



## **With >pDRIVE< 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**

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# Product catalogue of frequency inverters

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# Schneider Electric Power Drives

Schneider Electric Power Drives a new powerful company name, >pDRIVE< an long established powerful brand name, which stands for frequency inverters, motors and mains restorers with the most modern technology, industrial design and utmost user-friendliness. Both together they make up a team for your success.



HUSI

8 P01 002 EN.05/05

With more than 25 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. A group of companies, with more than 100.000 employees worldwide and a business volume of € 13 billion, standing for industrial continuity and technological progress.



The >pDRIVE< sales team comprises of a network of specialists who over more than 25 countries and who are available 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 >pDRIVE< products and systems.

With >pDRIVE< products you always make the right choice.

>pDRIVE< MX eco



>pDRIVE< 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	All drives with high performance in industry, machine building and automation
Power ranges	
0.75...630 kW	4V: 0.75...500/630 kW 6V: 2.2/3.0...630/800 kW
Voltage ranges	
3 AC 380...440 V; 50 Hz 3 AC 380...480 V; 60 Hz	4V: 3 AC 380...440 V; 50 Hz / 3 AC 380...480 V; 60 Hz 6V: 3 AC 500...690 V; 50 / 60 Hz
Output frequency	
0.00...300 Hz	0.00...300 Hz
Control method	
V/f-characteristic, SVC (Sensorless Vector Control) SVC- and V/f-energy saving mode	V/f-characteristic SVC (with or without encoder), Synchronous motor (with or without encoder)
Interfaces	
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
Further reading	
All information about project planning and order can be found in this product catalogue.	All information about project planning and order can be found in this product catalogue.

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8 P01 002 EN.05/05

>pDRIVE< MX multi-eco



>pDRIVE< MX multi-pro



**Product range**

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

**Brief description**

Cubicle device series of the >pDRIVE< MX eco and MX pro inverters with increased protection degree, alternatively in the standard design, with additionally installed options or as a customized solution

**Applications**

Pumps, fans, compressors and screw conveyors

All drives with high performance in industry, machine building and automation

**Power ranges**

22 ... 630 kW

4V & 4C: 22...1300/1400 kW  
 5V & 5C: 15/18.5...2000/2400 kW  
 6V & 6C: 18.5/22...2000/2400 kW

**Voltage ranges**

3 AC 400 V; 50 Hz standard design  
 3 AC 380 ... 480 V; 50/60 Hz on request

4V & 4C: 3 AC 400 V; 50 Hz  
 5V & 5C: 3 AC 500 V; 50 Hz  
 6V & 6C: 3 AC 690 V; 50 Hz

**Output frequency**

0.00 ... 300 Hz

0.00 ... 300 Hz

**Control method**

V/f-characteristic,  
 SVC (Sensorless Vector Control)  
 SVC- and V/f-energy saving mode

V/f-characteristic  
 SVC (with or without encoder),  
 Synchronous motor (with or without encoder)

**Interfaces**

Matrix operating panel in the cubicle door with a transparent cover,  
 control terminals alternatively directly in the inverter or in the cubicle,  
 control terminals can be extended,  
 fieldbus connection via Modbus, Profibus DP or CANopen

**Protection degree**

IP23 cubicle design  
 IP54 cubicle design, alternatively with filter fan or separated air flow

**Further reading**

Detailed information about the available cubicle variants and their characteristics is given in the product catalogue "Frequency inverters in cubicle design", order number 8 P01 004 EN.

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8 P01 002 EN.05/05

## >pDRIVE< MX eco Products

### For standard drives in buildings, communities and industry



With the >pDRIVE< 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.

Optimized device features suitable for your application range:

Application	Device features
Pump drives in industry, residential environment and communities, from 0.75 to 630 kW	<ul style="list-style-type: none"> <li>– Cascade control for up to 4 pumps in different circuit variations</li> <li>– Integrated PID controller for pressure, flow, quantity or filling level</li> <li>– An energy saving mode ensures highest efficiency of the whole drive also in partial load range</li> </ul>
Fan drives for air conditioning, combustion, flue gas hood, tunnel ventilation and many more	<ul style="list-style-type: none"> <li>– Separate operation mode "Emergency operation" can be selected to protect people in case of fire</li> <li>– Automatic motor recognition enables the safe operation of the service switch</li> <li>– Excellent braking action of the drive without additional components</li> </ul>
Compressors, screw conveyors, stirrer drives and many more for use e.g. in waste water treatment plants	<ul style="list-style-type: none"> <li>– Varnished printed circuit boards offer the best protection against environmental influences</li> <li>– Integrated logic modules for varied control tasks in the system</li> <li>– Built-in RFI filter for 1st environment "Residential environments" and 2nd environment "Industrial environments" up to 630 kW</li> </ul>

## >pDRIVE< 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

>pDRIVE<	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	ME4U07AAA
MX eco 4V1,5	1.5 kW	4.1 A	130 x 230 x 175 mm	ME4U15AAA
MX eco 4V2,2	2.2 kW	5.8 A	130 x 230 x 175 mm	ME4U22AAA
MX eco 4V3,0	3.0 kW	7.8 A	155 x 260 x 187 mm	ME4U30AAA
MX eco 4V4,0	4.0 kW	10.5 A	155 x 260 x 187 mm	ME4U40AAA
MX eco 4V5,5	5.5 kW	14.3 A	175 x 295 x 187 mm	ME4U55AAA
MX eco 4V7,5	7.5 kW	17.6 A	175 x 295 x 187 mm	ME4U75AAA
MX eco 4V11	11 kW	27.7 A	210 x 295 x 213 mm	ME4D11AAA
MX eco 4V15	15 kW	33 A	230 x 400 x 213 mm	ME4D15AAA
MX eco 4V18	18.5 kW	41 A	230 x 400 x 213 mm	ME4D18AAA
MX eco 4V22	22 kW	48 A	240 x 420 x 236 mm	ME4D22AAA
MX eco 4V30	30 kW	66 A	240 x 550 x 266 mm	ME4D30AAA
MX eco 4V37	37 kW	79 A	240 x 550 x 266 mm	ME4D37AAA
MX eco 4V45	45 kW	94 A	320 x 630 x 290 mm	ME4D45AAA
MX eco 4V55	55 kW	116 A	320 x 630 x 290 mm	ME4D55AAA
MX eco 4V75	75 kW	160 A	320 x 630 x 290 mm	ME4D75AAA
MX eco 4V90	90 kW	179 A	310 x 680 x 377 mm	ME4D90AAA
MX eco 4V110	110 kW	215 A	310 x 680 x 377 mm	ME4C11AAA
MX eco 4V132	132 kW	259 A	350 x 782 x 377 mm	ME4C13AAA
MX eco 4V160	160 kW	314 A	330 x 950 x 377 mm	ME4C16AAA
MX eco 4V200	200 kW	387 A	430 x 950 x 377 mm	ME4C20AAA
MX eco 4V250	250 kW	481 A	585 x 950 x 377 mm	ME4C25AAA
MX eco 4V315	315 kW	616 A	585 x 950 x 377 mm	ME4C31AAA
MX eco 4V355	355 kW	671 A	880 x 1150 x 377 mm	ME4C35AAA
MX eco 4V400	400 kW	759 A	880 x 1150 x 377 mm	ME4C40AAA
MX eco 4V500	500 kW	941 A	880 x 1150 x 377 mm	ME4C50AAA
MX eco 4V630	630 kW	1188 A	1110 x 1150 x 377 mm	ME4C63AAA

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

## >pDRIVE< MX pro Products

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



With the >pDRIVE< 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.

Optimized device features suitable for your application range:

Application	Device features
Coupled drives system such as sheet metal processing machines	<ul style="list-style-type: none"> <li>– Master/Slave control for balanced load distribution with group drives</li> <li>– Simple possibility of coupling the DC link provides an optimum balance of energy</li> <li>– Safety function "Safe Standstill" also with coupled drives</li> </ul>
Drives with energy regeneration to the mains or to braking resistors such as e.g. crane hoisting and carriages	<ul style="list-style-type: none"> <li>– Extremely efficient braking option up to 630 kW with 50% overload, built-in braking unit as standard up to 200 kW</li> <li>– Extended crane functions increase the safety and accelerate the operating cycle</li> <li>– Set of motor data and parameter sets which can be switched separately</li> </ul>
Intelligent drive solutions with functions for control and monitoring directly in the drive	<ul style="list-style-type: none"> <li>– Integrated logic modules for varied control tasks</li> <li>– Positioning functionality and position switch evaluation for quick production plants</li> <li>– Free configurable alarm categories increase the safety and availability of the system</li> </ul>
Synchronous motors	<ul style="list-style-type: none"> <li>– Standard starting torque without speed feedback</li> <li>– High starting torque with speed feedback (&gt;pDRIVE&lt; MX pro ...-SY with another order code)</li> </ul>
Medium voltage motors	<ul style="list-style-type: none"> <li>– Motors up to 6000 V with step-up transformer (&gt;pDRIVE&lt; MX pro ...-MV with another order code)</li> </ul>

## >pDRIVE< 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

>pDRIVE<	Motor output	Output current	Dimensions W x H x D	Order code 1.)
<i>MX pro 4V0,75</i>	0.75 kW	2.3 A	130 x 230 x 175 mm	MP4U07AAB
<i>MX pro 4V1,5</i>	1.5 kW	4.1 A	130 x 230 x 175 mm	MP4U15AAB
<i>MX pro 4V2,2</i>	2.2 kW	5.8 A	130 x 230 x 175 mm	MP4U22AAB
<i>MX pro 4V3,0</i>	3.0 kW	7.8 A	155 x 260 x 187 mm	MP4U30AAB
<i>MX pro 4V4,0</i>	4.0 kW	10.5 A	155 x 260 x 187 mm	MP4U40AAB
<i>MX pro 4V5,5</i>	5.5 kW	14.3 A	175 x 295 x 187 mm	MP4U55AAB
<i>MX pro 4V7,5</i>	7.5 kW	17.6 A	175 x 295 x 187 mm	MP4U75AAB
<i>MX pro 4V11</i>	11 kW	27.7 A	210 x 295 x 213 mm	MP4D11AAB
<i>MX pro 4V15</i>	15 kW	33 A	230 x 400 x 213 mm	MP4D15AAB
<i>MX pro 4V18</i>	18.5 kW	41 A	230 x 400 x 213 mm	MP4D18AAB
<i>MX pro 4V22</i>	22 kW	48 A	240 x 420 x 236 mm	MP4D22AAB
<i>MX pro 4V30</i>	30 kW	66 A	240 x 550 x 266 mm	MP4D30AAB
<i>MX pro 4V37</i>	37 kW	79 A	240 x 550 x 266 mm	MP4D37AAB
<i>MX pro 4V45</i>	45 kW	94 A	320 x 630 x 290 mm	MP4D45AAB
<i>MX pro 4V55</i>	55 kW	116 A	320 x 630 x 290 mm	MP4D55AAB
<i>MX pro 4V75</i>	75 kW	160 A	320 x 630 x 290 mm	MP4D75AAB
<i>MX pro 4V90/110</i>	90/110 kW	179/215 A	310 x 680 x 377 mm	MP4D90AAB
<i>MX pro 4V110/132</i>	110/132 kW	215/259 A	350 x 782 x 377 mm	MP4C11AAB
<i>MX pro 4V132/160</i>	132/160 kW	259/314 A	330 x 950 x 377 mm	MP4C13AAB
<i>MX pro 4V160/200</i>	160/200 kW	314/387 A	430 x 950 x 377 mm	MP4C16AAB
<i>MX pro 4V200/250</i>	200/250 kW	387/481 A	585 x 950 x 377 mm	MP4C20AAA 2.)
<i>MX pro 4V250/315</i>	250/315 kW	481/616 A	585 x 950 x 377 mm	MP4C25AAA 2.)
<i>MX pro 4V315/400</i>	315/400 kW	616/759 A	880 x 1150 x 377 mm	MP4C31AAA 2.)
<i>MX pro 4V400/500</i>	400/500 kW	759/941 A	880 x 1150 x 377 mm	MP4C40AAA 2.)
<i>MX pro 4V500/630</i>	500/630 kW	941/1188 A	1110 x 1150 x 377 mm	MP4C50AAA 2.)

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

In case of drives with synchronous motors or step-up transformers another order code is required.

2.) The braking option is an optional component.

## >pDRIVE< 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

>pDRIVE<	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.)
<i>MX pro 6V2,2/3,0</i>	(1.5/2.2) 2.2/3.0 kW	(3.2/4.5) 4.0/4.5 A	240 x 420 x 236	MP6U22AAB
<i>MX pro 6V3,0/4,0</i>	(2.2/3.0) 3.0/4.0 kW	(4.5/5.8) 4.5/5.5 A	240 x 420 x 236	MP6U30AAB
<i>MX pro 6V4,0/5,5</i>	(3.0/4.0) 4.0/5.5 kW	(5.8/7.5) 5.5/7.5 A	240 x 420 x 236	MP6U40AAB
<i>MX pro 6V5,5/7,5</i>	(4.0/5.5) 5.5/7.5 kW	(7.5/10) 7.5/10 A	240 x 420 x 236	MP6U55AAB
<i>MX pro 6V7,5/11</i>	(5.5/7.5) 7.5/11 kW	(10/13.5) 10/13.5 A	240 x 420 x 236	MP6U75AAB
<i>MX pro 6V11/15</i>	(7.5/11) 11/15 kW	(13.5/18.5) 13.5/18.5 A	240 x 420 x 236	MP6D11AAB
<i>MX pro 6V15/18</i>	(11/15) 15/18 kW	(18.5/24) 18.5/24 A	240 x 420 x 236	MP6D15AAB
<i>MX pro 6V18/22</i>	(15/18) 18/22 kW	(24/29) 24/27 A	240 x 420 x 236	MP6D18AAB
<i>MX pro 6V22/30</i>	(18/22) 22/30 kW	(29/35) 27/35 A	240 x 420 x 236	MP6D22AAB
<i>MX pro 6V30/37</i>	(22/30) 30/37 kW	(35/47) 35/43 A	320 x 630 x 290	MP6D30AAB
<i>MX pro 6V37/45</i>	(30/37) 37/45 kW	(47/59) 43/54 A	320 x 630 x 290	MP6D37AAB
<i>MX pro 6V45/55</i>	(37/45) 45/55 kW	(59/68) 54/62 A	320 x 630 x 290	MP6D45AAB
<i>MX pro 6V55/75</i>	(45/55) 55/75 kW	(68/85) 62/84 A	320 x 630 x 290	MP6D55AAB
<i>MX pro 6V75/90</i>	(55/75) 75/90 kW	(85/110) 84/104 A	320 x 630 x 290	MP6D75AAB
<i>MX pro 6V90/110</i>	(75/90) 90/110 kW	(110/136) 104/125 A	330 x 950 x 377	MP6D90AAB
<i>MX pro 6V110/132</i>	(90/110) 110/132 kW	(136/165) 125/150 A	330 x 950 x 377	MP6C11AAB
<i>MX pro 6V132/160</i>	(110/132) 132/160 kW	(165/200) 150/180 A	330 x 950 x 377	MP6C13AAB
<i>MX pro 6V160/200</i>	(132/160) 160/200 kW	(200/240) 180/220 A	330 x 950 x 377	MP6C16AAB
<i>MX pro 6V200/250</i>	(160/200) 200/250 kW	(240/312) 220/290 A	585 x 950 x 377	MP6C20AAA 2.)
<i>MX pro 6V250/315</i>	(200/250) 250/315 kW	(312/390) 290/355 A	585 x 950 x 377	MP6C25AAA 2.)
<i>MX pro 6V315/400</i>	(250/315) 315/400 kW	(390/462) 355/420 A	585 x 950 x 377	MP6C31AAA 2.)
<i>MX pro 6V400/500</i>	(315/400) 400/500 kW	(462/590) 420/543 A	1110 x 1150 x 377	MP6C40AAA 2.)
<i>MX pro 6V500/630</i>	(400/500) 500/630 kW	(590/740) 543/675 A	1110 x 1150 x 377	MP6C50AAA 2.)
<i>MX pro 6V630/800</i>	(500/630) 630/800 kW	(740/900) 675/840 A	1110 x 1150 x 377	MP6C63AAA 2.)

- 1.) The Matrix operating panel >pDRIVE< BE11 is to be ordered separately.  
In case of drives with synchronous motors or step-up transformers another order code is required.
- 2.) The braking option is an optional component.

## >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< MX multi

The >pDRIVE< MX multi is an extension to the >pDRIVE< frequency inverter offer. The basic equipment contains a frequency inverter >pDRIVE< 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.



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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.

>pDRIVE< MX multi-eco 400 V

General technical data	
Mains voltage	380 V -15% up to 415 V +10%, 50 Hz for TT, TN 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 >pDRIVE< 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
<b>&gt;pDRIVE&lt; MX multi-eco 4V</b>					
4V22-S	22	48	600	600	IP23: 2155 mm
4V30-S	30	66	600	600	
4V37-S	37	79	600	600	
4V45-S	45	94	600	600	IP54: 2260 mm
4V55-S	55	116	600	600	
4V75-S	75	160	600	600	
4V90-S	90	179	600	600	IP23: 2155 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	IP54: 2260 (2355) mm
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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>pDRIVE< MX multi-pro 400 V

General technical data	
Mains voltage	380 V -15% up to 415 V +10%, 50 Hz for TT, TN 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	>pDRIVE< 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 >pDRIVE< 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
<b>&gt;pDRIVE&lt; MX multi-pro 4V</b>					
4V22-S	22	48	600	600	IP23: 2155 mm
4V30-S	30	66	600	600	
4V37-S	37	79	600	600	
4V45-S	45	94	600	600	IP54: 2260 mm
4V55-S	55	116	600	600	
4V75-S	75	160	600	600	
4V90/110-S	90 / 110	179 / 215	600	600	IP23: 2155 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	IP54: 2260 (2355) mm
4V400/500-S	400 / 500	759 / 941	1000 (1400)	600	
4V500/630-S	500 / 630	941 / 1188	1200 (1600)	600	
<b>&gt;pDRIVE&lt; MX multi-pro 4C</b>					
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	3000	600	2000
4C900/1100-S	900 / 1100	1580 / 1860	3000	600	2000
4C1100/1300-S	1100 / 1300	1860 / 2200	3000	600	2000
4C1300/1400-S	1300 / 1400	2200 / 2430	3000	600	2000

( ) Values in brackets for IP54 with separated air flow

## >pDRIVE< MX multi-pro 500 V

General technical data	
Mains voltage	500 V -15% +10% 50 Hz, for TT, TN 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	>pDRIVE< 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 >pDRIVE< 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

Type	Motor output P1 / P2 [kW]	Output current I1 / I2 [A]	Dimensions [mm]		
			Width	Depth	Height
<b>&gt;pDRIVE&lt; MX multi-pro 5V</b>					
5V15/18-S	15 / 18.5	24 / 29	600 (1000)	600	IP23: 2155 mm
5V18/22-S	18.5 / 22	29 / 35	600 (1000)	600	
5V22/30-S	22 / 30	35 / 47	600 (1000)	600	
5V30/37-S	30 / 37	47 / 59	600 (1000)	600	IP54: 2260 mm
5V37/45-S	37 / 45	59 / 68	600 (1000)	600	
5V45/55-S	45 / 55	68 / 85	600 (1000)	600	
5V55/75-S	55 / 75	85 / 110	600 (1000)	600	IP23: 2155 mm
5V75/90-S	75 / 90	110 / 136	600 (1000)	600	
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	IP54: 2260 (2355) mm
<b>&gt;pDRIVE&lt; MX multi-pro 5C</b>					
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	3000	600	2000
5C1100/1300-S	1100 / 1300	1580 / 1860	3000	600	2000
5C1300/1500-S	1300 / 1500	1860 / 2140	3000	600	2000
5C1500/1800-S	1500 / 1800	2020 / 2430	3000	600	2000

( ) Values in brackets for IP54 with separated air flow

>pDRIVE< MX multi-pro 690 V

General technical data	
Mains voltage	690 V -15% +10% 50 Hz, for TT, TN 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	>pDRIVE< 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 >pDRIVE< 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
<b>&gt;pDRIVE&lt; MX multi-pro 6V</b>					
6V18/22-S	18 / 22	24 / 27	600 (1000)	600	IP23: 2155 mm
6V22/30-S	22 / 30	27 / 35	600 (1000)	600	
6V30/37-S	30 / 37	35 / 43	600 (1000)	600	
6V37/45-S	37 / 45	43 / 54	600 (1000)	600	IP54: 2260 mm
6V45/55-S	45 / 55	54 / 62	600 (1000)	600	
6V55/75-S	55 / 75	62 / 84	600 (1000)	600	
6V75/90-S	75 / 90	84 / 104	600 (1000)	600	IP23: 2155 mm
6V90/110-S	90 / 110	104 / 125	600 (1000)	600	
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	IP54: 2260 (2355) mm
<b>&gt;pDRIVE&lt; MX multi-pro 6C</b>					
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	3000	600	2000
6C1500/1800-S	1500 / 1800	1580 / 1860	3000	600	2000
6C1800/2100-S	1800 / 2100	1860 / 2140	3000	600	2000
6C2000/2400-S	2000 / 2400	2020 / 2430	3000	600	2000

( ) Values in brackets for IP54 with separated air flow

# Operation of the >pDRIVE< 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.

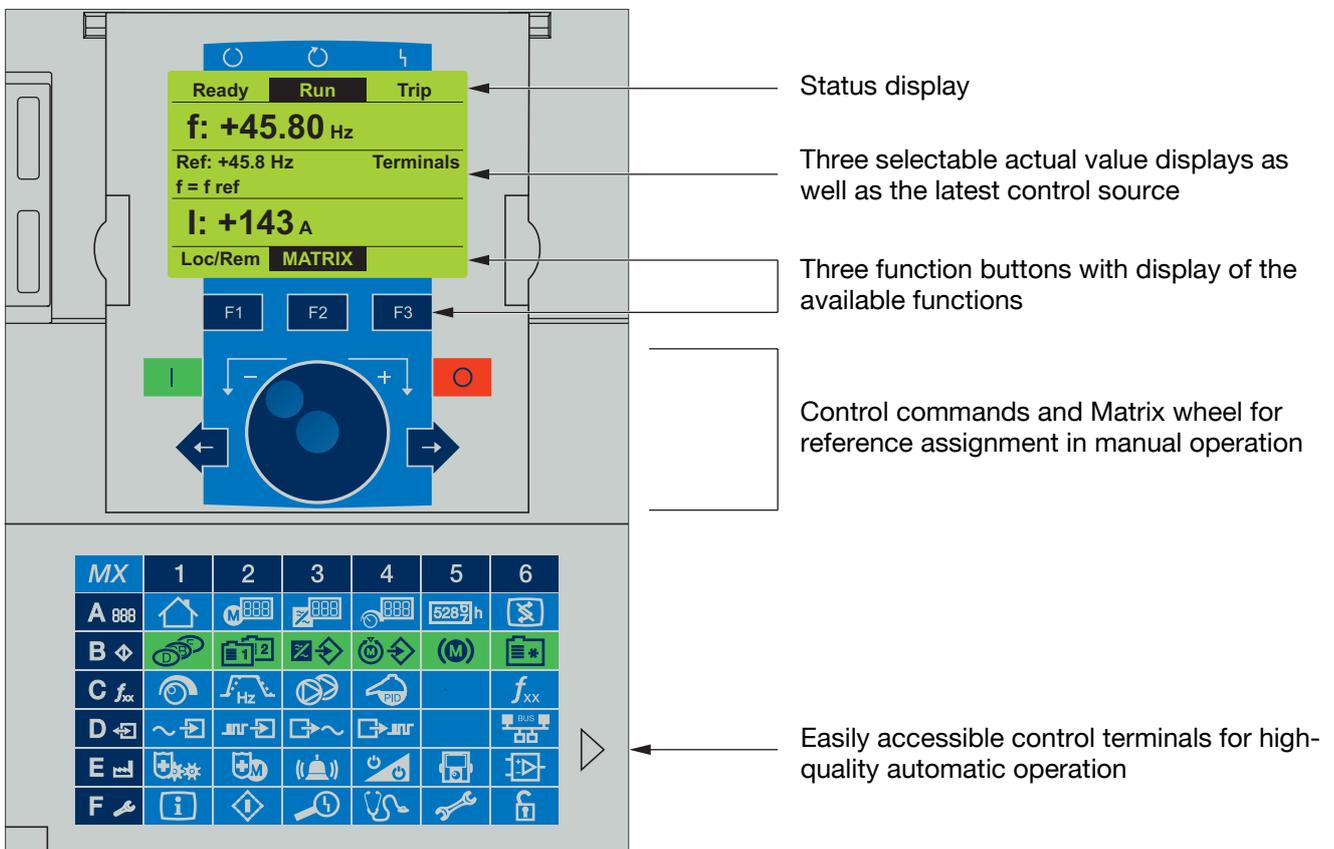
The programming of the >pDRIVE< MX eco & pro frequency inverters does not call for special requirements and is geared towards utmost ease of use. In this way you have a full overview of the device in each situation.

The keypad of the >pDRIVE< 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



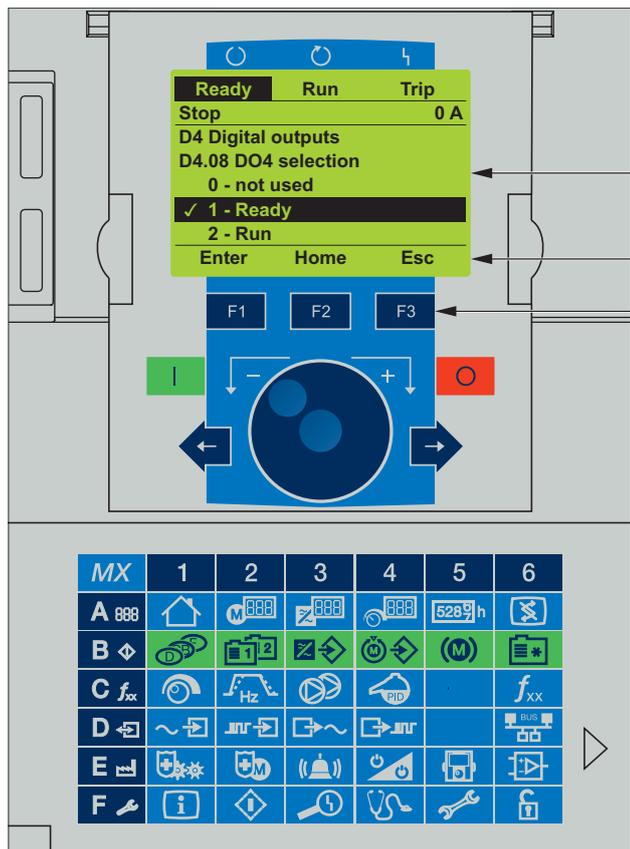
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## The keypad at parameterization

The >pDRIVE< 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.

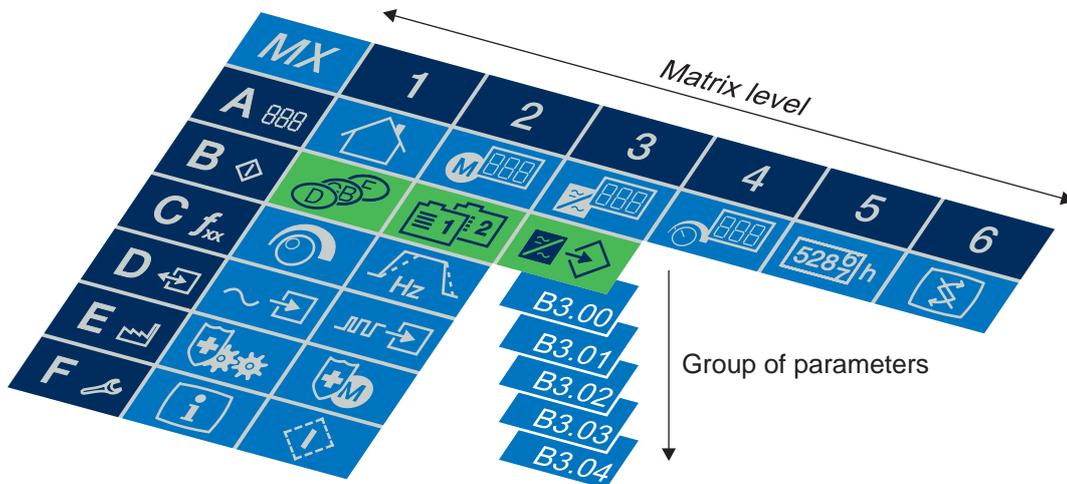
Only few impulses on the Matrix wheel are necessary in order to set the desired parameter values.

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

## Matrix philosophy

The secret of the simple and quick parameterization of the >pDRIVE< 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.



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Ready	Run	Trip
Stop		0.00 A
D1 Analog inputs		
C	C1 C2 C3 C4	C6
D	D1 D2 D3 D4	D6
E	E1 E2 E3 E4 E5 E6	
Home		Esc

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.

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Ready	Run	Trip
Stop		0.00 A
D4 Digital outputs		
D4.08 DO4 selection		
0 - not used		
✓ 1 - Ready		
2 - Operation		
Enter	Home	Esc

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 >pDRIVE< 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).

## Presettings

Our >pDRIVE< 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.

>pDRIVE< 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

>pDRIVE< MX eco:

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

>pDRIVE< MX pro:

Preset parameters for crane drives with braking unit



### Macro M3

>pDRIVE< MX eco:

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

>pDRIVE< 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 >pDRIVE< 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.

# 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 >pDRIVE< MX eco & pro devices. Based on the familiar Windows-surface and the well proven functions of the Matrix 2.0 PC software, it offers numerous tools for considerable quicker commissioning and for the safe archiving of the parameter 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.

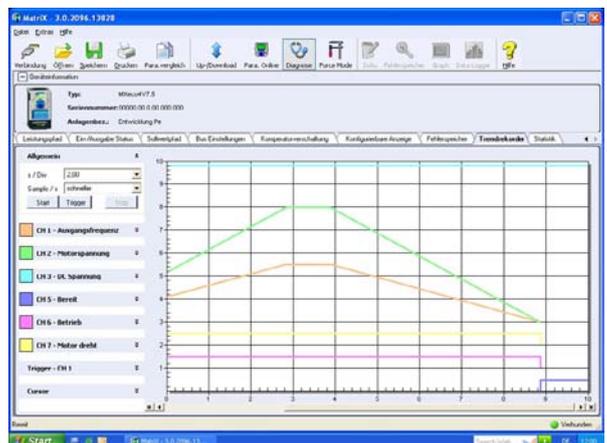
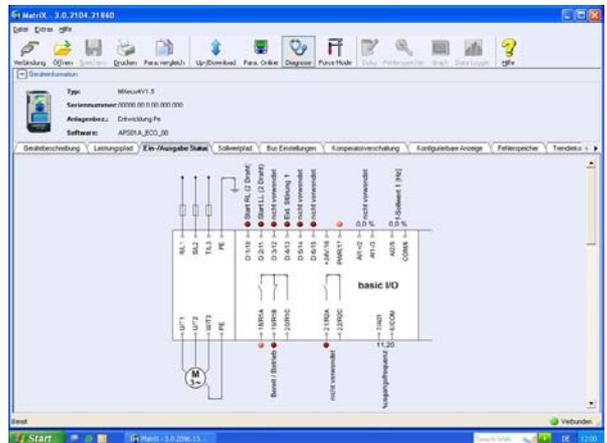
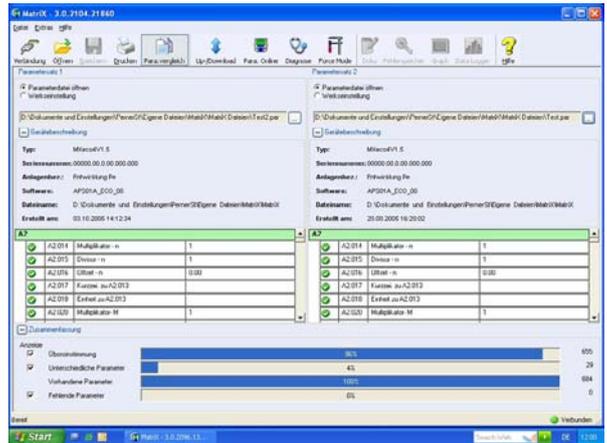
By means of the Parameter-Upload and Download, the device settings can be archived or printed out as lists. For a quick recognition of the specific setting values, the parameter list can be compared with the factory setting or with other parameter lists.

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: >pDRIVE< 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 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

>pDRIVE< 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.

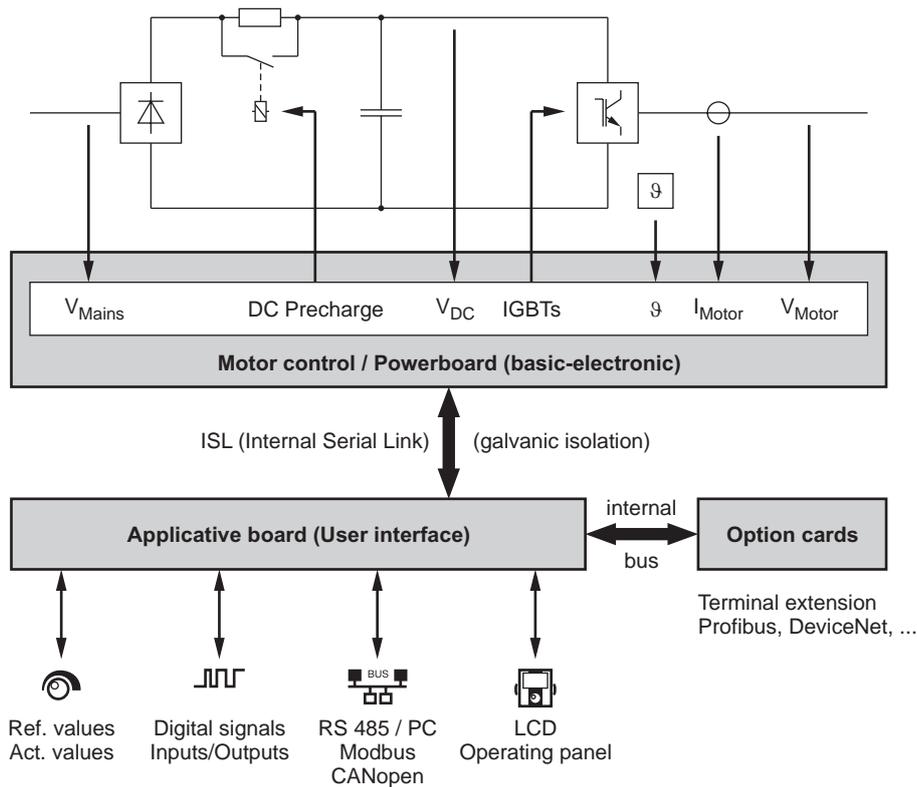
The >pDRIVE< MX eco frequency inverters are suitable for the motor operation of motors in both rotational directions. The function "motor braking" is available for a quick shut-down of the drive, which enables a quick deceleration without additional components.

>pDRIVE< 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 >pDRIVE< LX in series.

>pDRIVE< 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.

>pDRIVE< 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/EC** 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/EC** 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 50178**.

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/EC.



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 *>pDRIVE< MX eco & pro* frequency inverters include a RFI filter for industrial environment (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 and 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<sup>2</sup>
- Laying of the motor cables separated from other cables, especially from the control wiring

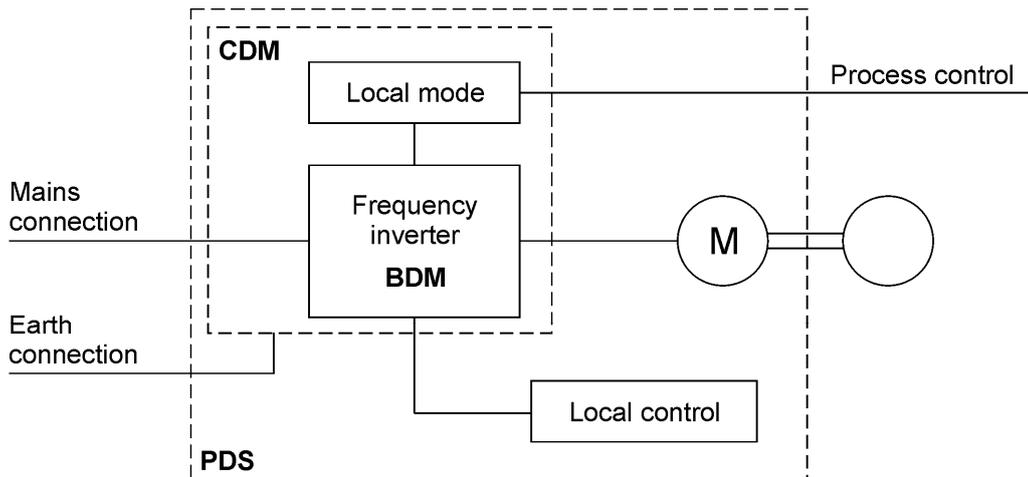
## EMC product standard for PDS (Power Drive Systems) EN 61800-3

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.



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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.

## 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".

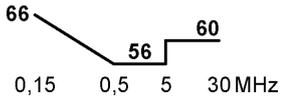
The valid limits for interferences are very low and can only be observed by compliance with all installation instructions.

### Category C1

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

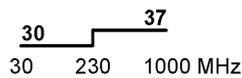
Conducted interferences

**dB $\mu$ V (QP)**



Radiation

**dB $\mu$ V/m (QP)**



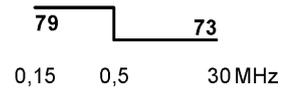
The admissible limits for interferences comply with the applied standard EN 55011 class B; i.e. 66-56/56/60 dB( $\mu$ V) quasi-peak and 30/37 dB( $\mu$ V/m) at a distance of 10 m.

### Category C2

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

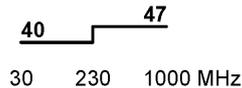
Conducted interferences

**dB $\mu$ V (QP)**



Radiation

**dB $\mu$ V/m (QP)**



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

i.e. 79/73/73 dB( $\mu$ V) quasi-peak and 40/47 dB( $\mu$ V/m) at a distance of 10 m

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## 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( $\mu$ V) quasi-peak apply. In case of industrial networks the higher limits 79/73/73 dB( $\mu$ V) quasi-peak can be used.

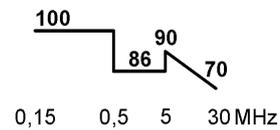
Furthermore, it is necessary to enhance the suppression of interferences if other devices are influenced. The operator of the plant is responsible for this improvement.

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

### Category C3

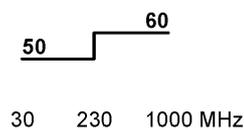
Use in industrial environments

Conducted interferences  
drive  $\leq 100$  A  
dB $\mu$ V (QP)



Radiation

dB $\mu$ V/m (QP)



For drives with a size  $\leq 100$  A the admissible limits for interferences are 100/86/90-70 dB( $\mu$ V) quasi-peak and 50/60 dB( $\mu$ V/m) at a distance of 10 m (class A group 2).

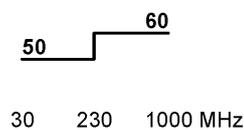
HUSI

Conducted interferences  
drive  $> 100$  A  
dB $\mu$ V (QP)



Radiation

dB $\mu$ V/m (QP)



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

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### 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.

# Mains conditions

## Mains voltage

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

3 AC 380 V -15 % up to 440 V +10 %, 50 Hz  $\pm$  5 %

3 AC 380 V -15 % up to 480 V +10 %, 60 Hz  $\pm$  5 %

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

3 AC 500 V -15 % to 690 V +10 %, 50/60 Hz  $\pm$  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 >pDRIVE< MX pro 6V90/110...6V630/800 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  $\pm$  5 %

3 AC 400 V -10 % to 480 V +10 %, 60 Hz  $\pm$  5 %

If this voltage is not available, so it is possible to generate this fan supply voltage with the Option >pDRIVE< TRAF0-BOX.

## Fuses

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



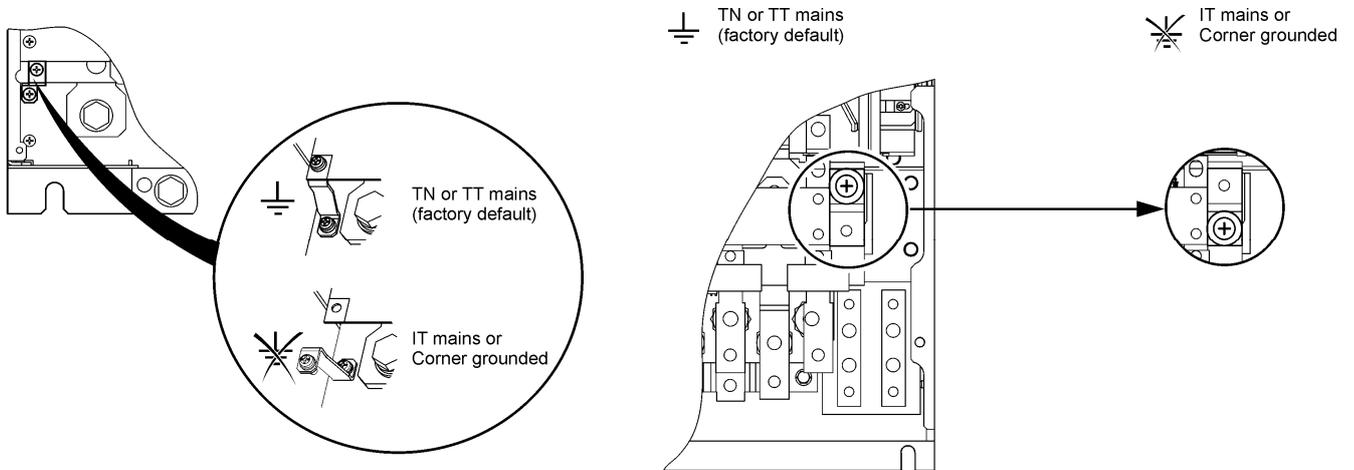
If the braking resistor does not match the overload characteristic to be used or the local regulations require an additional protective device, a thermal relay should be integrated into the mains disconnection mechanism.

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.

## Nongrounded mains

The use of the >pDRIVE< MX eco & pro frequency inverters is basically in all mains variants permitted. But >pDRIVE< 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 >pDRIVE< RFI is not qualified for the use in IT mains !

## Radio interferences

The >pDRIVE< 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
>pDRIVE< MX eco & pro 4V0,75 ... 4V4,0	C2 residential environment – EMC-versed user (in the past: EN 55011 class A group 1)
>pDRIVE< MX eco & pro from 4V5,5 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< DCL

This external option is available for the devices >pDRIVE< MX eco & pro 4V0,75...4V75 with protection degree IP20. For devices from 90 kW a DCL box with protection degree IP31 is available.

- Use of a three-phase choke option >pDRIVE< NDU in the mains lines

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

- Installation of a mains current harmonic filter option >pDRIVE< HF

This option is available for the devices >pDRIVE< MX eco & pro from 4V4,0.

- 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:

>pDRIVE< MX eco 4V500...4V630

>pDRIVE< MX pro 4V400/500...4V500/630

>pDRIVE< MX pro 6V400/500...6V630/800

## 12-pulse supply

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

>pDRIVE< MX eco 4V500...4V630

>pDRIVE< MX pro 4V400/500...4V500/630

>pDRIVE< MX pro 6V400/500...6V630/800

The supply results from a separate transformer with two out-of-phase secondary windings (e.g. Yy6 d5).

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

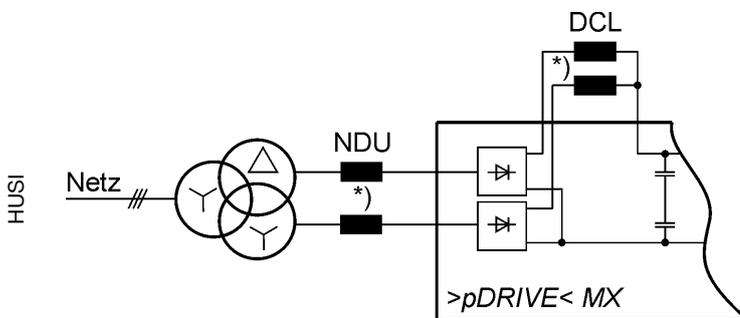
The transformer must keep to the following tolerances in order to guarantee a constant current sharing:



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

Tolerance of the relative short circuit voltage:  $\pm 5.0$  % 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.



\*) Line chokes or alternative DC-chokes (not for MX pro 6V) are only necessary if a transformer is used for several inverters or if the transformer power is notably larger than the inverter power (see chapter "Mains impedance / Short-circuit current", page 33).



