,75...4V75 and MX pro 6V2,2/3,0…6V75/90 inverters are delivered with an EMC plate including screws and suitable cable clamps. It is used to fix all cables to the inverter and presents an optimal connection between motor cable screen and radio interference filter. Moreover, all screens of the control wires can be connected to the EMC plate.

MX eco & pro 4V0,75…4V18



MX eco & pro 4V22...4V75
MX pro 6V2,2/3,0...6V75/90



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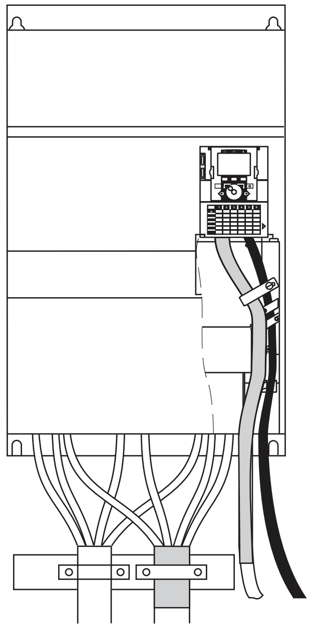
The total height of the inverter alters when using the EMC plate corresponding to this additional element.

Device	Height of the device
MX eco & pro 4V0,75…4V4,0	+83 mm
MX eco & pro 4V5,5…4V18	+95 mm
MX eco & pro 4V22...4V75 MX pro 6V2,2/3,0...6V75/90	+120 mm

For the leading-in of the control wires the MX eco & pro from 90kW have a separate cable tray which is insulated from the power part. Therein, the cable clamps for connecting the screens can be found just underneath the control terminals.



The connection between the motor cable screen and the radio interference filter inside the inverter or the option MX RFI is established via a well-conductive mounting plate. Alternatively the terminal box option MX TER-BOX can be used.

Control terminals

The frequency inverters MX pro are equipped with extensive control terminals as standard. The use and the function of all inputs and outputs can be parameterized.

For extension the option cards IO11 and IO12 are available. The same option card can be plugged in only one time per unit.

The inverters MX pro can be equipped at most with 2 option cards (terminal extension and/or field bus).

Listing of all control terminals

Control terminals		Standard equipment	Option IO11	Option IO12	Max. equipment
Reference voltages	+10 V	x	–	–	x
	-10 V	–	x	x	x
	+24 V	x	x	x	x
Ext. buffer voltage	24 V DC	x	–	–	x
Inputs					
Analog inputs (limits and usage can be parameterized)	0...±10 V (differential)	1x	–	–	1x
	0(4)...20 mA (differential)	–	–	1x	1x
	alternatively 0...+10 V or 0(4)...20 mA	1x	–	1x	2x
Digital inputs (function can be parameterized)	DI (24 V, positive / negative logic)	5x	4x	4x	13x
	alternatively DI or thermistor	1x	–	–	1x
Thermistor inputs	Thermistor	–	1x	1x	2x
	alternatively DI or thermistor	1x	–	–	1x
Safety input	"Safe Standstill"	1x	–	–	1x
Digital ref. value	0...30 kHz	–	–	1x	1x
Outputs					
Analog outputs (selection of actual values can be parameterized)	alternatively 0...+10 V or 0(4)...20 mA	1x	–	–	1x
	alternatively ±10 V or 0(4)...20 mA	–	–	2x	2x
Digital outputs (function can be parameterized)	Open Collector 24 V DC	–	2x	2x	4x
Relay outputs (function can be parameterized)	N.O./N.C.	1x	1x	1x	3x
	N.O.	1x	–	–	1x

The ground (0 V) can float up to 35 V compared to PE. The connection 0 V – ground which is necessary to limit the voltage can therefore e.g. also occur far away in the PLC (if necessary by the analog output related to 0 V).

The analog input AI1 with differential amplifier (as well as AI3 of the option card IO12) enables the reference assignment decoupled from the ground.

Keep the maximum cable length of 15 m for the wiring of the safety input PWR "Safe standstill".

The device fulfills all requirements for protective separation between power and electronic connections according to EN 61800-5-1.

Also all connected circuits must fulfil the requirements for protective separation to guarantee protective separation.

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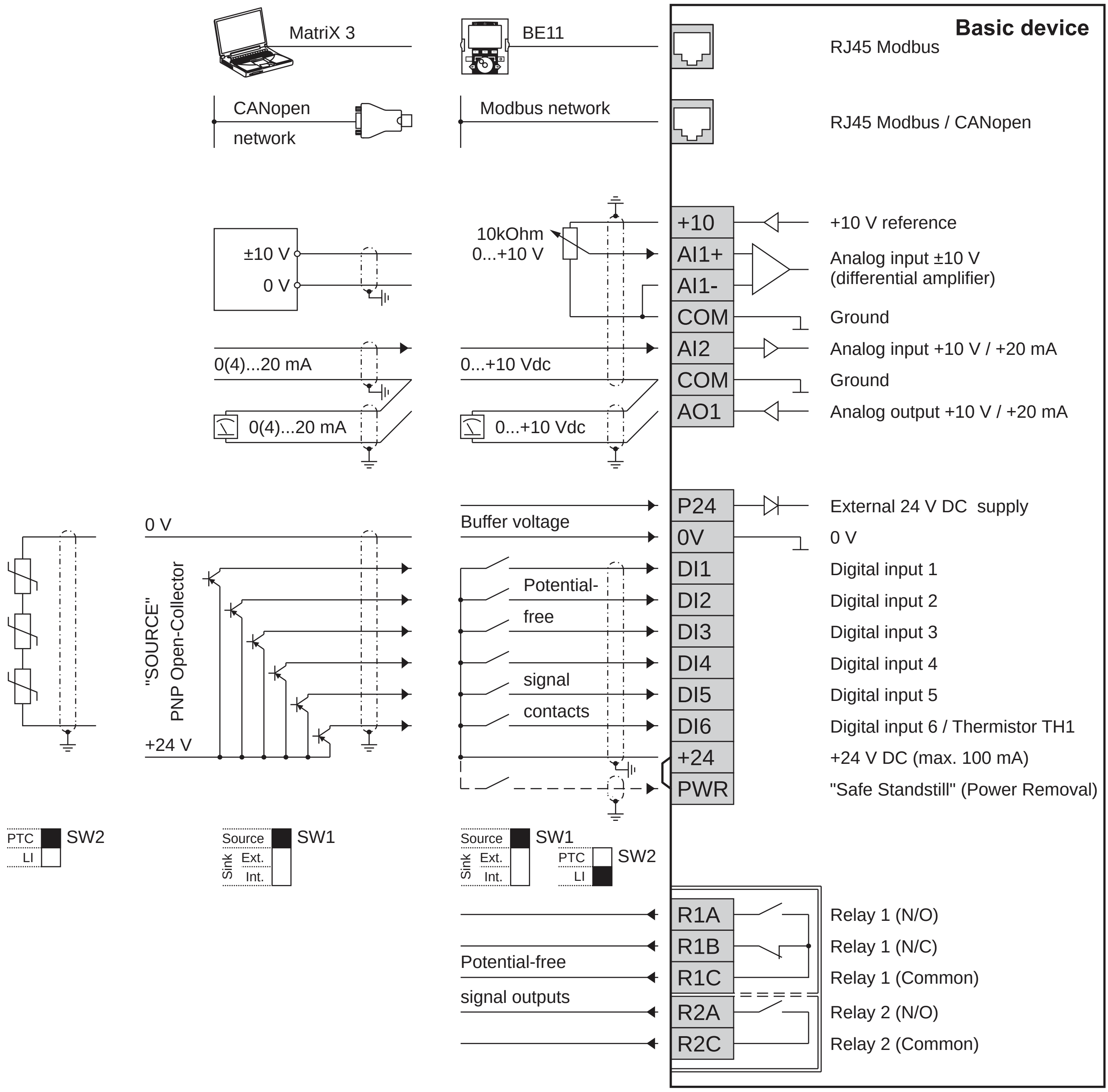
Standard control terminals of the frequency inverter



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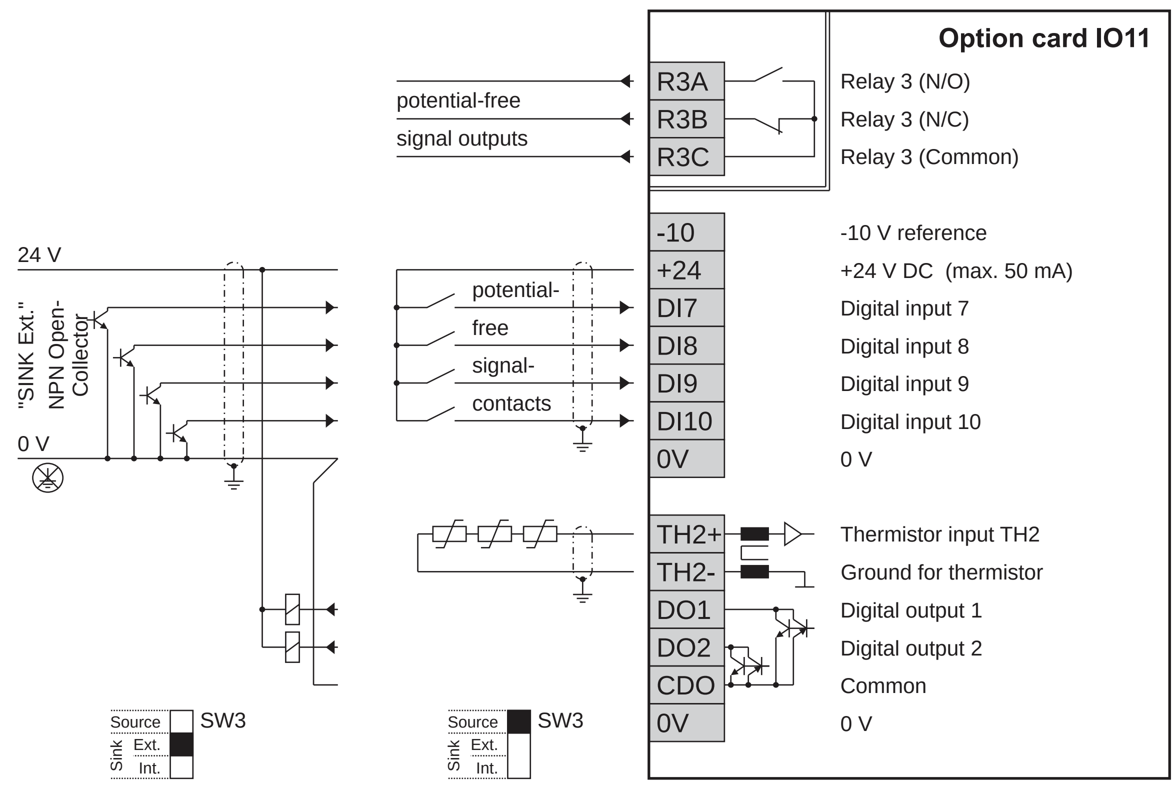
The use of the individual inputs and outputs as well as their limits can be adjusted by means of the device software. Only the alternative use of the digital input DI6 for motor thermistor monitoring and the selection of the switching method for all digital inputs has to be adjusted by means of the sliding switch.

The inverters MX pro are equipped with a built-in interface for control via Modbus. In addition to the external wiring (connection to the T-pieces in the bus line) only the adjustment of few parameters is necessary.

Alternatively, this interface can be also used for the CANopen bus. Therefore, an adapter is required for conversion of the RJ45 plug to SUB-D (CANopen standard CiA DRP 303-1). The bus wiring is taken by connection to the next device.

A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 209.

Control terminals of option card IO11



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The terminal extension IO11 is a cost-effective solution with additional digital inputs and outputs, one relay output and one high-quality thermistor input. The card cannot be used twice.

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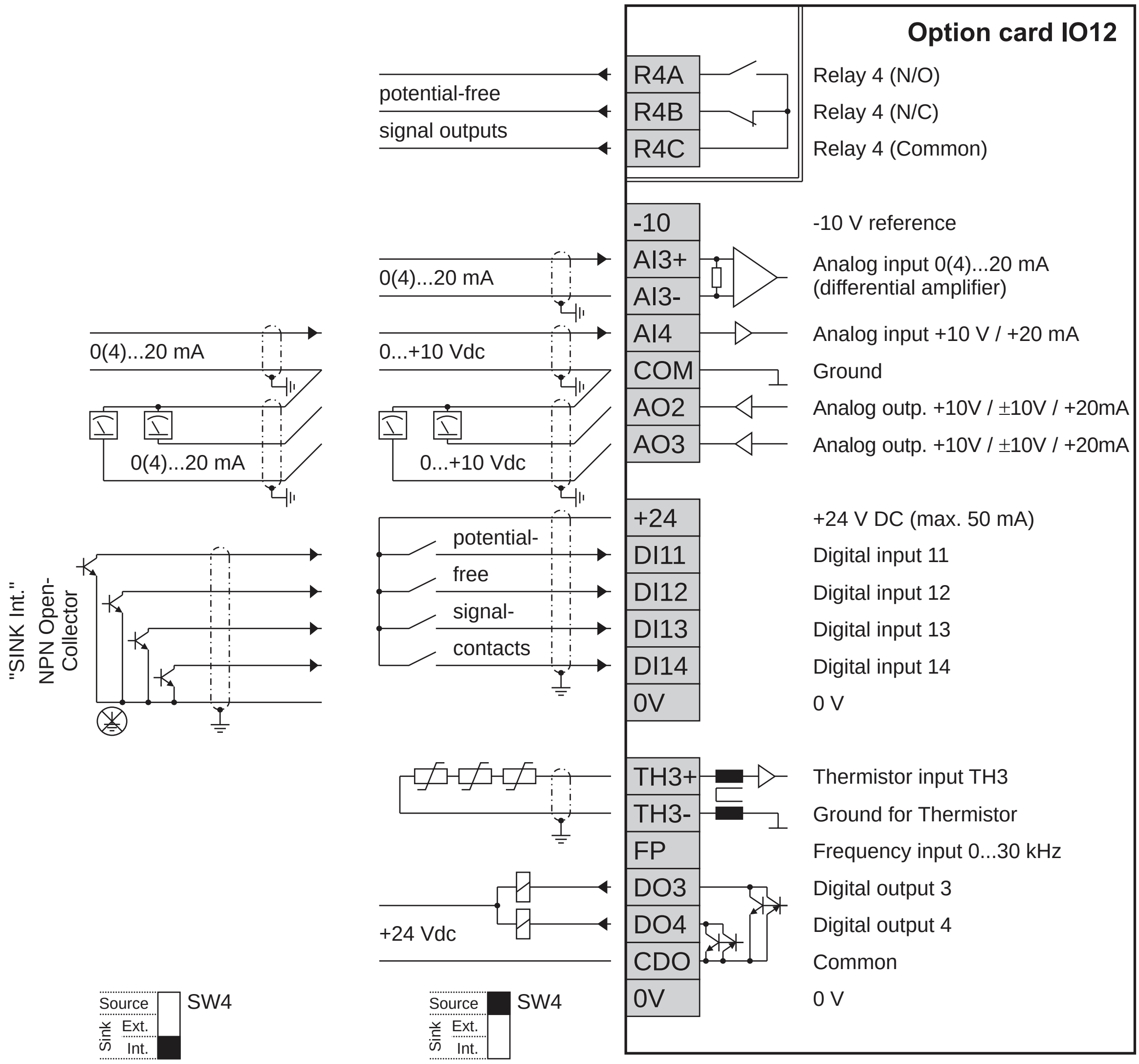
The setting for positive or negative logic of the option card can be taken independent from the digital inputs of the basic device by means of the sliding switch SW3.

Parameters which belong to the inputs and outputs of the option cards are only available at the inverter when the card(s) are plugged. Thus, wrong parameterization of functions close to the terminals is extensively prevented.

A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 209.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

Control terminals of option card IO12



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The terminal extension IO12 can be plugged in addition or as an alternative to the option IO11. The card cannot be used twice.

The setting for positive or negative logic of the option card can be taken independent from the digital inputs of the basic device by means of the sliding switch SW4.

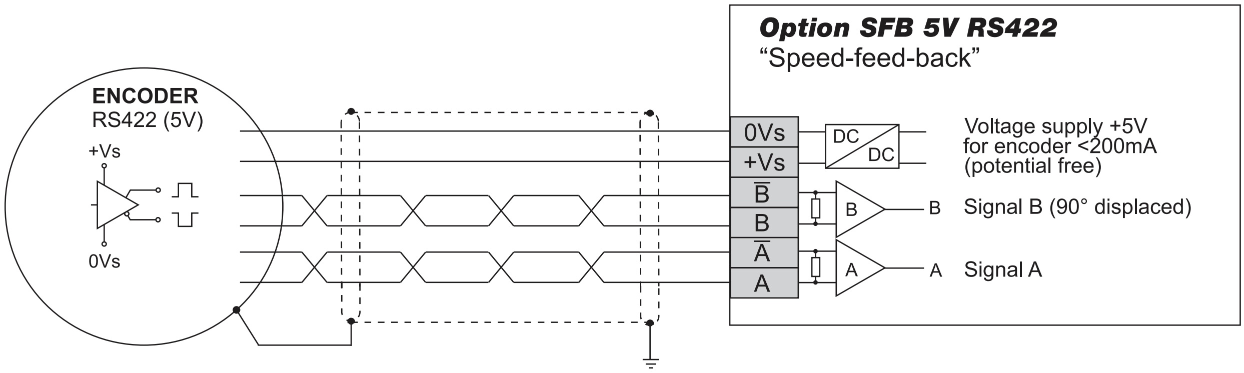
All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

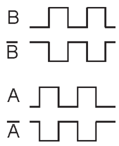
Control terminals of the option cards SFB

The option cards SFB are used to evaluate the pulses of an encoder which is attached to the motor.

Three option cards with different supply voltages for the encoder and with different types of signals are available.

SFB 5V RS422

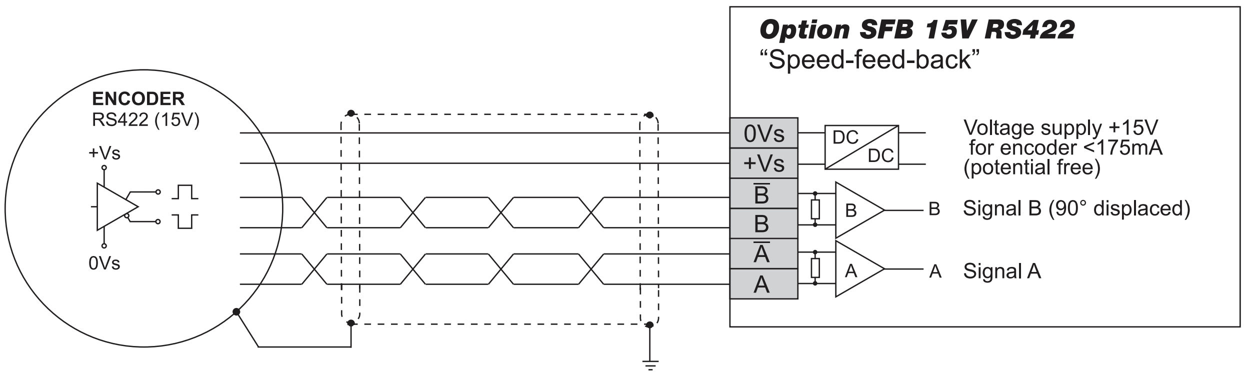


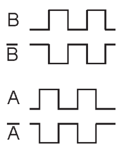


Recommended minimum cable cross section:

up to 25 m: 0.5 mm²
up to 50 m: 0.75 mm²
up to 100 m: 1.5 mm²

SFB 15V RS422

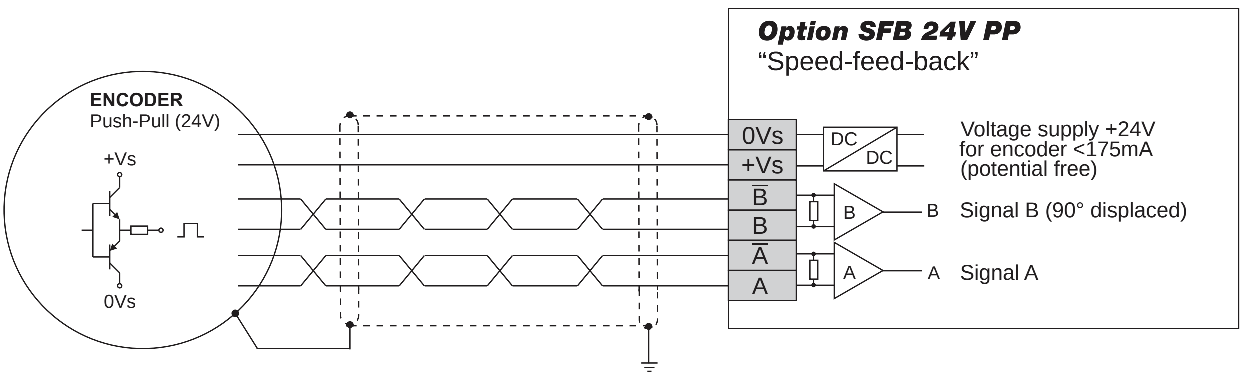


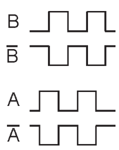


Recommended minimum cable cross section:

up to 25 m: 0.2 mm²
up to 100 m: 0.5 mm²
up to 600 m: 1.0 mm²

SFB 24V PP





Recommended minimum cable cross section:

up to 600 m: 0.2 mm²

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Purchase order

The order code of the MX pro frequency inverter consists of 9 points of reference (characters and figures). The meaning of each point is illustrated in the following example.

	1	2	3	4	5	6	7	8	9	*Ref. point*
ELN	M	P	6	C	1	6	A	A	B	Example

	Meaning
Point 9	Hardware configuration "A" ... without built-in braking unit (from MX pro 6V200/250) "B" ... with built-in braking unit (up to MX pro 6V160/200)
Point 8	Specification of language / Software "A" ... standard "S" ... applications with synchronous motor "T" ... applications with step-up transformer "D" ... liquid-cooled inverter
Point 7	Favored device variant "A" ... standard "T" ... device variant TRAFO-BOX (from MX pro 6V90/110) "L" ... liquid-cooled inverter
Points 4...6	Indication of device power (with high overload) U22...U75 for MX pro 6V2,2/3,0...6V7,5/11 D11...D90 for MX pro 6V11/15...6V90/110 C11...C63 for MX pro 6V110/132...630/800
Point 3	"6" for devices with 500...690 V mains voltage
Point 2	"P" for product line MX pro
Point 1	"M" for product family MX

Options for the inverter device must be ordered additionally. The respective order numbers are given in chapter "Options", as from page 197.

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Documentation

The documentation of the MX pro frequency inverters is divided into different documents for better clarity:

- **Product leaflets** give an overview of the characteristics and functions of the devices
- **Product catalogue** for planning and ordering of the drives
- Printed copies of the **operating instructions** are enclosed with each device
- **Description of the functions** with detailed description of all functions and parameters
- **Operating instructions** for divers fieldbuses like Modbus, CANopen and Profibus
- **Mounting instructions** for professional mounting and connection of the inverters
- **Installation instructions** for the individual options

In addition to the operating instructions a CD-ROM is attached to each inverter (order number 8 P01 021). It contains all above-mentioned instructions as well as the PC-program Matrix 3 for perfect commissioning and diagnosis of the inverters.

Further reading

If you need instructions in printed form, you can ask for them by means of the below-mentioned order number.

Designation	Order number	Brief description
Product leaflet of MX eco & MX pro frequency inverters	8 P01 000 DE 8 P01 000 EN	Overview of the characteristics of the device, external design of the inverter and its most important functions
Product catalogue of MX eco & MX pro frequency inverters	8 P01 002 DE 8 P01 002 EN	General description of the device, technical data, valid standards, information about planning and ordering of the frequency inverters and its options
Product catalogue of MX multi-eco & MX multi-pro frequency inverters in cubicle design	8 P01 004 DE 8 P01 004 EN	General description of the device, technical data, valid standards, information about planning and ordering of the frequency inverters and its options
Operating instructions for MX eco & MX pro	8 P01 022	Unpacking, operating, mounting and trouble shooting as well as important remarks for handling and possible dangers
Description of functions for MX pro	8 P01 323 DE 8 P01 323 EN	Operating and parameterizing, complete parameter list, alarm and trip messages, description of the PC-program Matrix 3
Mounting instructions for MX pro 4V	8 P01 325 DE 8 P01 325 EN	Technical data, valid standards, mounting, connection, ambient conditions
Mounting instructions for MX pro 6V	8 P01 329 DE 8 P01 329 EN	Technical data, valid standards, mounting, connection, ambient conditions
Mounting instructions for MX pro 4L & 6L	8 P01 344 DE 8 P01 344 EN	Technical data, valid standards, mounting, connection, ambient conditions
Operating instructions Modbus for MX pro	8 P01 333 DE 8 P01 333 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions CANopen for MX pro	8 P01 331 DE 8 P01 331 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions Profibus DP for MX pro	8 P01 327 DE 8 P01 327 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Projecting guide medium voltage motors for MX pro	8 P01 037 DE 8 P01 037 EN	Dimensioning and parameterization of drives for medium voltage motors

Further information can also be found on our homepage www.schneider-electric-power-drives.com.

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Available options for MX pro 6V inverters

To enlarge the field of applications for the frequency inverters MX pro, various options are available concerning control and operation, extensions referring to the electric arrangement and to increase the protection degree.

General options

Designation	Order number	Brief description	Reference
Operating options			
MX BE11	ELN 8 P01 100 (8 P01 100/B)	Matrix operating panel affords optimal operating comfort by means of the matrix philosophy	Page 198
MX DMK11	ELN 8 P01 120	Door mounting kit for installing the operating panel BE11 in a cubicle door, up to 10 m away from the inverter	Page 200
MX DMK11-IP65	VW3 A1 103	Transparent IP65 cover for the door mounting kit of the operating panel BE11	
MX CABLE3-BE	VW3 A1 104R30	Connecting cable operating panel – inverter with 3 m length	
MX CABLE10-BE	VW3 A1 104 R100	Connecting cable operating panel – inverter with 10 m length	
Manual-CD MX eco & pro	8 P01 021	This CD-ROM provides the whole documentation of the inverter as well as the PC program Matrix 3	Page 31
MX CABLE3-PC	ELN 8 P01 124	Connecting cable inverter – PC with 3 m length, incl. RS232/485 interface converter on the computer side	
MX ADAP BLUE	VW3 A8 114	Bluetooth adapter	
MX RS232/485	Phönix Contact PSM-ME-RS232/RS485-P	RS232/485 interface converter with supply and active bus connection	
MX MATRIX REMOTE LINK	8 P01 128	Remote maintenance option for analog modem connection or Ethernet network.	
MX ADAP RJ45	VW3 A1 105	RJ45 F/F adapter is required for the connection of the operating panel BE11 to the connecting cable	
Control options			
MX IO11	ELN 8 P01 101	Terminal extension for additional digital inputs and outputs	Page 209
MX IO12	ELN 8 P01 102	Terminal extension for additional analog and digital inputs and outputs	
MX SFB 5V RS422	VW3 A3 401	Extension card for encoder feedback. Supply voltage 5 V / RS422	Page 213
MX SFB 15V RS422	VW3 A3 402	Extension card for encoder feedback. Supply voltage 15 V / RS422	
MX SFB 24V PP	VW3 A3 407	Extension card for encoder feedback. Supply voltage 24 V / push-pull	
MX MODBUS T-ADAP 03	VW3 A8 306 TF03	Modbus T-adapter with 0.3 m connecting cable	Page 205
MX MODBUS T-ADAP 1	VW3 A8 306 TF10	Modbus T-adapter with 1 m connecting cable	
MX MODBUS RC	VW3 A8 306 RC	Bus termination RC	
MX MODBUS SPLITTER	LU9 GC3	Divides the Modbus signal into eight further channels	
MX MODBUS PLUG	Phönix Contact VS-08-RJ45-5-Q/IP20	RJ45 connector IP20 with quick-connecting technology	
MX ADAP CAN	VW3 CAN A71	RJ45/Sub-D adapter for the connection of the inverter to a CANopen fieldbus network	Page 207
MX CANOPEN PLUG	TSX CAN KCDF 180 T	Connecting plug for CANopen network	
MX CAN TAP2	VW3 CAN TAP 2	Passive CAN adapter with shiftable terminating resistor	
MX PBO11	ELN 8 P01 103	Option card for control of the inverter via Profibus DP	Page 208
MX PROFIBUS PLUG	Phönix Contact SUBCON-PLUS-PROFIB/AX/SC	Connecting plug for Profibus network	

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Options depending on the power

Designation	Order number	Brief description	Reference
Options depending on the power			
MX TRAFO-BOX	See following allocation table	Fan supply transformer to provide 3AC 400V out of 500…600 V or 690 V mains supply. Available as inverter device variant	Page 244
MX NDU		Three-phase choke to reduce the mains current harmonics to THD I ≤ 48 %	Page 223
MX BU		External braking unit for MX pro 6V200/250 to 6V630/800.	Page 228
MX BR		Braking resistor for short deceleration time or short-time dynamic loads	Page 232
MX AMF		Output motor filter enables the use of the inverter with long motor cables and limits the voltage peaks in the motor	Page 236
MX SMF		Sinus motor filter enables the use of the inverter with very long motor cables and prevents additional noises in the motor, necessary in case of step-up transformers	Page 240
MX TER-BOX		Terminal box which is attached at the bottom of the inverter for mechanical support and connection of the motor cable screen	Page 246
MX FLANGE		Flange mounting kit to install the inverter in flange mounting technology (heat sink outside the cubicle)	Page 249

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Allocation table for options depending on the power

	Option NDU	Option AMF	Device variant with TRAFO-BOX	Option SMF
MX pro 6V2,2/3,0	VW3 A4 551	VW3 A5 102 (AMF 48-1)	-	-
MX pro 6V3,0/4,0	VW3 A4 551	VW3 A5 102 (AMF 48-1)	-	-
MX pro 6V4,0/5,5	VW3 A4 551	VW3 A5 102 (AMF 48-1)	-	-
MX pro 6V5,5/7,5	VW3 A4 553	VW3 A5 102 (AMF 48-1)	-	-
MX pro 6V7,5/11	VW3 A4 553	VW3 A5 102 (AMF 48-1)	-	-
MX pro 6V11/15	VW3 A4 554	VW3 A5 102 (AMF 48-1)	-	-
MX pro 6V15/18	VW3 A4 554	VW3 A5 102 (AMF 48-1)	-	-
MX pro 6V18/22	VW3 A4 554	VW3 A5 103 (AMF 90-1)	-	-
MX pro 6V22/30	VW3 A4 555	VW3 A5 103 (AMF 90-1)	-	-
MX pro 6V30/37	VW3 A4 555	VW3 A5 103 (AMF 90-1)	-	-
MX pro 6V37/45	VW3 A4 555	VW3 A5 103 (AMF 90-1)	-	-
MX pro 6V45/55	VW3 A4 555	VW3 A5 103 (AMF 90-1)	-	-
MX pro 6V55/75	VW3 A4 556	VW3 A5 104 (AMF 215-3)	-	-
MX pro 6V75/90	VW3 A4 570 (NDU 160)	VW3 A5 104 (AMF 215-3)	-	-
MX pro 6V90/110	VW3 A4 570 (NDU 160)	VW3 A5 104 (AMF 215-3)	ELNMP6D90TAB (MX pro incl. MX TRAFO-BOX 330)	VW3 A5 212 (SMF 6V240)
MX pro 6V110/132	VW3 A4 570 (NDU 160)	VW3 A5 104 (AMF 215-3)	ELNMP6C11TAB (MX pro incl. MX TRAFO-BOX 330)	VW3 A5 212 (SMF 6V240)
MX pro 6V132/160	VW3 A4 571 (NDU 230)	VW3 A5 105 (AMF 320-3)	ELNMP6C13TAB (MX pro incl. MX TRAFO-BOX 330)	VW3 A5 212 (SMF 6V240)
MX pro 6V160/200	VW3 A4 571 (NDU 230)	VW3 A5 105 (AMF 320-3)	ELNMP6C16TAB (MX pro incl. MX TRAFO-BOX 330)	VW3 A5 212 (SMF 6V240)
MX pro 6V200/250	VW3 A4 560 (NDU 280)	VW3 A5 106 (AMF 480-3)	ELNMP6C20TAA (MX pro incl. MX TRAFO-BOX 585)	VW3 A5 213 (SMF 6V460)
MX pro 6V250/315	VW3 A4 572 (NDU 450)	VW3 A5 106 (AMF 480-3)	ELNMP6C25TAA (MX pro incl. MX TRAFO-BOX 585)	VW3 A5 213 (SMF 6V460)
MX pro 6V315/400	VW3 A4 572 (NDU 450)	VW3 A5 107 (AMF 760-3)	ELNMP6C31TAA (MX pro incl. MX TRAFO-BOX 585)	VW3 A5 213 (SMF 6V460)
MX pro 6V400/500	2 x VW3 A4 568 (2 x NDU 315)	VW3 A5 107 (AMF 760-3)	ELNMP6C40TAA (MX pro incl. MX TRAFO-BOX 1100)	VW3 A5 214 (SMF 6V900)
MX pro 6V500/630	2 x VW3 A4 572 (2 x NDU 450)	VW3 A5 108 (AMF 1190-3)	ELNMP6C50TAA (MX pro incl. MX TRAFO-BOX 1100)	VW3 A5 214 (SMF 6V900)
MX pro 6V630/800	2 x VW3 A4 572 (2 x NDU 450)	VW3 A5 108 (AMF 1190-3)	ELNMP6C63TAA (MX pro incl. MX TRAFO-BOX 1100)	VW3 A5 214 (SMF 6V900)

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	Option BU	Option BR Hoist	Option BR Long-travel
MX pro 6V2,2/3,0	Integrated braking unit	1 x VW3 A7 801	1 x VW3 A7 801
MX pro 6V3,0/4,0	Integrated braking unit	1 x VW3 A7 801	1 x VW3 A7 801
MX pro 6V4,0/5,5	Integrated braking unit	1 x VW3 A7 801	1 x VW3 A7 801
MX pro 6V5,5/7,5	Integrated braking unit	1 x VW3 A7 802	1 x VW3 A7 801
MX pro 6V7,5/11	Integrated braking unit	1 x VW3 A7 802	1 x VW3 A7 802
MX pro 6V11/15	Integrated braking unit	1 x VW3 A7 802	1 x VW3 A7 802
MX pro 6V15/18	Integrated braking unit	1 x VW3 A7 803	1 x VW3 A7 803
MX pro 6V18/22	Integrated braking unit	1 x VW3 A7 803	1 x VW3 A7 803
MX pro 6V22/30	Integrated braking unit	1 x VW3 A7 803	1 x VW3 A7 803
MX pro 6V30/37	Integrated braking unit	1 x VW3 A7 804	1 x VW3 A7 803
MX pro 6V37/45	Integrated braking unit	1 x VW3 A7 804	1 x VW3 A7 804
MX pro 6V45/55	Integrated braking unit	1 x VW3 A7 804	1 x VW3 A7 804
MX pro 6V55/75	Integrated braking unit	1 x VW3 A7 805	1 x VW3 A7 804
MX pro 6V75/90	Integrated braking unit	1 x VW3 A7 805	1 x VW3 A7 805
MX pro 6V90/110	Integrated braking unit	1 x VW3 A7 806	1 x VW3 A7 806
MX pro 6V110/132	Integrated braking unit	1 x VW3 A7 806	1 x VW3 A7 806
MX pro 6V132/160	Integrated braking unit	1 x VW3 A7 806	1 x VW3 A7 806
MX pro 6V160/200	Integrated braking unit	1 x VW3 A7 806	1 x VW3 A7 806
MX pro 6V200/250	VW3 A7 103 (BU 6V450)	1 x VW3 A7 812	1 x VW3 A7 811
MX pro 6V250/315	VW3 A7 103 (BU 6V450)	2 x VW3 A7 806 [1)]	1 x VW3 A7 811
MX pro 6V315/400	VW3 A7 103 (BU 6V450)	2 x VW3 A7 806 [1)]	1 x VW3 A7 812
MX pro 6V400/500	VW3 A7 104 (BU 6V900)	3 x VW3 A7 806 [1)]	1 x VW3 A7 716
MX pro 6V500/630	VW3 A7 104 (BU 6V900)	4 x VW3 A7 806 [1)]	2 x VW3 A7 811 [1)]
MX pro 6V630/800	VW3 A7 104 (BU 6V900)	4 x VW3 A7 806 [1)]	2 x VW3 A7 812 [1)]

[1)] Resistors in parallel

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	Option TER-BOX	Option FLANGE
MX pro 6V2,2/3,0	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V3,0/4,0	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V4,0/5,5	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V5,5/7,5	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V7,5/11	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V11/15	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V15/18	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V18/22	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V22/30	VW3 A9 105 (TER-BOX 230)	VW3 A9 505 (FLANGE 230 x 400)
MX pro 6V30/37	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 6V37/45	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 6V45/55	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 6V55/75	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 6V75/90	VW3 A9 108 (TER-BOX 320)	VW3 A9 509 (FLANGE 320 x 630)
MX pro 6V90/110	VW3 A9 111 (TER-BOX 330)	VW3 A9 509 (FLANGE 330 x 950)
MX pro 6V110/132	VW3 A9 111 (TER-BOX 330)	VW3 A9 509 (FLANGE 330 x 950)
MX pro 6V132/160	VW3 A9 111 (TER-BOX 330)	VW3 A9 509 (FLANGE 330 x 950)
MX pro 6V160/200	VW3 A9 111 (TER-BOX 330)	VW3 A9 509 (FLANGE 330 x 950)
MX pro 6V200/250	VW3 A9 113 (TER-BOX 585)	VW3 A9 513 (FLANGE 585 x 950)
MX pro 6V250/315	VW3 A9 113 (TER-BOX 585)	VW3 A9 513 (FLANGE 585 x 950)
MX pro 6V315/400	VW3 A9 113 (TER-BOX 585)	VW3 A9 513 (FLANGE 585 x 950)
MX pro 6V400/500	VW3 A9 116 (TER-BOX 1100)	-
MX pro 6V500/630	VW3 A9 116 (TER-BOX 1100)	-
MX pro 6V630/800	VW3 A9 116 (TER-BOX 1100)	-

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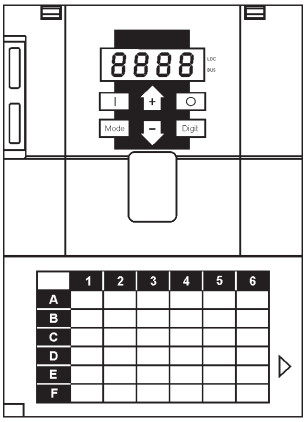
Options

Operating options



The MX eco & pro frequency inverters include a four-digit, seven-segment LED display as standard which can be used to operate and parameterize the inverter.

This integrated keypad is sufficient to obtain queries and adjustments of single parameters whereas not all special functions can be used. Also the adjustment without instructions is not possible because of the unavailable parameter texts.

By means of the integrated buttons the inverter can be operated in panel mode.

For expanded operation, several interfaces are available on the frequency inverter:

RJ45 interface on the front can be used for:

- Matrix operating panel BE11 - can be plugged in directly
  or
- Matrix operating panel BE11 in the door mounting kit DMK11
  (connected via the connecting cable CABLE 3-BE or CABLE 10-BE)
  or
- Matrix 3 PC program (via connecting cable CABLE 3-PC)

RJ45 interface next to control terminals can be used for:

- Matrix operating panel BE11 in the door mounting kit DMK11 [1)]
  (connected via the connecting cable CABLE 3-BE or CABLE 10-BE)
  or
- Matrix 3 PC program (via connecting cable CABLE 3-PC) [1)]
  or
- Matrix 3 PC program (via Bluetooth adapter)
  or
- Matrix 3 PC program (for several inverters via the Modbus interface converter)
  or
- Matrix 3 PC program (remote maintenance for several inverters by means of matrix remote link by modem or Ethernet connection)
  or
- MODBUS fieldbus
  or
- CANopen fieldbus (ADAP-CAN adapter required)

[1)] The parameters in matrix field D6 for adjusting the Modbus must be set to the factory setting !

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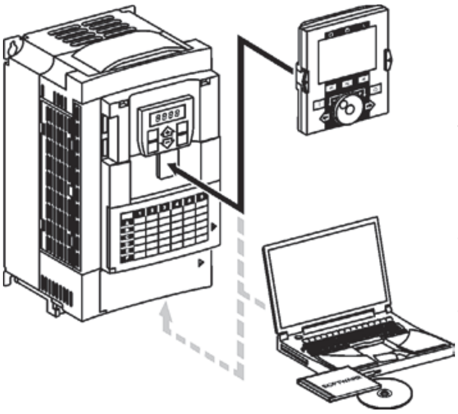
Matrix operating panel BE11



Utmost ease of use is provided by means of the matrix operating panel MX BE11. It is plugged at the front door of the device and adapts itself ergonomically into the device design.

Designation:	Option MX BE11 (Option MX BE11/A)
Order number:	ELN 8 P01 100
Designation:	Option MX BE11/B
Order number:	8 P01 100/B

Properties of the removable matrix operating panel BE11:

- 8-line LCD full-graphic display (240 x 160 pixel) for indication of plaintext
- Proven parameter access by means of the matrix structure in various languages
- Integrated indication of the operating state in the chosen language
- Indication of three selectable actual values
- Indication of the actual control source
- Rotating wheel with keying function for quick parameter access
- Seven further buttons (thereof 3 function keys for simple navigation)
- Protection degree IP54
- Copying of existing parameter settings onto other devices by simply connecting the matrix operating panel BE11 onto them

Because the matrix operating panel MX BE11 is plugged at the front side of the inverter, it affects the total depth of the device.

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All language-dependent texts in the MX eco & pro are stored in the removable Matrix operating panel.

Corresponding to the used language package, different national languages are selectable. When an inverter with connected matrix operating panel is switched on first-time, all languages that are available in the BE11 are displayed for selection.

The language selected is kept also when the Matrix operating panel is connected to another inverter.

Language	Languages contained in the matrix operating panel	
	BE11	BE11/B
German	✓	–
English	✓	✓
Bulgarian	✓	–
French	✓	–
Italian	✓	–
Korean	–	✓
Lithuanian	–	✓
Polish	–	✓
Russian	✓	✓
Slovak	–	✓
Spanish	✓	–
Czech	–	✓
Turkish	✓	–
Hungarian	–	✓

✓ ... Available

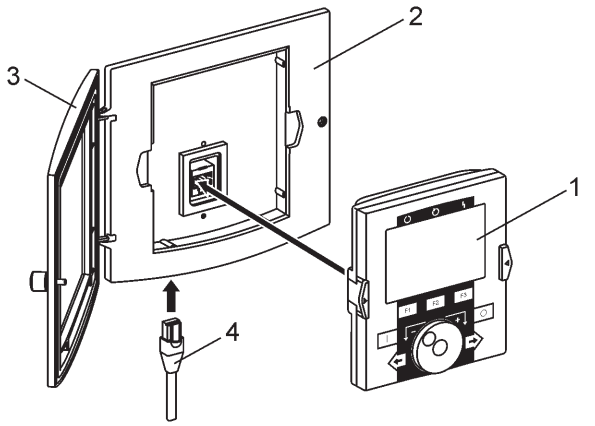
The set language can be changed later by means of parameter B1.01.

If the software versions do not correspond between device and operating panel, it can happen that individual parameter texts are missing. In this case the respective Matrix code or the line number is displayed.

Door mounting kit DMK11

The door mounting kit MX DMK11 enables the installation of the matrix operating panel BE11 in the cubicle door (protection degree IP54). It guarantees safe operation of the inverter with closed cubicle door and separates the position of the inverter in the cubicle from the optimal height for handling.

An additional "IP65 transparent cover" protects the made device settings against unintentional modifications whereas the operating state can be still read off.



1 Option Matrix operating panel MX BE 11

2 Door mounting kit
Designation: Option MX DMK11
Order number: ELN 8 P01 120

3 IP65 transparent cover
Designation: Option MX DMK11-IP65
Order number: VW3 A1 103

4 Connecting cable operating panel – inverter
3 m length:
Designation: Option MX CABLE 3-BE
Order number: VW3 A1 104 R30
10 m length:
Designation: Option MX CABLE 10-BE
Order number: VW3 A1 104 R100

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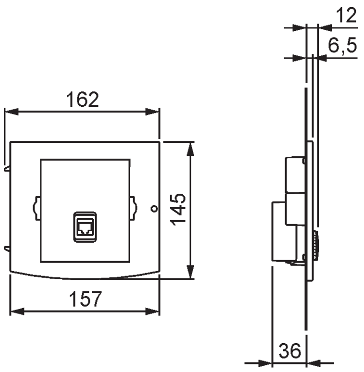
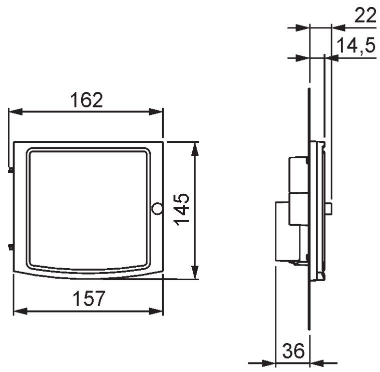
Dimensions in mm

Door mounting kit DMK11

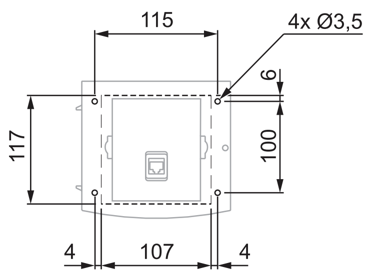


IP65 transparent cover DMK11-IP65



Drilling plan

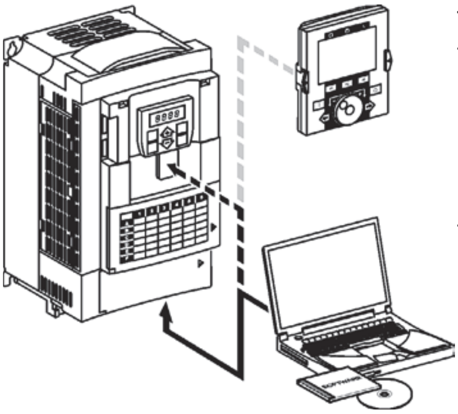
Cut-out 117 x 107 mm



Thickness of sheet metal:
1.5...3 mm

The connecting cable for the door mounting kit DMK11 can be connected to the front of the inverter or to RJ45 plug next to the terminals, alternatively. In this case, the parameters in matrix field D6 for adjusting the Modbus must be set to the factory setting.

PC software Matrix 3



The easy to operate and powerful PC software makes a further step towards the improvement of the user-friendliness of the MX eco & pro devices.

Based on the familiar Windows-surface and well proven functions, it offers numerous tools for considerable quicker commissioning and for the safe archiving of the settings. Special attention was paid to the clearly arranged display and the comparability of drive parameters.

The Matrix 3 computer software is designed as parameterization and diagnostic software which can be operated in two operating modes:

- ONLINE mode
  - Upload and download of parameters
  - Parameterization of individual parameters
  - Diagnostics (power part, I/O status, fieldbus status, trend recorder, online monitor and fault memory)
- OFFLINE mode
  - Documentation (parameter list, reference path, fieldbus,...)
  - Fault memory
  - Data Logger
  - Comparison of parameters

A description of the basic functions of the Matrix 3 software can also be found in chapter "PC software Matrix 3", page 31.

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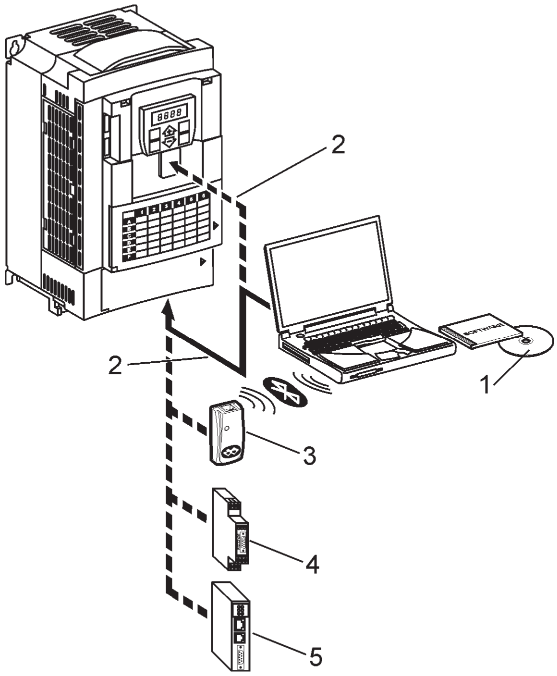
Specification of the operating system

Specification	Minimal system requirements	Recommended system requirements
IBM compatible PC	Pentium 2, 500 MHz	Pentium 3, 1 GHz
Operating system	Microsoft 2000 (SP3), XP, Vista, Windows 7	Microsoft XP
Free hard-disk space	50 MB	120 MB
Screen resolution	800 x 600 / 256 colours	1024 x 768 / 256 colours
RAM	128 MB	512 MB
General	Microsoft .NET Framework 1.1, Microsoft mouse or compatible pointing device	

The connection of the PC onto the frequency inverter occurs via OPC technology using a serial interface (RS232, Bluetooth, virtual RS232 via USB) and an external RS232/485 (2-wire) interface converter.



1 Matrix 3 PC program

There are various possibilities for the connection of a computer:

2 Connecting cable for inverter

3 Bluetooth adapter

4 RS232/RS485 interface converter

5 Remote maintenance option "Matrix remote link"

The cable option MX CABLE 3-PC is not identical to the cable option MX CABLE 3-BE or 10-BE ! An alternate use is not possible.

The connecting cable for the PC can be connected to the front of the inverter or to RJ45 plug next to the terminals, alternatively. In this case, the parameters in matrix field D6 for adjusting the Modbus must be set to the factory setting.

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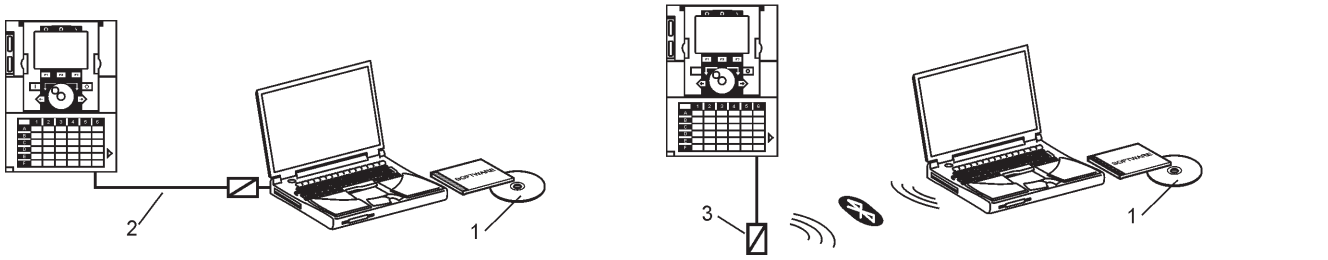
Possible connection variants

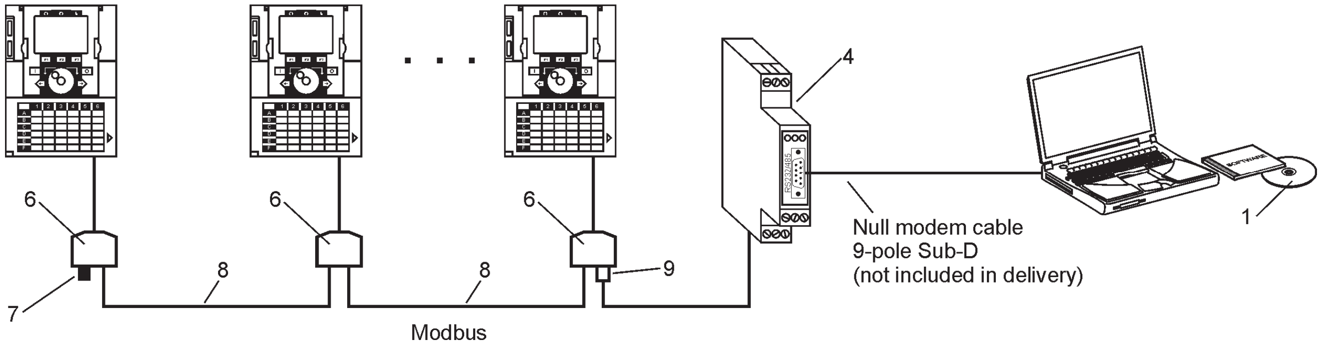
Connection with a device:

The connection with a device can be realized alternatively using the interface cable or by wireless (Bluetooth).



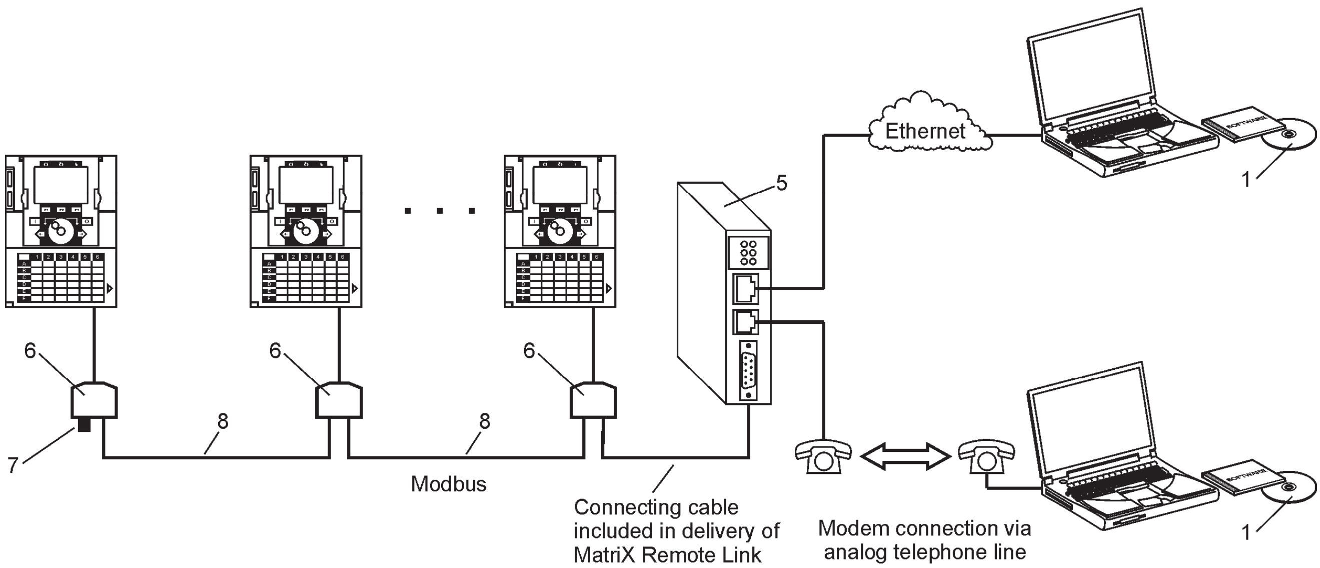
Bus structure with active interface converter:

When a computer should be connected to several inverters, this is possible using the Modbus connection of the inverter group and an active interface converter.



Remote maintenance route via an analog modem connection or via Ethernet:

When the MX MatriX Remote Link option is used instead of the interface converter, remote maintenance of the inverter group is also possible via modem or Ethernet.

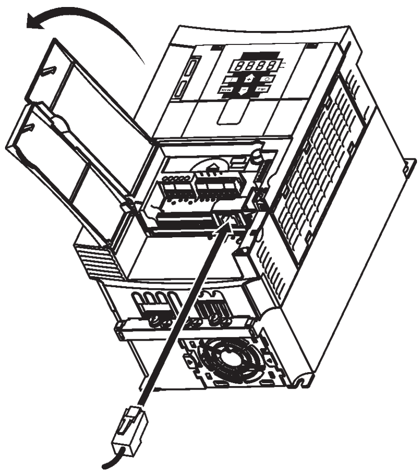


Components:

No.	Designation	Description
1	Manual-CD MX eco & pro Order number: 8 P01 021	This CD-ROM is attached to each inverter and includes the whole documentation of the inverter as well as the PC program Matrix 3. The program is also provided on our homepage www.schneider-electric-power-drives.com.
2	Option MX CABLE 3-PC Order number: ELN 8 P01 124	Connecting cable to the inverter, length: 3 m, incl. RS232/485 interface converter on the computer side
3	Option MX ADAP BLUE Order number: VW3 A8 114	Bluetooth adapter incl. 15 cm connecting cable. The computer must have a Bluetooth interface !
4	Option MX RS232/485 Phönix Contact Order number: PSM-ME-RS232/RS485-P	RS232/RS485 interface converter with supply and active bus termination. A nine-pole SUB-D zero-modem cable is required for the connection to the computer (not included in delivery).
5	Option MX Matrix Remote Link Order number: 8 P01 128	Option for remote maintenance via analog modem connection or Ethernet. A connecting cable for the inverter (length: 1.5 m) is included in delivery.
6	Option MX MODBUS T-ADAP 03 Order number: VW3 A8 306 TF03	Modbus T-adapter with 0.3 m connecting cable
7	Option MX MODBUS T-ADAP 10 Order number: VW3 A8 306 TF10	Modbus T-adapter with 1 m connecting cable
	Option MX MODBUS RC Order number: VW3 A8 306 RC	Bus termination RC
8	Option MX CABLE 3-BE Order number: ELN 8 P01 122	Pre-assembled RJ45 connecting cable 3 m
	Option MX CABLE 10-BE Order number: VW3 A1 104 R100	Pre-assembled RJ45 connecting cable 10 m
9	Option MX MODBUS PLUG Phönix Contact VARIOSUB RJ45 QUICKON Order number: VS-08-RJ45-5-Q/IP20	RJ45 connector IP20 with quick-connecting technology

Control options

Fieldbus Modbus



The frequency inverters MX eco & pro are equipped with a Modbus interface to control and monitor the drive as standard.