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

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## Mains impedance / Short-circuit current

The >pDRIVE< 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 >pDRIVE< DCL or option >pDRIVE< 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. If a power factor correction system is used, their capacitors are additionally stressed by means of the harmonics.



To protect against overload, we recommend the installation of chokes for those parts.

## Switching rate

The >pDRIVE< MX eco & pro inverters can be directly switched on and off by means of the line contactor which can be easily 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)
as above, but with permanent supply for the device fans (only possible for MX eco 4V132...4V630, MX pro 4V110/132...4V500/630 and MX pro 6V90/110...6V630/800)	only dependent from the line contactor
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).

# 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 a 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.

## Earth leakage circuit breaker

Frequency inverters, especially those with additional radio frequency interference 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 his 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.

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 restart

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)

## Locking of the frequency inverter

The *>pDRIVE< 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 *>pDRIVE< MX eco* and *>pDRIVE< 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 *>pDRIVE< MX eco* and *>pDRIVE< 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.



# >pDRIVE< 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 >pDRIVE< 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 156
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 >pDRIVE< 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 189
Wall-mounting in IP21 / IP31	Compact wall-mounting device with terminal box as a cheap alternative to the cubicle installation	Page 243
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 246
Optimized for cubicle installation	>pDRIVE< 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 150

## 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 21
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 19
PC software	Free PC program Matrix 3 for commissioning, programming, documentation and analysis	Page 23
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 200
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 30
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 139
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 176
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 139

## Useful functions



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

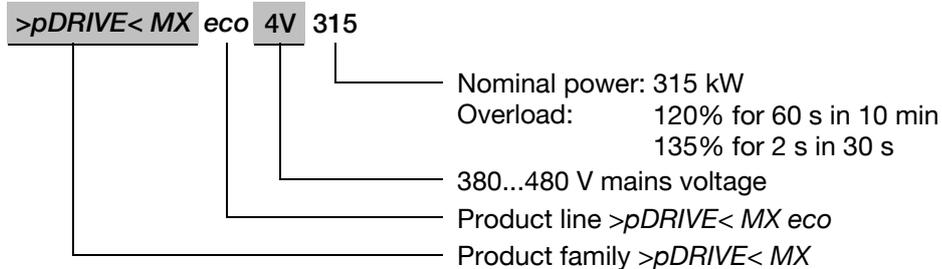
# Specification

## Technical data

The frequency inverters of the >pDRIVE< 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



Input	
Voltage	380 V -15% up to 480 V +10% for TT, TN or IT mains *)
Frequency	50 / 60 Hz $\pm 5$ % *)
Overvoltage class	Class III according to EN 50178
Power factor	Fundamental (displacement factor): > 0.98 Total ( $\lambda$ ) at full load: 0.93...0.95 (with AC or DC choke) Total ( $\lambda$ ) 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: $\pm 0.01$ % / 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 30.

Ambient conditions	
Operating temperature	>pDRIVE< MX eco 4V0,75...4V90: -10...+50°C >pDRIVE< 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	>pDRIVE< MX eco 4V0,75...4V75: bottom, sideways, front IP21 top IP41 (IP20 without protective cover) >pDRIVE< 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 >pDRIVE< MX eco 4V0,75...4V75: 3C1 and 3S2 according to EN 60721-3-3 >pDRIVE< MX eco 4V90...4V630: 3C2 and 3S2 according to EN 60721-3-3
Protection class	Class 1 according to EN 50178
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 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 C1, C2, C3
Insulation	Galvanic insulation in accordance with EN 50178 PELV (Protective Extra Low Voltage)
Approvals	CE, UL, CSA, GOST, ATEX

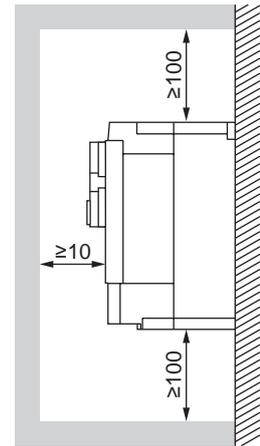
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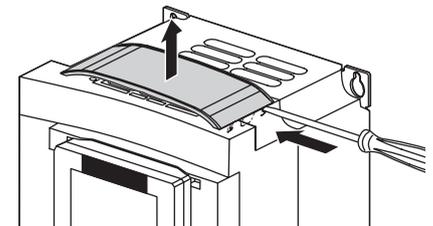


Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

>pDRIVE< MX eco	4V0,75	4V1,5	4V2,2	4V3,0	4V4,0
<b>Nominal data</b>					
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					
$S_{N400}$ [kVA] $V_N = 400$ V	1.6	2.8	4.0	5.4	7.3
$S_{N460}$ [kVA] $V_N = 460$ V	1.8	3.3	4.6	6.2	8.4
Continuous output current					
$I_{N400}$ [A] $V_N = 400$ V	2.3	4.1	5.8	7.8	10.5
$I_{N460}$ [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
<b>Input current (without choke)</b>					
$I_{IN400}$ [A] $V_N = 400$ V	3.7	5.8	8.2	10.7	14.1
$I_{IN460}$ [A] $V_N = 460$ V	3.0	5.3	7.1	9	11.5
<b>Characteristics</b>					
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
<b>Ambient conditions</b>					
Volume cooling air [m <sup>3</sup> /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
<b>Dimensions</b>					
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 $\varnothing$ 4.5				



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

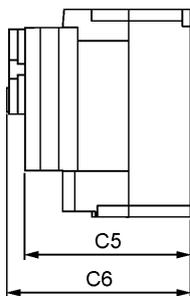


When you remove the IP41 protective cover the units can be mounted without any distance sideways. See also chapter "Power decrease", page 154.

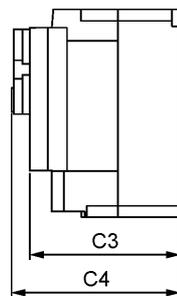
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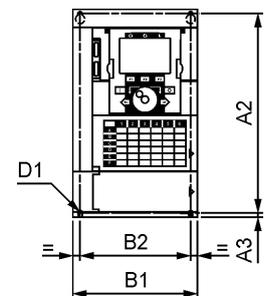
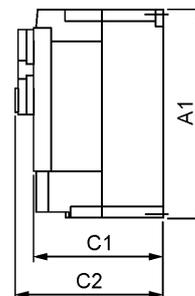
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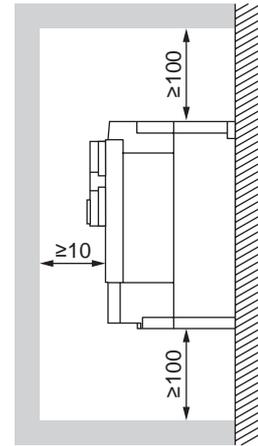
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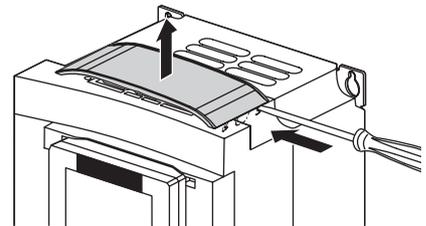
Basic device without option card



>pDRIVE< MX eco	4V5,5	4V7,5	4V11	4V15	4V18
<b>Nominal data</b>					
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					
$S_{N400}$ [kVA] $V_N = 400$ V	9.9	12.2	19.2	23	28
$S_{N460}$ [kVA] $V_N = 460$ V	11.4	14	22	26	33
Continuous output current					
$I_{N400}$ [A] $V_N = 400$ V	14.3	17.6	27.7	33	41
$I_{N460}$ [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
<b>Input current (without choke)</b>					
$I_{IN400}$ [A] $V_N = 400$ V	20.3	27.0	36.6	48	46
$I_{IN460}$ [A] $V_N = 460$ V	17.0	22.2	30.0	39	38
<b>Characteristics</b>					
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
<b>Ambient conditions</b>					
Volume cooling air [m <sup>3</sup> /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
<b>Dimensions</b>					
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 Ø5.5				



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

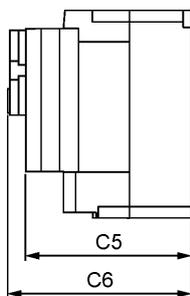


When you remove the IP41 protective cover the units can be mounted without any distance sideways. See also chapter "Power decrease", page 154.

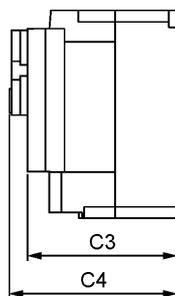
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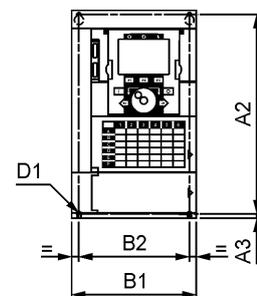
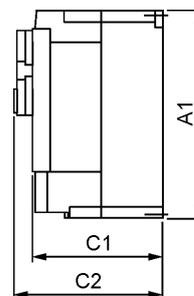
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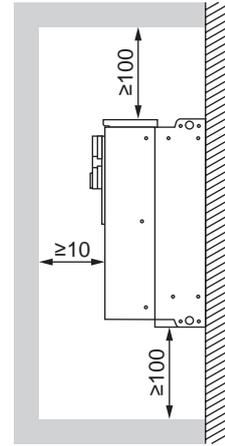
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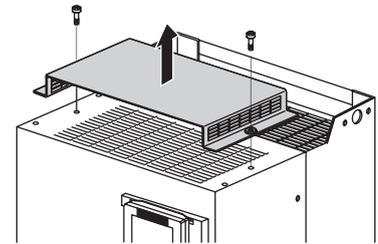
Basic device without option card



>pDRIVE< MX eco	4V22	4V30	4V37
<b>Nominal data</b>			
Motor rating			
P <sub>N</sub> [kW]	22	30	37
P <sub>N</sub> [hp]	30	40	50
Continuous output power			
S <sub>N400</sub> [kVA] V <sub>N</sub> = 400 V	33	46	55
S <sub>N460</sub> [kVA] V <sub>N</sub> = 460 V	38	53	63
Continuous output current			
I <sub>N400</sub> [A] V <sub>N</sub> = 400 V	48	66	79
I <sub>N460</sub> [A] V <sub>N</sub> = 460 V	48	66	79
Maximum current for 60 s per 10 minutes			
I <sub>MAX</sub> [A]	58	79	95
<b>Input current (without choke)</b>			
I <sub>IN400</sub> [A] V <sub>N</sub> = 400 V	50	66	84
I <sub>IN460</sub> [A] V <sub>N</sub> = 460 V	42	56	69
<b>Characteristics</b>			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at I <sub>N</sub>	720	980	1180
Weight approx. [kg]	19	26	26
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	200	200	200
Sound pressure [dB(A)]	60	64	64
Mains short circuit c. [kA]	22	22	22
<b>Dimensions</b>			
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

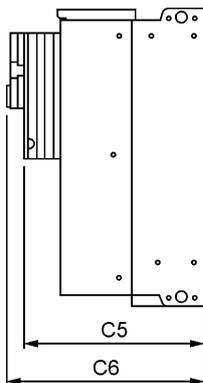


For installation keep a minimum distance of 50 mm between the units and the side wall.

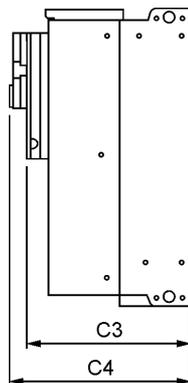


When you remove the IP41 protective cover the units can be mounted without any distance sideways. See also chapter "Power decrease", page 154.

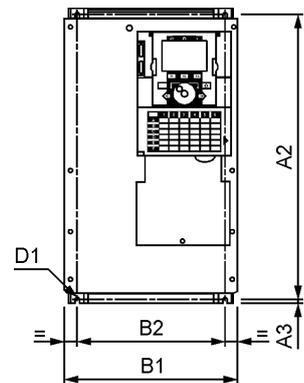
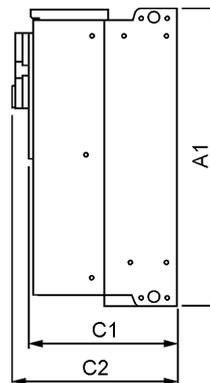
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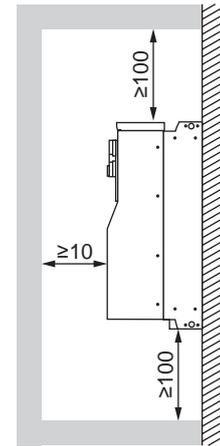
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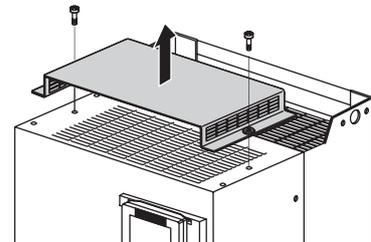
Basic device without option card



>pDRIVE< MX eco	4V45	4V55	4V75
<b>Nominal data</b>			
Motor rating			
$P_N$ [kW]	45	55	75
$P_N$ [hp]	60	75	100
Continuous output power			
$S_{N400}$ [kVA] $V_N = 400$ V	65	80	111
$S_{N460}$ [kVA] $V_N = 460$ V	75	92	128
Continuous output current			
$I_{N400}$ [A] $V_N = 400$ V	94	116	160
$I_{N460}$ [A] $V_N = 460$ V	94	116	160
Maximum current for 60 s per 10 minutes			
$I_{MAX}$ [A]	113	139	192
<b>Input current (without choke)</b>			
$I_{IN400}$ [A] $V_N = 400$ V	104	120	167
$I_{IN460}$ [A] $V_N = 460$ V	85	101	137
<b>Characteristics</b>			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at $I_N$	1360	1560	2320
Weight approx. [kg]	44	44	44
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	400	400	400
Sound pressure [dB(A)]	64	64	64
Mains short circuit c. [kA]	22	22	22
<b>Dimensions</b>			
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 $\varnothing$ 9	4 x $\varnothing$ 9	4 x $\varnothing$ 9



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

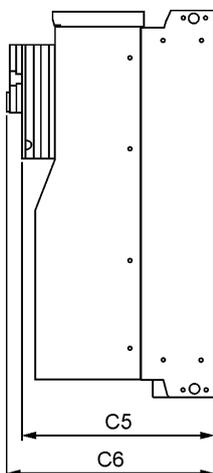


When you remove the IP41 protective cover the units can be mounted without any distance sideways.  
See also chapter "Power decrease", page 154.

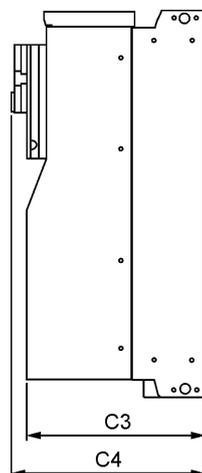
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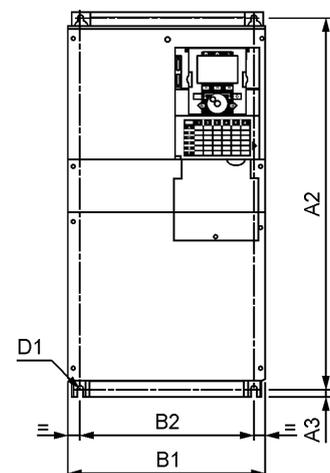
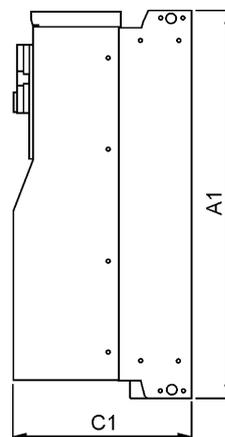
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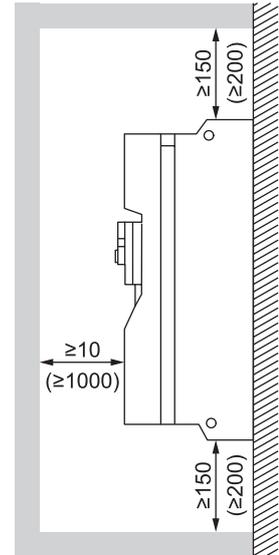
with 1 option card



Basic device without option card



>pDRIVE< MX eco	4V90	4V110	4V132	4V160
<b>Nominal data</b>				
Motor rating				
$P_N$ [kW]	90	110	132	160
$P_N$ [hp]	125	150	200	250
Continuous output power				
$S_{N400}$ [kVA] $V_N = 400$ V	124	149	179	218
$S_{N460}$ [kVA] $V_N = 460$ V	143	171	206	250
Continuous output current				
$I_{N400}$ [A] $V_N = 400$ V	179	215	259	314
$I_{N460}$ [A] $V_N = 460$ V	179	215	259	314
Maximum current for 60 s per 10 minutes				
$I_{MAX}$ [A]	215	258	311	377
<b>Input current (with option &gt;pDRIVE&lt; DCL-BOX)</b>				
$I_{IN400}$ [A] $V_N = 400$ V	158	188	226	271
$I_{IN460}$ [A] $V_N = 460$ V	143	168	224	275
<b>Characteristics</b>				
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
<b>Ambient conditions</b>				
Volume cooling air [m <sup>3</sup> /h]	400	400	600	600
Sound pressure [dB(A)]	61	61	69	71
Mains short circuit c. [kA]	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>
<b>Dimensions</b>				
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 Ø11.5	4x Ø11.5	4x Ø11.5	4x Ø11.5



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

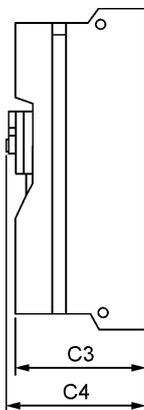
In either case avoid air short circuits.

<sup>1.)</sup> in combination with DC choke option >pDRIVE< DCL-BOX

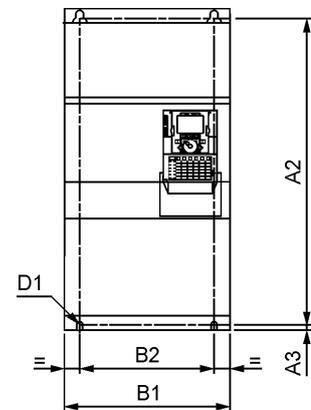
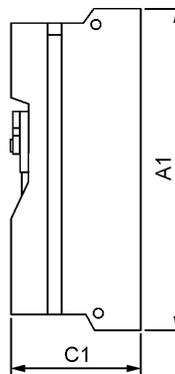
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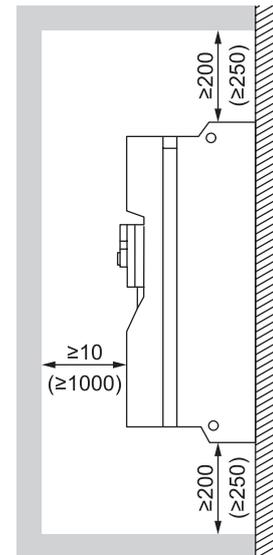
with 2 option cards



Basic device without or with 1 option card



>pDRIVE< MX eco	4V200	4V250	4V315
<b>Nominal data</b>			
Motor rating			
$P_N$ [kW]	200	250	315
$P_N$ [hp]	300	400	500
Continuous output power			
$S_{N400}$ [kVA] $V_N = 400$ V	268	333	427
$S_{N460}$ [kVA] $V_N = 460$ V	308	383	491
Continuous output current			
$I_{N400}$ [A] $V_N = 400$ V	387	481	616
$I_{N460}$ [A] $V_N = 460$ V	387	481	616
Maximum current for 60 s per 10 minutes			
$I_{MAX}$ [A]	464	577	739
<b>Input current (with option &gt;pDRIVE&lt; DCL-BOX)</b>			
$I_{IN400}$ [A] $V_N = 400$ V	338	418	527
$I_{IN460}$ [A] $V_N = 460$ V	331	435	544
<b>Characteristics</b>			
Efficiency [%]	> 97.7	> 97.7	> 97.7
Losses [W] at $I_N$	4450	5890	7250
Weight approx. [kg]	110	140	140
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	800	1200	1200
Sound pressure [dB(A)]	72	73	73
Mains short circuit c. [kA]	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>
<b>Dimensions</b>			
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 $\varnothing$ 11.5	4x $\varnothing$ 11.5	4x $\varnothing$ 11.5

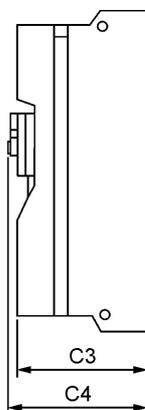


If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

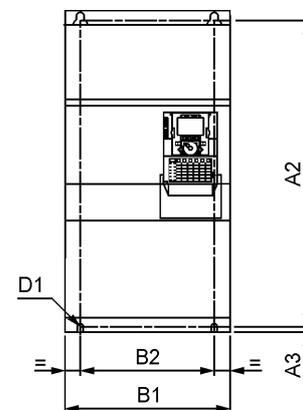
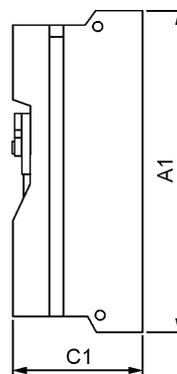
In either case avoid air short circuits.

<sup>1.)</sup> in combination with DC choke option >pDRIVE< DCL-BOX

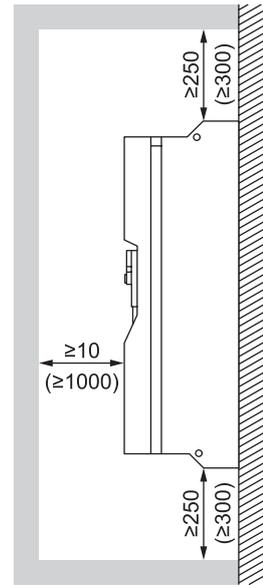
with 2 option cards



Basic device without or with 1 option card



>pDRIVE< MX eco	4V355	4V400	4V500	4V630
<b>Nominal data</b>				
Motor rating				
P <sub>N</sub> [kW]	355	400	500	630
P <sub>N</sub> [hp]	550	600	700	900
Continuous output power				
S <sub>N 400</sub> [kVA] V <sub>N</sub> = 400 V	465	526	652	823
S <sub>N 460</sub> [kVA] V <sub>N</sub> = 460 V	535	605	750	947
Continuous output current				
I <sub>N 400</sub> [A] V <sub>N</sub> = 400 V	671	759	941	1188
I <sub>N 460</sub> [A] V <sub>N</sub> = 460 V	671	759	941	1080
Maximum current for 60 s per 10 minutes				
I <sub>MAX</sub> [A]	805	911	1129	1426
<b>Input current (with option &gt;pDRIVE&lt; DCL-BOX)</b>				
I <sub>IN 400</sub> [A] V <sub>N</sub> = 400 V	592	660	834	1037
I <sub>IN 460</sub> [A] V <sub>N</sub> = 460 V	597	644	760	964
<b>Characteristics</b>				
Efficiency [%]	> 97.8	> 97.8	> 97.8	> 97.8
Losses [W] at I <sub>N</sub>	7660	8810	11150	13830
Weight approx. [kg]	215	215	225	300
<b>Ambient conditions</b>				
Volume cooling air [m <sup>3</sup> /h]	1800	1800	1800	2400
Sound pressure [dB(A)]	75	75	75	75
Mains short circuit c. [kA]	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>
<b>Dimensions</b>				
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 Ø11.5	5x Ø11.5	5x Ø11.5	6x Ø11.5



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.

<sup>1.)</sup> in combination with DC choke option >pDRIVE< DCL-BOX

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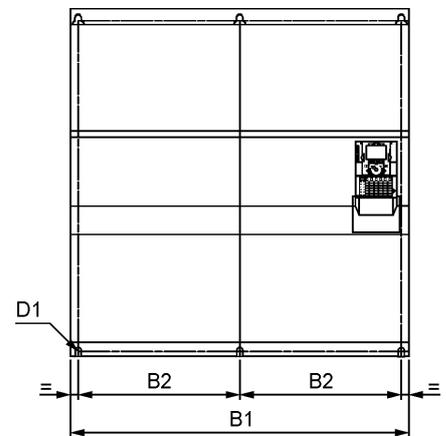
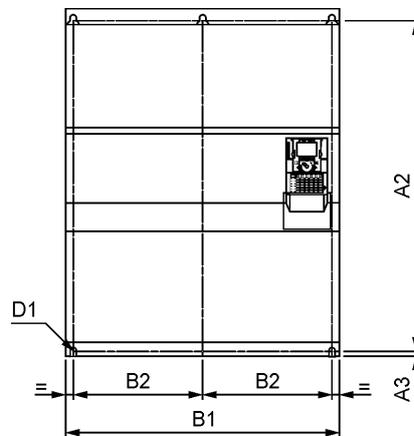
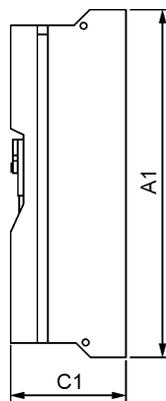
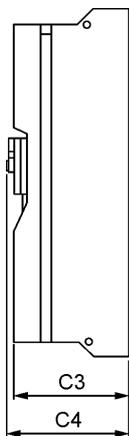
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2 option cards

0/1 option card

MX eco 4V400...4V500

MX eco 4V630



## Mounting place and mounting position

As it is usual with electronic built-in devices, the >pDRIVE< 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 139).



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

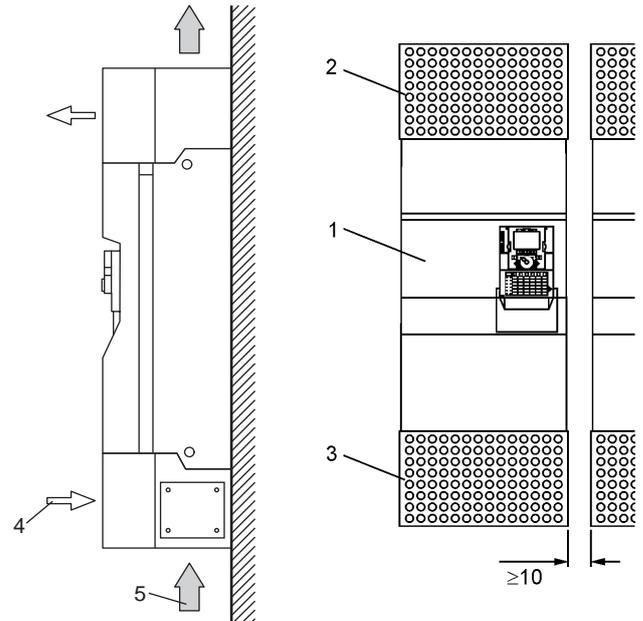
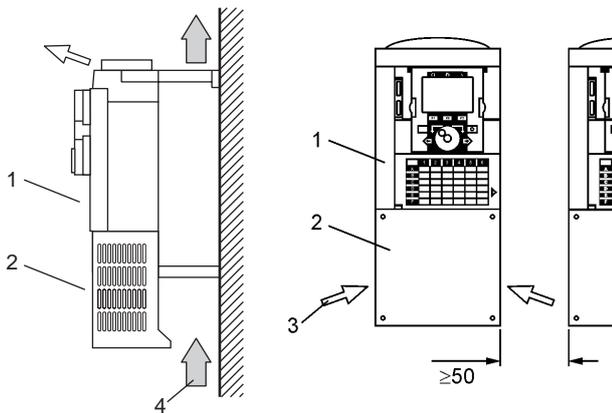
The >pDRIVE< MX eco is designed for installation on the wall or in an electrical room. When using the option >pDRIVE< TER-BOX and DCL-BOX (for devices from 90 kW on) the devices comply with protection degree IP21/31.

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

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

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

- 1 >pDRIVE< MX eco 4V90 ... 4V630
- 2 Option >pDRIVE< DCL-BOX
- 3 Option >pDRIVE< TER-BOX
- 4 Cooling air for control part
- 5 Cooling air for power part

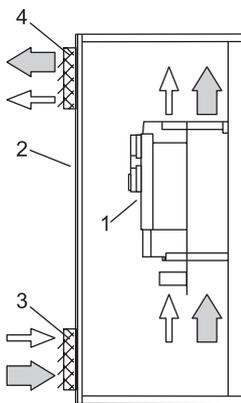
Protection degree: above IP41, all around IP21  
Ambient temperature: -10...+45°C

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

## 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.

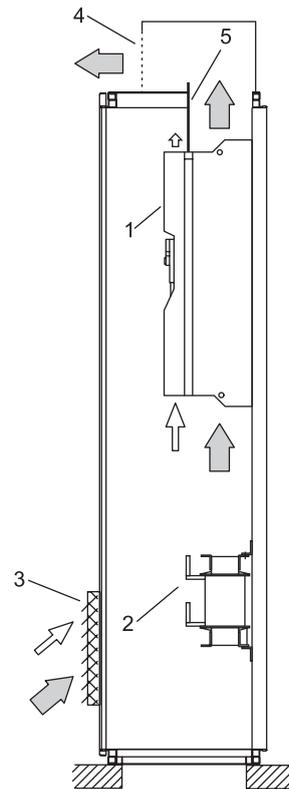
Cubicle installation protection degree IP23  
for frequency inverters up to 75 kW



- 1 >pDRIVE< 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 >pDRIVE< MX eco from 90 kW
- 2 Line choke option >pDRIVE< 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.

## Cubicle installation IP54

Cubicle installation IP54 with separated air flow or flange mounting:

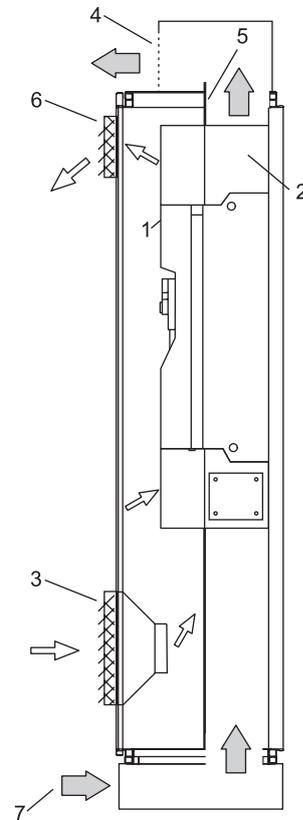
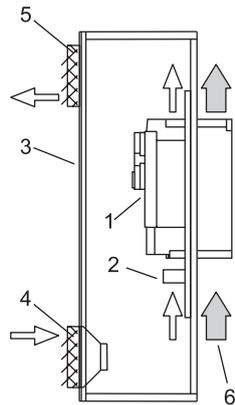
The power part of all devices is designed in IP54 and is sealed from the control electronics. In case of cubicle installation a plinth is necessary for separated air flow. The power part fan which is inside the device exhausts the losses of the power part (external). The losses of the control part must 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 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

Cubicle installation protection degree IP54 for frequency inverters from 90 kW



- 1 >pDRIVE< MX eco 4V0,75...4V75
- 2 >pDRIVE< 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

- 1 >pDRIVE< MX eco from 90 kW
- 2 >pDRIVE< 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

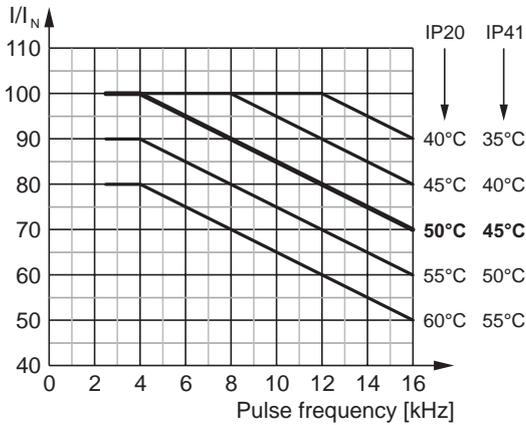
Protection degree: IP54  
Ambient temperature: -10...+40°C

Protection degree: IP54  
Ambient temperature: -10...+40°C

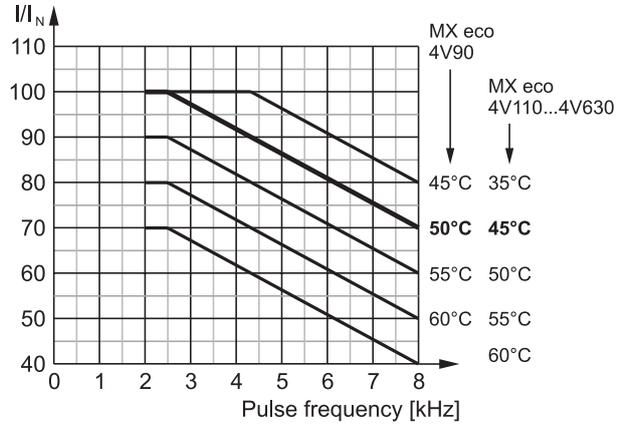
## Power decrease

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.

>pDRIVE< MX eco 4V0,75...4V75



>pDRIVE< 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 62).
- Select a motor which is at most one type bigger.



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



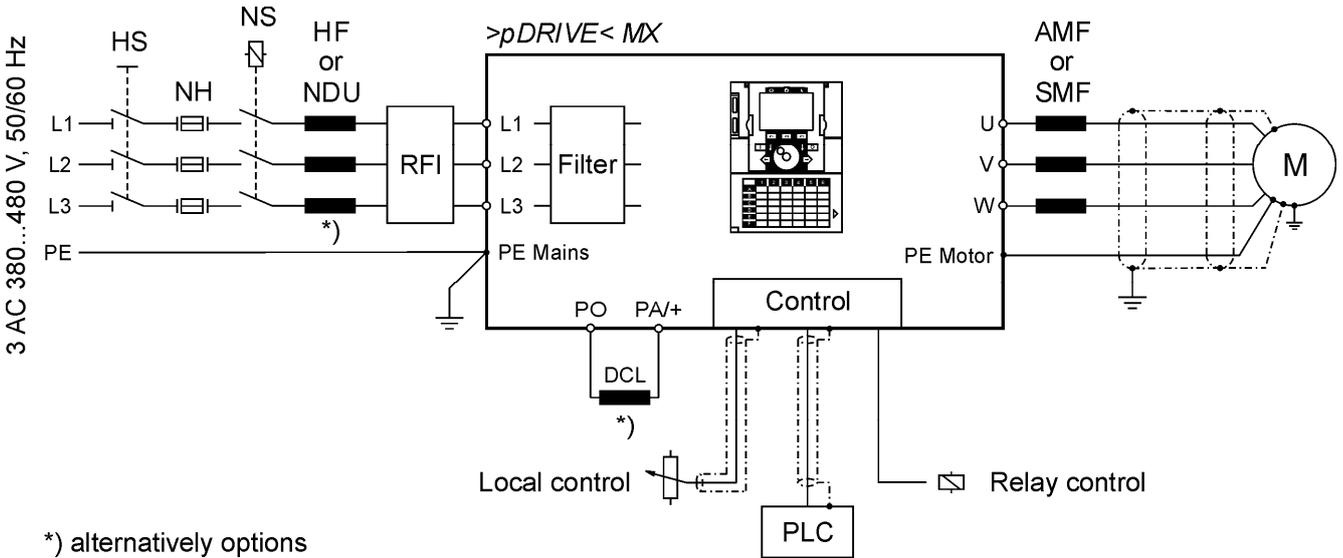
If the heat sink temperature is too high, the pulse frequency is automatically reduced to prevent an overload of the inverter.

# 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.

>pDRIVE< MX eco 4V0,75...4V400



>pDRIVE< MX..... Frequency inverter

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)

>pDRIVE< NDU .... Option line reactor to reduce the current main harmonics caused by the DC link, use as an alternative to the options >pDRIVE< HF and >pDRIVE< DCL

>pDRIVE< HF ..... Option mains current harmonic filter to reduce the current harmonics on the mains caused by the DC link, use as an alternative to the options >pDRIVE< NDU and >pDRIVE< DCL

>pDRIVE< RFI..... Option 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 >pDRIVE< MX eco 4V4,0)

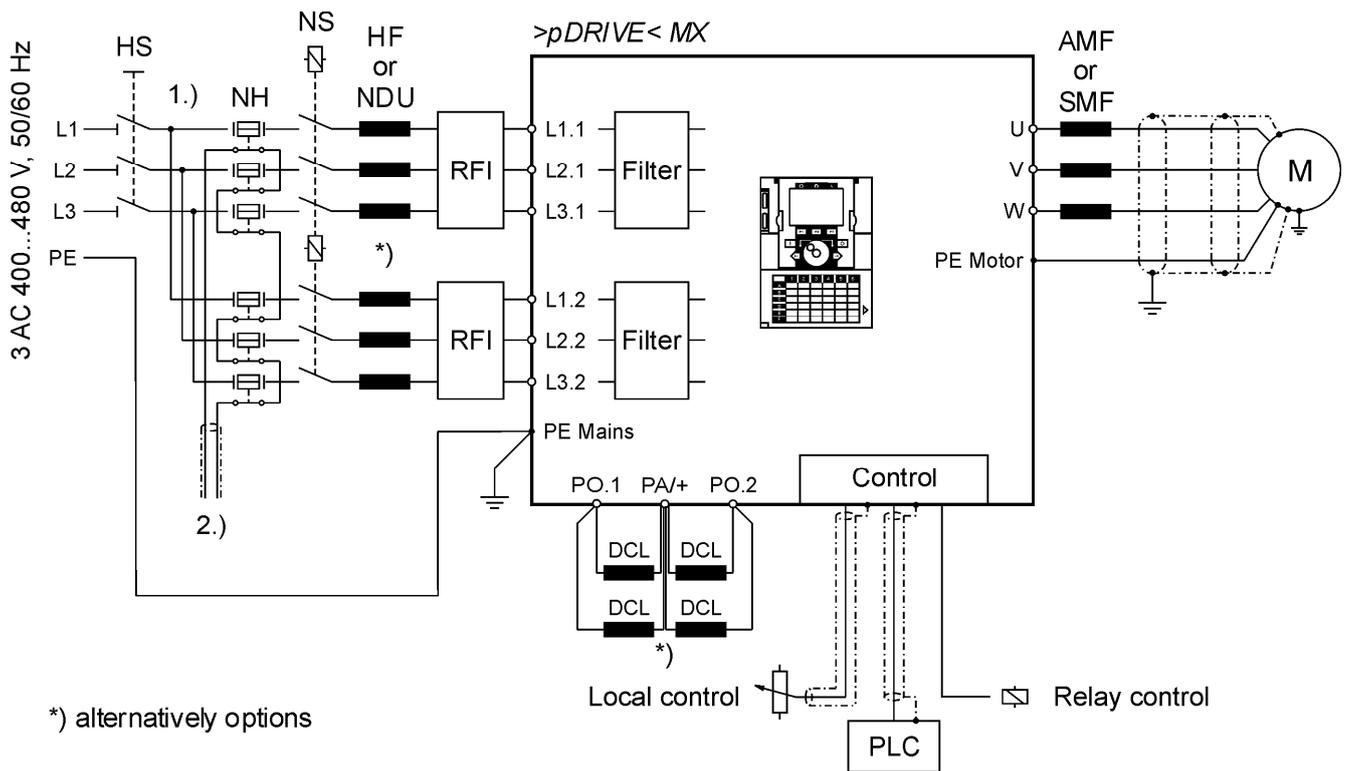
>pDRIVE< AMF .... Option Output motor filter to reduce the voltage peaks at the motor in case of long motor cables

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

>pDRIVE< DCL ..... Option DC choke to reduce the current harmonics, use as an alternative to the option >pDRIVE< NDU.

For MX eco 4V0,75...4V75 as an external option, above as add-on option available

>pDRIVE< MX eco 4V500...4V630



\*) alternatively options

>pDRIVE< MX.....Frequency inverter

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)

>pDRIVE< NDU .... Option line reactor to reduce the current main harmonics caused by the DC link, use as an alternative to the options >pDRIVE< HF and >pDRIVE< DCL

>pDRIVE< HF ..... Option mains current harmonic filter to reduce the current harmonics on the mains caused by the DC link, use as an alternative to the options >pDRIVE< NDU and >pDRIVE< DCL

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

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

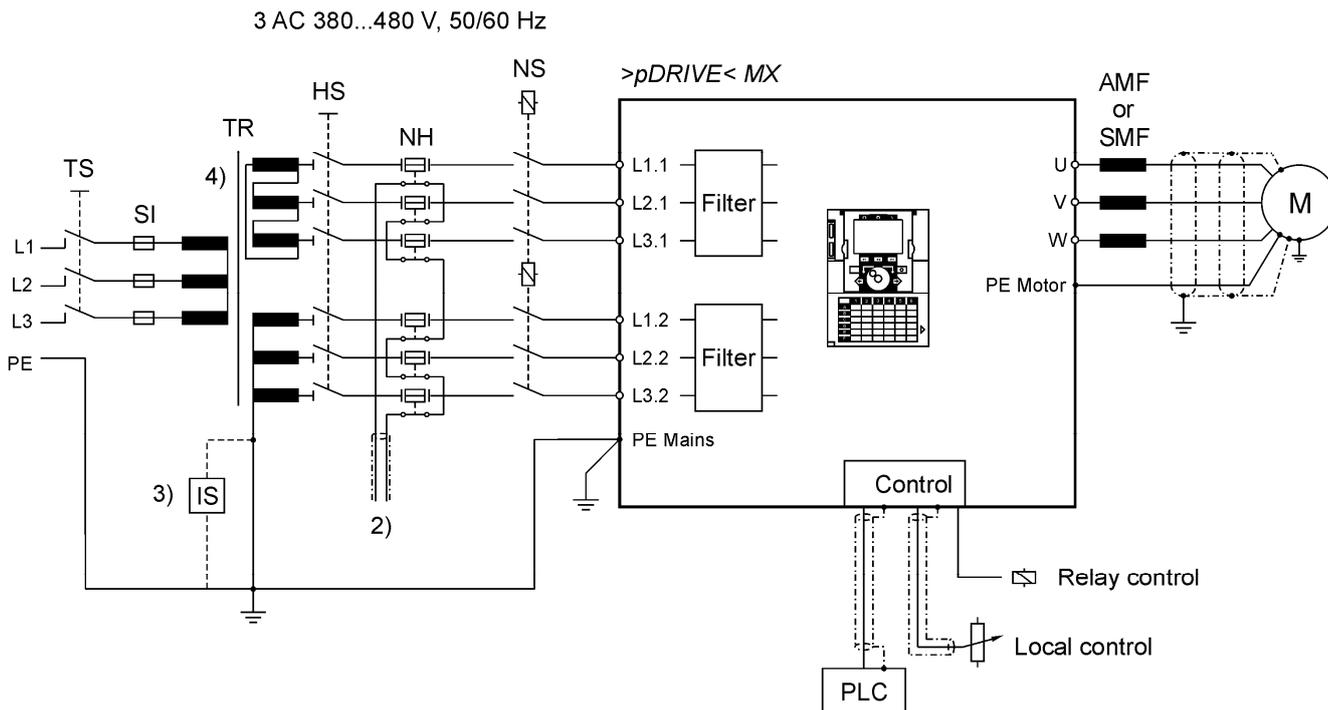
>pDRIVE< SMF..... Option sinus motor filter for nearly sinusoidal motor current and total prevention of additional noises at the motor

>pDRIVE< DCL .....Add-on option DC choke to reduce the current harmonics, use as an alternative to the option >pDRIVE< NDU.

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. Therefore set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).

>pDRIVE< MX eco 4V500...4V630

12-pulse rectification



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>pDRIVE< MX..... Frequency inverter

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"

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

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

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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. Therefore 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:  $\pm 5.0$  % 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.

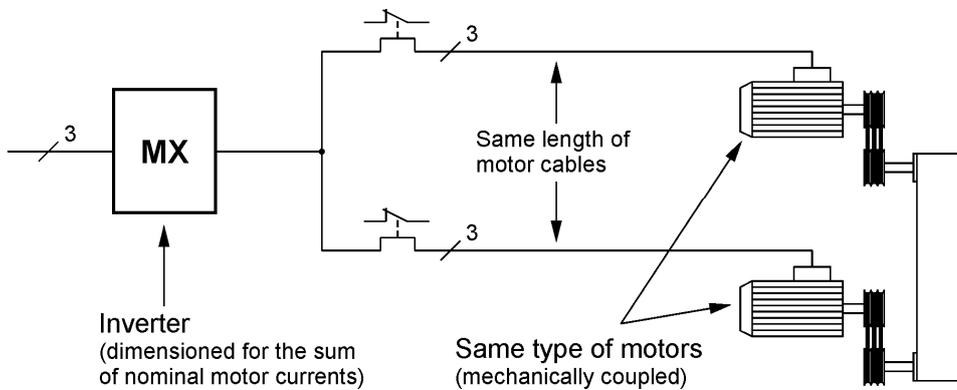
## Multi-motor operation

It is basically possible to operate several motors with a >pDRIVE< 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 !