Technical data:

- Max. 247 subscribers in all segments
- Max. 32 subscribers including repeater per segment
- Max. 1000 m line length at 19.2 kBaud
- Bus cable: screened, 2 x twisted, two-wire line (typ. Cat5)
- Bus termination: serial connection of R = 120 Ω and C = 1 nF for each bus segment
- RJ45 port: screened, pin assignment 4, 5, 8
- No galvanic isolation

The Modbus interface cannot be used at the same time as the ADAP-CAN option!

More information on the Modbus network and a precise description of the Modbus parameters can be found in the Modbus operating instructions.

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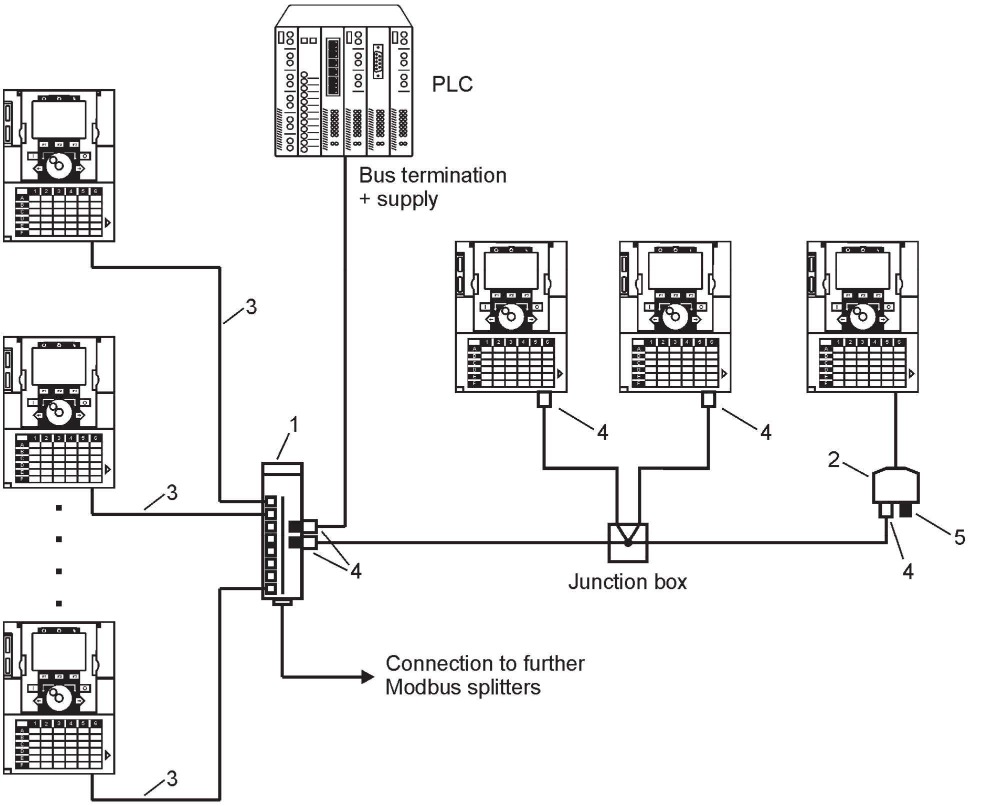
Example for a Modbus network:



Required components:

No.	Designation	Description
1	Option MX MODBUS SPLITTER Order number: LU9 GC3	Divides the Modbus signal into eight additional channels using a star configuration. Several Modbus splitters can be connected parallel. Suitable for mounting on a top hat rail.
2	Option MX MODBUS T-ADAP 03 Order number: VW3 A8 306 TF03	Modbus T-adapter with 0.3 m connecting cable
	Option MX MODBUS T-ADAP 10 Order number: VW3 A8 306 TF10	Modbus T-adapter with 1 m connecting cable
3	Option MX CABLE 3-BE Order number: ELN 8 P01 122	Pre-assembled RJ45 connecting cable 3 m
	Option MX CABLE 10-BE Order number: VW3 A1 104 R100	Pre-assembled RJ45 connecting cable 10 m
4	Option MX MODBUS PLUG Phönix Contact VARIOSUB RJ45 QUICKON Order number: VS-08-RJ45-5-Q/IP20	RJ45 connector IP20 with quick-connecting technology
5	Option MX MODBUS RC Order number: VW3 A8 306 RC	Bus termination RC

Further recommended Modbus components

Cable LAPPKABEL, UNITRONIC® BUS FD P LD, 2x2 x0.22

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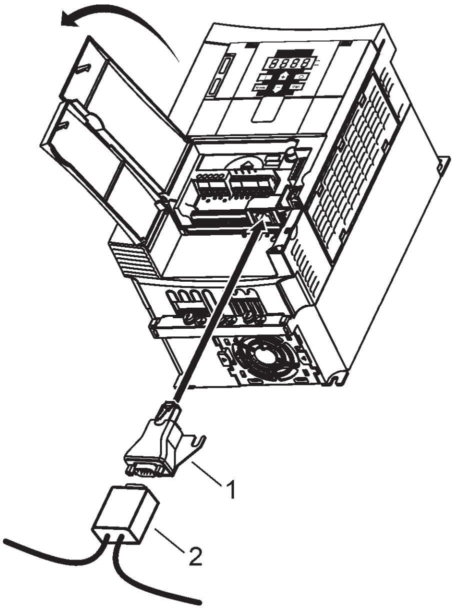
Fieldbus adapter ADAP-CAN for CANopen



All MX eco & pro frequency inverters support the CANopen fieldbus system as standard. For the integration of the CANopen-typical Sub-D fieldbus connection, an optional CANopen adapter must be installed at the RJ45 interface next to the terminals of the inverter.

In the CANopen network the frequency inverter is operated as a slave. The used profile is designed on the basis of the Profidrive profile VDI/VDE 3689.

1 CANopen adapter
Designation: Option MX ADAP CAN
Order number: VW3 CAN A71

2 CANopen plug
Designation: Option MX CANOPEN PLUG
Order number: TSX CAN KCDF 180T

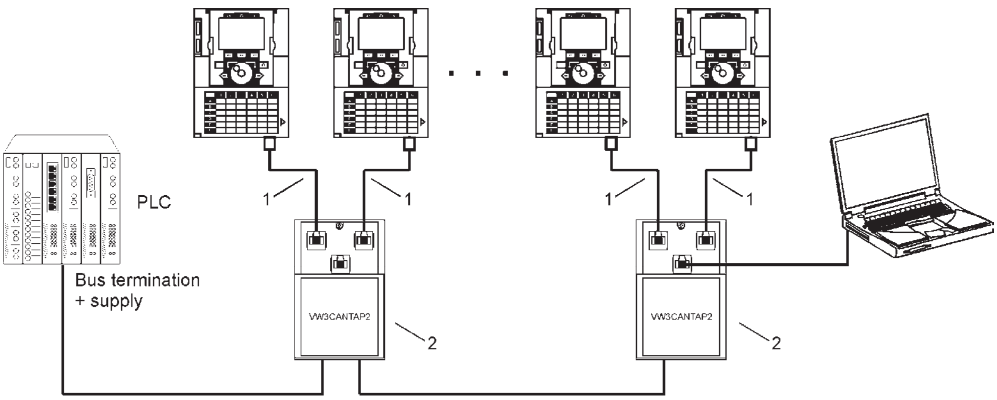
Technical data:

- Max. 32...126 subscribers (according to the CAN controller used)
- Bus cable: screened, twisted two-wire line
- Bus terminating resistor: R = 120 Ω (108…132 Ω)
- SUB-D port according to ISO 11898
- CAN interface according to CiA DS 102
- No galvanic isolation

The ADAP-CAN option cannot be used at the same time as the Modbus interface!

More information on the CANopen network and a precise description of the CANopen parameters can be found in the CANopen operating instructions.

Further connection possibilities at higher distances or frequency inverters with higher power:



No.	Designation	Description
1	RJ45 connecting cable (8-pole)	Pin assignment according to specifications in instruction sheet of option MX CAN TAP2. Max. length 3m.
2	Option MX CAN TAP2 Order number: VW3 CAN TAP2	Passive CAN adapter with shiftable terminating resistor

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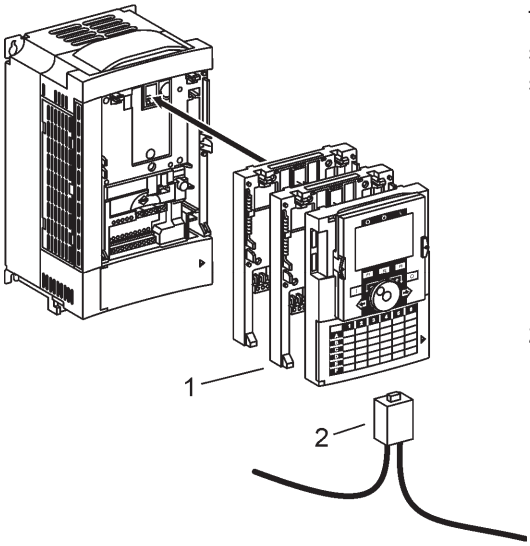
Fieldbus card PBO11 for Profibus DP



The option card MX PBO11 is completely provided by the inverter software and works as DP slave according to the PROFIDRIVE specification.

1 Profibus option card

Designation:	Option MX PBO11
Order number:	ELN 8 P01 103

2 Profibus plug (straight) with switchable terminating resistor

Designation:	Option MX PROFIBUS PLUG Phönix Contact
Order number:	SUBCON-PLUS-PROFIB/AX/SC

Technical data:

- Address 1 to 126, adjustable via switch
- Max. 126 subscribers (32 per segment)
- 9.6 / 19.2 / 93.75 kBit/s baud rate at max. 1200 m cable length (cable type A, 0.34 mm^2)
- 187.5 kBit/s baud rate at max. 1000 m cable length (cable type A, 0.34 mm^2)
- 500 kBit/s baud rate at max. 400 m cable length (cable type A, 0.34 mm^2)
- 1.5 MBit/s baud rate at max. 200 m cable length (cable type A, 0.34 mm^2)
- 3 / 6 / 12 MBit/s baud rate at max. 100 m cable length
- RS 485 interface according to EN 50170
- Configuration file: MXPB1101.GSD
  The file is provided on the CD-ROM which is attached to each inverter as well as on our homepage www.schneider-electric-power-drives.com for free download.
- PBO types 1 to 5
- Diagnostic LED's: 2 (state and data exchange)

Because this option is plugged at the front side of the inverter, it affects the total depth of the device (see chapter "Technical data" of the respective inverter).

The inverters MX eco & pro can be equipped at most with 2 option cards (terminal extension and/or field bus).

In order to address an inverter via fieldbus also during mains cut-off (line contactor control, disconnecting switch, ...) the MX eco & pro has to be supplied with an external 24 V buffer voltage.

More information on the Profibus network and a precise description of the Profibus parameters can be found in the Profibus operating instructions.

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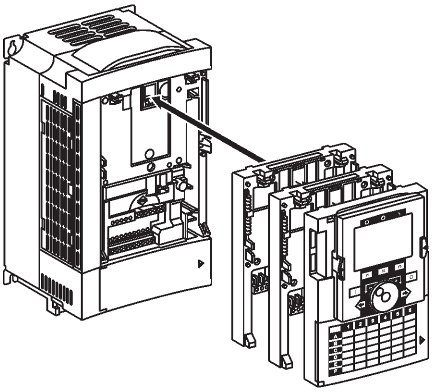
Terminal extension IO11 and IO12



The frequency inverters MX eco & pro are equipped with extensive control terminals as standard. The use and the function of all inputs and outputs can be parameterized.

For extension the option cards MX IO11 and MX IO12 are available. Both option cards can be installed, but the same card cannot be plugged twice.

Designation: Option MX IO11
Order number: ELN 8 P01 101

Designation: Option MX IO12
Order number: ELN 8 P01 102

Listing of all control terminals

Control terminals		Standard equip-ment	Option IO11	Option IO12	Max. equip-ment
Reference voltages	+10 V	x	–	–	x
	-10 V	–	x	x	x
	+24 V	x	x	x	x
Ext. buffer voltage	24 V DC	x	–	–	x
Inputs					
Analog inputs (limits and usage can be parameterized)	0...±10 V (differential)	1x	–	–	1x
	0(4)...20 mA (differential)	–	–	1x	1x
	alternatively 0...+10 V or 0(4)...20 mA	1x	–	1x	2x
Digital inputs (function can be parameterized)	DI (24 V, positive / negative logic)	5x	4x	4x	13x
	alternatively DI or thermistor	1x	–	–	1x
Thermistor inputs	Thermistor	–	1x	1x	2x
	alternatively DI or thermistor	1x	–	–	1x
Safety input	"Safe Standstill"	1x	–	–	1x
Digital ref. value	0...30 kHz	–	–	1x	1x
Outputs					
Analog outputs (selection of actual values can be parameterized)	alternatively 0...+10 V or 0(4)...20 mA	1x	–	–	1x
	alternatively ±10 V or 0(4)...20 mA	–	–	2x	2x
Digital outputs (function can be parameterized)	Open Collector 24 V DC	–	2x	2x	4x
Relay outputs (function can be parameterized)	N.O./N.C.	1x	1x	1x	3x
	N.O.	1x	–	–	1x

Because this option is plugged at the front side of the inverter, it affects the total depth of the device (see chapter "Technical data" of the respective inverter).

The inverters MX eco & pro can be equipped at most with 2 option cards (terminal extension and/or field bus).

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Specifications of the standard control terminals in the inverter

Terminal	Designation	Specification
+10	Voltage supply for potentiometer 1...10 kΩ	+10 V DC (10.5 V ±0.5 V) max. 10 mA; short-circuit-proof
AI1+ AI1-	Analog input AI1 (Usage and limits can be parameterized)	-10...+10 V DC, differential amplifier, floating up to max. 24 V *) Reaction time 2 ms ±0.5 ms, resolution 11 Bits + 1 sign bit, accuracy ±0.6 % at $\Delta\vartheta$ = 60 °C (140 °F), linearity ±0.15 %
COM	Ground	0 V reference potential for analog in-/outputs
AI2	Analog input AI2 (Selection, usage and limits can be parameterized)	– 0...+10 V DC (floating up to max. 24 V), impedance 30 kΩ *) or – 0(4)...20 mA, impedance 250 Ω Reaction time 2 ms ±0.5 ms, resolution 11 Bits, Accuracy ±0.6 % at $\Delta\vartheta$ = 60 °C (140 °F), linearity ±0.15 %
COM	Ground	0 V reference potential for analog in-/outputs
AO1	Analog output AO1 (Selection, usage and limits can be parameterized)	– 0...+10 V DC, min. load impedance 500 Ω *) or – 0(4)...20 mA, max. load impedance 500 Ω Resolution 10 Bits, reaction time 2 ms ± 0.5 ms, accuracy ±1 % at $\Delta\vartheta$ = 60 °C (140 °F), linearity ±0.2 %
P24	Supply buffer voltage	+24 V DC (min. 19 V, max. 30 V) external supply of the control part, power demand 30 W
0 V	Ground	Reference potential of the digital inputs and 0 V of the external voltage supply P24
DI1 DI2 DI3 DI4 DI5	Digital inputs DI1...DI5 (Usage can be parameterized, Sink/Source-switching with selector switch SW1)	+24 V DC (max. 30 V), impedance 3.5 kΩ, reaction time 2 ms ±0.5 ms Positive logic (Source) or negative logic (Sink) compatible with Level 1 PLC Standard IEC 65A-68 SW1 at Source (factory setting): High > 11 V DC, Low < 5 V DC SW1 at Sink Int. or Sink Ext.: High < 10 V DC, Low > 16 V DC
DI6 (TH1)	Digital input DI6 or thermistor input 1 (Usage can be parameterized, Sink/Source-switching with selector switch SW2)	– *Selector switch SW2 at LI (factory setting):* Digital input DI6, same data as with DI1 up to DI5 – *Selector switch SW2 at PTC:* Thermistor TH1, for max. 6 PTC thermistors in series *) Thermistor nominal value < 1.5 kΩ, threshold value 3 kΩ, Disengaging value 1.8 kΩ, short-circuit monitoring at < 50 Ω
+24	Sampling voltage for digital inputs (Sink/Source-switching with selector switch SW1)	– *Selector switch SW1 in position Source or Sink Int.:* +24 V DC (min. 21 V, max. 27 V), short-circuit proof max. 100 mA (incl. all options) – *Selector switch SW1 in position Sink Ext.:* Input for external voltage supply +24 V DC of the digital inputs
PWR	Input of the safety function "Safe Standstill" (Power Removal)	Digital input 24 V DC (max. 30 V) *) Impedance 1.5 kΩ, filter time 10 ms, High > 17 V, Low < 2 V If PWR is not connected to 24 V, the starting of the motor is not possible (according to the standard for functional safety EN 954-1 / ISO 13849-1, IEC / EN 61508) and IEC/EN 61800-5-2
R1A R1B R1C	Relay output 1 (R1A N.O. contact, R1B N.C. contact)	Switching capacity min. 3 mA at 24 V DC (relay as good as new) Switching capacity max. 5 A at 250 V AC (cos φ = 1) or 30 V DC, max. 2 A at 250 V AC (cos φ = 0.4) or 30 V DC (L/R = 7 ms) Reaction time 7 ms ±0.5 ms, life cycle of 100.000 switching cycles at max. switching capability Sampling voltage must correspond to overvoltage category II so that the PELV conditions for the remaining control terminals are fulfilled.
R2A R2C	Relay output 2 (R2A N.O. contact)	

Max. connection cross-section: 1.5 mm^2 (AWG16), 0.25 Nm (2.5 mm^2 (AWG14), 0.6 Nm for relay terminals)

*) Screen the wiring and lay the cables separate from the motor cable !
The maximum cable length is 20 m for thermistor input TH1 and 15 m for the safety input PWR "Safe Standstill".

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Specification of the control terminals at option card IO11

Terminal	Designation	Specification
R3A R3B R3C	Relay output 3 R3A N.O. contact, R3B N.C. contact)	Switching capacity min. 3 mA at 24 V DC (relay as good as new) Switching capacity max. 5 A at 250 V AC (cos φ = 1) or 30 V DC, max. 2 A at 250 V AC (cos φ = 0.4) or 30 V DC (L/R = 7 ms) Reaction time 7 ms $\pm$0.5 ms, life cycle of 100.000 switching cycles at max. switching capability Sampling voltage must correspond to overvoltage category II so that the PELV conditions for the remaining control terminals are fulfilled.
-10	Voltage supply for potentiometer 1...10 $k\Omega$	-10 V DC (-10.5 V $\pm$0.5 V) max. 10 mA; short-circuit-proof
+24	Sampling voltage for digital inputs (Sink/Source-switching with selector switch SW3)	– *Selector switch SW3 in position Source or Sink Int.:* +24 V DC (min. 21 V, max. 27 V), short-circuit proof max. 50 mA (for basic device and options) – *Selector switch SW3 in position Sink Ext.:* Input for external voltage supply +24 V DC of the digital inputs
DI7 DI8 DI9 DI10	Digital inputs DI7...DI10 (Usage can be parameterized, Sink/Source-switching with selector switch SW1)	+24 V DC (max. 30 V), impedance 3.5 $k\Omega$, reaction time 2 ms $\pm$0.5 ms Positive logic (Source) or negative logic (Sink) compatible with Level 1 PLC Standard IEC 65A-68 SW3 at Source (factory setting): High > 11 V DC, Low < 5 V DC SW3 at Sink Int. or Sink Ext.: High < 10 V DC, Low > 16 V DC
0 V	Ground	0 V reference potential for digital inputs
TH2+ TH2-	Thermistor input 2	for max. 6 PTC thermistors in series *) Thermistor nominal value < 1.5 $k\Omega$, threshold value 3 $k\Omega$, Disengaging value 1.8 $k\Omega$, short-circuit monitoring at < 50 Ω
DO1	Digital output DO1 (Usage can be parameterized)	+24 V DC Open-Collector-Outputs, floating ground Positive logic (Source) or negative logic (Sink) compatible with Level 1 PLC Standard IEC 65A-68 Switching capacity max. 200 mA at 12...30 VDC Reaction time: 2 ms $\pm$0.5 ms
DO2	Digital output DO2 (Usage can be parameterized)	
CDO	Common	Reference potential of the digital outputs
0 V	Ground	0 V general use

Max. connection cross-section: 1.5 mm^2 (AWG16), 0.25 Nm (2.5 mm^2 (AWG14), 0.6 Nm for relay terminals)

*) Screen the wiring and lay the cables separate from the motor cable !

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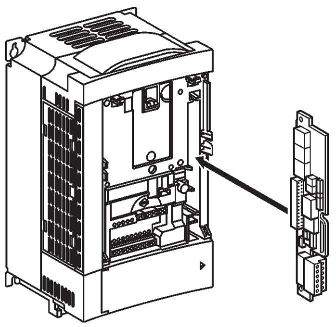
Specification of the control terminals at option card IO12

Terminal	Designation	Specification
R4A R4B R4C	Relay output 4 (R4A N.O. contact, R4B N.C. contact)	Switching capacity min. 3 mA at 24 V DC (relay as good as new) Switching capacity max. 5 A at 250 V AC (cos φ = 1) or 30 V DC, max. 2 A at 250 V AC (cos φ = 0.4) or 30 V DC (L/R = 7 ms) Reaction time 10 ms ±0.5 ms, life cycle of 100.000 switching cycles at max. switching capability Sampling voltage must correspond to overvoltage category II so that the PELV conditions for the remaining control terminals are fulfilled.
-10	Voltage supply for potentiometer 1...10 kΩ	-10 V DC (-10.5 V ±0.5 V) max. 10 mA; short-circuit-proof
AI3+ AI3-	Analog input AI3 (Usage and limits can be parameterized)	0(4)...20 mA, differential amplifier, impedance 250 Ω, Reaction time 5 ms ±1 ms, resolution 11 Bits + 1 sign bit, accuracy ±0.6 % at $\Delta\vartheta$ = 60 °C (140 °F), linearity ±0.15 %
AI4	Analog input AI4 (Selection, usage and limits can be parameterized)	– 0...+10 V DC (floating up to max. 24 V), impedance 30 kΩ *) or – 0(4)...20 mA, impedance 250 Ω Reaction time 5 ms ±1 ms, resolution 11 Bits, Accuracy ±0.6 % at $\Delta\vartheta$ = 60 °C (140 °F), linearity ±0.15 %
COM	Ground	0 V reference potential for analog in-/outputs
AO2	Analog output AO2	– 0...10 V DC or -10/+10 V DC according to software configuration, min. load impedance 500 Ω *) or – 0(4)...20 mA, max. load impedance 500 Ω Resolution 10 Bits, reaction time 5 ms ±1 ms, accuracy ±1 % at $\Delta\vartheta$ = 60 °C (140 °F), linearity ±0.2 %
AO3	Analog output AO3	
+24	Sampling voltage for digital inputs (Sink/Source-switching with selector switch SW4)	– *Selector switch SW4 in position Source or Sink Int.:* +24 V DC (min. 21 V, max. 27 V), short-circuit proof max. 50 mA (for basic device and options) – *Selector switch SW4 in position Sink Ext.:* Input for external voltage supply +24 V DC of the digital inputs
DI11 DI12 DI13 DI14	Digital inputs DI11...DI14 (Usage can be parameterized, Sink/Source-switching with selector switch SW4)	+24 V DC (max. 30 V), impedance 3.5 kΩ, reaction time 5 ms ±1 ms Positive logic (Source) or negative logic (Sink) compatible with Level 1 PLC Standard IEC 65A-68 SW4 at Source (factory setting): High > 11 V DC, Low < 5 V DC SW4 at Sink Int. or Sink Ext.: High < 10 V DC, Low > 16 V DC
0 V	Ground	0 V reference potential for digital inputs
TH3+ TH3-	Thermistor input 3	for max. 6 PTC thermistors in series *) Thermistor nominal value < 1.5 kΩ, threshold value 3 kΩ, Disengaging value 1.8 kΩ, short circuit monitoring at < 50 Ω,
FP	Frequency input FP	Frequency range 0...30 kHz, 1:1 ±10 %, reaction time 5 ms ±1 ms Input voltage 5 V DC, 15 mA Series resistor for 12 V = 510 Ω, for 15 V = 910 Ω, for 24 V = 1.3 kΩ (max. 30 V); High > 3.5 V, Low < 1.2 V
DO3	Digital output DO3 (Usage can be parameterized)	+24 V DC Open-Collector-Outputs, floating ground Positive logic (Source) or negative logic (Sink) compatible with Level 1 PLC Standard IEC 65A-68 Switching capacity max. 200 mA at 12...30 VDC Reaction time: 2 ms ±0.5 ms
DO4	Digital output DO4 (Usage can be parameterized)	
CDO	Common	Reference potential of the digital outputs
0 V	Ground	0 V general use

Max. connection cross-section: 1.5 mm^2 (AWG16), 0.25 Nm (2.5 mm^2 (AWG14), 0.6 Nm for relay terminals)

*) Screen the wiring and lay the cables separate from the motor cable !

Speed feedback SFB



The option SFB "speed feedback" can be used for exact speed indication and prevention of a breakdown at 0 Hz or alternatively for exact speed control. This option is only available for the MX pro!

There are three different options available:

Designation: Option MX SFB 5V RS422
Order number: VW3 A3 401

Designation: Option MX SFB 15V RS422
Order number: VW3 A3 402

Designation: Option MX SFB 24V PP
Order number: VW3 A3 407

Specification MX SFB 5V RS422

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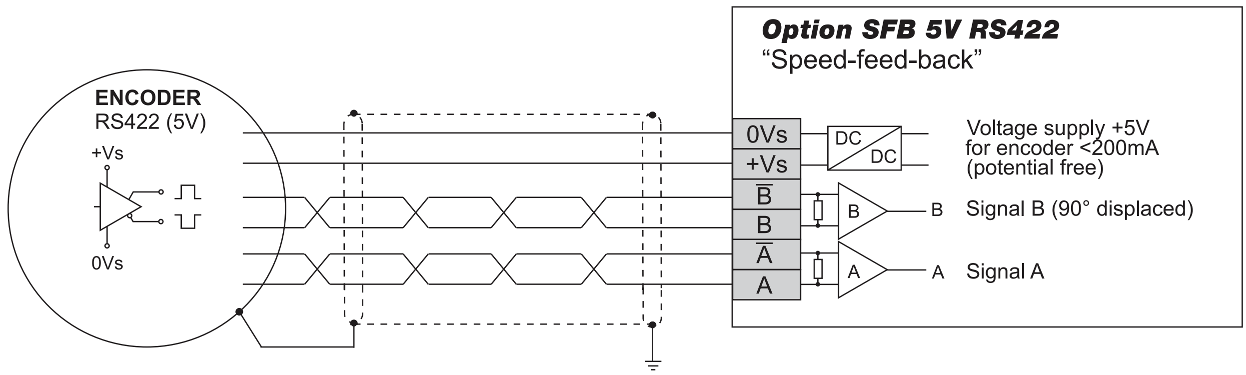

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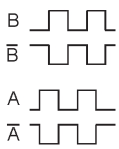
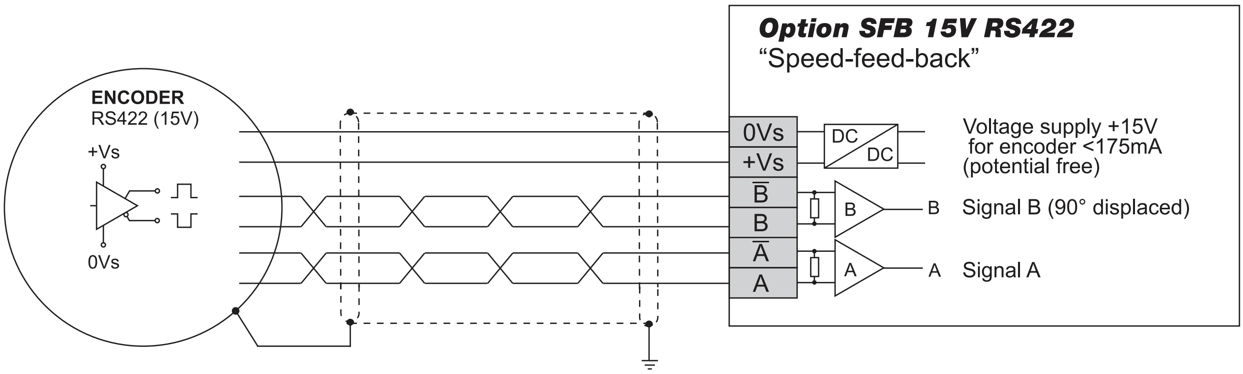
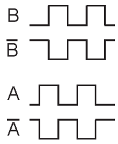


Recommended minimum cable cross section:
up to 25 m: 0.5 mm^2
up to 50 m: 0.75 mm^2
up to 100 m: 1.5 mm^2

Terminal	Designation	Specification
0Vs +Vs	Voltage supply of the encoder	max. 200 mA at 5 V DC (max. 5.5 V), protected against short-circuit and overload
$\overline{B}$ B	Incremental logic inputs (90° displaced to signal A)	Max. 5,000 pulses / rotation Min. 100 pulses / rotation Max. 300 kHz
$\overline{A}$ A	Incremental logic inputs	

Specification MX SFB 15V RS422



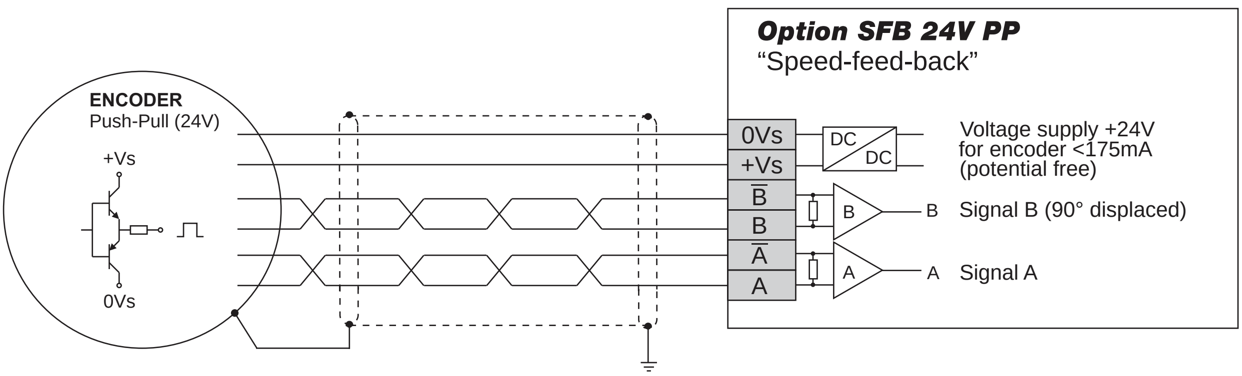


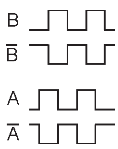
Recommended minimum cable cross section:

up to 25 m: 0.2 mm²
up to 100 m: 0.5 mm²
up to 600 m: 1.0 mm²

Terminal	Designation	Specification
0Vs +Vs	Voltage supply of the encoder	max. 175 mA at 15 V DC (max. 16 V), protected against short-circuit and overload
B̅ B	Incremental logic inputs (90° displaced to signal A)	Max. 5,000 pulses / rotation Min. 100 pulses / rotation Max. 300 kHz
A̅ A	Incremental logic inputs	

Specification MX SFB 24V PP





Recommended minimum cable cross section:

up to 600 m: 0.2 mm²

Terminal	Designation	Specification
0Vs +Vs	Voltage supply of the encoder	max. 175 mA at 24 V DC (max. 25 V), protected against short-circuit and overload
B̅ B	Incremental logic inputs (90° displaced to signal A)	Max. 5,000 pulses / rotation Min. 100 pulses / rotation Max. 300 kHz State 0 if < 1.5 V State 1 if > 11.5 and < 25 V
A̅ A	Incremental logic inputs	

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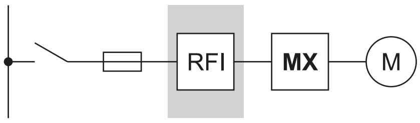
External options

Radio frequency interference filter RFI



The MX frequency inverters include a radio frequency interference filter for use in industrial environments which is built-in as standard.

For MX eco 4V and pro 4V this filter complies with the specifications of category C2 "Use in residential environments" according to EN 61800-3 for MX eco & pro 4V0,75...4V4,0 and category C3 "Use in industrial environments" for all inverters from 5.5 kW on.

For applications in "1st environment - residential environments" of category C1 or C2 and in case of long motor cables the use of the additional filters option MX RFI is required. These filters are connected at the mains side of the inverter.

The determining factor for the radio frequency interference filters to be effective is a HF connection as good as possible between motor, motor cable screen and filter !

The MX RFI filters are not qualified for nongrounded (IT) mains as well as for "Corner Grounded Networks".

The radio frequency interference filters which are built-in as standard can be switched-over/reconnected for use in IT mains.

Please use the allocation table for selection of the option MX RFI suitable for the chosen inverter.

– MX eco 4V: page 81 ff.
– MX pro 4V: page 138 ff.

The allowed lengths of motor cables are given in the tables on the following pages:

– MX eco 4V: page 70
– MX pro 4V: page 126
– MX pro 6V: page 180

	General technical data
Operating voltage RFI 480	3AC 380 V -15 % ... 480 V +10 %
Nominal frequency	50/60 Hz ±5 %
Overload capability	150 % for 60 s per 10 min, 200 % for 2 s
Ambient temperature	-10...+50°C (14...144°C), up to 60°C (140°F) with derating
Storage temperature	-40...+70°C (-40...+158°F)
Altitude	0...1000 m (0...3281 ft), up to 3000 m (9843 ft) with derating
Vibration resistance	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz according to IEC/EN 60068-2-6
Shock resistance	15 g for 11 ms according to IEC/EN 60068-2-27
Approvals	CE, UR, GOST

The filters option MX RFI 480/12-TN...480/180-TN are designed for mounting behind the inverter ("footprint filter") or sideways, to the left of the inverter. In either case take care of a well-conductive and large surface connection between the screen connection of the motor cable and the inverter.

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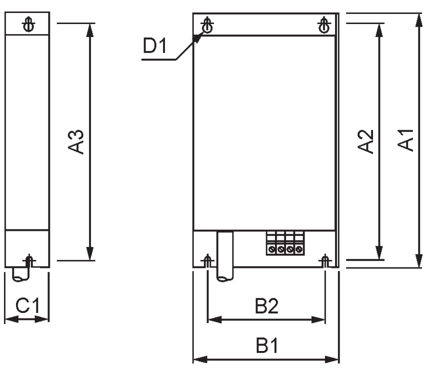
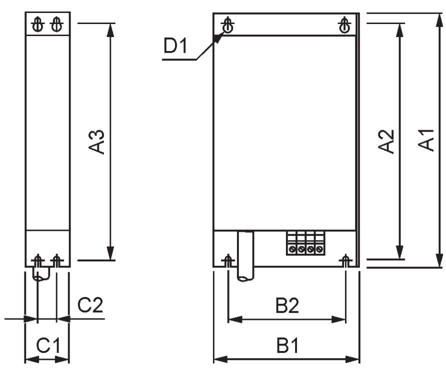
	Option RFI			
Order number	VW3 A4 401	VW3 A4 402	VW3 A4 403	VW3 A4 404
Equivalent	RFI 480/12-TN (8 P01 280)	RFI 480/26-TN (8 P01 281)	RFI 480/35-TN (8 P01 282)	RFI 480/46-TN (8 P01 283)
Nominal current	12 A	26 A	35 A	46 A
Maximum leakage current	7 mA	8 mA	7 mA	14 mA
Continuous leakage current	3 mA	3 mA	3 mA	3 mA
Protection degree	IP20, top side IP41			
Losses	5 W	6 W	14 W	13 W
Weight	2.2 kg	4 kg	6 kg	7 kg
Dimension A1	290 mm	325 mm	370 mm	380 mm
Dimension A2	275 mm	309 mm	355 mm	365 mm
Dimension A3	275 mm	309 mm	355 mm	365 mm
Dimension B1	130 mm	155 mm	175 mm	210 mm
Dimension B2	105 mm	130 mm	150 mm	190 mm
Dimension C1	40 mm	50 mm	60 mm	60 mm
Fixing D1	4 x ∅ 4.5 mm / 2 x ∅ 4.5 mm	4 x ∅ 4.5 mm / 2 x ∅ 4.5 mm	4 x ∅ 5.5 mm / 2 x ∅ 5.5 mm	4 x ∅ 5.5 mm / 2 x ∅ 5.5 mm
Connection terminal	max. 4 mm²	max. 6 mm²	max. 10 mm²	max. 16 mm²
Connection PE terminal	max. 4 mm²	max. 6 mm²	max. 10 mm²	max. 16 mm²

	Option RFI			
Order number	VW3 A4 405	VW3 A4 406	VW3 A4 407	VW3 A4 408
Equivalent	RFI 480/72-TN (8 P01 284)	RFI 480/90-TN (8 P01 285)	RFI 480/92-TN (8 P01 286)	RFI 480/180-TN (8 P01 287)
Nominal current	72 A	90 A	92 A	180 A
Maximum leakage current	60 mA	60 mA	60 mA	140 mA
Continuous leakage current	3 mA	3 mA	3 mA	3 mA
Protection degree	IP20, top side IP41			
Losses	14 W	11 W	30 W	58 W
Weight	12 kg	15 kg	17 kg	40 kg
Dimension A1	500 mm	525 mm	650 mm	750 mm
Dimension A2	460 mm	502.5 mm	631 mm	725 mm
Dimension A3	480 mm	502.5 mm	631 mm	725 mm
Dimension B1	230 mm	240 mm	240 mm	320 mm
Dimension B2	190 mm	200 mm	200 mm	280 mm
Dimension C1	62 mm	79 mm	79 mm	119 mm
Dimension C2	–	40 mm	40 mm	80 mm
Fixing D1	4 x ∅ 6.6 mm / 2 x ∅ 6.6 mm	4 x ∅ 6.6 mm / 4 x ∅ 6.6 mm	4 x ∅ 6.6 mm / 4 x ∅ 6.6 mm	4 x ∅ 9 mm / 4 x ∅ 9 mm
Connection terminal	max. 50 mm²	max. 50 mm²	max. 50 mm²	max. 150 mm²
Connection PE terminal	max. 50 mm²	max. 50 mm²	max. 50 mm²	max. 150 mm²

VW3 A4 401 to VW3 A4 405



VW3 A4 406 to VW3 A4 408



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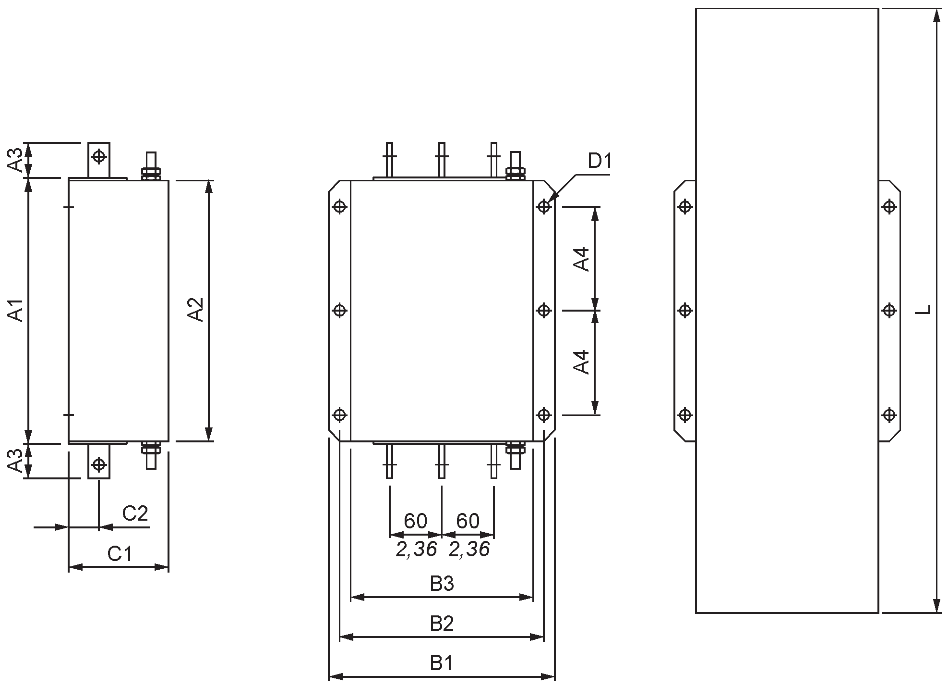
	Option RFI		
Order number	VW3 A4 410	VW3 A4 411	VW3 A4 412
Equivalent	RFI 480/300-TN (8 P01 288)	RFI 480/600-TN (8 P01 289)	RFI 480/800-TN (8 P01 290)
Nominal current	300 A	580 A	740 A
Maximum leakage current	350 mA	350 mA	350 mA
Continuous leakage current	3 mA	3 mA	3 mA
Protection degree	IP00, with protection against contact		
Losses	60 W	125 W	210 W
Weight	13 kg	15 kg	25 kg
Dimension A1	306 mm	306 mm	356 mm
Dimension A2	300 mm	300 mm	350 mm
Dimension A3	40 mm	95 mm	100 mm
Dimension A4	120 mm	120 mm	145 mm
Dimension B1	260 mm	260 mm	280 mm
Dimension B2	235 mm	235 mm	255 mm
Dimension B3	210 mm	210 mm	230 mm
Dimension C1	135 mm	135 mm	170 mm
Dimension C2	65 mm	65 mm	85 mm
Protective cover L	800 mm	800 mm	900 mm
Fixing D1	6 x ∅ 12 mm	6 x ∅ 12 mm	6 x ∅ 12 mm
Connection bar	25 x 6 mm 1 x M10	32 x 8 mm 2 x M10	40 x 10 mm 2 x M10
PE connection	M12	M12	M12

VW3 A4 410 to VW3 A4 412



The filters option MX RFI 480/300-TN...480/800-TN must be mounted with a well-conductive and large surface connection between the screen connection of the motor cable and the inverter. This well HF connection is determining for the radio interference suppression of the drive.

The protective cover which is delivered with the inverter prevents an unintended contact with the terminals.

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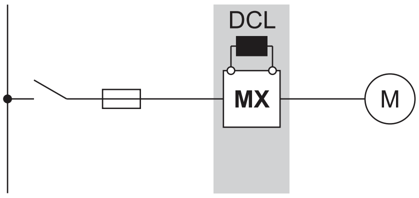
DC choke DCL



The DC choke reduces the mains current harmonics and thus it reduces the total mains current.

The MX eco & pro 4V inverters can be connected to a standard industry mains without additional actions.

Typically, devices with small power are operated on mains supply with low short-circuit power.

Devices of the power range 18.5...75 kW have a DC choke built-in and so they are also qualified for higher mains short-circuit powers up to 22 kA.

The MX eco & pro 4V inverters from 90 kW are designed for operation on a transformer with matching power. In case of mains with higher short-circuit power a choke is absolutely necessary and it is always recommended to reduce the current harmonics.

Using the option MX DCL is generally required:

- in case of using the inverters in residential environments
- in case of mains short circuit currents at the inverter supply up to 35 (50) kA
- if several inverters are operated on common mains supply
- if power factor correction systems may be overloaded by means of the inverter
- if the inverter is operated by means of a generator
- if the mains supply has an unsymmetry ≥ 1.8 %

Additionally, please observe depending on the size of the device:

- **MX eco & pro 4V0,75...4V15**
  The use of the option MX DCL is required if the mains short-circuit current is 5…35 kA.
- **MX eco & pro 4V18...4V75**
  The use of the option MX DCL is required if the mains short-circuit current is 22...35 kA.
- **MX eco & pro 4V from 90 kW**
  The device variant with DCL-BOX is required if the device is not supplied by means of a transformer with matching power. Maximum mains short circuit current 50 kA.

When the option MX DCL is used, the inverters with a nominal current of 16…75 A observe the limits for current harmonics which are specified in the IEC/EN 61000-3-12 standard. Therefore a short circuit ratio ≥ 120 is required.

Please use the allocation table on page 81 ff or 138 ff for selection of the option MX DCL suitable for the chosen inverter.

	General technical data option MX DCL
Operating voltage	400...850 V DC
Overload capability	150 % for 60 s per 10 min, 200 % for 2 s
Ambient temperature	-10...+50 °C (up to 60 °C with derating)
Storage temperature	-40...+70 °C
Altitude	0...1000 m (up to 3000 m with derating)
Vibration resistance	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz according to IEC/EN 60068-2-6
Shock resistance	15 g for 11 ms according to IEC/EN 60068-2-27
Protection degree	IP20
Approvals	CE, GOST

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Typical current harmonics when the DC choke MX DCL is used at 400 V, 50 Hz

MX eco	P_N [kW]	I_{cc} [kA]	I_N [A]	H1 [A]	Harmonics at nominal load [%] H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	THD
4V0,75	0.75	5	1.77	1.6	34.6	23.7	8.90	7.80	5.60	4.80	4.10	3.50	3.20	2.80	2.60	2.30	2.20	1.90	1.90	1.70	45.0
4V1,5	1.5	5	3.34	3.0	35.6	23.5	8.95	7.65	5.61	4.74	4.06	3.49	3.16	2.76	2.57	2.28	2.15	1.94	1.83	1.68	45.5
4V2,2	2.2	5	4.83	4.4	35.8	22.8	8.70	7.11	5.41	4.36	3.89	3.20	3.01	2.53	2.43	2.09	2.01	1.77	1.70	1.53	45.0
4V3,0	3.0	5	6.13	5.7	31.6	18.8	9.41	6.82	5.88	4.57	4.24	3.38	3.28	2.67	2.63	2.19	2.16	1.86	1.80	1.60	40.1
4V4,0	4.0	5	8.23	7.5	36.2	21.6	9.00	8.17	5.52	4.17	3.93	3.05	3.00	2.40	2.38	1.98	1.93	1.68	1.58	1.45	44.7
4V5,5	5.5	22	10.8	9.8	34.9	23.1	9.68	4.05	6.12	5.18	4.45	3.83	3.48	3.04	2.85	2.52	2.40	2.14	2.06	1.85	45.2
4V7,5	7.5	22	15.0	14	34.1	20.5	8.57	6.43	5.28	3.95	3.78	2.89	2.90	2.28	2.32	1.88	1.90	1.59	1.58	1.37	42.3
4V11	11	22	21.1	19	35.2	20.1	8.95	6.50	5.41	4.02	3.80	2.95	2.86	2.32	2.23	1.90	1.77	1.60	1.42	1.37	43.1
4V15	15	22	28.2	26	35.2	20.0	8.98	6.49	5.43	4.02	3.82	2.94	2.88	2.32	2.24	1.90	1.78	1.60	1.43	1.37	43.1
4V18	18.5	22	33.9	32	29.4	15.2	8.85	6.18	5.39	4.04	3.78	2.98	2.83	2.34	2.18	1.90	1.70	1.58	1.33	1.33	35.2
4V22	22	22	40.9	38	32.8	18.7	8.60	6.42	5.28	4.09	3.75	3.03	2.85	2.40	2.25	1.97	1.81	1.67	1.48	1.44	40.4
4V30	30	22	54.1	51	30.0	16.3	8.75	6.27	5.32	4.07	3.73	3.01	2.79	2.37	2.15	1.94	1.69	1.62	1.33	1.38	37.0
4V37	37	22	66.4	63	28.5	15.0	8.63	6.08	5.23	4.00	3.65	2.97	2.71	2.34	2.07	1.90	1.61	1.58	1.26	1.32	35.1
4V45	45	22	83.1	76	38.3	21.0	8.24	5.81	4.85	3.48	3.33	2.54	2.44	2.00	1.85	1.64	1.42	1.38	1.10	1.17	45.6
4V55	55	22	98.6	92	32.9	16.8	8.50	5.68	4.98	3.62	3.38	2.67	2.44	2.09	1.81	1.69	1.37	1.39	1.04	1.14	39.3
4V75	75	22	134	126	30.7	14.4	8.40	5.40	4.84	3.52	3.21	2.59	2.25	2.00	1.61	1.58	1.17	1.25	0.88	0.96	36.2
4V90	90	35	158	145	36.7	20.7	8.33	6.19	4.93	3.78	3.43	2.75	2.56	2.13	1.99	1.72	1.59	1.40	1.29	1.16	44.3
4V110	110	35	188	175	33.2	16.6	8.29	5.60	4.81	3.57	3.26	2.58	2.36	1.97	1.77	1.53	1.36	1.20	1.04	0.95	39.3
4V132	132	35	226	210	34.9	17.1	8.21	5.36	4.66	3.33	3.11	2.40	2.22	1.82	1.64	1.41	1.24	1.10	0.94	0.86	40.9
4V160	160	50	271	252	34.0	17.2	8.28	5.59	4.80	3.51	3.23	2.56	2.35	1.94	1.76	1.51	1.34	1.20	1.04	0.95	40.2
4V200	200	50	338	314	34.4	16.8	8.23	5.33	4.65	3.32	3.09	2.39	2.20	1.81	1.63	1.38	1.22	1.07	0.91	0.84	40.2
4V250	250	50	418	391	32.7	14.9	8.15	5.14	4.56	3.26	2.98	2.32	2.07	1.71	1.48	1.29	1.07	0.97	0.78	0.72	38.0
4V315	315	50	527	492	33.1	14.4	8.08	4.85	4.41	3.05	2.81	2.15	1.90	1.57	1.32	1.15	0.92	0.84	0.65	0.61	38.0
4V355	355	50	592	556	32.6	13.7	8.00	4.73	4.32	2.99	2.71	2.09	1.80	1.50	1.22	1.08	0.84	0.78	0.57	0.55	37.2
4V400	400	50	660	623	31.2	12.6	7.95	4.71	4.26	2.99	2.63	2.06	1.71	1.45	1.12	1.01	0.75	0.70	0.51	0.49	35.6
4V500	500	50	835	782	33.5	13.1	7.75	4.28	3.97	2.65	2.37	1.82	1.49	1.26	0.96	0.88	0.63	0.61	0.43	0.42	37.5
4V630	630	50	1037	980	31.1	11.1	7.64	4.23	3.81	2.63	2.15	1.73	1.27	1.13	0.77	0.73	0.50	0.48	0.39	0.36	34.6

MX pro	P_N [kW]	I_{cc} [kA]	I_N [A]	H1 [A]	Harmonics at nominal load [%] H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	THD
4V0,75	0.75	5	1.77	1.6	34.6	23.7	8.90	7.80	5.60	4.80	4.10	3.50	3.20	2.80	2.60	2.30	2.20	1.90	1.90	1.70	45.0
4V1,5	1.5	5	3.34	3.0	35.6	23.5	8.95	7.65	5.61	4.74	4.06	3.49	3.16	2.76	2.57	2.28	2.15	1.94	1.83	1.68	45.5
4V2,2	2.2	5	4.83	4.4	35.8	22.8	8.70	7.11	5.41	4.36	3.89	3.20	3.01	2.53	2.43	2.09	2.01	1.77	1.70	1.53	45.0
4V3,0	3.0	5	6.13	5.7	31.6	18.8	9.41	6.82	5.88	4.57	4.24	3.38	3.28	2.67	2.63	2.19	2.16	1.86	1.80	1.60	40.1
4V4,0	4.0	5	8.23	7.5	36.2	21.6	9.00	8.17	5.52	4.17	3.93	3.05	3.00	2.40	2.38	1.98	1.93	1.68	1.58	1.45	44.7
4V5,5	5.5	22	10.8	9.8	34.9	23.1	9.68	4.05	6.12	5.18	4.45	3.83	3.48	3.04	2.85	2.52	2.40	2.14	2.06	1.85	45.2
4V7,5	7.5	22	15.0	14	34.1	20.5	8.57	6.43	5.28	3.95	3.78	2.89	2.90	2.28	2.32	1.88	1.90	1.59	1.58	1.37	42.3
4V11	11	22	21.1	19	35.2	20.1	8.95	6.50	5.41	4.02	3.80	2.95	2.86	2.32	2.23	1.90	1.77	1.60	1.42	1.37	43.1
4V15	15	22	28.2	26	35.2	20.0	8.98	6.49	5.43	4.02	3.82	2.94	2.88	2.32	2.24	1.90	1.78	1.60	1.43	1.37	43.1
4V18	18.5	22	33.9	32	29.4	15.2	8.85	6.18	5.39	4.04	3.78	2.98	2.83	2.34	2.18	1.90	1.70	1.58	1.33	1.33	35.2
4V22	22	22	40.9	38	32.8	18.7	8.60	6.42	5.28	4.09	3.75	3.03	2.85	2.40	2.25	1.97	1.81	1.67	1.48	1.44	40.4
4V30	30	22	54.1	51	30.0	16.3	8.75	6.27	5.32	4.07	3.73	3.01	2.79	2.37	2.15	1.94	1.69	1.62	1.33	1.38	37.0
4V37	37	22	66.4	63	28.5	15.0	8.63	6.08	5.23	4.00	3.65	2.97	2.71	2.34	2.07	1.90	1.61	1.58	1.26	1.32	35.1
4V45	45	22	83.1	76	38.3	21.0	8.24	5.81	4.85	3.48	3.33	2.54	2.44	2.00	1.85	1.64	1.42	1.38	1.10	1.17	45.6
4V55	55	22	98.6	92	32.9	16.8	8.50	5.68	4.98	3.62	3.38	2.67	2.44	2.09	1.81	1.69	1.37	1.39	1.04	1.14	39.3
4V75	75	22	134	126	30.7	14.4	8.40	5.40	4.84	3.52	3.21	2.59	2.25	2.00	1.61	1.58	1.17	1.25	0.88	0.96	36.2
4V90/110	110	35	188	175	33.2	16.6	8.29	5.60	4.81	3.57	3.26	2.58	2.36	1.97	1.77	1.53	1.36	1.20	1.04	0.95	39.3
4V110/132	132	35	226	210	34.9	17.1	8.21	5.36	4.66	3.33	3.11	2.40	2.22	1.82	1.64	1.41	1.24	1.10	0.94	0.86	40.9
4V132/160	160	50	271	252	34.0	17.2	8.28	5.59	4.80	3.51	3.23	2.56	2.35	1.94	1.76	1.51	1.34	1.20	1.04	0.95	40.2
4V160/200	200	50	338	314	34.4	16.8	8.23	5.33	4.65	3.32	3.09	2.39	2.20	1.81	1.63	1.38	1.22	1.07	0.91	0.84	40.2
4V200/250	250	50	418	391	32.7	14.9	8.15	5.14	4.56	3.26	2.98	2.32	2.07	1.71	1.48	1.29	1.07	0.97	0.78	0.72	38.0
4V250/315	315	50	527	492	33.1	14.4	8.08	4.85	4.41	3.05	2.81	2.15	1.90	1.57	1.32	1.15	0.92	0.84	0.65	0.61	38.0
4V315/400	400	50	660	623	31.2	12.6	7.95	4.71	4.26	2.99	2.63	2.06	1.71	1.45	1.12	1.01	0.75	0.70	0.51	0.49	35.6
4V400/500	500	50	835	782	33.5	13.1	7.75	4.28	3.97	2.65	2.37	1.82	1.49	1.26	0.96	0.88	0.63	0.61	0.43	0.42	37.5
4V500/630	630	50	1037	980	31.1	11.1	7.64	4.23	3.81	2.63	2.15	1.73	1.27	1.13	0.77	0.73	0.50	0.48	0.39	0.36	34.6

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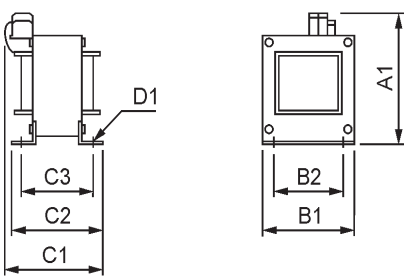
The option MX DCL is available as an external option for the devices MX eco & pro 4V0,75...4V75. It is connected to the terminals PO and PA/+ at the bottom of the inverter instead of the wire link.

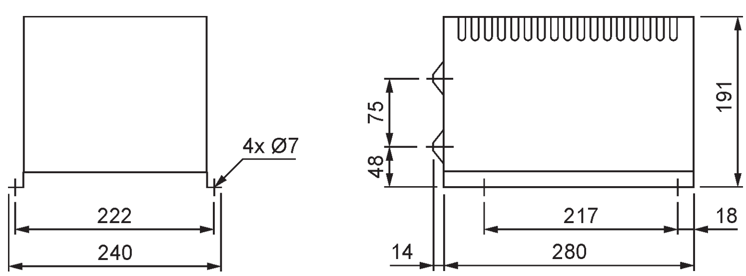
	Option DCL				
Order number	**VW3 A4 501**	**VW3 A4 502**	**VW3 A4 503**	**VW3 A4 504**	**VW3 A4 505**
Equivalent	DCL 2 (8 P01 200)	DCL 4 (8 P01 201)	DCL 8 (8 P01 202)	DCL 11 (8 P01 203)	DCL 14 (8 P01 204)
Nom. current (therm.) @50°C	2.25 A	4.3 A	8 A	10.7 A	14.3 A
Nominal inductivity	18 mH	10 mH	6.8 mH	3.9 mH	3.2 mH
Losses	8 W	11 W	23 W	27 W	32 W
Weight	0.65 kg	1 kg	1.7 kg	1.7 kg	2.2 kg
Dimension A1	103 mm	103 mm	134 mm	134 mm	134 mm
Dimension B1	60 mm	60 mm	96 mm	96 mm	96 mm
Dimension B2	50 mm	50 mm	80 mm	80 mm	80 mm
Dimension C1	95 mm	118 mm	115 mm	115 mm	120 mm
Dimension C2	60 mm	77 mm	80 mm	79 mm	85 mm
Dimension C3	51 mm	68 mm	65 mm	64 mm	70 mm
Fixing D1	4 x ∅ 3.5 mm	4 x ∅ 3.5 mm	4 x ∅ 5.5 mm	4 x ∅ 5.5 mm	4 x ∅ 5.5 mm
Connection to inverter	Terminal max. 2.5 mm²	Terminals max. 2.5 mm²	Terminals max. 2.5 mm²	Terminals max. 2.5 mm²	Terminals max. 2.5 mm²
Recommended cable	1.5 mm²	1.5 mm²	1.5 mm²	1.5 mm²	1.5 mm²
Connection PE	Terminal max. 10 mm²	Terminal max. 10 mm²	Terminal max. 10 mm²	Terminal max. 10 mm²	Terminal max. 10 mm²

	Option DCL				
Order number	**VW3 A4 506**	**VW3 A4 507**	**VW3 A4 508**	**VW3 A4 510**	**VW3 A4 511**
Equivalent	DCL 19 (8 P01 205)	DCL 27 (8 P01 206)	DCL 44 (8 P01 207)	DCL 85 (8 P01 208)	DCL 171 (8 P01 209)
Nom. current (therm.) @50°C	19.2 A	27.4 A	44 A	84.5 A	171 A
Nominal inductivity	2.2 mH	1.6 mH	1.2 mH	0.52 mH	0.22 mH
Losses	33 W	43 W	58 W	98 W	125 W
Weight	2.5 kg	3 kg	4.3 kg	5.6 kg	9 kg
Dimension A1	134 mm	134 mm	142 mm	171 mm	–
Dimension B1	96 mm	96 mm	108 mm	126 mm	–
Dimension B2	80 mm	80 mm	90 mm	105 mm	–
Dimension C1	120 mm	130 mm	145 mm	170 mm	–
Dimension C2	89 mm	99 mm	112 mm	120 mm	–
Dimension C3	74 mm	84 mm	97 mm	103 mm	–
Fixing D1	4 x ∅ 5.5 mm	4 x ∅ 5.5 mm	4 x ∅ 5.5 mm	4 x ∅ 7 mm	4 x ∅ 7 mm
Connection to inverter	Terminals max. 4 mm²	Terminals max. 6 mm²	Terminals max. 10 mm²	Terminals max. 35 mm²	∅ 7 mm
Recommended cable	2.5 mm²	4 mm²	10 mm²	35 mm²	70 mm²
Connection PE	Terminal max. 10 mm²	Terminal max. 10 mm²	Terminal max. 10 mm²	Terminal max. 16 mm²	Terminal max. 35 mm²

VW3 A4 501 to VW3 A4 510



VW3 A4 511



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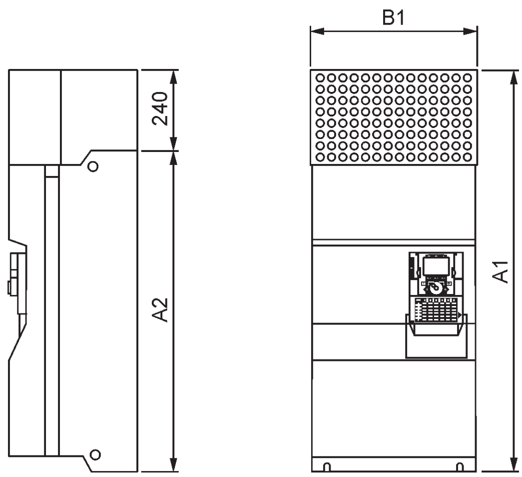
For the inverters MX eco & pro from 90 kW in device variant with DCL-BOX the box is installed at the top of the inverter. Use the terminals PO and PA/+ at the top of the frequency inverter for the electric connection with the inverter. The DCL-Box needs the air flow of the inverter for cooling but simultaneously it increases the protection degree of the top of the device to IP31. The cooling air channel in the DCL box and in the inverter is designed in protection degree IP54.

	General technical data option MX DCL-BOX
Operating voltage	400...850 V DC
Overload capability	125 % for 60 s per 10 min, 135 % for 2 s
Ambient temperature	-10...+50 °C (up to 60 °C with derating)
Storage temperature	-25...+70 °C
Altitude	0...1000 m (up to 3000 m with derating)
Vibration resistance	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz according to IEC/EN 60068-2-6
Shock resistance	7 g for 11 ms according to IEC/EN 60068-2-27
Cooling	forced, by means of the air flow of the inverter
Protection degree	IP31, cooling air channel IP54
Approvals	CE, UR, cUR, GOST

	Device variant with DCL-BOX		
Order code	ELNME4D90DAA ELNME4C11DAA ELNMP4D90DAB	ELNME4C13DAA ELNMP4C11DAB	ELNME4C16DAA ELNMP4C13DAB
Equivalent	DCL-BOX 240 (8 P01 210)	DCL-BOX 290 (8 P01 211)	DCL-BOX 350 (8 P01 212)
Nominal current (therm.) @50°C	243 A	290 A	351 A
Nominal current (magn.)	380 A	471 A	558 A
Nominal inductivity	210 µH	150 µH	138 µH
Losses	205 W	210 W	270 W
Weight	24 kg	32 kg	36 kg
Dimension A1	920 mm	1022 mm	1190 mm
Dimension A2	680 mm	782 mm	950 mm
Dimension B1	320 mm	360 mm	340 mm
Fixing D1	4x ∅ 11.5 mm	4x ∅ 11.5 mm	4x∅ 11.5 mm

MX DCL-BOX 240 to DCL-BOX 700



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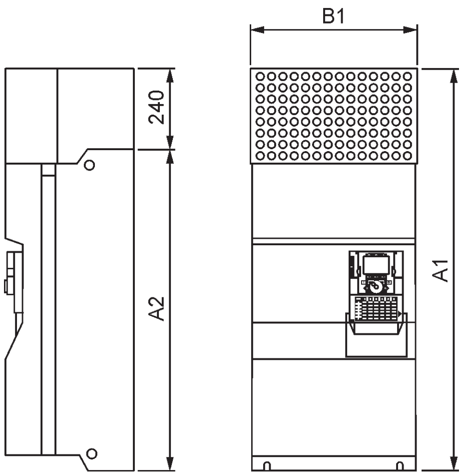
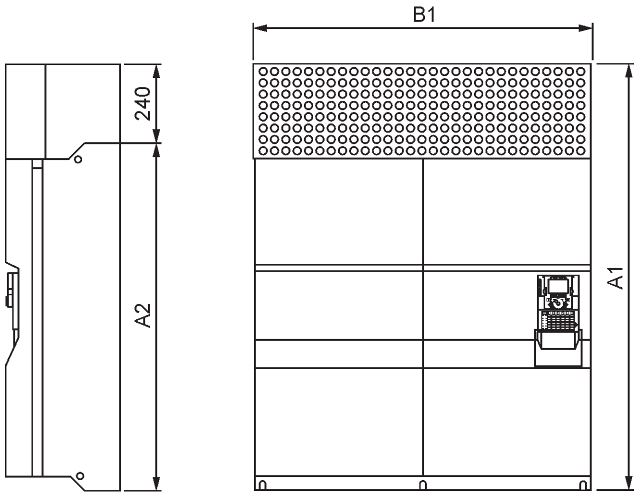
	Device variant with DCL-BOX		
Order code	ELNME4C20DAA ELNMP4C16DAB	ELNME4C25DAA ELNMP4C20DAA	ELNME4C31DAA ELNMP4C25DAA
Equivalent	DCL-BOX 490 (8 P01 213)	DCL-BOX 570 (8 P01 214)	DCL-BOX 700 (8 P01 215)
Nominal current (therm.) @50°C	486 A	574 A	702 A
Nominal current (magn.)	760 A	840 A	1116 A
Nominal inductivity	105 µH	95 µH	69 µH
Losses	345 W	390 W	495 W
Weight	53 kg	67 kg	67 kg
Dimension A1	1190 mm	1190 mm	1190 mm
Dimension A2	950 mm	950 mm	950 mm
Dimension B1	440 mm	595 mm	595 mm
Fixing D1	4x ∅ 11.5 mm	4x ∅ 11.5 mm	4x ∅ 11.5 mm

	Device variant with DCL-BOX		
Order code	ELNME4C35DAA ELNME4C40DAA ELNMP4C31DAA	ELNME4C50DAA ELNMP4C40DAA	ELNMP4C63DAA ELNMP4C50DAA
Equivalent	DCL-BOX 860 (8 P01 216)	DCL-BOX 1160 (8 P01 217)	DCL-BOX 1400 (8 P01 218)
Nominal current (therm.) @50°C	861 A	1160 A	1404 A
Nominal current (magn.)	1260 A	1884 A	2232 A
Nominal inductivity	63 µH	37.5 µH	34.5 µH
Losses	625 W	700 W	920 W
Weight	105 kg	115 kg	135 kg
Dimension A1	1390 mm	1390 mm	1390 mm
Dimension A2	1150 mm	1150 mm	1150 mm
Dimension B1	2 x 445 mm	2 x 445 mm	2 x 560 mm
Fixing D1	8x ∅ 11.5 mm	8x ∅ 11.5 mm	8x ∅ 11.5 mm

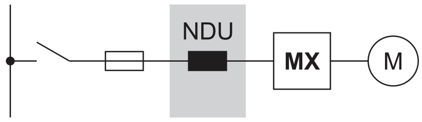
MX DCL-BOX 240 to DCL-BOX 700



MX DCL-BOX 860 to DCL-BOX 1400



Line reactor NDU



The option NDU can be used to reduce the mains current harmonics.

This option is available for all MX eco 4V & pro 4V. The inverters can be connected to a standard industry mains without additional actions.

Typically, devices with small power are operated on mains supply with low short-circuit power.

Devices of the power range 18.5...75 kW have a DC choke built-in and so they are also qualified for higher mains short-circuit powers up to 22 kA.

From 90 kW the inverters are designed for operation on a transformer with matching power. In case of mains with higher short-circuit power a choke is absolutely necessary and it is always recommended to reduce the current harmonics.

The option MX NDU is available for all MX pro 6V. The inverters can be connected to a standard industry mains without additional actions.

Typically, devices with small power are operated on mains supply with low short-circuit power.

Devices of the power range up to 75/90 kW have a DC choke built-in and so they are also qualified for higher mains short-circuit powers up to 22 kA.

From MX pro 6V90/110 the inverters are designed for operation on a transformer with matching power. In case of mains with higher short-circuit power a choke is absolutely necessary and it is always recommended to reduce the current harmonics.

Using the option MX NDU is required:

- in case of using the inverters in residential environments
- if several inverters are operated on common mains supply
- if power factor correction systems may be overloaded by means of the inverter
- if the inverter is operated by means of a generator
- if the mains supply has an unsymmetry ≥ 1.8 %
- in case of mains short circuit currents up to 100 kA
- in case of MX eco 4V & pro 4V from 90 kW if the use of the DCL box is not possible for lack of space

At full load the voltage drop at the choke cannot be balanced any longer by the inverter, that means that the output voltage is up to 3 % smaller than the mains voltage in front of the choke.

Please use the allocation table for selection of the option MX NDU suitable for the chosen inverter.

- MX eco 4V: page 82 ff.
- MX pro 4V: page 139 ff.
- MX pro 6V: page 193 ff.

The power allocation already includes the current decrease according to the respective maximum ambient temperature of the inverters.

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The option MX NDU is connected on the mains-side of the inverter. The line reactors can be mounted in any position. But in either case take care of well ventilation.

An installation on the mounting wall is also possible by means of the shipping brackets.

	General technical data
Operating voltage	3AC 380 V -15 % ... 690 V +10 %
Nominal frequency	50/60 Hz ±5 %
Overload capability	VW3 A4 551...556: 150 % for 60 s per 10 min, 200 % for 2 s VW3 A4 558...574: 125 % for 60 s per 10 min, 135 % for 2 s
Ambient temperature	-10...+50 °C (up to 60 °C with derating)
Storage temperature	-40...+70 °C
Altitude	0...1000 m (up to 3000 m with derating)
Vibration resistance	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz according to IEC/EN 60068-2-6
Shock resistance	15 g for 11 ms according to IEC/EN 60068-2-27
Protection degree	IP00
Approvals	CE, UR, cUR, GOST
Connection	Using connection lugs

Typical current harmonics when the line reactor MX NDU is used at 400 V, 50 Hz

MX eco	P_N	I_{cc}	I_N	H1	Harmonics at nominal load [%]																
	[kW]	[kA]	[A]	[A]	H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	THD
4V15	15	22	28.5	25.9	40.8	15.8	7.34	3.80	3.26	1.96	1.85	1.33	1.11	0.98	0.73	0.73	0.54	0.54	0.43	0.43	44.7
4V18	18.5	22	33.8	31.6	33.6	10.7	7.13	3.56	3.12	2.09	1.54	1.36	0.87	0.87	0.62	0.58	0.51	0.45	0.45	0.40	36.5
4V22	22	22	40.0	37.3	34.4	12.1	7.37	3.78	3.40	2.27	1.89	1.51	1.10	1.02	0.68	0.68	0.51	0.49	0.42	0.38	37.7
4V30	30	22	53.0	49.9	31.5	9.73	7.05	3.67	3.10	2.26	1.55	1.41	0.83	0.82	0.58	0.54	0.48	0.41	0.39	0.35	34.2
4V37	37	22	65.6	61.6	32.2	10.2	7.09	3.66	3.09	2.17	1.49	1.37	0.85	0.83	0.57	0.54	0.47	0.40	0.39	0.34	35.0
4V45	45	22	78.7	74.3	31.3	9.29	6.73	3.51	2.75	2.09	1.33	1.23	0.74	0.72	0.56	0.47	0.45	0.39	0.35	0.33	33.8
4V55	55	22	96.2	90.4	32.5	10.4	7.09	3.66	3.12	2.18	1.56	1.40	0.86	0.86	0.56	0.54	0.45	0.39	0.37	0.33	35.4
4V75	75	22	131	124	30.3	8.81	6.48	3.52	2.56	1.99	1.19	1.14	0.68	0.63	0.55	0.45	0.42	0.38	0.31	0.30	32.6
4V90	90	35	159	147	37.2	12.8	6.97	3.34	2.96	1.91	1.48	1.24	0.81	0.81	0.53	0.53	0.43	0.37	0.35	0.30	40.4
4V110	110	35	194	178	38.5	13.8	6.99	3.32	3.00	1.89	1.54	1.26	0.87	0.83	0.55	0.55	0.43	0.38	0.34	0.29	41.8
4V132	132	35	231	213	37.7	13.1	7.03	3.33	2.97	1.88	1.52	1.25	0.83	0.83	0.53	0.53	0.43	0.36	0.33	0.29	40.9
4V160	160	50	279	257	38.1	13.5	6.96	3.31	2.96	1.89	1.51	1.23	0.82	0.82	0.55	0.55	0.41	0.38	0.33	0.27	41.4
4V200	200	50	347	319	37.8	13.2	6.97	3.31	2.95	1.90	1.48	1.23	0.82	0.82	0.53	0.53	0.42	0.37	0.33	0.29	41.0
4V250	250	50	428	398	35.8	11.6	6.70	3.24	2.72	1.89	1.31	1.19	0.73	0.73	0.51	0.46	0.41	0.34	0.32	0.28	38.6
4V315	315	50	543	501	37.5	13.2	6.93	3.30	2.93	1.88	1.46	1.24	0.80	0.80	0.52	0.52	0.41	0.37	0.34	0.28	40.8
4V355	355	50	612	564	37.9	13.3	6.91	3.30	2.94	1.87	1.46	1.22	0.81	0.81	0.52	0.52	0.40	0.36	0.32	0.27	41.1
4V400	400	50	683	634	36.1	11.8	6.68	3.21	2.73	1.88	1.31	1.19	0.73	0.73	0.51	0.47	0.40	0.33	0.31	0.28	38.9
4V500	500	50	858	791	37.6	13.0	6.89	3.28	2.90	1.87	1.44	1.23	0.79	0.79	0.52	0.52	0.40	0.36	0.33	0.28	40.7
4V630	630	50	1072	992	36.8	12.3	6.86	3.24	2.85	1.89	1.40	1.21	0.77	0.77	0.51	0.50	0.40	0.35	0.33	0.27	39.8
12-pulse rectification																					
4V500	500	50	793	791	0	0	5.41	3.25	0	0	0.89	0.81	0	0	0.45	0.40	0	0	0.23	0.21	6.46
4V630	630	50	995	992	0	0	5.59	3.23	0	0	0.93	0.88	0	0	0.47	0.40	0	0	0.23	0.22	6.62

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MX pro	P_N	I_{cc}	I_N	H1	Harmonics at nominal load [%]																
	[kW]	[kA]	[A]	[A]	H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	THD
4V15	15	22	28.5	25.9	40.8	15.8	7.34	3.80	3.26	1.96	1.85	1.33	1.11	0.98	0.73	0.73	0.54	0.54	0.43	0.43	44.7
4V18	18.5	22	33.8	31.6	33.6	10.7	7.13	3.56	3.12	2.09	1.54	1.36	0.87	0.87	0.62	0.58	0.51	0.45	0.45	0.40	36.5
4V22	22	22	40.0	37.3	34.4	12.1	7.37	3.78	3.40	2.27	1.89	1.51	1.10	1.02	0.68	0.68	0.51	0.49	0.42	0.38	37.7
4V30	30	22	53.0	49.9	31.5	9.73	7.05	3.67	3.10	2.26	1.55	1.41	0.83	0.82	0.58	0.54	0.48	0.41	0.39	0.35	34.2
4V37	37	22	65.6	61.6	32.2	10.2	7.09	3.66	3.09	2.17	1.49	1.37	0.85	0.83	0.57	0.54	0.47	0.40	0.39	0.34	35.0
4V45	45	22	78.7	74.3	31.3	9.29	6.73	3.51	2.75	2.09	1.33	1.23	0.74	0.72	0.56	0.47	0.45	0.39	0.35	0.33	33.8
4V55	55	22	96.2	90.4	32.5	10.4	7.09	3.66	3.12	2.18	1.56	1.40	0.86	0.86	0.56	0.54	0.45	0.39	0.37	0.33	35.4
4V75	75	22	131	124	30.3	8.81	6.48	3.52	2.56	1.99	1.19	1.14	0.68	0.63	0.55	0.45	0.42	0.38	0.31	0.30	32.6
4V90/110	110	35	194	178	38.5	13.8	6.99	3.32	3.00	1.89	1.54	1.26	0.87	0.83	0.55	0.55	0.43	0.38	0.34	0.29	41.8
4V110/132	132	35	231	213	37.7	13.1	7.03	3.33	2.97	1.88	1.52	1.25	0.83	0.83	0.53	0.53	0.43	0.36	0.33	0.29	40.9
4V132/160	160	50	279	257	38.1	13.5	6.96	3.31	2.96	1.89	1.51	1.23	0.82	0.82	0.55	0.55	0.41	0.38	0.33	0.27	41.4
4V160/200	200	50	347	319	37.8	13.2	6.97	3.31	2.95	1.90	1.48	1.23	0.82	0.82	0.53	0.53	0.42	0.37	0.33	0.29	41.0
4V200/250	250	50	428	398	35.8	11.6	6.70	3.24	2.72	1.89	1.31	1.19	0.73	0.73	0.51	0.46	0.41	0.34	0.32	0.28	38.6
4V250/315	315	50	543	501	37.5	13.2	6.93	3.30	2.93	1.88	1.46	1.24	0.80	0.80	0.52	0.52	0.41	0.37	0.34	0.28	40.8
4V315/400	400	50	683	634	36.1	11.8	6.68	3.21	2.73	1.88	1.31	1.19	0.73	0.73	0.51	0.47	0.40	0.33	0.31	0.28	38.9
4V400/500	500	50	858	791	37.6	13.0	6.89	3.28	2.90	1.87	1.44	1.23	0.79	0.79	0.52	0.52	0.40	0.36	0.33	0.28	40.7
4V500/630	630	50	1072	992	36.8	12.3	6.86	3.24	2.85	1.89	1.40	1.21	0.77	0.77	0.51	0.50	0.40	0.35	0.33	0.27	39.8
12-pulse rectification																					
4V400/500	500	50	793	791	0	0	5.41	3.25	0	0	0.89	0.81	0	0	0.45	0.40	0	0	0.23	0.21	6.46
4V500/630	630	50	995	992	0	0	5.59	3.23	0	0	0.93	0.88	0	0	0.47	0.40	0	0	0.23	0.22	6.62

Typical current harmonics when the line reactor MX NDU is used at 690 V, 50 Hz

MX pro	P_N	I_{cc}	I_N	H1	Harmonics at nominal load [%]																
	[kW]	[kA]	[A]	[A]	H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	THD
6V2,2/3,0	3.0	22	5.2	3.7	75.8	56.6	20.7	10.5	7.96	6.54	3.40	3.35	2.46	1.93	1.79	1.54	1.16	1.16	0.89	0.80	98.1
6V3,0/4,0	4.0	22	6.2	4.5	73.7	53.2	17.1	8.90	7.51	5.54	3.31	3.25	2.02	1.82	1.58	1.26	1.15	1.04	0.80	0.80	93.6
6V4,0/5,5	5.5	22	8.2	6.2	70.1	47.7	12.5	7.92	6.27	4.05	3.25	2.69	1.80	1.77	1.18	1.14	0.92	0.80	0.74	0.63	86.6
6V5,5/7,5	7.5	22	10.6	8.3	66.0	42.6	9.34	8.06	4.75	3.44	2.71	2.14	1.62	1.56	1.01	1.19	0.67	0.94	0.51	0.74	80.0
6V7,5/11	11	22	13.4	11.1	56.9	34.8	7.88	7.19	4.05	3.10	2.57	1.84	1.80	1.29	1.33	0.99	1.02	0.79	0.80	0.65	67.8
6V11/15	15	22	17.3	15.2	47.0	25.4	7.91	5.48	4.07	2.64	2.56	1.73	1.76	1.28	1.27	1.00	0.93	0.79	0.70	0.63	54.7
6V15/18	18.5	22	21.7	19.6	41.0	19.6	7.87	4.64	4.03	2.51	2.49	1.73	1.65	1.28	1.14	0.97	0.80	0.73	0.57	0.55	46.8
6V18/22	22	22	24.1	22.1	38.8	17.5	7.82	4.40	3.99	2.50	2.43	1.73	1.58	1.26	1.06	0.93	0.72	0.68	0.50	0.50	43.9
6V22/30	30	22	30.7	28.6	34.7	13.7	7.67	4.12	3.83	2.51	2.23	1.71	1.37	1.18	0.86	0.81	0.56	0.55	0.40	0.39	38.8
6V30/37	37	22	38.9	35.2	41.5	19.3	7.98	4.54	3.95	2.37	2.38	1.61	1.55	1.19	1.05	0.89	0.72	0.67	0.51	0.51	47.1
6V37/45	45	22	47.9	44.2	37.4	15.4	7.82	4.08	3.82	2.35	2.22	1.61	1.38	1.15	0.88	0.82	0.58	0.58	0.41	0.41	41.8
6V45/55	55	22	54.5	50.8	35.3	13.6	7.69	3.94	3.70	2.35	2.09	1.59	1.25	1.09	0.77	0.75	0.51	0.51	0.38	0.36	39.2
6V55/75	75	22	73.2	68.7	33.0	12.0	7.58	3.97	3.64	2.43	2.01	1.60	1.16	1.06	0.70	0.69	0.47	0.46	0.38	0.34	36.6
6V75/90	90	22	91.7	85.0	36.1	14.5	7.65	4.05	3.78	2.41	2.19	1.65	1.34	1.15	0.84	0.80	0.55	0.55	0.40	0.39	40.3
6V90/110	110	28	117	103	46.8	21.8	7.52	4.45	3.35	2.05	1.92	1.16	1.16	0.89	0.75	0.60	0.49	0.46	0.33	0.32	52.6
6V110/132	132	28	137	124	43.2	18.1	7.33	3.72	3.32	1.83	1.77	1.14	1.03	0.86	0.63	0.57	0.42	0.39	0.27	0.27	47.7
6V132/160	160	35	163	149	39.7	14.9	7.24	3.31	3.08	1.89	1.61	1.18	0.85	0.85	0.52	0.52	0.35	0.35	0.28	0.24	43.3
6V160/200	200	35	199	186	36.2	11.7	6.75	3.16	2.78	1.83	1.33	1.14	0.72	0.72	0.46	0.42	0.36	0.29	0.27	0.22	39.0
6V200/250	250	35	257	230	44.2	19.2	7.40	3.96	3.32	1.90	1.84	1.17	1.11	0.86	0.68	0.61	0.46	0.46	0.31	0.31	49.1
6V250/315	315	35	317	291	39.7	14.9	7.20	3.28	3.11	1.90	1.63	1.19	0.90	0.85	0.56	0.56	0.39	0.39	0.29	0.27	43.3
6V315/400	400	35	394	367	35.9	11.4	6.72	3.14	2.73	1.81	1.29	1.14	0.69	0.69	0.46	0.42	0.35	0.29	0.27	0.23	38.6
6V400/500	500	35	504	460	40.7	15.9	7.31	3.44	3.21	1.89	1.71	1.21	0.97	0.88	0.60	0.57	0.40	0.41	0.31	0.28	44.7
6V500/630	630	35	616	572	37.0	12.1	7.01	3.15	2.94	1.82	1.43	1.16	0.77	0.73	0.49	0.44	0.37	0.28	0.30	0.22	39.9
6V630/800	800	42	775	730	33.4	9.63	6.36	3.14	2.43	1.82	1.08	1.05	0.63	0.59	0.46	0.37	0.35	0.28	0.24	0.22	35.6
12-pulse rectification																					
6V400/500	500	35	462	460	0	0	5.87	3.29	0	0	0.97	0.94	0	0	0.49	0.41	0	0	0.24	0.24	6.90
6V500/630	630	35	574	572	0	0	5.85	3.28	0	0	0.97	0.94	0	0	0.49	0.41	0	0	0.24	0.24	6.88
6V630/800	800	42	732	730	0	0	5.85	3.24	0	0	1.00	0.96	0	0	0.49	0.40	0	0	0.25	0.24	6.87

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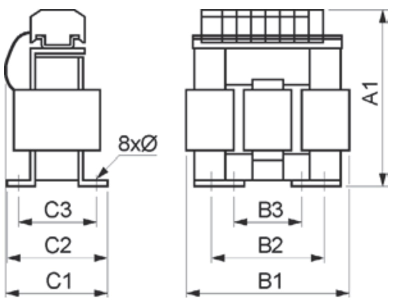
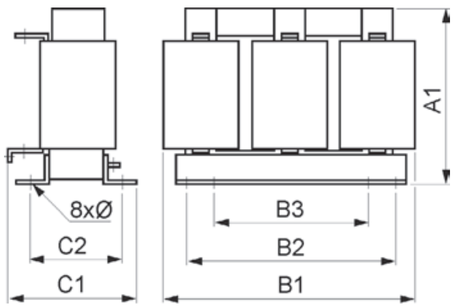
	Option NDU					
Order number	VW3 A4 551	VW3 A4 552	VW3 A4 553	VW3 A4 554	VW3 A4 555	VW3 A4 556
Nom. current @45°C	4 A	10 A	16 A	30 A	60 A	100 A
Nominal inductivity	10 mH	4 mH	2 mH	1 mH	500 µH	300 µH
Losses	45 W	65 W	75 W	90 W	94 W	260 W
Weight	1.5 kg	3 kg	3.5 kg	6 kg	11 kg	16 kg
Dimension A1	135 mm	155 mm	155 mm	170 mm	210 mm	210 mm
Dimension B1	100 mm	130 mm	130 mm	155 mm	180 mm	270 mm
Dimension B2	60 mm	80.5 mm	80.5 mm	107 mm	122 mm	181 mm
Dimension B3	40 mm	60 mm	60 mm	75 mm	85 mm	105 mm
Dimension C1	60 mm	90 mm	90 mm	135 mm	165 mm	100 mm
Dimension C2	55 mm	85 mm	85 mm	115 mm	125 mm	100 mm
Dimension C3	42 mm	62 mm	62 mm	90 mm	105 mm	---
Fixing D1	6 x 9 mm	6 x 12 mm	6 x 12 mm	6 x 12 mm	6 x 12 mm	11 x 22 mm
Connection D2	Terminal max. 2.5 mm²	Terminal max. 2.5 mm²	Terminal max. 6 mm²	Terminal max. 16 mm²	Terminal max. 35 mm²	∅ 6.5 mm
Recommended cable	1.5 mm²	2.5 mm²	6 mm²	16 mm²	25 mm²	35 mm²

VW3 A4 551 ... 555



VW3 A4 556



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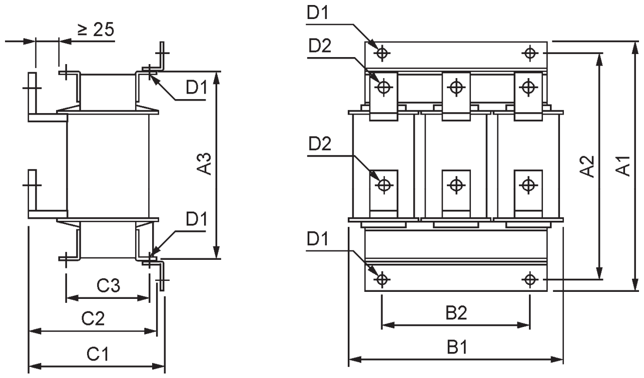
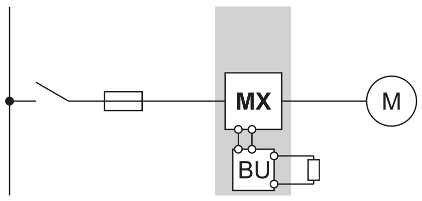
	Option NDU							
Order number	VW3 A4 570	VW3 A4 558	VW3 A4 571	VW3 A4 559	VW3 A4 560	VW3 A4 568	VW3 A4 561	VW3 A4 572
Equivalent	NDU 160 (8 P01 223)	NDU 195 (8 P01 224)	NDU 230 (8 P01 236)	NDU 235 (8 P01 225)	NDU 280 (8 P01 226)	NDU 315 (8 P01 227)	NDU 365 (8 P01 228)	NDU 450 (8 P01 237)
Nom. current @40°C @45°C	160 A 152 A	195 A 185 A	230 A 220 A	235 A 222 A	280 A 266 A	315 A 300 A	365 A 345 A	450 A 428 A
Nom. current (magn.)	320 A	370 A	405 A	445 A	530 A	570 A	685 A	770 A
Nom. inductivity	220 µH	155 µH	230 µH	120 µH	98 µH	85 µH	66 µH	100 µH
Losses	220 W	230 W	330 W	240 W	260 W	280 W	280 W	495 W
Weight	28 kg	30 kg	79 kg	35 kg	40 kg	46 kg	43 kg	90 kg
Dimension A1	305 mm	330 mm	440 mm	380 mm	380 mm	380 mm	380 mm	440 mm
Dimension A2	275 mm	300 mm	400 mm	350 mm	350 mm	350 mm	350 mm	400 mm
Dimension A3	240 mm	260 mm	340 mm	300 mm	300 mm	300 mm	300 mm	340 mm
Dimension B1	280 mm	280 mm	385 mm	320 mm	320 mm	320 mm	320 mm	385 mm
Dimension B2	200 mm	200 mm	300 mm	225 mm	225 mm	225 mm	225 mm	300 mm
Dimension C1	210 mm	210 mm	265 mm	210 mm	210 mm	210 mm	250 mm	305 mm
Dimension C2	200 mm	200 mm	245 mm	200 mm	200 mm	200 mm	230 mm	295 mm
Dimension C3	125 mm	125 mm	150 mm	150 mm	150 mm	150 mm	150 mm	190 mm
Fixing D1	∅ 9 mm	∅ 9 mm	∅ 13 mm	∅ 9 mm	∅ 9 mm	∅ 9 mm	∅ 11 mm	∅ 13 mm
Connection D2	∅ 9 mm	∅ 11 mm	∅ 13 mm	∅ 11 mm	∅ 11 mm	∅ 11 mm	∅ 13 mm	∅ 13 mm
Recom. cable [mm²]	70 mm²	95 mm²	95 mm²	95 mm²	–	–	–	–
PE connection	M10	M10	M12	M10	M10	M10	M12	M12

	Option MX						
Order number	VW3 A4 562	VW3 A4 569	VW3 A4 563	VW3 A4 573	VW3 A4 564	VW3 A4 565	VW3 A4 574
Equivalent	NDU 455 (8 P01 229)	NDU 475 (8 P01 230)	NDU 540 (8 P01 231)	NDU 620 (8 P01 232)	NDU 650 (8 P01 233)	NDU 760 (8 P01 234)	NDU 790 (8 P01 235)
Nom. current @40°C @45°C	455 A 432 A	475 A 450 A	540 A 513 A	620 A 590 A	650 A 618 A	760 A 722 A	790 A 750 A
Nom. current (magn.)	855 A	850 A	1025 A	1180 A	1150 A	1350 A	1500 A
Nom. inductivity	49 µH	60 µH	38 µH	26 µH	38 µH	32 µH	20 µH
Losses	300 W	320 W	320 W	320 W	320 W	450 W	350 W
Weight	50 kg	70 kg	55 kg	60 kg	62 kg	82 kg	82kg
Dimension A1	380 mm	380 mm	380 mm	380 mm	380 mm	440 mm	440 mm
Dimension A2	350 mm	350 mm	350 mm	350 mm	350 mm	400 mm	400 mm
Dimension A3	300 mm	300 mm	300 mm	300 mm	300 mm	340 mm	340 mm
Dimension B1	320 mm	320 mm	320 mm	320 mm	320 mm	385 mm	385 mm
Dimension B2	225 mm	225 mm	225 mm	225 mm	225 mm	300 mm	300 mm
Dimension C1	250 mm	250 mm	250 mm	250 mm	250 mm	275 mm	275 mm
Dimension C2	230 mm	230 mm	230 mm	230 mm	230 mm	250 mm	250 mm
Dimension C3	150 mm	150 mm	150 mm	150 mm	150 mm	125 mm	125 mm
Fixing D1	∅ 11 mm	∅ 11 mm	∅ 11 mm	∅ 13 mm	∅ 13 mm	∅ 13 mm	∅ 13.5 mm
Connection D2	∅ 13 mm	∅ 13 mm	∅ 13 mm	∅ 13 mm	2x ∅ 13 mm	2x ∅ 13 mm	2x ∅ 13 mm
Connection PE	M12	M12	M12	M12	M12	M12	M12

VW3 A4 558 ... 574



Braking unit BU



The use of the option MX BU is required if more power is returned to the DC link during the braking procedure than the losses in the motor and inverter amount to or the application requires very short braking times.

The braking unit (internally or as an external option) is controlled and monitored by the MX pro. If the DC link voltage exceeds an adjustable value due to a braking procedure, an external braking resistor is switched into the DC link as a consumer. The braking resistor converts the power incurred into heat and thus prevents a further rising of the DC link voltage and thus a shut-down with overvoltage.

This option is required only for MX pro from 4V200/250 and 6V200/250; smaller types of the MX pro have a braking transistor built-in!

Parameters permit the entry of the resistor data and thus the protection of the braking resistor from an excessively long operating time.

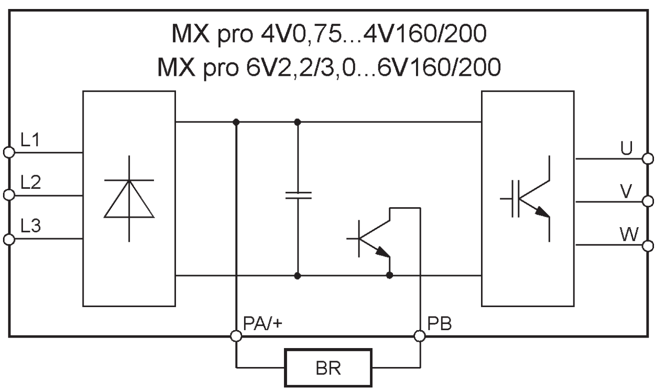
If the braking resistor does not match the overload characteristic to be used or the local regulations require an additional protective device, a thermal relay should be integrated into the mains disconnection mechanism.

When the braking function is activated, it acts as soon as the MX pro is in "Ready" or "Run" state, but not in case of "Trip".

The braking unit requires the following connecting lines:

- Control line (included in delivery)
- Supply cable for the fan (included in delivery)
- Power connection between the inverter and the braking unit (DC link terminals BU+ and BU–) (included in delivery)
- Power connection between the braking unit and the braking resistor (terminals PA and PB); max. 50 m
- Grounding of the braking unit at the bolt marked as PE

The frequency inverters MX pro 4V0,75...4V160/200 and MX pro 6V2,2/3,0…6V160/200 have a built-in braking transistor. It is thus only necessary to connect an external braking resistor BR and to activate the braking function.



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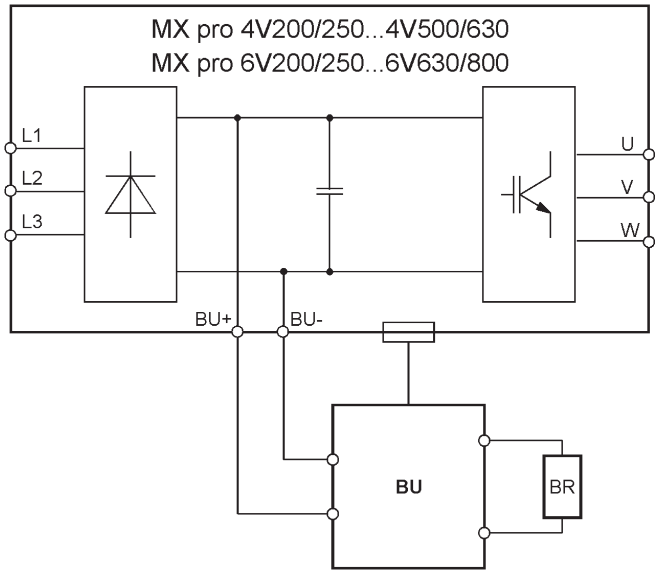
In case of the inverters MX pro 4V200/250...4V500/630 and MX pro 6V200/250…6V630/800 the braking unit is designed as an external option. It is supplied, controlled and monitored by the inverter as if it were integrated. An operation without an inverter or on a device other than the allocated one is thus not possible.



	General technical data
Mechanical vibration	According to IEC/EN 60068-2-6 1.5 mm in the range of 3...10 Hz, 0.6 g of 10...200 Hz (3M3 according to IEC/EN 60721-3-3)
Shock	According to IEC/EN 60068-2-27 4 g for 11 ms (3M2 according to IEC/EN 60721-3-3)
Operating temperature	-10...+45°C (3K3 according to IEC/EN 60721-3-3) up to +60°C with derating
Storage / Transport temperature	-25...+70°C
Protection degree	sideways, front IP31 top IP20 bottom IP00
Environmental class / Humidity	Class 3K3 in accordance with IEC/EN 60721-3-3 / no condensation, max. 95 % relative humidity
Altitude	Up to 1000 m, beyond power decrease of 1 % per 100 m up to 3000 m
Allowed pollution	Pollution degree 2 according to EN 61800-5-1 3C2 and 3S2 according to EN 60721-3-3
Protection class	Class 1 according to EN 50178
Basic standard	The devices are designed, built and tested on the basis of EN 50178.
EMC immunity	According to EN 61800-3, 1st and 2nd environment (IEC 1000-4-2; IEC 1000-4-3; IEC 1000-4-4; IEC 1000-4-5; IEC 1000-4-6)
EMC emission	in accordance with product standard EN 61800-3, 1st and 2nd environment, category C2, C3
Insulation	Galvanic insulation in accordance with EN 50178 PELV (Protective Extra Low Voltage)
Approvals	CE, GOST

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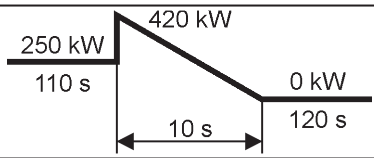
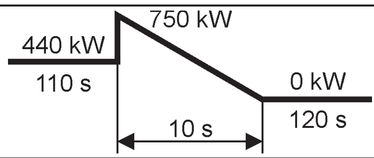
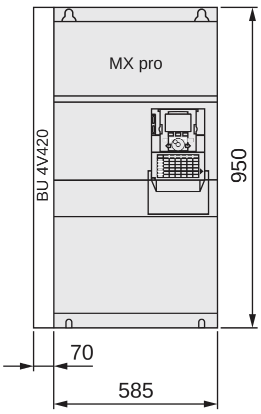
	Option BU	
Order number	VW3 A7 101	VW3 A7 102
Equivalent	**BU 4V420** (8 P01 260)	**BU 4V750** (8 P01 261)
Peak braking power	420 kW	750 kW
Max. continuous braking power	200 kW	200 kW
Possible braking power depending on the duty cycle	420 kW for 5 % 320 kW for 15 % 250 kW for 50 %	750 kW for 5 % 550 kW for 15 % 440 kW for 50 %
Cycle time	240 s	240 s
Typ. braking power for crane operation		
Min. braking resistance	1.05 Ω	0.7 Ω
Losses at 100% I_N	550 W	1050 W
Volume of cooling air	100 m³/h	600 m³/h
Weight	30 kg	70 kg
Mounting	Mounting on the left side wall of the inverter. Thus, the total width of the device is increased to 655 mm.	Installation left to the frequency inverter. Connection lines for a distance of 110 mm to the inverter case are included in delivery. A distance up to 1 m is permitted with adapted line connections.

VW3 A7 101



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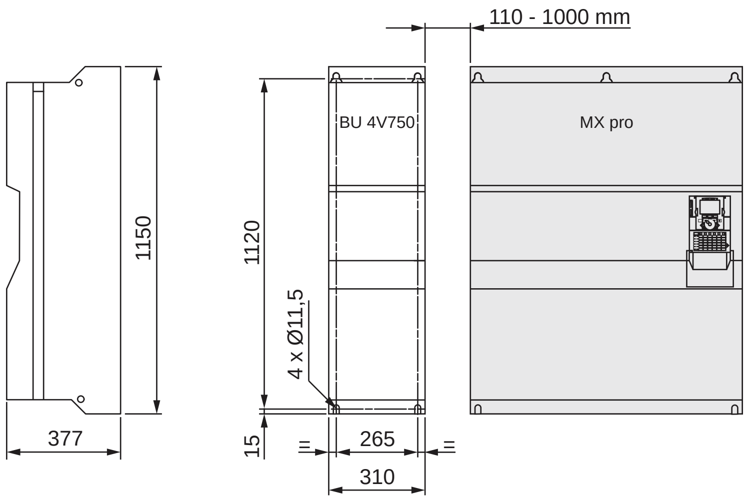
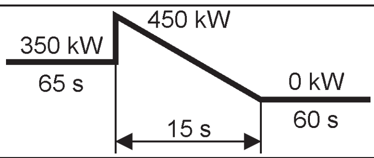
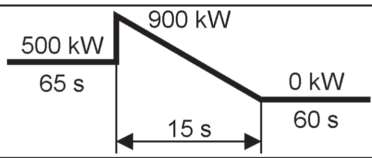
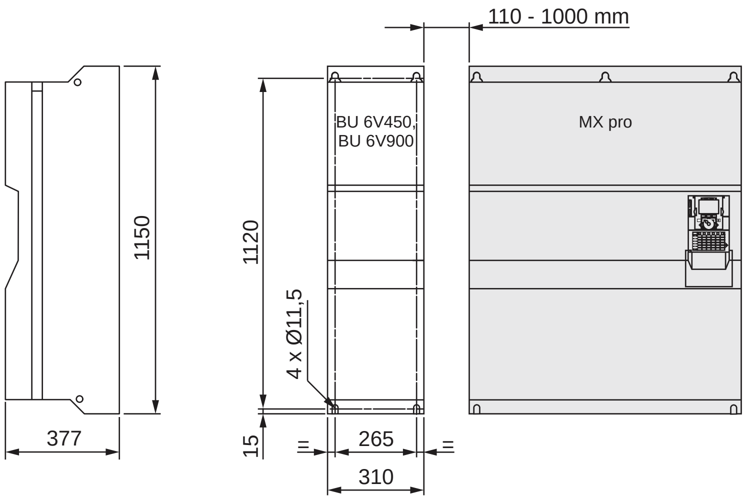
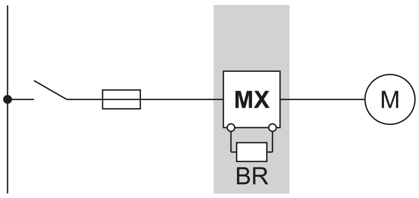


	Option BU	
Order number	VW3 A7 103	VW3 A7 104
Equivalent	**BU 6V450** (8 P01 278)	**BU 6V900** (8 P01 279)
Peak braking power	450 kW	900 kW
Max. continuous braking power	200 kW	200 kW
Possible braking power depending on the duty cycle	450 kW for 5 % 400 kW for 15 % 350 kW for 50 %	900 kW for 5 % 600 kW for 15 % 500 kW for 50 %
Cycle time	140 s	140 s
Typ. braking power for crane operation		
Min. braking resistance	2 Ω	1 Ω
Losses at 100% I_N	650 W	1500 W
Volume of cooling air	600 m^3/h	600 m^3/h
Weight	70 kg	70 kg
Mounting	Installation left to the frequency inverter. Connection lines for a distance of 110 mm to the inverter case are included in delivery. A distance up to 1 m is permitted with adapted line connections.	Installation left to the frequency inverter. Connection lines for a distance of 110 mm to the inverter case are included in delivery. A distance up to 1 m is permitted with adapted line connections.

VW3 A7 103 and VW3 A7 104



Braking resistor BR



The braking resistor converts the power accumulating during generator operation into heat and thus prevents a further rising of the DC link voltage.

The following inverters are prepared for the direct connection of a braking resistor:

- MX pro 4V0,75...4V160/200
- MX pro 6V2,2/3,0...6V160/200

An external braking unit MX BU is required for

- MX pro from 4V200/250
- MX pro from 6V200/250

When allocating the braking resistors to the frequency inverters, observe the following points:

- Minimum braking resistance per inverter power
- Required maximum braking power in order to avoid shut down due to overvoltage
- Necessary continuous power depending on the application requirements
- Correct adjustment of parameters to protect the resistor
- Installation of an additional thermal relay, if required

The surface of the resistor may reach up to 250°C. Thus it should be mounted on non-combustible material.

The unhindered air flow may not be impaired by other devices or casing parts!

Please use the planning information on page 119 ff or the allocation table for selection of the MX BR:

- MX pro 4V: page 138 ff.
- MX pro 6V: page 192 ff.

	General technical data
Ambient temperature	Operation 0 ... + 50°C Storage – 25 ... +70°C
Thermal protection	Software function of the frequency inverter or by means of a thermal relay (motor protection relay)
Protection degree	IP23
Approvals	CE

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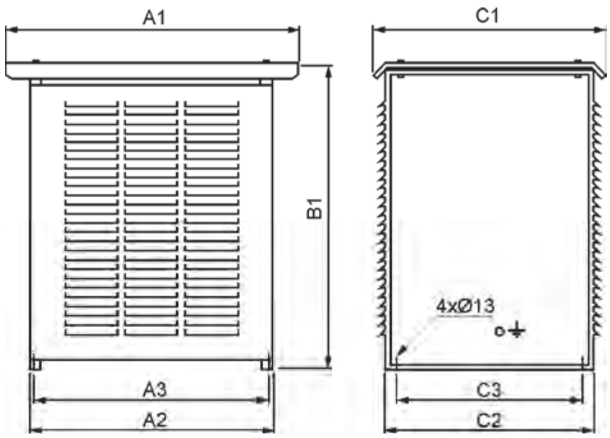
	Option braking resistors BR				
Order number	VW3 A7 710	VW3 A7 711	VW3 A7 712	VW3 A7 715	VW3 A7 716
Resistor	2.75 Ω	2.1 Ω	2.1 Ω	1.05 Ω	1.05 Ω
Continuous power	25 kW	37 kW	44 kW	56 kW	75 kW
Peak power @ 680 V DC	170 kW	220 kW	220 kW	440 kW	440 kW
Peak power @ 785 V DC	225 kW	295 kW	295 kW	585 kW	585 kW
Peak power @ 975 V DC	345 kW	455kW	455kW	905 kW	905 kW
Peak power @ 1075 V DC	420 kW	550 kW	550 kW	1100 kW	1100 kW
Duty cycle at 120 s cycle @680V / 785V / 975V / 1075V	8 / 6 / 4 / 3 %	9 / 7 / 4 / 4 %	11 / 8 / 5 / 4 %	7 / 5 / 3 / 2 %	9 / 7 / 4 / 4 %
Set value of thermal relay	95 A	133 A	145 A	231 A	267 A
Protection degree	IP23	IP23	IP23	IP23	IP23
Dimension A1	1040 mm	1140 mm	1040 mm	1040 mm	1140 mm
Dimension A2	860 mm	960 mm	860 mm	860 mm	960 mm
Dimension A3	832 mm	932 mm	832 mm	932 mm	932 mm
Dimension B1	690 mm	1150 mm	1150 mm	1150 mm	1150 mm
Dimension C1	560 mm	460 mm	620 mm	620 mm	820 mm
Dimension C2	480 mm	380 mm	540 mm	540 mm	740 mm
Dimension C3	400 mm	300 mm	460 mm	460 mm	660 mm
Connection	M10	M10	M10	M10	M10
Weight	80 kg	86 kg	104 kg	136 kg	172 kg

VW3 A7 710 ... 716



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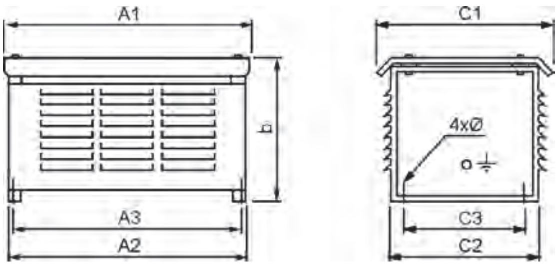
	Option braking resistors			
Order number	VW3 A7 801	VW3 A7 802	VW3 A7 803	VW3 A7 804
Resistor	100 Ω	60 Ω	24.5 Ω	14 Ω
Continuous power	1.6 kW	5.6 kW	9.8 kW	22.4 kW
Peak power @ 680 V DC	4.6 kW	8 kW	19 kW	33 kW
Peak power @ 785 V DC	6.2 kW	10 kW	25 kW	44 kW
Peak power @ 975 V DC	10 kW	16 kW	39 kW	68 kW
Peak power @ 1075 V DC	12 kW	19 kW	47 kW	83 kW
Duty cycle at 120 s cycle @680V / 785V / 975V / 1075V	20 / 14 / 9 / 8 %	50 / 33 / 20 / 17%	35 / 25 / 14 / 11%	50 / 33 / 20 / 16%
Set value of thermal relay	4 A	10 A	20 A	40 A
Protection degree	IP23	IP23	IP23	IP23
Dimension A1	490 mm	450 mm	610 mm	990 mm
Dimension A2	452 mm	420 mm	580 mm	960 mm
Dimension A3	470 mm	392 mm	552 mm	932 mm
Dimension B1	203.5 mm	440 mm	440 mm	440 mm
Dimension C1	202 mm	540 mm	540 mm	540 mm
Dimension C2	153 mm	480 mm	480 mm	480 mm
Dimension C3	95 mm	400 mm	400 mm	400 mm
Connection	M6	M10	M10	M10
Weight	6 kg	21 kg	28 kg	54 kg

VW3 A7 801 ... 804



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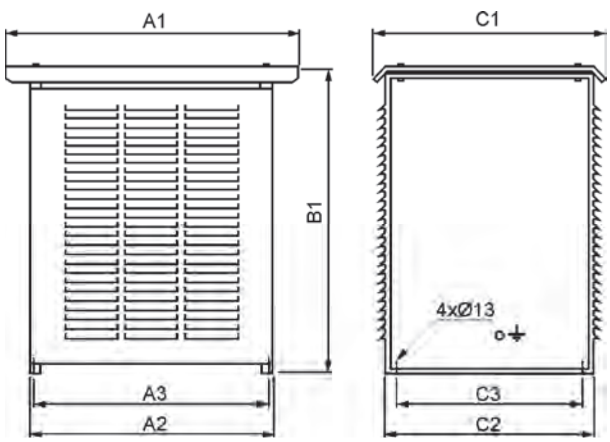
	Option braking resistors			
Order number	VW3 A7 805	VW3 A7 806	VW3 A7 811	VW3 A7 812
Resistor	8.1 Ω	4.2 Ω	2.75 Ω	2.1 Ω
Continuous power	44 kW	62 kW	56 kW	75 kW
Peak power @ 680 V DC	57 kW	110 kW	170 kW	220 kW
Peak power @ 785 V DC	76 kW	147 kW	225 kW	295 kW
Peak power @ 975 V DC	117 kW	225 kW	345 kW	455 kW
Peak power @ 1075 V DC	143 kW	275 kW	420 kW	550 kW
Duty cycle at 120 s cycle @680V / 785V / 975V / 1075V	50 / 40 / 25 / 20%	40 / 25 / 17 / 12%	20 / 14 / 9 / 7%	20 / 14 / 9 / 8%
Set value of thermal relay	74 A	121 A	143 A	189 A
Protection degree	IP23	IP23	IP23	IP23
Dimension A1	1040 mm	1040 mm	1140 mm	1140 mm
Dimension A2	860 mm	860 mm	960 mm	960 mm
Dimension A3	832 mm	832 mm	932 mm	932 mm
Dimension B1	1150 mm	1150 mm	1150 mm	1150 mm
Dimension C1	620 mm	820 mm	620 mm	820 mm
Dimension C2	540 mm	740 mm	540 mm	740 mm
Dimension C3	460 mm	660 mm	460 mm	660 mm
Connection	M10	M10	M10	M10
Weight	92 kg	126 kg	130 kg	181 kg

VW3 A7 805 ... 812



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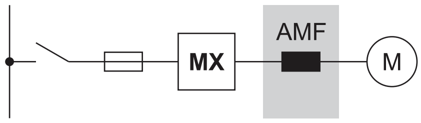
Output motor filter AMF



At the output of a voltage source frequency inverter there is a pulsed voltage with a pulse frequency of 2...max. 16 kHz (depending on the device) and a slew rate of more than 10 kV/µs.

The use of the option AMF has significant advantages concerning the trouble-free operation of the drive:

- Decrease of the voltage load of the motor –recommended from 50 m, necessary from 100 m for 400 V mains supply
  10 m, necessary from 30 m for 690 V mains supply
- Prevention of common mode bearing currents in the motor – especially important at high power
- Great reduction of the influences to other cables – important if the separate laying of motor cables cannot be ensured

By means of the especially developed system the voltage drop at the AMF is negligible small.

Please use the allocation table for selection of the option MX AMF suitable for the chosen inverter.

- MX eco 4V: page 82 ff.
- MX pro 4V: page 139 ff.
- MX pro 6V: page 193 ff.

Additionally observe the information of the respective inverter range to guarantee trouble-free operation:

- MX eco 4V: page 70
- MX pro 4V: page 126
- MX pro 6V: page 180

The option AMF is connected at the output side of the inverter into the connection to the motor.

The filters AMF 215-3 up to 1190-3 have to be installed vertically to ensure sufficient cooling. Furthermore observe the required distance to other devices and case parts.

	General technical data
Operating voltage	3AC 0...690 V
Operating frequency	0...100 Hz
Overload capability	150 % for 60 s per 10 min, 165 % for 2 s
Ambient temperature	-10...+50 °C (up to 60 °C with derating)
Storage temperature	-40…+70 °C
Altitude	0...1000 m (up to 3000 m with derating)
Vibration resistance	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz according to IEC/EN 60068-2-6
Shock resistance	15 g for 11 ms according to IEC/EN 60068-2-27
Protection degree	IP00, with protection against contact
Approvals	CE, UR, cUR, GOST

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The MX AMF 12-1...90-1 are equipped with a built-in temperature sensor (thermoclick opens at > 125°C). This must be integrated either in the trip message circuit of the whole drive or in the inverter (e.g. digital input for "External fault").

	Option AMF		
Order number	VW3 A5 101	VW3 A5 102	VW3 A5 103
Equivalent	AMF 12-1 (8 P01 140)	AMF 48-1 (8 P01 141)	AMF 90-1 (8 P01 142)
Nominal current @50°C	12 A	48 A	90 A
Losses	150 W	250 W	350 W
Weight	3.0 kg	5.0 kg	8.5 kg
Dimension A1	200 mm	235 mm	226 mm
Dimension B1	190 mm	200 mm	234 mm
Dimension B2	170 mm	170 mm	200 mm
Dimension C1	90 mm	130 mm	126 mm
Dimension C2	45 mm	48 mm	78 mm
Fixing D1	8 x 12 mm	8 x 12 mm	8 x 12 mm
Connection D2	Terminal max. 10 mm²	Terminals max. 16 mm²	M8
Connection PE	Terminal max. 10 mm²	Terminals max. 16 mm²	M8

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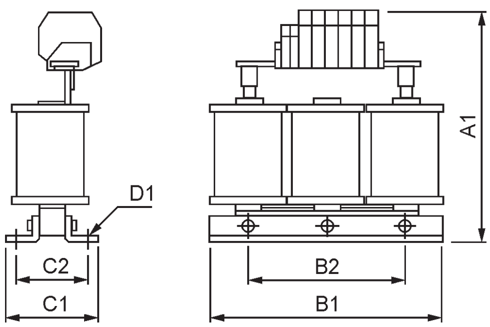
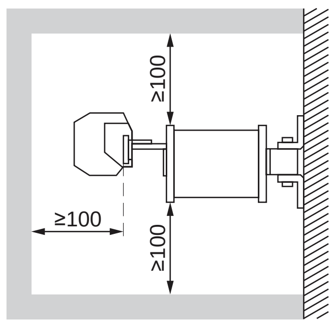
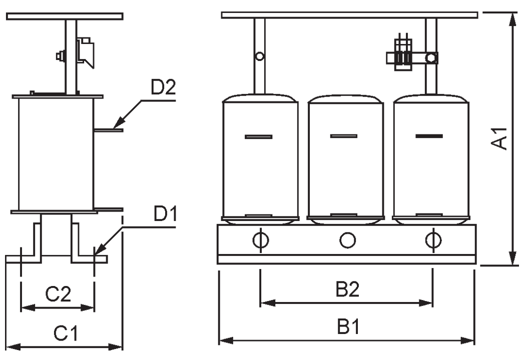
VW3 A5 101 and VW3 A5 102



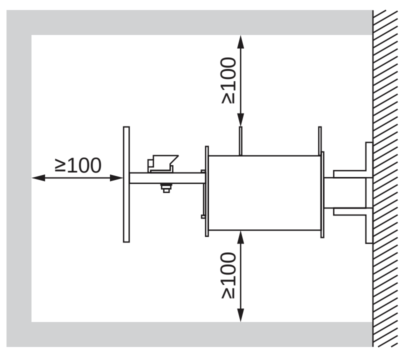
Required minimum distances



VW3 A5 103



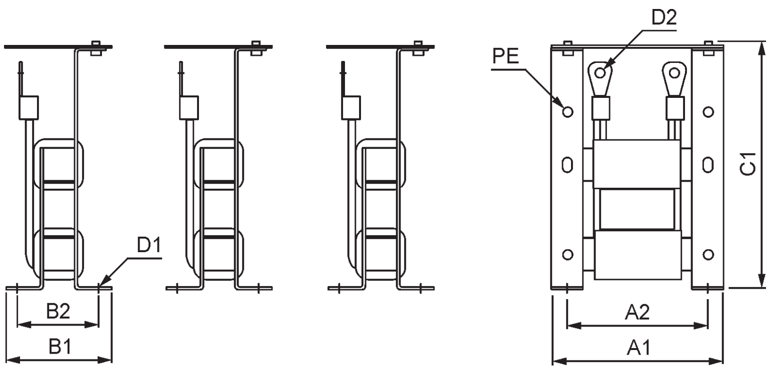
Required minimum distances



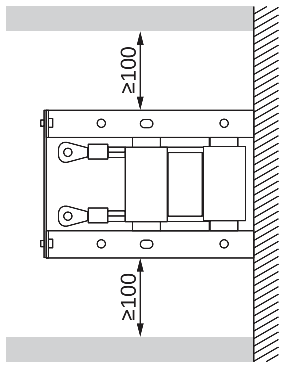
For better effect and cooling the MX AMF 215-3...1190-3 consist of 3 single-phase chokes. Each has to be connected with one motor phase.