## Fuses and cable cross sections

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

The below-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 <sup>1.)</sup>	Cu cable mm <sup>2</sup>	Mains fuse "inverter protection" "sf"	Lines in the cubicle mm <sup>2</sup> (per phase)	>pDRIVE< MX eco	Max. cont. current	Max. connection	Motor cable mm <sup>2</sup> <sup>3.)</sup>
10 A	3 x 1.5	10 A (sf)	1.5	4V0,75	2.3 A	6 mm <sup>2</sup>	3 x 1.5
10 A	3 x 1.5	10 A (sf)	1.5	4V1,5	4.1 A	6 mm <sup>2</sup>	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 <sup>2</sup>	3 x 1.5
16 [20] A	3 x 2.5	16 [20] A (sf)	2.5	4V3,0	7.8 A	6 mm <sup>2</sup>	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 <sup>2</sup>	3 x 1.5
25 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V5,5	14.3 A	6 mm <sup>2</sup>	3 x 2.5
32 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V7,5	17.6 A	6 mm <sup>2</sup>	3 x 2.5
40 [63] A	3 x 6 [16]	40 [63] A (sf)	6 [10]	4V11	27.7 A	16 mm <sup>2</sup>	3 x 4
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V15	33 A	35 mm <sup>2</sup>	3 x 6
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V18	41 A	35 mm <sup>2</sup>	3 x 10
63 [80] A	3 x 16 [25]	63 [80] A sf A	10 [16]	4V22	48 A	50 mm <sup>2</sup>	3 x 10
80 [100] A	3 x 25 [35]	80 [100] A sf A	16 [25]	4V30	66 A	50 mm <sup>2</sup>	3 x 16
100 [125] A	3 x 35 [50]	100 [125] A sf A	25 [35]	4V37	79 A	50 mm <sup>2</sup>	3 x 25
125 [160] A	3 x 50 [70]	125 [160] A sf B	35 [50]	4V45	94 A	120 mm <sup>2</sup>	3 x 35
160 [200] A	3 x 70 [95]	160 [200] A sf B	50 [70]	4V55	116 A	120 mm <sup>2</sup>	3 x 50
200 [250] A	3 x 95 [120]	200 [250] A sf B	70 [95]	4V75	160 A	120 mm <sup>2</sup>	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 <sup>2.)</sup> 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 <sup>2.)</sup> 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 option >pDRIVE< DCL, >pDRIVE< NDU or >pDRIVE< HF 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
$5 \cdot 10^3 \text{ A}^2\text{s}$	$50 \cdot 10^3 \text{ A}^2\text{s}$	$160 \cdot 10^3 \text{ A}^2\text{s}$	$320 \cdot 10^3 \text{ A}^2\text{s}$	$780 \cdot 10^3 \text{ A}^2\text{s}$	$1000 \cdot 10^3 \text{ A}^2\text{s}$



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.



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.

>pDRIVE<	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 211 and chapter "Line reactor NDU", page 216.

## 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< AMF.

Especially in case of big motors with middle up to high motor cable lengths the option >pDRIVE< 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:

>pDRIVE< 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

>pDRIVE< 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

Recommended maximum lengths of motor cables in 1st environment

>pDRIVE< options	4V0,75...4V4,0	4V5,5...4V45	4V55...4V630	Type of motor cable
<b>C1 residential environment - unrestricted sales (EN 55011 - class B group 1)</b>				
Option RFI	50 m	50 m	–	screened
<b>C2 residential environment - EMC qualified user (EN 55011 - class A group 1)</b>				
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)

>pDRIVE< options	4V0,75...4V4,0	4V5,5...4V45	4V55...4V630	Type of motor cable
<b>C3 (EN 55011 - class A group 2)</b>				
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
<b>C4 (EMC concept)</b>				
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 >pDRIVE< 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.

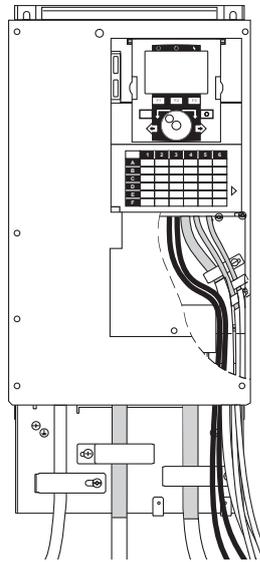
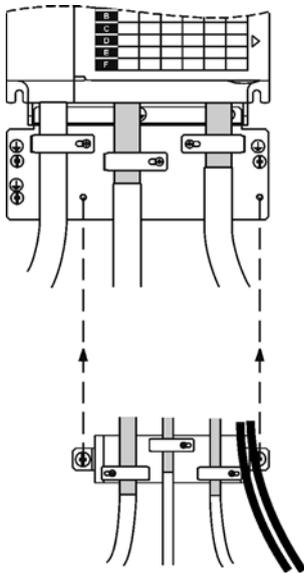
All >pDRIVE< MX eco & pro 4V0,75...4V75 and MX pro 6V2,2/3,0...6V75/90 inverters are delivered with an EMC plate including screws and suitable cable clamps. It is used to fix all cables to the inverter and presents an optimal connection between motor cable screen and radio interference filter. Moreover,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

>pDRIVE< MX eco & pro 4V0,75...4V18

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

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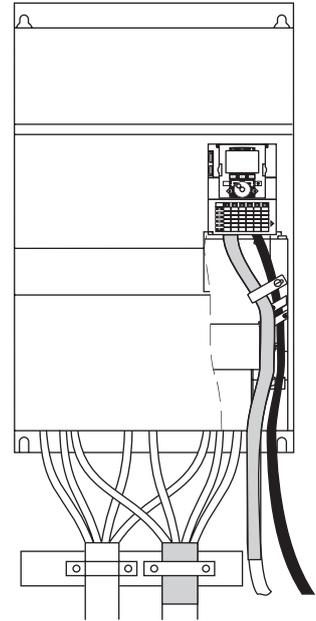
The total height of the inverter alters when using the EMC plate corresponding to this additional element.

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

For the leading-in of the control wires the >pDRIVE< 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 >pDRIVE< RFI is established via a well-conductive mounting plate. Alternatively the terminal box option >pDRIVE< TER-BOX can be used.



## Control terminals

The frequency inverters >pDRIVE< 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 >pDRIVE< IO11 and >pDRIVE< IO12 are available. The same option card can be plugged in only one time per unit.



The inverters >pDRIVE< 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 >pDRIVE< IO11	Option >pDRIVE< 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
<b>Inputs</b>					
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
<b>Outputs</b>					
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

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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).

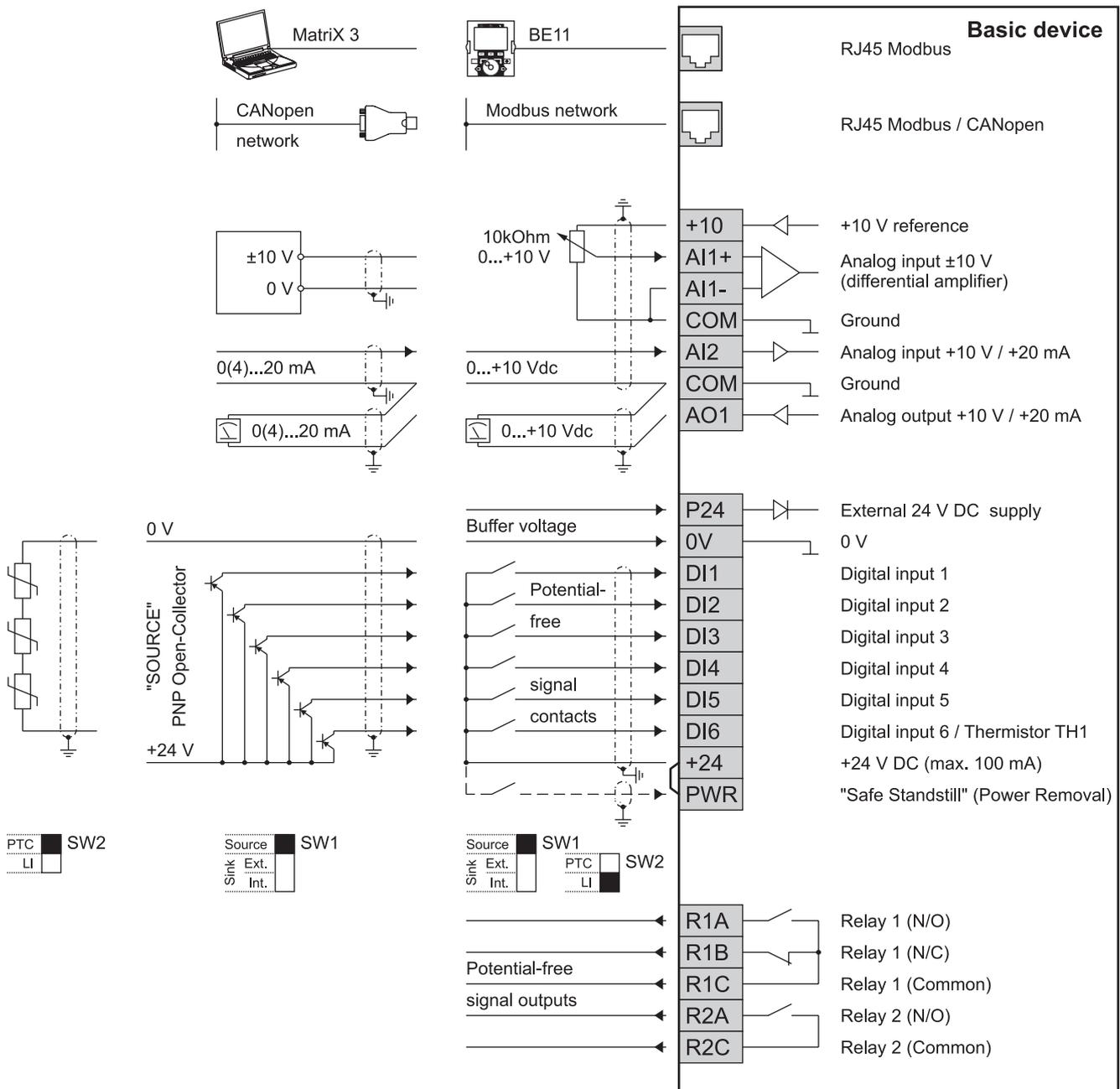
The whole electronics is separated from the power part according to EN 50178 PELV (Protective-Extra-Low-Voltage) in compliance with "Protective separation" by double insulation.

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".

## 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.

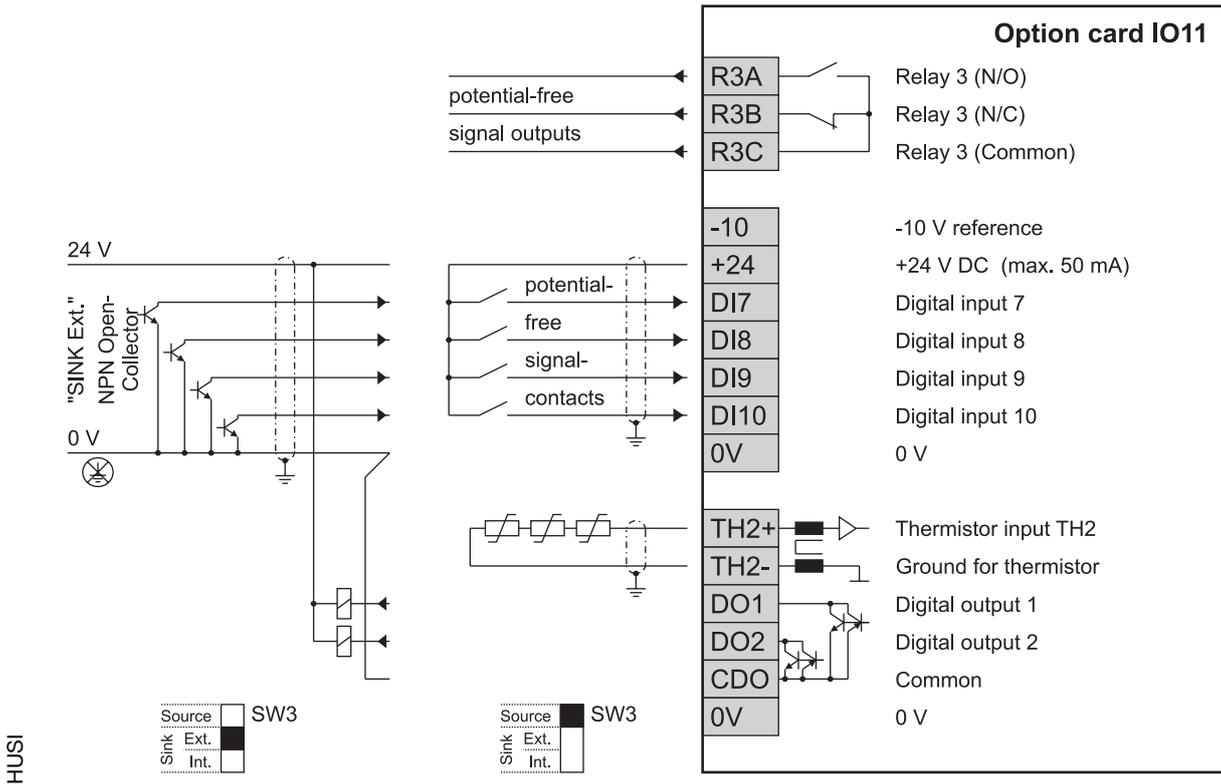
The inverters *>pDRIVE< MX eco* are equipped with a built-in interface for control via Modbus. In addition to the external wiring (connection to the T-pieces in the bus line) only the adjustment of few parameters is necessary.

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 201.

## Control terminals of option card IO11



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The terminal extension  $\text{>pDRIVE< IO11}$  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.



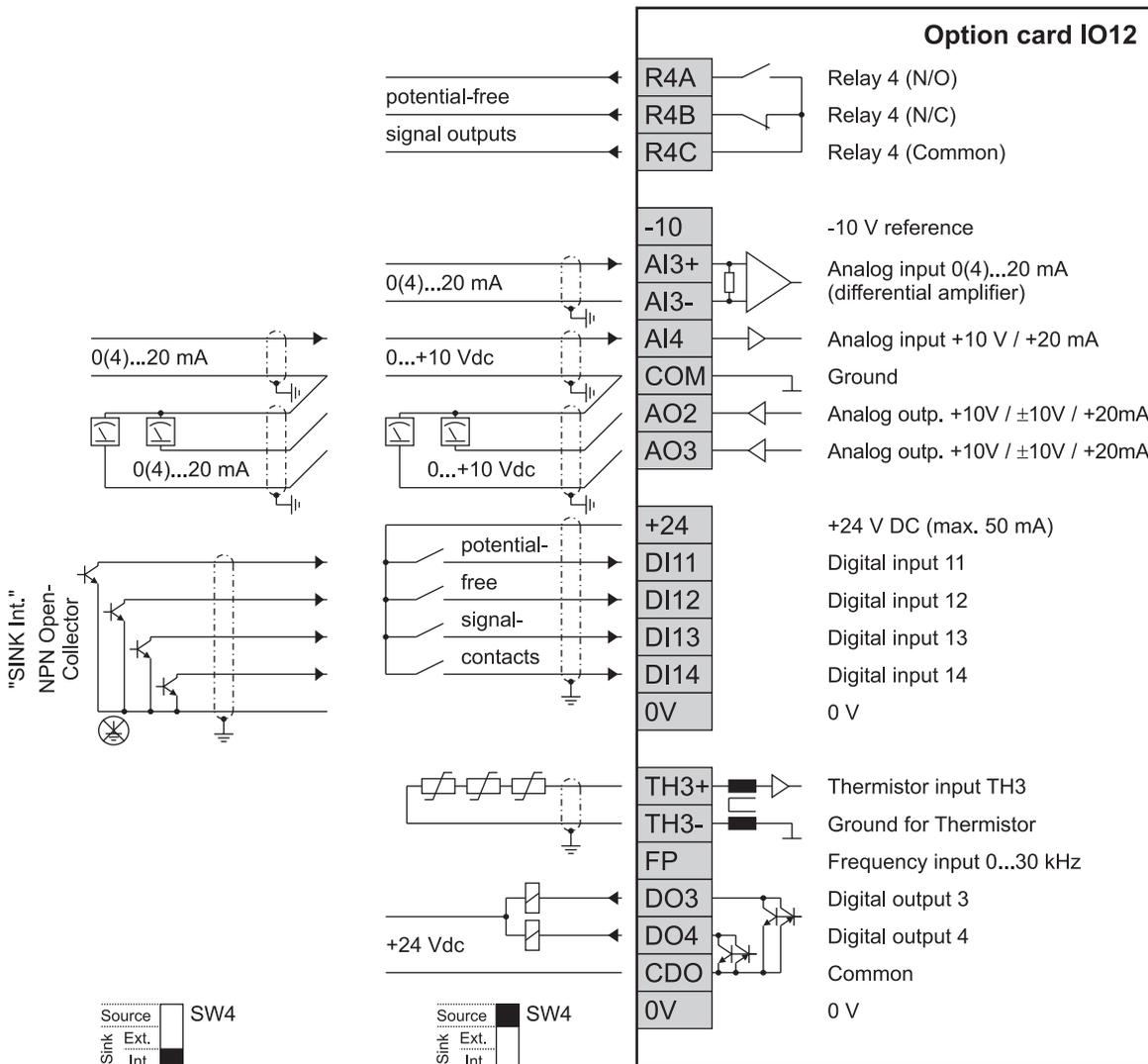
A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 201.



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



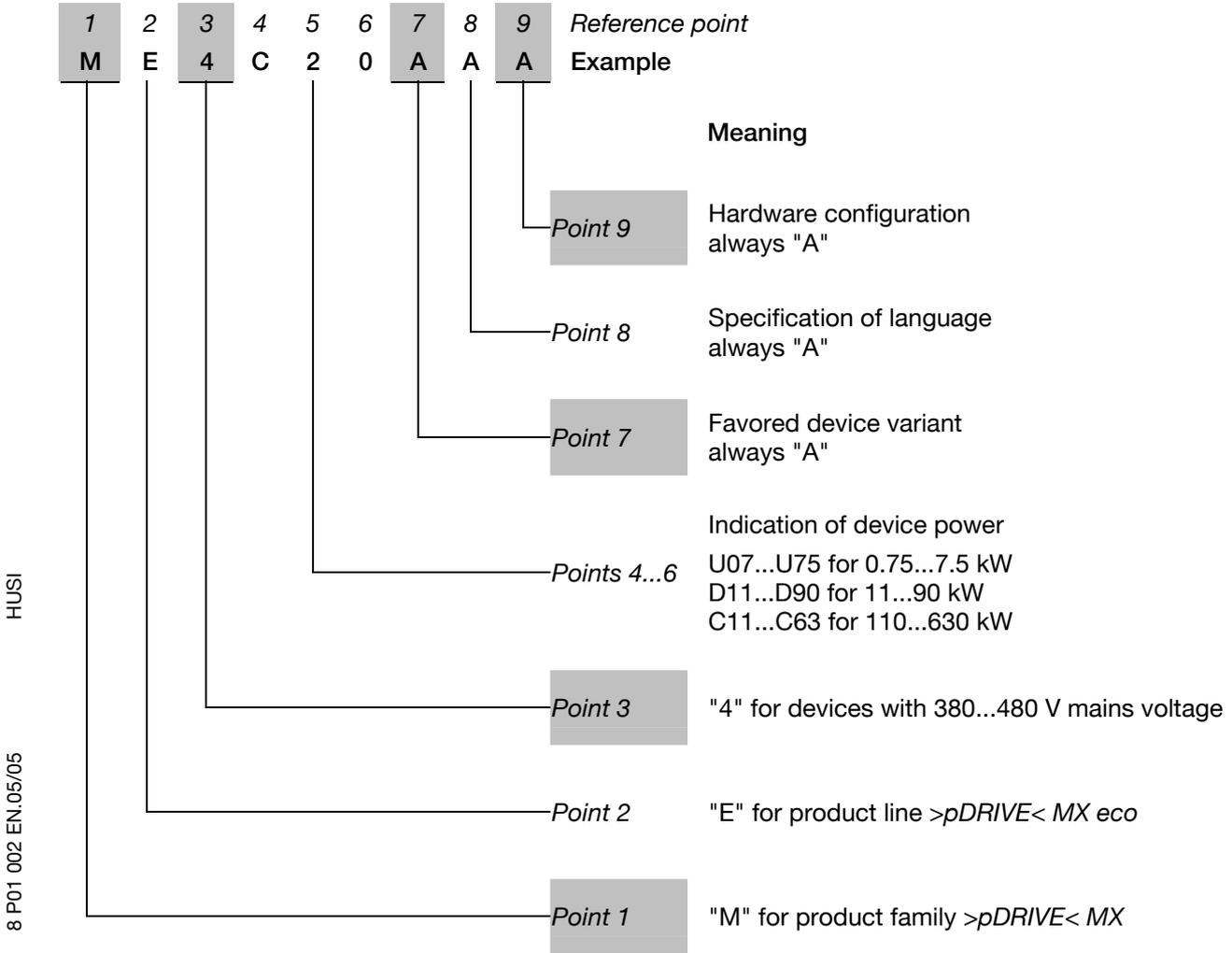
The terminal extension *>pDRIVE< IO12* can be plugged in addition or as an alternative to the option *>pDRIVE< IO11*. The card cannot be used twice.

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



Options for the inverter device must be ordered additionally. The respective order numbers are given in chapter "Options", as from page 189.

## Documentation

The documentation of the >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< MX eco	8 P01 025 DE 8 P01 025 EN	Technical data, valid standards, mounting, connection, ambient conditions
Operating instructions Modbus for >pDRIVE< MX eco	8 P01 033 DE 8 P01 033 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions CANopen for >pDRIVE< 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 >pDRIVE< 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.pdrive.com](http://www.pdrive.com).

## Available options for >pDRIVE< MX eco inverters

To enlarge the field of applications for the frequency inverters >pDRIVE< 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
<b>Operating options</b>			
>pDRIVE< BE11	8 P01 100/A...G	Matrix operating panel affords optimal operating comfort by means of the matrix philosophy	Page 190
>pDRIVE< DMK11	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 192
>pDRIVE< DMK11-IP65	8 P01 121	Transparent IP65 cover for the door mounting kit of the operating panel BE11	
>pDRIVE< CABLE3-BE	8 P01 122	Connecting cable operating panel – inverter with 3 m length	
>pDRIVE< CABLE10-BE	8 P01 123	Connecting cable operating panel – inverter with 10 m length	Page 23
Manual-CD >pDRIVE< MX eco & pro	8 P01 021	This CD-ROM provides the whole documentation of the inverter as well as the PC program Matrix 3	
>pDRIVE< CABLE3-PC	8 P01 124	Connecting cable inverter – PC with 3 m length, incl. RS232/485 interface converter on the computer side	
>pDRIVE< ADAP BLUE	8 P01 126	Bluetooth adapter	
>pDRIVE< RS232/485	8 P01 304	RS232/485 interface converter with supply and active bus connection	
>pDRIVE< MATRIX REMOTE LINK	8 P01 128	Remote maintenance option for analog modem connection or Ethernet network.	
>pDRIVE< ADAP RJ45	8 P01 127	RJ45 F/F adapter is required for the connection of the operating panel BE11 to the connecting cable	
<b>Control options</b>			
>pDRIVE< IO11	8 P01 101	Terminal extension for additional digital inputs and outputs	Page 201
>pDRIVE< IO12	8 P01 102	Terminal extension for additional analog and digital inputs and outputs	
>pDRIVE< MODBUS T-ADAP 03	8 P01 300	Modbus T-adapter with 0.3 m connecting cable	Page 197
>pDRIVE< MODBUS T-ADAP 1	8 P01 301	Modbus T-adapter with 1 m connecting cable	
>pDRIVE< MODBUS RC	8 P01 302	Bus termination RC	
>pDRIVE< MODBUS SPLITTER	8 P01 303	Divides the Modbus signal into eight further channels	
>pDRIVE< MODBUS PLUG	8 P01 305	RJ45 connector IP20 with quick-connecting technology	Page 199
>pDRIVE< ADAP CAN	8 P01 125	RJ45/Sub-D adapter for the connection of the inverter to a CANopen fieldbus network	
>pDRIVE< CANOPEN PLUG	8 P01 307	Connector for the CANopen network	
>pDRIVE< PBO11	8 P01 103	Option card for control of the inverter via Profibus DP	Page 200
>pDRIVE< PROFIBUS PLUG	8 P01 306	Connector for the Profibus network	

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## Options depending on the power

Designation	Order number	Brief description	Reference
<b>Options depending on the power</b>			
>pDRIVE< RFI	See following allocation table	Additional radio interference filter to reduce the high-frequency interferences for use in residential environment	Page 207
>pDRIVE< DCL		DC choke to reduce the mains current harmonics to THD I ≤ 45 %	Page 211
>pDRIVE< NDU		Three-phase choke to reduce the mains current harmonics to THD I ≤ 45 %	Page 216
>pDRIVE< FPK		Mounting kit to install a DC choke or line reactor behind the inverter	Page 220
>pDRIVE< HF		Harmonic filter to reduce the mains current harmonics significantly (alternatively to NDU)	Page 221
>pDRIVE< AMF		Output motor filter enables the use of the inverter with long motor cables and limits the voltage peaks in the motor	Page 233
>pDRIVE< 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 237
>pDRIVE< TER-BOX		Terminal box which is attached at the bottom of the inverter for mechanical support and connection of the motor cable screen	Page 243
>pDRIVE< FLANGE		Flange mounting kit to install the inverter in flange mounting technology (heat sink outside the cubicle)	Page 246
>pDRIVE< CMK		Cubicle mounting kit for an optimal mounting of the frequency inverter in a Rittal TS8 cubicle	Page 249
>pDRIVE< RMK	Mounting kit in order to replace the old >pDRIVE< MX basic & plus devices without anew drilling	Page 252	

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Allocation table for options depending on the power

>pDRIVE<	Option >pDRIVE< RFI	Option >pDRIVE< DCL	Option *) >pDRIVE< FPK	Option >pDRIVE< NDU	Option >pDRIVE< HF-A
MX eco 4V0,75	RFI 480/12-TN 8 P01 280	DCL 2 8 P01 200	FPK 155x260 8 P01 461	NDU 10 8 P01 238	–
MX eco 4V1,5	RFI 480/12-TN 8 P01 280	DCL 4 8 P01 201	FPK 155x260 8 P01 461	NDU 10 8 P01 238	–
MX eco 4V2,2	RFI 480/12-TN 8 P01 280	DCL 8 8 P01 202	FPK 155x260 8 P01 461	NDU 10 8 P01 238	–
MX eco 4V3,0	RFI 480/26-TN 8 P01 281	DCL 8 8 P01 202	FPK 155x260 8 P01 461	NDU 10 8 P01 238	–
MX eco 4V4,0	RFI 480/26-TN 8 P01 281	DCL 11 8 P01 203	FPK 155x260 8 P01 461	NDU 23 8 P01 239	HF-A 4V7 8 P01 400
MX eco 4V5,5	RFI 480/35-TN 8 P01 282	DCL 14 8 P01 204	FPK 175x295 8 P01 462	NDU 23 8 P01 239	HF-A 4V13 8 P01 401
MX eco 4V7,5	RFI 480/35-TN 8 P01 282	DCL 19 8 P01 205	FPK 175x295 8 P01 462	NDU 23 8 P01 239	HF-A 4V13 8 P01 401
MX eco 4V11	RFI 480/46-TN 8 P01 283	DCL 27 8 P01 206	FPK 210x295 8 P01 463	NDU 23 8 P01 239	HF-A 4V18 8 P01 402
MX eco 4V15	RFI 480/72-TN 8 P01 284	DCL 44 8 P01 207	FPK 230x400 8 P01 464	NDU 40 8 P01 220	HF-A 4V24 8 P01 403
MX eco 4V18	RFI 480/72-TN 8 P01 284	DCL 44 8 P01 207	FPK 230x400 8 P01 464	NDU 40 8 P01 220	HF-A 4V24 8 P01 403
MX eco 4V22	RFI 480/90-TN 8 P01 285	DCL 85 8 P01 208	FPK 240x420 8 P01 465	NDU 70 8 P01 221	HF-A 4V30 8 P01 404
MX eco 4V30	RFI 480/92-TN 8 P01 286	DCL 85 8 P01 208	FPK 240x550 8 P01 466	NDU 70 8 P01 221	HF-A 4V50 8 P01 405
MX eco 4V37	RFI 480/92-TN 8 P01 286	DCL 85 8 P01 208	FPK 240x550 8 P01 466	NDU 100 8 P01 222	HF-A 4V50 8 P01 405
MX eco 4V45	RFI 480/180-TN 8 P01 287	DCL 171 8 P01 209	–	NDU 100 8 P01 222	HF-A 4V70 8 P01 406
MX eco 4V55	RFI 480/180-TN 8 P01 287	DCL 171 8 P01 209	–	NDU 160 8 P01 223	HF-A 4V70 8 P01 406
MX eco 4V75	RFI 480/180-TN 8 P01 287	DCL 171 8 P01 209	–	NDU 160 8 P01 223	HF-A 4V100 8 P01 407
MX eco 4V90	RFI 480/300-TN 8 P01 288	DCL-BOX 240 8 P01 210	–	NDU 195 8 P01 224	HF-A 4V125 8 P01 408
MX eco 4V110	RFI 480/300-TN 8 P01 288	DCL-BOX 240 8 P01 210	–	NDU 235 8 P01 225	HF-A 4V150 8 P01 409
MX eco 4V132	RFI 480/300-TN 8 P01 288	DCL-BOX 290 8 P01 211	–	NDU 280 8 P01 226	HF-A 4V150 8 P01 409
MX eco 4V160	RFI 480/300-TN 8 P01 288	DCL-BOX 350 8 P01 212	–	NDU 315 8 P01 227	HF-A 4V200 8 P01 410
MX eco 4V200	RFI 480/600-TN 8 P01 289	DCL-BOX 490 8 P01 213	–	NDU 365 8 P01 228	HF-A 4V255 8 P01 412
MX eco 4V250	RFI 480/600-TN 8 P01 289	DCL-BOX 570 8 P01 214	–	NDU 475 8 P01 230	2 x HF-A 4V150 2 x 8 P01 409
MX eco 4V315	RFI 480/600-TN 8 P01 289	DCL-BOX 700 8 P01 215	–	NDU 650 8 P01 233	2 x HF-A 4V200 2 x 8 P01 410
MX eco 4V355	RFI 480/800-TN 8 P01 290	DCL-BOX 860 8 P01 216	–	NDU 760 8 P01 234	2 x HF-A 4V200 2 x 8 P01 410
MX eco 4V400	RFI 480/800-TN 8 P01 290	DCL-BOX 860 8 P01 216	–	NDU 760 8 P01 234	2 x HF-A 4V225 2 x 8 P01 411
MX eco 4V500	2 x RFI 480/600-TN 2 x 8 P01 289	DCL-BOX 1160 8 P01 217	–	2 x NDU 540 2 x 8 P01 231	4 x HF-A 4V150 4 x 8 P01 409
MX eco 4V630	2 x RFI 480/600-TN 2 x 8 P01 289	DCL-BOX 1400 8 P01 218	–	2 x NDU 620 2 x 8 P01 232	4 x HF-A 4V200 4 x 8 P01 410

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\*) The option >pDRIVE< FPK can be used for mounting the option >pDRIVE< DCL behind the inverter.

>pDRIVE<	Option >pDRIVE< AMF	Option >pDRIVE< SMF	Option >pDRIVE< TER-BOX	Option >pDRIVE< FLANGE
MX eco 4V0,75	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 130 8 P01 240	FLANGE 130 x 230 8 P01 180
MX eco 4V1,5	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 130 8 P01 240	FLANGE 130 x 230 8 P01 180
MX eco 4V2,2	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 130 8 P01 240	FLANGE 130 x 230 8 P01 180
MX eco 4V3,0	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 155 8 P01 241	FLANGE 155 x 260 8 P01 181
MX eco 4V4,0	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 155 8 P01 241	FLANGE 155 x 260 8 P01 181
MX eco 4V5,5	AMF 48-1 8 P01 141	SMF 480/16 8 P01 149	TER-BOX 175 8 P01 242	FLANGE 175 x 295 8 P01 182
MX eco 4V7,5	AMF 48-1 8 P01 141	SMF 480/33 8 P01 150	TER-BOX 175 8 P01 242	FLANGE 175 x 295 8 P01 182
MX eco 4V11	AMF 48-1 8 P01 141	SMF 480/33 8 P01 150	TER-BOX 210 8 P01 243	FLANGE 210 x 295 8 P01 183
MX eco 4V15	AMF 48-1 8 P01 141	SMF 480/33 8 P01 150	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184
MX eco 4V18	AMF 48-1 8 P01 141	SMF 480/66 8 P01 151	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184
MX eco 4V22	AMF 48-1 8 P01 141	SMF 480/66 8 P01 151	TER-BOX 240 8 P01 245	FLANGE 240 x 420 8 P01 185
MX eco 4V30	AMF 90-1 8 P01 142	SMF 480/66 8 P01 151	TER-BOX 241 8 P01 246	FLANGE 240 x 550 8 P01 186
MX eco 4V37	AMF 90-1 8 P01 142	SMF 480/95 8 P01 152	TER-BOX 241 8 P01 246	FLANGE 240 x 550 8 P01 186
MX eco 4V45	AMF 90-1 8 P01 142	SMF 480/95 8 P01 152	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187
MX eco 4V55	AMF 215-3 8 P01 143	SMF 480/180 8 P01 153	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187
MX eco 4V75	AMF 215-3 8 P01 143	SMF 480/180 8 P01 153	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187
MX eco 4V90	AMF 215-3 8 P01 143	SMF 480/180 8 P01 153	TER-BOX 310 8 P01 248	FLANGE 310 x 680 8 P01 188
MX eco 4V110	AMF 215-3 8 P01 143	SMF 480/200 8 P01 154	TER-BOX 310 8 P01 248	FLANGE 310 x 680 8 P01 188
MX eco 4V132	AMF 320-3 8 P01 144	SMF 480/300 8 P01 155	TER-BOX 350 8 P01 249	FLANGE 350 x 780 8 P01 189
MX eco 4V160	AMF 320-3 8 P01 144	SMF 480/400 8 P01 156	TER-BOX 330 8 P01 250	FLANGE 330 x 950 8 P01 190
MX eco 4V200	AMF 480-3 8 P01 145	SMF 480/400 8 P01 156	TER-BOX 430 8 P01 251	FLANGE 430 x 950 8 P01 191
MX eco 4V250	AMF 480-3 8 P01 145	SMF 480/600 8 P01 157	TER-BOX 585 8 P01 252	FLANGE 585 x 950 8 P01 192
MX eco 4V315	AMF 760-3 8 P01 146	SMF 480/600 8 P01 157	TER-BOX 585 8 P01 252	FLANGE 585 x 950 8 P01 192
MX eco 4V355	AMF 760-3 8 P01 146	SMF 480/1200 8 P01 158	TER-BOX 880 8 P01 253	—
MX eco 4V400	AMF 760-3 8 P01 146	SMF 480/1200 8 P01 158	TER-BOX 880 8 P01 253	—
MX eco 4V500	AMF 1190-3 8 P01 147	SMF 480/1200 8 P01 158	TER-BOX 880 8 P01 253	—
MX eco 4V630	AMF 1190-3 8 P01 147	SMF 480/1200 8 P01 158	TER-BOX 1100 8 P01 254	—

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>pDRIVE<	Option CMK-IP23	Option CMK-IP54FL	Option CMK-IP54GL	Option >pDRIVE< RMK
MX eco 4V0,75	–	–	–	–
MX eco 4V1,5	–	–	–	–
MX eco 4V2,2	–	–	–	–
MX eco 4V3,0	–	–	–	–
MX eco 4V4,0	–	–	–	RMK BG-A/4,0 8 P01 470
MX eco 4V5,5	–	–	–	RMK BG-A/5,5 8 P01 471
MX eco 4V7,5	–	–	–	RMK BG-B/7,5 8 P01 472
MX eco 4V11	–	–	–	RMK BG-A/11 8 P01 473
MX eco 4V15	–	–	–	RMK BG-1/15-22 + 6V 8 P01 475
MX eco 4V18	–	–	–	RMK BG-1/15-22 + 6V 8 P01 475
MX eco 4V22	–	–	–	RMK BG-1/15-22 + 6V 8 P01 475
MX eco 4V30	–	–	–	RMK BG-1/30-37 8 P01 476
MX eco 4V37	–	–	–	RMK BG-1/30-37 8 P01 476
MX eco 4V45	–	–	–	RMK BG-2/45 8 P01 477
MX eco 4V55	–	–	–	RMK BG-2/55-75 8 P01 478
MX eco 4V75	–	–	–	RMK BG-2/55-75 8 P01 478
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	–



# >pDRIVE< MX pro 4V

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

The >pDRIVE< MX pro adds even more numerous functions to the well-known and extremely well-proven features of the >pDRIVE< 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 156
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 >pDRIVE< 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 189
Wall-mounting in IP21 / IP31	Compact wall-mounting device with terminal box as a cheap alternative to the cubicle installation	Page 243
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 246
Optimized for cubicle installation	>pDRIVE< 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 150

## 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 21
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 19
PC software	Free PC program Matrix 3 for commissioning, programming, documentation and analysis	Page 23
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 200
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 30
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 139
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 176
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 139

## Useful functions



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

# Specification

## Technical data

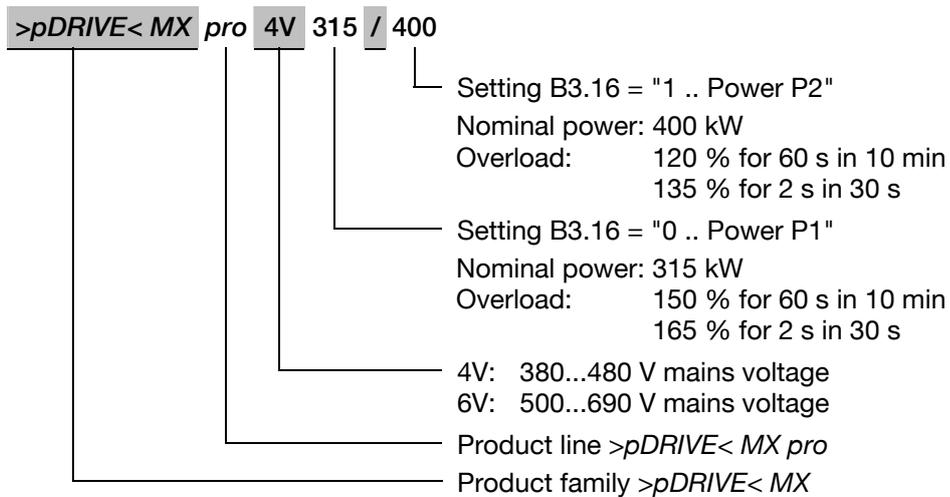
The frequency inverters *>pDRIVE< MX pro 4V* from type 4V90/110 as well as the devices of the *>pDRIVE< MX pro 6V* range are equipped with a dual rating function.

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 of "1 .. Power P2").

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

Example



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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 50178
Power factor	Fundamental (displacement factor): > 0.98 Total ( $\lambda$ ) at full load: 0.93...0.95 (with AC- or DC choke) Total ( $\lambda$ ) 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 (> <i>pDRIVE</i> < <i>MX pro 4V...-SY</i> 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	<i>MX pro 4V0,75...4V75</i> : 4 kHz, adjustable from 2...16 kHz <i>MX pro 4V90/110...4V500/630</i> : 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 <i>MX pro 4V0,75...4V75</i> : 1.5 mm at 3...13 Hz, 1 g at 13...200 Hz (3M3 according to IEC/EN 60721-3-3) <i>MX pro 4V90/110...4V500/630</i> : 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 <i>MX pro 4V0,75...4V75</i> : 15 g for 11 ms (3M3 according to IEC/EN 60721-3-3) <i>MX pro 4V90/110...4V132/160</i> : 7 g for 11 ms (3M3 according to IEC/EN 60721-3-3) <i>MX pro 4V160/200...4V500/630</i> : 4 g for 11 ms (3M2 according to IEC/EN 60721-3-3)

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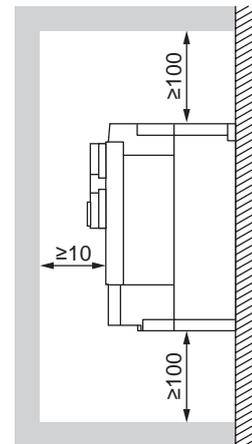
\*) Technical data and remarks for mains voltages are given in chapter "Mains conditions", page 30.

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	>pDRIVE< MX pro 4V0,75...4V75: bottom, sideways, front IP21 top IP41 (IP20 without protective cover) >pDRIVE< 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 >pDRIVE< MX pro 4V0,75...4V75: 3C1 and 3S2 according to EN 60721-3-3 >pDRIVE< MX pro 4V90/110...4V500/630: 3C2 and 3S2 according to EN 60721-3-3
Protection class	Class 1 according to EN 50178
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 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 C1, C2, C3
Insulation	Galvanic insulation in accordance with EN 50178 PELV (Protective Extra Low Voltage)
Approvals	CE, UL, CSA, GOST, ATEX

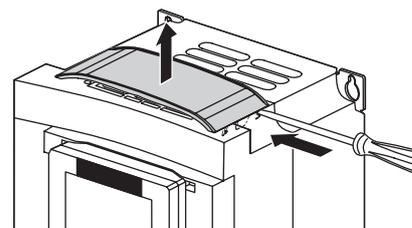


Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

>pDRIVE< MX pro	4V0,75	4V1,5	4V2,2	4V3,0	4V4,0
<b>Nominal data</b>					
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					
$S_{N400}$ [kVA] $V_N = 400$ V	1.6	2.8	4.0	5.4	7.3
$S_{N460}$ [kVA] $V_N = 460$ V	1.8	3.3	4.6	6.2	8.4
Continuous output current					
$I_{N400}$ [A] $V_N = 400$ V	2.3	4.1	5.8	7.8	10.5
$I_{N460}$ [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
<b>Input current (without choke)</b>					
$I_{IN400}$ [A] $V_N = 400$ V	3.7	5.8	8.2	10.7	14.1
$I_{IN460}$ [A] $V_N = 460$ V	3.0	5.3	7.1	9	11.5
<b>Braking unit</b>					
$P_{CONT}$ [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
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]	56/500	56/250	56/175	34/125	34/100
<b>Characteristics</b>					
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
<b>Ambient conditions</b>					
Volume cooling air [m <sup>3</sup> /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
<b>Dimensions</b>					
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 $\varnothing$ 4.5				



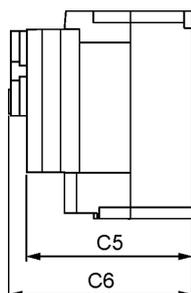
For installation keep a minimum distance of 50 mm between the units and the side wall.



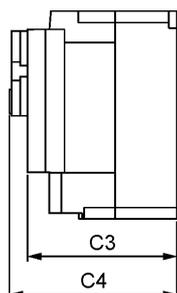
When you remove the IP41 protective cover the units can be mounted without any distance sideways. See also chapter "Power decrease", page 154.

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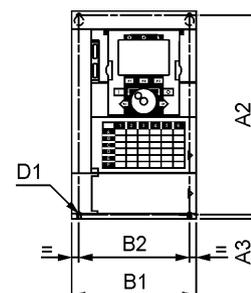
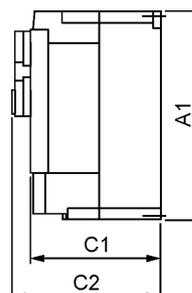
with 2 option cards



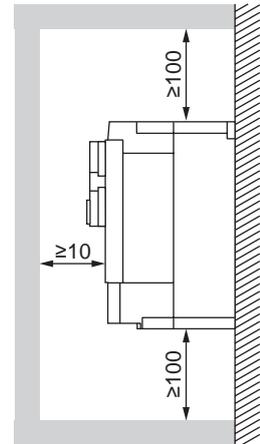
with 1 option card



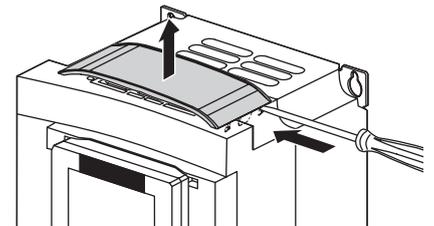
Basic device without option card



>pDRIVE< MX pro	4V5,5	4V7,5	4V11	4V15	4V18
<b>Nominal data</b>					
Motor rating					
P <sub>N</sub> [kW] - Power 1	5.5	7.5	11	15	18.5
P <sub>N</sub> [hp] - Power 1	7.5	10	15	20	25
Continuous output power					
S <sub>N400</sub> [kVA] V <sub>N</sub> = 400 V	9.9	12.2	19.2	23	28
S <sub>N460</sub> [kVA] V <sub>N</sub> = 460 V	11.4	14	22	26	33
Continuous output current					
I <sub>N400</sub> [A] V <sub>N</sub> = 400 V	14.3	17.6	27.7	33	41
I <sub>N460</sub> [A] V <sub>N</sub> = 460 V	14.3	17.6	27.7	33	41
Maximum current for 60 s per 10 minutes					
I <sub>MAX</sub> [A] - Power 1	21.5	26.4	42	50	62
<b>Input current (without choke)</b>					
I <sub>IN400</sub> [A] V <sub>N</sub> = 400 V	20.3	27.0	36.6	48	46
I <sub>IN460</sub> [A] V <sub>N</sub> = 460 V	17.0	22.2	30.0	39	38
<b>Braking unit</b>					
P <sub>CONT</sub> [kW]	5.5	7.5	11	15	18.5
P <sub>MAX</sub> for 60 s [kW]	8.3	11	17	23	28
R <sub>MIN</sub> / R <sub>MAX</sub> [Ω]	25/75	20/55	15/38	14/28	14/24
<b>Characteristics</b>					
Efficiency [%]	> 96.5	> 97.0	> 97.0	> 97.0	> 97.0
Losses [W] at I <sub>N</sub>	180	220	320	390	485
Weight approx. [kg]	5.5	5.5	7	9	9
<b>Ambient conditions</b>					
Volume cooling air [m <sup>3</sup> /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
<b>Dimensions</b>					
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 Ø5.5				

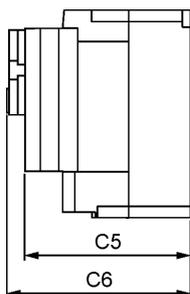


For installation keep a minimum distance of 50 mm between the units and the side wall.

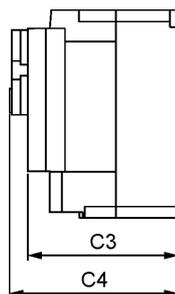


When you remove the IP41 protective cover the units can be mounted without any distance sideways.  
See also chapter "Power decrease", page 154.

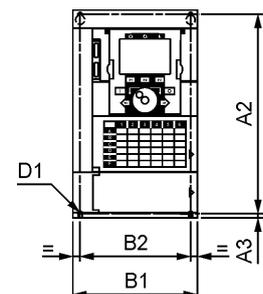
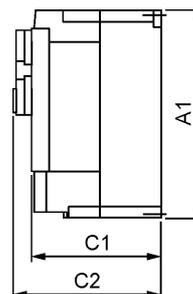
with 2 option cards



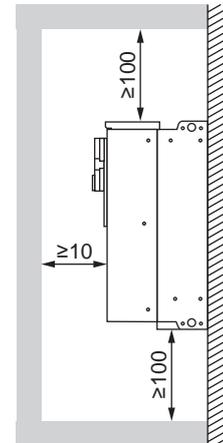
with 1 option card



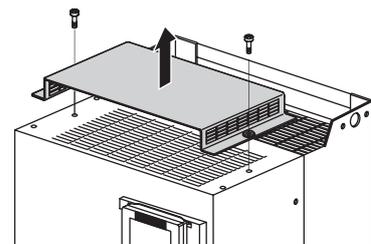
Basic device without option card



>pDRIVE< MX pro	4V22	4V30	4V37
<b>Nominal data</b>			
Motor rating			
$P_N$ [kW] - Power 1	22	30	37
$P_N$ [hp] - Power 1	30	40	50
Continuous output power			
$S_{N400}$ [kVA] $V_N = 400$ V	33	46	55
$S_{N460}$ [kVA] $V_N = 460$ V	38	53	63
Continuous output current			
$I_{N400}$ [A] $V_N = 400$ V	48	66	79
$I_{N460}$ [A] $V_N = 460$ V	48	66	79
Maximum current for 60 s per 10 minutes			
$I_{MAX}$ [A] - Power 1	72	99	119
<b>Input current (without choke)</b>			
$I_{IN400}$ [A] $V_N = 400$ V	50	66	84
$I_{IN460}$ [A] $V_N = 460$ V	42	56	69
<b>Braking unit</b>			
$P_{CONT}$ [kW]	22	30	37
$P_{MAX}$ for 60 s [kW]	33	45	56
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]	14/20	10/15	7/12
<b>Characteristics</b>			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at $I_N$	720	980	1180
Weight approx. [kg]	19	26	26
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	200	200	200
Sound pressure [dB(A)]	60	64	64
Mains short circuit c. [kA]	22	22	22
<b>Dimensions</b>			
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 $\varnothing$ 5.5	4 x $\varnothing$ 5.5	4 x $\varnothing$ 5.5



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

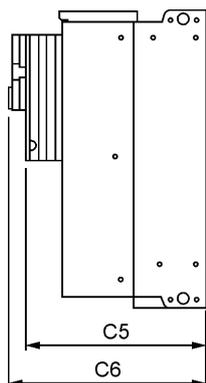


When you remove the IP41 protective cover the units can be mounted without any distance sideways. See also chapter "Power decrease", page 154.

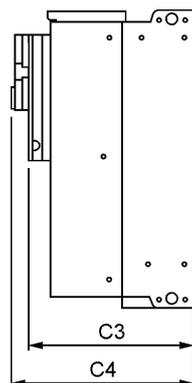
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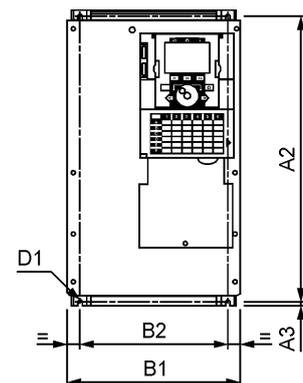
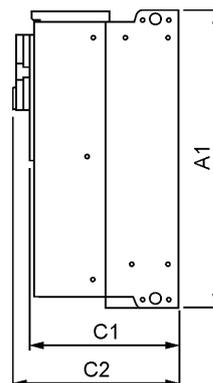
with 2 option cards



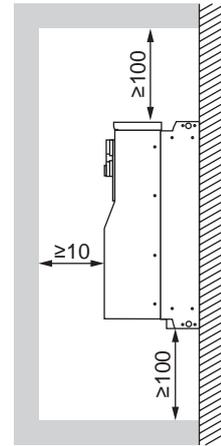
with 1 option card



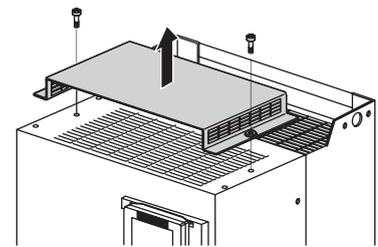
Basic device without option card



>pDRIVE< MX pro	4V45	4V55	4V75
<b>Nominal data</b>			
Motor rating			
$P_N$ [kW] - Power 1	45	55	75
$P_N$ [hp] - Power 1	60	75	100
Continuous output power			
$S_{N400}$ [kVA] $V_N = 400$ V	65	80	111
$S_{N460}$ [kVA] $V_N = 460$ V	75	92	128
Continuous output current			
$I_{N400}$ [A] $V_N = 400$ V	94	116	160
$I_{N460}$ [A] $V_N = 460$ V	94	116	160
Maximum current for 60 s per 10 minutes			
$I_{MAX}$ [A] - Power 1	141	174	240
<b>Input current (without choke)</b>			
$I_{IN400}$ [A] $V_N = 400$ V	104	120	167
$I_{IN460}$ [A] $V_N = 460$ V	85	101	137
<b>Braking unit</b>			
$P_{CONT}$ [kW]	45	55	75
$P_{MAX}$ for 60 s [kW]	68	83	113
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]	5/10	4/8	3.3/6
<b>Characteristics</b>			
Efficiency [%]	> 97.0	> 97.0	> 97.0
Losses [W] at $I_N$	1360	1560	2320
Weight approx. [kg]	44	44	44
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	400	400	400
Sound pressure [dB(A)]	64	64	64
Mains short circuit c. [kA]	22	22	22
<b>Dimensions</b>			
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 $\varnothing$ 9	4 x $\varnothing$ 9	4 x $\varnothing$ 9

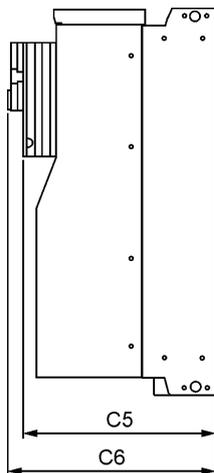


For installation keep a minimum distance of 50 mm between the units and the side wall.

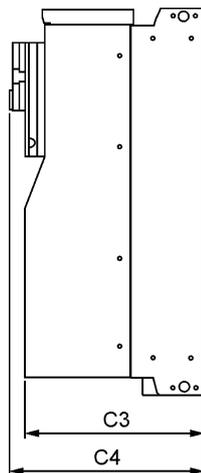


When you remove the IP41 protective cover the units can be mounted without any distance sideways.  
See also chapter "Power decrease", page 154.

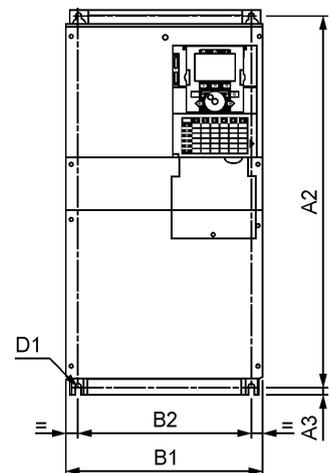
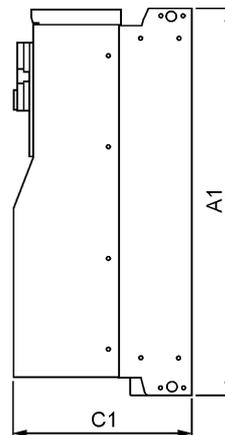
with 2 option cards



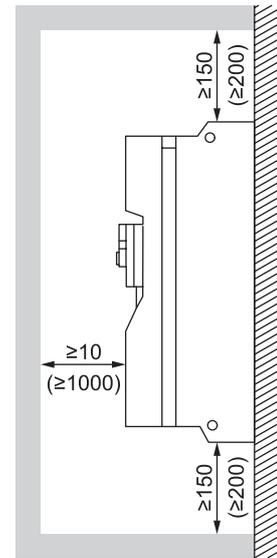
with 1 option card



Basic device without option card



>pDRIVE< MX pro	4V90/110	4V110/132	4V132/160
<b>Nominal data</b>			
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			
$S_{N400}$ [kVA] $V_N = 400$ V	124/149	149/179	179/218
$S_{N460}$ [kVA] $V_N = 460$ V	143/171	171/206	206/250
Continuous output current			
$I_{N400}$ [A] $V_N = 400$ V	179/215	215/259	259/314
$I_{N460}$ [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
<b>Input current (with option &gt;pDRIVE&lt; DCL-BOX)</b>			
$I_{IN400}$ [A] $V_N = 400$ V	159/188	194/226	229/271
$I_{IN460}$ [A] $V_N = 460$ V	143/168	173/224	225/275
<b>Braking unit</b>			
$P_{CONT}$ [kW]	70	85	100
$P_{MAX}$ for 10 s [kW]	135	165	200
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]	2.5/5.0	2.1/4.0	1.75/3.5
<b>Characteristics</b>			
Efficiency [%]	> 97.5	> 97.5	> 97.6
Losses [W] at $I_N$	2210/2810	2520/3330	2950/3710
Weight approx. [kg]	60	74	80
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	400	600	600
Sound pressure [dB(A)]	61	69	71
Mains short circuit c. [kA]	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>
<b>Dimensions</b>			
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 $\varnothing$ 11.5	4x $\varnothing$ 11.5	4x $\varnothing$ 11.5

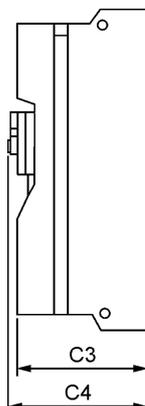


If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

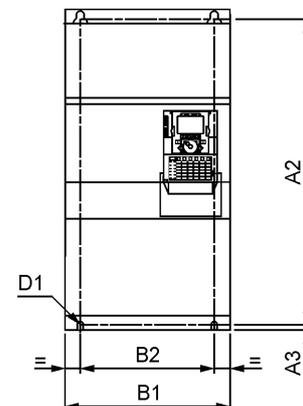
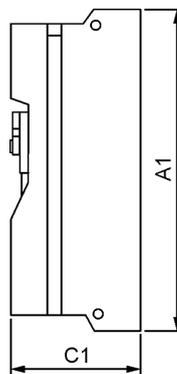
In either case avoid air short circuits.

<sup>1.)</sup> in combination with DC choke option >pDRIVE< DCL-BOX

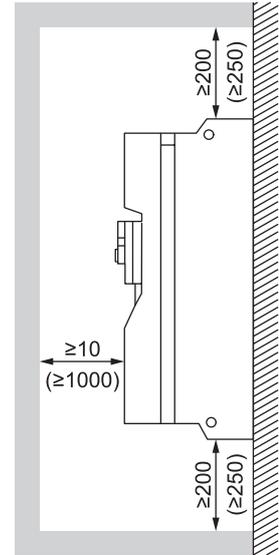
with 2 option cards



Basic device without or with 1 option card



>pDRIVE< MX pro	4V160/200	4V200/250	4V250/315
<b>Nominal data</b>			
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			
$S_{N400}$ [kVA] $V_N = 400$ V	218/268	268/333	333/427
$S_{N460}$ [kVA] $V_N = 460$ V	250/308	308/383	383/491
Continuous output current			
$I_{N400}$ [A] $V_N = 400$ V	314/387	387/481	481/616
$I_{N460}$ [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
<b>Input current (with option &gt;pDRIVE&lt; DCL-BOX)</b>			
$I_{IN400}$ [A] $V_N = 400$ V	277/338	340/418	424/527
$I_{IN460}$ [A] $V_N = 460$ V	281/331	333/435	442/544
<b>Braking unit</b>			
$P_{CONT}$ [kW]	120	200 <sup>2.)</sup>	200 <sup>2.)</sup>
$P_{MAX}$ for 10 s [kW]	240	300	375
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]	1.75/2.75	1.05/2.2	1.05/1.75
<b>Characteristics</b>			
Efficiency [%]	> 97.7	> 97.7	> 97.7
Losses [W] at $I_N$	3490/4450	4560/5890	5430/7250
Weight approx. [kg]	110	140	140
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	800	1200	1200
Sound pressure [dB(A)]	72	73	73
Mains short circuit c. [kA]	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>
<b>Dimensions</b>			
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 $\varnothing$ 11.5	4x $\varnothing$ 11.5	4x $\varnothing$ 11.5

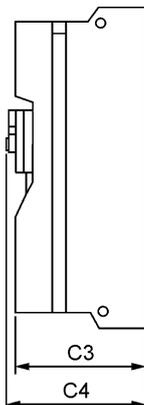


If the devices are installed without any free space sideways, higher minimum distances are required for sufficient cooling (values in brackets).

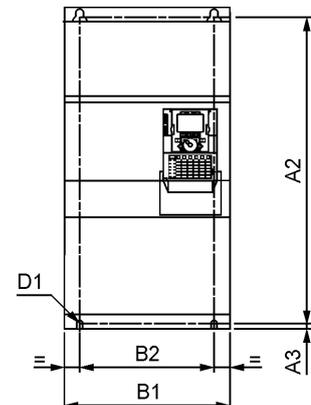
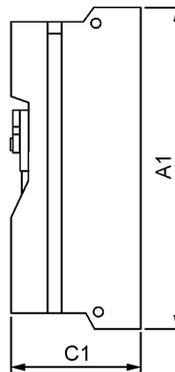
In either case avoid air short circuits.

- 1.) in combination with DC choke option >pDRIVE< DCL-BOX  
2.) external braking unit

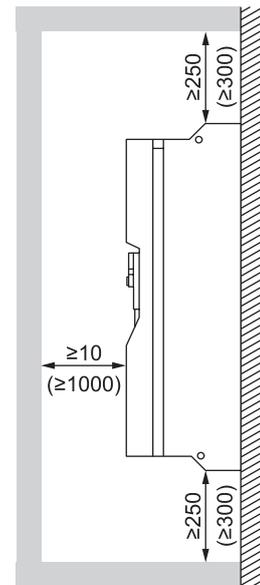
with 2 option cards



Basic device without or with 1 option card



>pDRIVE< MX pro	4V315/400	4V400/500	4V500/630
<b>Nominal data</b>			
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			
$S_{N400}$ [kVA] $V_N = 400$ V	427/526	526/652	652/823
$S_{N460}$ [kVA] $V_N = 460$ V	491/605	605/750	750/861
Continuous output current			
$I_{N400}$ [A] $V_N = 400$ V	616/759	759/941	941/1188
$I_{N460}$ [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
<b>Input current (with option &gt;pDRIVE&lt; DCL-BOX)</b>			
$I_{IN400}$ [A] $V_N = 400$ V	529/660	675/834	834/1037
$I_{IN460}$ [A] $V_N = 460$ V	547/644	660/760	761/964
<b>Braking unit</b>			
$P_{CONT}$ [kW]	400 <sup>2.)</sup>	400 <sup>2.)</sup>	400 <sup>2.)</sup>
$P_{MAX}$ for 10 s [kW]	475	600	750
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]	0.7/1.4	0.7/1.1	0.7/0.85
<b>Characteristics</b>			
Efficiency [%]	> 97.8	> 97.8	> 97.8
Losses [W] at $I_N$	6880/8810	8630/11150	10530/13830
Weight approx. [kg]	215	225	300
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]	1800	1800	2400
Sound pressure [dB(A)]	75	75	75
Mains short circuit c. [kA]	50 <sup>1.)</sup>	50 <sup>1.)</sup>	50 <sup>1.)</sup>
<b>Dimensions</b>			
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 $\varnothing$ 11.5	5x $\varnothing$ 11.5	6x $\varnothing$ 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.

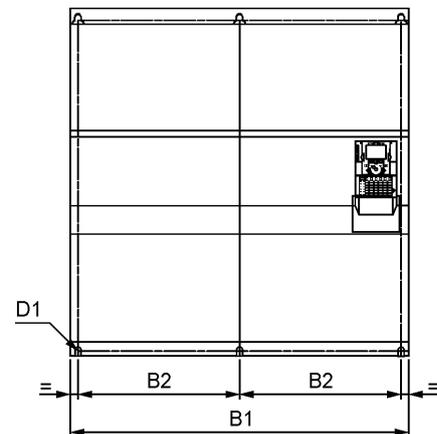
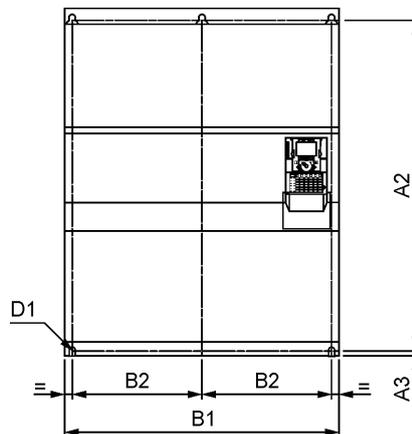
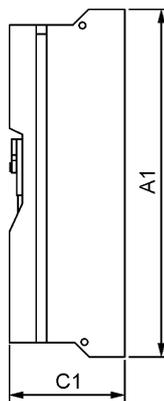
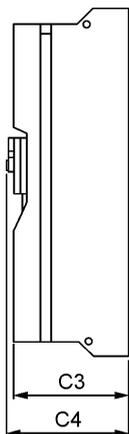
- 1.) in combination with DC choke option >pDRIVE< DCL-BOX
- 2.) external braking unit

2 option cards

0/1 option card

MX pro 4V315/400...4V400/500

MX pro 4V500/630



## Mounting place and mounting position

As it is usual with electronic built-in devices, the >pDRIVE< 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 139).



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.



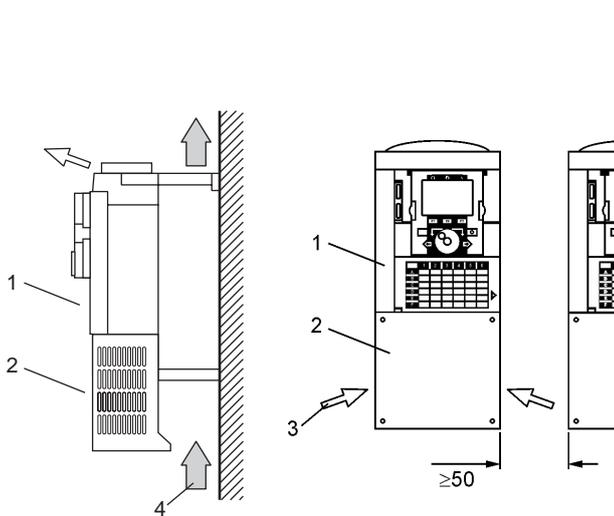
Do not install the device near heat generating equipment.

# Wall-mounting

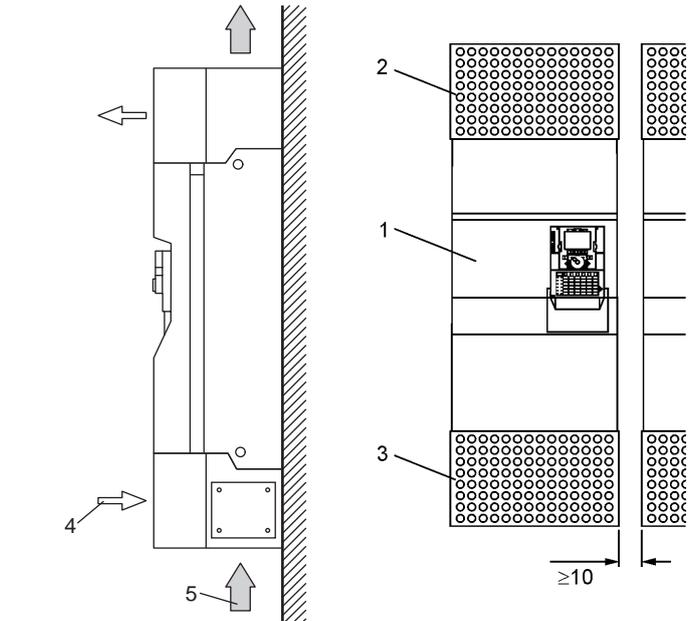
The >pDRIVE< MX pro is designed for installation on the wall or in an electrical room. When using the option >pDRIVE< TER-BOX and DCL-BOX (for devices from 90 kW on) the devices comply with protection degree IP21/31.

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



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



- 1 >pDRIVE< MX pro 4V0,75 ... 4V75
- 2 Option >pDRIVE< TER-BOX 130...320
- 3 Cooling air for control part
- 4 Cooling air for power part

- 1 >pDRIVE< MX pro 4V90 ... 4V630
- 2 Option >pDRIVE< DCL-BOX
- 3 Option >pDRIVE< TER-BOX
- 4 Cooling air for control part
- 5 Cooling air for power part

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

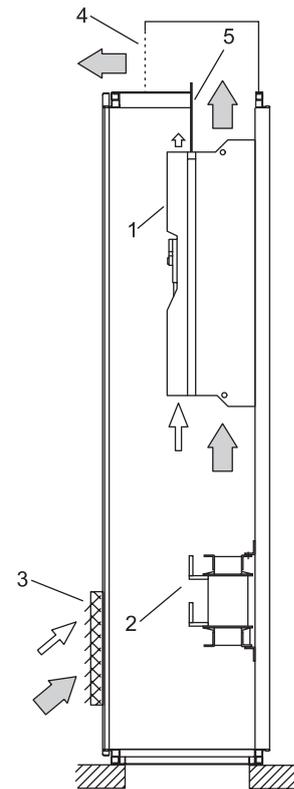
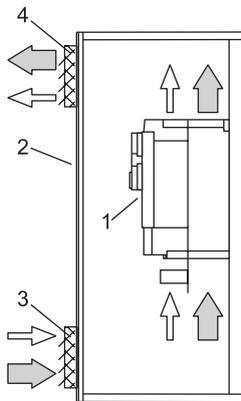
Protection degree: IP31  
 Ambient temperature: -10...+45°C

## 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

Cubicle installation protection degree IP23  
for frequency inverters from 90 kW



- 1 >pDRIVE< 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

- 1 >pDRIVE< MX pro from 90 kW
- 2 Line choke option >pDRIVE< 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

Protection degree: IP23

Ambient temperature: -10...+40°C



For RITTAL TS8 cubicles an optional installation kit is available.

## Cubicle installation IP54

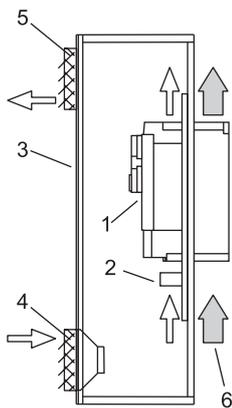
Cubicle installation IP54 with separated air flow or flange mounting:

The power part of all devices is designed in IP54 and is sealed from the control electronics. In case of cubicle installation a plinth 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 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

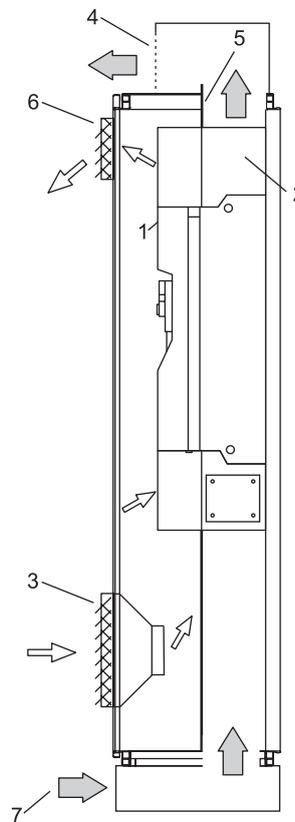


- 1 >pDRIVE< MX pro 4V0,75...4V75
- 2 >pDRIVE< DCL
- 3 Cubicle
- 4 Air inlet grid (with filter fan) for control part
- 5 Air outlet grid (with filter mat) for control part
- 6 Cooling air for power part

Protection degree: IP54

Ambient temperature: -10...+40°C

Cubicle installation protection degree IP54  
for frequency inverters from 90 kW



- 1 >pDRIVE< MX pro from 90 kW
- 2 >pDRIVE< 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

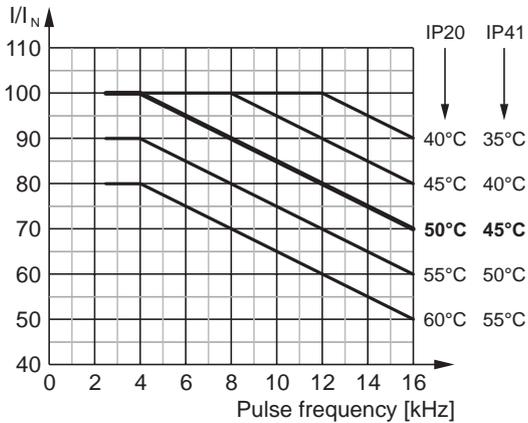
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## Power decrease

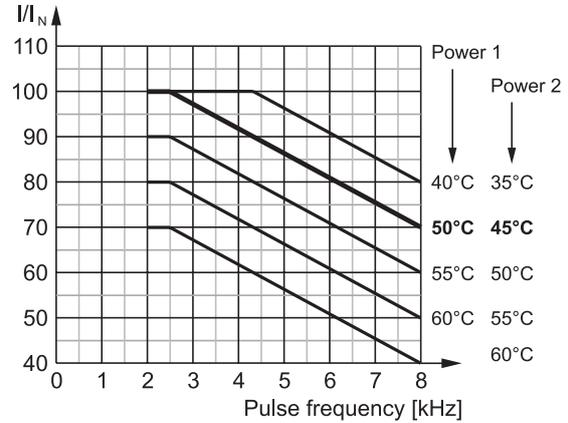
Depending on the chosen pulse frequency and the maximum ambient temperature a power increase is possible or a power reduction is necessary. This can be determined by means of the following diagrams.

>pDRIVE< MX pro 4V0,75...4V75



IP20...Top protective cover removed  
IP41...Device with top protective cover

>pDRIVE< 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 118 ).
- Select a motor which is at most one type bigger.



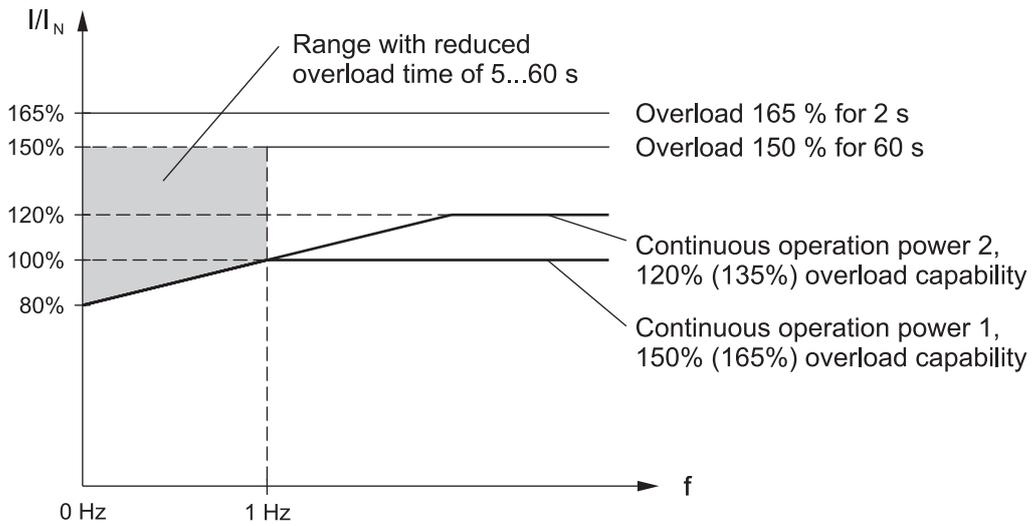
The installation of the DCL box and the terminal box does not have any effect on the cooling and from there also the power increase or reduction of the frequency inverter is independent from the use of these options.



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 pulse 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.

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.

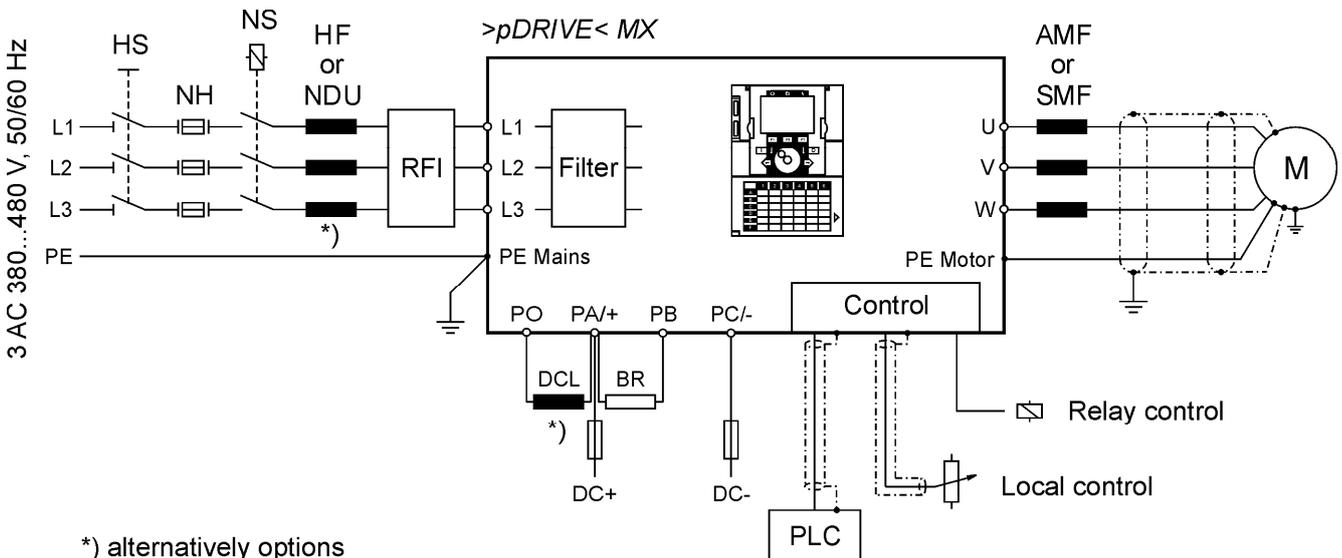
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# Wiring and connection

## 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.

### >pDRIVE< MX pro 4V0,75...4V160/200



>pDRIVE< MX.....Frequency inverter

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)

>pDRIVE< NDU .... Option line reactor to reduce the current main harmonics caused by the DC link, use as an alternative to the options >pDRIVE< HF and >pDRIVE< DCL

>pDRIVE< HF ..... Option mains current harmonic filter to reduce the current harmonics on the mains caused by the DC link, use as an alternative to the options >pDRIVE< NDU and >pDRIVE< DCL

>pDRIVE< RFI..... Option 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 >pDRIVE< MX pro 4V4,0)

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

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

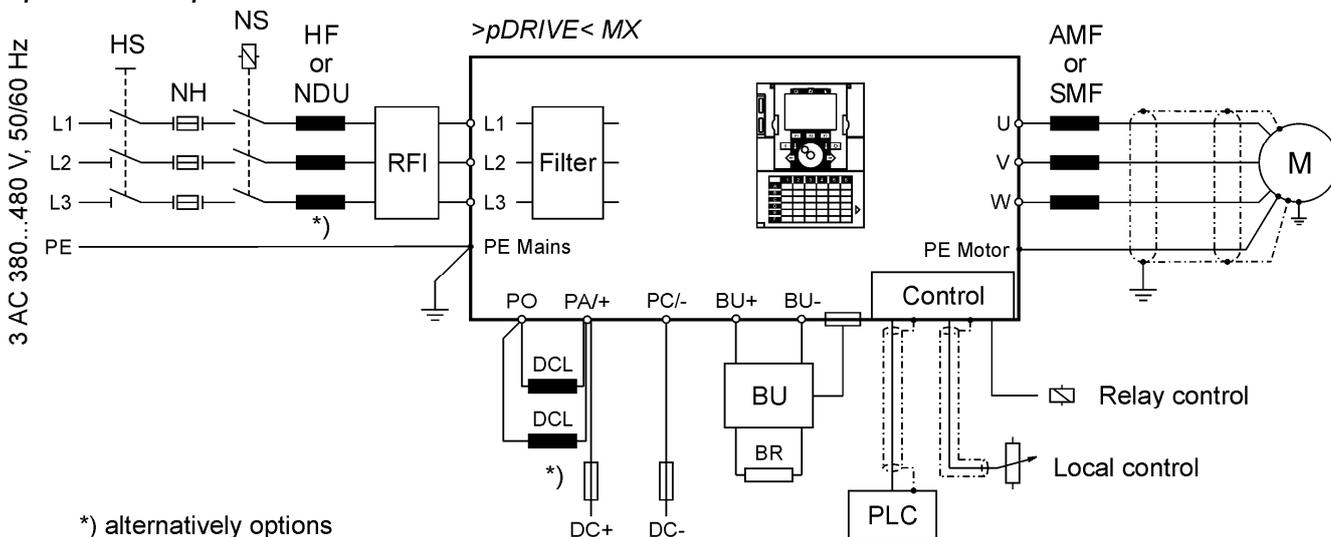
>pDRIVE< DCL..... Option DC choke to reduce the current harmonics, use as an alternative to the option >pDRIVE< NDU.

For MX pro 4V0,75...4V75 as an external option, above as add-on option available

>pDRIVE< 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.

>pDRIVE< MX pro 4V200/250...4V315/400



\*) alternatively options

>pDRIVE< MX.....Frequency inverter

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)

>pDRIVE< NDU .... Option line reactor to reduce the current main harmonics caused by the DC link, use as an alternative to the options >pDRIVE< HF and >pDRIVE< DCL

>pDRIVE< HF ..... Option mains current harmonic filter to reduce the current harmonics on the mains caused by the DC link, use as an alternative to the options >pDRIVE< NDU and >pDRIVE< DCL

>pDRIVE< 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"

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

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

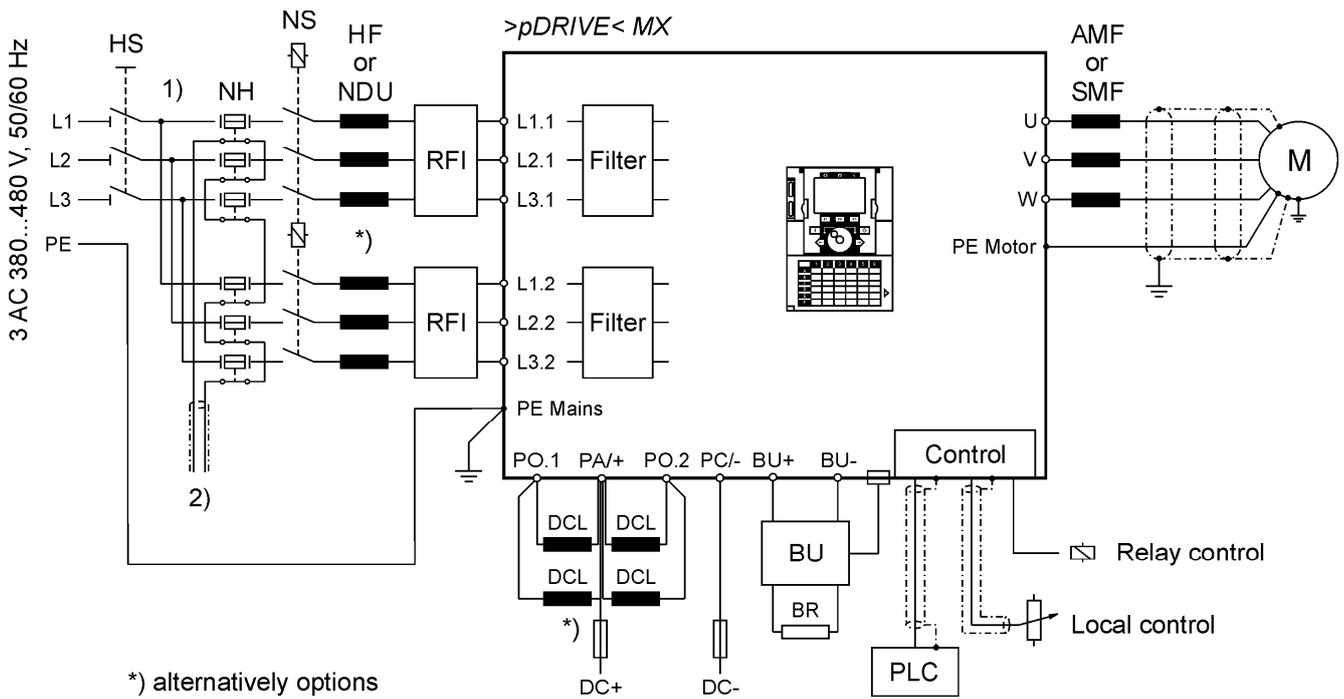
>pDRIVE< DCL ..... Add-on option DC choke to reduce the current harmonics, use as an alternative to the option >pDRIVE< NDU.

>pDRIVE< BU ..... External braking unit option for >pDRIVE< MX pro 4V200/250 ... 4V500/630

>pDRIVE< 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.

>pDRIVE< MX pro 4V400/500...4V500/630



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>pDRIVE< MX.....Frequency inverter

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)

>pDRIVE< NDU .... Option line reactor to reduce the current main harmonics caused by the DC link, use as an alternative to the options >pDRIVE< HF and >pDRIVE< DCL

>pDRIVE< HF ..... Option mains current harmonic filter to reduce the current harmonics on the mains caused by the DC link, use as an alternative to the options >pDRIVE< NDU and >pDRIVE< DCL

>pDRIVE< 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"

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

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

>pDRIVE< DCL ..... Add-on option DC choke to reduce the current harmonics, use as an alternative to the option >pDRIVE< NDU.

>pDRIVE< BU ..... External braking unit option for >pDRIVE< MX pro 4V200/250 ... 4V500/630

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

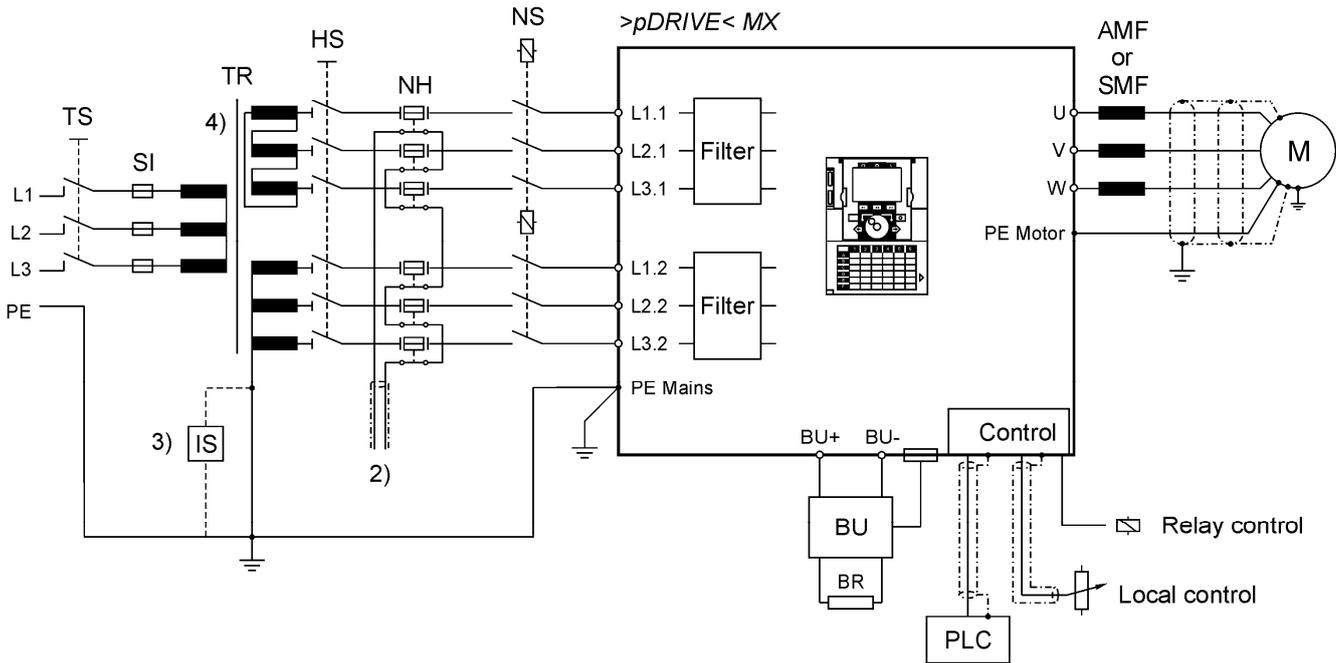
DC+ / DC- ..... Power supply from a DC-bar; alternatively to 3AC mains supply.

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. Therefore set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).

>pDRIVE< MX pro 4V400/500...4V500/630

12-pulse rectification

3 AC 380...480 V, 50/60 Hz



>pDRIVE< MX.....Frequency inverter

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"

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

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

>pDRIVE< BU .....External braking unit option for >pDRIVE< MX pro 4V200/250 ... 4V500/630

>pDRIVE< 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. Therefore 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:  $\pm 5.0$  % 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.

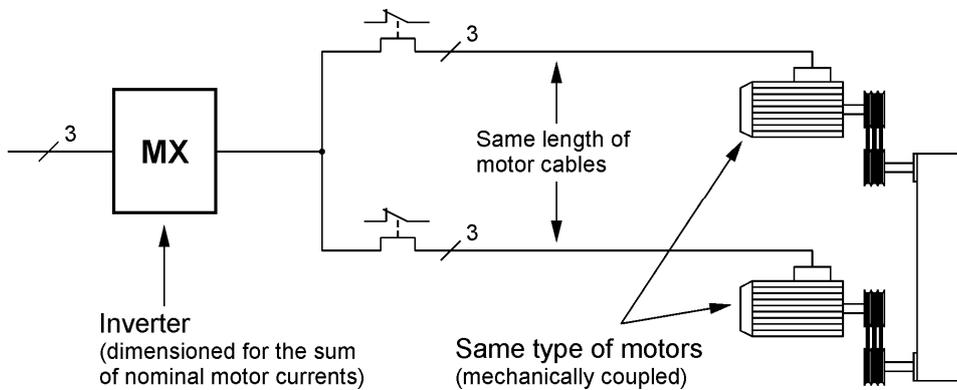
## Multi-motor operation

It is basically possible to operate several motors with a >pDRIVE< 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.