	Option AMF				
Order number	VW3 A5 104	VW3 A5 105	VW3 A5 106	VW3 A5 107	VW3 A5 108
Equivalent	AMF 215-3 (8 P01 143)	AMF 320-3 (8 P01 144)	AMF 480-3 (8 P01 145)	AMF 760-3 (8 P01 146)	AMF 1190-3 (8 P01 147)
Nominal current @50°C	215 A	314 A	481 A	759 A	1188 A
Losses	430 W	475 W	530 W	600 W	680 W
Weight	15.5 kg	32 kg	58 kg	93 kg	120 kg
Dimension A1	170 mm	210 mm	245 mm	315 mm	370 mm
Dimension A2	150 mm	175 mm	225 mm	275 mm	325 mm
Dimension B1	100 mm	110 mm	200 mm	210 mm	230 mm
Dimension B2	75 mm	75 mm	175 mm	200 mm	200 mm
Dimension C1	250 mm	250 mm	250 mm	250 mm	250 mm
Fixing D1	9 x 13 mm	9 x 13 mm	9 x 13 mm	9 x 13 mm	9 x 13 mm
Connection D2	M10	M10	2 x M12	2 x M12	3 x M12
Connection PE	M8	M8	M8	M8	M8

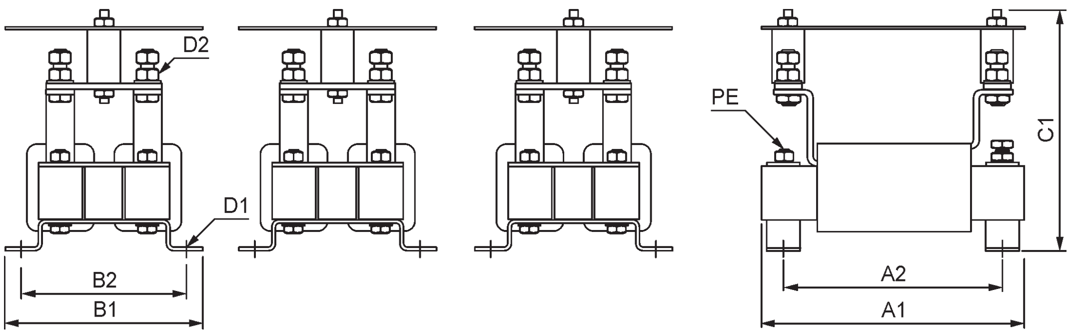
VW3 A5 104 and VW3 A5 105



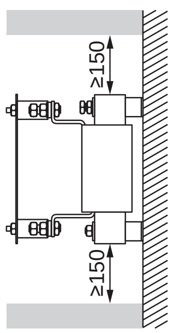
Required minimum distances



VW3 A5 106, VW3 A5 107 and VW3 A5 108



Required minimum distances



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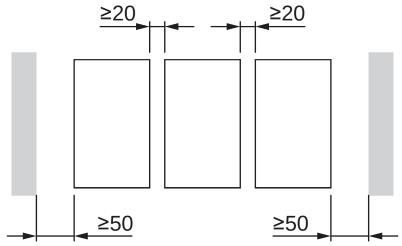
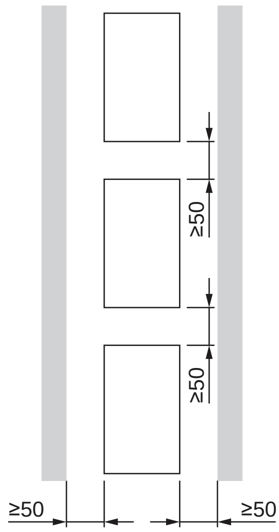
The filters AMF 215-3...1190-3 consist of 3 single-phase chokes.

During installation observe the free space above and below as well as the required minimum distance between the three components.

Arrangement side by side



Arrangement on top of each other



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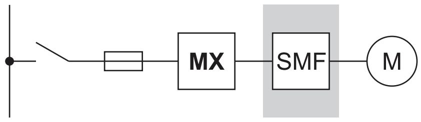
Sinus motor filter SMF



The use of the option MX SMF is recommended:

- in case of MX eco & pro standard drives in order to arise nearly sinusoidal motor voltage. Therefore, additional noises at the motor are totally prevented.
- for MX eco & pro standard drives in the power range ≤ 75 kW to observe the EMC directive in case of unscreened motor cables.
- for MX pro ...-MV inverters and step-up transformers for medium voltage motors up to 6 kV.

The option MX SMF is connected at the output side of the inverter into the connection to the motor.

For operation with a step-up transformer to > 1000 V motor voltage, the option MX SMF is absolutely necessary.

For standard drives the use of the option MX SMF is only permitted combined with control method "V/f" !

Set parameter B3.40 "Output filter" of the inverter to "2 .. Sinus filter" for the operation with option MX SMF. Thus, at all MX eco & pro the pulse frequency is fixed to 4 kHz. Therefore a reduction of power or of the max. ambient temperature must be considered.

Furthermore, consider the reduced output voltage due to the voltage drop at the sinus motor filter.

Please use the allocation table for selection of the option MX SMF suitable for the chosen inverter.

- MX eco 4V: page 82 ff.
- MX pro 4V: page 139 ff.
- MX pro 6V: page 193 ff.

The allowed lengths of motor cables are given in the tables on the following pages:

- MX eco 4V: page 70
- MX pro 4V: page 126
- MX pro 6V: page 180

	General technical data
Operating voltage	MX eco & pro 4V: 3AC 0...480 V MX pro 6V: 3AC 0...690 V
Operating frequency	0...100 Hz
Pulse frequency	MX eco & pro: 4 kHz (corresponding setting at the inverter necessary) MX pro ...-MV: 3 kHz (400 V), 2.5 kHz (690 V)
Overload capability	150 % for 60 s per 10 min, 165 % for 2 s
Voltage drop	approx. 10 %
Ambient temperature	+5...+50 °C (up to 55 °C with derating)
Storage temperature	-25…+70 °C
Altitude	0...1000 m (up to 3000 m with derating)
Vibration resistance	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz according to IEC/EN 60068-2-6
Shock resistance	15 g for 11 ms according to IEC/EN 60068-2-27
Approvals	CE, UR, cUR, GOST

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	Option SMF					
Order number	VW3 A5 201	VW3 A5 202	VW3 A5 203	VW3 A5 204	VW3 A5 205	VW3 A5 206
Equivalent	SMF 480/11 (8 P01 148)	SMF 480/16 (8 P01 149)	SMF 480/33 (8 P01 150)	SMF 480/66 (8 P01 151)	SMF 480/95 (8 P01 152)	SMF 480/180 (8 P01 153)
Nominal current @50°C	11 A	16 A	33 A	66 A	95 A	180 A
Protection degree	IP20					
Losses	50 W	70 W	120 W	180 W	250 W	400 W
Weight	9 kg	11 kg	24 kg	47 kg	99 kg	125 kg
Dimension A1	335 mm	375 mm	470 mm	650 mm	780 mm	1130 mm
Dimension A2	280 mm	320 mm	380 mm	530 mm	650 mm	880 mm
Dimension B1	120 mm	120 mm	150 mm	210 mm	250 mm	310 mm
Dimension B2	100 mm	100 mm	120 mm	160 mm	200 mm	220 mm
Dimension C1	160 mm	190 mm	240 mm	280 mm	360 mm	375 mm
Fixing D1	∅ 6.6 mm	∅ 6.6 mm	∅ 6.6 mm	∅ 8.6 mm	∅ 11 mm	∅ 11 mm
Connection – L on the inverter side	Cable 0.7 m	Cable 0.7 m	Cable 0.9 m	Cable 1.5 m	Cable 1.6 m	Cable 2.7 m
– D2 on the motor side	Terminal 4 mm²	Terminal 6 mm²	Terminal 10 mm²	Terminal 25 mm²	Terminal 50 mm²	Terminal 150 mm²

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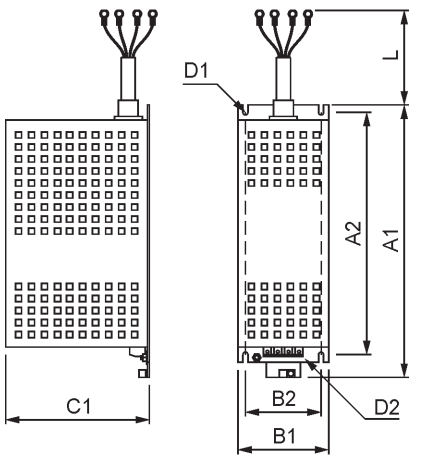
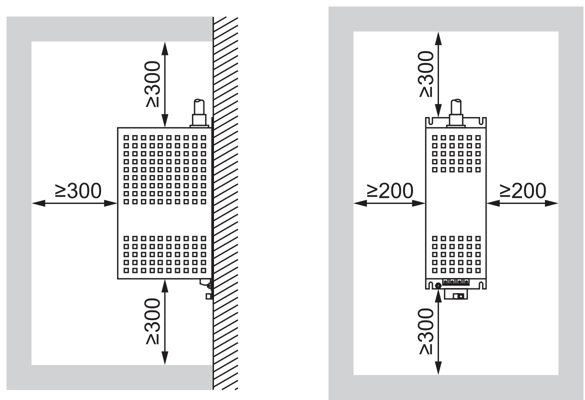
VW3 A5 201 to VW3 A5 206

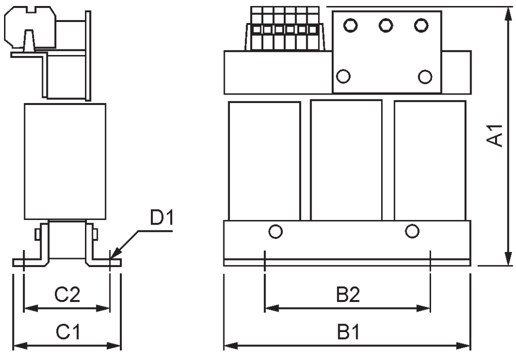


Required minimum distances

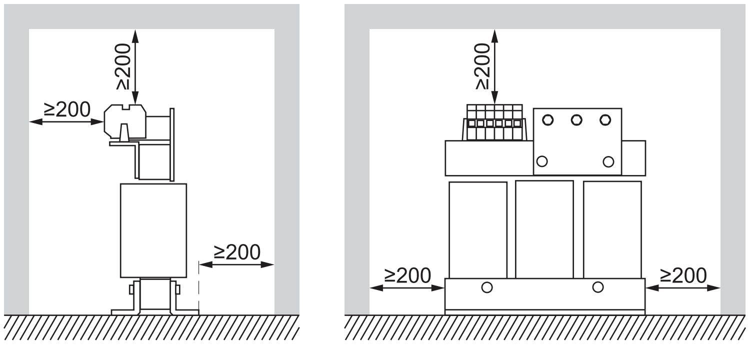


	Option SMF				
Order number	VW3 A5 207	VW3 A5 208	VW3 A5 209	VW3 A5 210	VW3 A5 211
Equivalent	SMF 480/200 (8 P01 154)	SMF 480/300 (8 P01 155)	SMF 480/400 (8 P01 156)	SMF 480/600 (8 P01 157)	SMF 480/1200 (8 P01 158)
Nominal current @50°C	200 A	300 A	400 A	600 A	1200 A
Protection degree	IP00				
Losses	945 W	1360 W	1900 W	2370 W	5150 W
Weight	130 kg	165 kg	190 kg	235 kg	600 kg
Dimension A1	500 mm	500 mm	600 mm	710 mm	930 mm
Dimension B1	420 mm	420 mm	480 mm	480 mm	620 mm
Dimension B2	370 mm	370 mm	430 mm	430 mm	525 mm
Dimension C1	290 mm	345 mm	340 mm	370 mm	500 mm
Dimension C2	194 mm	231 mm	238 mm	258 mm	352 mm
Fixing D1	11 x 15 mm	11 x 15 mm	13 x 18 mm	13 x 18 mm	13 x 22 mm
Connection D2	Terminal 95 mm²	∅ 11 mm	∅ 11 mm	∅ 11 mm	4 x ∅ 11 mm

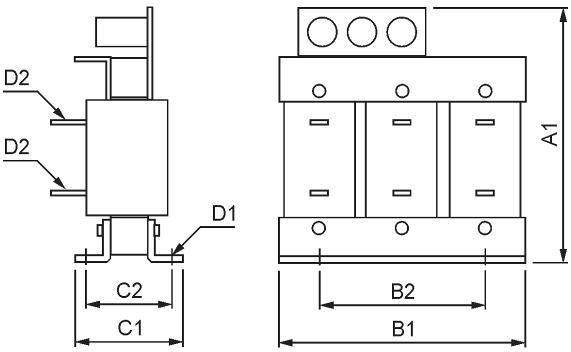
VW3 A5 207



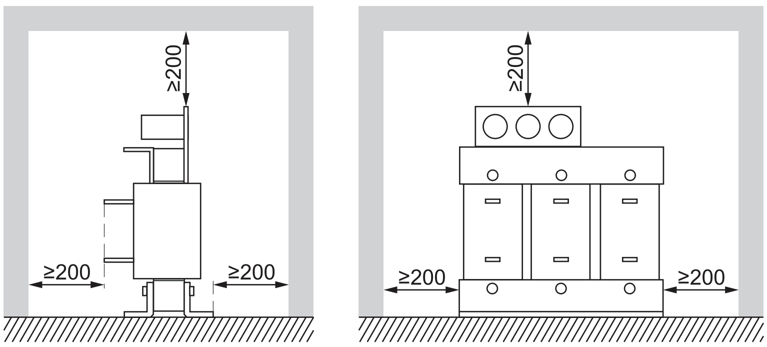
Required minimum distances



VW3 A5 208 to VW3 A5 211



Required minimum distances



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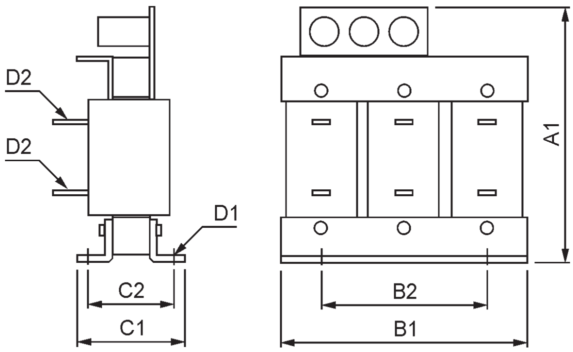
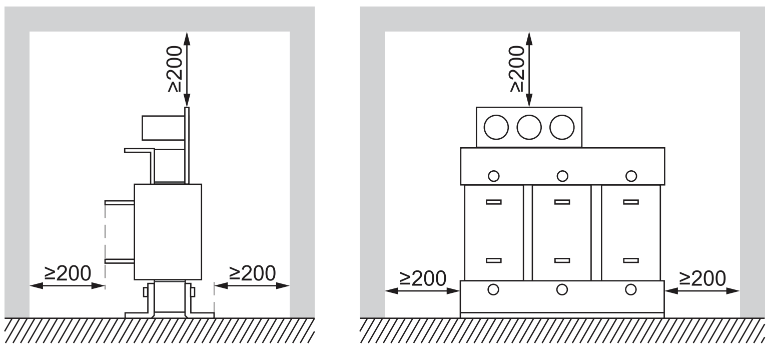
	Option SMF		
Order number	VW3 A5 212	VW3 A5 213	VW3 A5 214
Equivalent	SMF 6V240 (8 P01 497)	SMF 6V460 (8 P01 498)	SMF 6V900 (8 P01 499)
Nominal current @50°C	240 A	460 A	900 A
Protection degree	IP00		
Losses	1500 W	2800 W	4810 W
Weight	210 kg	300 kg	400 kg
Dimension A1	700 mm	870 mm	1150 mm
Dimension B1	420 mm	480 mm	600 mm
Dimension B2	370 mm	430 mm	525 mm
Dimension C1	380 mm	420 mm	450 mm
Dimension C2	244 mm	295 mm	305 mm
Fixing D1	11 x 15 mm	13 x 18 mm	13 x 22 mm
Connection D2	∅ 11 mm	∅ 14 mm	2 x ∅ 11 mm

VW3 A5 212 …VW3 A5 214



Required minimum distances



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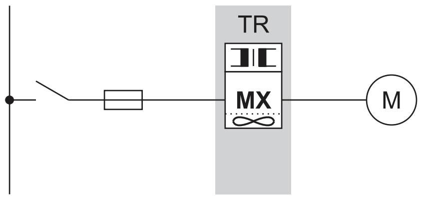
Transformer TRAFO-BOX



The transformer box MX TRAFO-BOX is required to supply the internal blower(s) if there is no 3 AC 400…480 V auxiliary voltage available.

The TRAFO-BOX is required for MX pro 6V90/110 up to 6V630/800. It provides an internal fan supply instead of an external fan voltage.

Because the drives can be used for 500 V up to 690 V there are two different possibilities for connection of the transformer box: 500…600 V or 690 V mains voltage.

The connection can be done via a simple, well marked plug X2.

For the inverters from MX pro 6V90/110 in device variant with TRAFO-BOX the box is installed at the top of the inverter. It is connected with the inverter via plug X2. The MX TRAFO-BOX needs the air flow of the inverter for cooling but simultaneously it increases the protection degree of the top of the device to IP31. The cooling air channel in the MX TRAFO-BOX and in the inverter is designed in protection degree IP54.

	General technical data	
Input voltage A	500…550 V (-15 % +10%) 50 Hz	500…600 V (-15 % +10%) 60 Hz
Output voltage A	400…440 V 50 Hz	400…480 V 60 Hz
Input voltage B	690 V (-15 % +10%) 50/60 Hz	
Output voltage B	440 V, 50/60 Hz	
Ambient temperature	-10...+60 °C	
Storage temperature	-40…+70 °C	
Altitude	0…3000 m	
Vibration resistance	1.5 mm at 3...13 Hz, 1 g at 13...200 Hz according to IEC/EN 60068-2-6	
Shock resistance	7 g for 11 ms according to IEC/EN 60068-2-27	
Cooling	forced, by means of the air flow of the inverter	
Protection degree	IP31, cooling air channel IP54	
Approvals	CE, UR, cUR, GOST	

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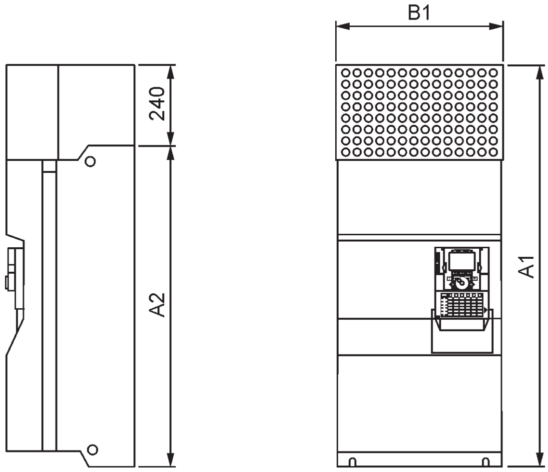
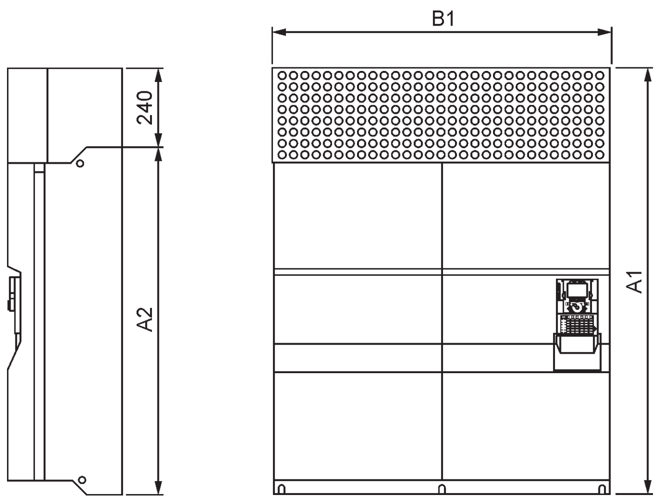
	Device variant with TRAFO-BOX		
Order code	ELNMP6D90TAB ELNMP6C11TAB ELNMP6C13TAB ELNMP6C16TAB	ELNMP6C20TAA ELNMP6C25TAA ELNMP6C31TAA	ELNMP6C40TAA ELNMP6C50TAA ELNMP6C63TAA
Equivalent	TRAFO-BOX 330 (8 P01 480)	TRAFO-BOX 585 (8 P01 481)	TRAFO-BOX 1100 (8 P01 482)
Built-in transformer	DL 0.5 (8 T00 898)	DL 1.5 (8 T00 899)	2x DL 1.5 (2x 8 T00 899)
Output	550 VA	1650 VA	2x 1650 VA
Weight	30 kg	50 kg	100 kg
Dimension A1	1190 mm	1190 mm	1390 mm
Dimension A2	950 mm	950 mm	1150 mm
Dimension B1	340 mm	595 mm	2 x 560 mm
Fixing D1	4x ∅ 11.5 mm	4x ∅ 11.5 mm	8x ∅ 11.5 mm

MX TRAFO-BOX 330 and *585*



MX TRAFO-BOX 1100



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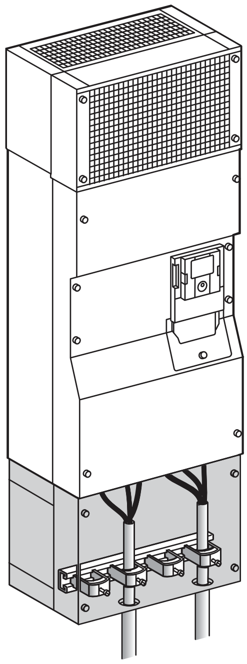
Terminal box TER-BOX



The terminal box option MX TER-BOX is a perfect supplement to the mounting of inverters outside of a cubicle, e.g. mounting directly at the wall. It increases the protection degree of the inverter, mechanically supports the power cables and it is a perfect possibility to connect the motor cable screens at the inverter.

The terminal box is installed directly at the bottom of the frequency inverter.

In case of MX eco & pro inverters from 90 kW the terminal box is screwed onto the mounting plate or the wall because of the weight of the cables. The air channel for the cooling air of the power part is designed as a flange at the bottom of these terminal boxes to attach an additional air flow channel. This is an important condition to build up a separate air flow inside of a cubicle.

Please use the allocation table for selection of the option MX TER-BOX suitable for the chosen inverter.

– MX eco 4V: page 82 ff.
– MX pro 4V: page 139 ff.
– MX pro 6V: page 193 ff.

	General technical data	
Design	Connection box made of galvanised, well-conductive sheet steel	
Protection degree	*TER-BOX 130 … 320*:	IP21
	TER-BOX 310 … 1100:	IP31 (IP54 for air channel)
Cable entry	*TER-BOX 130 … 320*:	cable glands
	TER-BOX 310 … 1100:	rubber seal, fixing of the cables inside by means of cable clamps
Air inflow for cooling air of control part	*TER-BOX 130 … 320*:	sideways, (50 mm distance sidewards necessary)
	TER-BOX 310 … 1100:	front (no distance sidewards necessary)
Air inflow for cooling air of power part	*TER-BOX 130 … 320*:	behind the terminal box
	TER-BOX 310 … 1100:	through the air channel of the terminal box

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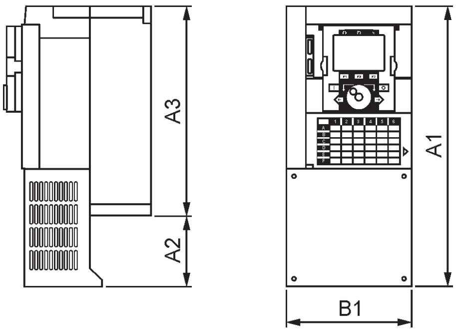
	Option TER-BOX				
Order number	VW3 A9 101	VW3 A9 102	VW3 A9 103	VW3 A9 104	VW3 A9 105
Equivalent	TER-BOX 130 (8 P01 240)	TER-BOX 155 (8 P01 241)	TER-BOX 175 (8 P01 242)	TER-BOX 210 (8 P01 243)	TER-BOX 230 (8 P01 244)
Weight	1.3 kg	1.5 kg	1.8 kg	2 kg	2.8 kg
Dimension A1	345 mm	365 mm	410 mm	410 mm	510 mm
Dimension A2	115 mm	105 mm	115 mm	115 mm	110 mm
Dimension A3	230 mm	260 mm	295 mm	295 mm	400 mm
Dimension B1	130 mm	155 mm	175 mm	210 mm	230 mm

VW3 A9 101...VW3 A9 105



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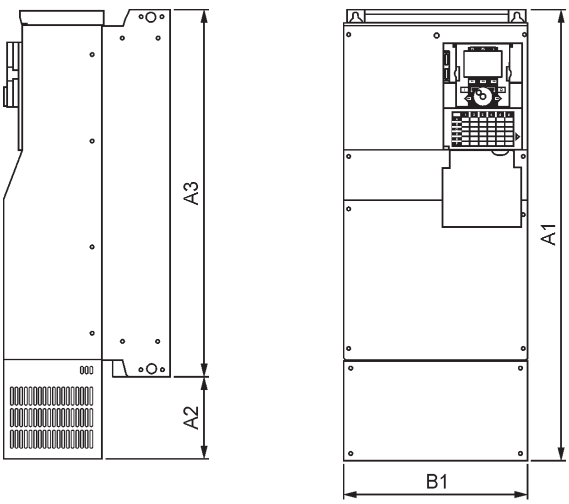
	Option MX		
Order number	VW3 A9 106	VW3 A9 107	VW3 A9 108
Equivalent	TER-BOX 240 (8 P01 245)	TER-BOX 241 (8 P01 246)	TER-BOX 320 (8 P01 247)
Weight	4 kg	5 kg	7 kg
Dimension A1	605 mm	730 mm	810 mm
Dimension A2	185 mm	180 mm	180 mm
Dimension A3	420 mm	550 mm	630 mm
Dimension B1	240 mm	240 mm	320 mm

VW3 A9 106, VW3 A9 107 and VW3 A9 108



The options MX TER-BOX 310...1100 have a removable plate on both sides to install or remove the fans of the power part.

Thus, replacing the fans without disconnecting the power and control cables is possible. Therefor, a minimum distance sideways of 300 mm is necessary.

	Option TER-BOX			
Order number	VW3 A9 109	VW3 A9 110	VW3 A9 111	VW3 A9 112
Equivalent	TER-BOX 310 (8 P01 248)	TER-BOX 350 (8 P01 249)	TER-BOX 330 (8 P01 250)	TER-BOX 430 (8 P01 251)
Weight	10 kg	12 kg	12 kg	15 kg
Dimension A1 *)	1140 mm	1322 mm	1505 mm	1565 mm
Dimension A2	220 mm	300 mm	315 mm	375 mm
Dimension A3	680 mm	782 mm	950 mm	950 mm
Dimension A4	75 mm	75 mm	75 mm	75 mm
Dimension A5	95 mm	172 mm	250 mm	250 mm
Dimension A6	65 mm	65 mm	65 mm	65 mm
Dimension B1	334 mm	374 mm	345 mm	445 mm
Dimension B2	250 mm	298 mm	285 mm	350 mm
Dimension C1	377 mm	377 mm	377 mm	377 mm
Fixing D1	4 x ∅ 11.5 mm	4 x ∅ 11.5 mm	4 x ∅ 11.5 mm	4 x ∅ 11.5 mm

	Option TER-BOX		
Order number	VW3 A9 113	VW3 A9 115	VW3 A9 116
Equivalent	TER-BOX 585 (8 P01 252)	TER-BOX 880 (8 P01 253)	TER-BOX 1100 (8 P01 254)
Weight	20 kg	25 kg	35 kg
Dimension A1 *)	1565 mm	1865 mm	1865 mm
Dimension A2	375 mm	475 mm	475 mm
Dimension A3	950 mm	1150 mm	1150 mm
Dimension A4	75 mm	75 mm	75 mm
Dimension A5	250 mm	350 mm	350 mm
Dimension A6	65 mm	65 mm	65 mm
Dimension B1	600 mm	895 mm	1125 mm
Dimension B2	540 mm	835 mm	495 mm
Dimension C1	377 mm	477 mm	477 mm
Fixing D1	4 x ∅ 11.5 mm	4 x ∅ 11.5 mm	8 x ∅ 11.5 mm

*) Dimension A1 is the total height of the inverter in device variant with MX DCL-BOX or with TRAFO-BOX.

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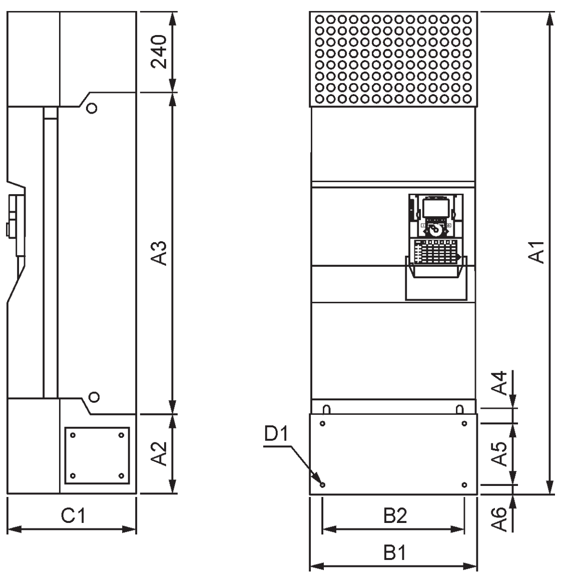
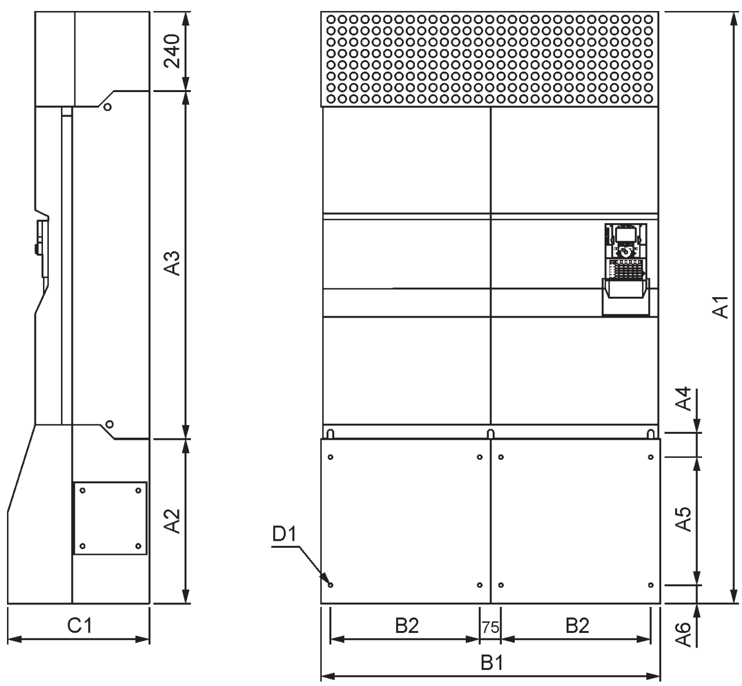
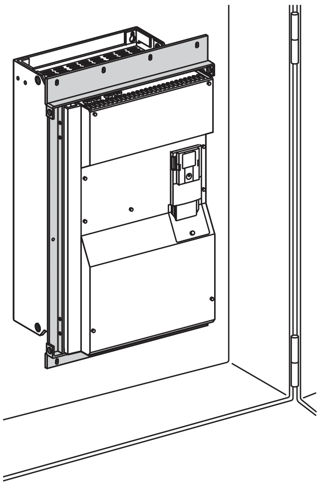
VW3 A9 109...VW3 A9 115



VW3 A9 116



Flange mounting kit FLANGE



When the frequency inverter is mounted using the flange mounting kit, most of the losses accumulate outside the cubicle. Inside the cubicle you only have to ensure the dissipation of the losses of the control part.

There are several possibilities to dissipate the heat from the cubicle:

- Heat dissipation via the cubicle surface
- Heat dissipation via filter fan
- Heat dissipation via active cooing unit

In case of MX eco & pro inverters from 90 kW the DC chokes or fan transformers must be built-in directly above the inverter to ensure sufficient cooling.

Without derating the temperature inside must not exceed +55°C. It might be necessary to install an internal fan for forced air circulation in order to avoid areas with too high temperature.

For the whole power range it is possible to exchange the fan of the power part without dismounting the inverter. Also mounting and dismounting of the whole inverter takes place inside the cubicle.

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Please use the allocation table for selection of the option MX FLANGE suitable for the chosen inverter.

- MX eco 4V: page 82 ff.
- MX pro 4V: page 139 ff.
- MX pro 6V: page 193 ff.

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	General technical data
Design	Flange mounting kit made of compact sheet steel and glued gaskets
Protection degree outside	IP54
Protection degree inside	IP20 / IP00

	Option FLANGE			
Order number	VW3 A9 501	VW3 A9 502	VW3 A9 503	VW3 A9 504
Equivalent	130x230 (8 P01 180)	155x260 (8 P01 181)	175x295 (8 P01 182)	210x295 (8 P01 183)
Weight	2.7 kg	3.1 kg	3.7 kg	4.6 kg
Dimension A1	397 mm	430 mm	465 mm	482 mm
Dimension A2	350 mm	385 mm	420 mm	440 mm
Dimension B1	222 mm	250 mm	267 mm	302 mm
Dimension B2	170 mm	198 mm	215 mm	250 mm
Dimension C1	60 mm	70 mm	70 mm	90 mm

	Option FLANGE			
Order number	VW3 A9 505	VW3 A9 506	VW3 A9 507	VW3 A9 509
Equivalent	230x400 (8 P01 184)	240x420 (8 P01 185)	240x550 (8 P01 186)	320x630 (8 P01 187)
Weight	4.9 kg	3.9 kg	4.2 kg	4.9 kg
Dimension A1	585 mm	650 mm	768 mm	838 mm
Dimension A2	540 mm	600 mm	720 mm	790 mm
Dimension B1	325 mm	340 mm	340 mm	420 mm
Dimension B2	270 mm	280 mm	280 mm	360 mm
Dimension C1	90 mm	105 mm	105 mm	105 mm

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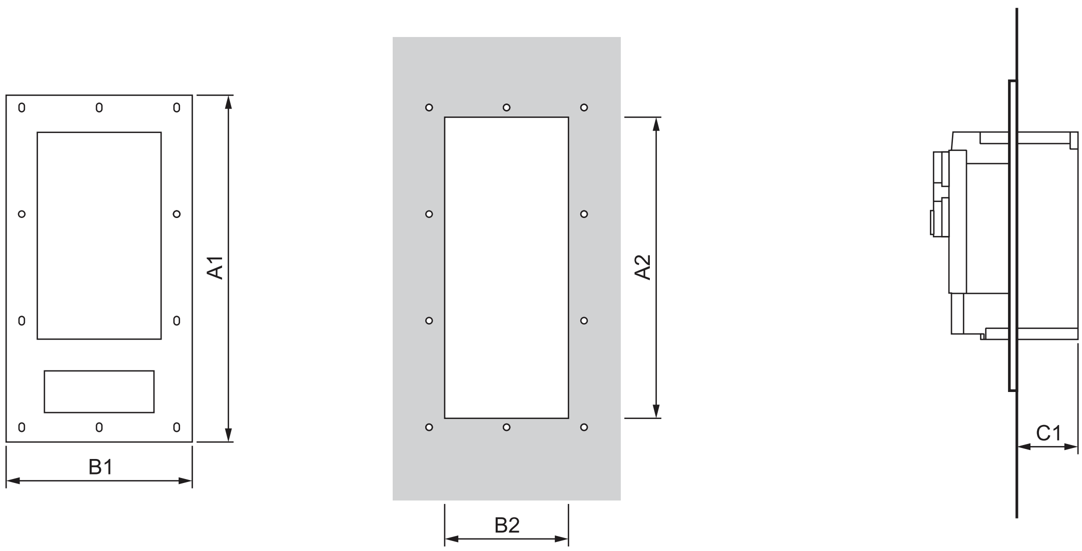
VW3 A9 501...VW3 A9 509



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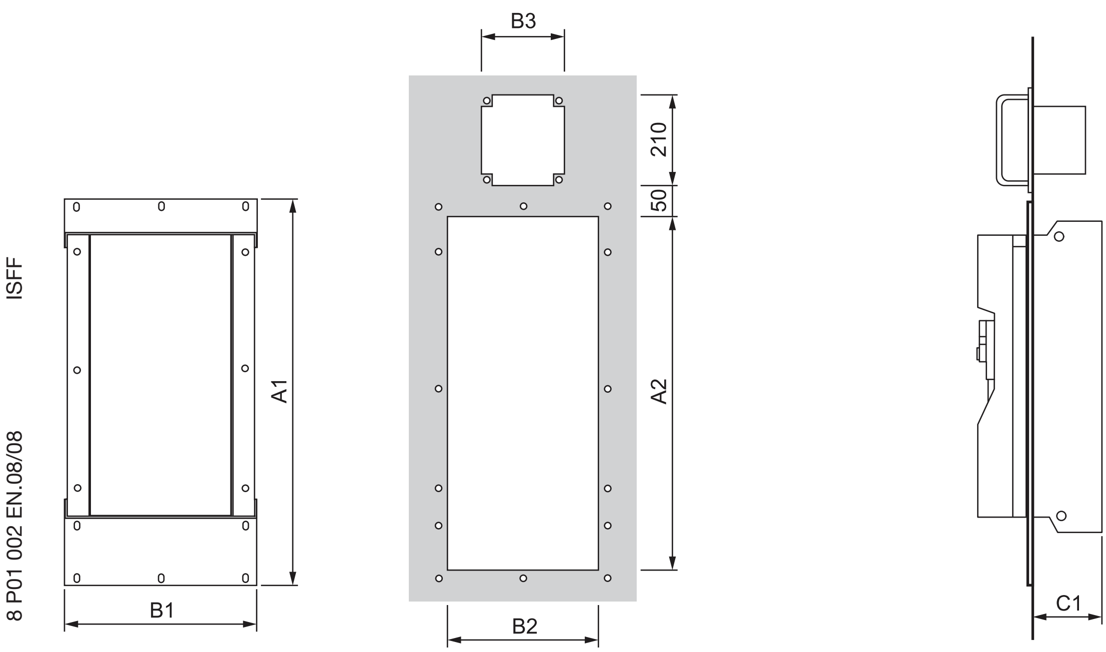
	Option MX FLANGE					
Order number	VW3 A9 510	VW3 A9 511	VW3 A9 512	VW3 A9 513	VW3 A9 514	VW3 A9 515
Equivalent	310x680 (8 P01 188)	350x780 (8 P01 189)	330x950 (8 P01 190)	430x950 (8 P01 191)	585x950 (8 P01 192)	660x950 (8 P01 193)
Weight	5.1 kg	3.6 kg	4.3 kg	4.7 kg	4.7 kg	4.9 kg
Dimension A1	850 mm	885 mm	1062 mm	1062 mm	1062 mm	1062 mm
Dimension A2	790 mm	845 mm	970 mm	970 mm	970 mm	970 mm
Dimension B1	420 mm	440 mm	442 mm	542 mm	697 mm	772 mm
Dimension B2	340 mm	360 mm	360 mm	460 mm	610 mm	685 mm
Dimension B3	180 mm	190 mm	190 mm	2x 180 mm	2x 190 mm	2x 190 mm
Dimension C1	150 mm	240 mm	240 mm	240 mm	240 mm	240 mm

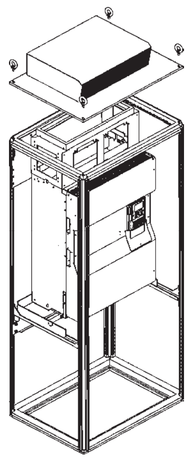
VW3 A9 510...VW3 A9 515



The number and dimensions of the necessary fixing threads are given in the mounting instructions. It also contains extensive information about dimensioning of the cubicle surface, filter fans or cooling unit.

Ensure adequate air flow within the external cooling area and sufficient head space in order to avoid an air short-cut (the inverter intakes the heated outlet air).

Cubicle mounting kit CMK



The cubicle mounting kit MX CMK is used for an optimal mounting of the frequency inverter in a Rittal TS8 cubicle. This option is suitable for MX eco & pro 4V from 90 kW.

There are three different types available:

- IP23 prepared for device variant with DCL-BOX or frequency inverter plus line reactor MX NDU
- IP54 with filter fan
- IP54 with separated air flow

Frequency inverter		Dimensions of the cubicle			
		Height	Width	Depth	Type
MX eco 4V90	–	2000 mm	600 mm	600 mm	TS 8606
MX eco 4V110	MX pro 4V90/110	2000 mm	600 mm	600 mm	TS 8606
MX eco 4V132	MX pro 4V110/132	2000 mm	600 mm	600 mm	TS 8606
MX eco 4V160	MX pro 4V132/160	2000 mm	600 mm	600 mm	TS 8606
MX eco 4V200	MX pro 4V160/200	2000 mm	600 mm	600 mm	TS 8606
MX eco 4V250	MX pro 4V200/250	2000 mm	800 mm	600 mm	TS 8806
MX eco 4V315	MX pro 4V250/315	2000 mm	800 mm	600 mm	TS 8806
MX eco 4V355	–	2000 mm	1000 mm	600 mm	TS 8006
MX eco 4V400	MX pro 4V315/400	2000 mm	1000 mm	600 mm	TS 8006
MX eco 4V500	MX pro 4V400/500	2000 mm	1000 mm	600 mm	TS 8006
MX eco 4V630	MX pro 4V500/630	2000 mm	1200 mm	600 mm	TS 8206

The cubicle dimensions mentioned above must be observed in order to guarantee the fitting accuracy of the cubicle mounting kit.

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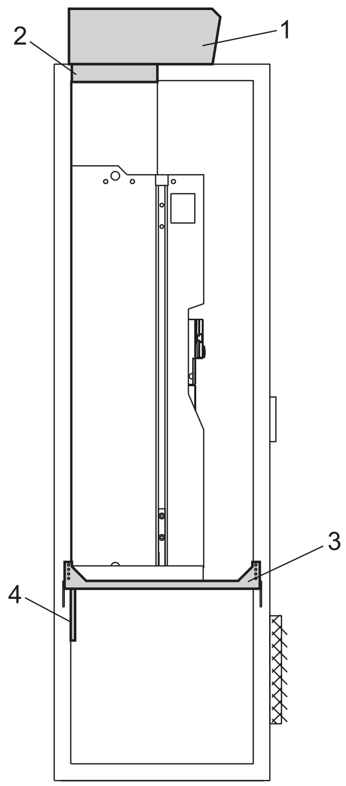
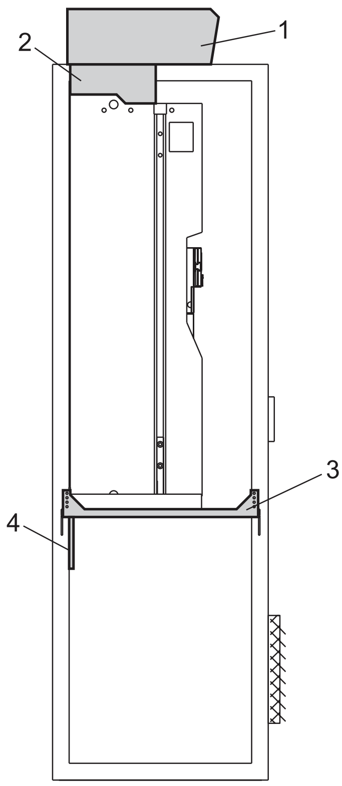
Option MX CMK-IP23



prepared for
MX with DCL-BOX



prepared for
MX with option NDU

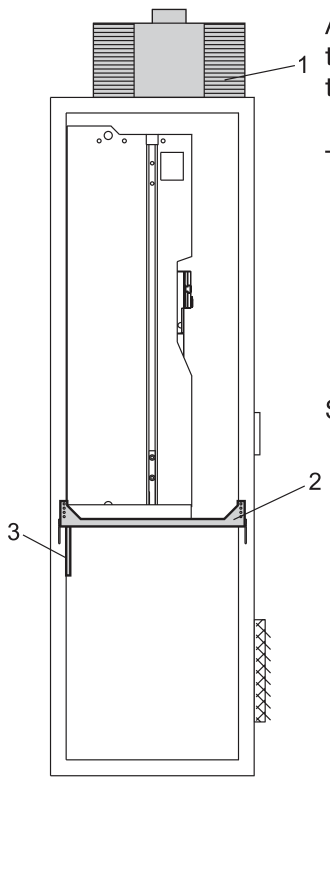
This mounting kit allows the built-in of the frequency inverter in Rittal TS8 cubicles according to protection degree IP23. In this case the input of the cooling air takes place by the cubicle door and the output through the top of the cubicle. The internal fan of the frequency inverter makes sure that there is enough cooling air for the cubicle.

This kit contains the following parts:

1. Cover hood
2. Air guide
3. Support with guide track
4. Bracket
+ Fixing material

For a higher protection degree there are two different IP54 solutions possible: IP54 with filter fan or separated air flow.

Option MX CMK-IP54FL



At protection degree IP54 with filter fans the input of the cooling air takes place through the filters in the cubicle door and the output through the fan at the top of the cubicle. This type of cubicle mounting kit requires the line reactor MX NDU!

This kit contains the following parts:

1. Filter fan
2. Support with guide track
3. Bracket
+ Fixing material

Specification of the filter fan:

Volume of air flow:	1200 m^3/h
Nominal voltage:	3 AC 400 V, 50 Hz
Nominal current:	0.3 A
Sound pressure level:	73 dB(A)
Number of fans:	1 piece in CMK 9-x...CMK 12-x 2 pieces in CMK 13-x...CMK 14-x 3 pieces in CMK 15-x

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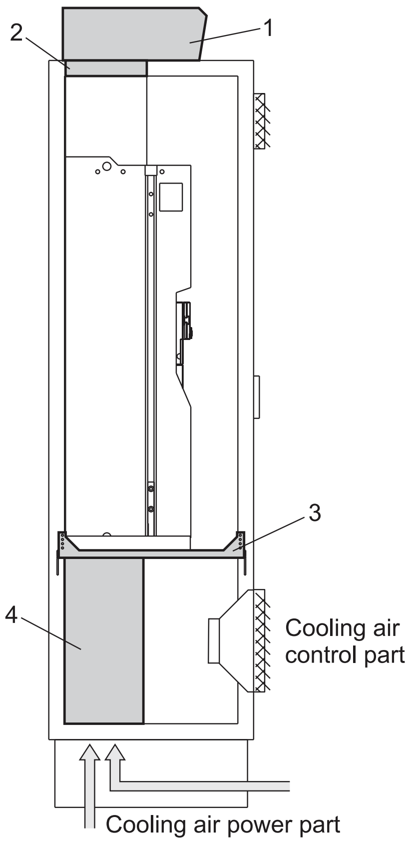
Option MX CMK-IP54GL



At the protection degree IP54 with separated air flow the input of the cooling air for the power part takes place by the cubicle plinth or from the bottom of the cubicle (raceway). The air outlet takes place through the top of the cubicle. The cooling of the control part takes place by the filter fan in the cubicle door or an air condition.

This type of the cubicle mounting kit requires the inverter device variant with DCL-BOX!

This kit contains the following parts:

1. Cover hood
2. Air guide
3. Support with guide track
4. Air channel

\+ Fixing material

The information about the losses, the dimensioning of the fans (necessary volume of cooling air) and the dimensions of the air inlet and outlet will be found in the mounting instructions of the respective inverter.

Functions

The MX eco & pro inverters include numerous standard functions for optimal performance in the shortest time as well as specific special function for the individual case.

These varied functions can be adapted right upto the smallest detail if necessary. In spite of the resulting high number of parameters, a quick and simple access to all setting and monitoring parameters is possible via the Matrix philosophy (see chapter "Matrix philosophy", page 29).

In addition further functions are provided in the device concept which makes working with the application-orientated functions and their settings easier.

Function	Symbol	eco	pro	Description	Reference
2nd set of application parameters	1 2	✓	✓	Switching of the set of parameters for two different system tasks	Page 258
2nd set of motor data	M 1 2	✓	✓	Switching the motor parameters between two motors	Page 259
Skip frequencies	Hz	✓	✓	Four variable skip frequencies with hysteresis	Page 260
Autoreset and trip behaviour		✓	✓	Adjustment of the behaviour in case of a fault and the autoreset function	Page 261
BE11 monitoring		✓	✓	Defines the behaviour of the inverter if the BE11 is removed	Page 262
Braking unit	BU	-	✓	Settings for braking unit and braking resistor	Page 262
Braking mode		✓	✓	Motor braking as economical alternative to a braking unit	Page 263
CANopen	CANopen	✓	✓	Configuration for coupling with a CANopen network	Page 207
Data Logger (statistic)		✓	✓	Recording of three channels for statistical evaluations	Page 264
DC-brake	DC	-	✓	Switchable DC-brake	Page 265
DC holding brake	DC	✓	✓	Short-time holding brake of a motor that is already in standstill	Page 266
Speed monitoring		✓	✓	Use of a digital input for determination and monitoring of speed	Page 266
Angle of rotation monitoring		-	✓	Monitors the permitted deviation of the rotation angle between actual speed and reference value.	Page 266
Dual rating	P1/P2	-	✓	Selection between high overload P1 and high continuous load P2	Page 267
Economy mode	€	✓	-	Energy saving by means of reduction of the magnetizing current	Page 267
Electric shaft	M-----M	-	✓	Allows to operate two or more motors synchronous in speed and rotation angle	Page 268
External faults	Ext.	✓	✓	Notification and analysis of two external faults with variable texts and units	Page 269
Catch on the fly	rpm	✓	✓	Quick and safe catch on the fly of a free-wheeling motor	Page 269
Function blocks		✓	✓	PLC functions like comparators, logic modules, flip flops and time modules	Page 270

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Function	Symbol	eco	pro	Description	Reference
Acceleration / Deceleration ramps		✓	✓	Adjustment of acceleration and deceleration ramp, start ramp and S-ramp	Page 271
Pulse counter		✓	✓	Pulse counter for registration and processing of electrical and non-electrical values	Page 272
Cascade control		✓	-	One master drive and up to four additional pumps can be controlled by the inverter	Page 272
Crane function		-	✓	Specific settings for hoists or long-travels	Page 279
Fast speed mode		-	✓	Enables a load dependent adaptation of the maximum reference speed limitation	Page 279
Curve generator		✓	✓	Providing reference values, cyclically processed	Page 280
Short menu		✓	✓	Compilation of a user-specific short-menu	Page 280
Load balance		-	✓	For easy load sharing among several drives	Page 281
Fan control		✓	✓	Control of the device fans as required	Page 282
Macros		✓	✓	Presetting of application parameters for quick start-up of the drive	Page 282
Modbus	Modbus	✓	✓	Configuration for coupling with a Modbus network	Page 205
Motor heating		✓	✓	Function to protect the motor against condensation	Page 296
Motor control		✓	✓	Selection of the motor control mode suited to the application	Page 297
Motor contactor control		✓	✓	Automatic control of the motor contactor	Page 298
Motor overload		✓	✓	Adjustment of the behaviour and the notification in case of motor overload	Page 299
Motor underload		✓	✓	Recognition and analysis of an underload situation	Page 300
n/T-controller		-	✓	Speed/Torque controller	Page 301
Line contactor control		✓	✓	Control of the line contactor by means of the inverter	Page 302
Emergency operation		✓	✓	Function to switch-off several protective functions (e.g. for tunnel ventilation systems)	Page 303
P15 Parameter set		✓	✓	Allows to change the setting of individual parameters during operation of the drive	Page 303
Parameter copy		✓	✓	Function for the transmission of parameter settings from an inverter to the operating panel BE11	Page 304
Parameter lock		✓	✓	Parameter lock to prevent unintended adjustment of parameters	Page 304
PID process controller		✓	✓	Configurable control circuit for constant pressure, quantity, temperature,...	Page 305

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Function	Symbol	eco	pro	Description	Reference
Positioning with SFB		-	✓	Uses the encoder for simple positioning without external mounted positioning switches	Page 306
Positioning module		-	✓	Compares the information of the position value that results from the encoder with four individual, definable position zones	Page 306
Profibus	PROFI BUS	✓	✓	Configuration for coupling with a Profibus network	Page 208
Process fault		✓	✓	Allows to integrate signals of the drive or the process to the inverter protection concept	Page 307
Pulse generator		✓	✓	Creates a square-wave signal with a frequency which is proportional to an adjustable constant or a selectable analog value	Page 307
Safe Standstill	STOP M	✓	✓	Safety function according to the standards for safety category 1 and 3, stop category 0 and 1	Page 308
Slowdown function		-	✓	For final position control and positioning tasks	Page 317
Reference value monitoring	4mA	✓	✓	The behaviour in case of loss of the reference value signal can be defined for each reference source	Page 319
Setting of reference values		✓	✓	Various possibilities for providing and switching of reference values	Page 319
Standby mode		✓	✓	The operation of the inverter is automatically controlled as required	Page 322
Control commands		✓	✓	Selection of the control method	Page 322
Stop behaviour		✓	✓	Selection of the desired stop behaviour	Page 324
Switching of the control sources		✓	✓	Possibility to switch-over between different control sources	Page 325
Recognition of undervoltage	DC	✓	✓	Adjustment of the behaviour in case of mains undervoltage (fault, fault operation, emergency stop)	Page 326
Alarm messages		✓	✓	Three configurable alarm categories	Page 326
Maintenance fan, motor		✓	✓	Two alarm signals to remind of maintenance	Page 327
XY graph	Y X	✓	✓	Reference source whose output is defined by the given input signal and an adjustable line shape	Page 327
Feed in monitoring		✓	✓	Device for the protection of the pump plant	Page 328
DC supply	+ - DC	✓	✓	Enables the supply of the inverter via the DC link with an existing DC voltage	Page 330

Further functions as well as a detailed description of the setting possibilities are given in the MX eco & pro description of functions.

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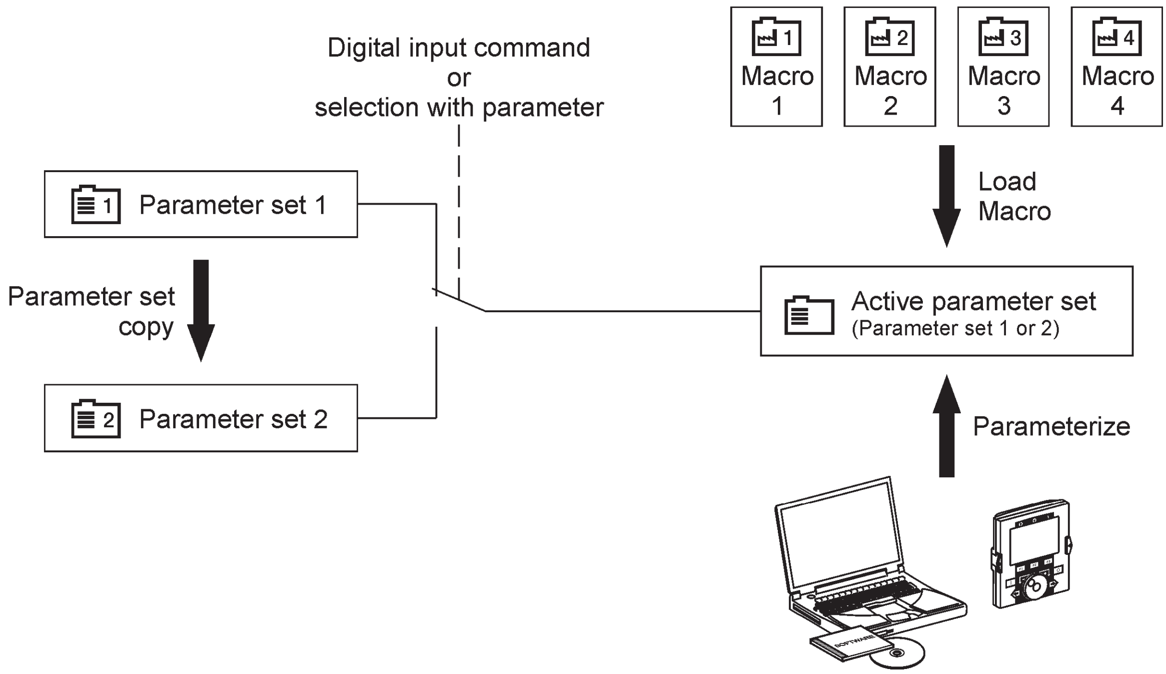
2nd Set of application parameters

MX eco ☑
MX pro ☑

If it is necessary to change the behaviour of the drive radically dependent from the process, two separate sets of parameters can be used.