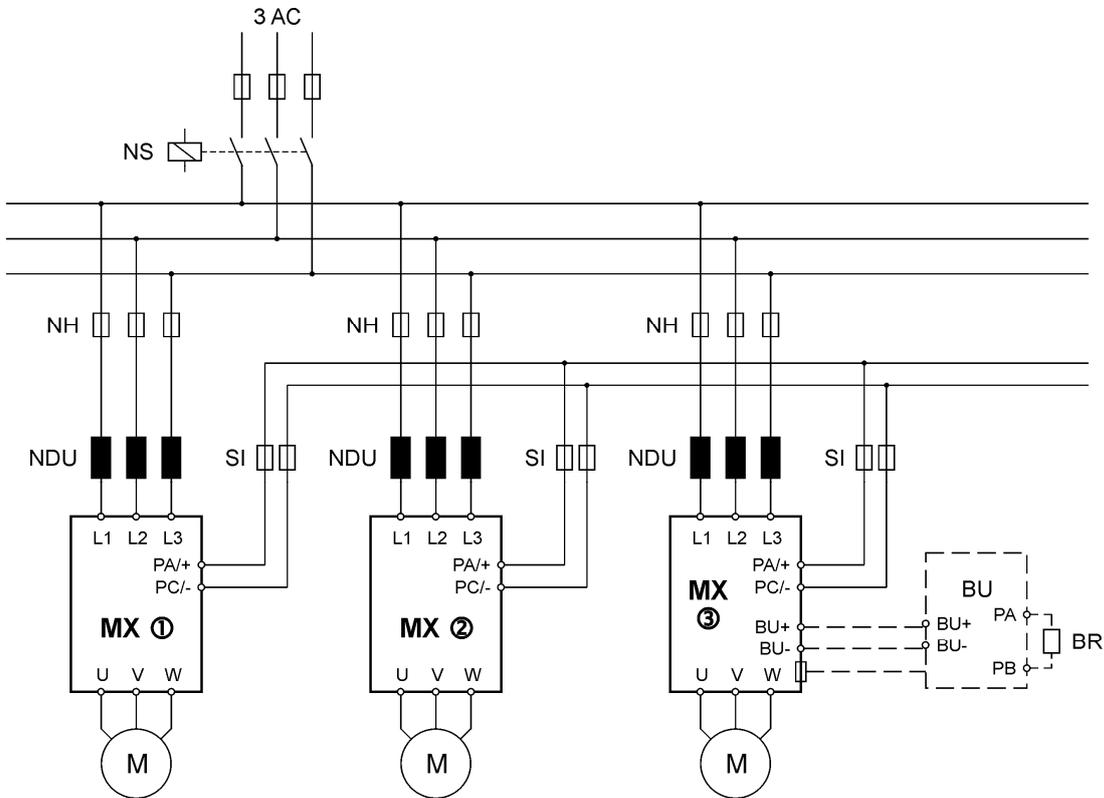


If thermal relays or motor circuit breakers are used, they must be set to about 110 % of the nominal current of the motor !

## DC coupling

### DC-coupling of several >pDRIVE< 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,...).



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 163. 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 107

①, ②, ③ .....>pDRIVE< 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.



>pDRIVE< 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).

**>pDRIVE< 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,...).

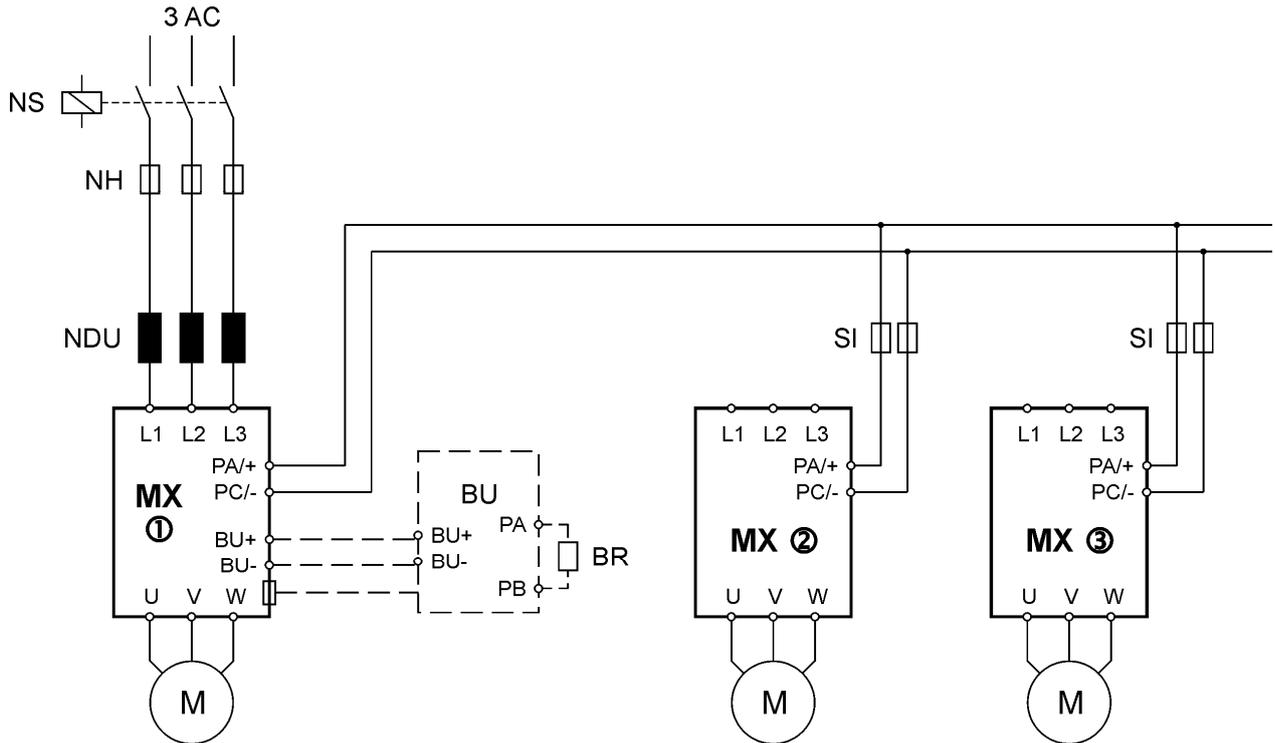


However, at any time there must not be needed more motor power than power which is required for the rectifier of the main drive (e.g. 250 kW + 20 % for 60 s for >pDRIVE< MX pro 4V 200/250).



DC supplied drives must not be connected during operation !

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- ① .....>pDRIVE< 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 >pDRIVE< 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 107  
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 >pDRIVE< MX pro frequency inverters do not include any input fuses. They have to be provided externally for the case that the electronic protective mechanism of the inverters fails. Thus they are a secondary protection of the inverter to protect the power cables against overload and to protect the input rectifier in case of an internal short-circuit.

The below-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 <sup>1.)</sup>	Cu cable mm <sup>2</sup>	Mains fuse "inverter protection" "sf"	Lines in the cubicle mm <sup>2</sup> (per phase)	>pDRIVE< MX pro	Max. cont. current	Max. connection	Motor cable mm <sup>2</sup> <sup>3.)</sup>
10 A	3 x 1.5	10 A (sf)	1.5	4V0,75	2.3 A	6 mm <sup>2</sup>	3 x 1.5
10 A	3 x 1.5	10 A (sf)	1.5	4V1,5	4.1 A	6 mm <sup>2</sup>	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 <sup>2</sup>	3 x 1.5
16 [20] A	3 x 2.5	16 [20] A (sf)	2.5	4V3,0	7.8 A	6 mm <sup>2</sup>	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 <sup>2</sup>	3 x 1.5
25 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V5,5	14.3 A	6 mm <sup>2</sup>	3 x 2.5
32 [40] A	3 x 4 [6]	25 [40] A (sf)	4 [6]	4V7,5	17.6 A	6 mm <sup>2</sup>	3 x 2.5
40 [63] A	3 x 6 [16]	40 [63] A (sf)	6 [10]	4V11	27.7 A	16 mm <sup>2</sup>	3 x 4
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V15	33 A	35 mm <sup>2</sup>	3 x 6
63 [80] A	3 x 16 [25]	50 [80] A (sf)	10 [16]	4V18	41 A	35 mm <sup>2</sup>	3 x 10
63 [80] A	3 x 16 [25]	63 [80] A sf A	10 [16]	4V22	48 A	50 mm <sup>2</sup>	3 x 10
80 [100] A	3 x 25 [35]	80 [100] A sf A	16 [25]	4V30	66 A	50 mm <sup>2</sup>	3 x 16
100 [125] A	3 x 35 [50]	100 [125] A sf A	25 [35]	4V37	79 A	50 mm <sup>2</sup>	3 x 25
125 [160] A	3 x 50 [70]	125 [160] A sf B	35 [50]	4V45	94 A	120 mm <sup>2</sup>	3 x 35
160 [200] A	3 x 70 [95]	160 [200] A sf B	50 [70]	4V55	116 A	120 mm <sup>2</sup>	3 x 50
200 [250] A	3 x 95 [120]	200 [250] A sf B	70 [95]	4V75	160 A	120 mm <sup>2</sup>	3 x 70
<b>Power 1 – high overload</b>							
250 A	3 x 120	250 A sf C	95	4V90/110	179 A	M10	3 x 95
315 A	3 x 185	315 A sf C	120	4V110/132	215 A	M10	3 x 120
400 A	2 x (3 x 120)	350 A sf D	150	4V132/160	259 A	M10	3 x 150
400 A	2 x (3 x 120)	400 A sf D	185	4V160/200	314 A	M12	2 x (3 x 95)
500 A	2 x (3 x 150)	500 A sf E	2 x 120	4V200/250	387 A	M12	2 x (3 x 120)
630 A	2 x (3 x 185)	630 A sf F	2 x 150	4V250/315	481 A	M12	2 x (3 x 150)
800 A	3 x (3 x 185)	800 A sf F	3 x 150	4V315/400	616 A	M12	3 x (3 x 150)
1000 A	4 x (3 x 185)	2 x 500 A sf <sup>2.)</sup> E	2 x 2 x 120	4V400/500	759 A	M12	3 x (3 x 185)
1250 A	4 x (3 x 240)	2 x 630 A sf <sup>2.)</sup> F	2 x 2 x 150	4V500/630	941 A	M12	4 x (3 x 185)

Mains supply				Frequency inverter			Motor output
Pre- or conduit fuses <sup>1.)</sup>	Cu cable mm <sup>2</sup>	Mains fuse "inverter protection" "sf"	Lines in the cubicle mm <sup>2</sup> (per phase)	>pDRIVE< MX pro	Max. cont. current	Max. connection	Motor cable mm <sup>2</sup> <sup>3.)</sup>
<b>Power 2 – high continuous load</b>							
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 <sup>2.)</sup> 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 <sup>2.)</sup> 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 option >pDRIVE< DCL, >pDRIVE< NDU or >pDRIVE< HF 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<sup>2</sup>t values (referring to 10 ms):

A	B	C	D	E	F
5.10 <sup>3</sup> A <sup>2</sup> s	50.10 <sup>3</sup> A <sup>2</sup> s	160.10 <sup>3</sup> A <sup>2</sup> s	320.10 <sup>3</sup> A <sup>2</sup> s	780.10 <sup>3</sup> A <sup>2</sup> s	1000.10 <sup>3</sup> A <sup>2</sup> s



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.



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.

>pDRIVE<	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	
<i>MX pro 4V0,75</i>	Class CC 6 A max.	5 kA	35 kA	100 kA	AWG 14
<i>MX pro 4V1,5</i>	Class CC 12 A max.	5 kA	35 kA	100 kA	AWG 14
<i>MX pro 4V2.2</i>	Class J 15 A max.	5 kA	35 kA	100 kA	AWG 14
<i>MX pro 4V3,0</i>	Class J 17.5 A max.	5 kA	35 kA	100 kA	AWG 14
<i>MX pro 4V4,0</i>	Class J 25 A max.	5 kA	35 kA	100 kA	AWG 12
<i>MX pro 4V5,5</i>	Class J 40A max.	5 kA	35 kA	100 kA	AWG 10
<i>MX pro 4V7,5</i>	Class J 40 A max.	5 kA	35 kA	100 kA	AWG 10
<i>MX pro 4V11</i>	Class J 60 A max.	5 kA	35 kA	100 kA	AWG 8
<i>MX pro 4V15</i>	Class J 70 A max.	5 kA	35 kA	100 kA	AWG 6
<i>MX pro 4V18</i>	Class J 70 A max.	5 kA	35 kA	100 kA	AWG 6
<i>MX pro 4V22</i>	Class J 80 A max.	5 kA	35 kA	100 kA	AWG 6
<i>MX pro 4V30</i>	Class J 90 A max.	5 kA	35 kA	100 kA	AWG 4
<i>MX pro 4V37</i>	Class J 110 A max.	5 kA	35 kA	100 kA	AWG 3
<i>MX pro 4V45</i>	Class J 150 A max.	10 kA	35 kA	100 kA	AWG 1
<i>MX pro 4V55</i>	Class J 175 A max.	10 kA	35 kA	100 kA	AWG 1/0
<i>MX pro 4V75</i>	Class J 225 A max.	10 kA	35 kA	100 kA	AWG 3/0
<i>MX pro 4V90/110</i>	Class J 300 A max.	(10 kA)	50 kA	100 kA	2x AWG 2/0
<i>MX pro 4V110/132</i>	Class J 350 A max.	(10 kA)	50 kA	100 kA	2x AWG 4/0
<i>MX pro 4V132/160</i>	Class J 400 A max.	(18 kA)	50 kA	100 kA	2x 250 MCM
<i>MX pro 4V160/200</i>	Class J 450 A max.	(18 kA)	50 kA	100 kA	2x 350 MCM
<i>MX pro 4V200/250</i>	Class J 600 A max.	(18 kA)	50 kA	100 kA	3x 250 MCM
<i>MX pro 4V250/315</i>	Class T 800 A max.	(30 kA)	50 kA	100 kA	3x 350 MCM
<i>MX pro 4V315/400</i>	Semiconductor fuse 900 A max.	(30 kA)	50 kA	100 kA	4x 350 MCM
<i>MX pro 4V400/500</i>	Class J 2x600 A max.	(30 kA)	50 kA	100 kA	Mains: 2x (2x 500 MCM) Motor: 4x 500 MCM
<i>MX pro 4V500/630</i>	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 211 and chapter "Line reactor NDU", page 216.

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

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

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## Braking unit BU

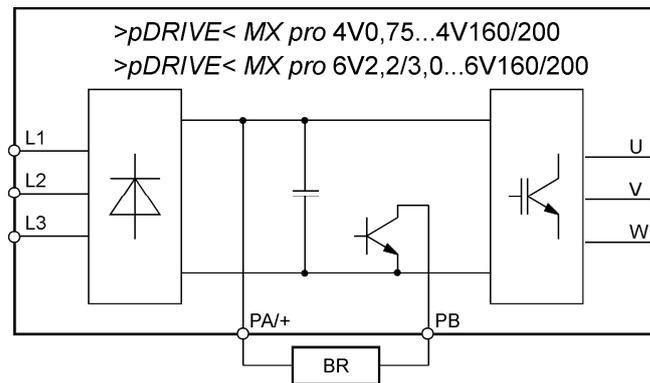
When a motor is braked on the deceleration ramp, the motor acts as a generator. Since voltage DC link inverters cannot return energy to the mains as standard, the DC link voltage increases in case of generator operation.

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.

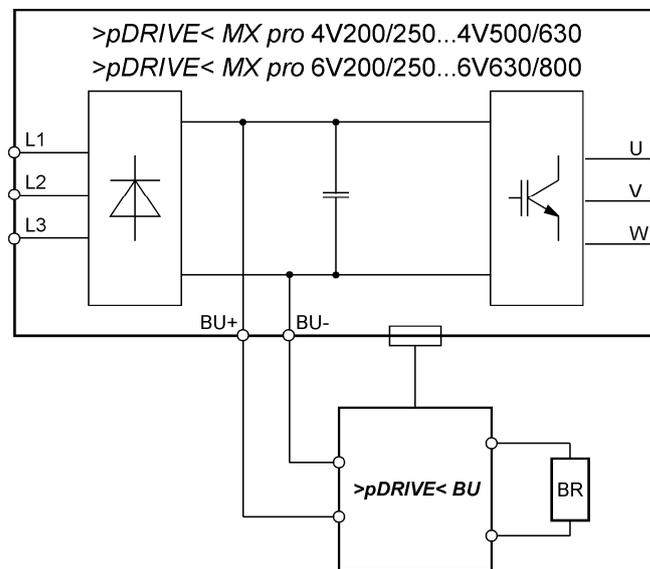
The generator power depends on the moment of inertia of the load and the set deceleration time, among other things.

The *>pDRIVE< 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 *>pDRIVE< BU*).

*>pDRIVE< MX pro with an internal braking transistor*



*>pDRIVE< MX pro with an external braking unit >pDRIVE< 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 *>pDRIVE< BR* enables the use of the frequency inverter *>pDRIVE< MX 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.

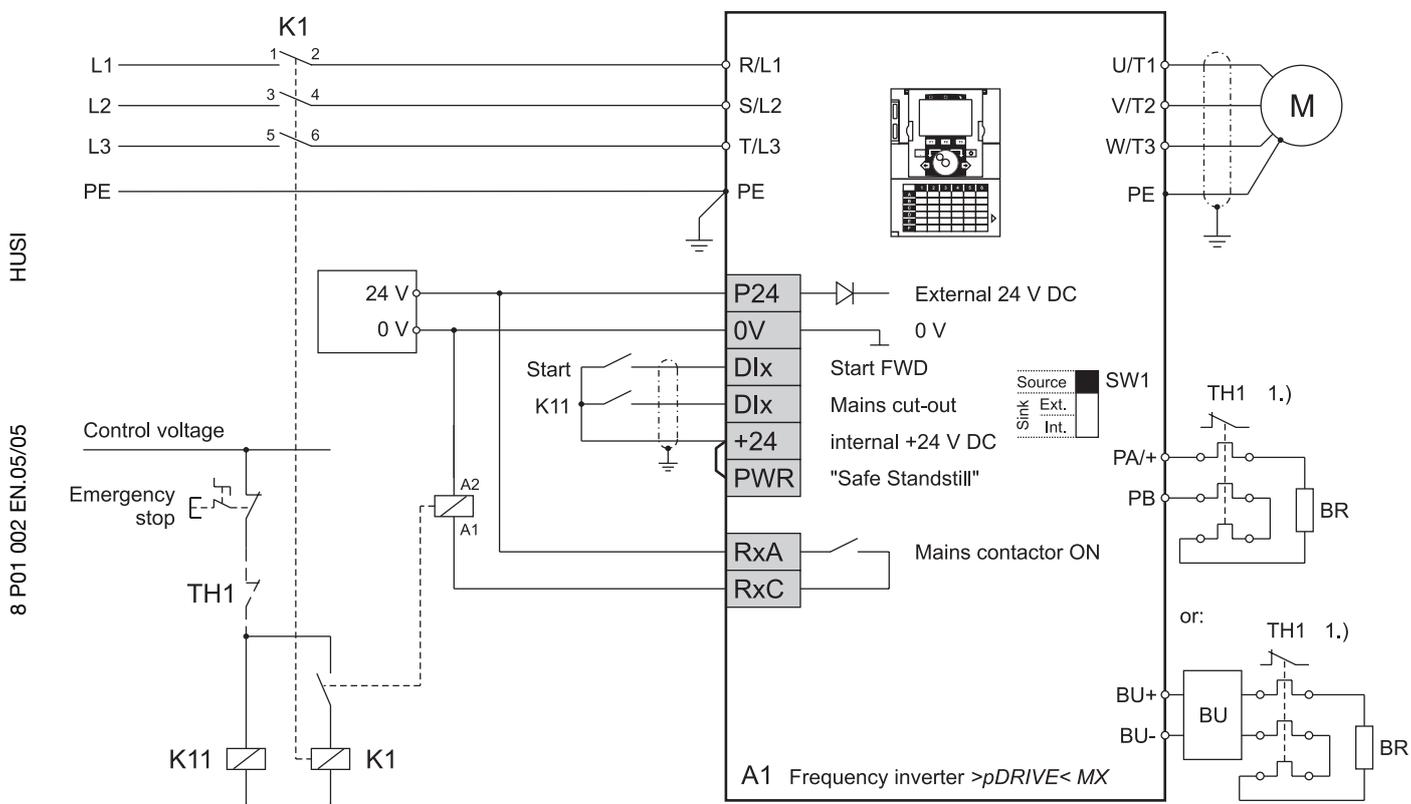
The >pDRIVE< MX pro frequency inverters have parameters to monitor the braking power.



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

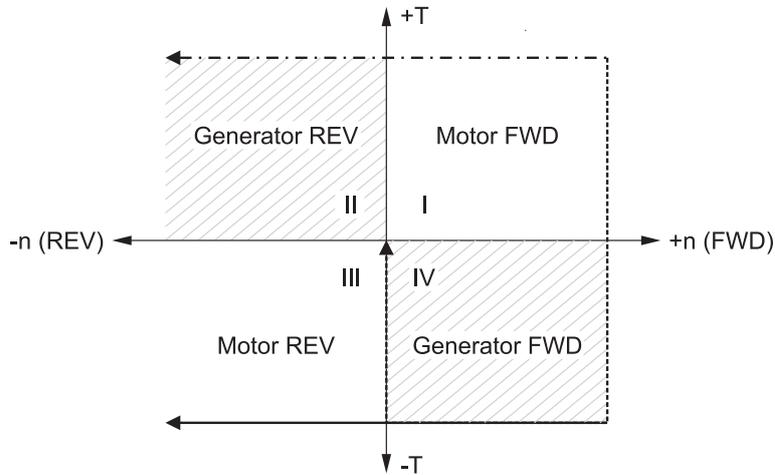
### Maximum resistance value of the braking resistor

In the technical data,  $R_{\text{MAX}}$  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:

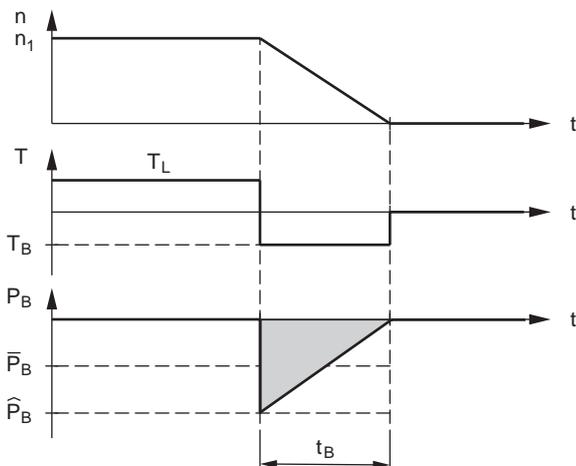
$$P = \frac{T \cdot n}{9.55}$$

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

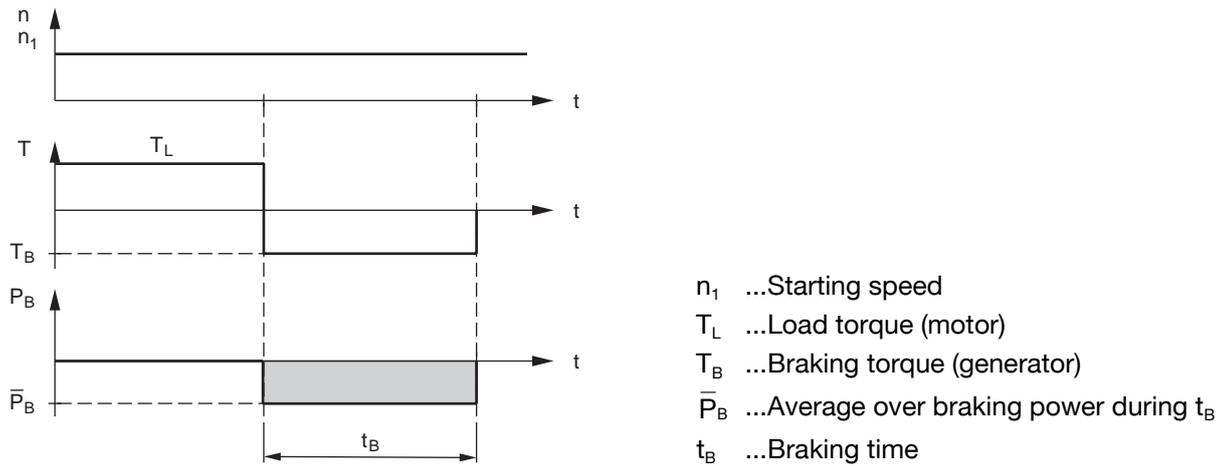


- $n_1$  ...Starting speed
- $T_L$  ...Load torque (motor)
- $T_B$  ...Braking torque (generator)
- $\hat{P}_B$  ...Peak braking power
- $\bar{P}_B$  ...Average over braking power during  $t_B$
- $t_B$  ...Braking time

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.

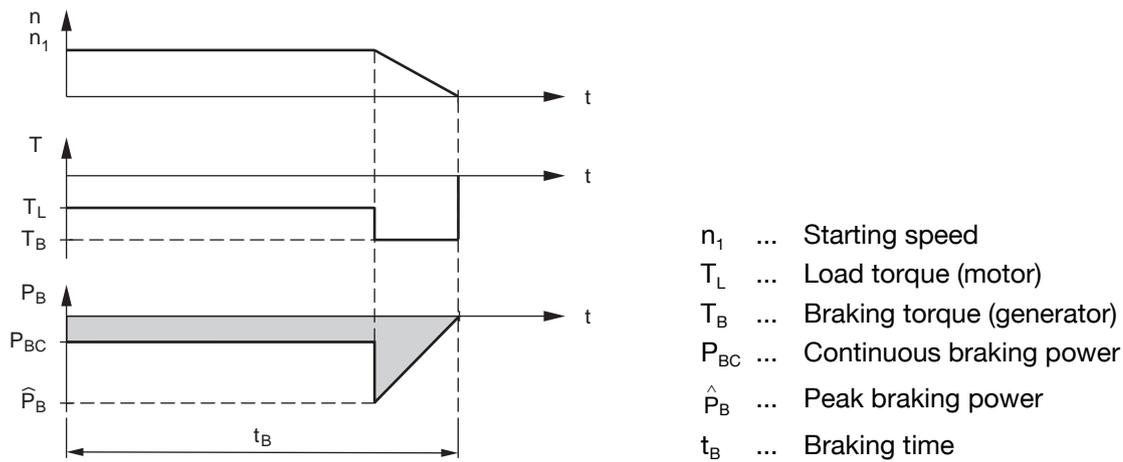
## 2. Braking at constant speed



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



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

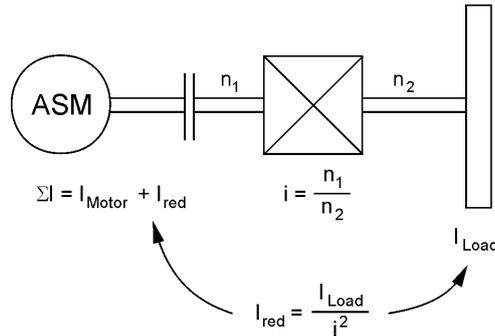
$$T_B = \frac{\sum I \cdot (n_1 - n_2)}{9.55 \cdot t_B}$$

$$P = T \cdot \omega$$

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

- $T_B$  ... Braking torque of the motor [Nm]  
 $\Sigma I$  ... Sum of the moments of inertia related to the motor shaft [ $\text{kgm}^2$ ]  
 $n_1$  ... 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

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

$$\bar{P}_B = \frac{W_{\text{kin}}}{t_B}$$

$$\hat{P}_B = \bar{P}_B \cdot 2$$

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

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

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

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

### 4. Braking of hoistings during lowering

$$\bar{P}_B = m \cdot g \cdot v$$

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

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

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

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:

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

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

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

$\hat{P}_{BReal}$  ... Actual peak braking power [W]  
 $\bar{P}_{BReal}$  ... Actual continuous braking power [W]  
 $\eta_{total}$  ... 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 [ $\Omega$ ]  
 $P_{Cycle}$  ... See the characteristic curve in the cycle diagram.



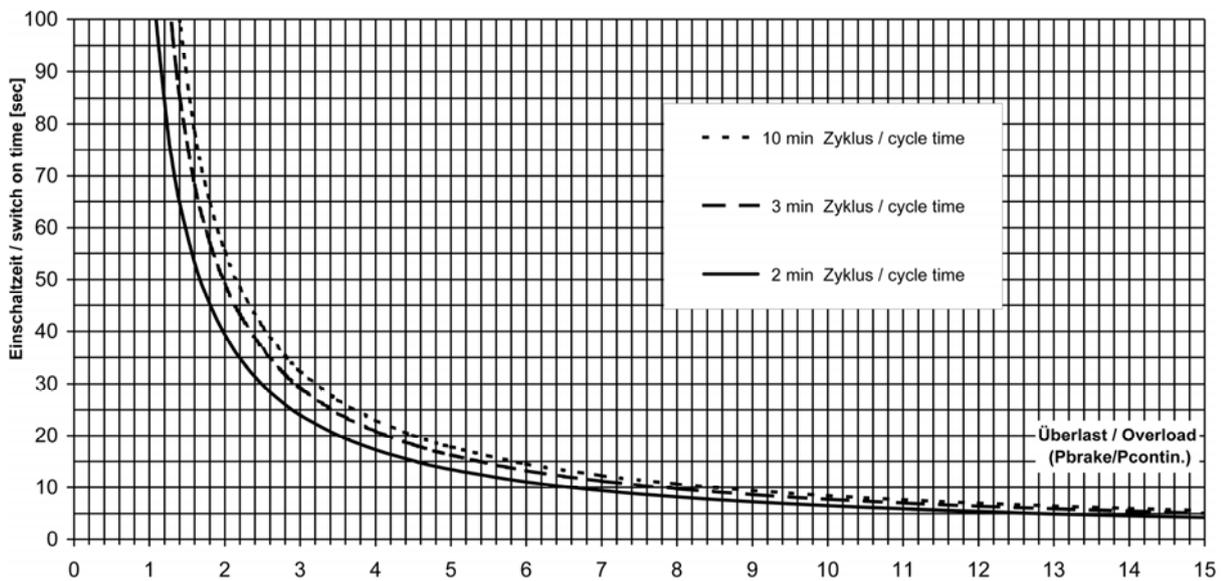
The >pDRIVE< MX pro frequency inverters have parameters to monitor the braking power. If the braking resistor does not match the overload characteristic to be used or the local regulations require an additional protective device, a thermal relay must be integrated into the mains disconnection mechanism.

## 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 ..  $-\Delta t$ -alarm" is set, however, an external reaction for the protection of the braking resistor BR must occur!
- B5.07 "Time  $\Delta t$ " 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)



## Allocation table for typical crane applications

Typical dimensioning for hoist applications

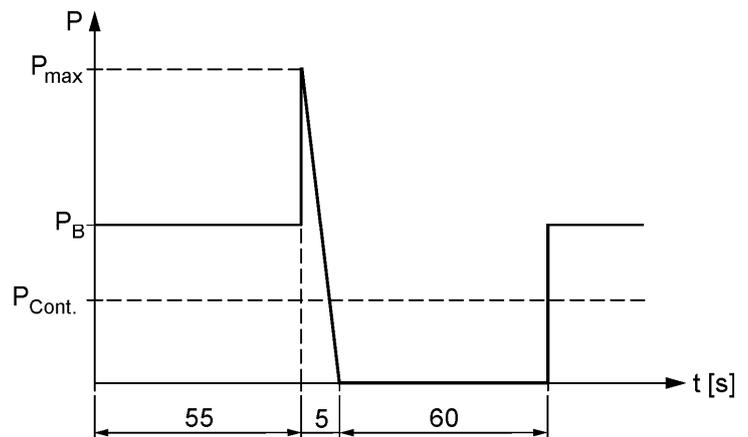
Typ. motor rating	Inverter	Braking unit	Braking resistor	$P_{max}$ @ 785 V	$P_B$	$P_{CONT}$
0.75 kW	<i>MX pro</i> 4V0,75	internal	1 x BR 200R	1.1 kW	0.55 kW	0.25 kW
1.5 kW	<i>MX pro</i> 4V1,5	internal	2 x BR 200R <sup>1)</sup>	2.3 kW	1.05 kW	0.5 kW
2.2 kW	<i>MX pro</i> 4V2,2	internal	3 x BR 200R <sup>1)</sup>	3.3 kW	1.5 kW	0.75 kW
3.0 kW	<i>MX pro</i> 4V3,0	internal	1 x BR 120R	4.5 kW	2.1 kW	1.0 kW
4.0 kW	<i>MX pro</i> 4V4,0	internal	2 x BR 120R <sup>1)</sup>	6.0 kW	3.0 kW	2.0 kW
5.5 kW	<i>MX pro</i> 4V5,5	internal	2 x BR 120R <sup>1)</sup>	8.3 kW	4.1 kW	2.0 kW
7.5 kW	<i>MX pro</i> 4V7,5	internal	2 x BR 50R <sup>1)</sup>	11 kW	5.6 kW	3.0 kW
11 kW	<i>MX pro</i> 4V11	internal	2 x BR 30R <sup>1)</sup>	17 kW	8.3 kW	4.0 kW
15 kW	<i>MX pro</i> 4V15	internal	1 x BR 15R	23 kW	12 kW	8.5 kW
18.5 kW	<i>MX pro</i> 4V18	internal	1 x BR 15R	28 kW	15 kW	8.5 kW
22 kW	<i>MX pro</i> 4V22	internal	1 x BR 15R	33 kW	18 kW	8.5 kW
30 kW	<i>MX pro</i> 4V30	internal	1 x BR 10R	45 kW	24 kW	14 kW
37 kW	<i>MX pro</i> 4V37	internal	1 x BR 10R	56 kW	30 kW	14 kW
45 kW	<i>MX pro</i> 4V45	internal	1 x BR 6R	68 kW	36 kW	22 kW
55 kW	<i>MX pro</i> 4V55	internal	1 x BR 6R	83 kW	44 kW	22 kW
75 kW	<i>MX pro</i> 4V75	internal	2 x BR 10R <sup>1)</sup>	113 kW	60 kW	28 kW
90 kW	<i>MX pro</i> 4V90/110	internal	1 x BR 3R3	135 kW	79 kW	44 kW
110 kW	<i>MX pro</i> 4V110/132	internal	1 x BR 3R3	165 kW	97 kW	44 kW
132 kW	<i>MX pro</i> 4V132/160	internal	1 x BR 2R1	200 kW	116 kW	66 kW
160 kW	<i>MX pro</i> 4V160/200	internal	1 x BR 2R1	240 kW	141 kW	66 kW
200 kW	<i>MX pro</i> 4V200/250	<i>BU 4V420</i>	2 x BR 3R3 <sup>1)</sup>	300 kW	176 kW	88 kW
250 kW	<i>MX pro</i> 4V250/315	<i>BU 4V420</i>	2 x BR 2R1 <sup>1)</sup>	375 kW	220 kW	132 kW
315 kW	<i>MX pro</i> 4V315/400	<i>BU 4V750</i>	2 x BR 2R1 <sup>1)</sup>	475 kW	277 kW	132 kW
400 kW	<i>MX pro</i> 4V400/500	<i>BU 4V750</i>	3 x BR 2R1 <sup>1)</sup>	600 kW	352 kW	198 kW
500 kW	<i>MX pro</i> 4V500/630	<i>BU 4V750</i>	3 x BR 2R1 <sup>1)</sup>	750 kW	440 kW	198 kW

<sup>1)</sup> 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



Typical dimensioning for long travel applications

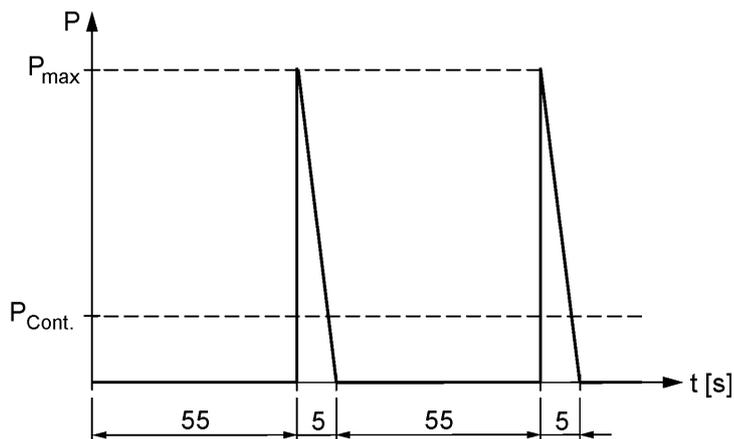
Typ. motor rating	Inverter	Braking unit	Braking resistor	P <sub>max</sub> @ 785 V	P <sub>CONT</sub>
0.75 kW	<i>MX pro 4V0,75</i>	internal	1 x BR 200R	1.1 kW	0.25 kW
1.5 kW	<i>MX pro 4V1,5</i>	internal	2 x BR 200R <sup>1)</sup>	2.3 kW	0.5 kW
2.2 kW	<i>MX pro 4V2,2</i>	internal	2 x BR 200R <sup>1)</sup>	3.3 kW	0.5 kW
3.0 kW	<i>MX pro 4V3,0</i>	internal	2 x BR 200R <sup>1)</sup>	4.5 kW	0.5 kW
4.0 kW	<i>MX pro 4V4,0</i>	internal	3 x BR 200R <sup>1)</sup>	6.0 kW	0.75 kW
5.5 kW	<i>MX pro 4V5,5</i>	internal	4 x BR 200R <sup>1)</sup>	8.3 kW	1.0 kW
7.5 kW	<i>MX pro 4V7,5</i>	internal	1 x BR 50R	11 kW	1.5 kW
11 kW	<i>MX pro 4V11</i>	internal	1 x BR 30R	17 kW	2.0 kW
15 kW	<i>MX pro 4V15</i>	internal	2 x BR 50R <sup>1)</sup>	23 kW	3.0 kW
18.5 kW	<i>MX pro 4V18</i>	internal	2 x BR 30R <sup>1)</sup>	28 kW	4.0 kW
22 kW	<i>MX pro 4V22</i>	internal	2 x BR 30R <sup>1)</sup>	33 kW	4.0 kW
30 kW	<i>MX pro 4V30</i>	internal	3 x BR 30R <sup>1)</sup>	45 kW	6.0 kW
37 kW	<i>MX pro 4V37</i>	internal	1 x BR 8R	56 kW	7.0 kW
45 kW	<i>MX pro 4V45</i>	internal	2 x BR 12R <sup>1)</sup>	68 kW	8.0 kW
55 kW	<i>MX pro 4V55</i>	internal	2 x BR 8R <sup>1)</sup>	83 kW	14 kW
75 kW	<i>MX pro 4V75</i>	internal	2 x BR 8R <sup>1)</sup>	113 kW	14 kW
90 kW	<i>MX pro 4V90/110</i>	internal	1 x BR 3R5	135 kW	22 kW
110 kW	<i>MX pro 4V110/132</i>	internal	1 x BR 3R5	165 kW	22 kW
132 kW	<i>MX pro 4V132/160</i>	internal	2 x BR 3R5 <sup>1)</sup>	200 kW	44 kW
160 kW	<i>MX pro 4V160/200</i>	internal	2 x BR 3R5 <sup>1)</sup>	240 kW	44 kW
200 kW	<i>MX pro 4V200/250</i>	<i>BU 4V420</i>	2 x BR 3R5 <sup>1)</sup>	300 kW	44 kW
250 kW	<i>MX pro 4V250/315</i>	<i>BU 4V420</i>	3 x BR 3R5 <sup>1)</sup>	375 kW	66 kW
315 kW	<i>MX pro 4V315/400</i>	<i>BU 4V750</i>	3 x BR 3R5 <sup>1)</sup>	475 kW	66 kW
400 kW	<i>MX pro 4V400/500</i>	<i>BU 4V750</i>	4 x BR 3R5 <sup>1)</sup>	600 kW	88 kW
500 kW	<i>MX pro 4V500/630</i>	<i>BU 4V750</i>	5 x BR 3R5 <sup>1)</sup>	750 kW	110 kW

<sup>1)</sup> Resistors in parallel

Typical braking power and cycles for long travel applications

P<sub>max</sub> ..... Maximum braking power  
 P<sub>Cont.</sub> .... 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 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 >pDRIVE< *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 >pDRIVE< *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 >pDRIVE< *AMF*.

Especially in case of big motors with middle up to high motor cable lengths the option >pDRIVE< *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:

>pDRIVE< 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

>pDRIVE< 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

Recommended maximum lengths of motor cables in 1st environment

>pDRIVE< options	4V0,75...4V4,0	4V5,5...4V45	4V55...4V500/630	Type of motor cable
<b>C1 residential environment - unrestricted sales (EN 55011 - class B group 1)</b>				
Option RFI	50 m	50 m	–	screened
<b>C2 residential environment - EMC qualified user (EN 55011 - class A group 1)</b>				
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)

>pDRIVE< options	4V0,75...4V4,0	4V5,5...4V45	4V55...4V500/630	Type of motor cable
<b>C3 (EN 55011 - class A group 2)</b>				
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
<b>C4 (EMC concept)</b>				
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 >pDRIVE< 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.

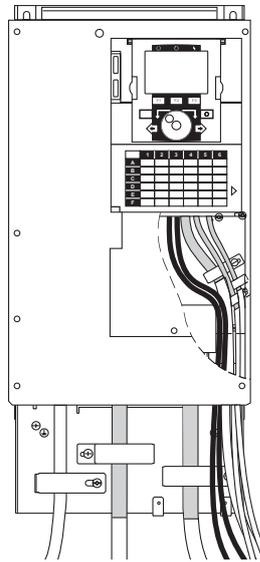
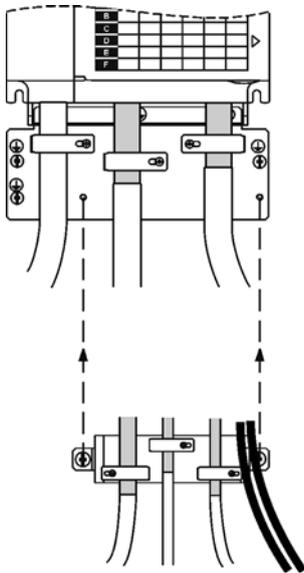
All >pDRIVE< MX eco & pro 4V0,75...4V75 and MX pro 6V2,2/3,0...6V75/90 inverters are delivered with an EMC plate including screws and suitable cable clamps. It is used to fix all cables to the inverter and presents an optimal connection between motor cable screen and radio interference filter. Moreover,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

>pDRIVE< MX eco & pro 4V0,75...4V18

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

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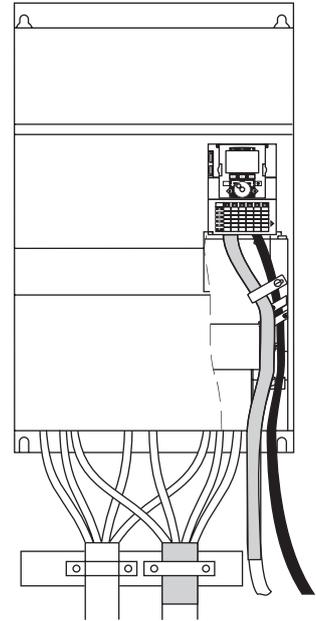
The total height of the inverter alters when using the EMC plate corresponding to this additional element.

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

For the leading-in of the control wires the >pDRIVE< 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 >pDRIVE< RFI is established via a well-conductive mounting plate. Alternatively the terminal box option >pDRIVE< TER-BOX can be used.



## Control terminals

The frequency inverters >pDRIVE< 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 >pDRIVE< IO11 and >pDRIVE< IO12 are available. The same option card can be plugged in only one time per unit.



The inverters >pDRIVE< 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 equip-ment	Option >pDRIVE< IO11	Option >pDRIVE< 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
<b>Inputs</b>					
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
<b>Outputs</b>					
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

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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).

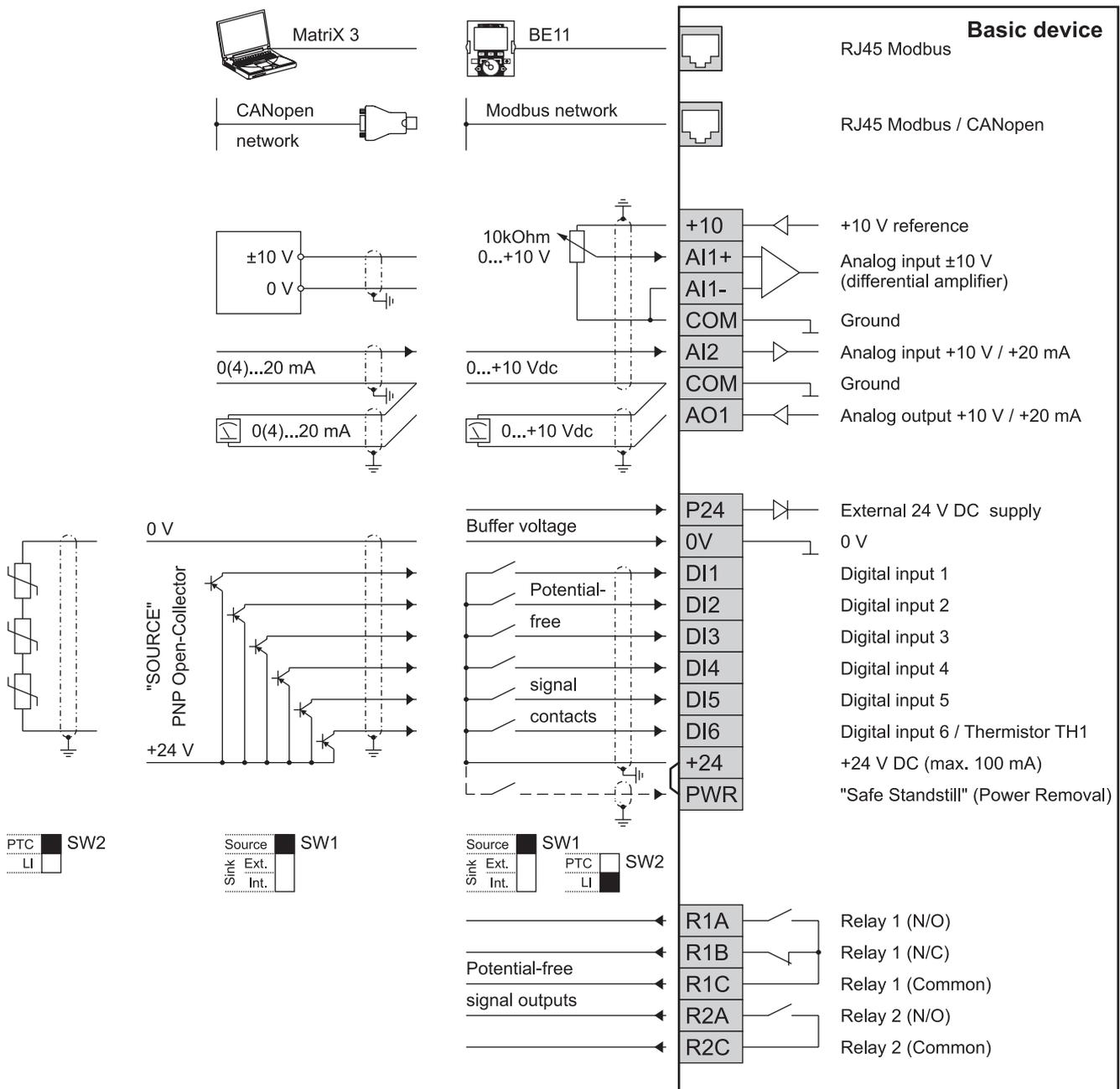
The whole electronics is separated from the power part according to EN 50178 PELV (Protective-Extra-Low-Voltage) in compliance with "Protective separation" by double insulation.

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".

## 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.

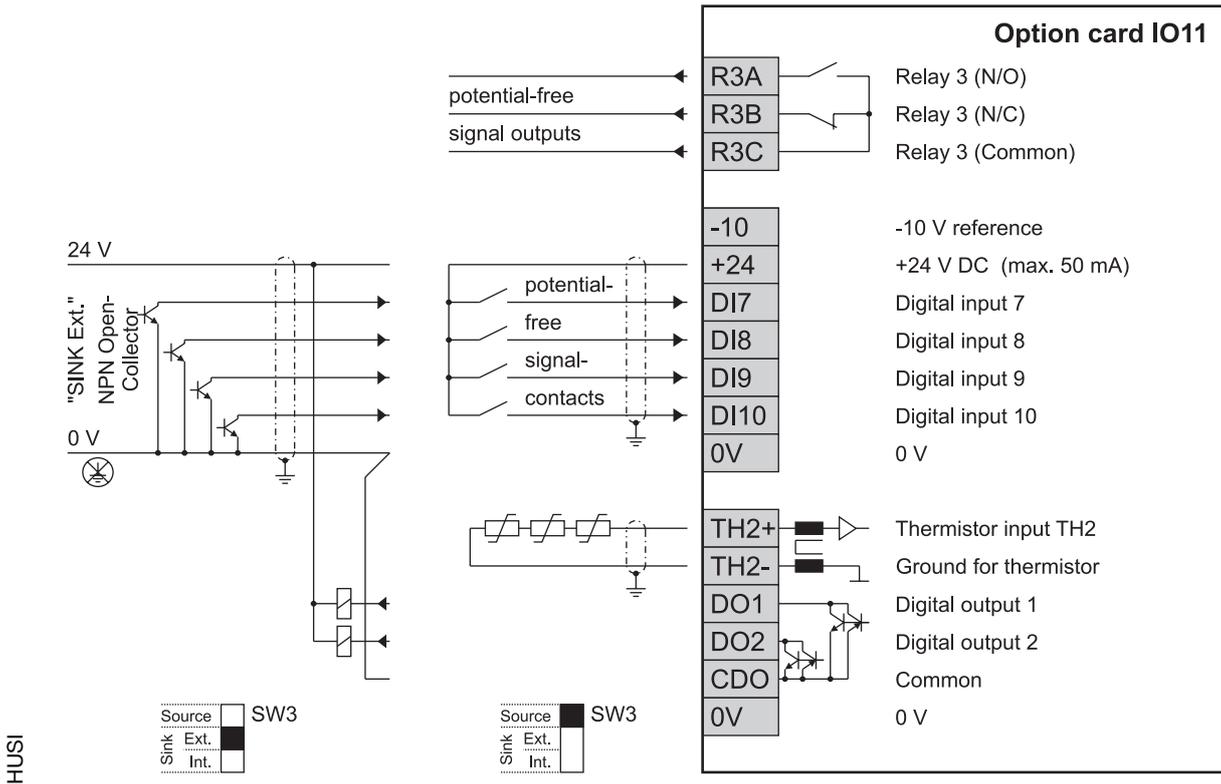
The inverters >pDRIVE< MX pro are equipped with a built-in interface for control via Modbus. In addition to the external wiring (connection to the T-pieces in the bus line) only the adjustment of few parameters is necessary.

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 201.

## Control terminals of option card IO11



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The terminal extension  $\text{>pDRIVE< IO11}$  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.



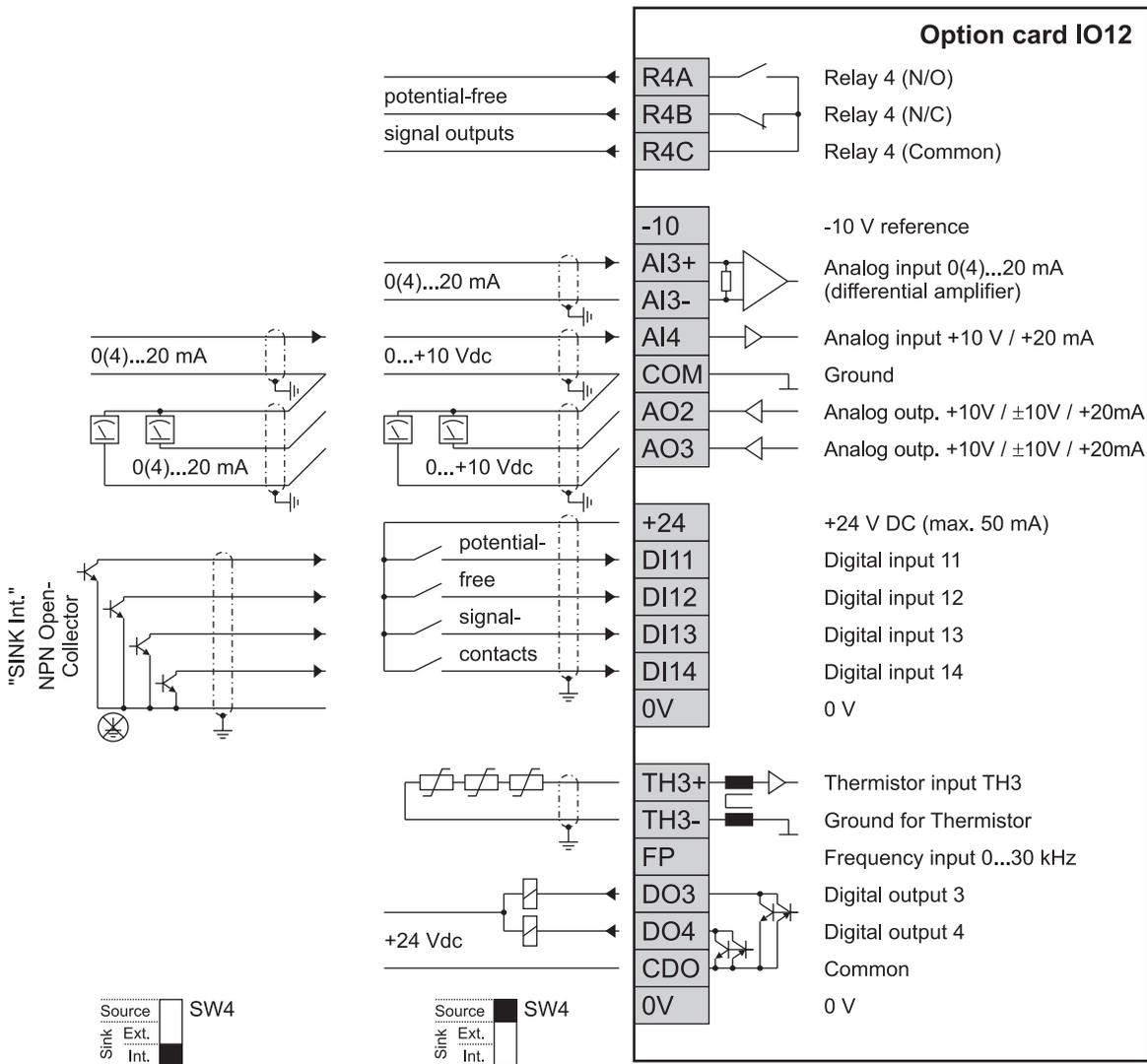
A detailed specification of the control terminals is given in chapter "Terminal extension IO11 and IO12", as from page 201.



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 *>pDRIVE< IO12* can be plugged in addition or as an alternative to the option *>pDRIVE< 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.

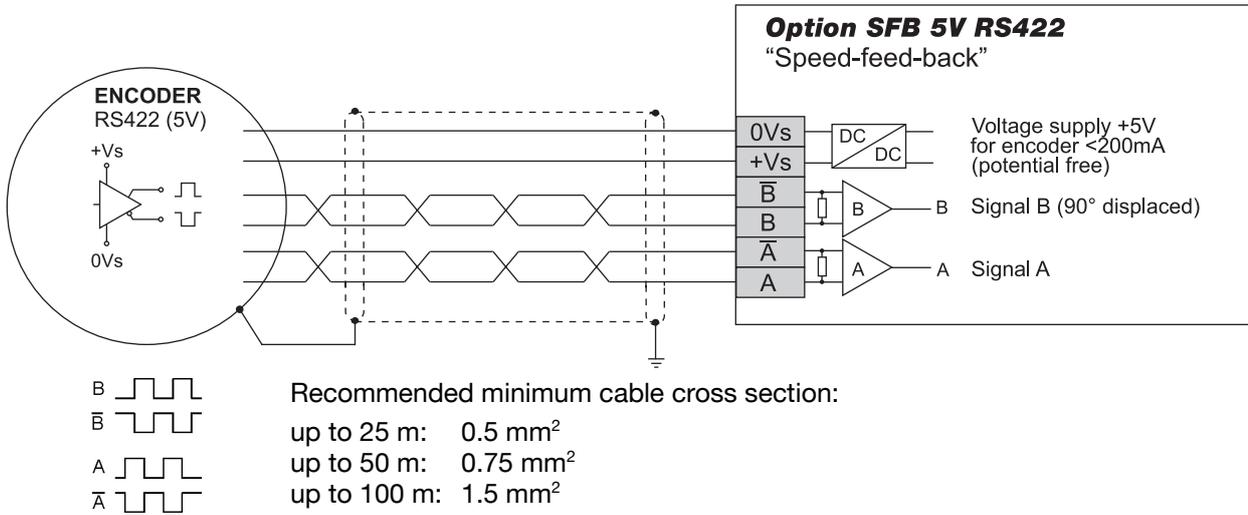


All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

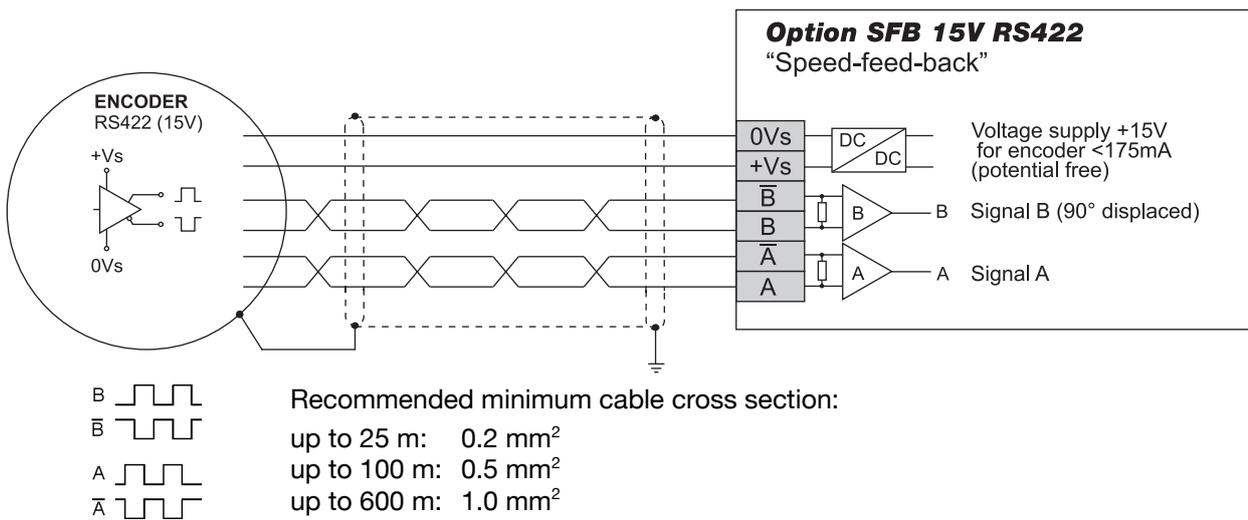
**Control terminals of the option cards >pDRIVE< SFB**

The option cards >pDRIVE< 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.

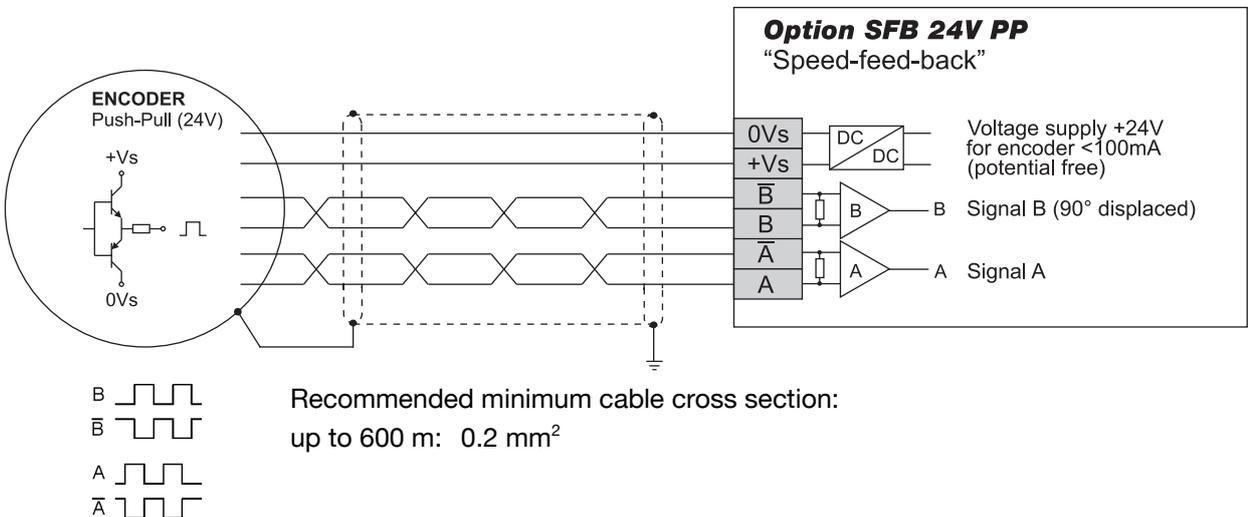
**>pDRIVE< SFB 5V RS422**



**>pDRIVE< SFB 15V RS422**



**>pDRIVE< SFB 24V PP**

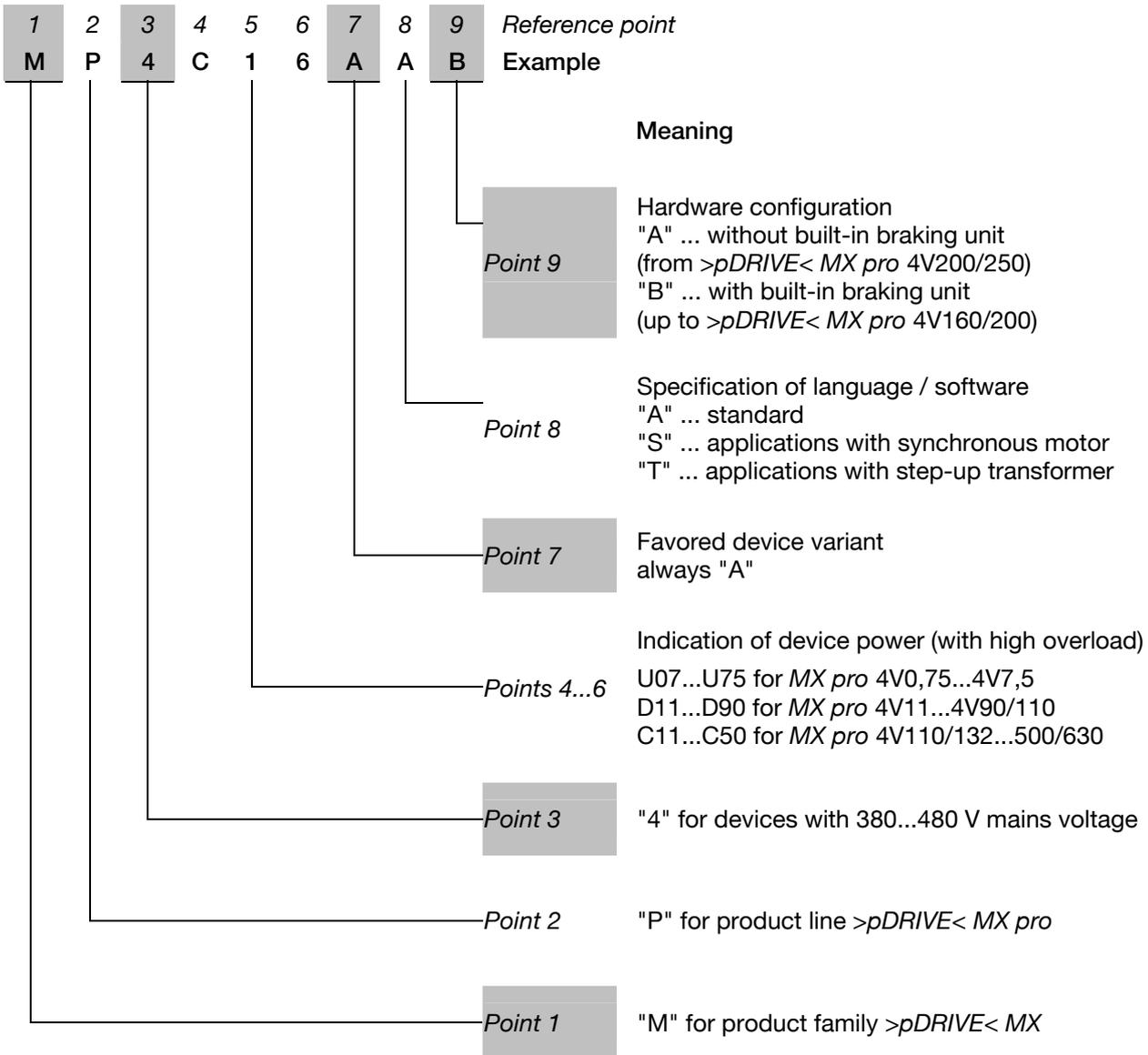


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# Purchase order

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



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Options for the inverter device must be ordered additionally. The respective order numbers are given in chapter "Options", as from page 189.

## Documentation

The documentation of the >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< MX pro 4V	8 P01 325 DE 8 P01 325 EN	Technical data, valid standards, mounting, connection, ambient conditions
Mounting instructions for >pDRIVE< MX pro 6V	8 P01 329 DE 8 P01 329 EN	Technical data, valid standards, mounting, connection, ambient conditions
Operating instructions Modbus for >pDRIVE< MX pro	8 P01 333 DE 8 P01 333 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions CANopen for >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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.pdrive.com](http://www.pdrive.com).

## Available options for >pDRIVE< MX pro 4V inverters

To enlarge the field of applications for the frequency inverters >pDRIVE< 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
<b>Operating options</b>			
>pDRIVE< BE11	8 P01 100/A...G	Matrix operating panel affords optimal operating comfort by means of the matrix philosophy	Page 190
>pDRIVE< DMK11	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 192
>pDRIVE< DMK11-IP65	8 P01 121	Transparent IP65 cover for the door mounting kit of the operating panel BE11	
>pDRIVE< CABLE3-BE	8 P01 122	Connecting cable operating panel – inverter with 3 m length	
>pDRIVE< CABLE10-BE	8 P01 123	Connecting cable operating panel – inverter with 10 m length	Page 23
Manual-CD >pDRIVE< MX eco & pro	8 P01 021	This CD-ROM provides the whole documentation of the inverter as well as the PC program Matrix 3	
>pDRIVE< CABLE3-PC	8 P01 124	Connecting cable inverter – PC with 3 m length, incl. RS232/485 interface converter on the computer side	
>pDRIVE< ADAP BLUE	8 P01 126	Bluetooth adapter	Page 23
>pDRIVE< RS232/485	8 P01 304	RS232/485 interface converter with supply and active bus connection	
>pDRIVE< MATRIX REMOTE LINK	8 P01 128	Remote maintenance option for analog modem connection or Ethernet network.	
>pDRIVE< ADAP RJ45	8 P01 127	RJ45 F/F adapter is required for the connection of the operating panel BE11 to the connecting cable	
<b>Control options</b>			
>pDRIVE< IO11	8 P01 101	Terminal extension for additional digital inputs and outputs	Page 201
>pDRIVE< IO12	8 P01 102	Terminal extension for additional analog and digital inputs and outputs	
>pDRIVE< SFB 5V RS422	8 P01 110	Extension card for encoder feedback. Supply voltage 5 V / RS422	Page 205
>pDRIVE< SFB 15V RS422	8 P01 111	Extension card for encoder feedback. Supply voltage 15 V / RS422	
>pDRIVE< SFB 24V PP	8 P01 112	Extension card for encoder feedback. Supply voltage 24 V / push-pull	
>pDRIVE< MODBUS T-ADAP 03	8 P01 300	Modbus T-adapter with 0.3 m connecting cable	Page 197
>pDRIVE< MODBUS T-ADAP 1	8 P01 301	Modbus T-adapter with 1 m connecting cable	
>pDRIVE< MODBUS RC	8 P01 302	Bus termination RC	
>pDRIVE< MODBUS SPLITTER	8 P01 303	Divides the Modbus signal into eight further channels	
>pDRIVE< MODBUS PLUG	8 P01 305	RJ45 connector IP20 with quick-connecting technology	Page 199
>pDRIVE< ADAP CAN	8 P01 125	RJ45/Sub-D adapter for the connection of the inverter to a CANopen fieldbus network	
>pDRIVE< CANOPEN PLUG	8 P01 307	Connector for the CANopen network	
>pDRIVE< PBO11	8 P01 103	Option card for control of the inverter via Profibus DP	Page 200
>pDRIVE< PROFIBUS PLUG	8 P01 306	Connector for the Profibus network	

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## Options depending on the power

Designation	Order number	Brief description	Reference
<b>Options depending on the power</b>			
>pDRIVE< RFI	See following allocation table	Additional radio interference filter to reduce the high-frequency interferences for use in residential environment	Page 207
>pDRIVE< DCL		DC choke to reduce the mains current harmonics to THD I ≤ 45 %	Page 211
>pDRIVE< NDU		Three-phase choke to reduce the mains current harmonics to THD I ≤ 45 % (alternatively to DCL)	Page 216
>pDRIVE< FPK		Mounting kit to install a DC choke or line reactor behind the inverter	Page 220
>pDRIVE< BU		External braking unit for >pDRIVE< MX pro 4V200/250 to 4V500/630	Page 225
>pDRIVE< BR		Braking resistor for short deceleration time or short-time dynamic loads	Page 229
>pDRIVE< HF		Harmonic filter to reduce the mains current harmonics significantly	Page 221
>pDRIVE< AMF		Output motor filter enables the use of the inverter with long motor cables and limits the voltage peaks in the motor	Page 233
>pDRIVE< 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 237
>pDRIVE< TER-BOX		Terminal box which is attached at the bottom of the inverter for mechanical support and connection of the motor cable screen	Page 243
>pDRIVE< FLANGE		Flange mounting kit to install the inverter in flange mounting technology (heat sink outside the cubicle)	Page 246
>pDRIVE< CMK		Cubicle mounting kit for an optimal mounting of the frequency inverter in a Rittal TS8 cubicle	Page 249
>pDRIVE< RMK	Mounting kit in order to replace the old >pDRIVE< MX basic & plus devices without anew drilling	Page 252	

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Allocation table for options depending on the power

>pDRIVE<	Option >pDRIVE< RFI	Option >pDRIVE< DCL	Option >pDRIVE< NDU	Option >pDRIVE< FPK	Option >pDRIVE< HF-A
<i>MX pro 4V0,75</i>	RFI 480/12-TN 8 P01 280	DCL 2 8 P01 200	NDU 10 8 P01 238	FPK 155x260 8 P01 461	–
<i>MX pro 4V1,5</i>	RFI 480/12-TN 8 P01 280	DCL 4 8 P01 201	NDU 10 8 P01 238	FPK 155x260 8 P01 461	–
<i>MX pro 4V2,2</i>	RFI 480/12-TN 8 P01 280	DCL 8 8 P01 202	NDU 10 8 P01 238	FPK 155x260 8 P01 461	–
<i>MX pro 4V3,0</i>	RFI 480/26-TN 8 P01 281	DCL 8 8 P01 202	NDU 10 8 P01 238	FPK 155x260 8 P01 461	–
<i>MX pro 4V4,0</i>	RFI 480/26-TN 8 P01 281	DCL 11 8 P01 203	NDU 10 8 P01 238	FPK 155x260 8 P01 461	HF-A 4V7 8 P01 400
<i>MX pro 4V5,5</i>	RFI 480/35-TN 8 P01 282	DCL 14 8 P01 204	NDU 23 8 P01 239	FPK 175x295 8 P01 462	HF-A 4V13 8 P01 401
<i>MX pro 4V7,5</i>	RFI 480/35-TN 8 P01 282	DCL 19 8 P01 205	NDU 23 8 P01 239	FPK 175x295 8 P01 462	HF-A 4V13 8 P01 401
<i>MX pro 4V11</i>	RFI 480/46-TN 8 P01 283	DCL 27 8 P01 206	NDU 23 8 P01 239	FPK 210x295 8 P01 463	HF-A 4V18 8 P01 402
<i>MX pro 4V15</i>	RFI 480/72-TN 8 P01 284	DCL 44 8 P01 207	NDU 40 8 P01 220	FPK 230x400 8 P01 464	HF-A 4V24 8 P01 403
<i>MX pro 4V18</i>	RFI 480/72-TN 8 P01 284	DCL 44 8 P01 207	NDU 40 8 P01 220	FPK 230x400 8 P01 464	HF-A 4V24 8 P01 403
<i>MX pro 4V22</i>	RFI 480/90-TN 8 P01 285	DCL 85 8 P01 208	NDU 70 8 P01 221	FPK 240x420 8 P01 465	HF-A 4V30 8 P01 404
<i>MX pro 4V30</i>	RFI 480/92-TN 8 P01 286	DCL 85 8 P01 208	NDU 70 8 P01 221	FPK 240x550 8 P01 466	HF-A 4V50 8 P01 405
<i>MX pro 4V37</i>	RFI 480/92-TN 8 P01 286	DCL 85 8 P01 208	NDU 100 8 P01 222	FPK 240x550 8 P01 466	HF-A 4V50 8 P01 405
<i>MX pro 4V45</i>	RFI 480/180-TN 8 P01 287	DCL 171 8 P01 209	NDU 100 8 P01 222	–	HF-A 4V70 8 P01 406
<i>MX pro 4V55</i>	RFI 480/180-TN 8 P01 287	DCL 171 8 P01 209	NDU 160 8 P01 223	–	HF-A 4V70 8 P01 406
<i>MX pro 4V75</i>	RFI 480/180-TN 8 P01 287	DCL 171 8 P01 209	NDU 160 8 P01 223	–	HF-A 4V100 8 P01 407
<i>MX pro 4V90/110</i>	RFI 480/300-TN 8 P01 288	DCL-BOX 240 8 P01 210	NDU 235 8 P01 225	–	HF-A 4V150 8 P01 409
<i>MX pro 4V110/132</i>	RFI 480/300-TN 8 P01 288	DCL-BOX 290 8 P01 211	NDU 280 8 P01 226	–	HF-A 4V150 8 P01 409
<i>MX pro 4V132/160</i>	RFI 480/300-TN 8 P01 288	DCL-BOX 350 8 P01 212	NDU 315 8 P01 227	–	HF-A 4V200 8 P01 410
<i>MX pro 4V160/200</i>	RFI 480/600-TN 8 P01 289	DCL-BOX 490 8 P01 213	NDU 365 8 P01 228	–	HF-A 4V255 8 P01 412
<i>MX pro 4V200/250</i>	RFI 480/600-TN 8 P01 289	DCL-BOX 570 8 P01 214	NDU 475 8 P01 230	–	2 x HF-A 4V150 2 x 8 P01 409
<i>MX pro 4V250/315</i>	RFI 480/600-TN 8 P01 289	DCL-BOX 700 8 P01 215	NDU 650 8 P01 233	–	2 x HF-A 4V200 2 x 8 P01 410
<i>MX pro 4V315/400</i>	RFI 480/800-TN 8 P01 290	DCL-BOX 860 8 P01 216	NDU 760 8 P01 234	–	2 x HF-A 4V225 2 x 8 P01 411
<i>MX pro 4V400/500</i>	2 x RFI 480/600-TN 2 x 8 P01 289	DCL-BOX 1160 8 P01 217	2 x NDU 540 2 x 8 P01 231	–	4 x HF-A 4V150 4 x 8 P01 409
<i>MX pro 4V500/630</i>	2 x RFI 480/600-TN 2 x 8 P01 289	DCL-BOX 1400 8 P01 218	2 x NDU 620 2 x 8 P01 232	–	4 x HF-A 4V200 4 x 8 P01 410

\*) The option >pDRIVE< FPK can be used for mounting the option >pDRIVE< DCL behind the inverter.

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>pDRIVE<	Option >pDRIVE< BU	Option >pDRIVE< BR Hoist	Option >pDRIVE< BR Long-travel
<i>MX pro 4V0,75</i>	Integrated braking unit	1 x BR 200R 1 x 8 P01 262	1 x BR 200R 1 x 8 P01 262
<i>MX pro 4V1,5</i>	Integrated braking unit	2 x BR 200R 2 x 8 P01 262	2 x BR 200R 2 x 8 P01 262
<i>MX pro 4V2,2</i>	Integrated braking unit	3 x BR 200R 3 x 8 P01 262	2 x BR 200R 2 x 8 P01 262
<i>MX pro 4V3,0</i>	Integrated braking unit	1 x BR 120R 1 x 8 P01 263	2 x BR 200R 2 x 8 P01 262
<i>MX pro 4V4,0</i>	Integrated braking unit	2 x BR 120R 2 x 8 P01 263	3 x BR 200R 3 x 8 P01 262
<i>MX pro 4V5,5</i>	Integrated braking unit	2 x BR 120R 2 x 8 P01 263	4 x BR 200R 4 x 8 P01 262
<i>MX pro 4V7,5</i>	Integrated braking unit	2 x BR 50R 2 x 8 P01 264	1 x BR 50R 1 x 8 P01 264
<i>MX pro 4V11</i>	Integrated braking unit	2 x BR 30R 2 x 8 P01 265	1 x BR 30R 1 x 8 P01 265
<i>MX pro 4V15</i>	Integrated braking unit	1 x BR 15R 1 x 8 P01 266	2 x BR 50R 2 x 8 P01 264
<i>MX pro 4V18</i>	Integrated braking unit	1 x BR 15R 1 x 8 P01 266	2 x BR 30R 2 x 8 P01 265
<i>MX pro 4V22</i>	Integrated braking unit	1 x BR 15R 1 x 8 P01 266	2 x BR 30R 2 x 8 P01 265
<i>MX pro 4V30</i>	Integrated braking unit	1 x BR 10R 1 x 8 P01 268	3 x BR 30R 3 x 8 P01 265
<i>MX pro 4V37</i>	Integrated braking unit	1 x BR 10R 1 x 8 P01 268	1 x BR 8R 1 x 8 P01 269
<i>MX pro 4V45</i>	Integrated braking unit	1 x BR 6R 1 x 8 P01 270	2 x BR 12R 2 x 8 P01 267
<i>MX pro 4V55</i>	Integrated braking unit	1 x BR 6R 1 x 8 P01 270	2 x BR 8R 2 x 8 P01 269
<i>MX pro 4V75</i>	Integrated braking unit	2 x BR 10R 2 x 8 P01 268	2 x BR 8R 2 x 8 P01 269
<i>MX pro 4V90/110</i>	Integrated braking unit	1 x BR 3R3 1 x 8 P01 272	1 x BR 3R5 1 x 8 P01 271
<i>MX pro 4V110/132</i>	Integrated braking unit	1 x BR 3R3 1 x 8 P01 272	1 x BR 3R5 1 x 8 P01 271
<i>MX pro 4V132/160</i>	Integrated braking unit	1 x BR 2R1 1 x 8 P01 273	2 x BR 3R5 2 x 8 P01 271
<i>MX pro 4V160/200</i>	Integrated braking unit	1 x BR 2R1 1 x 8 P01 273	2 x BR 3R5 2 x 8 P01 271
<i>MX pro 4V200/250</i>	BU 4V420 8 P01 260	2 x BR 3R3 2 x 8 P01 272	2 x BR 3R5 2 x 8 P01 271
<i>MX pro 4V250/315</i>	BU 4V420 8 P01 260	2 x BR 2R1 2 x 8 P01 273	3 x BR 3R5 3 x 8 P01 271
<i>MX pro 4V315/400</i>	BU 4V750 8 P01 261	2 x BR 2R1 2 x 8 P01 273	3 x BR 3R5 3 x 8 P01 271
<i>MX pro 4V400/500</i>	BU 4V750 8 P01 261	3 x BR 2R1 3 x 8 P01 273	4 x BR 3R5 4 x 8 P01 271
<i>MX pro 4V500/630</i>	BU 4V750 8 P01 261	3 x BR 2R1 3 x 8 P01 273	5 x BR 3R5 5 x 8 P01 271

>pDRIVE<	Option >pDRIVE< AMF	Option >pDRIVE< SMF	Option >pDRIVE< TER-BOX	Option >pDRIVE< FLANGE
<i>MX pro 4V0,75</i>	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 130 8 P01 240	FLANGE 130 x 230 8 P01 180
<i>MX pro 4V1,5</i>	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 130 8 P01 240	FLANGE 130 x 230 8 P01 180
<i>MX pro 4V2,2</i>	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 130 8 P01 240	FLANGE 130 x 230 8 P01 180
<i>MX pro 4V3,0</i>	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 155 8 P01 241	FLANGE 155 x 260 8 P01 181
<i>MX pro 4V4,0</i>	AMF 12-1 8 P01 140	SMF 480/11 8 P01 148	TER-BOX 155 8 P01 241	FLANGE 155 x 260 8 P01 181
<i>MX pro 4V5,5</i>	AMF 48-1 8 P01 141	SMF 480/16 8 P01 149	TER-BOX 175 8 P01 242	FLANGE 175 x 295 8 P01 182
<i>MX pro 4V7,5</i>	AMF 48-1 8 P01 141	SMF 480/33 8 P01 150	TER-BOX 175 8 P01 242	FLANGE 175 x 295 8 P01 182
<i>MX pro 4V11</i>	AMF 48-1 8 P01 141	SMF 480/33 8 P01 150	TER-BOX 210 8 P01 243	FLANGE 210 x 295 8 P01 183
<i>MX pro 4V15</i>	AMF 48-1 8 P01 141	SMF 480/33 8 P01 150	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184
<i>MX pro 4V18</i>	AMF 48-1 8 P01 141	SMF 480/66 8 P01 151	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184
<i>MX pro 4V22</i>	AMF 48-1 8 P01 141	SMF 480/66 8 P01 151	TER-BOX 240 8 P01 245	FLANGE 240 x 420 8 P01 185
<i>MX pro 4V30</i>	AMF 90-1 8 P01 142	SMF 480/66 8 P01 151	TER-BOX 241 8 P01 246	FLANGE 240 x 550 8 P01 186
<i>MX pro 4V37</i>	AMF 90-1 8 P01 142	SMF 480/95 8 P01 152	TER-BOX 241 8 P01 246	FLANGE 240 x 550 8 P01 186
<i>MX pro 4V45</i>	AMF 90-1 8 P01 142	SMF 480/95 8 P01 152	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187
<i>MX pro 4V55</i>	AMF 215-3 8 P01 143	SMF 480/180 8 P01 153	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187
<i>MX pro 4V75</i>	AMF 215-3 8 P01 143	SMF 480/180 8 P01 153	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187
<i>MX pro 4V90/110</i>	AMF 215-3 8 P01 143	SMF 480/200 8 P01 154	TER-BOX 310 8 P01 248	FLANGE 310 x 680 8 P01 188
<i>MX pro 4V110/132</i>	AMF 320-3 8 P01 144	SMF 480/300 8 P01 155	TER-BOX 350 8 P01 249	FLANGE 350 x 780 8 P01 189
<i>MX pro 4V132/160</i>	AMF 320-3 8 P01 144	SMF 480/400 8 P01 156	TER-BOX 330 8 P01 250	FLANGE 330 x 950 8 P01 190
<i>MX pro 4V160/200</i>	AMF 480-3 8 P01 145	SMF 480/400 8 P01 156	TER-BOX 430 8 P01 251	FLANGE 430 x 950 8 P01 191
<i>MX pro 4V200/250</i>	AMF 480-3 8 P01 145	SMF 480/600 8 P01 157	TER-BOX 585 8 P01 252	FLANGE 585 x 950 8 P01 192 *)
<i>MX pro 4V250/315</i>	AMF 760-3 8 P01 146	SMF 480/600 8 P01 157	TER-BOX 585 8 P01 252	FLANGE 585 x 950 8 P01 192 *)
<i>MX pro 4V315/400</i>	AMF 760-3 8 P01 146	SMF 480/1200 8 P01 158	TER-BOX 880 8 P01 253	–
<i>MX pro 4V400/500</i>	AMF 1190-3 8 P01 147	SMF 480/1200 8 P01 158	TER-BOX 880 8 P01 253	–
<i>MX pro 4V500/630</i>	AMF 1190-3 8 P01 147	SMF 480/1200 8 P01 158	TER-BOX 1100 8 P01 254	–

\*) When using a BU 4V420 the option >pDRIVE< FLANGE 660 x 950 (order no. 8 P01 193) is necessary!

>pDRIVE<	Option CMK-IP23	Option CMK-IP54FL	Option CMK-IP54GL	Option >pDRIVE< RMK
<i>MX pro 4V0,75</i>	–	–	–	–
<i>MX pro 4V1,5</i>	–	–	–	–
<i>MX pro 4V2,2</i>	–	–	–	–
<i>MX pro 4V3,0</i>	–	–	–	–
<i>MX pro 4V4,0</i>	–	–	–	RMK BG-A/4,0 8 P01 470
<i>MX pro 4V5,5</i>	–	–	–	RMK BG-A/5,5 8 P01 471
<i>MX pro 4V7,5</i>	–	–	–	RMK BG-B/7,5 8 P01 472
<i>MX pro 4V11</i>	–	–	–	RMK BG-A/11 8 P01 473
<i>MX pro 4V15</i>	–	–	–	RMK BG-1/15-22 + 6V 8 P01 475
<i>MX pro 4V18</i>	–	–	–	RMK BG-1/15-22 + 6V 8 P01 475
<i>MX pro 4V22</i>	–	–	–	RMK BG-1/15-22 + 6V 8 P01 475
<i>MX pro 4V30</i>	–	–	–	RMK BG-1/30-37 8 P01 476
<i>MX pro 4V37</i>	–	–	–	RMK BG-1/30-37 8 P01 476
<i>MX pro 4V45</i>	–	–	–	RMK BG-2/45 8 P01 477
<i>MX pro 4V55</i>	–	–	–	RMK BG-2/55-75 8 P01 478
<i>MX pro 4V75</i>	–	–	–	RMK BG-2/55-75 8 P01 478
<i>MX pro 4V90/110</i>	CMK 9-23 8 P02 003	CMK 9-54FL 8 P02 023	CMK 9-54GL 8 P02 043	–
<i>MX pro 4V110/132</i>	CMK 10-23 8 P02 004	CMK 10-54FL 8 P02 024	CMK 10-54GL 8 P02 044	–
<i>MX pro 4V132/160</i>	CMK 11-23 8 P02 005	CMK 11-54FL 8 P02 025	CMK 11-54GL 8 P02 045	–
<i>MX pro 4V160/200</i>	CMK 12-23 8 P02 006	CMK 12-54FL 8 P02 026	CMK 12-54GL 8 P02 046	–
<i>MX pro 4V200/250</i>	CMK 13-23 8 P02 007	CMK 13-54FL 8 P02 027	CMK 13-54GL 8 P02 047	–
<i>MX pro 4V250/315</i>	CMK 13-23 8 P02 007	CMK 13-54FL 8 P02 027	CMK 13-54GL 8 P02 047	–
<i>MX pro 4V315/400</i>	CMK 14-23 8 P02 008	CMK 14-54FL 8 P02 028	CMK 14-54GL 8 P02 048	–
<i>MX pro 4V400/500</i>	CMK 14-23 8 P02 008	CMK 14-54FL 8 P02 028	CMK 14-54GL 8 P02 048	–
<i>MX pro 4V500/630</i>	CMK 15-23 8 P02 009	CMK 15-54FL 8 P02 029	CMK 15-54GL 8 P02 049	–



# >pDRIVE< MX pro 6V

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

The >pDRIVE< MX pro 6V adds even more numerous functions to the well-known and extremely well-proven features of the >pDRIVE< 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 156
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 >pDRIVE< 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 189
Wall-mounting in IP21 / IP31	Compact wall-mounting device with terminal box as a cheap alternative to the cubicle installation	Page 243
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 246
Optimized for cubicle installation	>pDRIVE< 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 150

## 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 21
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 19
PC software	Free PC program Matrix 3 for commissioning, programming, documentation and analysis	Page 23
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 200
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 30
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 139
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 176
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 139

## Useful functions



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

# Specification

## Technical data

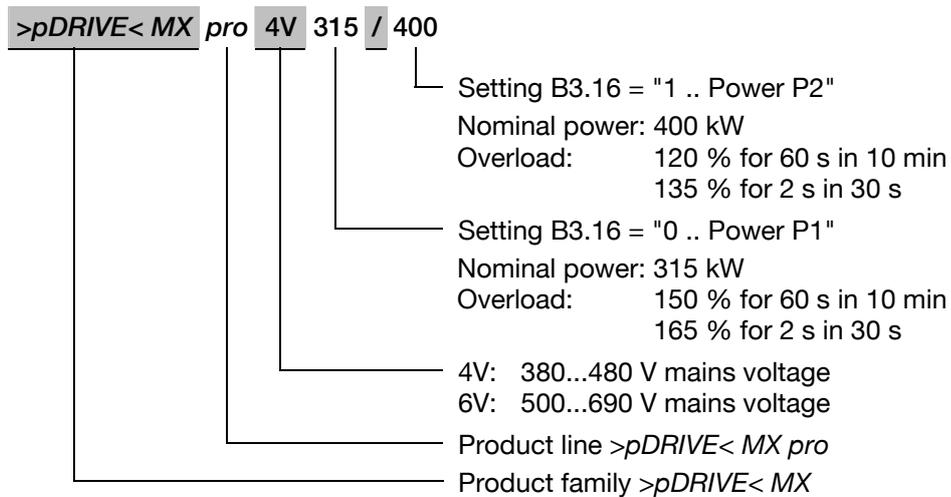
The frequency inverters *>pDRIVE< MX pro* 4V from type 4V90/110 as well as the devices of the *>pDRIVE< MX pro* 6V range are equipped with a dual rating function.