These parameter sets can be switched over by parameterization or by means of a digital input signal. The switch-over always occurs in drive state "Ready". A switch-over command which appears during operation is carried out if the drive state changes to "Ready".

A digital output function is available for confirmation of the active set of parameters.



Application: Use of a frequency inverter for two different drives with different parameterization, creating of an emergency or service operation

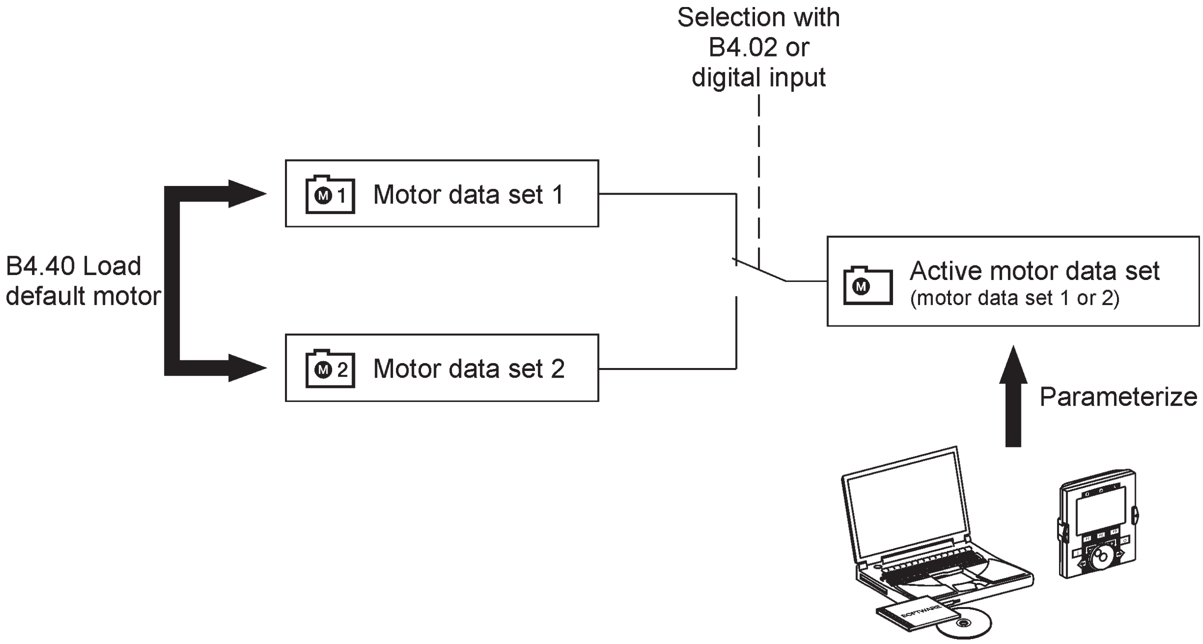
The use of the 2nd set of motor data (see chapter "2nd Set of motor data", page 259) is possible in addition to the switch-over of parameter sets.

If a recognition of wire break of the signal outputs is necessary, two outputs are required instead of one.

2nd Set of motor data

For the optimal operation and protection of the motor via the frequency inverter, it is absolutely necessary for all motor control variants to have knowledge of the motor to be operated. The electrical definition of the motor occurs by the entry of the name plate data as well as via the starting of the autotuning function by which further electrical characteristics are registered.

All motor data are pooled together in a set of motor data. In order to be able to operate the MX eco & pro on two different motors, two independent sets of motor data are available which can be switched over by means of parameterization or a digital input.



The switchable sets of motor data are carried out completely independent from the two sets of parameters.

A motor switching does not urgently need a changed parameterization, nor does the use of 2nd set of application parameters need two different motors.

In addition to the motor data, the thermal motor model and the operating hours meter are also switched over.

The switching occurs always in drive state "Ready". A switch-over command which is given during device state "Run", is carried out when the drive state changes to "Ready".

A digital output function is available for confirmation of the active motor.

If a recognition of wire break of the signal outputs is necessary, two outputs are required instead of one.

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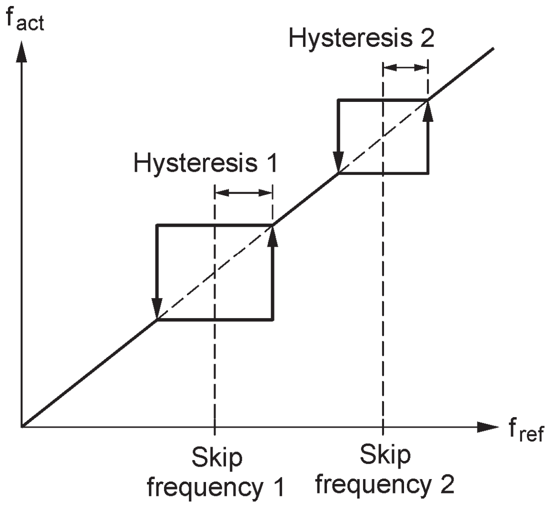
Skip frequencies

For drives with speed-dependent resonance problems (e.g. noises in ventilation systems) the function "Skip frequency" prevents the static operation in relevant frequency range.



The skip frequency is set according to the frequency of the determined point of resonance. The hysteresis, which acts symmetrically to the skip frequency, has to be set according to the band width.

Up to four different skip areas can be defined for the operation of complex plants with multifarious configuration.

The skip frequencies have to be set separately for both rotational directions.

If a hysteresis is set to zero Hz it is not effective.

Autoreset and trip behaviour

MX eco ☑
MX pro ☑

The behaviour after the recognition of a fault can be adapted to the respective process demands by means of parameter E3.01. In general it can be differentiated between inverter faults recognized by the inverter (e.g. Overcurrent) and process faults generated by the software (e.g. Overspeed).

In order to protect the power part of the device against destruction, faults recognized by the hardware lead to an immediate lock of the output-side transistors and also to a free-wheeling of the motor, independent of the parameter setting.

When a process fault occurs the inverter reacts according to the set fault behaviour.

Setting	Behaviour when a process fault occurs
1 .. Free wheel	Immediate locking of the transistors and change to the drive state "Trip". In the removable matrix operating panel the name of the occurring fault is displayed, the LED-keypad shows a trip code.
2 .. Deceleration	The occurrence of a fault initiates a deceleration along the deceleration ramp. After reaching speed zero the devices changes to the operating state "Trip". A given start command is suppressed.
3 .. Fast stop	A deceleration occurs with very short ramp time. After reaching speed zero the devices changes to the operating state "Trip". A given start command is suppressed. By activating a variant of motor braking (see B5.01 "Braking mode") the deceleration time can be clearly shortened.
4 .. DC-brake	The occurrence of a fault leads to the activation of the DC brake. At the end of the braking time, the drive changes to the operating state "Trip". This function is only available for the MX pro !

The occurrence of a fault leads to the following actions:

- automatic entry of the fault in the fault memory
- For control with 2-wire-ramp, 3-wire, Fieldbus or control in local mode, the starting command is deleted.
- For control with 2-wire-level, the starting command is inhibited (see function "Control configuration", page 322.
- Display of the trip message on the LCD- and LED-Display
- Message of the fault via relays, digital output or Fieldbus

The fault state can only be canceled by means of a manual reset (keypad, digital input "Ext. reset" or fieldbus) or by means of a voltage disconnection of the inverter (incl. possibly existing 24 V buffer voltage). If the cause of the fault still exists at the time of the reset, the reset is not accepted (e.g. "ℨ M1 >").

If autoreset is activated, the inverter tries to start the system by automatic reset when a fault occurs.

Those faults, which should be reset automatically by the device, can be selected by means of parameter E3.04. Moreover, the number of the autoreset attempts as well as the time span within which the autoreset attempts should be carried out, is adjustable. The time between two autoreset attempts is one second.

In case of an inadmissible high number of reset attempts within the set time span or for faults, which are not selected for the autoresetting, the normal fault shut-down and message is initiated.

The autoreset function should only be activated in special cases (e.g. unmanned locations). The reset can lead to an automatic restart of the plant !

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BE11 monitoring

MX eco ☑
MX pro ☑

The removable matrix operating panel MX BE11 can be used as an easy-to-use reference source.

When the matrix operating panel is plugged at the inverter, it is no safety risk to remove the BE11 even during active panel control because its function is taken over from the integrated LED keypad.

But when the operating panel is connected to the inverter by means of the door mounting kit DMK11, removing the BE11 may lead to loss of control when panel control is active. For this case, the function "BE11 monitoring" must be activated.

Braking unit

MX eco ☐
MX pro ☑

The frequency inverters MX (multi-)pro 4V & 6V up to 160/200 have a built-in braking unit as standard. For devices from 200/250 an optional braking unit controlled by the frequency inverter electronics is available. The built-in braking unit or the external braking unit option is activated when parameter B5.01 Braking mode is set to "4 .. Braking unit".

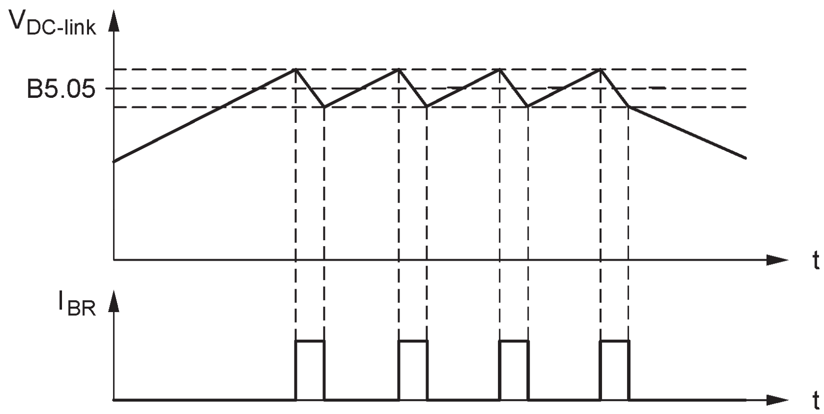
External braking unit

When a MX pro without built-in braking unit is coupled by the DC link with devices with built-in and activated braking unit, parameter B5.01 Braking mode should be set to "5 .. External braking unit" to adapt the internal levels for voltage limitation to operation with the external braking unit.

If the DC link voltage exceeds the value set by parameter B5.02 BU-braking level due to the braking sequence, the internal (or optional) braking transistor is activated and thus conducts the accumulating braking energy to the braking resistor, which converts this energy into heat.

Thereby, the maximum achievable braking power depends on the set braking level and the ohm value of the braking resistor used (P_{MAX} = BU braking level ^{2} / R).

The achievable continuous power depends on the storage and cooling capability of the braking resistor used. Its maximum value is limited only by the power data of the braking transistor.



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Brake mode

MX eco ☑
MX pro ☑

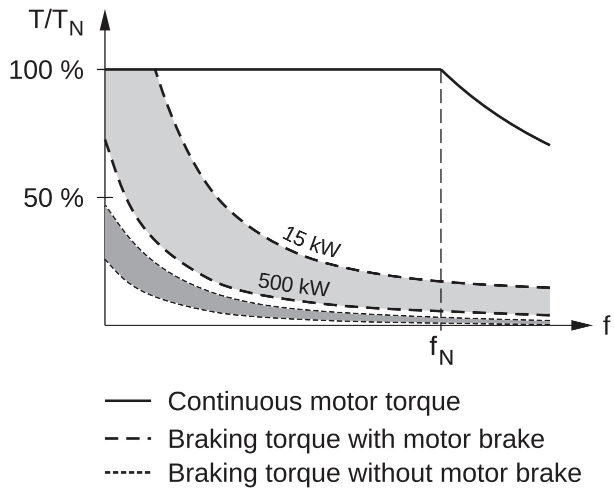
The motor brake is an utmost economical alternative to the use of a braking unit device with external braking resistor. The braking action is achieved by using a specially tuned modulation pattern which produces losses in the system of the stator windings, the motor cable, the IGBTs and the DC link capacitors. The occurring losses are in the range of the respective nominal losses and are directly covered by the load. During braking no energy consumption from the supplying mains takes place !

The achievable braking power depends on the type of motor winding and the speed range or field weakening range and is around 8...12 % of the nominal device power. As the braking torque increases with decreasing speed, the achievable deceleration is not constant.

By means of the three possible settings motor braking A-B-C, the braking action for the respective operating case can be empirically optimised.

The activation of the motor braking occurs automatically with increasing DC link voltage.

The use of the motor braking is only permitted in case of field oriented motor control variants.



At the shutdown of fan drives the quadratic decreasing load torque acts in addition to the motor braking torque. The deceleration time can be typically reduced to 1/4 of the deceleration time with free wheeling.

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Data-Logger

MX eco ☑
MX pro ☑

The function of the Data Logger offers the possibility to record up to three channels in time averaged form or as peak value. The recording serves as listing or as statistical evaluation of electrical values (e.g. energy) or known process values of the inverter (pressure, flow, speed, vibration). Therefore the number of channels, the value to be recorded and the time base can be set.

The selected values to be recorded are averaged during the set time base or the maximum value is determined and saved as data point. The data points are deposited in the MX eco & pro in form of a ring buffer, from which they can be read and graphically represented by means of the PC program Matrix 3.

The maximum number of storable data points depends on the number of channels to be recorded. If the maximum recording low is reached, the oldest data is automatically overwritten.

Number of channels	Data points per channel
1	90
2	45
3	30

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DC-brake

MX eco ☐
MX pro ☑

The behaviour of the DC-brake is similar to the motor brake (see B5.01 Brake mode). It reaches its braking torque, however, not through a change in the modulation pattern while keeping speed control, but rather through the modulation of frequency zero and thus producing a DC field in the stator of the ASM.

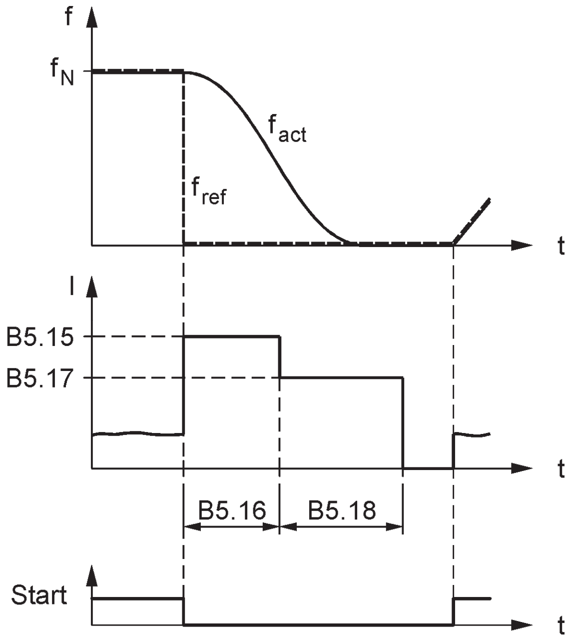
The braking torque created in this way depends on the motor winding data, the applied braking current and the actual speed.

The braking action can be set and optimized by means of parameters B5.15...B5.18.

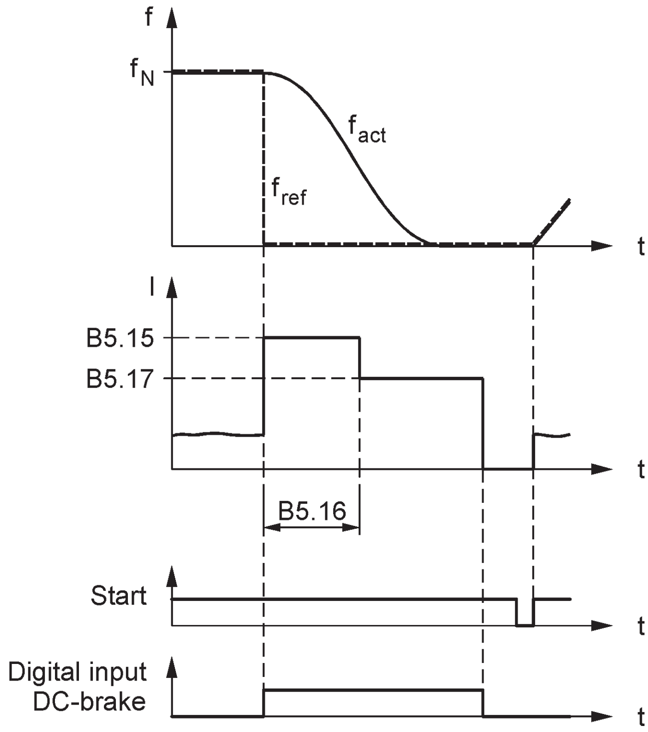
The DC brake can be activated in various ways:

- By means of the digital input function "DC-brake"
- B3.24 Stop mode is set to "5 .. DC-brake"
- E3.01 Reaction at a trip is set to "4 .. DC-brake"

Activation of the DC brake in case of a stop or trip



Activation depending on the digital input "DC-brake"



The most part of the power taken from the mechanical system during braking is converted into heat in the rotor of the ASM. In the stator, the applied braking current causes losses so that the thermal stress of the motor can be very high.

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DC-Holdingbrake

MX eco ☑
MX pro ☑

The DC holding brake is used to keep a rotor shaft that has just come to a standstill stopped for a short time. For this purpose, a magnetic DC field is built up in the stator which leads to a braking torque when the rotor is turning. The holding brake must not be understood as a fixing brake. On the contrary, the braking action does not come into force until the rotor is slightly turning, whereby acceleration is prevented, however.

The braking torque depends on the set braking current and the winding data. The speed required for braking is about 0.5...3 times the nominal motor slip.

Typical applications are holding unbalanced machine parts, protection of mechanical parking brakes (long-travel), keeping pressure of pumps for a short time,...

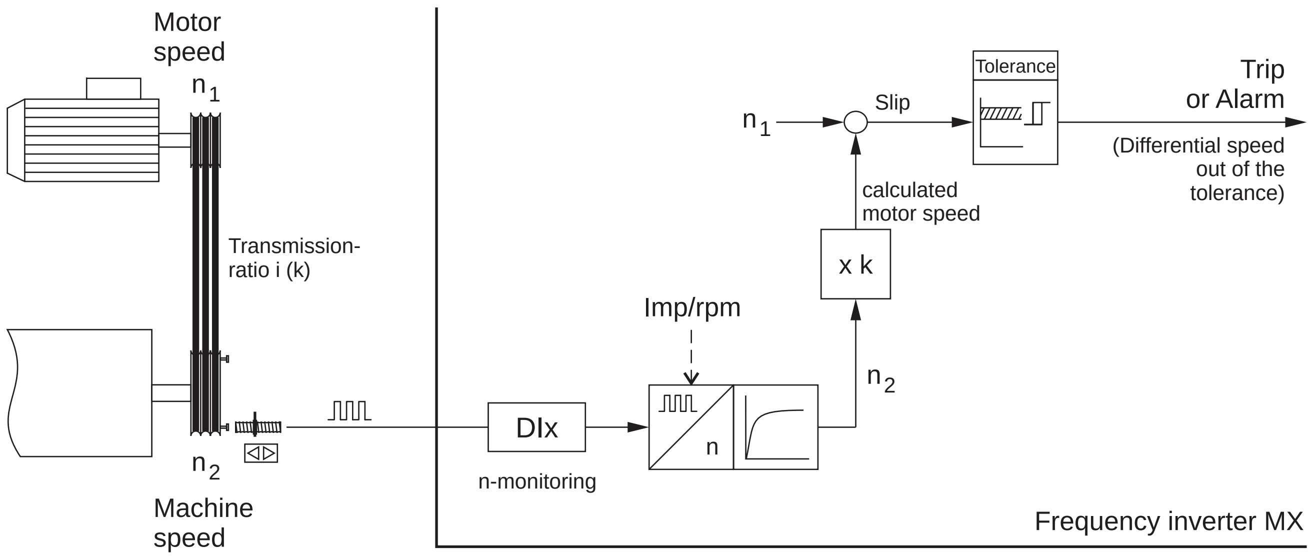
Speed monitoring

MX eco ☑
MX pro ☑

Between motor and machine varied mechanical transmission systems can be found. Gears, V-, flat- or toothed belts, drive shafts, different couplings etc. In many cases it is necessary to integrate these transmission elements into the monitoring and protection concept of the drive.

The speed check at the shaft of the gear box displays the usual method for this purpose. As a result the speed is determined with a simply mounted inductive pulse generator and a frequency meter downstream. These can, subject to possible transformation ratios, be compared with the speed of the motor.

The impulses of the inductive sensor can be conducted directly to a digital input of the MX eco & pro with the function "n-monitoring".



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Rotation angle monitoring

MX eco ☐
MX pro ☑

Using the angle of rotation monitoring, a constant observation of the frequency reference value after the ramp function generator and the actual motor speed takes place. If the actual speed deviates from the reference value, a positively or negatively growing angle of rotation error forms. If this error exceeds the values set by parameter E1.55, an alarm message or a fault shut-down occurs.

This function is used wherever an impermissible angle of rotation deviation leads to process-related faults (e.g. hoist drives).

P1/P2 Dual rating

MX eco ☐
MX pro ☑

The frequency inverters are equipped with a dual rating function (exception: MX pro 4V0,75...4V75).

So the frequency inverter can be used either:

- with a high dynamic overload capability and nominal continuous power (setting "0 .. Power P1") or
- with high continuous load at a simultaneously reduced dynamic overload capacity (setting "1 .. Power P2").

The difference between the maximum permissible continuous output power of both settings is one step of IEC motor list.

Example MX pro 4V 315 / 400

- 400: Setting B3.16 = "1 .. Power P2"
  Nominal power: 400 kW
  Overload: 120 % for 60 s in 10 min
  135 % for 2 s in 30 s
- 315: Setting B3.16 = "0 .. Power P1"
  Nominal power: 315 kW
  Overload: 150 % for 60 s in 10 min
  165 % for 2 s in 30 s
- 4V: 4V, 4C: 380...480 V mains voltage
  6V, 6C: 500...690 V mains voltage
- pro: Product line MX pro
- MX: Product family MX

Economy mode

MX eco ☑
MX pro ☐

The frequency inverter control maintains the magnetic motor flux constant within the speed range of zero to the nominal frequency of the motor in order to be able to react dynamically to load requirements. For applications with quadratic load torque, such as e.g. centrifugal pumps or fan drives, the motor flux must however not be maintained constant as the load decreases quadratic with the speed.

The function economy mode lowers the flux systematic depending on the speed and the actual load. In this way, the magnetizing current decreases without causing losses to the availability of the drive. The resulting energy saving effect is especially great with drives that are often operated in partial-load operational range.

In this context, it should also always be checked if the drive cannot be completely switched off in low load situations by using the standby mode (see function "Standby Mode", page 322).

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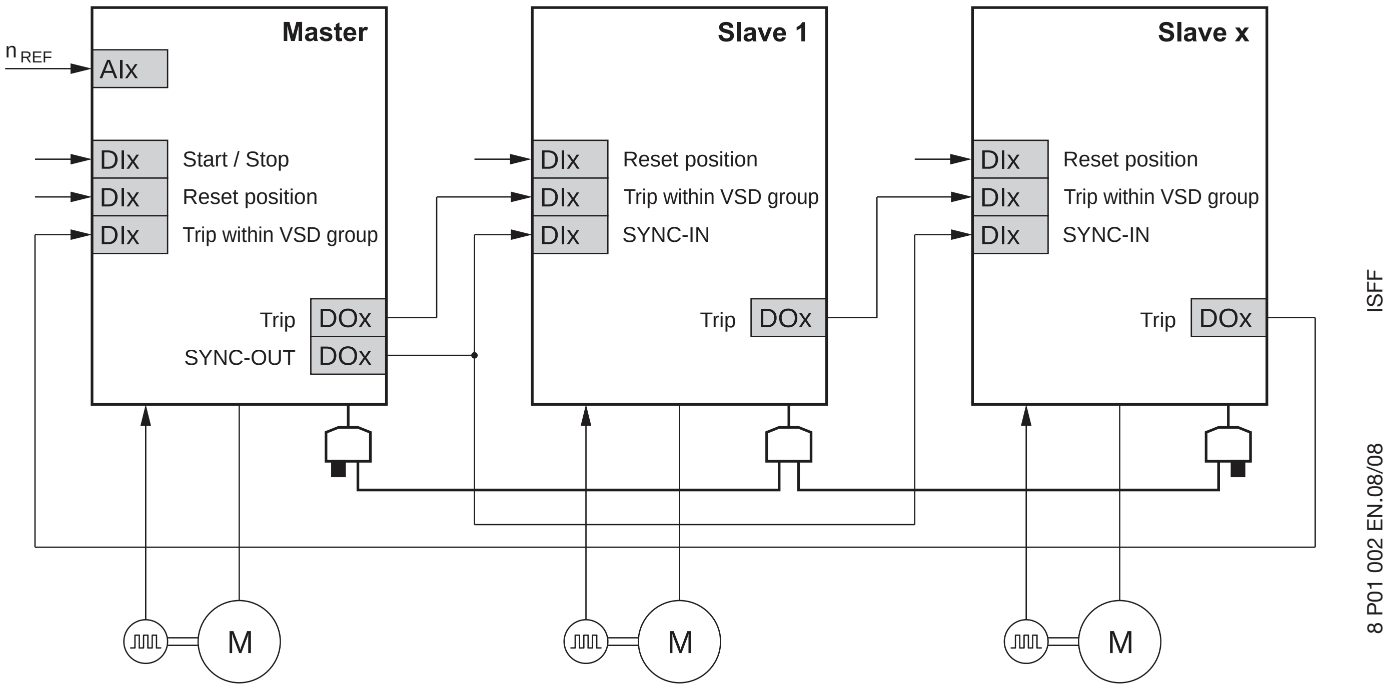
Electric shaft

MX eco ☐
MX pro ☑

The function "Electric shaft" is used to operate two or more motors synchronous in speed and rotation angle (e.g. parallel operation of two hoisting drives). This is realized by means of control engineering evaluation of the position value that is created from the signals of an encoder.

The operating state of the "master drive" and its position value is transmitted serial via Modbus connection to all "slaves" which adapt its speed in such a way that synchronism of all drives is reached. In order to compensate the transmission time occurring at the Modbus, the master sends a cyclic synchronization signal at a digital output which has to be integrated at the slaves as digital input. If the signal fails (wire break or failure in the master), the slave drive reacts with the trip message "Sync-Error".

The Modbus has to be connected using the Modbus interface next to the terminals. More information on the Modbus network can be found in the Modbus operating instructions.



If a trip occurs at an inverter within the VSD group of the electric shaft, the trip has to be transmitted to the other slaves and the master drive by means of wiring (DO → DI). Thus, all drives change to trip state. The inverter message "Trip within VSD group" indicates that the respective drive has transmitted the trip message. The drive that caused the trip state however indicates the actual cause of the fault.

When the cause of the trip is eliminated, reset is possible at the master drive. The master drive transmits the reset command to the other drives via Modbus connection.

For first-time synchronization all drives have to be in the desired position and the position value has to be set to zero ("Reset position" via digital input).

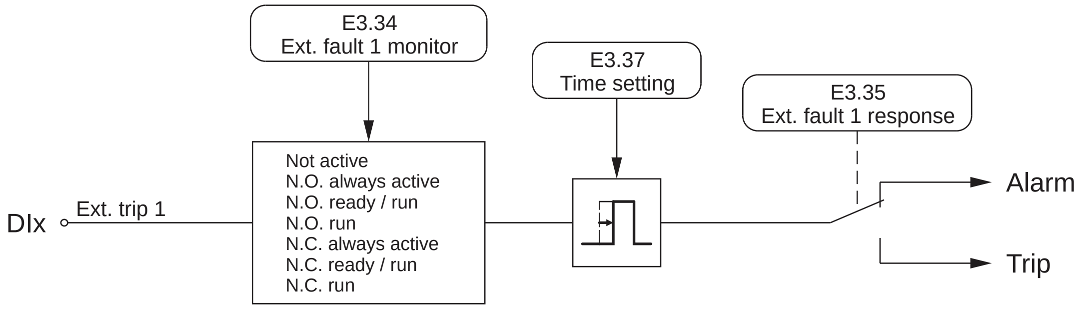
If the function of the electric shaft should be activated/deactivated during the process, this can be realized by using the 2nd parameter set. Even in this case the position values of all drives have to be set to zero before giving the start command !

Ext. External faults

MX eco ☑
MX pro ☑

Should signals of the drive or the process be integrated in the inverter protection concept then this occurs with the digital input "External fault 1" or "External fault 2". The tripping behaviour and the temporal trigger performance are therefore adjustable to the demands of the system.

For easy user guidance the fault message text displayed on the removable Matrix operating panel can be freely edited.



Depending on the process demands the behaviour of the inverter for triggered digital input "Ext. fault 1" or "Ext. fault 2" can be selected:

Setting	Behaviour after trigger of the external fault
1 .. -Δt- alarm	No shut-down of the inverter takes place. An alarm message "Ext. fault 1" with free editable text display (E3.38), which can be delayed, is set.
2 .. Alarm -Δt- fault	Immediate setting of the alarm message "Ext. fault 1". After the adjustable delay a fault shut-down with a free editable text message (E3.38) takes place if the state is still unchanged.
3 .. -Δt- fault	After the adjustable delay a fault shut-down with a free editable text message (E3.38) takes place.

Catch on the fly

MX eco ☑
MX pro ☑

The frequency inverters of the MX eco & pro range are designed to be able to catch on the fly a free wheeling but still energized motor. The inverter is connected speed and voltage synchronous to the free wheeling motor.

Function blocks

MX eco ☑
MX pro ☑

The MX eco & pro includes a multitude of PLC functions such as comparators, logic blocks, storage elements (Flip/Flop) and time modules which are free for use. In this way the multiple functions of the MX eco & pro can be additionally adapted to the requirements of the application without installing an external control logic.

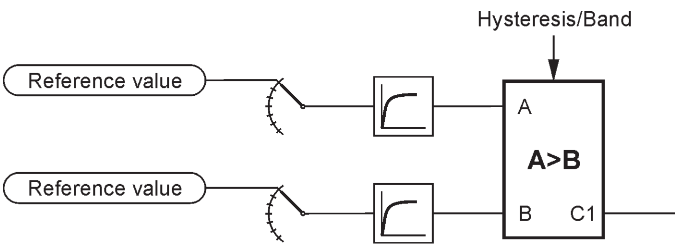
In addition to external components, extensive planning, mounting, checking and documentation are also omitted as they are covered by the inverter electronics and the parameter documentation.

The usability ranges from the adaptation of the software functions when exchanging devices from other companies up to small self-sufficient controls, which for example monitor process sequences and which can be used for messages as well as for autonomous intervention in the inverter operation.

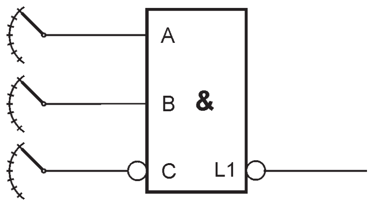
The biggest advantage is the simple handling by means of the inverter parameterization. Required functions are simply described and programmed by means of only few basic modules and usage of the standard available analog and digital in- and outputs in the inverter, processing of the reference value, computing functions, counters etc.

Following functional units are available:

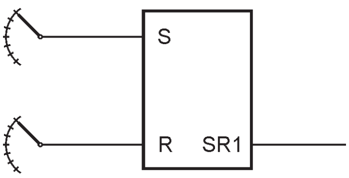
Comparator



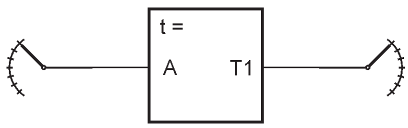
Logic module



Storage element



Time module



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Function	Quantity	Description	Additional functions
Comparator	4	Module for comparison of two analog values All actual values known in the inverter as well as all reference value inputs are available as values.	– Comparison "A > B", "A < B", "A = B" and "A <> B" – Adjustable hysteresis or band width – Adjustable filter for both input signals – Comparison with fixed reference value or analog size
Logic module	6	Module with logical operation of maximum 3 digital signals. All digital states known in the inverter as well as digital inputs, free bits in the fieldbus, comparator outputs, flip-flops and time modules are available as signals.	– Logical functions "and", "Or", "equal" and "unequal" – Negation of the input possible – Inverting the function – Automatic adaptation of functions when using only 2 inputs
Storage element	2	Flip-flop storage element with set- and reset- input Control inputs like for logic modules	– Prioritized setting or deleting selectable
Time module	6	Freely connectable time modules Control inputs like for logic modules Outputs for connecting to internal objects (inverter functions) or to a digital output / relay	– Selectable time functions "ON delayed", "OFF delayed", "ON & OFF delayed" and pulse output – Extensible adjustable time range
Alarm logic module	1	Allows a logical operation of up to 6 free selectable alarm messages for free further use within the function blocks.	– Logical functions "and", "Or"
Trip logic module	1	Allows a logical operation of up to 6 free selectable trip messages for free further use within the function blocks.	– Logical functions "and", "Or"
Positioning module	1	Interpretation of the position value to create up to 4 positions/zones for free further use within the function blocks.	– Defining position zones by entry of begin and end value possible

The "Positioning module" function is only supported by MX pro !

Acceleration/deceleration ramps

MX eco ☑
MX pro ☑

The prepared frequency reference value, which can be selected from different sources, is rated with adjustable ramps. Two separate sets of acceleration and deceleration ramps are available which can be switched over automatically or by means of a digital input signal.

Furthermore there is the possibility to activate various S-ramps additionally to the acceleration/deceleration ramps.

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Pulse counter

MX eco ☑
MX pro ☑

The pulse counter evaluates a pulse train from a digital input in different variants.

The counter can be used as follows:

- Pedometer for the joint usage of comparators and logic modules (see function "Function blocks", page 270)
- Total counter with adjustable scaling and reset input for control tasks (filling level, position, weight,…)
- Determination of the average from the pulse count (leads to a scaleable size and can be used as PID-actual value feedback or as indicated value)

Push-buttons, initiators, measuring devices for electrical and non-electrical values with pulse output (water meter, turbine wheel instrument, energy meter,...) etc. can be used as signal sources for the counting input. The maximum allowed input frequency is 100 Hz.

The determined value is scaleable and can be performed with a free editable abbreviation and a unit for the display on the Matrix operating panel.

Cascade control

MX eco ☑
MX pro ☐

If big flow differences occur due to the process, consider the use of several smaller pumps in cascade connection instead of a big speed-controlled pump system. Thus several pumps are connected in parallel on the draw- and pressure-side and controlled or connected/disconnected depending on the process load.

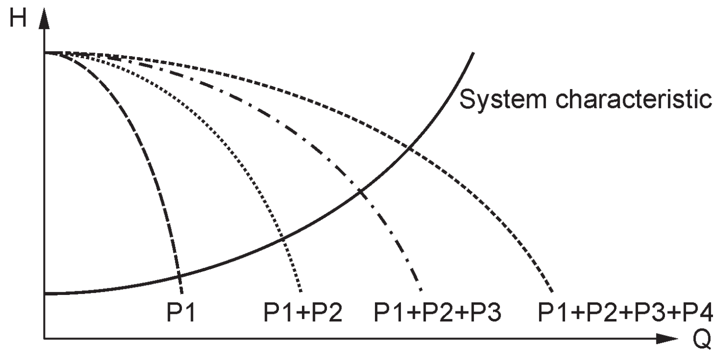
The individual pumps and drives are always operated in their optimal control- or efficiency range. In addition to the lower operating costs (energy saving), an additional reduction of costs arises by using smaller system units at simultaneous increased reliability !

The required functions for cascade operation such as the switching point determination for tailor-made connection and disconnection of individual cascade drives, permanent monitoring of operation up to recording occur by means of the standard function in the MX eco.

No external open-loop- and closed-loop controlled systems are necessary for the cascade operation.

Cascade connections are mainly used for pump systems in industry and also communities. Typical application ranges are water supply plants, booster station or irrigation plants, fire water supply, process pumps etc.

The range of applications is principally not only limited to pumps. Compressors, air conditioning and refrigerating devices can also be operated in this way.



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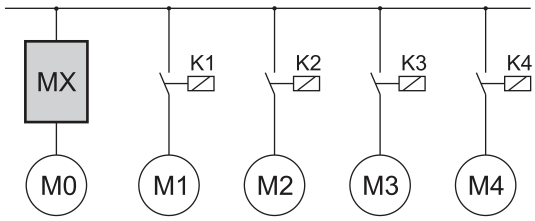
The principal conception of the electrical design of the cascade occurs according to system-relevant factors.

The MX eco can be used for the control of three typical configurations:

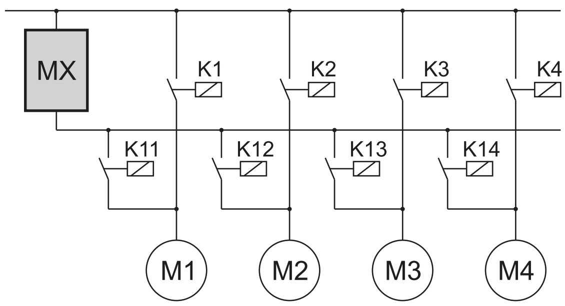
Setting "1 .. Mains cascade 1"



Master drive + max. 4 slave drives

One pump serves as master drive and is operated speed-controlled on the MX eco. The remaining drives work directly or via softstarters on the supplying mains, controlled by the frequency inverter of the master drive. By using the process control (typical pressure or flow control) in connection with the speed-controlled drive the unsteadiness due to the stepwise connection is avoided. The connection and disconnection of the individual pumps can be carried out periodically or depending on the operating hours.

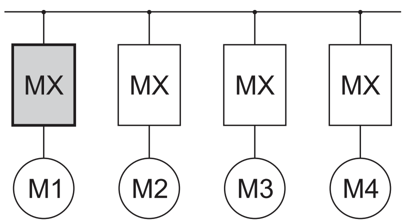
Setting "2 .. Mains cascade 2"



max. 4 drives (incl. master drive)

Function such as "Mains cascade 1", however with this connection the master drive can also participate in the automatic pump change with balancing of operating hours.

Setting "3 .. VSD cascade"



max. 4 inverter-controlled drives
(incl. master drive)

All cascade drives are carried out speed-controlled with MX eco frequency inverters and are controlled by the master drive (with activated function "VSD cascade"). Because of the frequency inverter the connection to the mains occurs without encumbering starting currents.

Typical for low-power drives (< 15 kW).

The inverter of the master drive determines the switching point for connection and disconnection of the respective slave drives by means of the evaluation and dynamic rating of the pressure (PID control operation) or the actual frequency of the master drive. The switching commands are available on the output relays or the digital outputs of the master drive.

Depending on the number of pumps the use of an optional terminal extension (option MX IO11 or MX IO12) can be required.

Corresponding to the selected type of cascade, hardware locking of the drive contactors is required. See the following control suggestions.

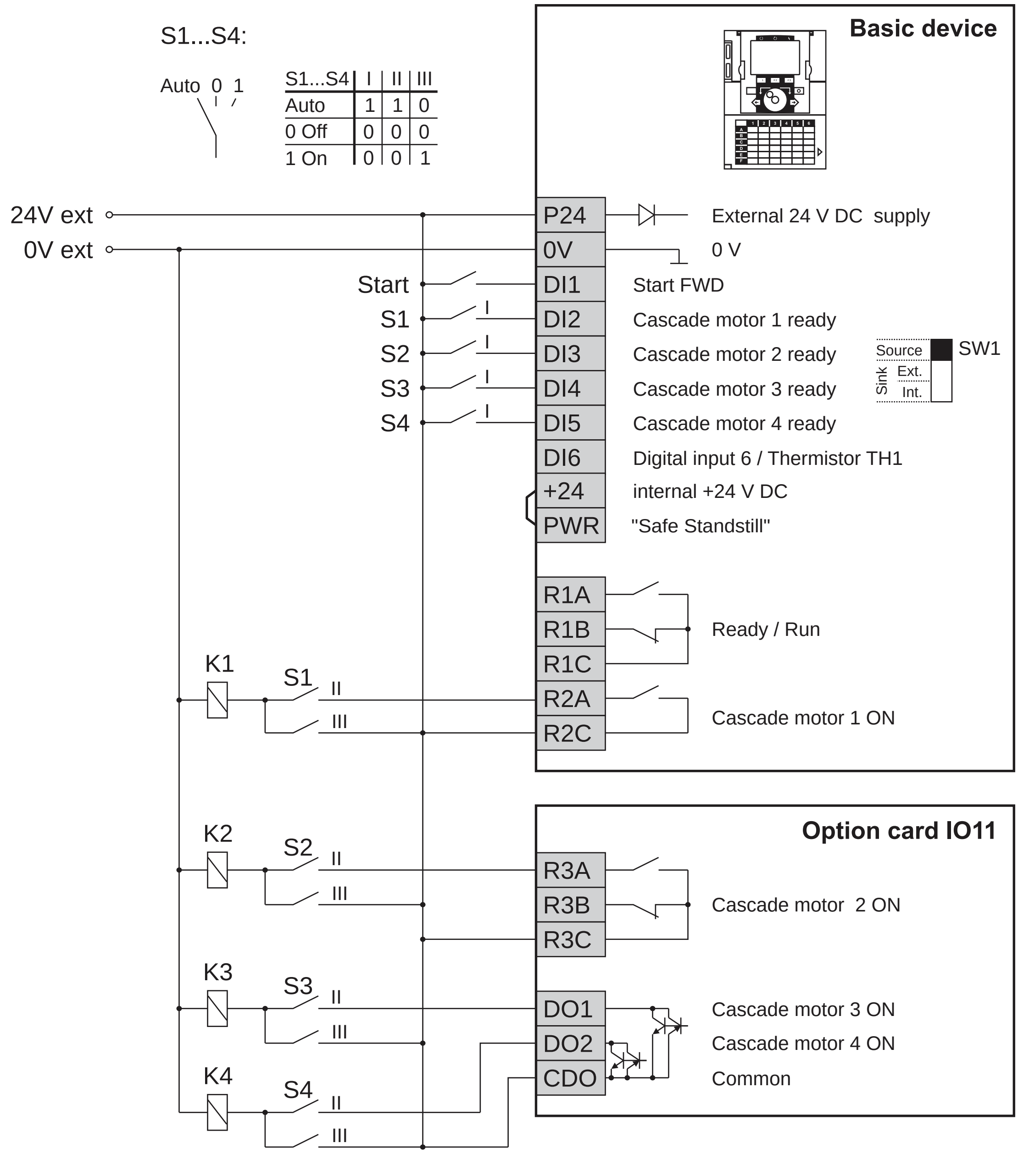
Control suggestions

Subsequent control suggestions contain an operating mode switch which enables the switching between:

- *Automatic*
  Cascade motors are connected and disconnected by the automatic cascade control
- *Off*
  Drive switched off
- *Manual on*
  Drive is manually connected independent of the cascade control

For each slave drive a digital input has to be planned to recognize the Ready state of the drive on the control process.

Mains cascade 1



Schematic diagram!

Typically, the switching of the motor contactors cannot occur directly via the inverter output relay or digital outputs. Appropriate auxiliary contactors are to be planned corresponding to the used contactors !

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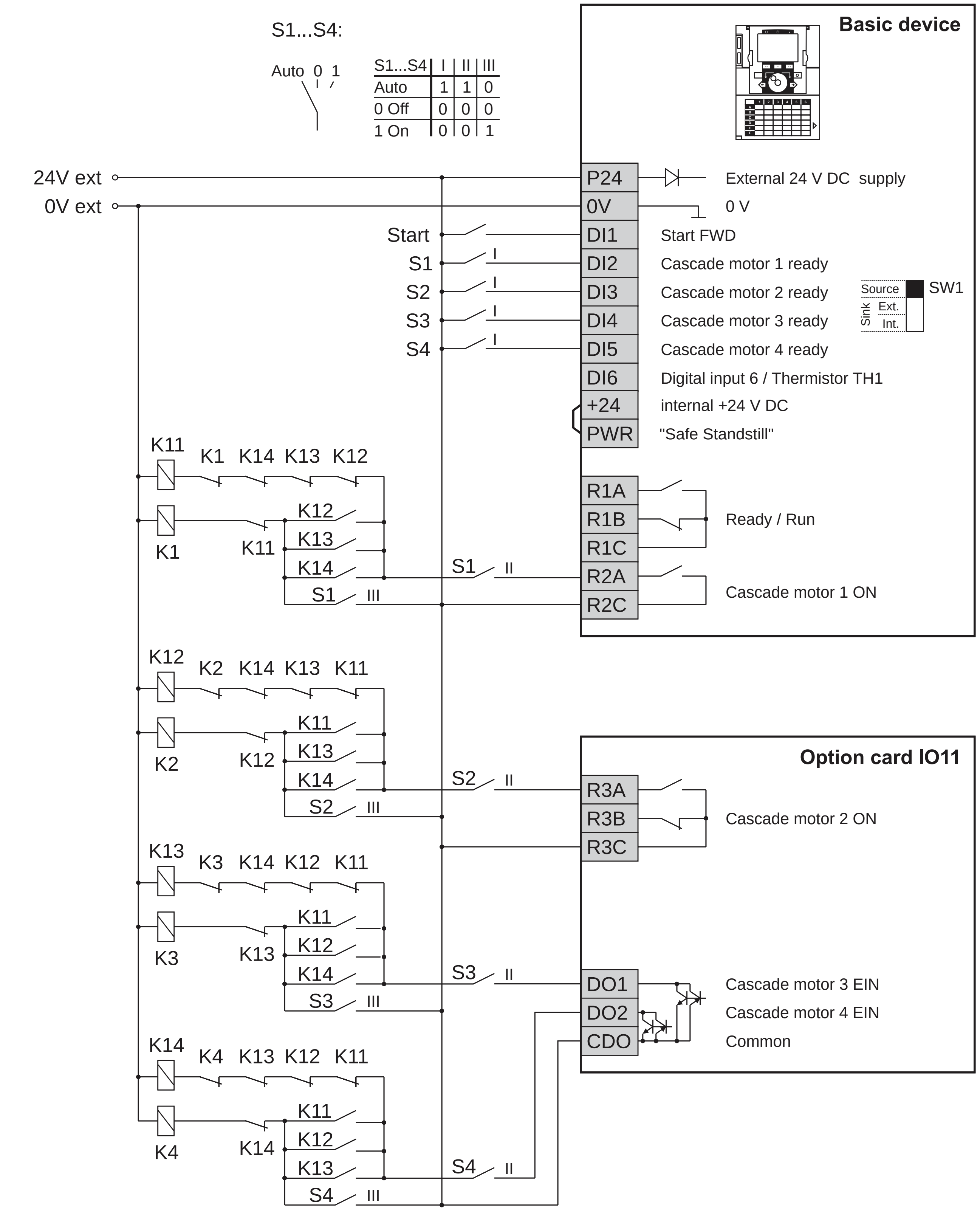
Mains cascade 2



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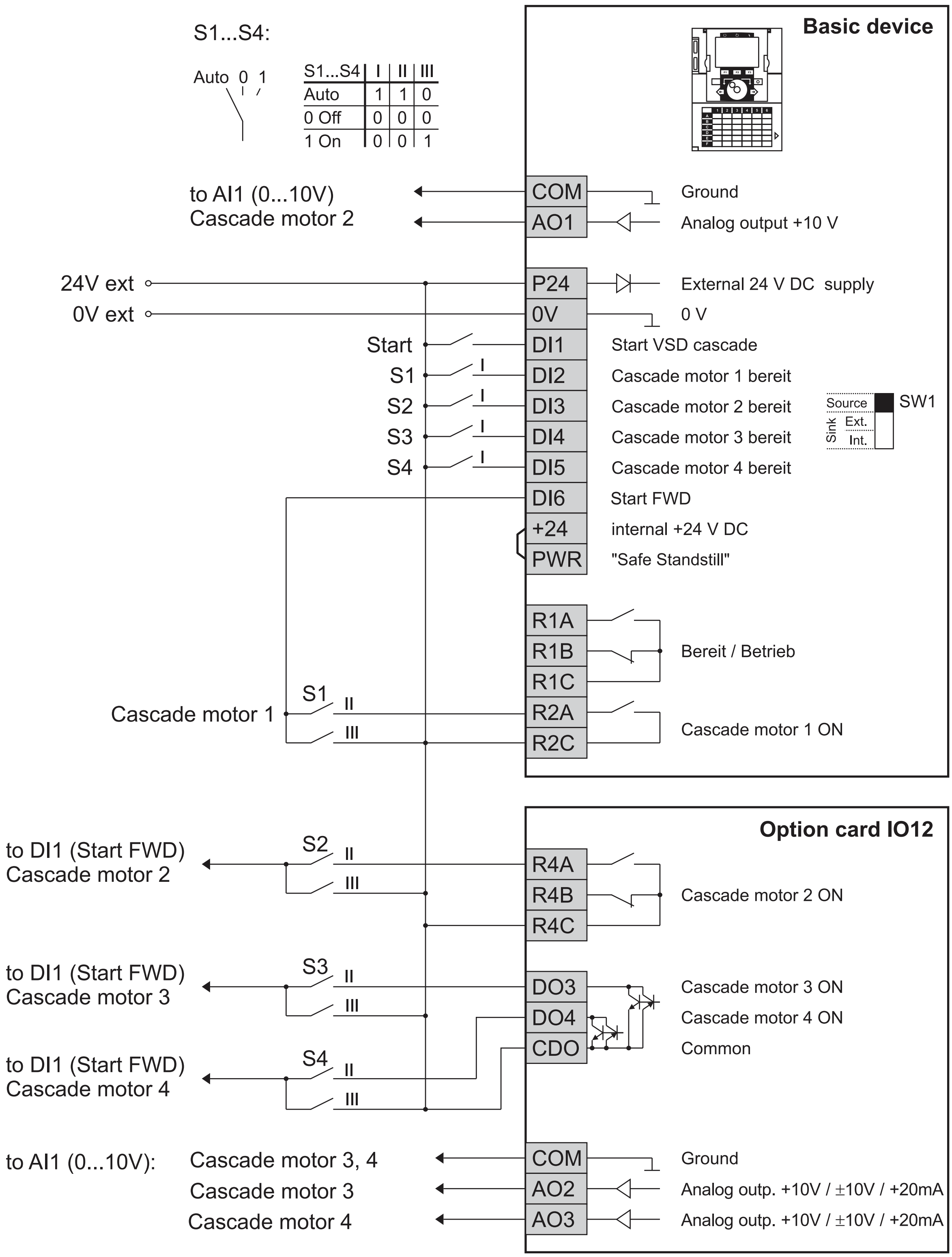
As above mentioned, the mains and motor contactors are locked against each other so that the first motor selection of the master drive activates an inverter output contactor. All following switching commands refer however to the line contactors.

Schematic diagram!

Typically, the switching of the motor contactors cannot occur directly via the inverter output relay or digital outputs. Appropriate auxiliary contactors are to be planned corresponding to the used contactors !

VSD cascade



The advantage of this connection is the simple control-sided design without using of line or auxiliary contactors. The connection and disconnection of the individual motors occur via digital signals on the respective inverter. In addition to the switching commands also the frequency reference value for each cascade drive is provided by the master drive. The inverter of cascade motor 1 assumes the functionality of the master drive.

The mains-sided current load at connection of a pump is in this way the least, so that it is especially suitable for drives in mains-weakened systems.

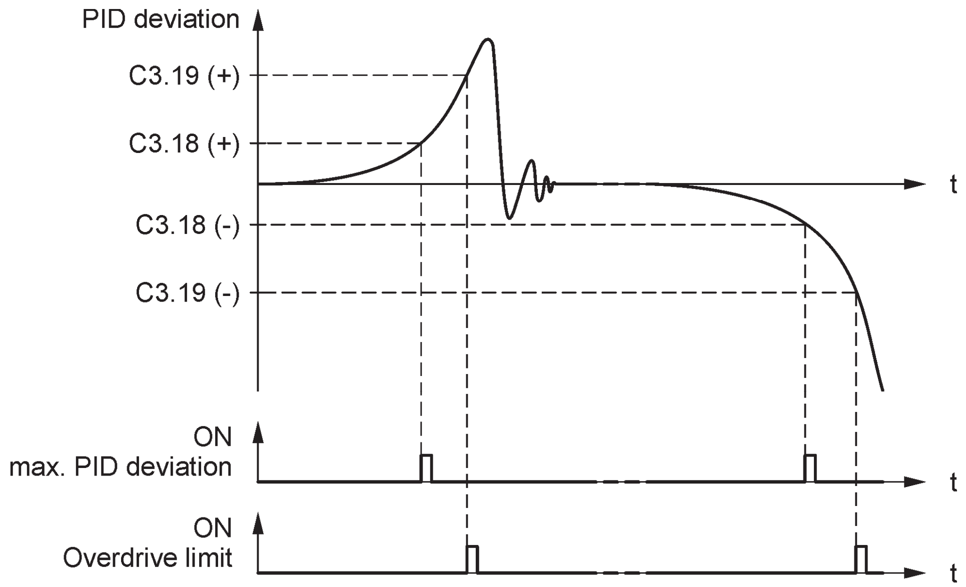
Alternatively to conventional reference values provided by the analog outputs (like described above) also the Modbus master function can be used (details see Modbus operating instructions).

Switching points pressure evaluation

With this switching mode the PID deviation of the PID controller is monitored at the value "Max. PID-deviation". If the system pressure decreases and the control circuit can no longer be balanced by the increase of speed, the PID deviation increases. When the max. PID deviation C3.18 has been reached, the request to connect a slave drive appears.

In reverse, if the system pressure is too high, the negative threshold of the PID deviation is reached, whereby the disconnection of a slave drive is initiated.

In order to be able to react more quickly at intense pressure fluctuations, the parameter C3.18 "Max. PID-deviation" is overlapped by a further threshold "Overdrive limit".



The exceeding or falling short of the allowed limits does not lead directly to a connection or disconnection of a drive. The temporal switching dynamics can be optimized by means of parameter C3.32...C3.35.

Switching points efficiency-optimized

For the switching mode "Efficiency optimised" the commands for the connection and disconnection of the cascade drives occur depending on the frequency. An individual point for connection and disconnection is selectable for each cascade drive.

The monitoring occurs by means of the internal frequency reference, whereby the operation is possible with the internal PID controller as well as with an external control circuit.

Switching dynamic

In order to reach a sufficiently fast and exact but nevertheless smooth-acting control, the requests for connection and disconnection, which result from the monitoring of the PID deviation or the output frequency, are assessed by means of adjustable delay times before they are carried out.

Change of motor

The principle of the cascade connection is the tailor-made connection and disconnection of the individual cascade steps. This however leads automatically to the fact that the basic load drive (= master drive) is more often in operation than the peak load drive. Thus, for a pump plant the operating hours of the individual cascade drives act proportionally to the necessary flow according to the daily operation of the plant.

According to the dimensioning, the peak load pump can e.g. only be used in emergency situations (fire water provision). In order to avoid problems or damages to each pump that is not used regularly (gasket problems, steadfast rust,...) and to balance the operating hours of all the cascade drives, it is a good idea to provide an automatic motor change.

Crane function

MX eco ☐
MX pro ☑

The frequency inverters of the MX pro range offer special functions for crane applications. Not only the basic functions like braking management optimised for hoists and long-travels, but also expanded functions for optimisation of the drive for various situations such as expanded safety aspects, optimization of elevator applications,... are available.

The area of application of MX pro devices thus ranges across all areas of conveying technology, such as hoistings, slewing gears, long-travels and trolleys, cable winches, conveyor belts, inclined conveyors, elevators, escalators, lift and ropeway installations,...

Trolley

When C3.45 is set to "1 .. Trolley" the torque is build-up optimal when the mechanical brake is opened and closed. To protect the mechanical brake, the closing of the brake can be specifically delayed when standstill is reached, whereby an adjustable DC holding brake counteracts any pendulum or wind loads during this delay.

An active working braking using the internal or external braking unit and braking resistor is required for operation. Alternatively, an overall concept with DC link coupling including a braking unit or an intelligent rectifier "Active Front End AFE" is possible.

Hoist

The setting of C3.45 to 2 .. Hoist" permits a safe, controlled torque build-up before the mechanical brake is opened or closed so that the load can be moved shock-free with a maximum protection of the mechanical brake.

The operating properties differ according to the motor control variant B3.02 used. In case of variant "4 .. VC feedback" with encoder feedback safe operation up to a speed of zero is possible (electrical holding of the load during standstill). Without encoder feedback the mechanical brake is always actuated in the speed range around zero and it must be guaranteed that the given speed reference is not less than five times the nominal slip.

An active working braking using the internal or external braking unit and braking resistor is required for operation. Alternatively, an overall concept with DC link coupling including a braking unit or an intelligent rectifier "Active Front End AFE" is possible.

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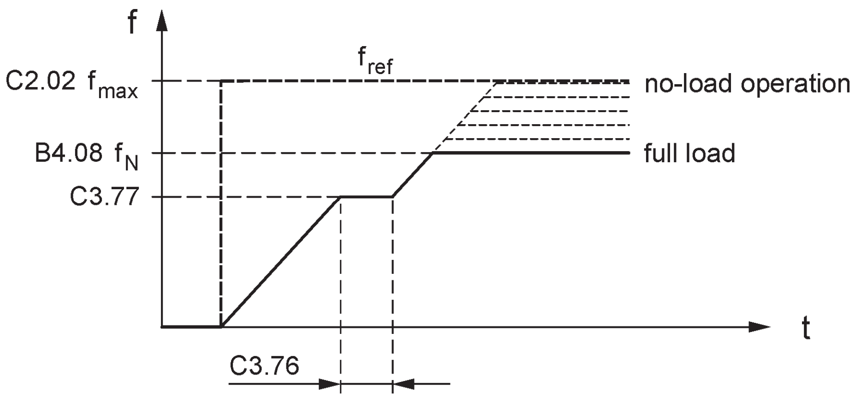
Fast speed for crane

MX eco ☐
MX pro ☑

The function "Fast speed for crane" enables a load dependent adaptation of the maximum reference speed limitation. In this way it is possible to use the field weakening range specifically for quicker dynamic sequences depending on the loading of a hoist or long-travel).

For determination of the real load a short measurement break is taken during acceleration in order to separate the dynamic load shares (acceleration) from the static (loading). Thereby a forecast of the maximum allowed speed is possible in consideration of the decreasing nominal torque within the field weakening range.



Curve generator

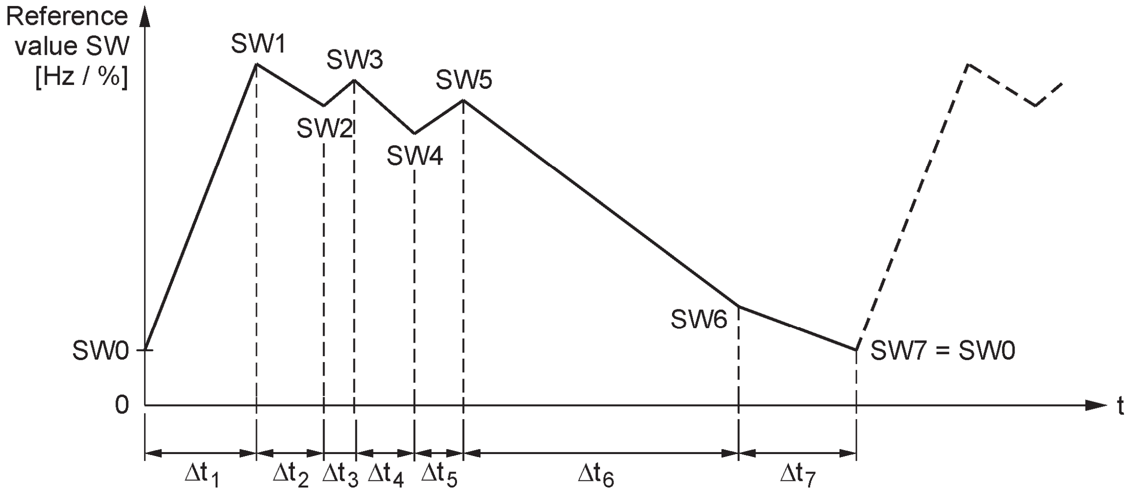
MX eco ☑
MX pro ☑

The curve generator provides a cyclically processed reference curve that is to be configured by setting seven value pairs (reference value and time).

In addition to the cyclic operation, level-controlled and edge-controlled operation (R/S, S/R) as well as a hold/reset function are available for the MX pro.

The curve generator is often used in combination with the correction reference value and the comparator functions (e.g. in case of automatic wash-up systems, irrigation plants, vibration movements, winding and coiling applications,...).

The points defined by means of parameters C1.63...C1.76 are connected to each other linearly and are executed cyclically.



After reaching the reference value point SW6 the reference value runs to the reference value point SW0 within the Δt_7 time and starts with a new cycle there.

If less than 7 value pairs are needed to illustrate the cyclical reference value sequence, the remaining time points are to be set to zero seconds and the rest of the reference points equal to the reference value SW0.

Short menu

MX eco ☑
MX pro ☑

The short menu offers the possibility of storing parameters selected from the entire range of the matrix structure as a copy in matrix field B6 "Short menu". In this way, parameters frequently used in operation for optimization or monitoring can be summarized for the user for adjustment or indication.

In addition, it is possible to except all parameters listed in the short menu from the generally applicable parameter lock in order to generate a freely editable security range.

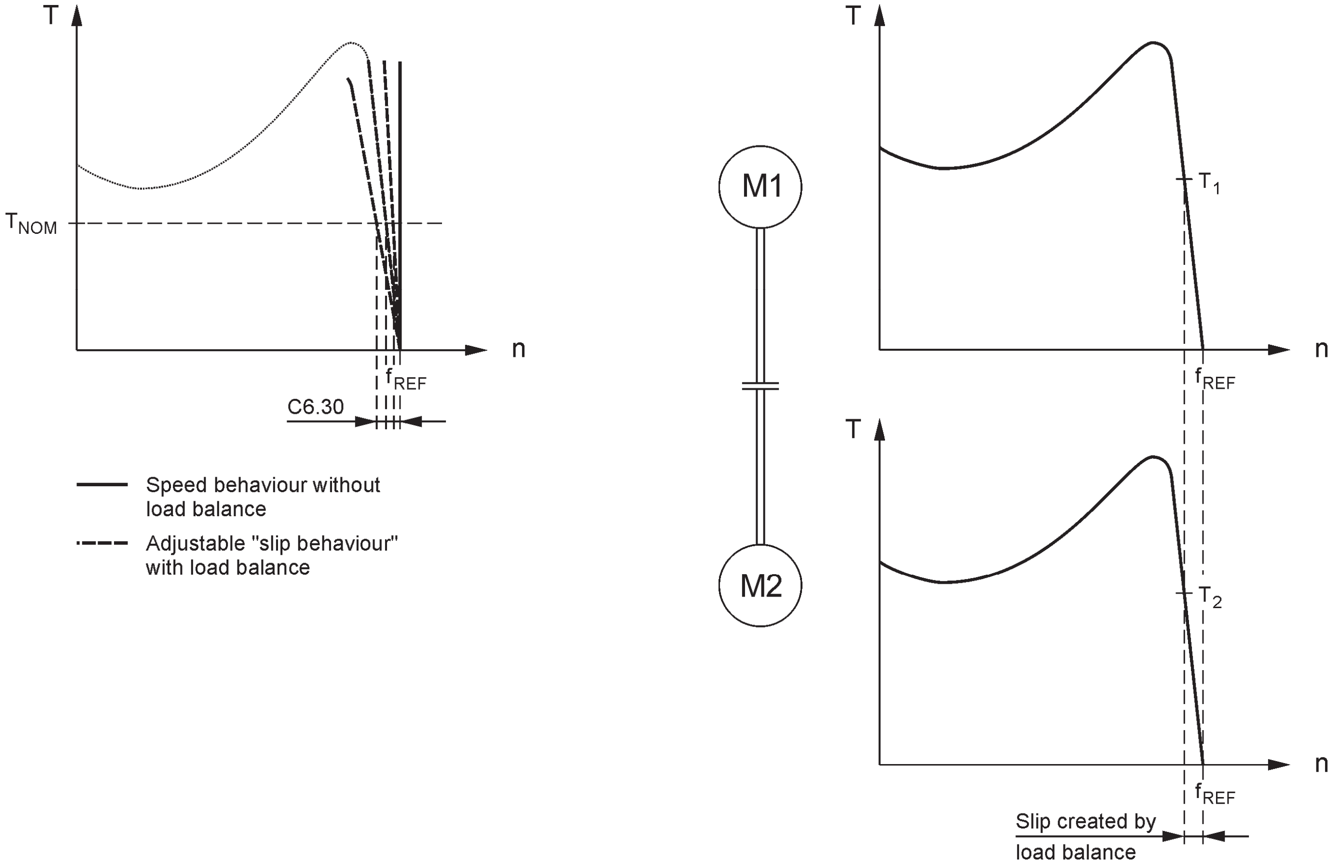
The factory presetting of the short menu depends on the loaded macro. Essentially, the parameters used for the optimization of the drive during operation (e.g. acceleration / deceleration time, PID settings,...) are noted here.

Load balance

MX eco ☐
MX pro ☑

The function "Load balance" can be easily used as an alternative to the master/slave connection for drives which are coupled directly or by the common load. For this function the use of equal motors (power, frame size, number of poles) is required because they are operated with the same speed due to their mechanical connection. The motors can be coupled mechanical either directly (tandem drives with two motors,...) or by the common load (several motors with a common gear ring, travel motors, common gear box,...).

The load is shared between the individual drives by means of the controllable slip of the individual asynchronous motors at the same speed. The slip behaviour and thus the load balance can be adjusted by parameterization regarding max. speed reduction at full load, start of load balance (frequency and torque) and the dynamic behaviour.



The function "Load balance" assumes the motor control variant VC standard or VC enhanced.

If another motor control variant is selected or torque control is active, the alarm message "Change control mode !" occurs.

Fan control

MX eco ☑
MX pro ☑

All MX eco & pro inverters are equipped with a configurable control of the power part fans. Switching off the fan when cooling is not required increases the life of the fans and reduces its energy consumption as well as the noise load.

Depending on the size of the device the function differs as following:

– MX eco & pro 4V0,75...4V75
  The fan is switched on at a thermal load of > 70 % and switched off again at < 60 %.
– MX eco & pro 4V from 90 kW
  MX pro 6V
  The fan runs as soon as the inverter is in operation. After a stop command the fan continues running until the thermal load drops to < 60 %.

Macros

MX eco ☑
MX pro ☑

Macros are factory presettings of the parameters for typical applications of the MX eco & pro. When loading a macro, the application data in the EEprom are overwritten. Parameter groups such as motor data, language setting, fault memory, operating hours, texts and basic communication settings as well as the parameters stored in the "Backup" remain unchanged.

Macro M1

Parameter pre-settings are optimized for standard drives with conventional control via the terminals (factory setting)

Macro M2

MX eco:	MX pro:
Preset parameters for the use of the integrated PID controller and conventional control (typical for pumps, fans and compressors)	Preset parameters for crane drives with braking unit

Macro M3

MX eco:	MX pro:
Parameter pre-setting for drives in cascade connection and with PID controller	Parameter presetting for speed-controlled drives in Master/Slave connection

Macro M4

Preset parameters for the control of the drive via fieldbus "Profibus DP"

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Macro M1:   General use (factory macro)

Macro M1 represents a consciously simple kept setting variant which has all required functions ready for a huge number of applications. It is used typically for PLC-automatic systems with conventional wiring in which the frequency inverter is used as intelligent actuator.

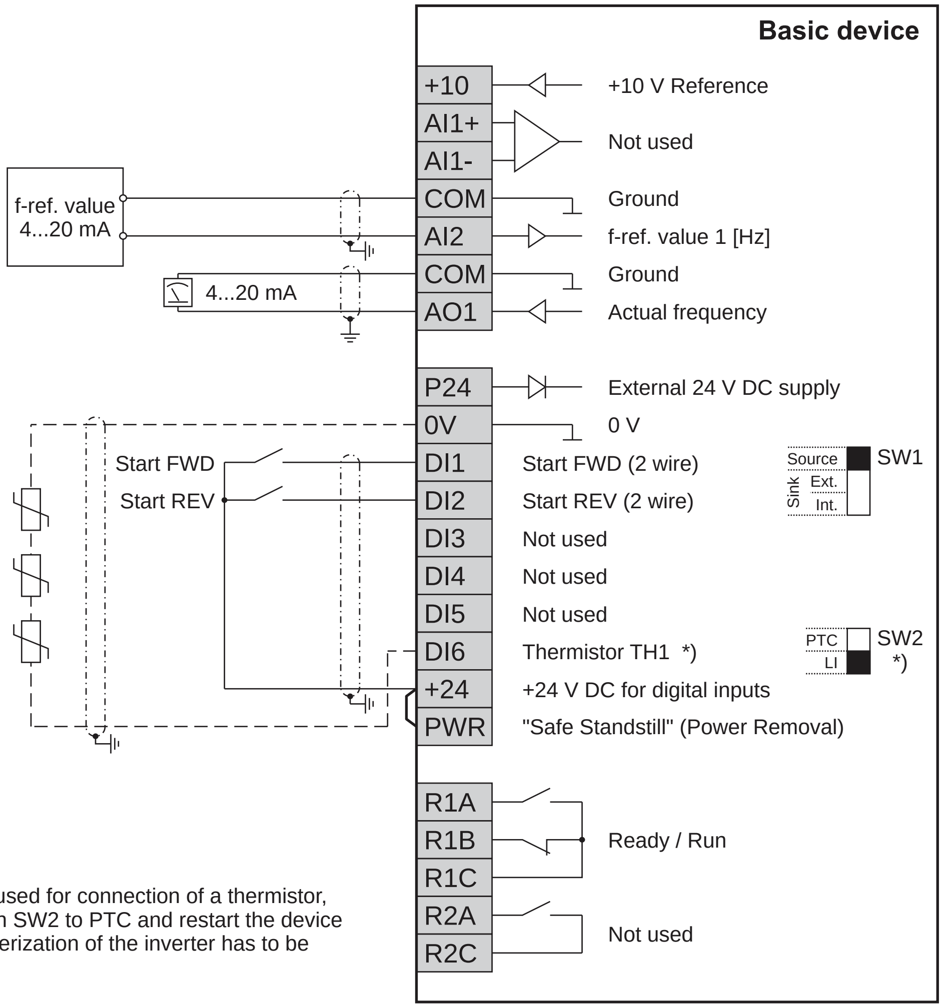
The control commands occur in 2-wire technology separate for both rotational directions via the terminals of the basic device. The reference value for the frequency is planned as 4...20 mA signal.

Panel control of the device is possible via the Matrix operating panel BE11 or the built-in LED-keypad.

The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the MX eco & pro. These can be activated or changed according to requests of the application.

The macro M1 corresponds to the factory setting.

Allocation of terminals for macro M1



*) If the digital input DI6 is used for connection of a thermistor, switch the selector switch SW2 to PTC and restart the device afterwards. The parameterization of the inverter has to be adjusted appropriate.

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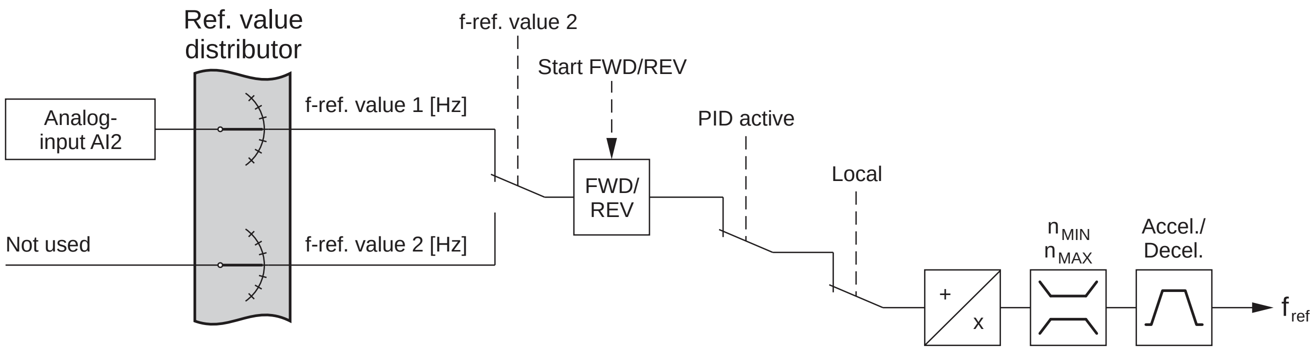
Reference value path of macro M1



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Macro M2: MX eco - Drives with PID process control

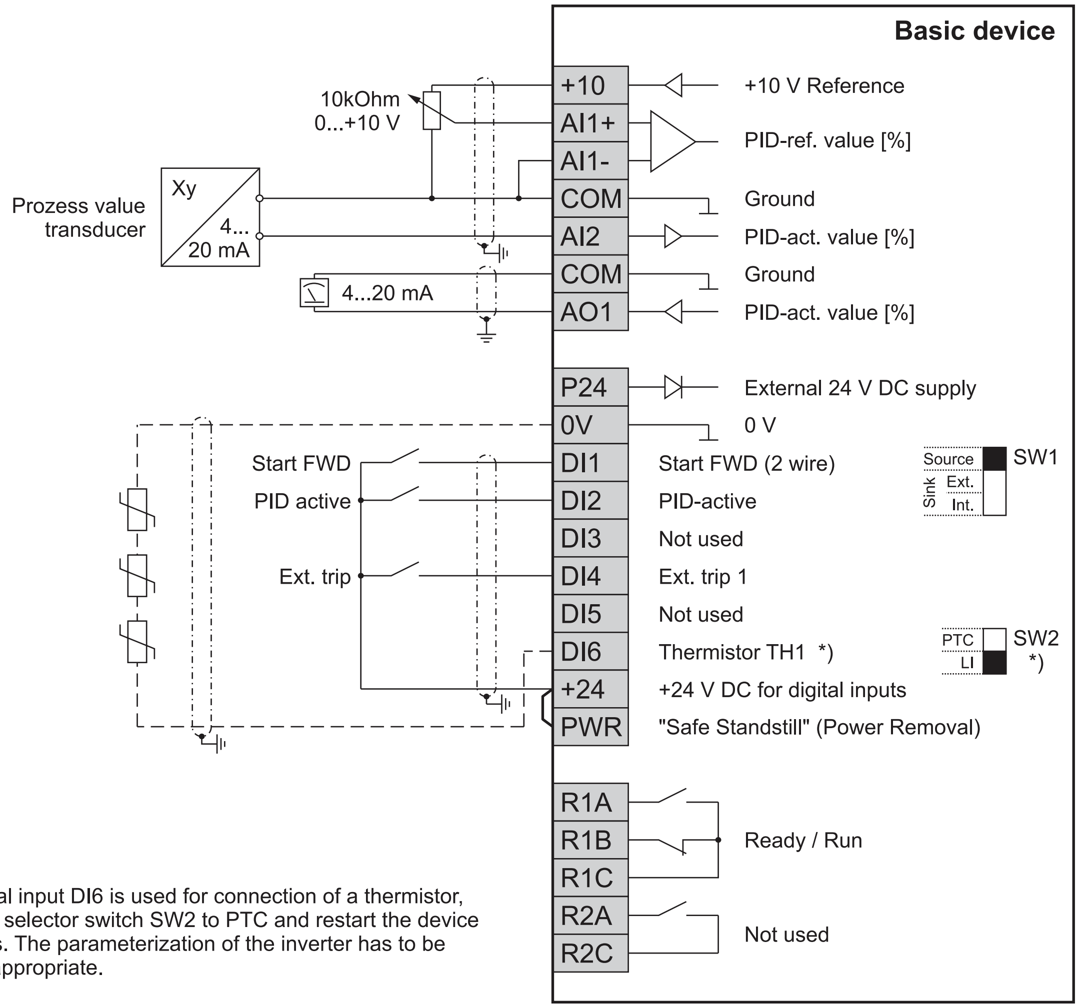
The macro M2 is a typical presetting for drives with PID-controller such as those which are used for pumps, fans, compressors etc.

The control commands occur in 2-wire technology for forward via the terminals of the basic device, the PID reference value is assigned to the analog input AI1 (0...10 V) and the PID actual value to AI2 (0...10 V or 4...20 mA). Switching-over from closed-loop control to open-loop control can be carried out by means of a digital input whereas in this case the reference value at AI1 can also be used as the frequency reference value.

In addition to the closed-loop and open-loop control (via the terminals) a panel control of the device is possible via the Matrix operating panel BE11 or the built-in LED keypad.

The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the MX eco & pro. These can be activated or changed according to requests of the application.

MX eco allocation of terminals for macro M2



*) If the digital input DI6 is used for connection of a thermistor, switch the selector switch SW2 to PTC and restart the device afterwards. The parameterization of the inverter has to be adjusted appropriate.

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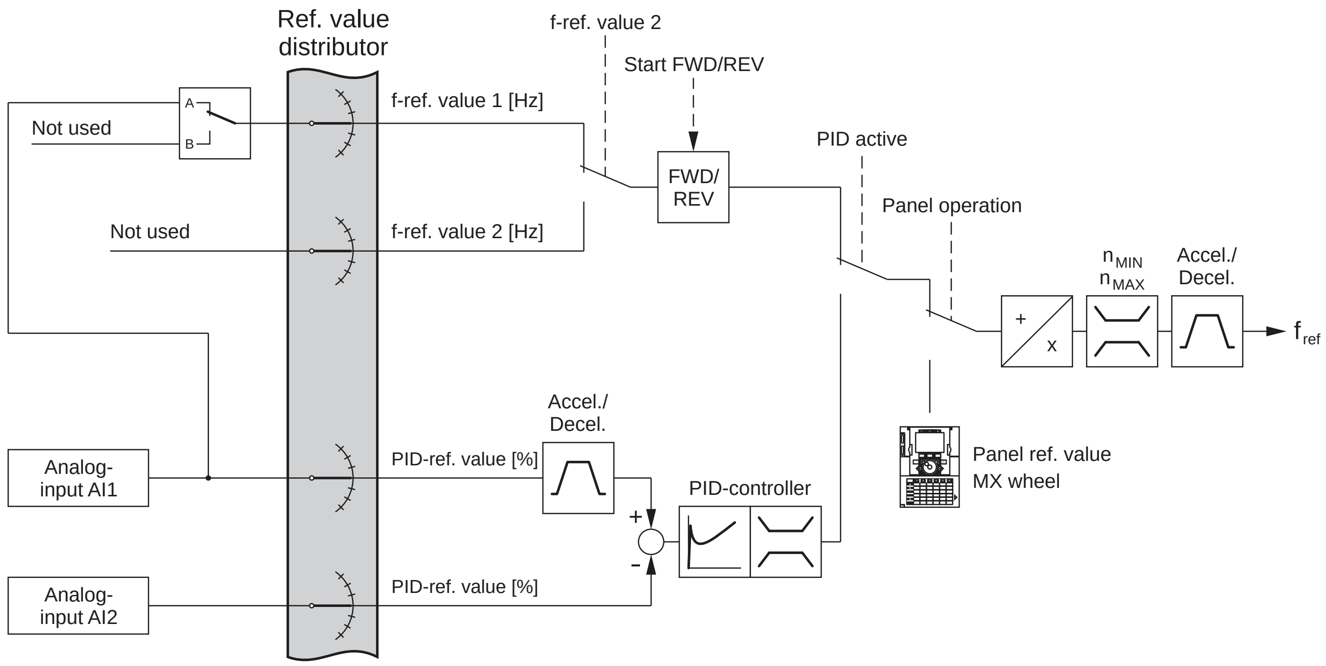
MX eco reference value path of macro M2



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Macro M2: MX pro - Hoist application

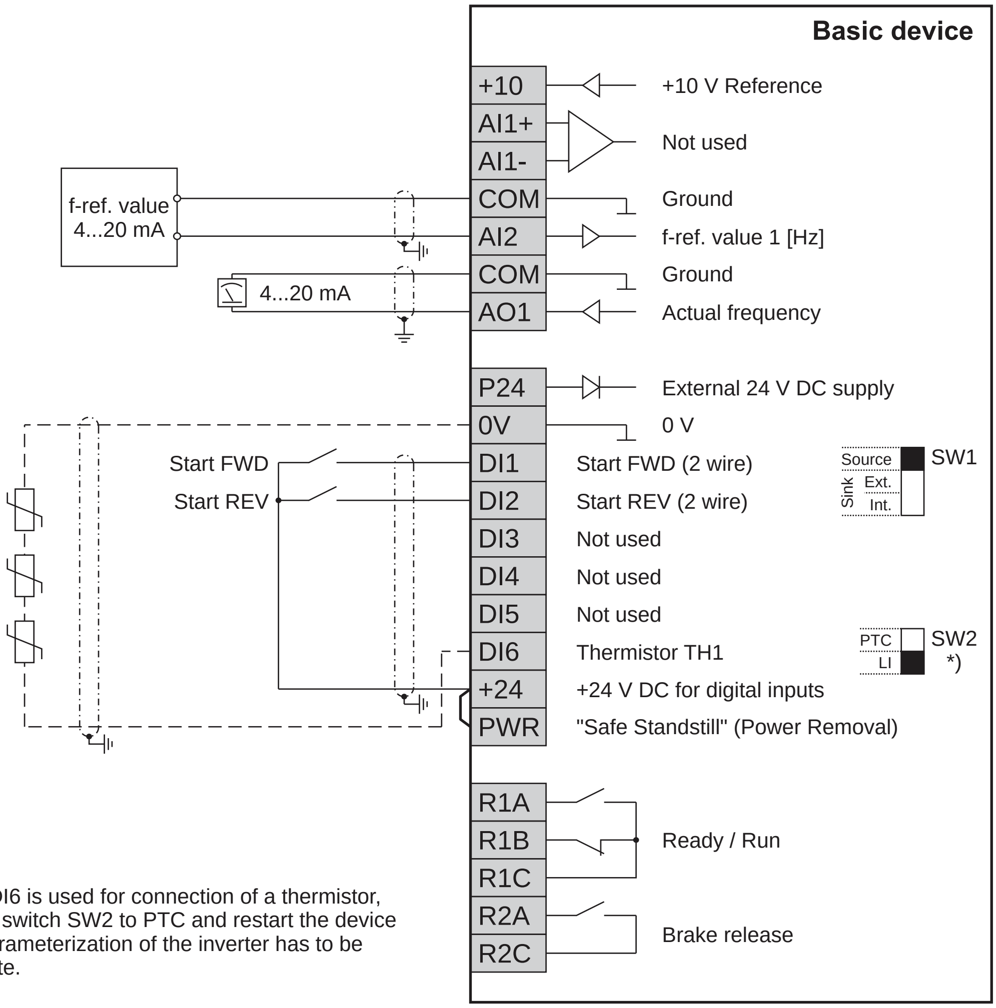
Macro M2 is a typical presetting for hoisting drives.

The control commands occur in 2-wire technology for forward operation (= lifting) and reverse operation (= lowering) via the terminals of the basic device. The speed reference value is assigned to the analog input AI2 (0...10 V or 4...20 mA).

The external mechanical brake is actuated via relay R2 on the basic card of the MX pro. The braking unit is activated as an electrical brake. The monitoring of the braking resistor is based on the evaluation of the thermal mathematical model.

The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the MX eco & pro. These can be activated or changed according to requests of the application.

MX pro allocation of terminals for macro M2



*) If the digital input DI6 is used for connection of a thermistor, switch the selector switch SW2 to PTC and restart the device afterwards. The parameterization of the inverter has to be adjusted appropriate.

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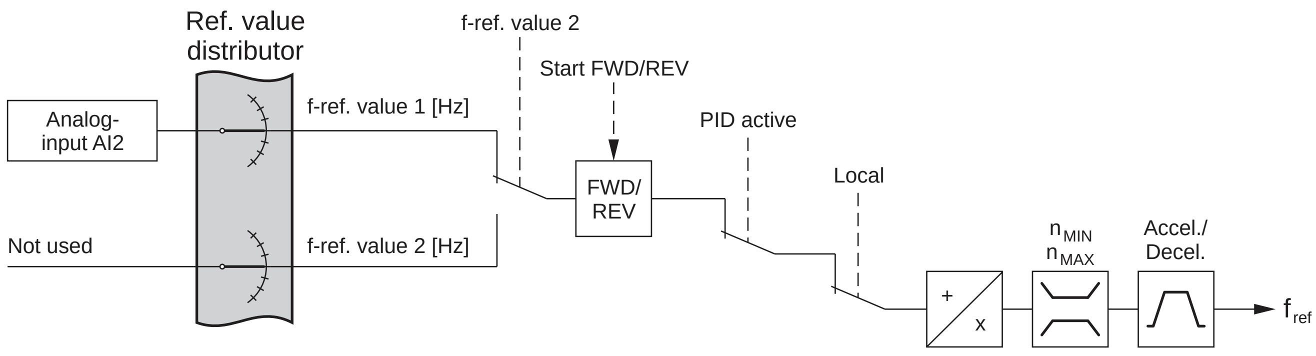
MX pro reference value path of macro M2



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Macro M3: MX eco - Drives with PID process control and cascade operation

The macro M3 is a typical presetting for drives with cascade control and active PID control circuit such as those which are used in booster stations, waterworks etc.

The device is configured according to the design of the "Mains cascade 1" with a speed-controlled master drive and two slave drives. The control of the slave drives occurs through the interpretation of the control deviation of the PID control circuit on the master drive which connects and disconnects the slave drives by means of two output relays.

The control commands occur in 2-wire technology for forward via the terminals of the basic device, the PID reference value is directly given on the inverter by means of the thumb wheel on the Matrix operating panel BE11 or with the arrow buttons on the built-in LED keypad. The PID actual value is assigned the analog input A12 (0...10 V or 4...20 mA). To recognize whether the slave drives are ready to run, for each of both slave drives a digital input has to be provided on the master drive. Based on the balancing of operating hours the slave drives are connected and disconnected by means of two relay outputs.

In addition to the closed-loop and open-loop control (via the terminals) a panel control of the device is possible via the Matrix operating panel BE11 or the built-in LED keypad.

The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the MX eco & pro. These can be activated or changed according to requests of the application.

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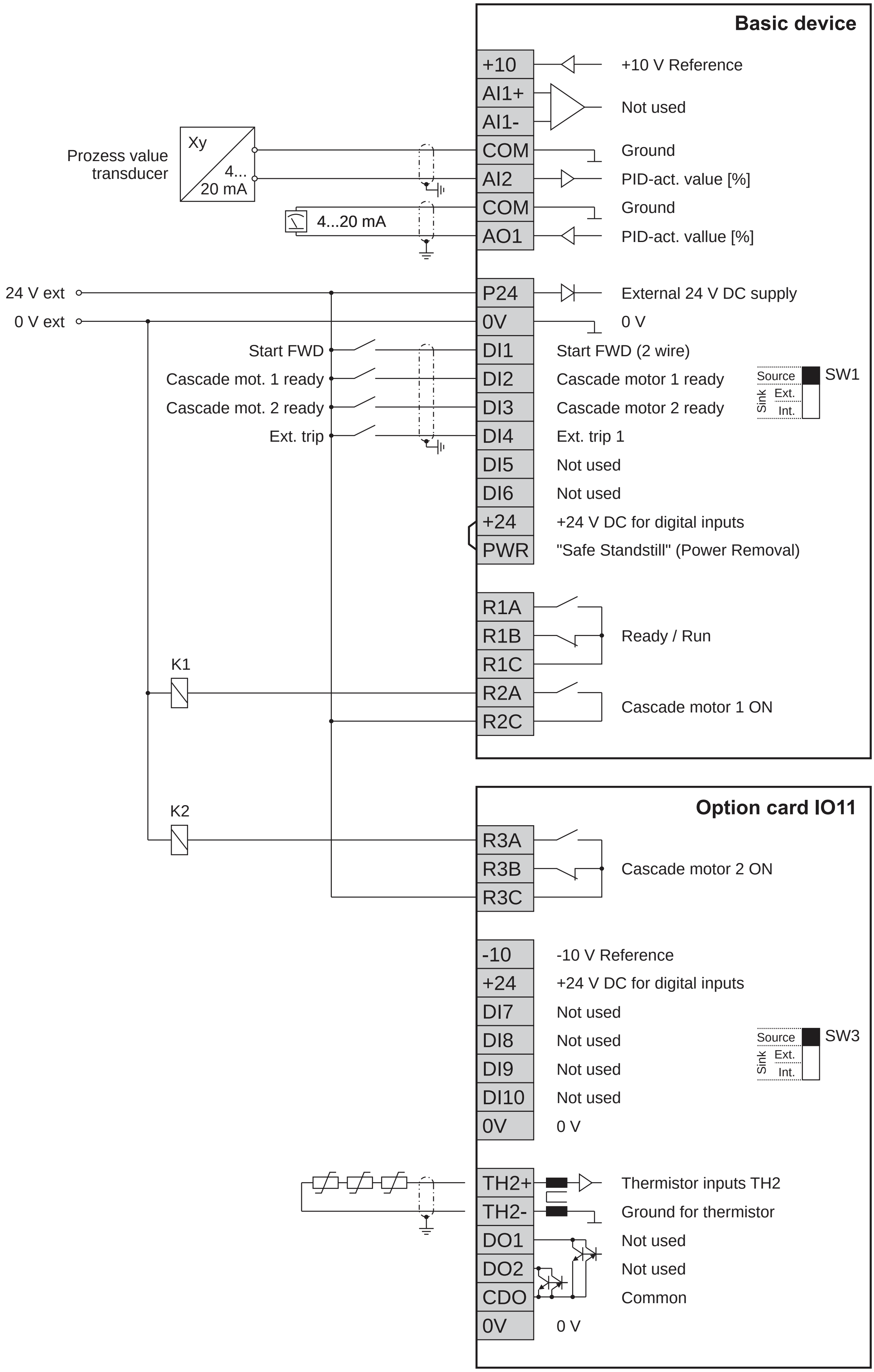
MX eco allocation of terminals for macro M3



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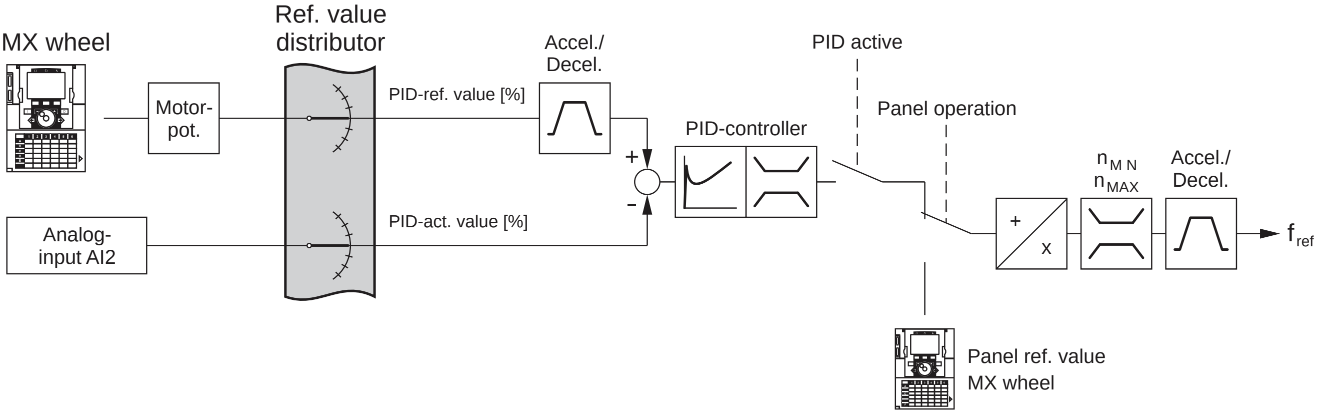
MX eco reference value path of macro M3



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Macro M3: MX pro - Drives with master/slave coupling

Macro M3 is a typical presetting for drives with mechanical coupling that are operated in the master/slave control variant (S-rolls, sheet metal processing machines, wire-drawing machines,...).

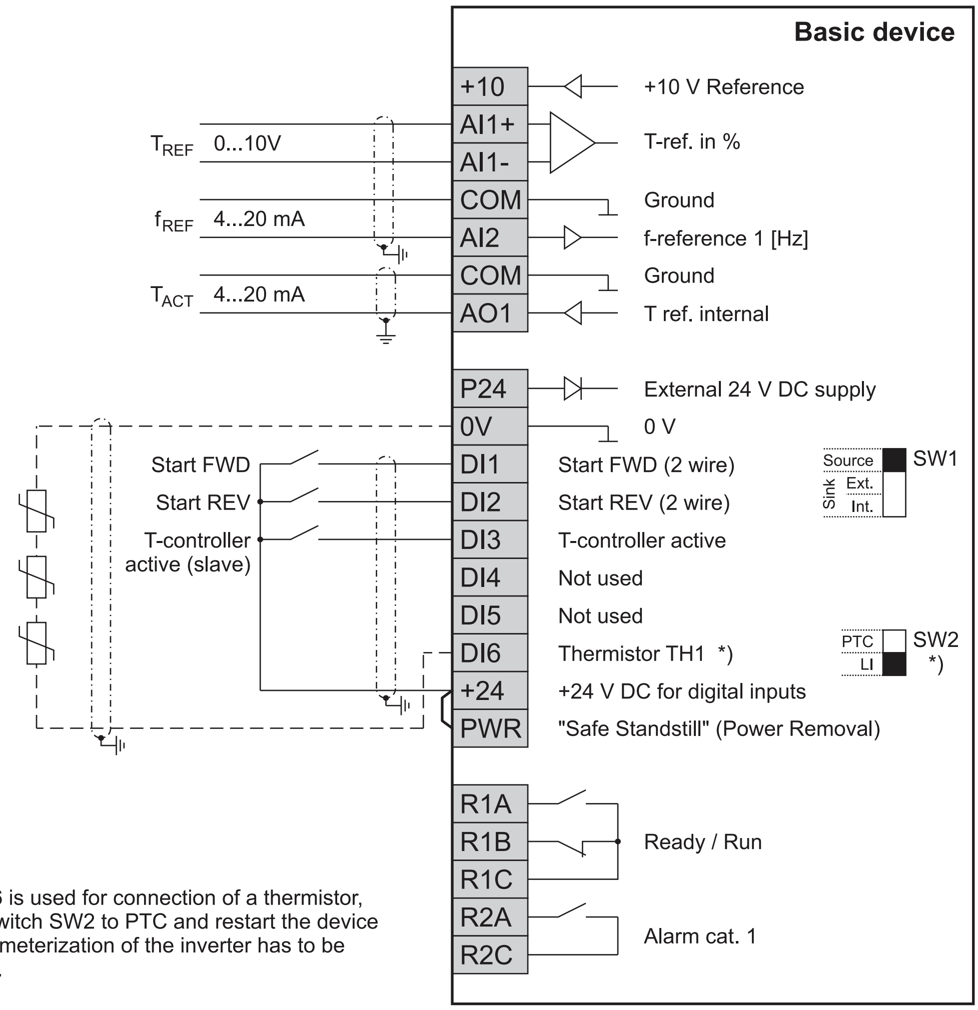
Therefore, one drive is determined as master. The internal speed controller (with or without encoder feedback) of the master drive is responsible for the common speed. The inverters, which are operated as slaves, obtain the reference torque from the master as torque reference. When using this method the load sharing among the individual drives can be set.

The selection between master and slave operation takes place when the torque controller on the slave is activated. If the slave drive, which receives the reference torque from the master, cannot remain within a defined speed window (e.g. missing load coupling), the torque controller automatically switches to speed-controlled operation and indicates this state via a relay output (alarm message).

It is also possible to switch between speed and torque control manually using a digital input.

The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the MX eco & pro. These can be activated or changed according to requests of the application.

MX pro allocation of terminals for macro M3



*) If the digital input DI6 is used for connection of a thermistor, switch the selector switch SW2 to PTC and restart the device afterwards. The parameterization of the inverter has to be adjusted appropriate.

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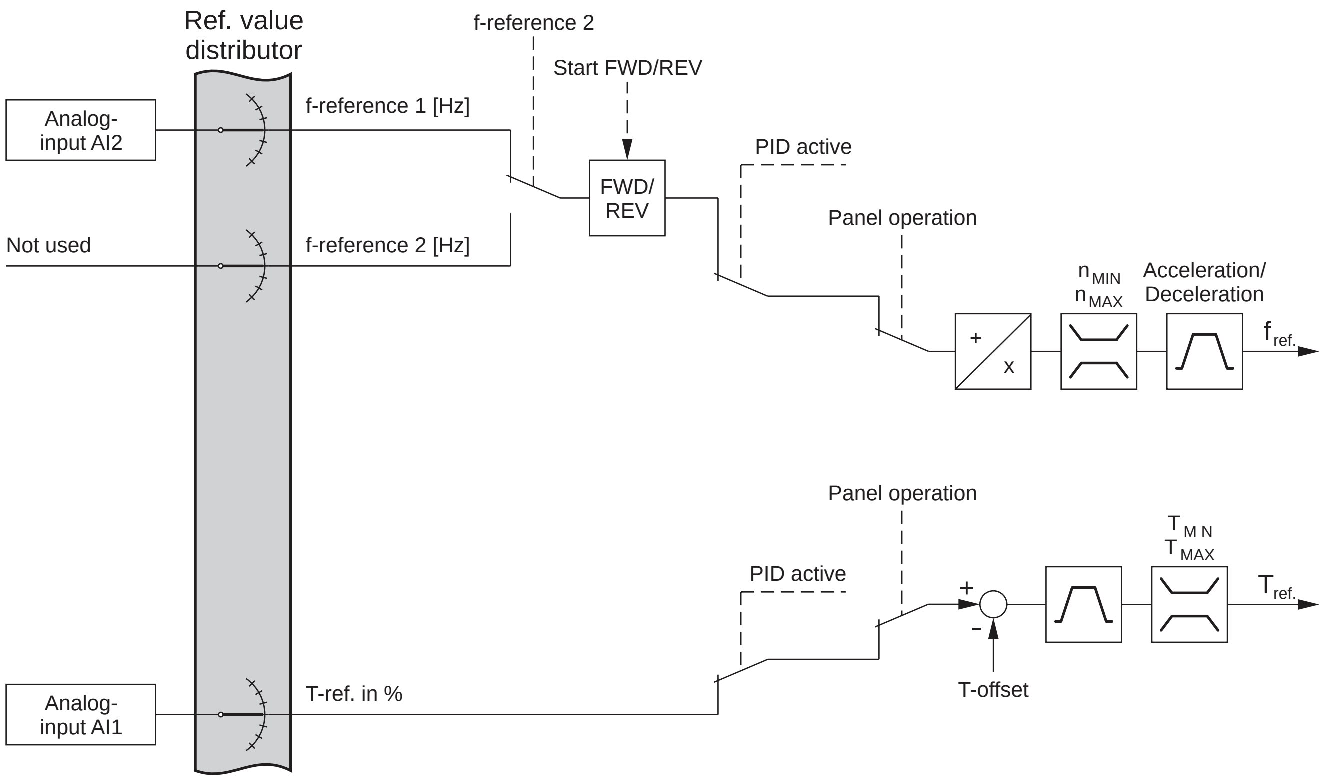
MX pro reference value path of macro M3



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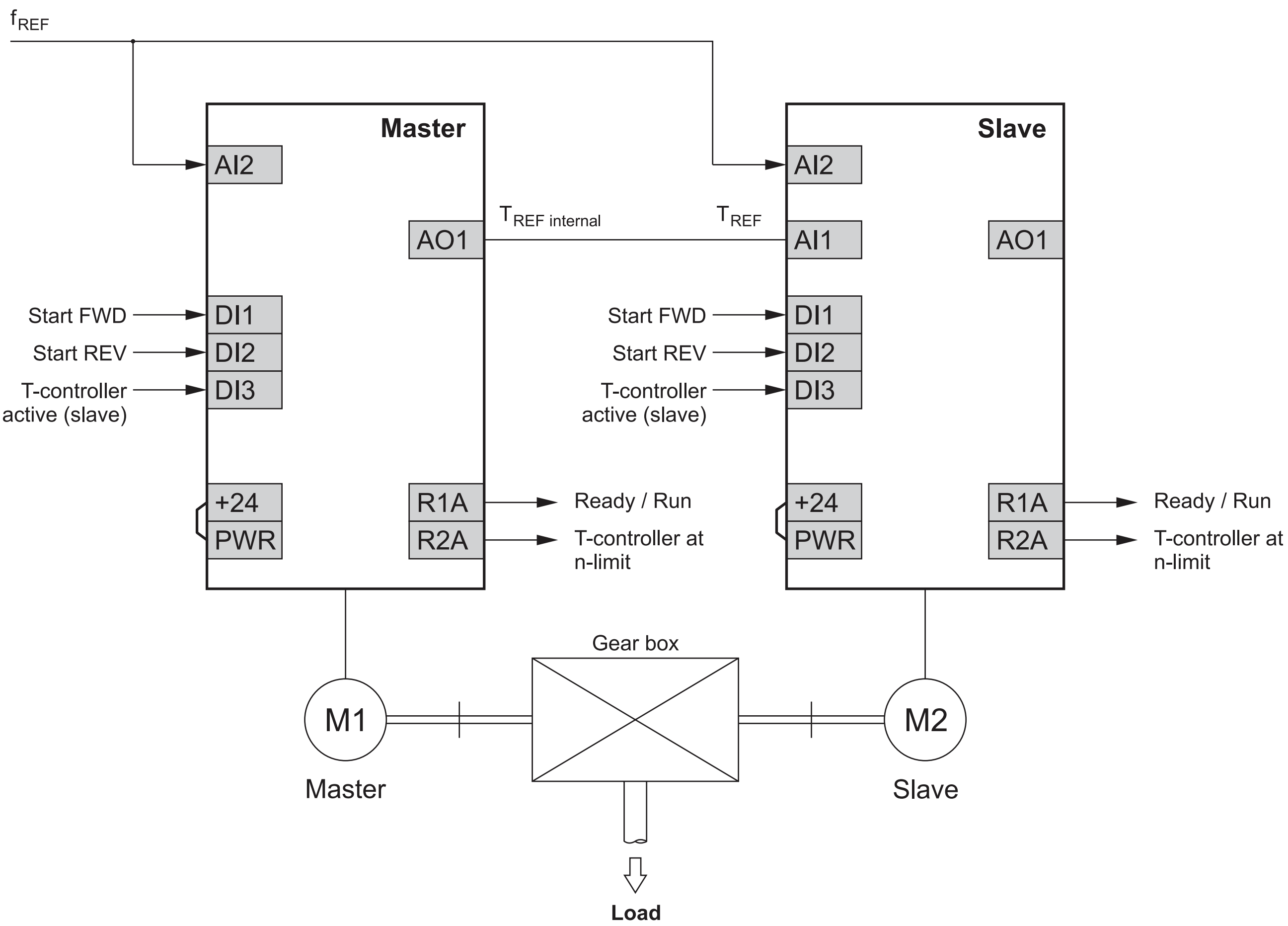
MX pro signal exchange master/slave



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Macro M4: General use with field bus

Macro M4 represents a consciously simple kept setting variant which is intended for a hugh number of industrial applications. The macro is used typically for PLC-automatic systems with Profibus connection in which the frequency inverter is used as intelligent actuator.

The control commands as well as the reference-/actual value transmission occurs according to the Profidrive-Profile to PPO4. To realize a switching of the control source also the conventional terminal operation with 2-wire control commands and a reference value at analog input AI2 must be parameterized in addition to the fieldbus connection.

It is possible to switch between bus- and terminal operation by means of a digital input.

Controlling the device is possible via the Matrix operating panel BE11 or the built-in LED keypad independent of the control source (bus / terminals).

The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the MX eco & pro. These can be activated or changed according to requests of the application.

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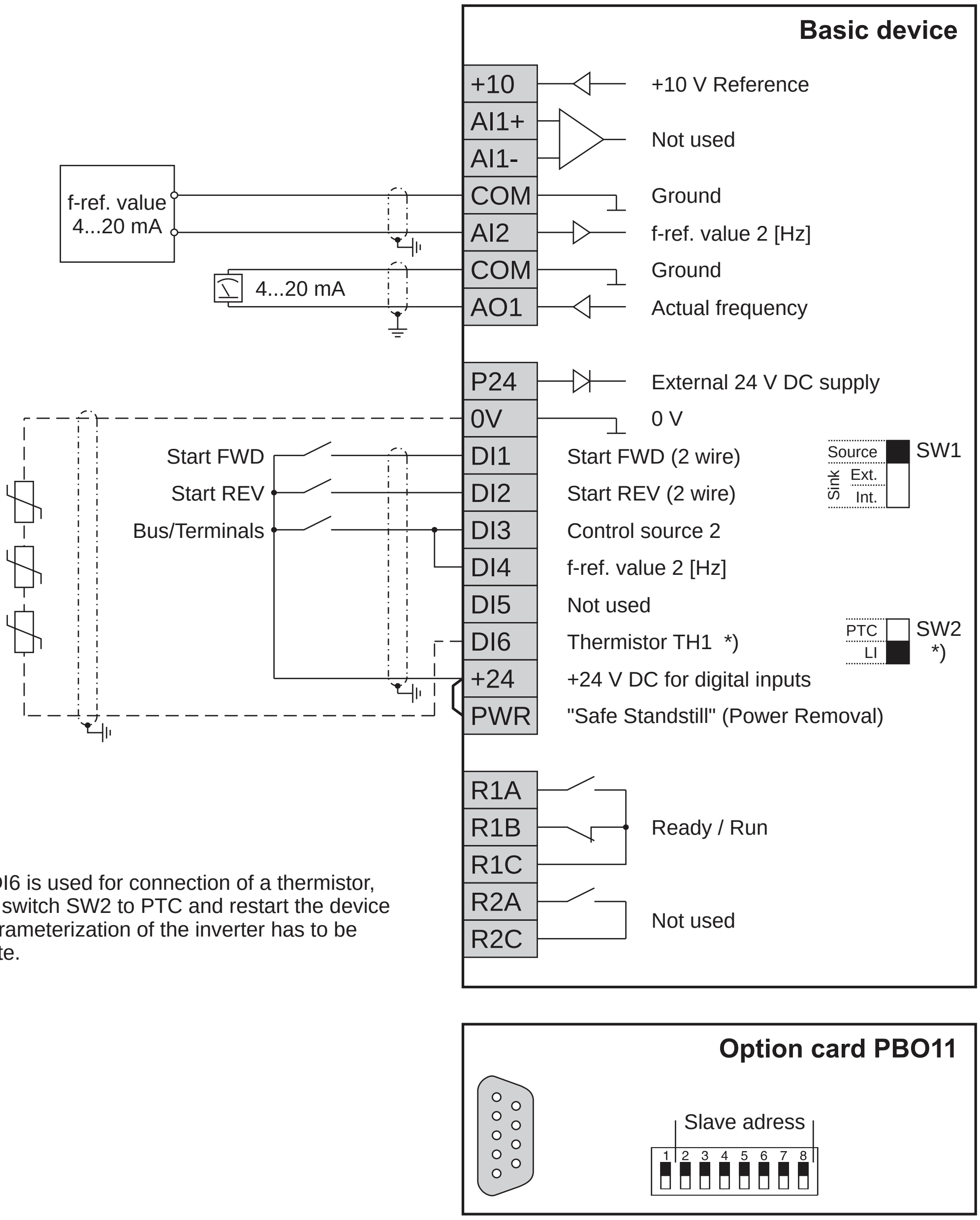
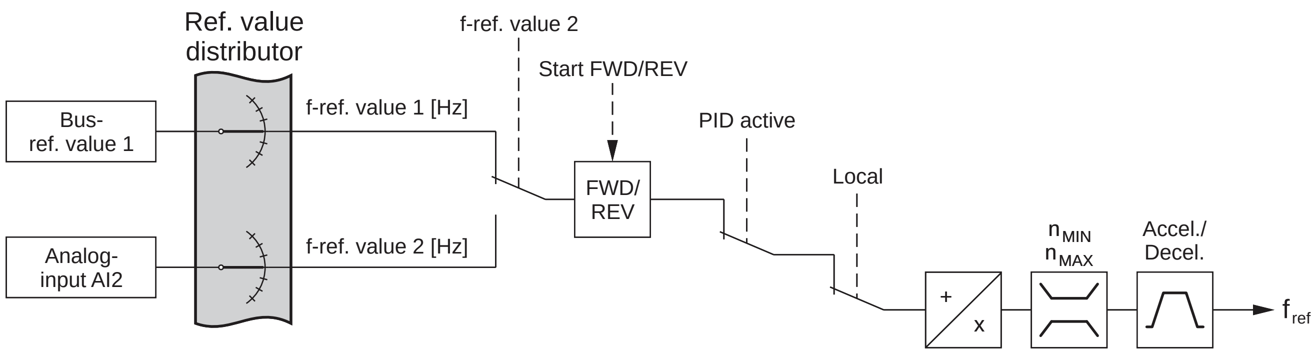
Allocation of terminals for macro M4



*) If the digital input DI6 is used for connection of a thermistor, switch the selector switch SW2 to PTC and restart the device afterwards. The parameterization of the inverter has to be adjusted appropriate.

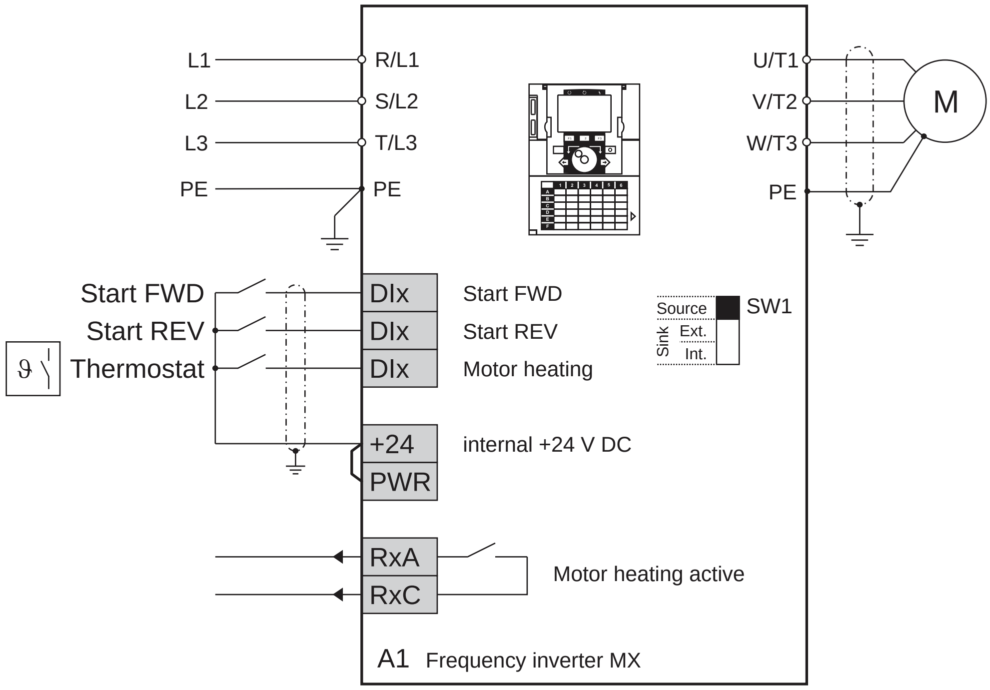
Reference value path of macro M4



Motor heating

MX eco ☑
MX pro ☑

When using motors in disadvantageous ambient conditions such as high humidity and / or severe temperature fluctuations, there is a danger of condensation in the motor. In order to prevent resulting damages to the motor the function "Motor heating" can be activated. In contrast to externally mounted motor heating systems, the heating occurs directly in the motor windings by means of a direct current which is applied from the inverter.



If heating should occur depending on an external sensor such as a hygro- or thermometer, select setting "2 .. DI dependent" and provide a corresponding configured digital input.

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Motor control

For the optimal adaptation of the used motor to the respective application, the input of the corresponding motor name plate data, the execution of the autotuning routine as well as the selection of an appropriate motor control method are necessary.

The MX eco & pro provides a range of different motor control methods:

Select the method according to the table below:

Control method	Brief description	Possible adjustments	Typical applications
V/f 2 point	Simple V/f-characteristic control	Nominal motor data Starting voltage	Standard applications, multimotor drives, special motors, special windings
V/f economy (only MX eco)	V/f characteristic control, optimised for quadratic loads	Nominal motor data Starting voltage Flux reduction	Simple applications in the range of pumps and fans
V/f 7 point	In 7 points free configur-able V/f-characteristic	Nominal motor data V1/f1...V5/f5	Special motors and windings, damping of resonance problems
VC standard	Field orientated control without speed feedback	Nominal motor data Starting torque Slip compensation V_{MAX} field weakening Autotuning	Factory setting, all-purpose field orientated control with very good dynamics (even for multimotor drives)
VC enhanced	Optimised field-oriented control without speed feedback	Nominal motor data Starting torque Slip compensation V_{MAX} field weakening Autotuning	Applications with special requests concerning dynamic and starting torque performances, only for single drives e.g. compres-sor, extruder, conveyor belt,...
VC economy (only MX eco)	Field orientated control without speed feedback optimised for quadratic load	Nominal motor data Starting torque Slip compensation V_{MAX} field weakening Autotuning Flux reduction	Drives with quadratic loads such as centrifugal pumps and fans. The energy consumption is optimised by means of a load dependent decrease of the magnetizing current vector.
VC feedback (only MX pro)	Field-oriented control with encoder feedback (closed loop variant)	Nominal motor data Starting torque Slip compensation V_{MAX} field weakening Autotuning	Applications with special require-ments concerning dynamics, speed precision, starting torque behaviour, behaviour at zero speed with high safety requirements, or torque control, only for single drives e.g. hoistings, test benches,...
Syn. Standard (only MX pro)	Control variant without position feedback for synchronous machines	Nominal motor and winding data	Applications without high starting torque requirements, e.g. textile machines, fans,...

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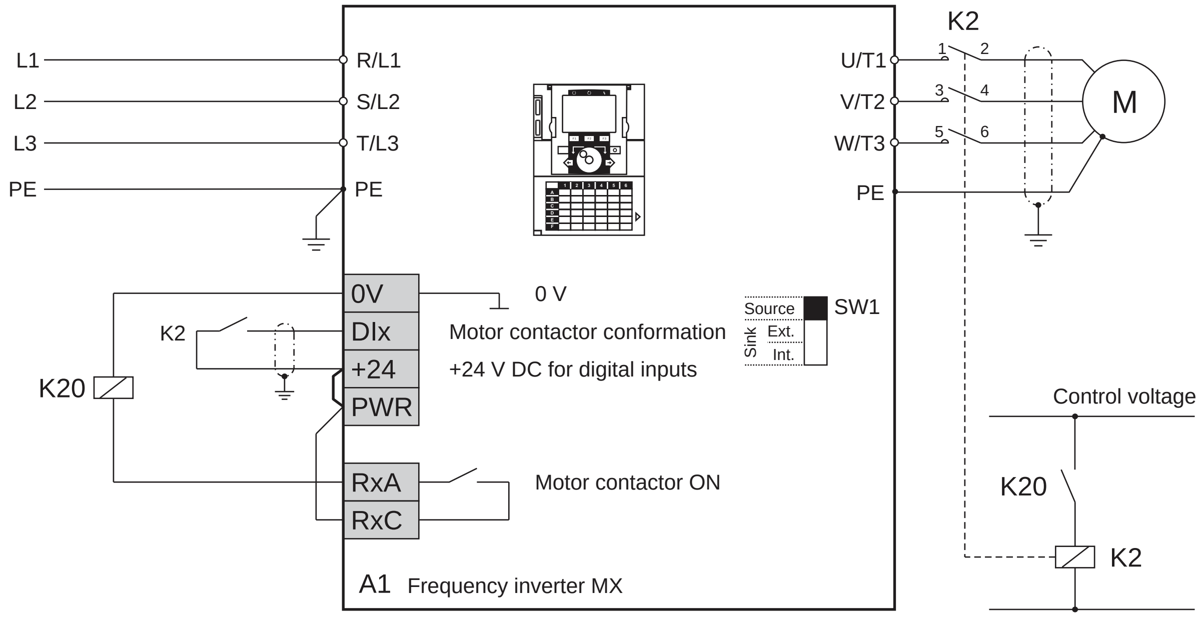
Motor contactor control

The motor contactor control is functionally divided into two different groups.