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 of "1 .. Power P2").

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

Example



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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 50178
Power factor	Fundamental (displacement factor): > 0.98 Total ( $\lambda$ ) at full load: 0.93...0.95 (with AC or DC choke) Total ( $\lambda$ ) 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 (>pDRIVE< 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 30.

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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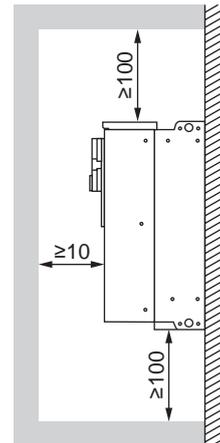
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Ambient conditions	
Operating temperature	in case of high overload (Power 1): -10...+50°C in case of increased output power (Power 2): -10...+45°C (3K3 according to IEC/EN 60721-3-3) up to +60°C with derating
Storage / Transport temperature	-25...+70°C
Protection degree	>pDRIVE< MX pro 6V2,2/3,0...6V75/90: bottom, sideways, front IP21 top IP41 (IP20 without protective cover) >pDRIVE< 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 >pDRIVE< MX pro 6V2,2/3,0...6V75/90: 3C1 and 3S2 according to EN 60721-3-3 >pDRIVE< MX pro 6V90/110...6V630/800: 3C2 and 3S2 according to EN 60721-3-3
Protection class	Class 1 according to EN 50178
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 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, 2nd environment, category C3
Insulation	Galvanic insulation in accordance with EN 50178 PELV (Protective Extra Low Voltage)
Standards	CE, UL, CSA, GOST, ATEX

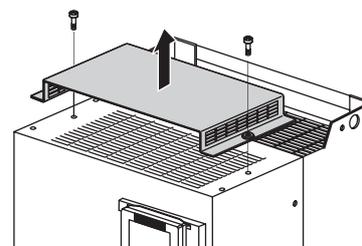


Frequency inverters are a product of the restricted sales according to IEC 61800-3. In a residential environment this product can cause radio frequency interferences whereupon the user can be called on to take suitable measures.

>pDRIVE< MX pro		6V2,2/3,0	6V3,0/4,0	6V4,0/5,5
<b>Nominal data</b>				
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)				
$S_{N500}$ [kVA]	$V_N = 500$ V	2.8/3.9	3.9/5	5/6.5
$S_{N600}$ [kVA]	$V_N = 600$ V	4.2/4.7	4.7/5.7	5.7/7.8
$S_{N690}$ [kVA]	$V_N = 690$ V	4.8/5.4	5.4/6.6	6.6/9
Continuous output current (P1/P2)				
$I_{N500}$ [A]	$V_N = 500$ V	3.2/4.5	4.5/5.8	5.8/7.5
$I_{N600}$ [A]	$V_N = 600$ V	4.0/4.5	4.5/5.5	5.5/7.5
$I_{N690}$ [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
<b>Input current (without external choke)</b>				
$I_{IN500}$ [A]	$V_N = 500$ V	3.8/5.2	5.2/6.8	6.8/8.6
$I_{IN600}$ [A]	$V_N = 600$ V	3.2/4.4	4.4/5.7	5.7/7.2
$I_{IN690}$ [A]	$V_N = 690$ V	4.0/5.2	5.2/6.6	6.6/8.6
<b>Braking unit</b>				
$P_{CONT}$ [kW]		2.2	3.0	4.0
$P_{MAX}$ for 60 s [kW]		3.3	4.5	6
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]		80/350	80/260	80/200
<b>Characteristics</b>				
Efficiency [%]		> 97	> 97	> 97
Losses [W]	at $I_N$	115/120	120/140	140/160
Weight approx. [kg]		20	20	20
<b>Ambient conditions</b>				
Volume cooling air [m <sup>3</sup> /h]		200	200	200
Sound pressure [dB(A)]		60	60	60
Mains short circuit [kA]		22	22	22



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

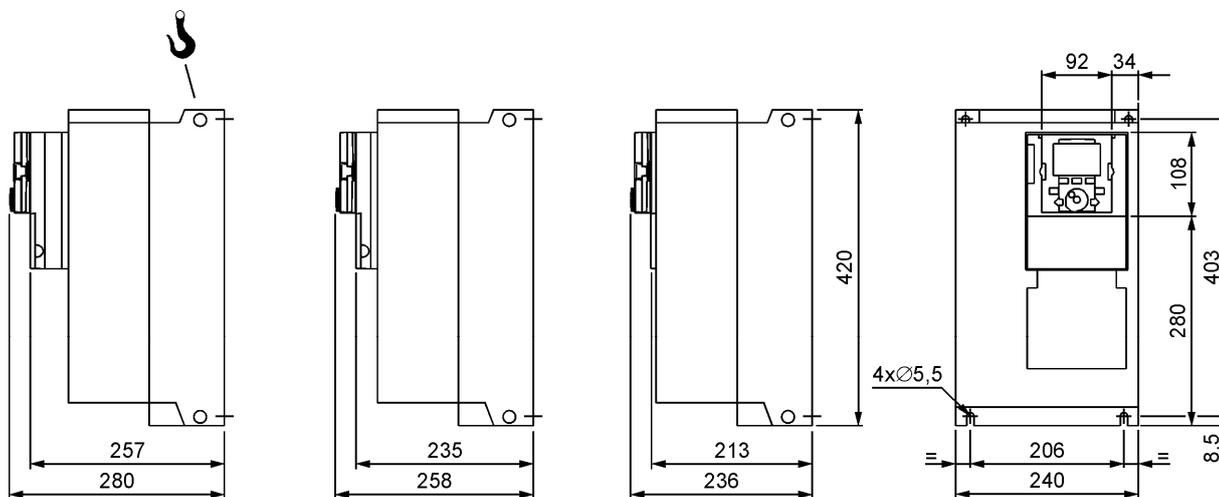


If you remove the IP41 protective cover the units can be installed without any distance sideways.

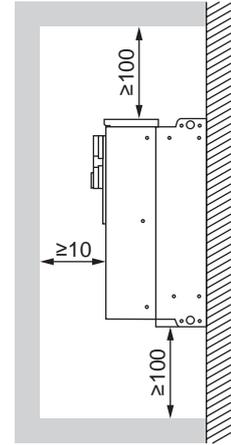
with 2 option cards

with 1 option card

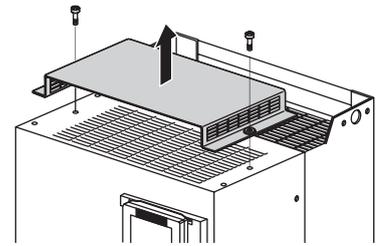
Basic device without option card



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



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

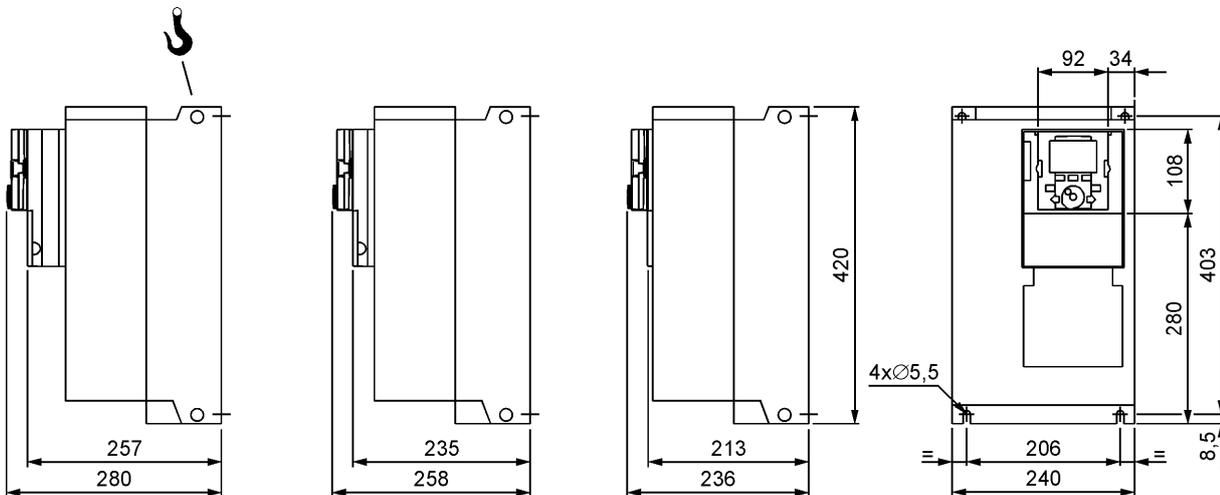


If you remove the IP41 protective cover the units can be installed without any distance sideways.

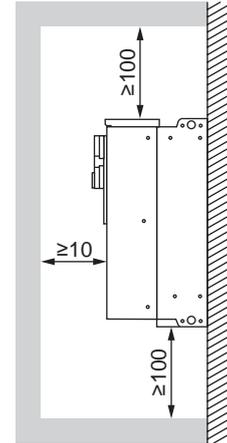
with 2 option cards

with 1 option card

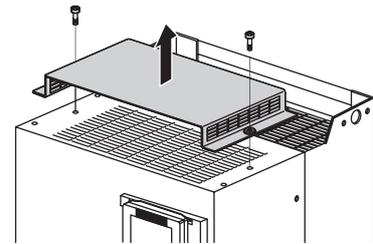
Basic device without option card



>pDRIVE< MX pro		6V15/18	6V18/22	6V22/30
<b>Nominal data</b>				
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)				
$S_{N500}$ [kVA]	$V_N = 500$ V	16/21	21/25	25/30
$S_{N600}$ [kVA]	$V_N = 600$ V	19.2/25	25/28	28/36
$S_{N690}$ [kVA]	$V_N = 690$ V	22/29	29/32	32/42
Continuous output current (P1/P2)				
$I_{N500}$ [A]	$V_N = 500$ V	18.5/24	24/29	29/35
$I_{N600}$ [A]	$V_N = 600$ V	18.5/24	24/27	27/35
$I_{N690}$ [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
<b>Input current (without external choke)</b>				
$I_{IN500}$ [A]	$V_N = 500$ V	20/25	25/29	29/33
$I_{IN600}$ [A]	$V_N = 600$ V	17/21	21/24	24/28
$I_{IN690}$ [A]	$V_N = 690$ V	20/24	24/27	29/34
<b>Braking unit</b>				
$P_{CONT}$ [kW]		15	18.5	22
$P_{MAX}$ for 60 s [kW]		23	28	33
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]		24/50	20/45	20/37
<b>Characteristics</b>				
Efficiency [%]		> 98	> 98	> 98
Losses [W]	at $I_N$	300/390	390/470	470/560
Weight approx. [kg]		20	20	20
<b>Ambient conditions</b>				
Volume cooling air [m <sup>3</sup> /h]		200	200	200
Sound pressure [dB(A)]		60	60	60
Mains short circuit [kA]		22	22	22



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

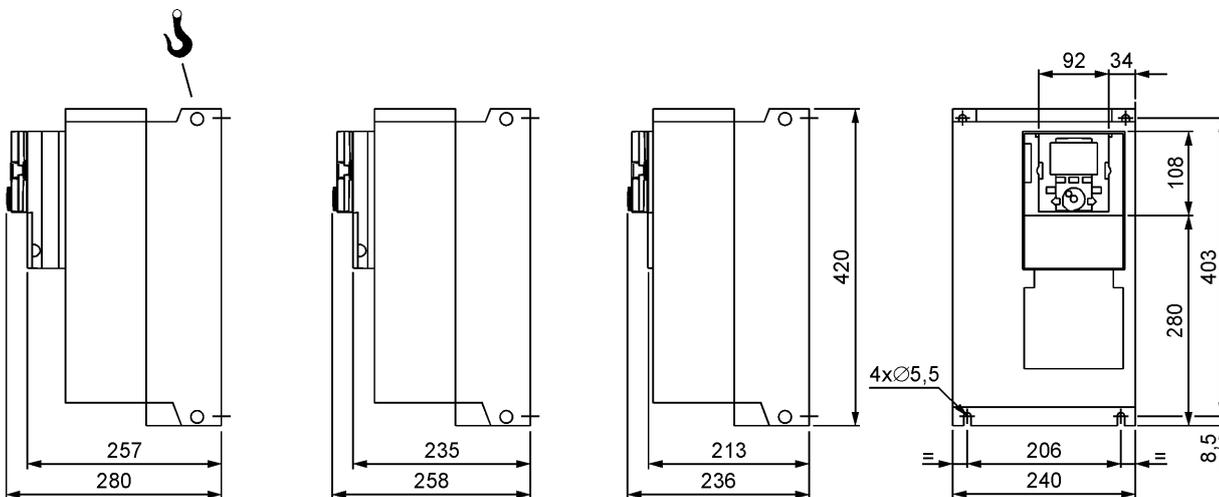


If you remove the IP41 protective cover the units can be installed without any distance sideways.

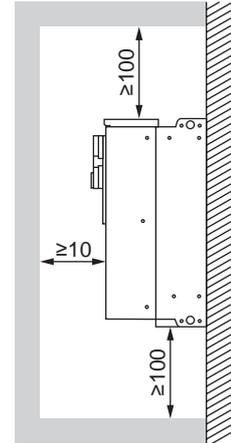
with 2 option cards

with 1 option card

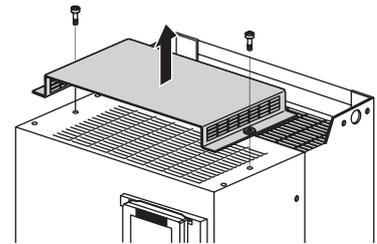
Basic device without option card



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



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

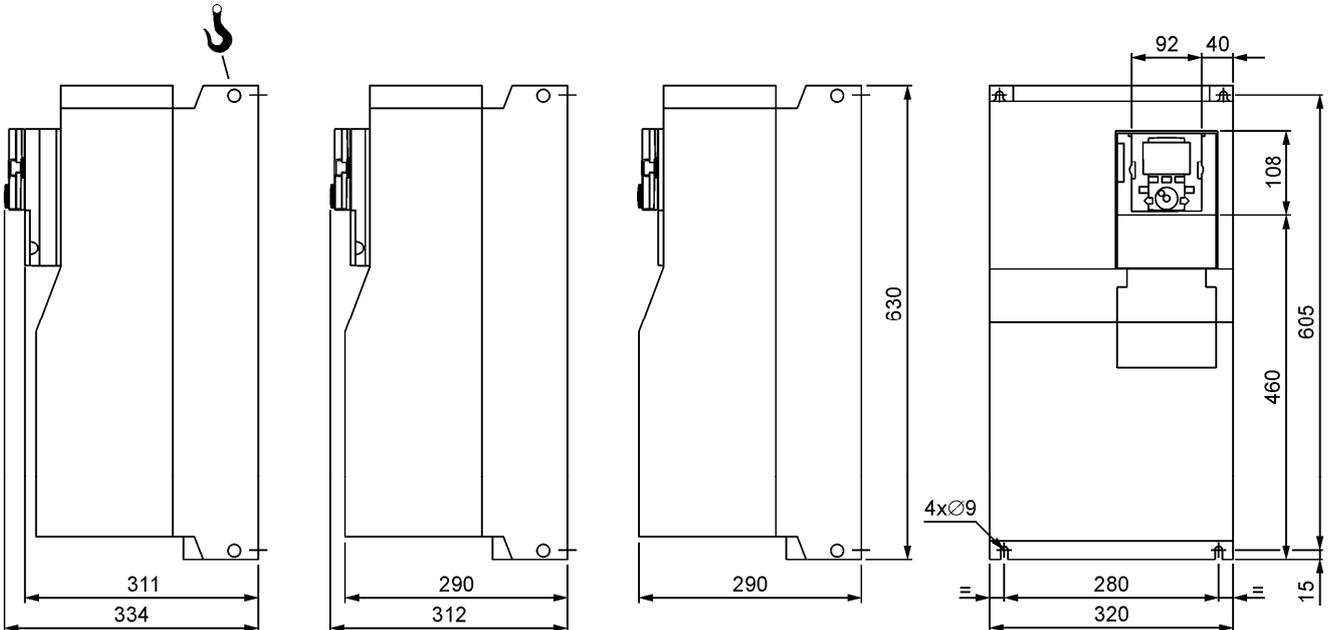


If you remove the IP41 protective cover the units can be installed without any distance sideways.

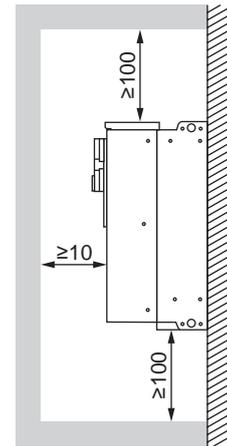
with 2 option cards

with 1 option card

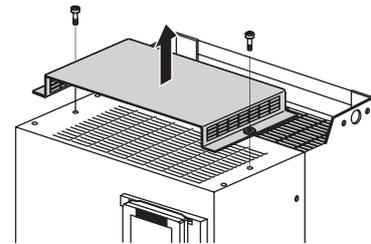
Basic device without option card



>pDRIVE< MX pro		6V55/75	6V75/90
<b>Nominal data</b>			
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)			
$S_{N500}$ [kVA]	$V_N = 500$ V	59/74	74/95
$S_{N600}$ [kVA]	$V_N = 600$ V	64/87	87/108
$S_{N690}$ [kVA]	$V_N = 690$ V	74/100	100/124
Continuous output current (P1/P2)			
$I_{N500}$ [A]	$V_N = 500$ V	68/85	85/110
$I_{N600}$ [A]	$V_N = 600$ V	62/84	84/104
$I_{N690}$ [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
<b>Input current (without external choke)</b>			
$I_{IN500}$ [A]	$V_N = 500$ V	68/84	84/110
$I_{IN600}$ [A]	$V_N = 600$ V	57/71	71/92
$I_{IN690}$ [A]	$V_N = 690$ V	63/88	88/101
<b>Braking unit</b>			
$P_{CONT}$ [kW]		55	75
$P_{MAX}$ for 60 s [kW]		83	113
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]		8/15	5/11
<b>Characteristics</b>			
Efficiency [%]		> 98	> 98
Losses [W]	at $I_N$	1100/1550	1550/1950
Weight approx. [kg]		57	57
<b>Ambient conditions</b>			
Volume cooling air [m <sup>3</sup> /h]		400	400
Sound pressure [dB(A)]		64	64
Mains short circuit [kA]		22	22



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

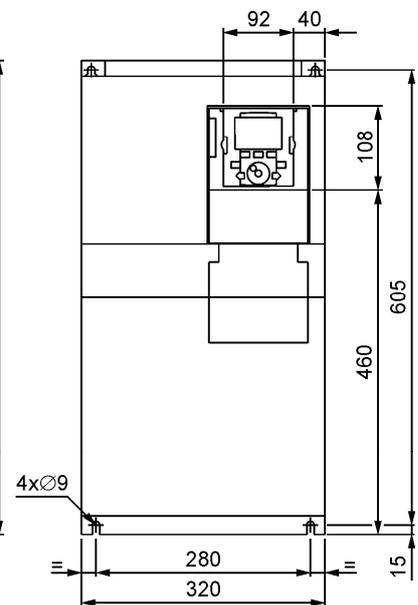
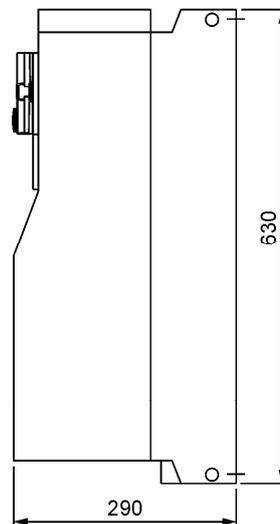
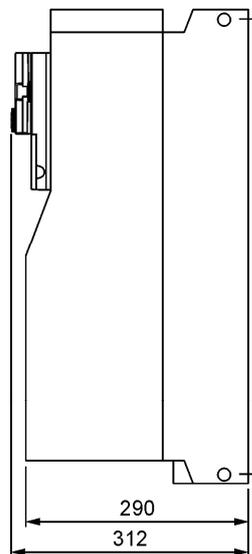
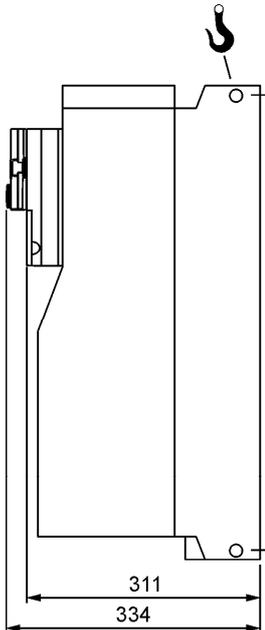


If you remove the IP41 protective cover the units can be installed without any distance sideways.

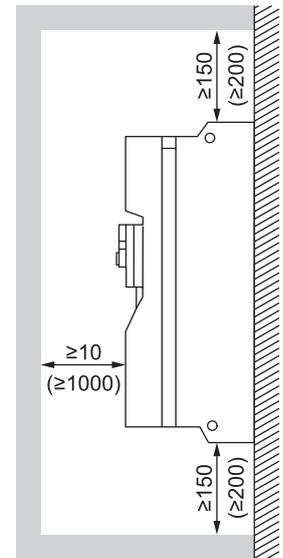
with 2 option cards

with 1 option card

Basic device without option card



>pDRIVE< MX pro		6V90/110	6V110/132	6V132/160	6V160/200
<b>Nominal data</b>					
Motor rating (P1/P2)					
P <sub>N</sub> [kW]	V <sub>N</sub> = 500 V	75/90	90/110	110/132	132/160
P <sub>N</sub> [hp]	V <sub>N</sub> = 600 V	100/125	125/150	150/(180)	(180)/200
P <sub>N</sub> [kW]	V <sub>N</sub> = 690 V	90/110	110/132	132/160	160/200
Continuous output power (P1/P2)					
S <sub>N 500</sub> [kVA]	V <sub>N</sub> = 500 V	95/118	118/143	143/173	173/208
S <sub>N 600</sub> [kVA]	V <sub>N</sub> = 600 V	108/130	130/156	156/187	187/228
S <sub>N 690</sub> [kVA]	V <sub>N</sub> = 690 V	124/149	149/179	179/215	215/263
Continuous output current (P1/P2)					
I <sub>N 500</sub> [A]	V <sub>N</sub> = 500 V	110/136	136/165	165/200	200/240
I <sub>N 600</sub> [A]	V <sub>N</sub> = 600 V	104/125	125/150	150/180	180/220
I <sub>N 690</sub> [A]	V <sub>N</sub> = 690 V	104/125	125/150	150/180	180/220
Maximum current (P1/P2) for 60 s per 10 minutes					
I <sub>MAX</sub> [A]	V <sub>N</sub> = 500 V	165/163	204/198	248/240	300/288
I <sub>MAX</sub> [A]	V <sub>N</sub> = 600 V	156/150	188/180	225/216	270/264
I <sub>MAX</sub> [A]	V <sub>N</sub> = 690 V	156/150	188/180	225/216	270/264
<b>Input current</b>					
I <sub>IN 500</sub> [A]	V <sub>N</sub> = 500 V	108/128	128/153	153/182	182/218
I <sub>IN 600</sub> [A]	V <sub>N</sub> = 600 V	94/113	113/133	133/159	159/197
I <sub>IN 690</sub> [A]	V <sub>N</sub> = 690 V	98/117	117/137	137/163	163/199
<b>Braking unit</b>					
P <sub>CONT</sub> [kW]		90	110	132	160
P <sub>MAX</sub> for 60 s [kW]		135	165	198	240
R <sub>MIN</sub> / R <sub>MAX</sub> [Ω]		4/9	4/7,3	4/6,1	4/5
<b>Characteristics</b>					
Efficiency [%]		> 97.9	> 97.9	> 97.9	> 97.9
Losses [W]	at I <sub>N</sub>	1960/2320	2320/2750	2740/3290	3270/4030
Weight approx. [kg]		80	80	80	80
<b>Ambient conditions</b>					
Volume cooling air [m <sup>3</sup> /h]		600	600	600	600
Sound pressure [dB(A)]		71	71	71	71
Mains short circuit [kA]		28	28	35	35
<b>Fan supply</b>					
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).

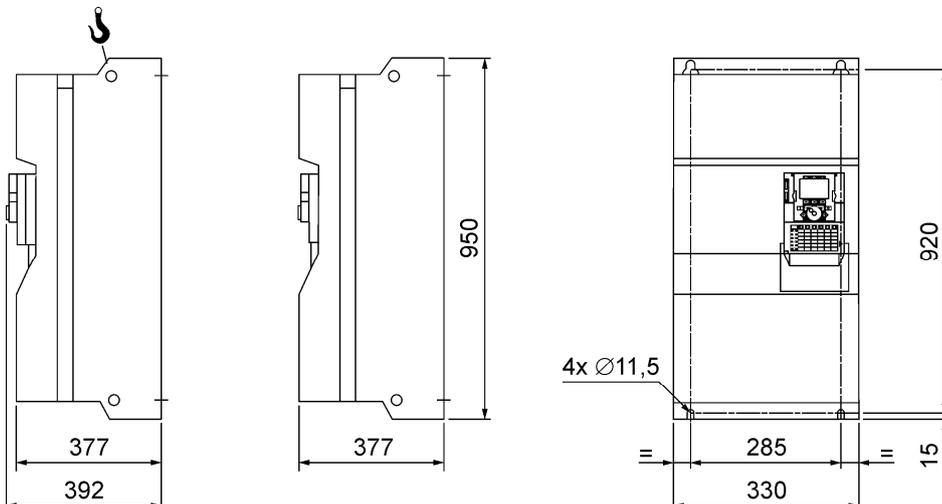
In either case avoid air short circuits.

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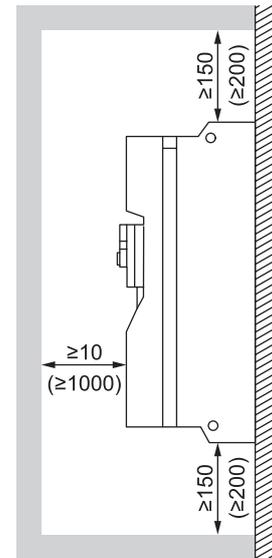
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with 2 option cards

Basic device without or with 1 option card



>pDRIVE< MX pro		6V200/250	6V250/315	6V315/400
<b>Nominal data</b>				
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)				
$S_{N500}$ [kVA]	$V_N = 500$ V	208/270	270/338	338/400
$S_{N600}$ [kVA]	$V_N = 600$ V	228/301	301/368	368/436
$S_{N690}$ [kVA]	$V_N = 690$ V	263/347	347/424	424/502
Continuous output current (P1/P2)				
$I_{N500}$ [A]	$V_N = 500$ V	240/312	312/390	390/462
$I_{N600}$ [A]	$V_N = 600$ V	220/290	290/355	355/420
$I_{N690}$ [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
<b>Input current</b>				
$I_{IN500}$ [A]	$V_N = 500$ V	227/277	277/342	342/426
$I_{IN600}$ [A]	$V_N = 600$ V	204/250	249/311	311/390
$I_{IN690}$ [A]	$V_N = 690$ V	212/257	256/317	317/394
<b>Braking unit</b>				
$P_{CONT}$ [kW]		200 <sup>1.)</sup>	250 <sup>1.)</sup>	315 <sup>1.)</sup>
$P_{MAX}$ for 60 s [kW]		300	375	473
$R_{MIN} / R_{MAX}$ [ $\Omega$ ]		2/4	2/3,2	2/2,6
<b>Characteristics</b>				
Efficiency [%]		> 98	> 98	> 98
Losses [W]	at $I_N$	4010/5160	5140/6310	6290/7550
Weight approx. [kg]		140	140	140
<b>Ambient conditions</b>				
Volume cooling air [m <sup>3</sup> /h]		1200	1200	1200
Sound pressure [dB(A)]		73	73	73
Mains short circuit [kA]		35	35	42
<b>Fan supply</b>				
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).

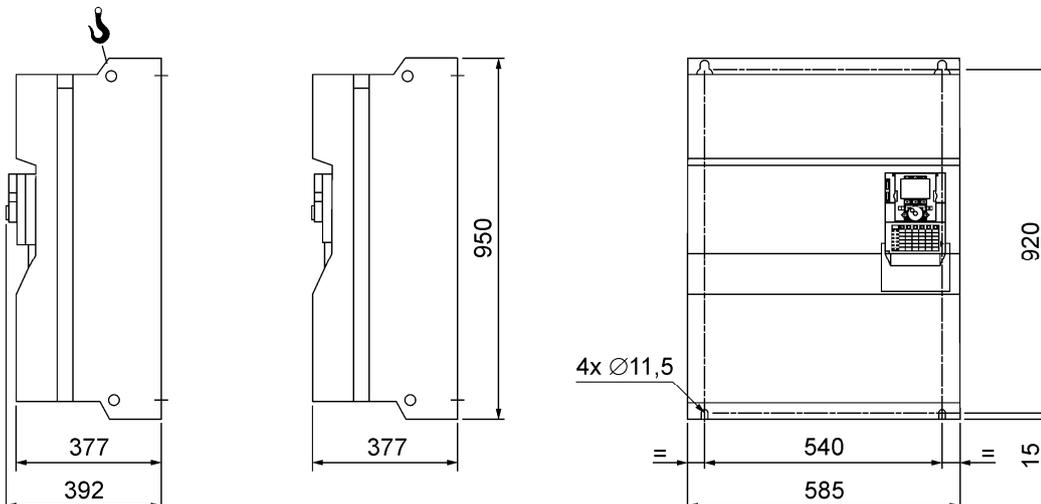
In either case avoid air short circuits.

1.) external braking unit

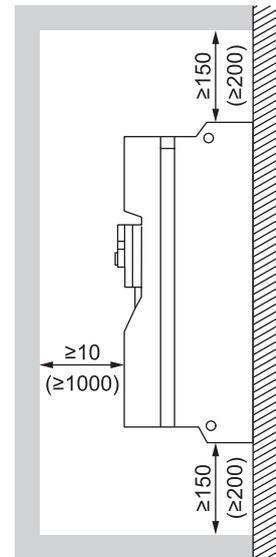
\*) 550 VA for braking unit

with 2 option cards

Basic device without or with 1 option card



>pDRIVE< MX pro		6V400/500	6V500/630	6V630/800
<b>Nominal data</b>				
Motor rating (P1/P2)				
P <sub>N</sub> [kW]	V <sub>N</sub> = 500 V	315/400	400/500	500/630
P <sub>N</sub> [hp]	V <sub>N</sub> = 600 V	450/550	550/700	700/800
P <sub>N</sub> [kW]	V <sub>N</sub> = 690 V	400/500	500/630	630/800
Continuous output power (P1/P2)				
S <sub>N 500</sub> [kVA]	V <sub>N</sub> = 500 V	400/511	511/641	641/779
S <sub>N 600</sub> [kVA]	V <sub>N</sub> = 600 V	436/564	564/701	701/872
S <sub>N 690</sub> [kVA]	V <sub>N</sub> = 690 V	502/649	649/807	807/1004
Continuous output current (P1/P2)				
I <sub>N 500</sub> [A]	V <sub>N</sub> = 500 V	462/590	590/740	740/900
I <sub>N 600</sub> [A]	V <sub>N</sub> = 600 V	420/543	543/675	675/840
I <sub>N 690</sub> [A]	V <sub>N</sub> = 690 V	420/543	543/675	675/840
Maximum current (P1/P2) for 60 s per 10 minutes				
I <sub>MAX</sub> [A]	V <sub>N</sub> = 500 V	693/708	885/888	1110/1080
I <sub>MAX</sub> [A]	V <sub>N</sub> = 600 V	630/652	815/810	1013/1008
I <sub>MAX</sub> [A]	V <sub>N</sub> = 690 V	630/652	815/810	1013/1008
<b>Input current</b>				
I <sub>IN 500</sub> [A]	V <sub>N</sub> = 500 V	439/547	544/673	673/847
I <sub>IN 600</sub> [A]	V <sub>N</sub> = 600 V	401/494	491/613	613/771
I <sub>IN 690</sub> [A]	V <sub>N</sub> = 690 V	409/505	498/616	616/775
<b>Braking unit</b>				
P <sub>CONT</sub> [kW]		400 <sup>1.)</sup>	500 <sup>1.)</sup>	630 <sup>1.)</sup>
P <sub>MAX</sub> for 60 s [kW]		600	750	945
R <sub>MIN</sub> / R <sub>MAX</sub> [Ω]		1/2,02	1/1,61	1/1,28
<b>Characteristics</b>				
Efficiency [%]		> 98	> 98	> 98
Losses [W]	at I <sub>N</sub>	7600/9660	9610/11950	11920/14980
Weight approx. [kg]		300	300	300
<b>Ambient conditions</b>				
Volume cooling air [m <sup>3</sup> /h]		2400	2400	2400
Sound pressure [dB(A)]		75	75	75
Mains short circuit [kA]		42	42	42
<b>Fan supply</b>				
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

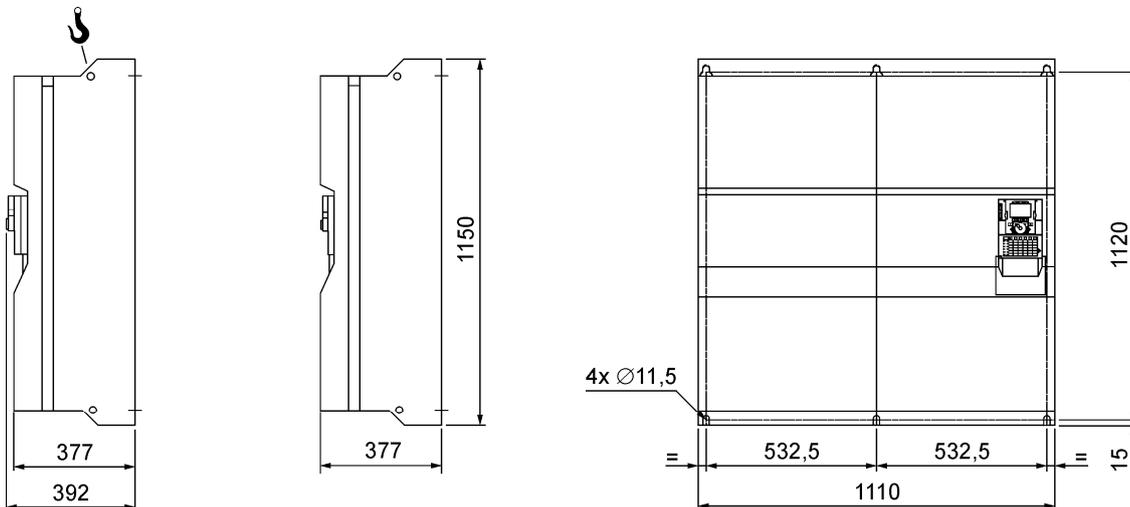
\*) 550 VA for braking unit

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with 2 option cards

Basic device without or with 1 option card



## Mounting place and mounting position

As it is usual with electronic built-in devices, the *>pDRIVE< 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 139).



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.

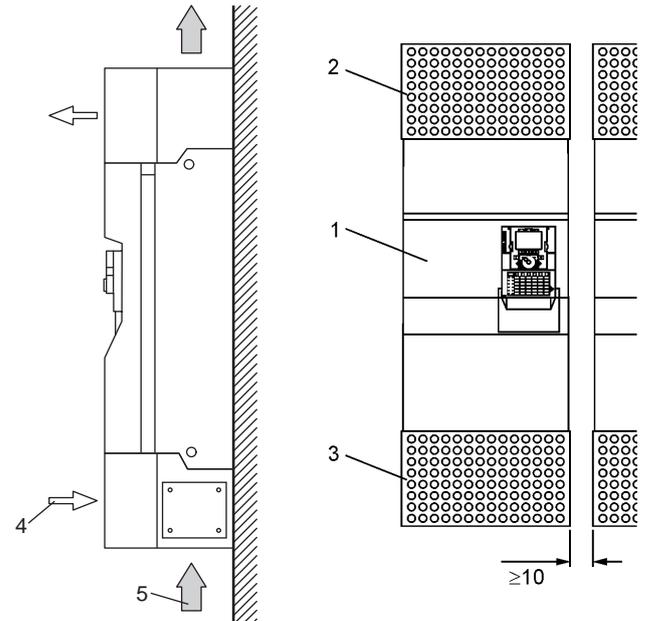
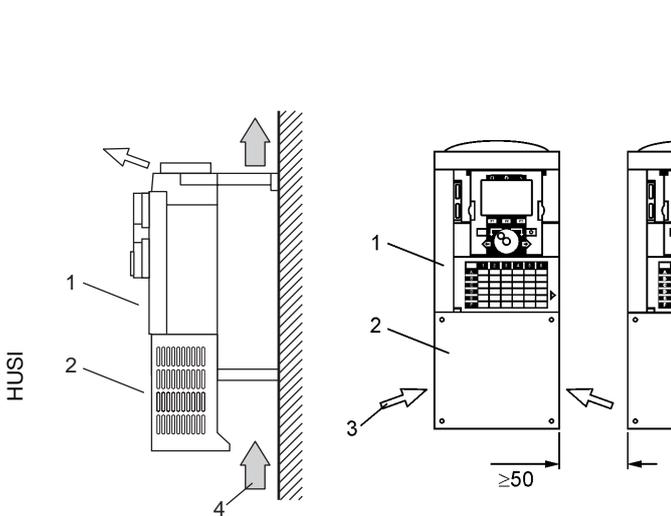
## Wall-mounting

The >pDRIVE< MX pro 6V is designed for installation on the wall or in an electrical room. When using the option >pDRIVE< TER-BOX and TRAF0-BOX (for devices from 90/110 kW on) 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 terminal box for frequency inverters up to 75/90 kW

Wall-mounting with option TRAF0-BOX and option terminal box for frequency inverters from 90/110 kW on



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- 1 >pDRIVE< MX pro 6V2,2/3,0 ... 6V75/90
- 2 Option >pDRIVE< TER-BOX 130...320
- 3 Cooling air for control part
- 4 Cooling air for power part

- 1 >pDRIVE< MX pro 6V from 90/110 kW
- 2 Option >pDRIVE< TRAF0-BOX
- 3 Option >pDRIVE< TER-BOX
- 4 Cooling air for control part
- 5 Cooling air for power part

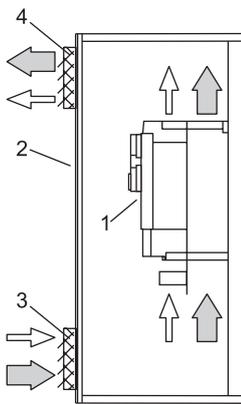
Protection degree: above IP41, all around IP21  
Ambient temperature: -10...+45°C

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

## 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 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 90/110 kW to avoid internal air short-cuts. Furthermore take care of an exhaust of the control part.

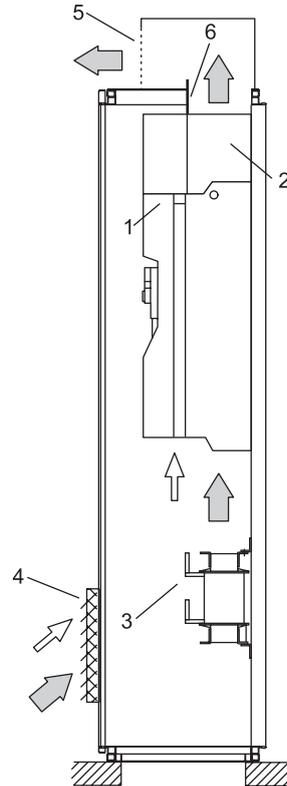
Cubicle installation protection degree IP23  
for frequency inverters up to 75/90 kW



- 1 >pDRIVE< 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 >pDRIVE< MX pro 6V from 90/110 kW
- 2 Transformer >pDRIVE< TRAFO-BOX
- 3 Line choke option >pDRIVE< 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.

## Cubicle installation IP54

Cubicle installation IP54 with separated air flow or flange mounting:

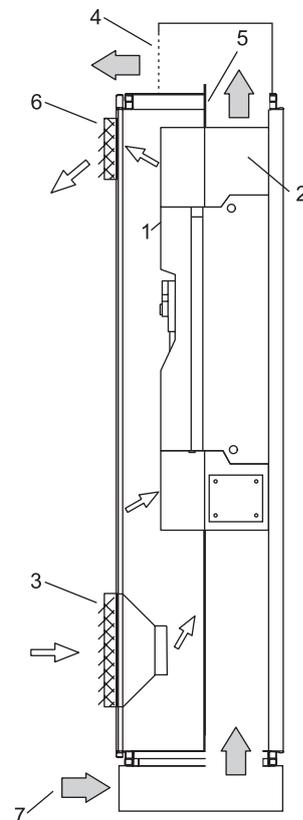
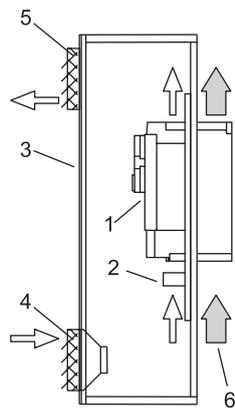
The power part of all devices is designed in IP54 and is sealed from the control electronics. In case of cubicle installation a basement is necessary for separated air flow. The power part fan which is inside the device exhausts the losses of the power part (external). The losses of the control part 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 TRAF0-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

Cubicle installation protection degree IP54  
for frequency inverters from 90/110 kW



- 1 >pDRIVE< MX pro 6V2,2/3,0...6V75/90
- 2 >pDRIVE< NDU
- 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

- 1 >pDRIVE< MX pro 6V from 90/110 kW
- 2 Transformer >pDRIVE< TRAF0-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

Protection degree: IP54  
Ambient temperature: -10...+40°C

## 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.

>pDRIVE< MX pro	I <sub>N</sub> (P1/P2) [A]	2.5 kHz				4.9 kHz					
		45°C	50°C	55°C	60°C	30°C	40°C	45°C	50°C	55°C	60°C
		% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>	% I <sub>N</sub> <sup>P1</sup> / % I <sub>N</sub> <sup>P2</sup>
6V2,2/3,0	4/4.5	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V3,0/4,0	4.5/5.5	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V4,0/5,5	5.5/7.5	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V5,5/7,5	7.5/10	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V7,5/11	10/13.5	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V11/15	13.5/18.5	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V15/18	18.5/24	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/96	100/90	100/85
6V18/22	24/27	100/100	100/100	100/100	100/100	100/100	100/96	100/91	96/85	90/80	85/75
6V22/30	27/35	100/100	100/100	100/95	100/89	100/82	95/74	90/70	85/66	80/62	76/58
6V30/37	35/43	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V37/45	43/54	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
6V45/55	54/62	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/98
6V55/75	62/84	100/100	100/100	100/100	100/100	100/100	100/92	100/87	100/82	100/77	98/72
6V75/90	84/104	100/100	100/100	100/95	100/89	100/82	91/74	86/70	81/66	77/62	72/58
6V90/110	104/125	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/96
6V110/132	125/150	100/100	100/100	100/100	100/100	100/100	100/100	100/97	94/91	89/85	84/80
6V132/160	150/180	100/100	100/100	100/100	100/100	97/96	88/86	83/81	79/76	74/71	70/67
6V160/200	180/220	100/100	100/95	95/89	89/84	80/78	73/70	69/66	66/62	62/58	58/55
6V200/250	220/290	100/100	100/100	100/100	100/100	100/100	100/97	100/95	100/89	100/84	95/78
6V250/315	290/355	100/100	100/100	100/100	100/99	99/85	90/79	85/77	81/73	76/68	72/64
6V315/400	355/420	100/100	100/95	95/89	90/84	80/72	73/67	70/65	66/62	62/58	59/54
6V400/500	420/543	100/100	100/100	100/100	100/100	100/100	100/99	100/92	98/86	93/80	87/75
6V500/630	543/675	100/100	100/100	100/100	100/100	92/91	84/80	80/74	76/69	72/65	68/60
6V630/800	675/840	100/100	100/94	95/88	90/82	73/72	67/64	64/60	61/56	58/52	54/48

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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 171).
- Select a motor which is at most one type bigger.