Setting "VSD controlled"

If setting "VSD controlled" is activated, the motor contactor is switched on and of by means of a digital output. This digital input has to be configured with the function "Motor contactor ON". The motor contactor is closed with every start command and opens after completion of deceleration.



The function of the motor contactor can be monitored by connecting an auxiliary contact to a digital input.

Setting "External control"

If setting "External control" is activated, the motor circuit is opened with an externally controlled motor contactor or by means of a manually operated switch. The frequency inverter recognizes the disconnection of the motor circuit due to its output phase monitoring and activates a routine which identifies the reclosing of the motor circuit. If the motor is connected again, the inverter synchronizes itself automatically to the motor speed and continues operation.

All coupling relays for control voltages >24V have to be performed according to protective separation !

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Motor overload

MX eco ☑
MX pro ☑

Each motor must be protected against winding temperatures that are too high as a result of inadmissible high load.

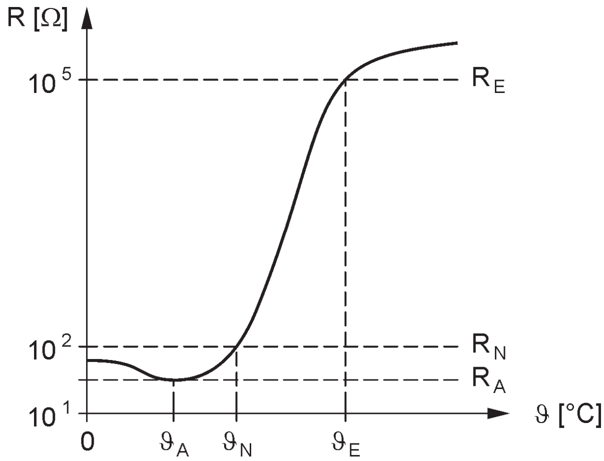
With motors without speed control this can be carried out with simple motor circuit breakers (I^2t protection). These determine an inadmissible load by registering the current and its residence time. The cooling of the motor is assumed as constant and is therefore not included in the registering of the load.

If a motor is operated at the output of an inverter, its speed can be changed. If the speed is smaller than its nominal value, the cooling effect of the motor is also reduced as with self-cooled motors the fan is driven directly by the motor shaft. Therefore the use of a motor circuit breaker is no sufficient overload protection in this case.

The most effective action of the motor protection is the measurement of the temperature in each of the three motor windings (complete motor protection). This takes place by integrating PTC thermistors in the end winding of the motor, whereby all three PTCs are connected in series and monitored together. The PTCs are monitored directly on the MX eco & pro without an additional evaluation instrument.

Switching points:

Overtemperature trigger	$R_{PTC} > 3\ k\Omega$
Reset value	$R_{PTC} < 1.8\ k\Omega$
Short-circuit recognition	$R_{PTC} < 50\ \Omega$
Wire break recognition	$R_{PTC} > 100\ k\Omega$



Typical resistance behaviour of a PTC thermistor

The following monitoring inputs are available:

Input	Position	Terminal marking	Note
TH 1	Basic device	DI6 0V	Selection DI6: digital input / PTC sensor Switchover with SW2 = PTC Change does not become active until Mains OFF/ON
TH 2	Option MX IO11	TH2+ TH2+	
TH 3	Option MX IO12	TH3+ TH3+	

If no PTC thermistor sensors are available on the motor, the protection of the motor can be realized by means of the thermal mathematical motor model.

The thermal motor model is a complex arithmetic algorithm which determines the actual temperature of the motor windings. The specification of the motor model occurs by entering the current behaviour with regard to the speed (cooling conditions) and the thermal storage properties of the motor (motor time constant). If the maximum ambient temperature at the location of the motor is known then this can also be taken into account.

The motor temperature results from the time rated balance of the supplied current heat losses and the emitted heat due to the cooling or self-convection of the motor. The determined thermal state of the motor can be used for protection-, alarm- or limitation functions.

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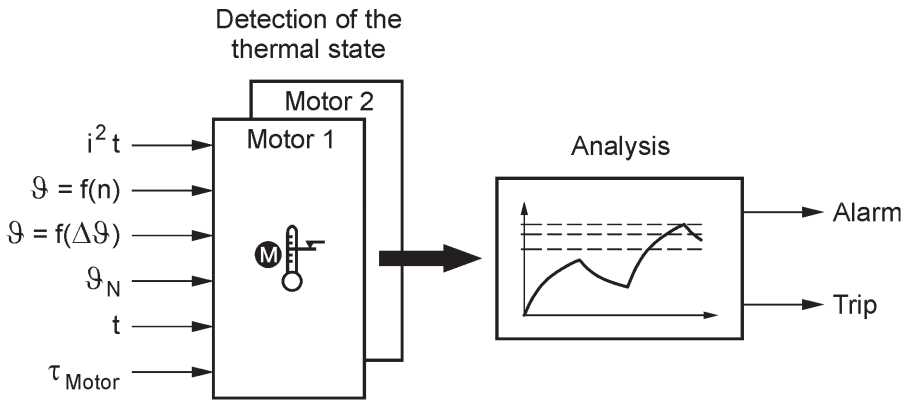
If the switchable 2nd set of motor data is used, the motor model can calculate simultaneously both motors even if they are different.



The information of the thermal motor states remains available, also when the inverter is in a dead state, therefore no external buffer voltage is needed.

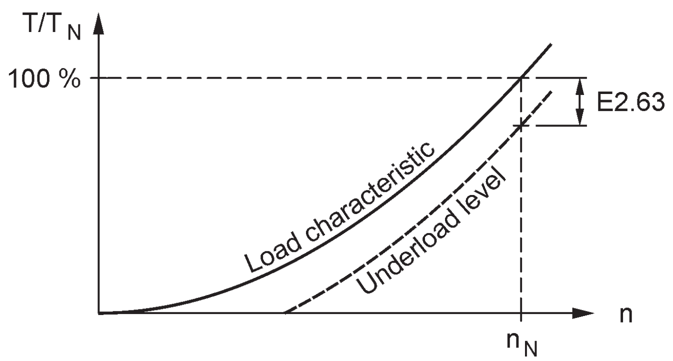
Motor underload

MX eco ☑
MX pro ☑

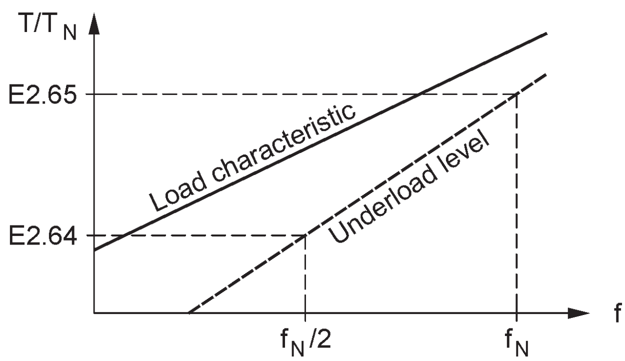
The function underload monitoring checks the mechanical load (torque) with respect to a characteristics in relation to the speed. If a load reduction occurs which is untypical for the speed range, this situation can be process-technically evaluated (e.g. checking the V-belt of a fan, output of a pump, ...).

The reference torque used for monitoring can be switched between quadratic and linear characteristics.

quadratic characteristic



linear characteristic



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n/T-controller

Speed controller

The MX pro frequency inverters are equipped with an extremely efficient speed/torque control circuit which makes a variety of different applications possible.

The speed control circuit is activated when a vector-oriented motor control variant (B3.02 = VC standard, VC enhanced or VC feedback) is used.

In case of operation without encoder, the actual speed required for speed control is calculated from the operating frequency, the parameterized motor data and the actual load of the motor. When the optional encoder feedback (VC feedback) is used, it is used for control.

The basic structure of the speed controller implemented in MX pro corresponds to a PI control circuit with a dynamic filtering possibility of the reference value path. When the direct torque setting is used, the speed controller assumes the speed limitation if the speed exceeds or falls short of an adjustable speed window.

T-controller

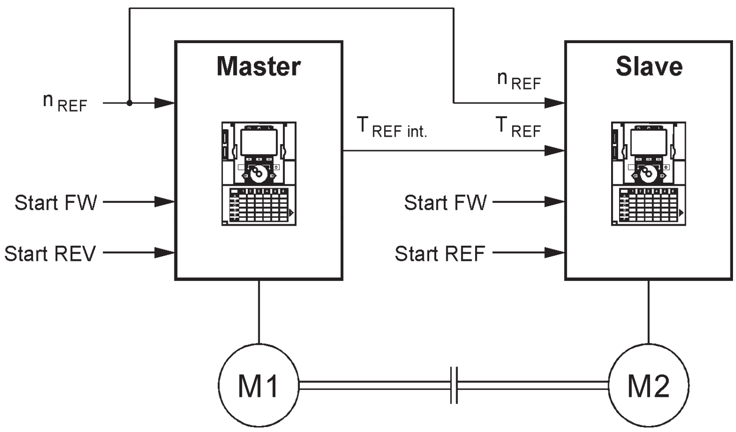
The reference torque supplied to the internal, vector-oriented motor control, is determined by the output of the speed controller in speed-controlled mode. If the drive is operated in a torque-controlled manner, the torque reference signal is switched to the external reference value channel by means of parameter C5.07 Torque controller.

Applications such as master/slave drives (drives coupled on the load side), coiler drives, grab crane controls and test bench applications (if the process controller is also used with a torque correction controller) are possible using this control variant.

If parameter C5.07 Torque controller is set to "2 .. DI dependent" and a digital input is configured correspondingly, it is possible to switch from speed control to torque control even during operation.

In case of operation with torque reference, the speed controller is used for speed limitation which keeps the drive in a safe operation state in case of load rejection or an inadmissible high load related to the reference value.

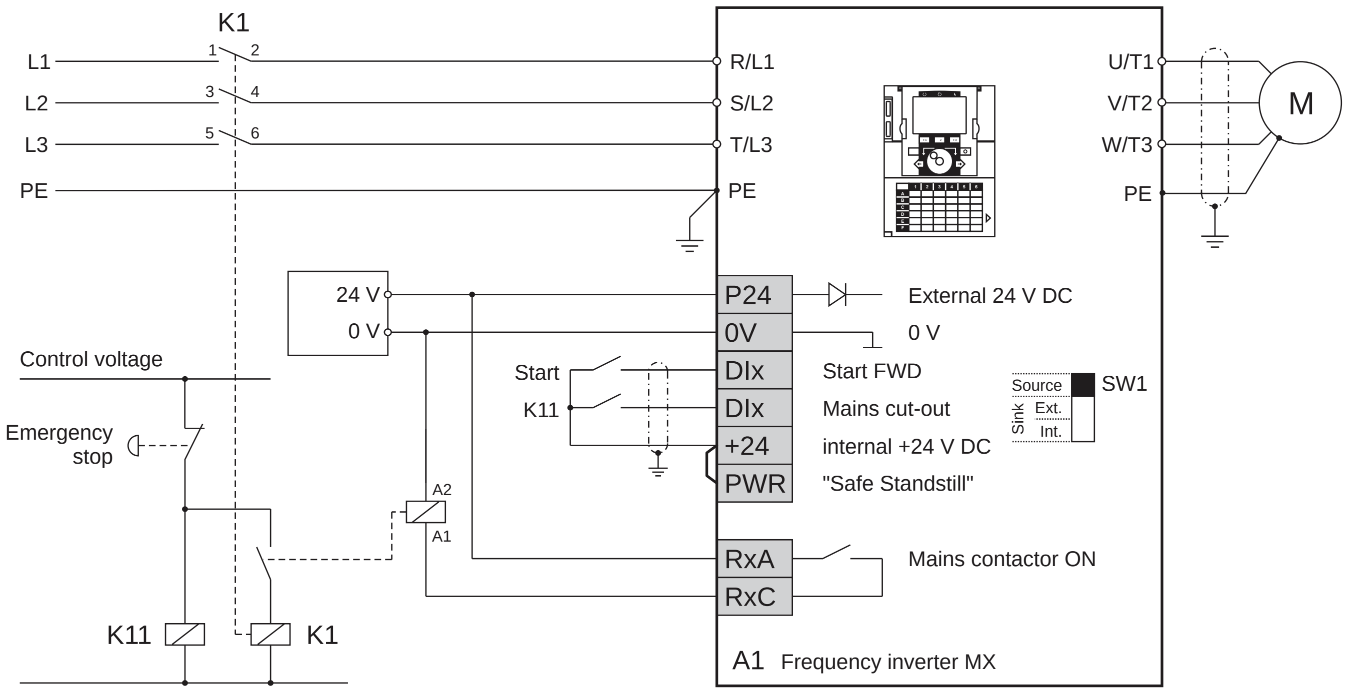
The torque reference value can be obtained from an external reference source, the output of the PID process controller or an internal reference source (MX wheel, XY graph, calculator, etc.). Therefor an adjustable, linear acting torque ramp and a reference value limitation are available.



In order to build up a master/slave-coupled drive group, the output signal of the speed controller of the master ($T_{REF\text{-}Internal}$) has to be integrated at the slave drives as torque reference value.

Line contactor control

By using the function "Line contactor control" the frequency inverter is itself able to connect and disconnect the mains by means of a contactor upstream. Therefore, a selectable digital output is activated with each start command (via keypad, terminals or bus) through which the line contactor is activated. The termination of the line contactor occurs with a stop command after a deceleration process has taken place, in the case of an occurring fault or if a lock signal is given, the line contactor releases immediately.



An external 24 V buffer voltage is required for the supply of the inverter electronics.

In order to guarantee a safe switching-off of the line contactor when using an emergency STOP control, a digital input with the function "Mains cut-off" must be integrated.

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Emergency operation

MX eco ☑
MX pro ☑

The function "Emergency operation" enables the operation of the inverter with deactivated device protection. This is necessary for plants in which all functions are primarily directed to personal protection in case of an emergency (e.g. tunnel ventilating systems).

The function is activated by a digital input that is parameterized at the function "Emergency operation". As a result all limitations of the inverter are switched off, process faults detected by the software are treated as alarms and the autoreset function is approved unlimited.

By means of the function "Emergency operation" the operation of the inverter and the motor can also occur outside the specifications. The warranty claim expires in this case !

In order to prevent an unintentional selection of this function, the entry of a service code is necessary before activation or deactivation of the function via parameter F6.05 Service code. The service code is mentioned in the service documentation or can be asked for from the manufacturer.

P15 Parameter set

MX eco ☑
MX pro ☑

The 2nd set of parameters and motor data provide two possibilities to change the configuration of the drive basically. The switch-over between the individual data sets must always occur in operating state "Stop" or "Lock".

When individual parameters should be changed during operation of the drive, the P15 function can be used. Up to 15 parameters can be selected for the P15 menu and for each three values switchable during operation can be defined. The individual values are parameterized using the menu items "P15 edit Set A...C". Switching between these three P15 parameter sets is possible using two digital inputs or via parameterization.

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Parameter copy

MX eco ☑
MX pro ☑

The removable Matrix operating panel MX BE11 provides also a parameter copy function in addition to the simple clear text parameterization in a multitude of languages. In one operating panel up to four different parameter settings can be saved.

By selecting E5.04 "Copy: MX -> Keypad" all adjustable parameters are loaded from the inverter into a free file on the keypad and are saved there.

A file that is saved in the operating panel is written back in an inverter by means of the parameter E5.05 "Copy: Keypad -> MX", whereby the transference in this direction can only be carried out by compliance with specific rules.

Before starting the parameter transfer, the file saved in the operating panel is compared with the actual frequency inverter type, its software status and the nominal power (scaling) by means of an automatic running test routine in order to guarantee a successful transference.

With the function "" the following areas can be selected:

Selection	Function
0 .. abort	Parameter transfer is not started.
1 .. all parameters	All available parameter groups (application parameters, motor data, calibration values of the system, texts) are transferred from the matrix operating panel into the inverter.
2 .. all para. excl. motor	The parameter groups application parameters, calibration values of the system and texts are transferred from the matrix operating panel into the inverter.
3 .. Application parameters	Only the application parameters are transferred from the matrix operating panel into the inverter (macro values).
4 .. Motor data	Only the group of motor data is transferred from the matrix operating panel into the inverter (motor data and autotuning values).
5 .. System values	Only the calibration values of the system are transferred from the matrix operating panel into the inverter (e.g. position values of the slowdown function or SFB positioning).
6 .. Texts	Only the group of texts is transferred from the matrix operating panel into the inverter (free editable texts, e.g. Ext. fault 1 name).

Parameters such as actual values, meters, routines, service parameters, release of emergency operation as well as scaling and calibration values are generally taken out of the copy function of the MX BE11.

Parameter lock

MX eco ☑
MX pro ☑

The parameter lock serves as protection against unintentional or unauthorized parameter changes. If a parameter is tried to be changed during active parameter lock, the message "Parameterization locked" appears on the Matrix operating panel.

The parameters can be locked with the software by means of a code entry or hardware-wise by means of a digital input.

Reading the parameters is possible at any time irrespective of an active lock.

PID process controller

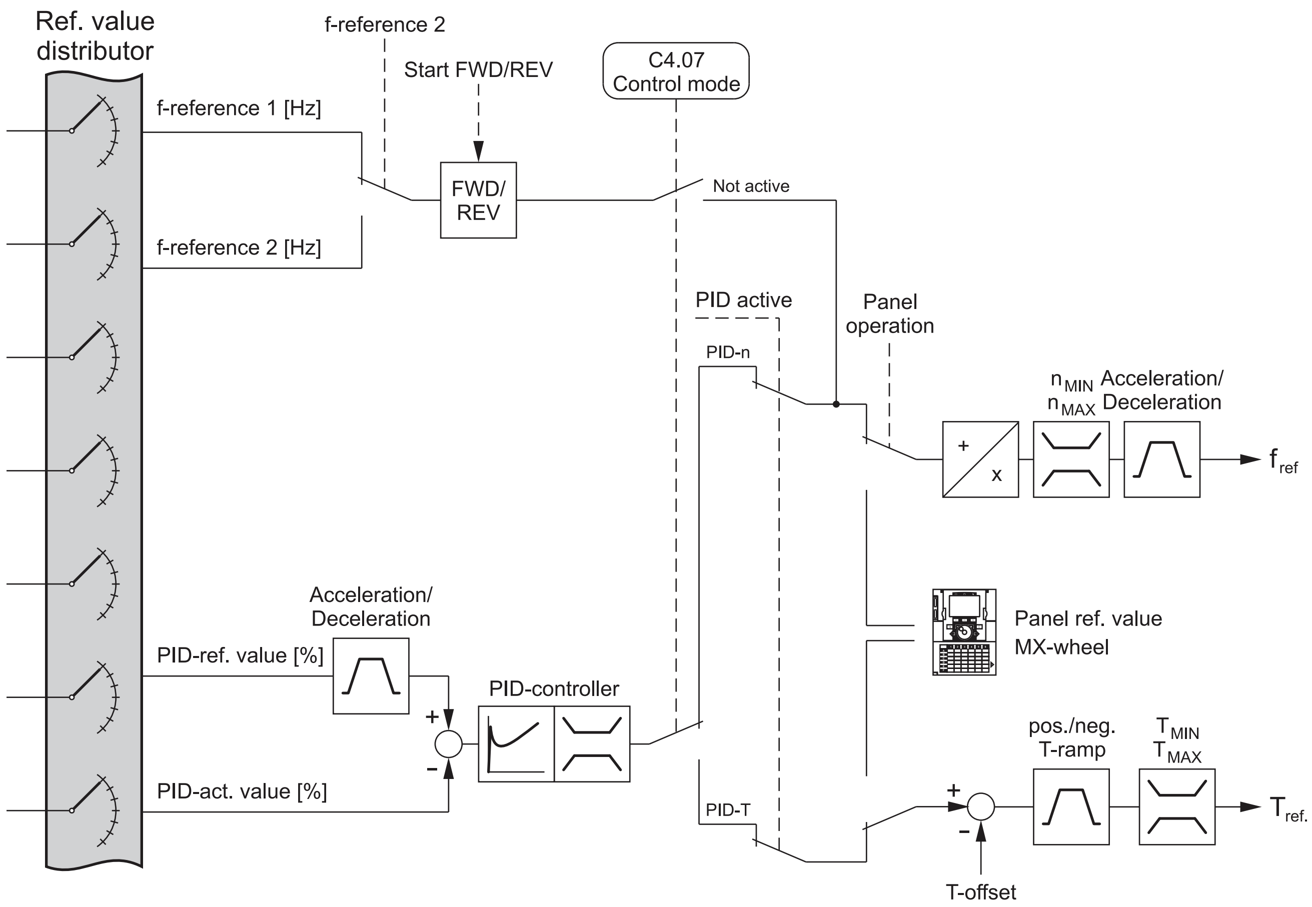
MX eco ☑
MX pro ☑

The PID controller which is integrated in the MX eco & pro is used in applications where a process-technical control is required but however where the required control circuit cannot or should not occur in a superposed open-loop/closed-loop control unit.

Typical application areas are controls for pressure, flow, power, speed, band tension and quantities.

The PID-controller has been designed as a process controller with adjustable proportional gain, integration- and derive-time with a PID-output in Hertz or % (torque). If the PID process controller is used the output frequency or the reference torque is influenced not directly by the respective reference value but by the manipulated variable of the controller output. The controller will try to regulate the difference between the PID-reference and actual value to zero and to keep it.

The two signals are scaled in% independent of their original unit.



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The "Torque Control" function is only supported by MX pro!

Positioning with SFB

MX eco ☐
MX pro ☑

When an encoder is available at the motor or the shaft to be positioned, the encoder can be used for simple positioning without external mounted positioning switches.

In this case the desired positions are stored in the inverter as a number of encoder increments. The desired positions can be either preset and are activated via digital inputs (max. 8 positions) or they are given external using a fieldbus. For positioning the inverter tries to reach the speed reference value along acceleration ramp 1. The stop command is automatically calculated internal in such a way that the drive comes to a standstill at the given position with deceleration ramp 1. It can be chosen from following behaviour:

- Standby mode
  (stop with pulse inhibit, when changing the reference position an automatic starting of the drive takes place)
- Standby ON
  (persistence at speed zero, when changing the reference position the motor turn forward to the new position)
- Stop
  (stop with pulse inhibit, but after changing the reference position a renewed start command is necessary)

Reaching the position can be implemented in a superior automation concept by means of the digital output message "Position reached" using relay or digital outputs or a fieldbus connection.

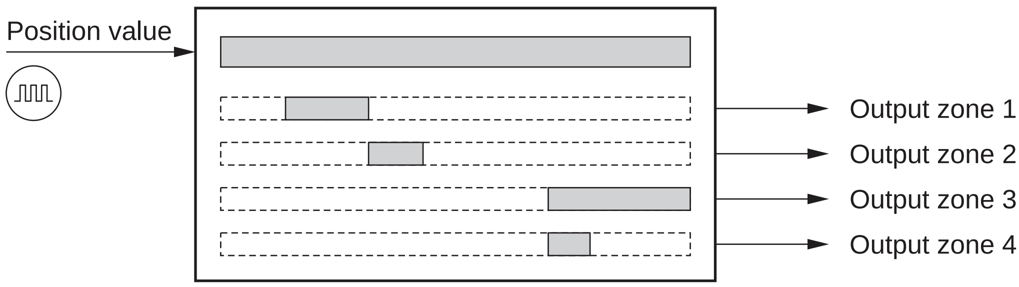
The actual position value is stored in the inverter even when the drive is stopped outside the defined position, in case of voltage loss or occurring trips. In order to raise the operating safety a defined zero position can be realized by integrating a digital input with the function "Reset position".

The SFB positioning can be used with all motor control variants (B3.02). It is also possible to combine this function with the final position control (slow down function).

Positioning module

MX eco ☐
MX pro ☑

The positioning module compares the information of the position value that results from the encoder with four individual, definable position zones. Depending on the actual position four outputs are created that can be further used by means of the function blocks. As a result, the slowdown function can be used without positioning switch, for example.



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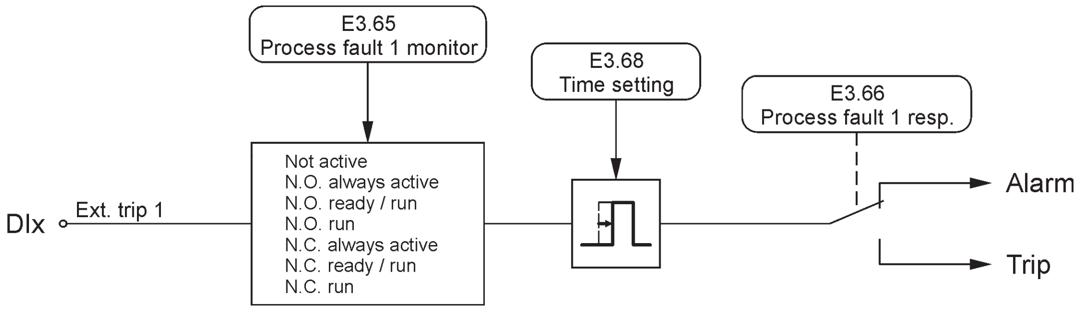
Process fault

MX eco ☑
MX pro ☑

Should signals of the drive or the process be integrated in the inverter protection concept then this occurs with the digital inputs "Process fault 1" to "Process fault 3". The tripping behaviour and the temporal trigger performance are therefore adjustable to the demands of the system.

For easy user guidance the fault message text displayed on the removable Matrix operating panel can be freely edited.



Pulse generator

MX eco ☑
MX pro ☑

The pulse generator (PG) creates a square-wave signal with a frequency that is proportional to an adjustable constant or a selectable analog value. Furthermore, it is possible to generate pulses depending on the current rotor position (rotational angle).

The output signal of the pulse generator can be further used by means of the function blocks or it is directly connected to further inverters or a superior PLC using the digital outputs DO1...DO4.

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Safe standstill

MX eco ☑
MX pro ☑

The MX eco & pro frequency inverters include the "Safe Standstill" function as standard (Power Removal, certificate no. 72148-2 /2006). This function prevents any unintended start-up of the motor and guarantees the safety of the machine and plant personnel.

This safety function complies with:

- the standard for safety of machinery EN 954-1 / ISO 13849-1, category 3
- the standard for functional safety IEC/EN 61508, SIL2 capability
  (functional safety of processes and systems and electrical/electronic/programmable electronic safetyrelated systems)

  The SIL (Safety Integrity Level) capability depends on the connection diagram for the drive and for the safety function. Failure to observe the setup recommendations could inhibit the SIL capability of the "Power Removal" safety function.
- the definition of the product standard IEC/EN 61800-5-2 for both stop functions:
  - Safe Torque Off (“STO”)
  - Safe Stop 1 (“SS1”)

The “Power Removal” safety function has a redundant electronic architecture (1) which is monitored continuously by a diagnostics function.

(1) Redundant: consists of mitigating the effects of failure of one component by means of the correct operation of another, assuming that faults do not occur simultaneously on both.

The “Power Removal” safety function cannot be considered as a means of electrical disconnection of the motor (no electrical isolation). If necessary, a contactor must be used in the line or motor cables.

The “Power Removal” safety function is not designed to overcome any malfunction in the drive process control or application functions.

The digital outputs (relay outputs) available on the drive (e.g. "Safe Standstill" active) must not be considered as safety related signals. The outputs of the external safety relay must be used for integration into a safety related control/command circuit.

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Safety categories according to EN 954-1 / ISO 13849-1

Category	Safety principle	Control system requirements	Behaviour in the event of a fault
B	Selection of components that conform to relevant standards	Control in accordance with good engineering practice	Possible loss of safety function
1	Selection of proven components and basic safety principles	Use of tried and tested components and proven safety principles	Possible loss of safety function, but with less probability of this than with category B
2	Selection of proven components and basic safety principles	Cyclic testing of the safety function in suitable intervals.	Fault detection at each test
3	Use of safety circuits	A single fault must not cause loss of the safety function. This single fault must be detected if reasonably practicable.	Safety function ensured in the event of a single fault
4	Use of safety circuits	A single fault must not cause loss of the safety function. This fault must be detected at or before the next demand on the safety function. An accumulation of faults must not cause loss of the safety function.	Safety function always ensured

The machinery manufacturer is responsible for selecting the required safety category. The category depends of the level of risk factors given in standard EN 954-1 / ISO 13849-1.

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Safety Integrity Levels (SIL) according to standard IEC/EN 61508

SIL1 according to standard IEC/EN 61508 is comparable with category 1 according to EN 954-1 / ISO 13849-1 (SIL1 means probability of undetected dangerous failure per hour between 10^{-5} and 10^{-6}).

SIL2 according to standard IEC/EN 61508 is comparable with category 3 according to EN 954-1 / ISO 13849-1 (SIL2 means probability of undetected dangerous failure per hour between 10^{-6} and 10^{-7}).

Stop categories according to standard IEC/EN 60204-1

The wiring diagrams on the following pages take into account conformity with standard IEC/EN 60204-1 which defines three categories of stops:

- Category 0: stopping by immediate removal of the power from the machine actuators (i.e. an uncontrolled stop)
- Category 1: a controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved
- Category 2: a controlled stop with power left available to the machine actuators

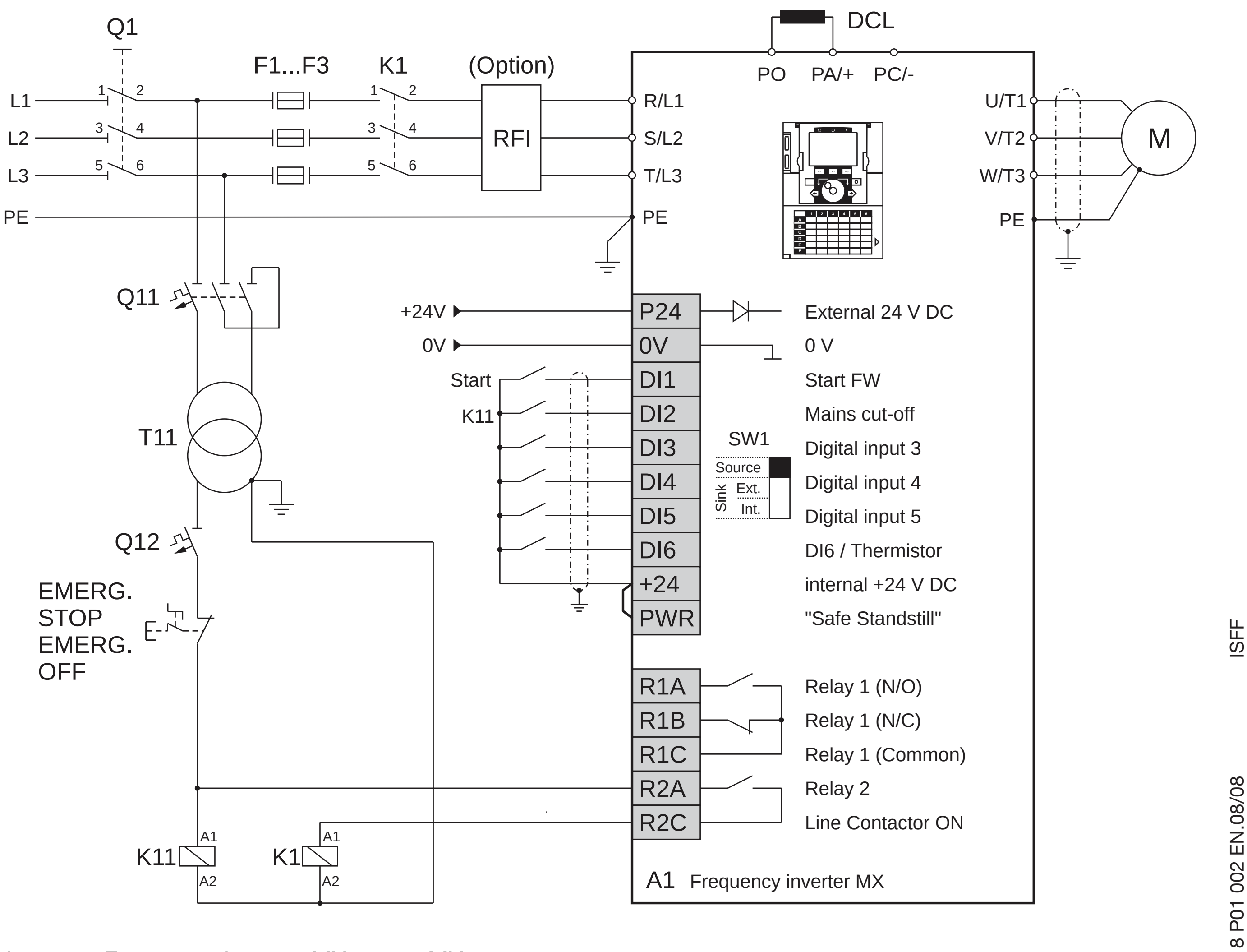
Periodic test

The “Power Removal” safety function must be activated at least once a year for preventive maintenance purposes.

The drive must be switched off before preventive maintenance takes place, and then powered up again. If during testing the power supply to the motor is not switched off, safety integrity is no longer assured for the “Power Removal” safety function. The drive must therefore be replaced to ensure the operational safety of the machine or of the process system.

Safety category 1 **Stop category 0**	according to EN 954-1 / ISO 13849-1 category 1; IEC/EN 61508, SIL1 according to IEC/EN 60204-1

Control of the drive by means of a line contactor (controlled by the inverter)



A1.......... Frequency inverter MX eco or MX pro

Q1 .... Main switch (selection corresponding to mains current of inverter)

F1...F3... Mains fuses (according to table "Fuses and cable cross sections" of the respective inverter)

K1.......... Line contactor (selection corresponding to mains current of inverter for safe switch-off in each load situation)

Q11 .... Protective switch “Transformer short-circuit protection“

T11 .... Transformer for control supply (secondary voltage 230 V)

Q12 .... Protective switch “Transformer overload protection“

K11........ Auxiliary relay to feedback the emergency stop command to the drive

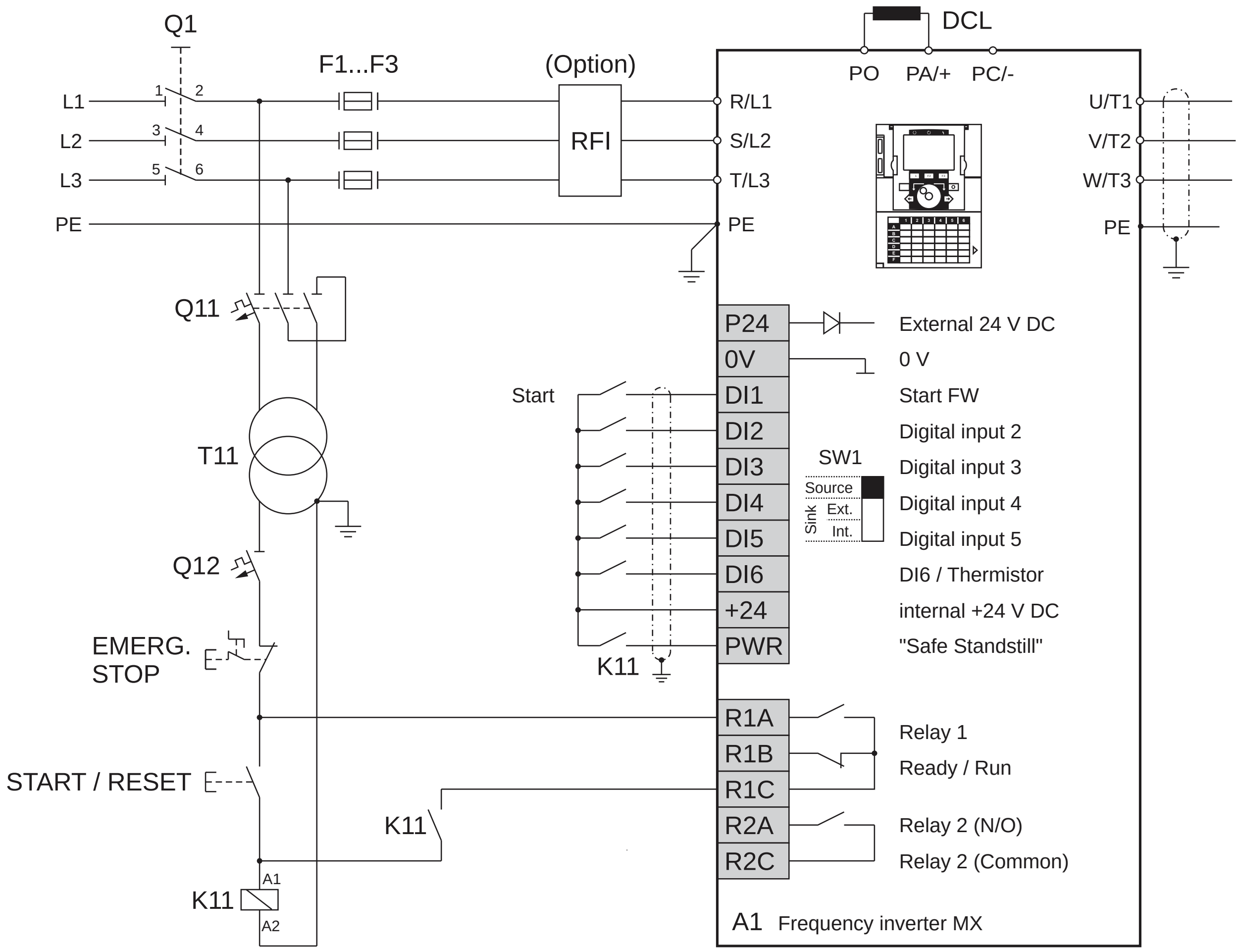
In this wiring, the safety function "Safe Standstill" is not used. This wiring corresponds to stop category 0 according to IEC/EN 60204-1.

In this wiring variant, the software function "Line contactor control" is used to control K1 via relay output 2 (set to "Line Contactor ON"). A safe OFF is triggered by the emergency stop button.
Depending on the coil consumption of K1 an additional auxiliary relay may be necessary.
The function, use and limits of the other inputs and outputs can be set as required.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

Safety category 1	according to EN 954-1 / ISO 13849-1 category 1; IEC/EN 61508, SIL1
Stop category 0	according to IEC/EN 60204-1

Control of the drive by means of the digital input PWR "Safe Standstill"



A1.......... Frequency inverter MX eco or MX pro
Q1 .... Main switch (selection corresponding to mains current of inverter)
F1...F3... Mains fuses (according to table "Fuses and cable cross sections" of the respective inverter)
Q11 .... Protective switch “Transformer short-circuit protection“
T11........ Transformer for control supply (secondary voltage 230 V)
Q12 .... Protective switch “Transformer overload protection“
K11........ Auxiliary relay for safe stop of the drive

This wiring diagram uses the safety function "Safe Standstill" with impulse inhibit of the MX eco & pro by means of the safety input PWR (Power removal). The emergency STOP circuit is monitored by means of the auxiliary relay K11.

The function, use and limits of the other inputs and outputs can be set as required.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

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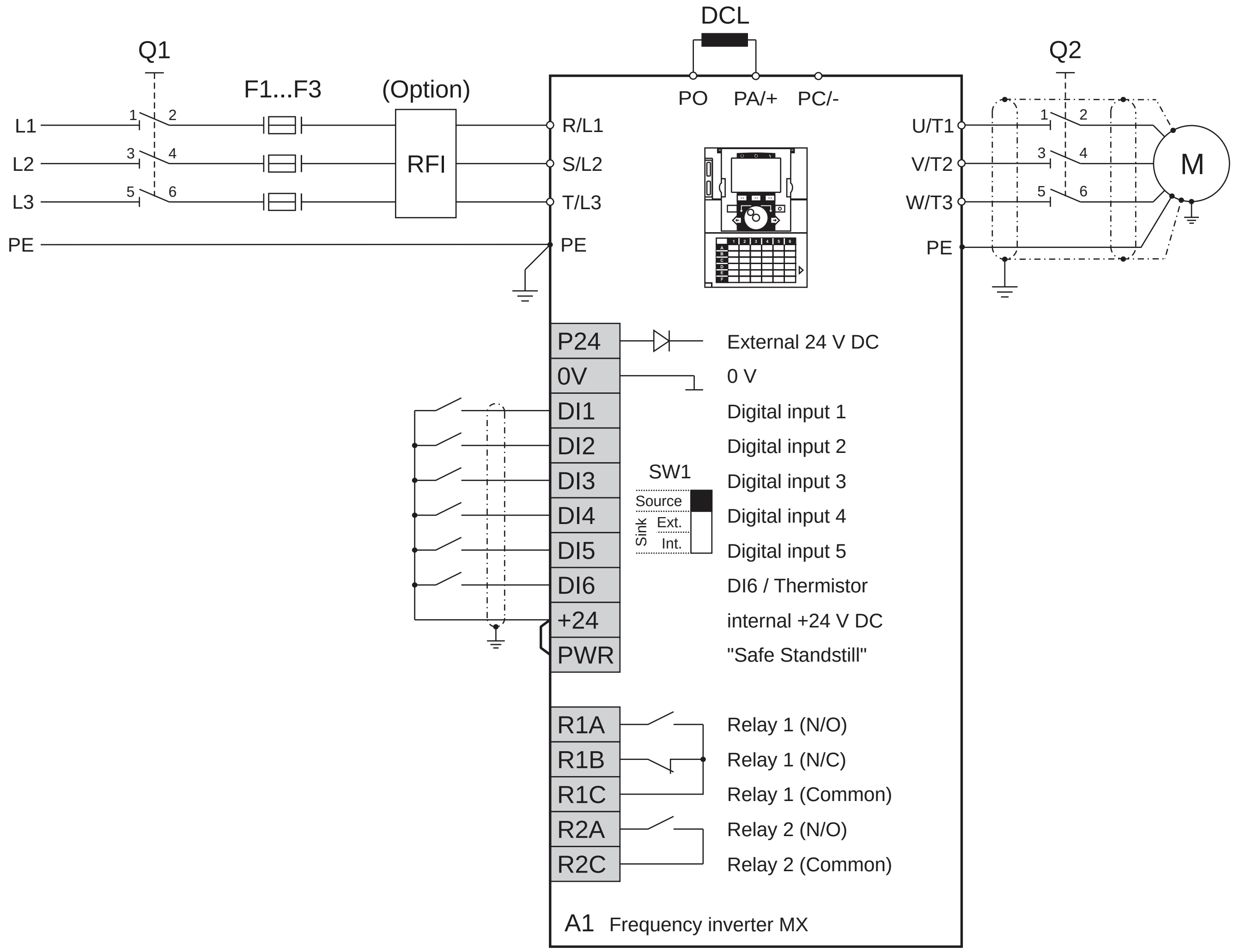
Safety category 1	according to EN 954-1 / ISO 13849-1 category 1; IEC/EN 61508, SIL1
Stop category 0	according to IEC/EN 60204-1

Control of the drive by means of a motor switch



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A1.......... Frequency inverter MX eco or MX pro

Q1 .... Main switch (selection corresponding to mains current of inverter)

F1...F3... Mains fuses (according to table "Fuses and cable cross sections" of the respective inverter)

Q2 .... Motor switch for safe disconnection of the motor (selection according to maximum output current of the inverter)

In this wiring, the safety function "Safe Standstill" is not used. This wiring corresponds to stop category 0 according to IEC/EN 60204-1.

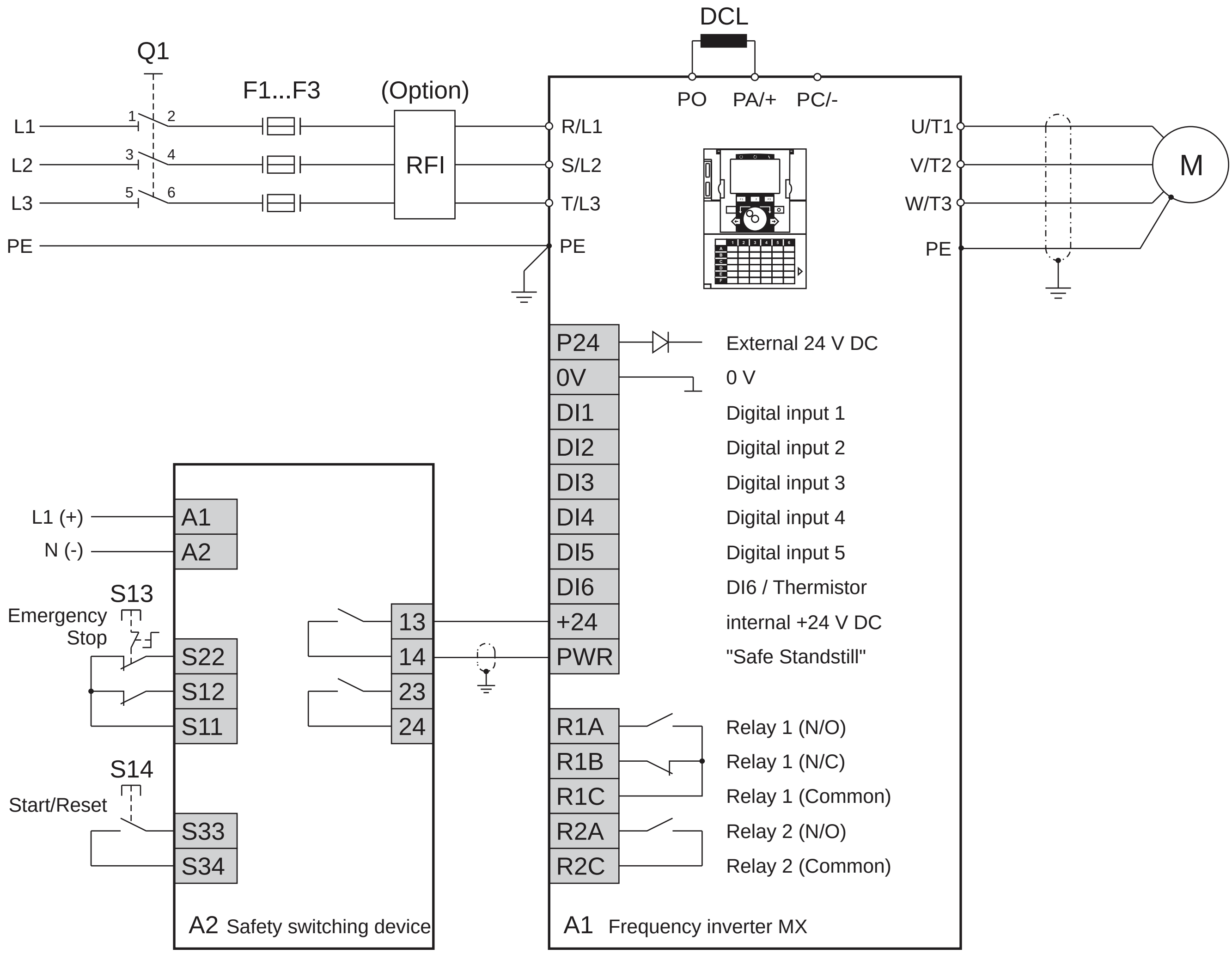
Function, use and limits of the inputs and outputs can be set as required.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

Safety category 3	according to EN 954-1 / ISO 13849-1 category 3; IEC/EN 61508, SIL2
Stop category 0	according to IEC/EN 60204-1

Control of the drive by means of the digital input PWR "Safe Standstill"

This wiring is typical for drives with short deceleration time (low moment of inertia or high resistive torque).



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A1.......... Frequency inverter MX eco or MX pro

Q1 .... Main switch (selection corresponding to mains current of inverter)

F1...F3... Mains fuses (according to table "Fuses and cable cross sections" of the respective inverter)

A2.......... Safety switching device PNOZ X5 (company Pilz or equivalent), supply voltage 24 V AC/DC

S13........ Emergency STOP push-button switches the drive to free wheel and activates the function “Safe Standstill“.

S14........ Start/Reset push-button

This wiring diagram uses the safety function "Safe Standstill" with impulse inhibit of the MX eco & pro by means of the safety input PWR (Power removal). The emergency STOP circuit is monitored by means of an external safety relay.

One safety relay can be used for several inverters.

Activating the function "Safe Standstill" by means of the digital input PWR leads to impulse inhibit and free-wheeling of the motor. This behaviour corresponds with stop category 0 according to IEC/EN 60204-1.

An automatic restart of the motor is prevented as long as the function "Safe Standstill" is activated by means of the digital input PWR. This also applies after complete stop of the motor ("STO").

For applications where the frequency inverter is used for controlling the mechanical brake (e.g. crane function), a safety output of the external safety relay must be integrated into the control circuit of the brake in serial.

For drives with braking unit a line contactor must be used additionally in order to switch off the braking resistor in case of a fault.

Function, use and limits of the inputs and outputs can be set as required. For example, the device state "Safe Standstill" can be used as a signal by means of a relay output, which is not part of the safety circuit however.

The connection of the safety relay and the input PWR "Safe Standstill" must be a screened coaxial-cable of type RG174/U according to MIL-C17 (company LAPP) or KX3B according to NF C 93-550, outer diameter 2.8 mm with maximum length of 15 m.

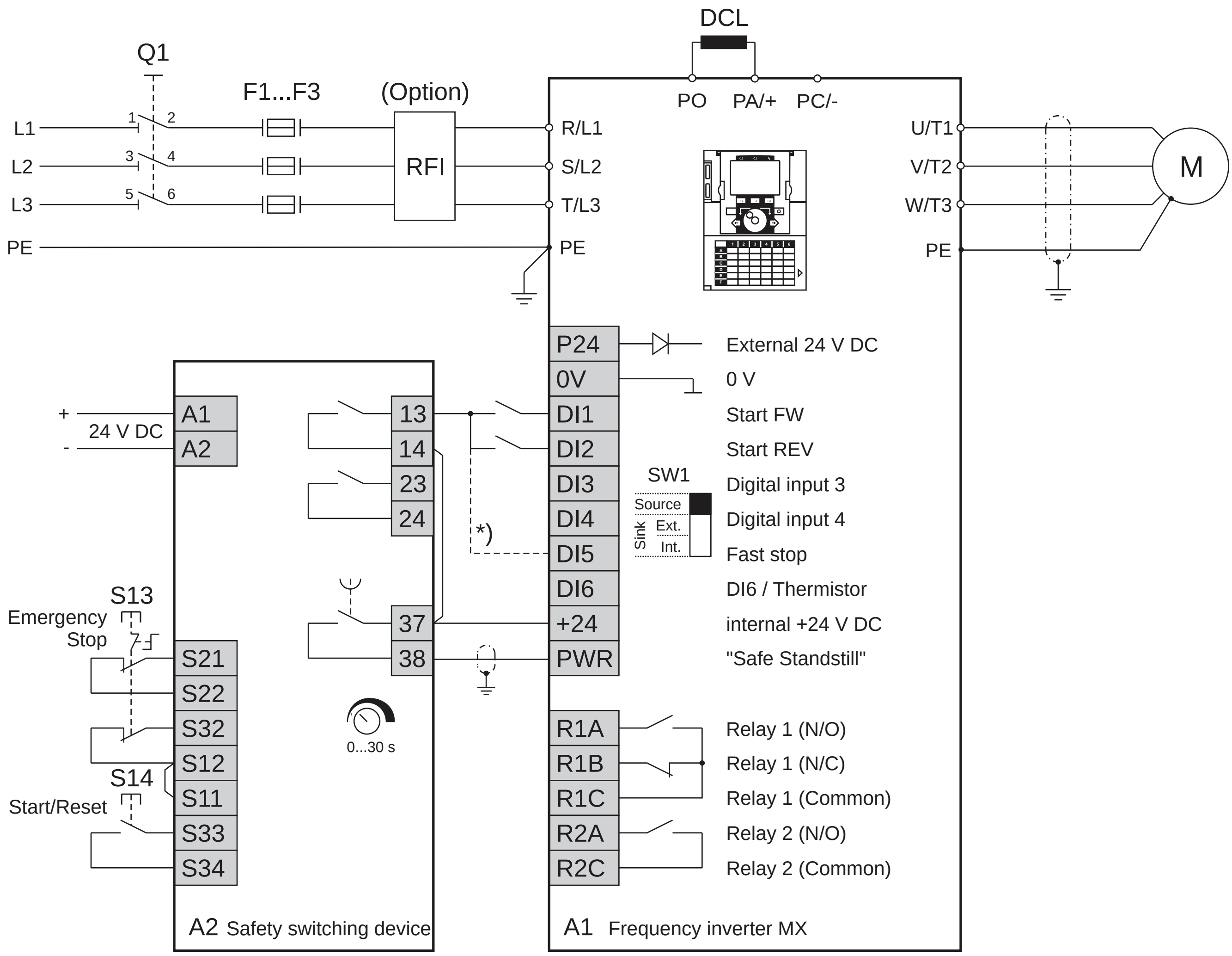
It is essential that the screen is grounded.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

Safety category 3 according to EN 954-1 / ISO 13849-1 category 3; IEC/EN 61508, SIL2
Stop category 1 according to IEC/EN 60204-1

Control of the drive by means of the digital input PWR "Safe Standstill" with controlled deceleration

This wiring diagram is typical for drives with long deceleration time (high moment of inertia or low resistive torque).



A1.......... Frequency inverter MX eco or MX pro
Q1 .... Main switch (selection corresponding to mains current of inverter)
F1...F3... Mains fuses (according to table "Fuses and cable cross sections" of the respective inverter)
A2.......... Safety switching device PNOZ XV1P (company Pilz or equivalent), supply voltage 24 V DC
S13........ The emergency stop button initiates a controlled deceleration of the drive and activates the "Safe Standstill" function after an adjustable time.
S14........ Start/Reset push-button
*)............ "Fast Stop" digital input when using a fieldbus control system or the panel reference source on the device keypad

This wiring diagram uses the safety function "Safe Standstill" with impulse inhibit of the MX eco & pro by means of the safety input PWR (Power removal). The emergency STOP circuit is monitored by means of an external safety relay.

One safety relay can be used for several inverters.

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As soon as the emergency STOP is triggered, the external safety relay leads to a deceleration of the drive. A second, time-delayed safety contact of the relay activates after a set time the function "Safe Standstill" of the inverter by means of the safety input PWR (Power removal). The function corresponds to stop category 1 according to IEC/EN 60204-1 (“SS1”).

In this wiring variant, the parameterization of the digital inputs DI1 and DI2 to "Start Forward" and "Start Reverse" (two-wire control) and the deactivation of the panel and fieldbus control source are required. (E5.01 "Local mode" = 2 .. Locked; E4.01 "Control source 1", E4.02 "Control source 2" ≠ 4 .. Bus)
The function, use and limits of the other inputs and outputs can be set as required.

If you intend to use a fieldbus control system or to control the inverter via the device keypad, the use of the digital input function "Fast stop" is required.

D2.05 "DI5 selection" = 6 .. Fast stop

D2.15 "DI at bus mode active" = DI 5 .. ☑

Function, use and limits of the inputs and outputs can be set as required. For example, the device state "Safe Standstill" can be used as a signal by means of a relay output, which is not part of the safety circuit however.

The connection of the safety relay and the input PWR "Safe Standstill" must be a screened coaxial-cable of type RG174/U according to MIL-C17 (company LAPP) or KX3B according to NF C 93-550, outer diameter 2.8 mm with maximum length of 15 m.

It is essential that the screen is grounded.

All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

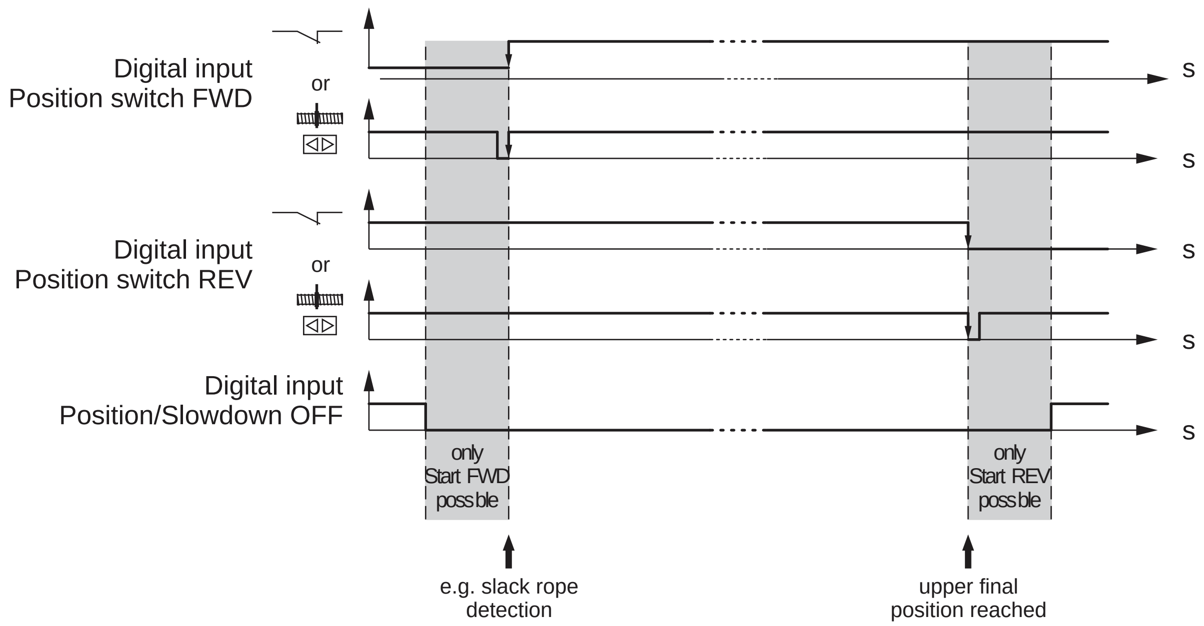
SlowDown Functionality

MX eco ☐
MX pro ☑

Two special slowdown functions of the MX pro are available for applications in the area of automated transport systems, hoist and movement drives, cable winch controls,...

By means of both digital input functions "Position switch FWD" and "Position switch REV", final position control can be activated. The final position is indicated by a switch or magnetic sensor at one of the two final positions; the drive is thus shut down and operation is blocked in the respective direction.

The final position control can be deactivated by means of the digital input command "Pos/Slowdown OFF".



The final position control can also be used without the slowdown function.

The slowdown function is used in combination with the final position control for positioning tasks. In addition to both final position switches, both digital inputs "Slowdown FWD" and "Slowdown REV" are required here.

Both signals show the slowdown control a defined position from which a target braking procedure can be initiated up to the final position contact. The time-optimised distance control model used in the process makes it possible to adjust the delay ramp independent of the position of the slowdown indicating switch optimally to the process.

The deceleration time selected with parameter C6.39 refers to the desired speed change from the nominal frequency to the standstill of the drive and is not changed during positioning. It replaces the deceleration ramp set in matrix field C2. For correct distance control, the distance between both sensors (separate for every direction) must be known. The determination of this distance takes place using an automatic measuring routine that should be performed once during commissioning.

The slowdown function can be used for positioning between two final points. Due to deactivation in the meantime using the digital command "Pos/Slowdown OFF", however, the function can also be used in only one direction with any stop positions.

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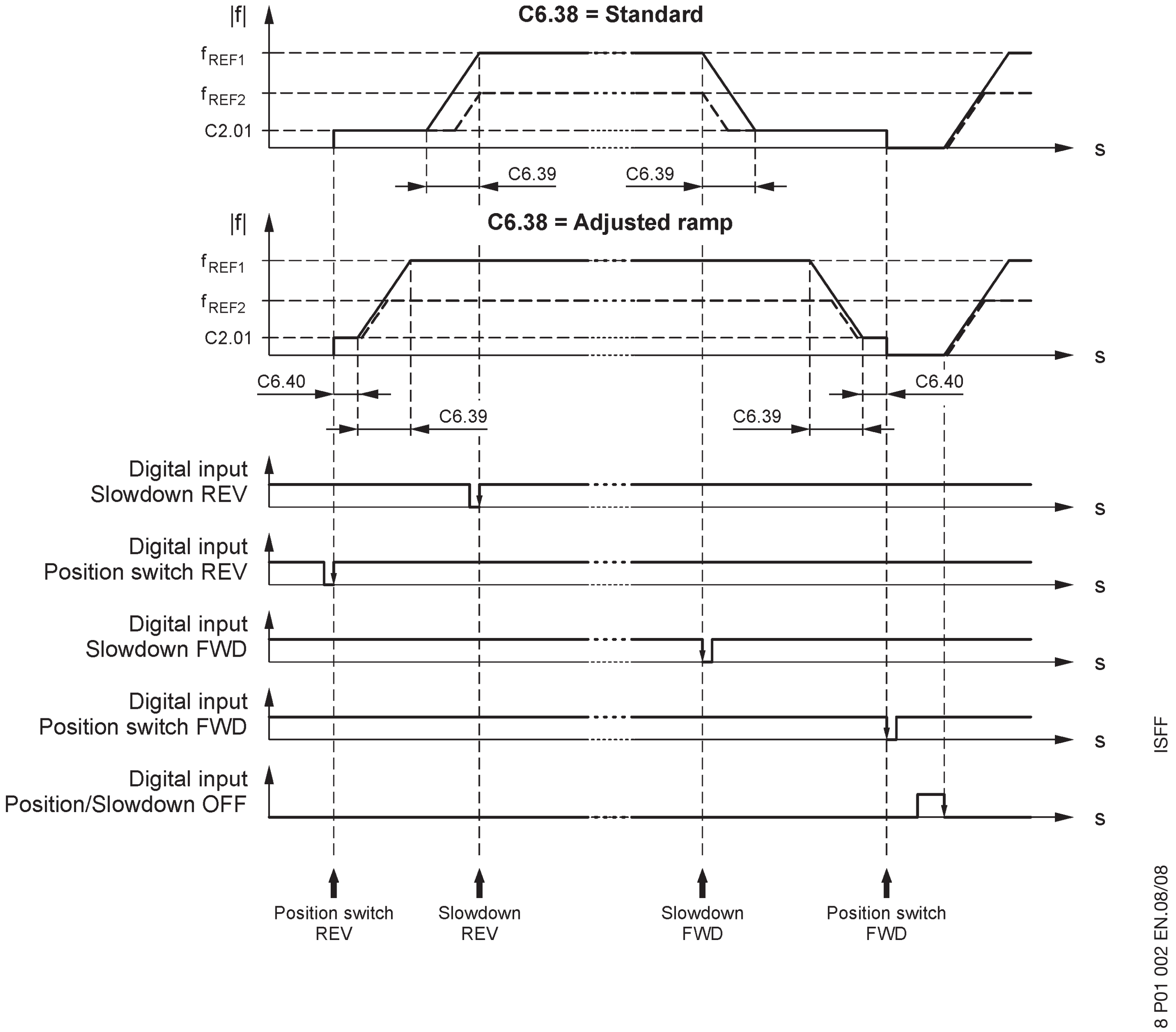
C6.38 = Standard
|f|
fREF1
fREF2
C2.01
s
C6.39
C6.39
C6.38 = Adjusted ramp
|f|
fREF1
fREF2
C2.01
s
C6.40
C6.40
C6.39
C6.39
Digital input
Slowdown REV
s
Digital input
Position switch REV
s
Digital input
Slowdown FWD
s
Digital input
Position switch FWD
s
Digital input
Position/Slowdown OFF
s
Position switch
REV
Slowdown
REV
Slowdown
FWD
Position switch
FWD
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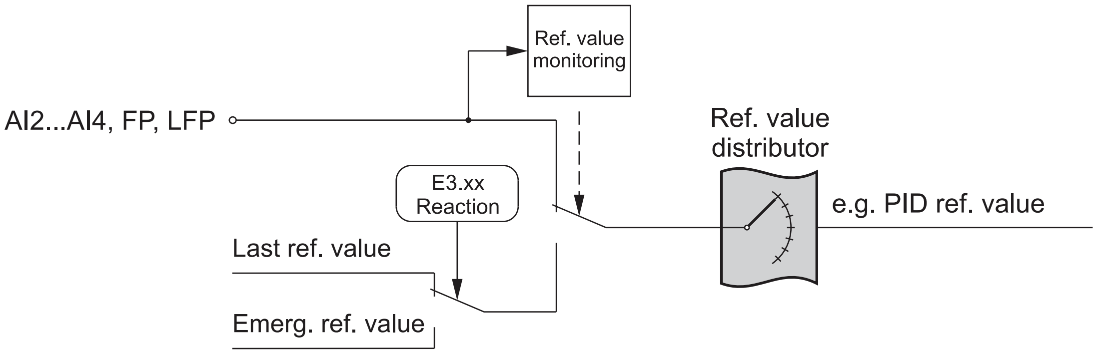
4mA ϟ Reference value monitoring

MX eco ☑
MX pro ☑

If a 4...20 mA standardized signal is used, the reference sources AI2, AI3 and AI4 can be monitored for reference failure. In this way the reference value is monitored at falling below 3 mA.

By using the pulse inputs FP or LFP the same method can be roughly used, whereby the signal is checked with respect to a decrease of the signal frequency smaller than 50 % of the set minimum value.



When a reference failure occurs, an appropriate behaviour for each reference value can be determined. By selecting "Last ref. val & alarm" or "Emerg ref val & alarm" the respective value is supplied as replacement for the reference source at the input of the reference value distributor. As a result the full functionality remains also when using the alternative reference path (e.g. PID controller, f-correction,...).

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Setting of reference values

MX eco ☑
MX pro ☑

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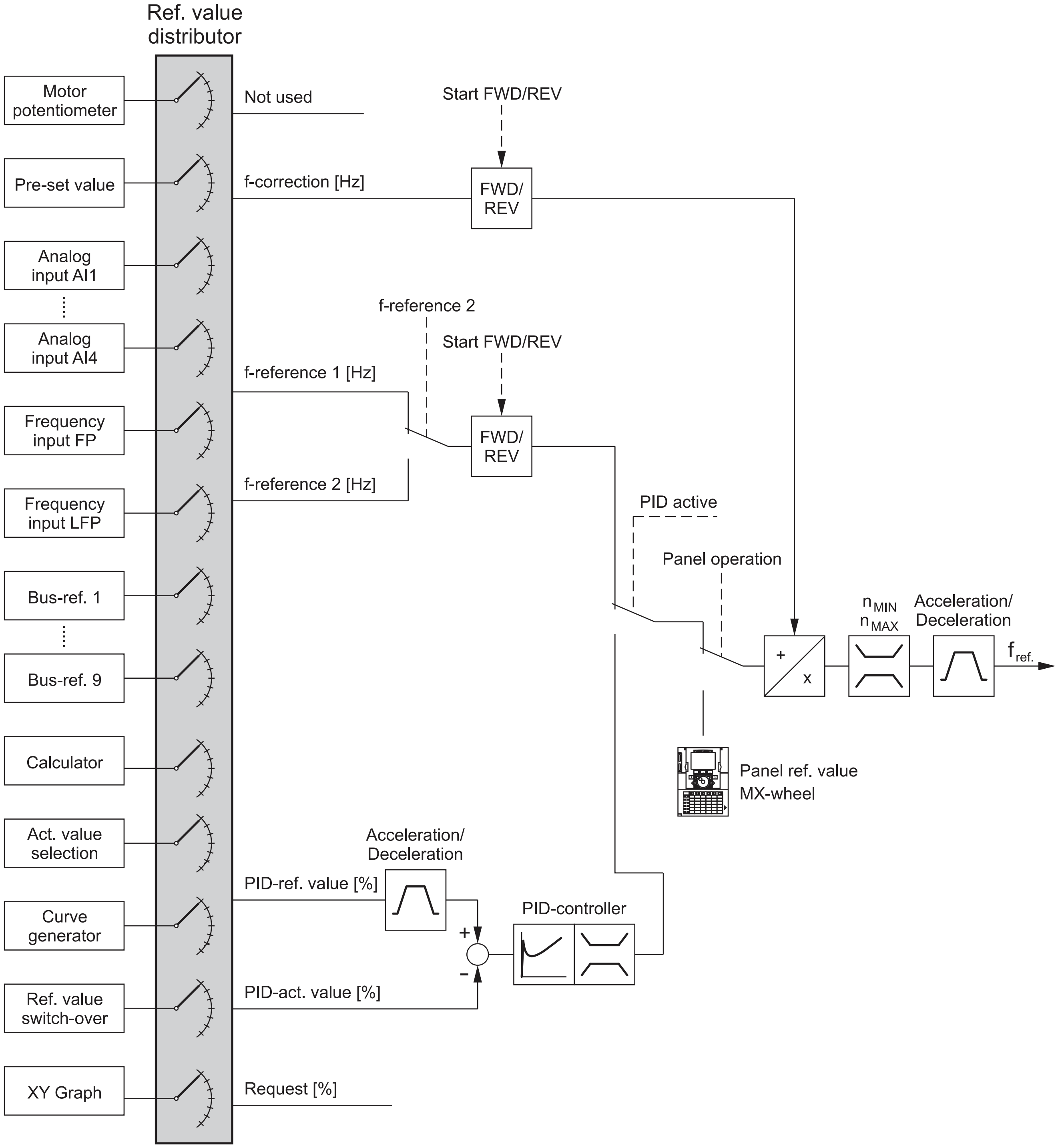
The frequency inverters MX eco & pro can process reference values of different forms. In addition to the established standard signals such as voltage [V] or current [mA], digital selectable pre-set reference values, a scalable frequency input, an electronic motor potentiometer, serial fieldbus reference values as well as different internal reference sources are also available.

All reference sources can be influenced via corresponding parameterization in their activity and finally can be further used via the reference value distributor.

The reference value distributor is the interface between the reference sources and the reference use. In addition to the control source selection and the Matrix parameter concept it represents the main functional principle of the MX eco & pro.

The processed and scaled reference values from the various reference sources end in the reference value distributor. The reference value distributor now has the task to transmit the given reference value to the reference use which suits the application.

MX eco reference value distributor with all objectives



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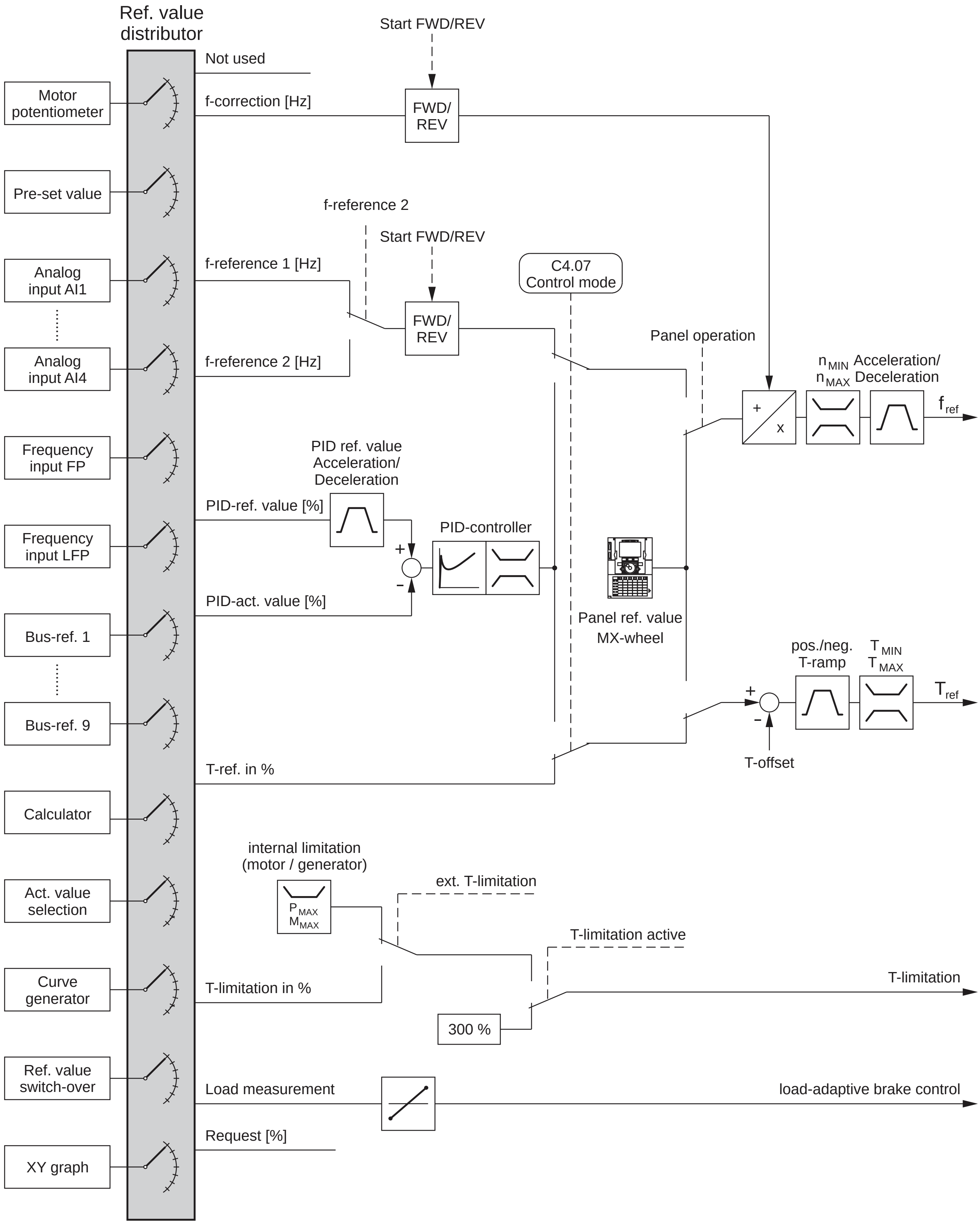
MX pro reference value distributor with all objectives



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Standby Mode

MX eco ☑
MX pro ☑

The standby function effects an energy-efficient operation of the plant. It is a measure especially intended for applications with a quadratic load behaviour and PID control. An internal PID controller as well as an external control system can be used.

If the standby function is active, the signals frequency actual value, frequency reference value and possibly existing PID actual value are evaluated in order to check if the system is being operated in an "expedient" range. If it is possible to disconnect the drive without interfering the process, the drive is stopped and the frequency inverter changes into standby mode. The Run message remains in standby mode, the internal PID controller active. The standby mode is automatically ended as soon as the control circuit registers a corresponding need.

Control configuration

MX eco ☑
MX pro ☑

The signals to connect and disconnect the inverter as well as to select the rotational direction can occur in different ways.

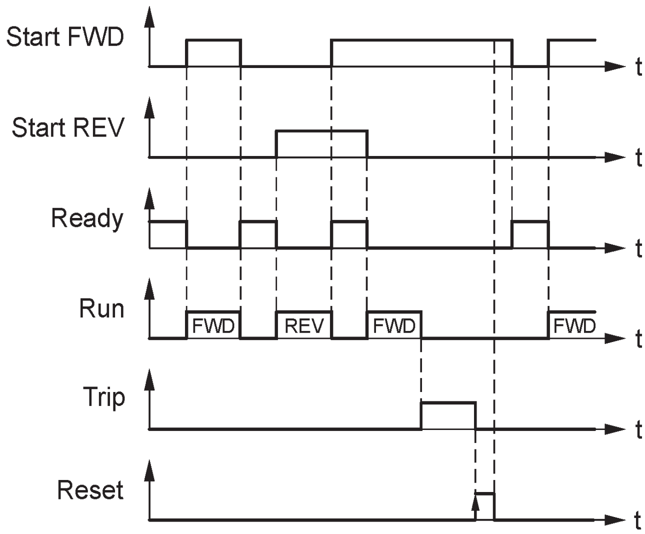
Basically you can differentiate between the panel control with the built-in LED-keypad or the removable Matrix operating panel and the remote control via the terminals or an integrated or optional fieldbus connection.

2-wire control (edge rated)

This control variant represents the factory-made basic setting. For control, both digital inputs "Start FW (2 wire)" and "Start REV (2 wire)" are to be configured.

A closed input leads to a start command of the corresponding direction, an open contact or the simultaneous selection of "Start FW (2 wire)" and "Start REV (2 wire)" leads to a stop command.

When the on command is given, the inverter changes by means of the reset command from an existing fault to the state "Not Ready", which remains until the start signal is opened. In this way, an automatic restart of the inverter after resetting the fault is prevented in case of a given start command.



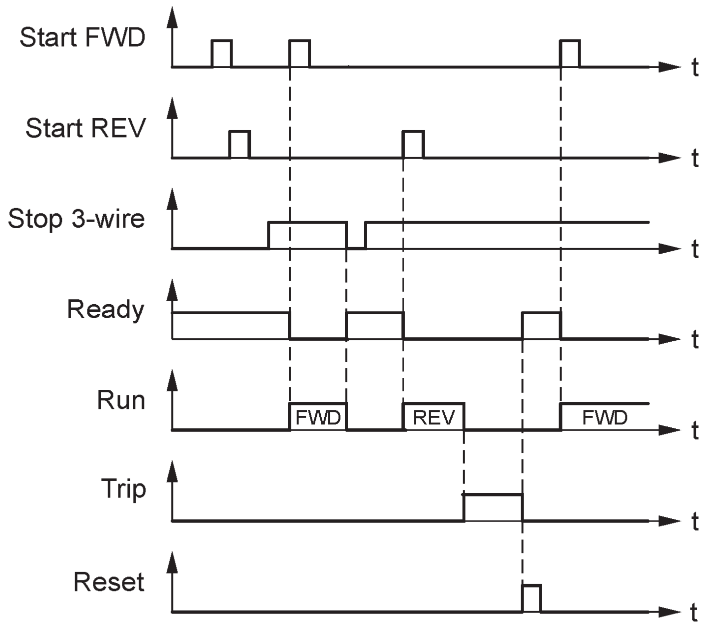
3-wire control

The three wire control is used for the processing of pulse commands. For control, the three digital inputs "Start FW (3 wire)", "Start REV (3 wire)" and "Stop (3 wire)" are to be configured.

A start command for the corresponding direction is triggered by switching-on the input "Start FW (3 wire)" for a short time (minimum pulse length 2 ms), if the input "Stop (3 wire)" is closed.

The stop command occurs by opening the stop input for a short time. If both signals "Start FW (3 wire)" and "Start REV (3 wire)" are given simultaneous, this also leads to a stop command.

The autoreset function must not be used in case of 3-wire control.



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2-wire control (level rated)

The level rated 2-wire-control is used when replacing devices of the range MX basic or MX plus by a MX eco & pro. With this control variant, only the signal levels of both digital inputs "Start FW (2 wire)" and "Start REV (2 wire)" are evaluated.

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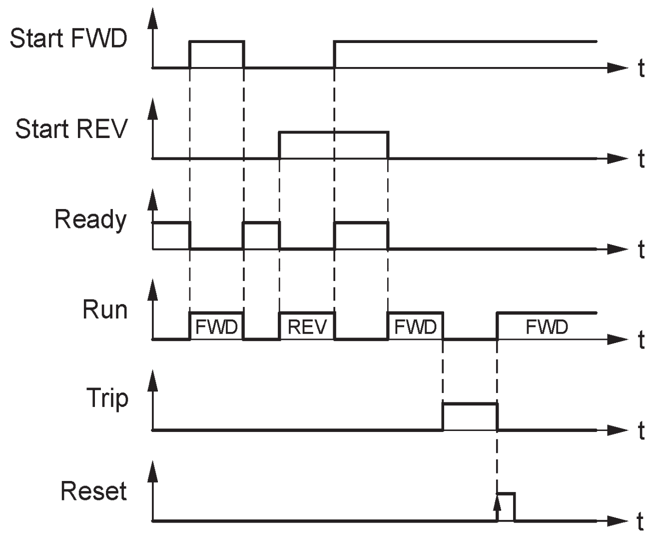
A closed input leads to a start command of the corresponding direction, an open contact or the simultaneous selection of "Start FW (2 wire)" and "Start REV (2 wire)" leads to a stop command.

The signal states of the terminal signals have top priority so that resetting of an existing fault or connection to the mains leads to an automatic starting of the motor if a start command is given.



Fieldbus

By using the fieldbuses Modbus or CANopen, which are standard integrated, or an optional fieldbus card (e.g. Profibus PBO11) the control of the inverter occurs by means of a control word which serves an inverter internal state machine.

The autoreset function must not be used in case of fieldbus control.

Details of the respective fieldbuses can be found in the belonging documentation.

Panel control

The panel control of the device occurs by means of the keys on the built-in LED-keypad or the removable Matrix operating panel. The switching between panel mode and remote mode (terminals or bus) can also occur by means of a key on the keypad or via a terminal command.

The autoreset function must not be used in case of panel control.

Stop behaviour

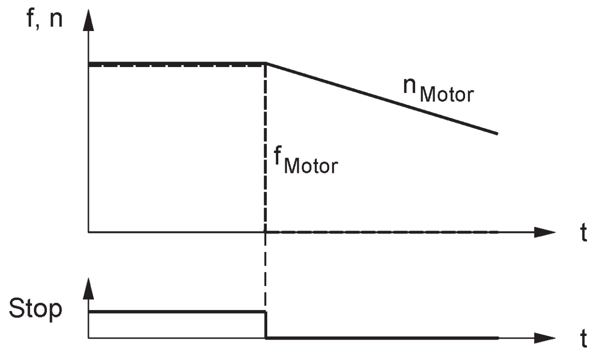
MX eco ☑
MX pro ☑

The behaviour of the frequency inverter when the stop command takes effect can be defined by parameter B3.24...B3.26. Therefore it is of no importance from which control source the stop command comes (see function "Control configuration", page 322).

In all cases a further start command leads to a restart of the drive.

Free wheel

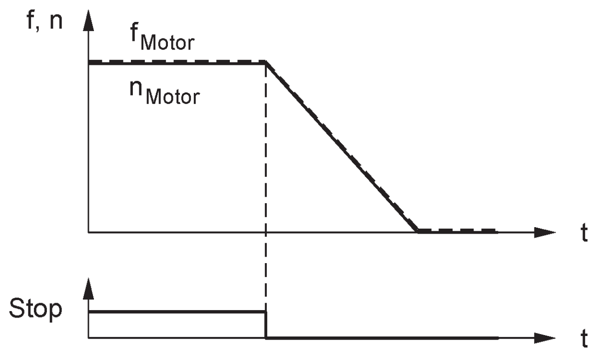
A stop command leads to immediate locking of the output-sided transistor bridge. The motor runs in free wheel without current.



Deceleration ramp (factory setting)

The stop command initiates a controlled stop. The motor is therefore delayed at the active deceleration ramp.

After reaching standstill, current to the motor is switched off.

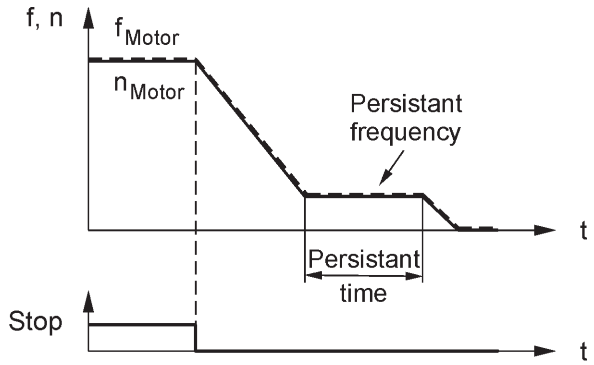


Deceleration with persistence

The stop command initiates a controlled stop with the deceleration ramp. This, however, does not lead directly to a standstill of the motor, but instead to keeping the adjustable persistence frequency for the period of the persistence time. The final switching-off occurs after the end of the persistence time.

The persistence function is mainly used for hydraulic systems in which a direct switching-off would lead to undesired pressure fluctuations or also cavitation effects.

The persistence frequency can also be set below the allowed minimum frequency.



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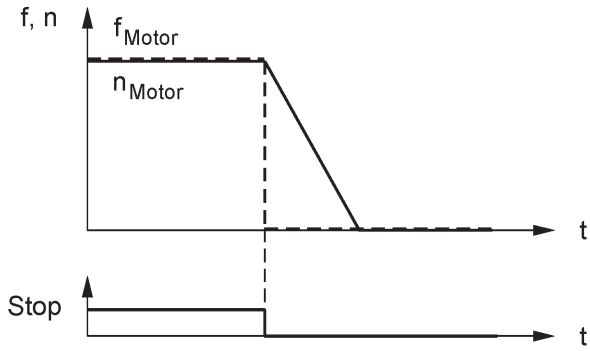
Fast stop

The stop command leads to a fastest possible standstill. The internal ramp time is therefore 0.1 seconds.

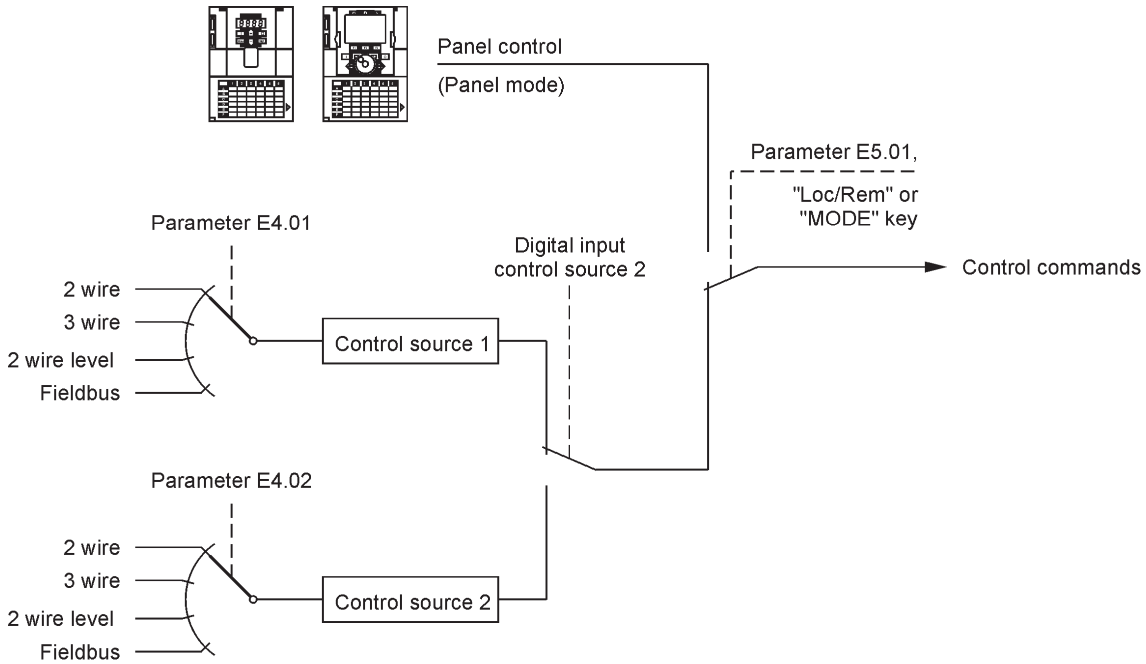
The real time until standstill depends on the centrifugal mass, the load and on possible active braking functions (see function "Brake mode", page 263).



Switching of the control sources

MX eco ☑
MX pro ☑

The internal design of the control path is structured in such a way that it can be switched between two configurable remote control sources and the panel mode. As a result you can switch between two different control sources or locations without losing the panel control on the inverter keypad.



If a switching of the control source from the fieldbus to the terminals is necessary, the actual operating state of the fieldbus can be assumed shock-free in case of switching by means of a tracking 3-wire-control.

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Recognition of undervoltage

MX eco ☑
MX pro ☑

Depending on the set mains voltage B3.01 the inverter electronics continuously monitors the DC link voltage. The signals for the under- and overvoltage protection and also the control of the undervoltage ride through function and fast stop function are derived from this monitoring.

If the DC link voltage drops below a value which depends on the mains voltage, the inverter recognises an acute undervoltage situation. Parameter E3.29 defines the behaviour of the inverter in this situation.

Depending on the process demands one of the following reactions can be selected:

Setting	Behaviour at registration of an undervoltage situation
-Δt- fault	An undervoltage leads to an immediate lock of the output transistors and therefore to a free-wheeling of the motor. If the voltage returns within the tolerated undervoltage time E3.30, the motor restarts automatically. If the permitted undervoltage time is exceeded, a fault shut-down occurs with the message "Undervoltage" (external 24 V buffer voltage required).
Alarm -Δt-fault	An undervoltage leads to an immediate lock of the output transistors and therefore to a free-wheeling of the motor. The alarm message "Undervoltage" is set. If the voltage returns within the tolerated undervoltage time E3.30, the motor restarts automatically, the alarm message is reset. If the undervoltage time is exceeded, a fault shut-down occurs with the message "Undervoltage" (external 24 V buffer voltage required).
Alarm only	An undervoltage leads to an immediate lock of the output transistors and therefore to a free-wheeling of the motor. The alarm message "Undervoltage" is set. If the voltage returns, the motor restarts automatically and the alarm message is reset.
V<< ride through	An undervoltage leads to slow reduction of the frequency reference value, whereby the motor changes to generator operation. In order to keep the DC link voltage constant (undervoltage ride through), energy is absorbed from the mechanical system (centrifugal mass of the motor and of the load) through braking. During the undervoltage ride through operation, the alarm message "Undervoltage" is set. If the voltage returns within the maximum undervoltage time E3.31, the motor continues to run in normal operation and the alarm is reset. If the undervoltage time is exceeded, a fault shut-down occurs with the message "Undervoltage" (external 24 V buffer voltage required).
Fast stop	An undervoltage leads to quick reduction of the frequency reference value, whereby the motor changes to generator operation. The DC link voltage increases and a possible activated motor braking will intervene (see function "Brake mode", page 263). During the fast stop process, the alarm message "Undervoltage" is set. If the rotational speed stands still within the maximum undervoltage time E3.31, the alarm message is reset. An existing start command from the sources 2-wire-edge, 3-wire or bus is deleted. If the undervoltage time is exceeded, a fault shut-down occurs with the message "Undervoltage" (external 24 V buffer voltage required).

Alarm messages

MX eco ☑
MX pro ☑

With the monitoring and protection concept of the MX eco & pro it is possible to transfer drive or process faults to the superposed control as fault messages, advance warning with delayed fault message or only as alarm message.

These can be divided into up to 3 alarm category groups for the assessment of arriving alarm messages.

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Maintenance fan, motor

MX eco ☑
MX pro ☑

The operating hours meter registers the actual operation time of the active motor. Times as a result of active DC-brake, motor heating or standby mode are not valued as operation time. For this reason the operating hours meter can be used as interval for the bearing maintenance.

The evaluation occurs separately for both switchable motors.

If the operating hours meter reaches the parameter value "Interval motor" then the alarm message "Service M1" or "Service M2" occurs. The alarm can be reset by means of parameter A5.13 "Clear interval counter" whereby a new time interval is started. The already elapsed time of a running interval can be seen in parameter "Interval counter".

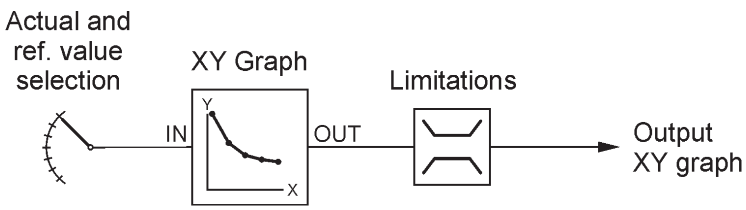
The operating hours meter "Fan" registers the operation time of the power part fan and can be evaluated for maintenance purposes.

If the operating hours meter reaches the parameter value "Interval fan" then the alarm message "Service fan" occurs. The alarm can be reset by means of parameter A5.13 "Clear interval counter" whereby a new time interval is started. The already elapsed time of a running interval can be seen in parameter A5.12 "Interval counter fan"

If the counters of operating hours exceed 60,000 hours (approx. 7 years in case of 24 hour operation) the counters are automatically reset and start counting again from zero hours.

XY Graph

MX eco ☑
MX pro ☑



The XY graph represents a reference source whose output is defined by the given input signal and a line shape that can be set using six points.

The output of the XY graph can be used as a general reference source or as a variable limitation for the PID controller. For example, the XY graph can be used to realize the maximum speed for compressors depending on the pressure (PID limitation), a speed-dependent torque limitation (simulation of combustion engines),...

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Feed-in monitoring

MX eco ☑
MX pro ☑

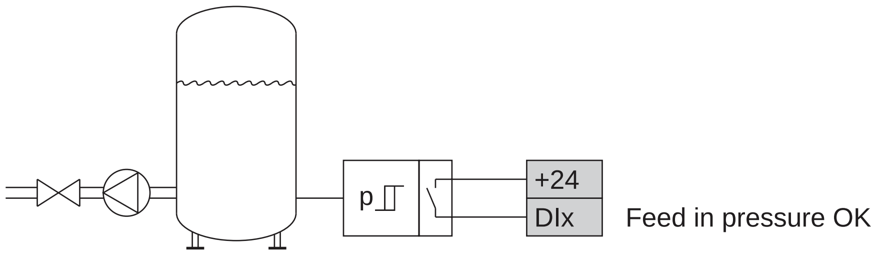
An inflow pressure that is too low can lead to cavitation problems up to dry running of centrifugal pumps. The protection function "Feed-in monitoring" recognises this risk and initiates a corresponding protection method.

The acquisition can occur in two different ways as described subsequently.

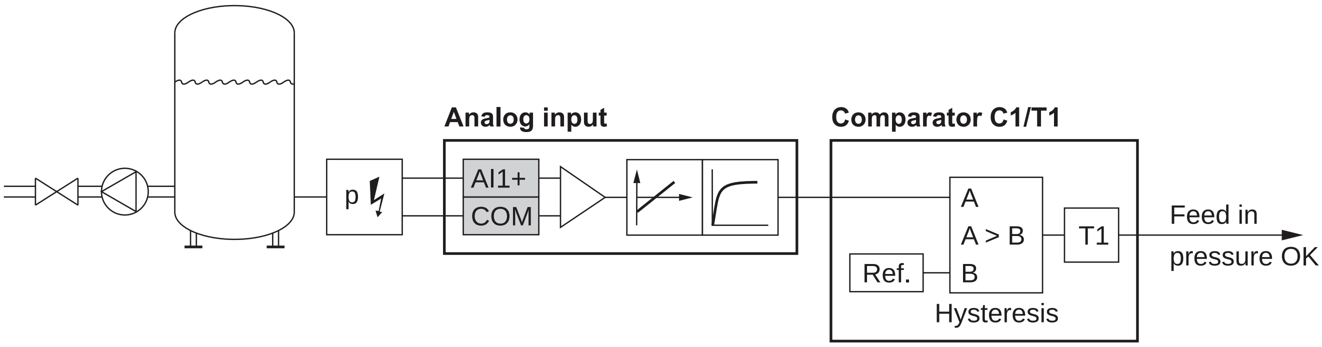
Pressure monitoring

With the pressure monitoring the feed-in pressure to the pump has to be registered with a suitable sensor. A pressure sensor with switching output and hysteresis function (link to the digital input "Feed in pressure OK") or an analog output signal of a pressure sensor (standard signal 0...10 V, 0(4)...20 mA) can be used.

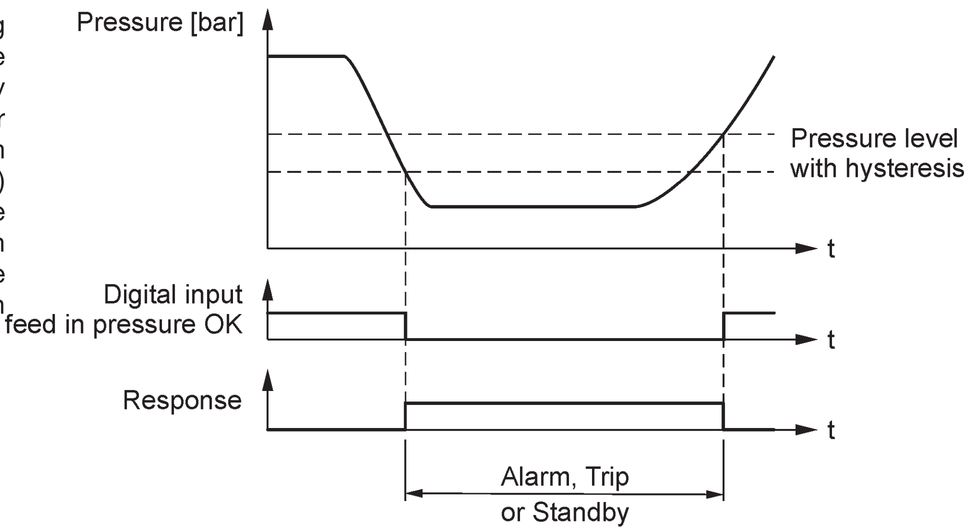
Pressure sensor with switching output



Pressure sensor with analog output signal



By using an analog measurement signal the switchpoint is generated by means of the comparator functions (see function "Function blocks", page 270) and an analog input. If the minimum allowed feed-in pressure falls short, the protection function "Feed-in monitoring" is triggered.



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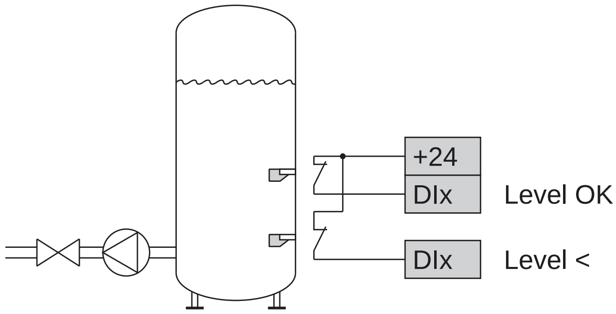
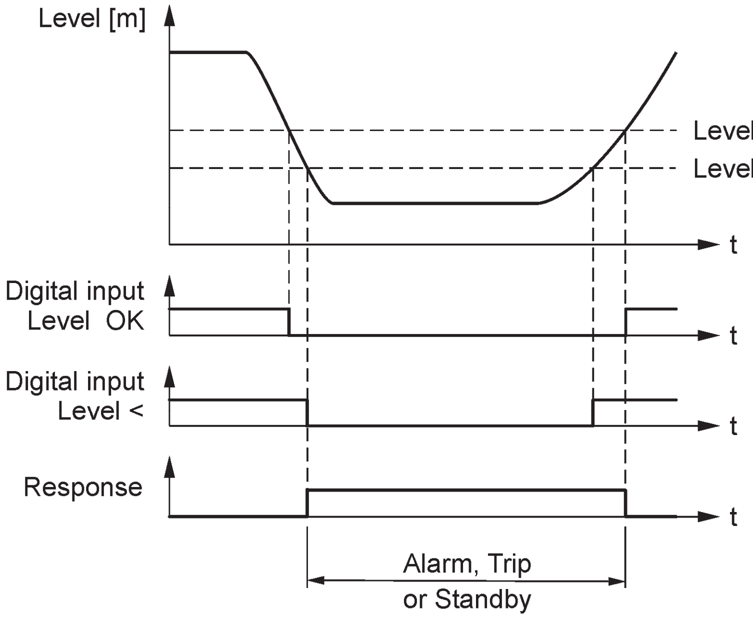
Level monitoring

The level monitoring is selected if two levels are measured by means of pressure controllers, level switches, float switches and the like. The measured levels can be supplied to the inverters via the digital inputs "Level OK" and "Level <".

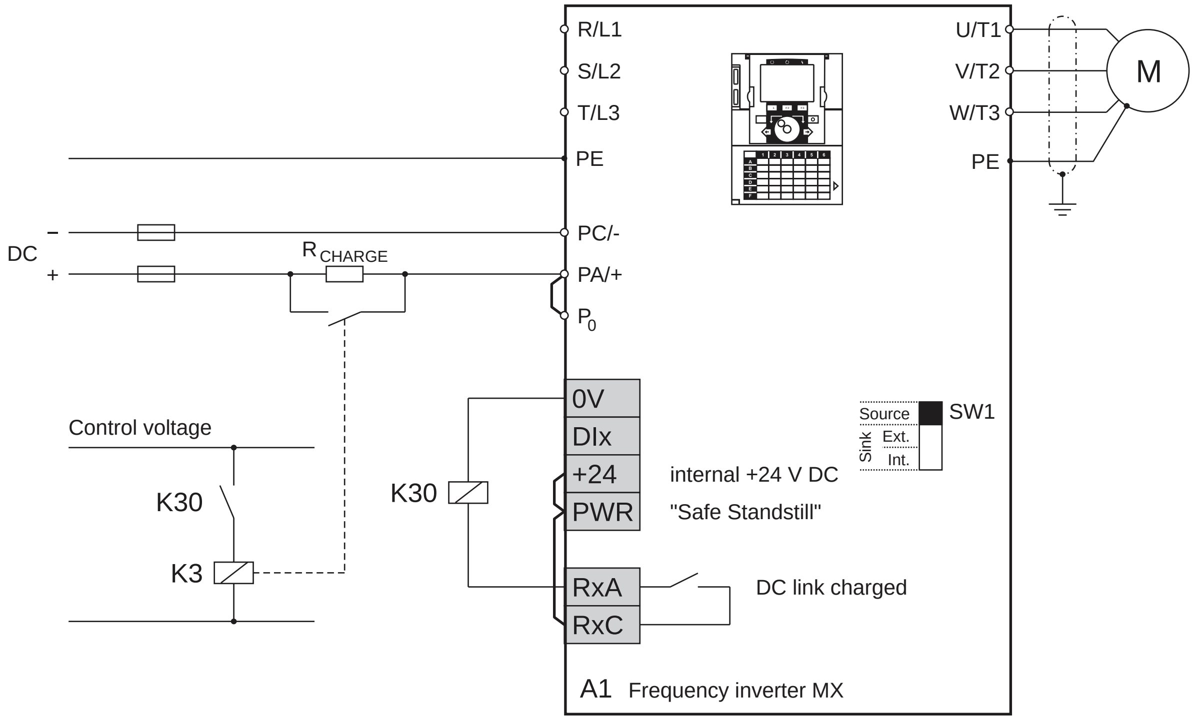




DC-supply

The function "DC-supply" enables the supply of the inverter via the DC link with an existing DC voltage. The DC voltage source must keep the specification (voltage, power, fuse protection) and has to be connected to the DC link terminals of the inverter with a suitable pre-charging unit.

When using an external DC supply or an external rectifier in order to achieve 12-pulse ore 18-pulse input rectification, parameter C6.65 has to be set accordingly. The external pre-charging contactor must be actuated by means of the digital output function "DC link charged". The additional switching delay of the external charging contactor has to be set with parameter C6.66.



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General Terms of Delivery

issued by the Austrian Electrical and Electronics Industry Association

1. Scope

1.1 These General Terms shall govern legal transactions between business enterprises, namely the delivery of commodities and, mutatis mutandis, the rendering of services. Software transactions are with precedence governed by the Software Conditions issued by the Austrian Electrical and Electronics Industry Association, assembly work by the Terms and Conditions for Assembly Work issued by the Austrian Power Current and Light Current Engineering Industry and/or (where applicable) the Terms and Conditions for the Assembly of Electrical Equipment used in Medicine issued by the Austrian Electrical and Electronics Industry.

1.2 Any departure from the terms and conditions mentioned in 1.1 above shall be valid only if expressly accepted in writing by Seller.

2. Submission of offers

2.1 Seller's offers shall be deemed offers without engagement.

2.2 Tender documents and project documentation must not be duplicated nor made available to third parties without the permission of Seller. They may be claimed back at any time and shall be returned to Seller immediately if the order is placed elsewhere.

3. Conclusion of contract

3.1. The contract shall be deemed concluded upon written confirmation by Seller of an order received or upon dispatch of a delivery.

3.2 Particulars appearing in catalog, folders etc. as well as any oral or written statements shall only be binding if Seller makes express reference to them in the confirmation of the order.

3.3 Subsequent amendments of or additions to the contract shall be subject to written confirmation.

4. Prices

4.1 Prices shall be quoted ex works or ex Seller's warehouse excluding packing and packaging, loading and turnover tax. Buyer shall be liable for any and all charges, taxes or other duties levied in respect of delivery. If the terms of delivery include transport to a destination designated by Buyer, transport costs as well as the cost of any transport insurance desired by Buyer shall be borne by the latter. Delivery does not, however, include unloading and subsequent handling. Packaging materials will be taken back only by express agreement.

4.2 Seller reserves the right to modify prices if the order placed is not in accordance with the offer submitted.

4.3 Prices are based on costs obtaining at the time of the first quotation. In the event that the costs have increased by the time of delivery, Seller shall have the right to adjust prices accordingly.

4.4 In carrying out repair orders, Seller shall provide all services deemed expedient and shall charge Buyer for the same on the basis of the work input and/or expenditures required. The same holds for any services or additional services the expediency of which becomes apparent only as the repair order is executed. In such an event special notification of Buyer shall not be required.

4.5 Expenses for estimates of costs of repair and maintenance or for expert valuations shall be invoiced to Buyer.

5. Delivery

5.1 The period allowed for delivery shall commence at the latest of the following dates
a) the date of order confirmation by Seller;
b) the date of fulfillment by Buyer of all the conditions, technical, commercial and other, for which he is responsible;
c) the date of receipt by Seller of a deposit or security due before delivery of the goods in question.

5.2 Buyer shall obtain whatever licences or approvals may be required from authorities or third parties for the construction of plant and equipment. If the granting of such licences or approvals is delayed for any reason the delivery period shall be extended accordingly.

5.3 Seller may carry out, and charge Buyer for, partial or advance deliveries. If delivery on call is agreed upon, the commodity shall be deemed called off at the latest one year after the order was placed.

5.4 In case of unforeseeable circumstances or circumstances beyond the parties control, such as all cases of force majeure, which impede compliance with the agreed period of delivery, the latter shall be extended in any case for the duration of such circumstances; these include in particular armed conflicts, official interventions and prohibitions, delays in transport or customs clearance, damages in transit, energy shortage and raw materials scarcity, labor disputes, and default on performance by a major component supplier who is difficult to replace. The aforesaid circumstances shall be deemed to prevail irrespective of whether they affect Seller or his sub-contractor(s).

5.5 If a contractual penalty for default of delivery was agreed upon by contracting parties when the contract was concluded, it shall be executed as follows, and any deviations concerning individual items shall not affect the remaining provisions: Where delay in performance can be shown to have occurred solely through the fault of Seller, Buyer may claim for each completed week of delay an indemnity of at most one half of one per cent, a total of no more than 5 %, however, of the value of that part of the goods to be delivered which cannot be used on account of Seller's failure to deliver an essential part thereof, provided the Buyer has suffered a damage to the aforesaid extent.

Assertion of rights of damages exceeding this extent is precluded.

6. Passage of risk and Place of performance

6.1 Enjoyment and risk shall pass to Buyer at the time of departure of the goods ex works or ex warehouse regardless of the terms of quotation (such as carriage paid, C.I.F. etc.) agreed upon. This provision also includes the case of shipment being effected, organised and supervised by Seller and the case of delivery being made in connection with assembly work to be undertaken by Seller.

6.2 For services the place of performance shall be the place at which the service is rendered; the risk in respect of such services or any part thereof that may have been agreed upon shall pass to Buyer at the time the services have been rendered.

7. Payment

7.1 Unless otherwise agreed, one third of the purchase price shall fall due at the time of receipt by Buyer of the order confirmation of Seller, one third after half the delivery period has elapsed and the balance at the time of delivery. Irrespective thereof the turnover tax comprised in the amount of the invoice shall be paid within 30 days of the invoice date.

7.2 In the case of part settlements the individual part payments shall fall due upon receipt of the respective invoices. The same shall apply to amounts invoiced for additional deliveries or resulting from additional agreements beyond the scope of the original contract, irrespective of the terms of payment agreed upon for the principal delivery.

7.3 Payment shall be made without any discount free Seller's domicile in the agreed currency. Drafts and checks shall be accepted on account of payment only, with all interest, fees and charges in connection therewith (such as collection and discounting charges) to be borne by Buyer.

7.4 Buyer shall not be entitled to withhold or offset payment on the grounds of any warranty claims or other counterclaims.

7.5 Payment shall be deemed to have been effected on the date at which the amount in question is at Seller's disposal.

7.6 If Buyer fails to meet the terms of payment or any other obligation arising from this or other transactions, Seller may without prejudice to his other rights

a) suspend performance of his own obligations until payments have been made or other obligations fulfilled, and exercise his right to extend the period of delivery to a reasonable extent,

b) call in debts arisen from this or any other transactions and charge default interest amounting to 1.25 % per month plus turnover tax for these amounts beginning with the due dates, unless Seller proves costs exceeding this. In any case Seller has the right to invoice all expenses arising prior to a lawsuit, especially reminder charges and lawyer's fees.

7.7 Discounts or bonuses are subject to complete payment in due time.

7.8 Seller retains title to all goods delivered by him until receipt of all amounts invoiced including interests and charges. Buyer herewith assigns his claim out of a resale of conditional commodities, even if they are processed, transformed or combined with other commodities, to Seller to secure the latter's purchase money claim, and he undertakes to make a corresponding entry in his books or on his invoices. Upon request Buyer has to notify the assigned claim and the debtor thereof to Seller, and to make all information and material required for his debt collection available and to notify the assignment to the third-party debtor. If the goods are attached or otherwise levied upon, Buyer shall draw attention to Sellers title and immediately inform Seller of the attachment or levy.

8. Warranty and acceptance of obligation to repair defects

8.1 Once the agreed terms of payment have been complied with, Seller shall, subject to the conditions hereunder, remedy any defect existing at the time of acceptance of the article in question whether due to faulty design, material or manufacture, that impairs the functioning of said article. From particulars appearing in catalogues, folders, promotional literature as well as written or oral statements, which have not been included in the agreement, no warranty obligations may be deduced.

8.2 Unless special warranty periods operate for individual items the warranty period shall be 12 months. These conditions shall also apply to any goods supplied, or services rendered in respect of goods supplied, that are firmly attached to buildings or the ground. The warranty period begins at the point of passage of risk acc. to paragraph 6.

8.3 The foregoing warranty obligations are conditional upon the Buyer giving immediate notice in writing of any defects that have occurred. Buyer shall prove immediately the presence of a defect, in particular he shall make available immediately to Seller all material and data in his possession. Upon receipt of such notice Seller shall, in the case of a defect covered by the warranty under 8.1 above, have the option to replace the defective goods or defective parts thereof or else to repair them on Buyer's premises or have them returned for repair, or to grant a fair and reasonable price reduction.

8.4 Any expenses incurred in connection with rectifying defects (e.g. expenses for assembly and disassembly, transport, waste disposal, travel and site-to-quarters time) shall be borne by Buyer. For warranty work on Buyer's premises Buyer shall make available free of charge any assistance, hoisting gear, scaffolding and sundry supplies and incidentals that may he required. Replaced parts shall become the property of Seller.

8.5 If an article is manufactured by Seller on the basis of design data, design drawings, models or other specifications supplied by Buyer, Sellers warranty shall be restricted to non-compliance with Buyers specifications.

8.6 Seller's warranty obligation shall not extend to any defects due to assembly and installation work not undertaken by Seller, inadequate equipment, or due to non-compliance with installation requirements and operating conditions, overloading of parts in excess of the design values stipulated by Seller, negligent or faulty handling or the use of inappropriate materials, nor for defects attributable to material supplied by Buyer. Nor shall Seller be liable for damage due to acts of third parties, atmospheric discharges. Excess voltage and chemical influences. The warranty does not cover the replacement of parts subject to natural wear and tear. Seller accepts no warranty for the sale of used goods.

8.7 The warranty shall lapse immediately if, without written consent of Seller, Buyer himself or a third party not expressly authorised undertakes modifications or repairs on any items delivered.

8.8 Claims acc. to § 933b ABGB are struck by the statute of limitation with lapse of the period mentioned under point 8.2.

8.9 The provisions of sub-paragraphs 8.1 to 8.7 shall apply, mutatis mutandis, to all cases where the obligation to repair defects has to be accepted for other reasons laid down by law.

9. Withdrawal from contract

9.1 Buyer may withdraw from the contract only in the event of delays caused by gross negligence on the part of Seller and only after a reasonable period of grace has elapsed. Withdrawal from contract shall be notified in writing by registered mail.

9.2 Irrespective of his other rights Seller shall be entitled to withdraw from the contract

a) if the execution of delivery or the inception or continuation of services to be rendered under the contract is made impossible for reasons within the responsibility of Buyer and if the delay is extended beyond a reasonable period of grace allowed;

b) if doubts have arisen as to Buyer's creditworthiness and if same fails, on Seller's request, to make an advance payment or to provide adequate security prior to delivery, or

c) if, for reasons mentioned in 5.4, the period allowed for delivery is extended by more than half of the period originally agreed or by at least 6 months.

9.3 For the reasons given above withdrawal from the contract shall also be possible in respect of any outstanding part of the delivery or service contracted for.

9.4 If bankruptcy proceedings are instituted against any contracting party or an application for bankruptcy proceedings against that party is not granted for insufficiency of assets, the other party may withdraw from the contract without allowing a period of grace.

9.5 Without prejudice to Seller's claim for damages including expenses arising prior to a lawsuit, upon withdrawal from contract any open accounts in respect of deliveries made or services rendered in whole or in part shall be settled according to contract. This provision also covers deliveries or services not yet accepted by Buyer as well as any preparatory acts performed by Seller. Seller shall, however, have the option alternatively to require the restitution of articles already delivered.

9.6 Withdrawal from contract shall have no consequences other than those stipulated above.

10. Liability

10.1 Outside the scope of the Product Liability Act, Seller shall be liable only if the damage in question is proved to be due to intentional acts or acts of gross negligence, within the limits of statutory provisions. Seller shall not be liable for damage due to acts of ordinary negligence nor for consequential damages or damages for economic losses, loss of savings or interest or damage resulting from third-party claims against buyer.

10.2 Seller shall not be liable for damages in case of non-compliance with instructions for assembly, commissioning and operation (such as are contained in instructions for use) or non-compliance with licensing requirements.

10.3 Claims that exceed the contractual penalties that were agreed on are excluded from the respective title.

11. Assertion of Claims

All claims to which Buyer is entitled must be asserted in court within three years from passage of risk as specified under paragraph 6, unless shorter limits of time are prescribed by law, otherwise claims shall become forfeited.

12. Industrial property rights and copyrights

12.1 Buyer shall indemnify Seller and hold him harmless against any claims for any infringement of industrial property rights raised against him if Seller manufactures an article pursuant to any design data, design drawings, models or other specifications made available to him by Buyer.

12.2 Design documents such as plans and drawings and other technical specifications as well as samples, catalogues, prospectuses, pictures and the like shall remain the intellectual property of Seller and are subject to the relevant statutory provisions governing reproduction, imitation, competition etc. The provisions of 2.2 above shall also cover design documents.

13. General

Should individual provisions of the contract or of these provisions be invalid the validity of the other provisions shall not be affected. The invalid provision shall be replaced by a valid one, which comes as close to the target goal as possible.

14. Jurisdiction and applicable law

Any litigations arising under the contract including litigations over the existence or non-existence thereof shall fall within the exclusive jurisdiction of the competent court at Sellers domicile; the competent court of the Bezirksgericht Innere Stadt, Vienna, shall have exclusive jurisdiction if Seller is domiciled in Vienna. The contract is subject to Austrian law excluding the referral rules. Application of the UN Convention on Contracts for the International Sale of Goods is renounced.

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