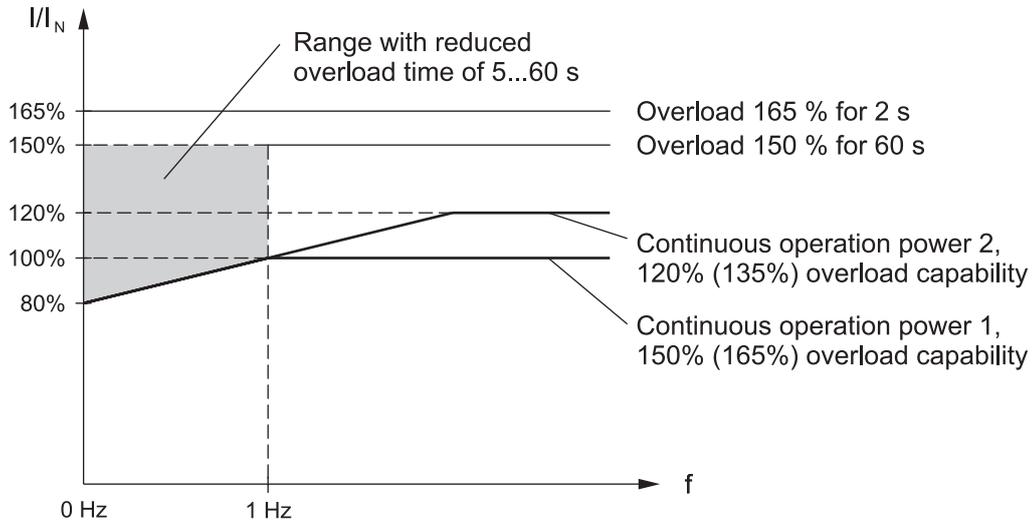
The installation of the TRAF0-BOX and the terminal box does not have any effect on the cooling and from there also the power increase or reduction of the frequency inverter is independent from the use of these options.



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 pulse 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.

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.



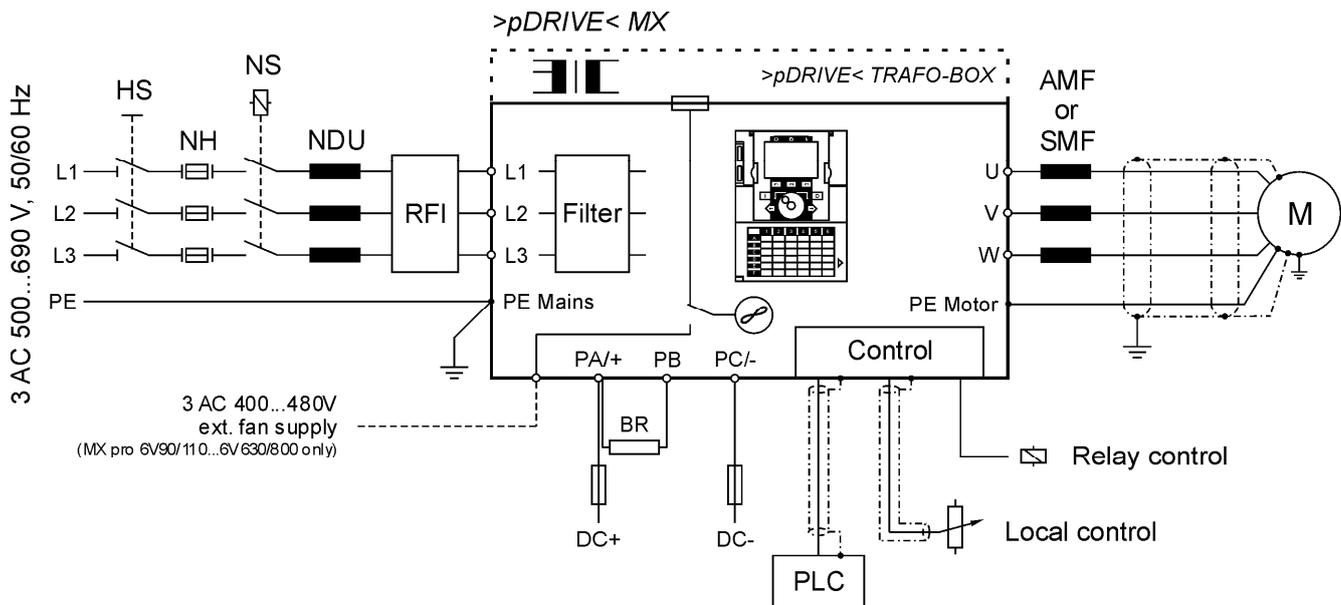
There is practically no effect on the start of a drive since even 500 kW motors already have a nominal slip of 0.3 Hz and thus an overload time of approx. 22 s is possible.

# 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.

### >pDRIVE< MX pro 6V2,2/3,0...6V160/200



>pDRIVE< MX.....Frequency inverter

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)

>pDRIVE< 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"

>pDRIVE< RFI.....Radio frequency interference filter

Option to keep category C3 in case of long motor cables.

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

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

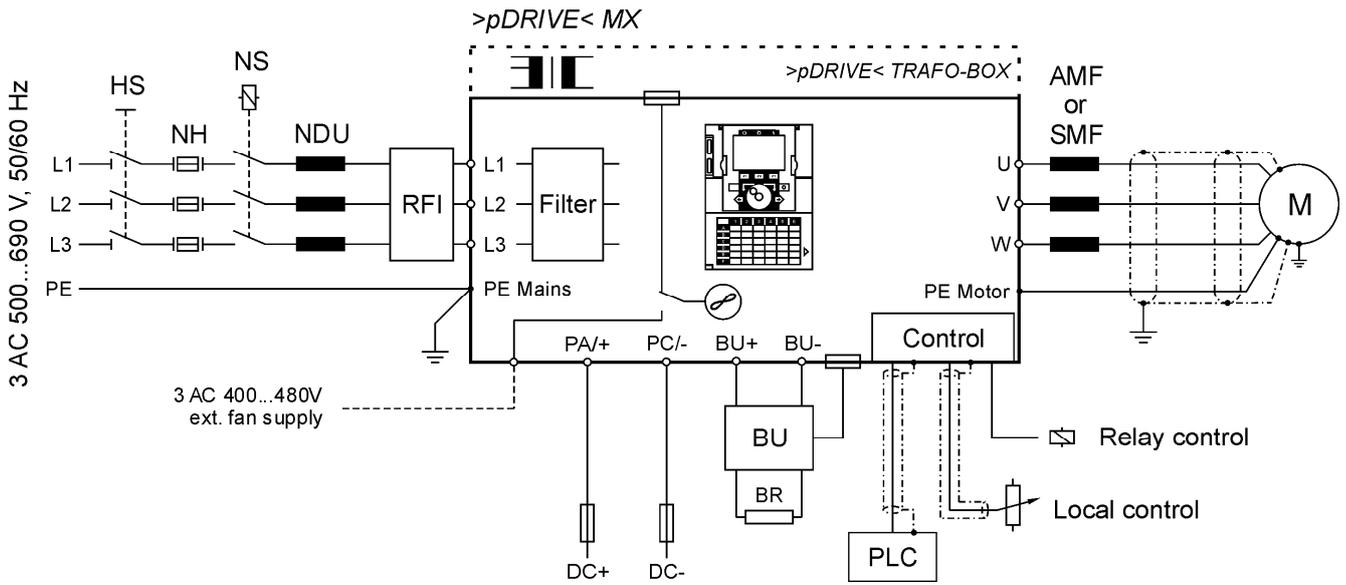
>pDRIVE< BR .....Option braking resistor for short deceleration time or short-time dynamic loads

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

TRAF0-BOX .....Transformer box (for >pDRIVE< MX pro 6V90/110...6V630/800 only)

This option can be used instead of an external auxiliary voltage for fan supply.

>pDRIVE< MX pro 6V200/250...6V315/400



>pDRIVE< MX.....Frequency inverter

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)

>pDRIVE< 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"

>pDRIVE< RFI.....Radio frequency interference filter

Option to keep category C3 in case of long motor cables.

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

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

>pDRIVE< BU.....Braking unit

External option for >pDRIVE< MX pro 6V200/250 ... 6V630/800

>pDRIVE< 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.

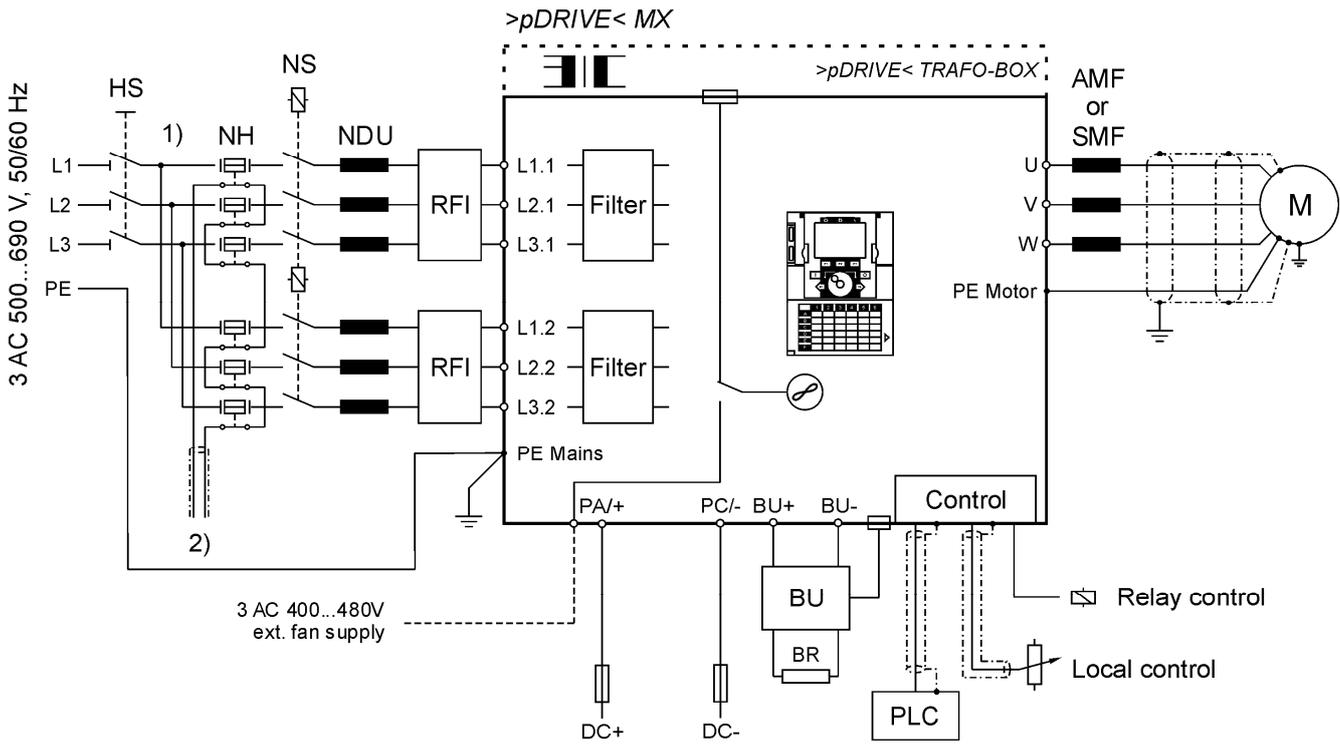
TRAFO-BOX .....Transformer box (for >pDRIVE< MX pro 6V90/110...6V630/800 only)

This option can be used instead of an external auxiliary voltage for fan supply.

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>pDRIVE< MX pro 6V400/500...6V630/800



>pDRIVE< MX.....Frequency inverter

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)

>pDRIVE< 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"

>pDRIVE< RFI.....Radio frequency interference filter

Option to keep category C3 in case of long motor cables.

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

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

>pDRIVE< BU .....Braking unit

External option for >pDRIVE< MX pro 6V200/250 ... 6V630/800

>pDRIVE< 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.

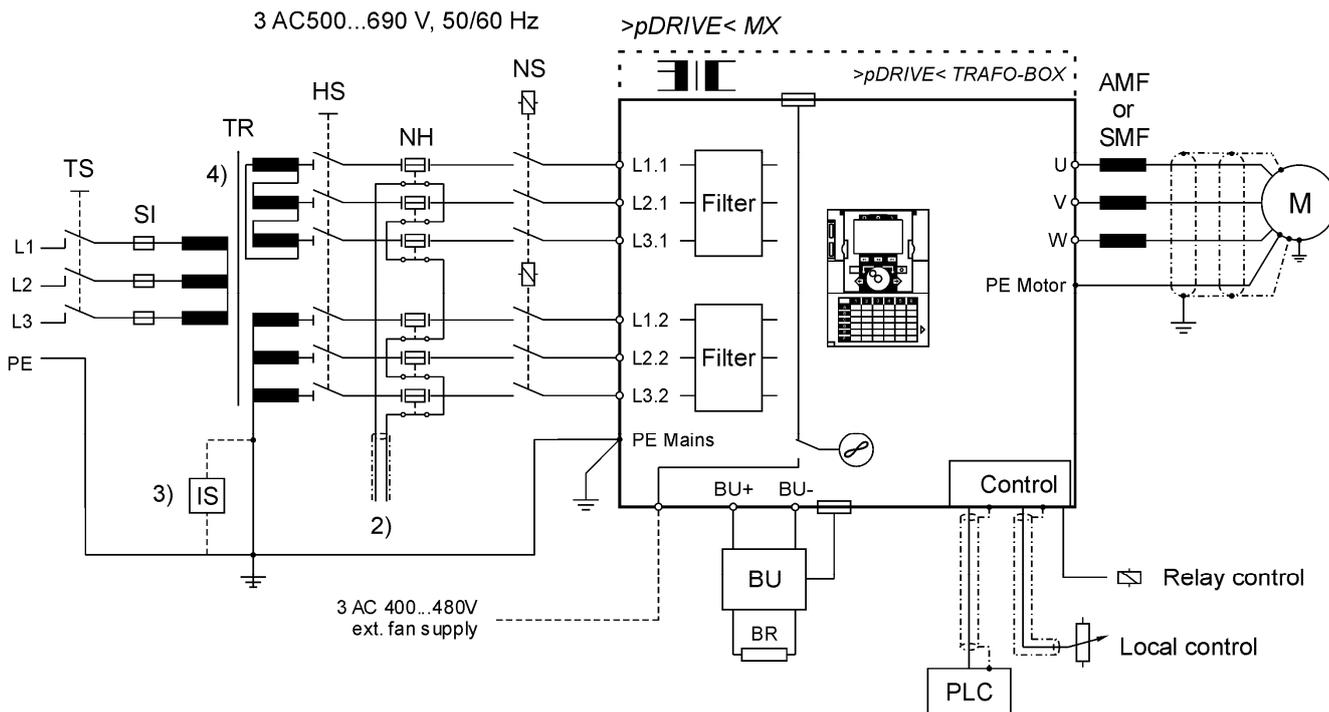
TRAFO-BOX .....Transformer box (for >pDRIVE< MX pro 6V90/110...6V630/800 only)

This option can be used instead of an external auxiliary voltage for fan 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. Therefore set the parameter E3.27 "Mains phase monitoring" to "1..Active" (factory default).

>pDRIVE< MX pro 6V400/500...6V630/800

12-pulse rectification



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>pDRIVE< MX..... Frequency inverter

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"

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

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

>pDRIVE< BU..... Braking unit  
External option for >pDRIVE< MX pro 6V200/250 ... 6V630/800

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

TRAFO-BOX..... Transformer box (for >pDRIVE< MX pro 6V90/110...6V630/800 only)  
This option can be used instead of an external auxiliary voltage for fan supply.

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. Therefore 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:  $\pm 5.0$  % 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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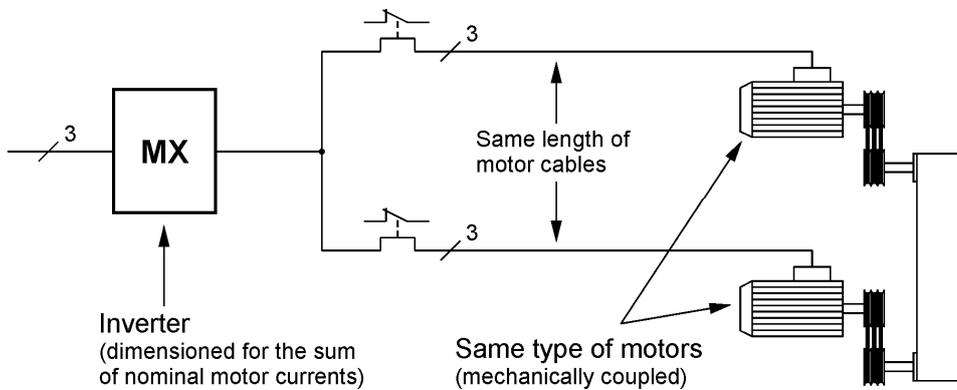
## Multi-motor operation

It is basically possible to operate several motors with a >pDRIVE< 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.

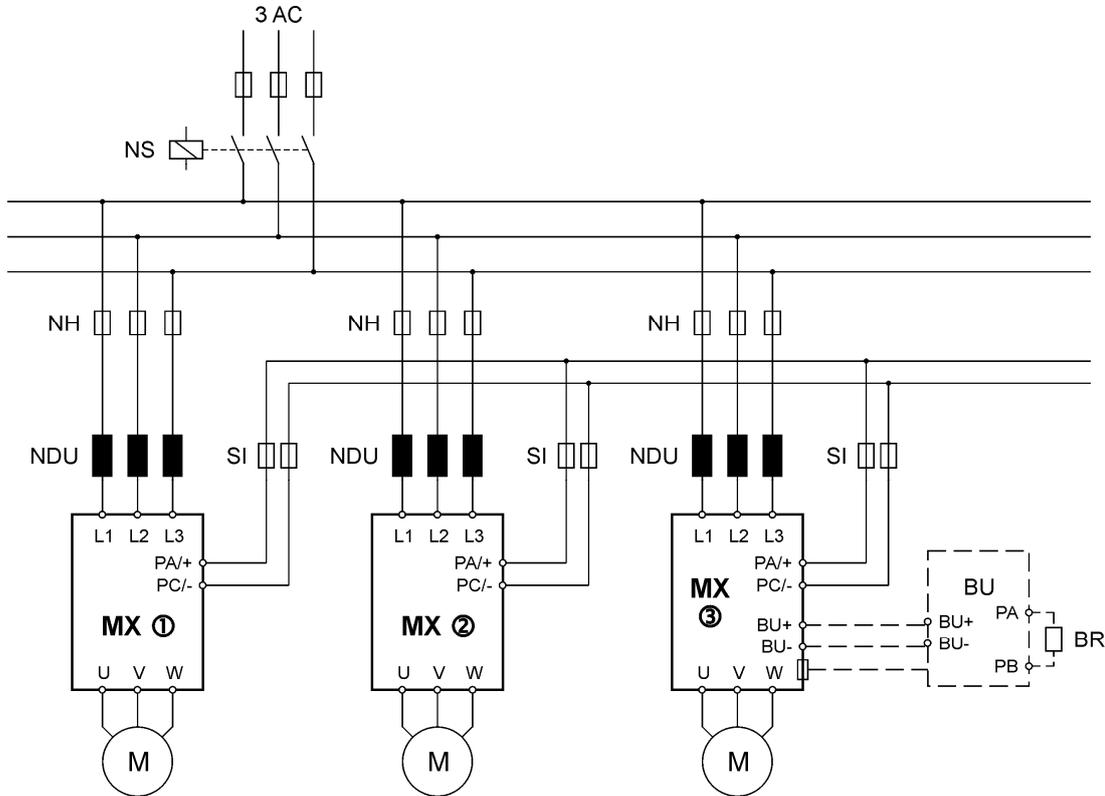


If thermal relays or motor circuit breakers are used, they must be set to about 110 % of the nominal current of the motor !

## DC coupling

### DC-coupling of several >pDRIVE< 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 163. 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 165

①, ②, ③ .....>pDRIVE< 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.



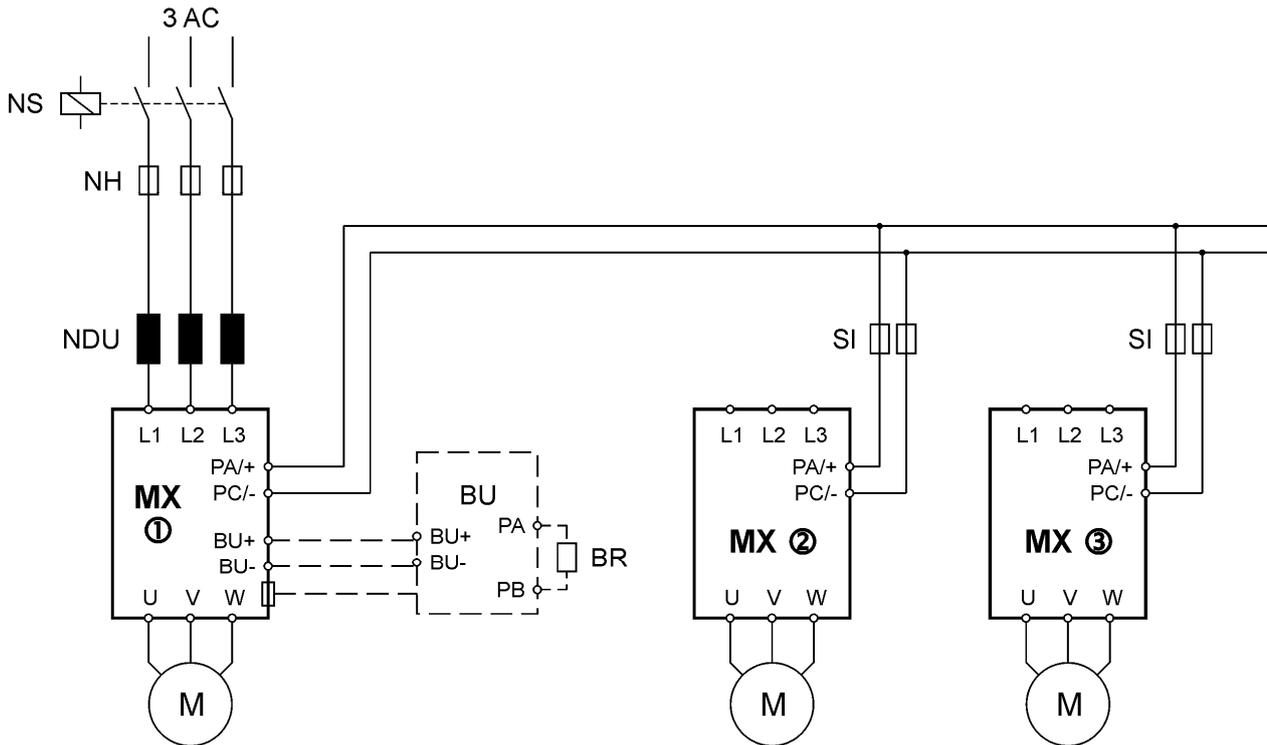
>pDRIVE< MX pro 6V frequency inverters can be operated at the same DC bus. However, some parameters have to be adjusted appropriate (see Description of functions).

**>pDRIVE< 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 >pDRIVE< MX pro 6V 200/250).

 DC supplied drives must not be connected during operation !



- ① .....>pDRIVE< 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 >pDRIVE< 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 165  
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 >pDRIVE< MX pro frequency inverters do not include any input fuses. They have to be provided externally for the case that the electronic protective mechanism of the inverters fails. Thus they are a secondary protection of the inverter to protect the power cables against overload and to protect the input rectifier in case of an internal short-circuit.

The below-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 <sup>1.)</sup>	Cu cable mm <sup>2</sup>	Mains fuse "inverter protection" "sf"	Lines in the cubicle mm <sup>2</sup> (per phase)	>pDRIVE< MX pro	Max. cont. current	Max. connection	Motor cable mm <sup>2</sup> <sup>1.)</sup>
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	6V18/22	29	50	3x 4.0
50 A	3x 10	50 A	A	6V22/30	35	50	3x 6.0
63 A	3x 16	63 A	A	6V30/37	47	120	3x 10
80 A	3x 25	80 A	A	6V37/45	59	120	3x 16
100 A	3x 35	100 A	A	6V45/55	68	120	3x 16
125 A	3x 50	125 A	A	6V55/75	85	120	3x 25
160 A	3x 70	160 A	B	6V75/90	110	120	3x 35
160 A	3x 70	160 A	C	6V90/110	136	M10	3x 70
200 A	3x 95	200 A	C	6V110/132	165	M10	3x 70
250 A	3x 120	250 A	C	6V132/160	200	M10	3x 95
315 A	3x 185	315 A	C	6V160/200	240	M10	3x 120
400 A	2x (3x 120)	400 A	D	6V200/250	312	M12	3x 185
500 A	2x (3x 150)	500 A	D	6V250/315	390	M12	2x (3x 120)
630 A	2x (3x 185)	630 A	D	6V315/400	462	M12	2x (3x 150)
800 A	3x (3x 185)	2x 400 A <sup>2.)</sup>	D	6V400/500	590	M12	3x (3x 150)
1000 A	4x (3x 185)	2x 500 A <sup>2.)</sup>	D	6V500/630	740	M12	3x (3x 185)
1250 A	4x (3x 240)	2x 630 A <sup>2.)</sup>	D	6V630/800	900	M12	4x (3x 185)

<sup>1.)</sup> In case of bypass operation the motor cable has to be dimensioned according to the pre- or conduit fuses !

<sup>2.)</sup> 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.

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
$11 \cdot 10^3 \text{ A}^2\text{s}$	$110 \cdot 10^3 \text{ A}^2\text{s}$	$200 \cdot 10^3 \text{ A}^2\text{s}$	$720 \cdot 10^3 \text{ A}^2\text{s}$



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.



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 J 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.

>pDRIVE<	UL-fuses 600V type Fast Acting	Max. mains short circuit current at 600V mains voltage according to UL listing		Cable cross section for line and motor cable (per phase)
		without choke	with line reactor	
<i>MX pro 6V2,2/3,0</i>	Class J 10A max.	22 kA	100 kA	AWG 14
<i>MX pro 6V3,0/4,0</i>	Class J 10A max.	22 kA	100 kA	AWG 14
<i>MX pro 6V4,0/5,5</i>	Class J 15A max.	22 kA	100 kA	AWG 14
<i>MX pro 6V5,5/7,5</i>	Class J 20A max.	22 kA	100 kA	AWG 14
<i>MX pro 6V7,5/11</i>	Class J 25A max.	22 kA	100 kA	AWG 12
<i>MX pro 6V11/15</i>	Class J 35A max.	22 kA	100 kA	AWG 10
<i>MX pro 6V15/18</i>	Class J 40A max.	22 kA	100 kA	AWG 10
<i>MX pro 6V18/22</i>	Class J 45A max.	22 kA	100 kA	AWG 8
<i>MX pro 6V22/30</i>	Class J 60A max.	22 kA	100 kA	AWG 8
<i>MX pro 6V30/37</i>	Class J 70A max.	22 kA	100 kA	AWG 6
<i>MX pro 6V37/45</i>	Class J 90A max.	22 kA	100 kA	AWG 4
<i>MX pro 6V45/55</i>	Class J 110A max.	22 kA	100 kA	AWG 4
<i>MX pro 6V55/75</i>	Class J 150A max.	22 kA	100 kA	AWG 3
<i>MX pro 6V75/90</i>	Class J 175A max.	22 kA	100 kA	AWG 1
<i>MX pro 6V90/110</i>	Class J 175A max.	–	100 kA	AWG 2/0
<i>MX pro 6V110/132</i>	Class J 200A max.	–	100 kA	AWG 3/0
<i>MX pro 6V132/160</i>	Class J 250A max.	–	100 kA	250 MCM
<i>MX pro 6V160/200</i>	Class J 300A max.	–	100 kA	300 MCM
<i>MX pro 6V200/250</i>	Class J 400A max.	–	100 kA	2 x 250 MCM
<i>MX pro 6V250/315</i>	Class J 500A max.	–	100 kA	2 x 350 MCM
<i>MX pro 6V315/400</i>	Class J 600A max.	–	100 kA	3 x 300 MCM
<i>MX pro 6V400/500</i>	Class J 2x 400A max.	–	100 kA	Line: 2 x (2 x 300 MCM) Motor: 4 x 300
<i>MX pro 6V500/630</i>	Class J 2x 500A max.	–	100 kA	Line: 2 x (2 x 400 MCM) Motor: 4 x 400
<i>MX pro 6V630/800</i>	Class J 2x 600A max.	–	100 kA	Line: 2 x (2 x 500 MCM) Motor: 4 x 500 MCM

## Fuses for DC-coupled inverters

DC mains supply	500 V	600 V	690 V
Nominal voltage	700 V DC	840 V DC	960 V DC
Voltage range	620...780 V DC	720...930 V DC	820...1070 V DC
Overvoltage shut-down	$1.50 \times V_{N-DC}$	$1.3 \times V_{N-DC}$	$1.15 \times V_{N-DC}$
Nominal current DC (approx.)	$1.15 \times I_{MOTOR}$	$1.15 \times I_{MOTOR}$	$1.15 \times I_{MOTOR}$
Type of fuse, Nominal voltage	1100 V DC *)	1100 V DC *)	1100 V DC *)

\*) 1100 V DC rated voltage at 10 ms L/R

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>pDRIVE< frequency inverter	Mains fuse for DC-Supply "inverter protection" ("Ferraz Protistor DC-Fuse gR" or equivalent)	Lines in the cubicle (per phase)
<i>MX pro</i> 6V2,2/3,0	16 A (FD20GB100V16T)	2.5 mm <sup>2</sup>
<i>MX pro</i> 6V3,0/4,0	16 A (FD20GB100V16T)	2.5 mm <sup>2</sup>
<i>MX pro</i> 6V4,0/5,5	16 A (FD20GB100V16T)	2.5 mm <sup>2</sup>
<i>MX pro</i> 6V5,5/7,5	20 A (FD20GB100V20T)	4 mm <sup>2</sup>
<i>MX pro</i> 6V7,5/11	25 A (FD20GB100V25T)	4 mm <sup>2</sup>
<i>MX pro</i> 6V11/15	32 A (FD20GB100V32T)	6 mm <sup>2</sup>
<i>MX pro</i> 6V15/18	40 A (FD20GC100V40T)	6 mm <sup>2</sup>
<i>MX pro</i> 6V18/22	50 A (D120GC75V50EF)	10 mm <sup>2</sup>
<i>MX pro</i> 6V22/30	63 A (D120GC75V63EF)	10 mm <sup>2</sup>
<i>MX pro</i> 6V30/37	80 A (D120GC75V80EF)	16 mm <sup>2</sup>
<i>MX pro</i> 6V37/45	100 A (D120GC75V100EF)	25 mm <sup>2</sup>
<i>MX pro</i> 6V45/55	125 A (D120GC75V125EF)	35 mm <sup>2</sup>
<i>MX pro</i> 6V55/75	160 A (D120GC75V160EF)	50 mm <sup>2</sup>
<i>MX pro</i> 6V75/90	160 A (D120GC75V160EF)	50 mm <sup>2</sup>
<i>MX pro</i> 6V90/110	200 A (D121GC75V200EF)	70 mm <sup>2</sup>
<i>MX pro</i> 6V110/132	250 A (D121GC75V250EF)	95 mm <sup>2</sup>
<i>MX pro</i> 6V132/160	315 A (D122GC75V315EF)	120 mm <sup>2</sup>
<i>MX pro</i> 6V160/200	350 A (D122GC75V350EF)	150 mm <sup>2</sup>
<i>MX pro</i> 6V200/250	450 A (D122GD75V450EF)	2 x 95 mm <sup>2</sup>
<i>MX pro</i> 6V250/315	630 A (D2122GC75V630TF) (or 2 x 315 A parallel)	2 x 150 mm <sup>2</sup>
<i>MX pro</i> 6V315/400	800 A (D2122GC75V800TF) (or 2 x 400 A parallel)	3 x 150 mm <sup>2</sup>
<i>MX pro</i> 6V400/500	900 A (D2122GD75V900TF) (or 2 x 450 A parallel)	3 x 150 mm <sup>2</sup>
<i>MX pro</i> 6V500/630	1250 A (D2123GD75V12CTF) (or 2 x 630 A parallel)	4 x 150 mm <sup>2</sup>
<i>MX pro</i> 6V630/800	1500 A (D2123GD75V1500TF) (or 2 x 750 A parallel)	6 x 150 mm <sup>2</sup>

## Braking unit BU

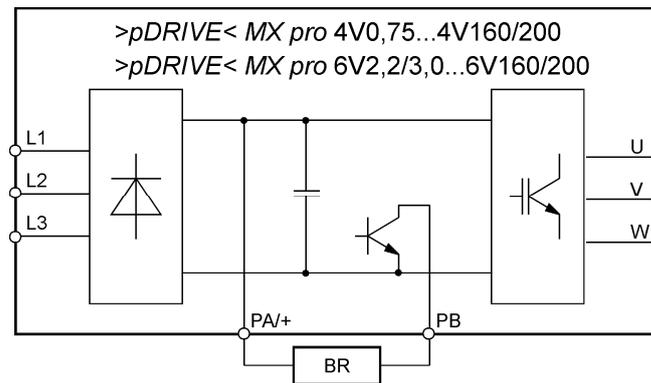
When a motor is braked on the deceleration ramp, the motor acts as a generator. Since voltage DC link inverters cannot return energy to the mains as standard, the DC link voltage increases in case of generator operation.

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.

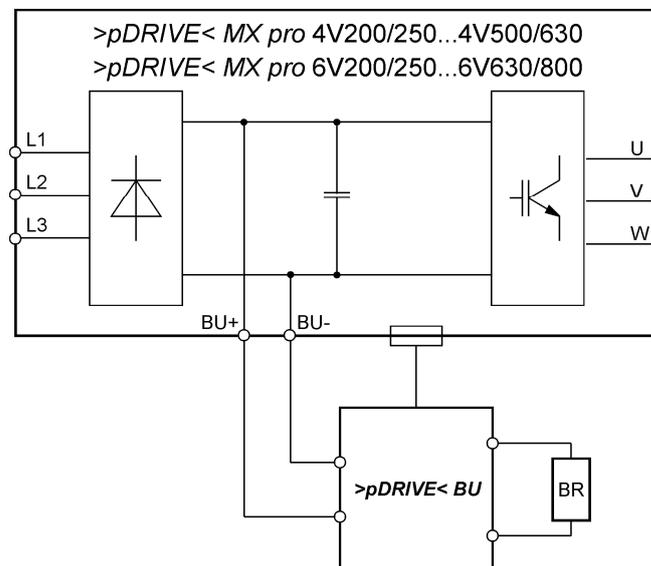
The generator power depends on the moment of inertia of the load and the set deceleration time, among other things.

The *>pDRIVE< 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 *>pDRIVE< BU*).

*>pDRIVE< MX pro with an internal braking transistor*



*>pDRIVE< MX pro with an external braking unit >pDRIVE< 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 *>pDRIVE< BR* enables the use of the frequency inverter *>pDRIVE< MX 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.

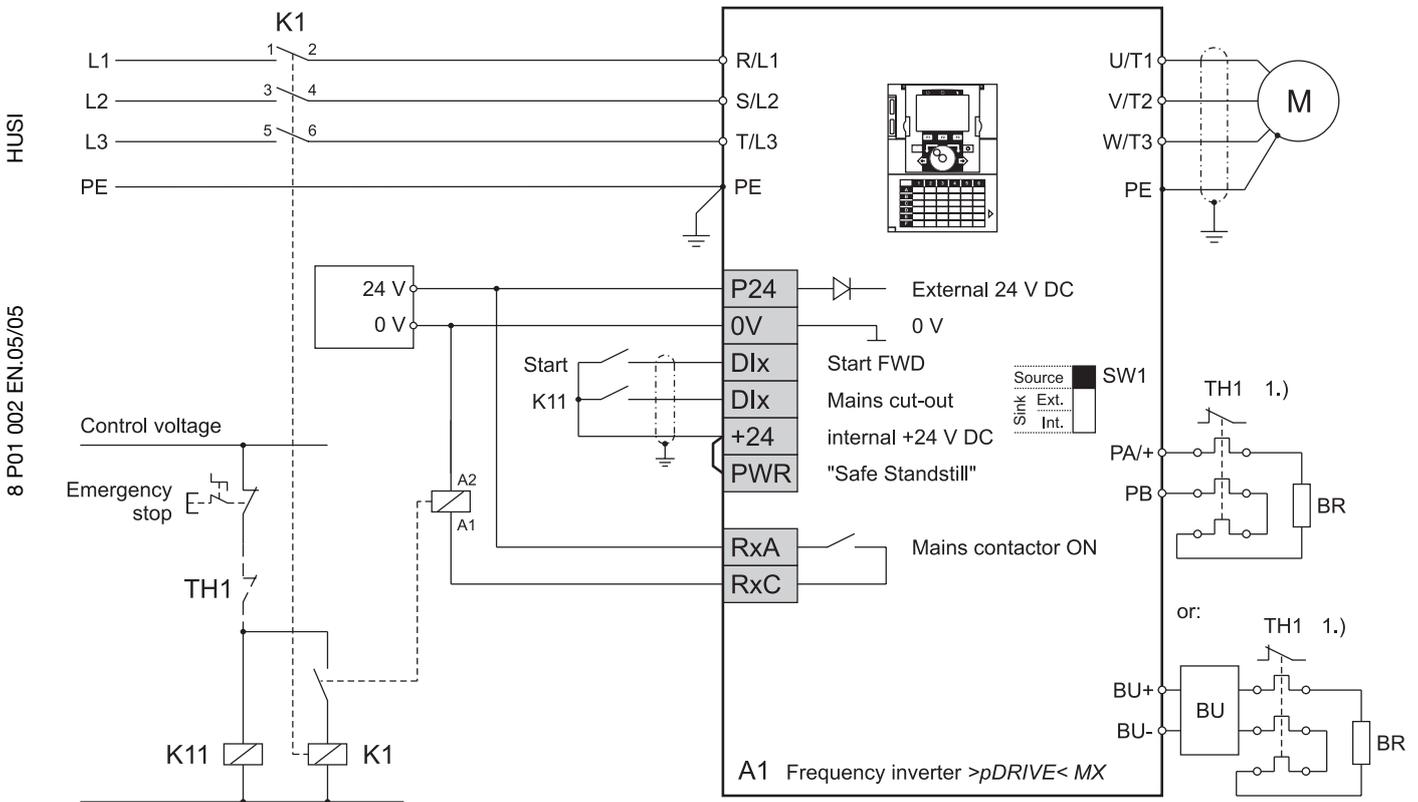
The >pDRIVE< MX pro frequency inverters have parameters to monitor the braking power.



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,  $R_{\text{MIN}}$  indicates the nominal value of the braking resistor that may not fall short due to the protection of the braking resistor (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,  $R_{\text{MAX}}$  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.

## 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	<i>MX pro</i> 6V2,2/3,0	internal	2 x BR 120R <sup>1.)</sup>	3.3 kW	1.5 kW	2.0 kW
3.0	<i>MX pro</i> 6V3,0/4,0	internal	2 x BR 120R <sup>1.)</sup>	4.5 kW	2.1 kW	2.0 kW
4.0	<i>MX pro</i> 6V4,0/5,5	internal	2 x BR 50R <sup>1.)</sup>	6.0 kW	3.0 kW	3.0 kW
5.5	<i>MX pro</i> 6V5,5/7,5	internal	2 x BR 50R <sup>1.)</sup>	8.3 kW	4.1 kW	3.0 kW
7.5	<i>MX pro</i> 6V7,5/11	internal	2 x BR 30R <sup>1.)</sup>	11 kW	5.6 kW	4.0 kW
11	<i>MX pro</i> 6V11/15	internal	2 x BR 30R <sup>1.)</sup>	17 kW	8.3 kW	4.0 kW
15	<i>MX pro</i> 6V15/18	internal	4 x BR 50R <sup>2.)</sup>	23 kW	12 kW	6.0 kW
18	<i>MX pro</i> 6V18/22	internal	1 x BR 24R	28 kW	15 kW	12 kW
22	<i>MX pro</i> 6V22/30	internal	1 x BR 24R	33 kW	18 kW	12 kW
30	<i>MX pro</i> 6V30/37	internal	1 x BR 24R	45 kW	24 kW	12 kW
37	<i>MX pro</i> 6V37/45	internal	2 x BR 24R <sup>3.)</sup>	56 kW	30 kW	24 kW
45	<i>MX pro</i> 6V45/55	internal	2 x BR 24R <sup>3.)</sup>	68 kW	36 kW	24 kW
55	<i>MX pro</i> 6V55/75	internal	2 x BR 24R <sup>3.)</sup>	83 kW	44 kW	24 kW
75	<i>MX pro</i> 6V75/90	internal	3 x BR 24R <sup>3.)</sup>	113 kW	60 kW	36 kW
90	<i>MX pro</i> 6V90/110	internal	3 x BR 24R <sup>3.)</sup>	135 kW	79 kW	36 kW
110	<i>MX pro</i> 6V110/132	internal	1 x BR 4R2	165 kW	97 kW	66 kW
132	<i>MX pro</i> 6V132/160	internal	1 x BR 4R2	200 kW	116 kW	66 kW
160	<i>MX pro</i> 6V160/200	internal	1 x BR 4R2	240 kW	141 kW	66 kW
200	<i>MX pro</i> 6V200/250	BU 6V450	2 x BR 4R2 <sup>3.)</sup>	300 kW	176 kW	132 kW
250	<i>MX pro</i> 6V250/315	BU 6V450	2 x BR 4R2 <sup>3.)</sup>	375 kW	220 kW	132 kW
315	<i>MX pro</i> 6V315/400	BU 6V450	2 x BR 4R2 <sup>3.)</sup>	475 kW	277 kW	132 kW
400	<i>MX pro</i> 6V400/500	BU 6V900	3 x BR 4R2 <sup>3.)</sup>	600 kW	352 kW	198 kW
500	<i>MX pro</i> 6V500/630	BU 6V900	3 x BR 4R2 <sup>3.)</sup>	750 kW	440 kW	198 kW
630	<i>MX pro</i> 6V630/800	BU 6V900	4 x BR 4R2 <sup>3.)</sup>	945 kW	554 kW	264 kW

<sup>1.)</sup> Resistors in serial connection

<sup>2.)</sup> Resistors in serial/parallel connection

<sup>3.)</sup> Resistors in parallel connection

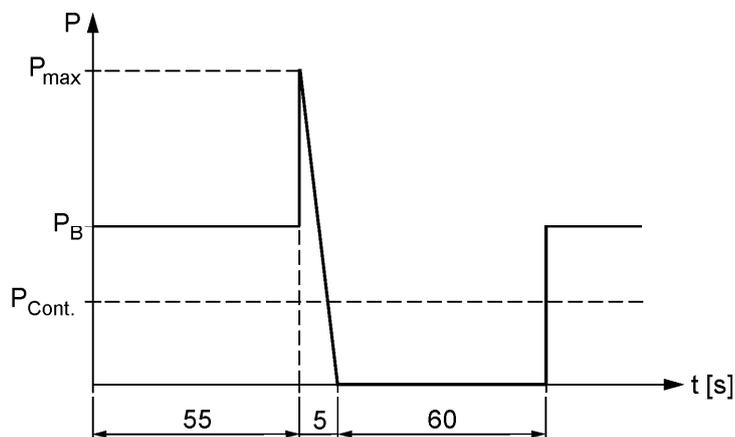
Typical braking power and cycles for hoist applications

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

$P_B$  ..... Braking power at lowering the load

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

max. cycle time: 120 s



Typical dimensioning for long travel applications

Typ. motor rating	Inverter	Braking unit	Braking resistor	P <sub>max</sub> @ 1075 V	P <sub>CONT</sub>
2.2	MX pro 6V2,2/3,0	internal	2 x BR 120R <sup>1.)</sup>	3.3 kW	2.0 kW
3.0	MX pro 6V3,0/4,0	internal	2 x BR 120R <sup>1.)</sup>	4.5 kW	2.0 kW
4.0	MX pro 6V4,0/5,5	internal	2 x BR 50R <sup>1.)</sup>	6.0 kW	3.0 kW
5.5	MX pro 6V5,5/7,5	internal	2 x BR 50R <sup>1.)</sup>	8.3 kW	3.0 kW
7.5	MX pro 6V7,5/11	internal	2 x BR 30R <sup>1.)</sup>	11 kW	4.0 kW
11	MX pro 6V11/15	internal	2 x BR 30R <sup>1.)</sup>	17 kW	4.0 kW
15	MX pro 6V15/18	internal	4 x BR 50R <sup>2.)</sup>	23 kW	6.0 kW
18	MX pro 6V18/22	internal	1 x BR 22R	28 kW	7.0 kW
22	MX pro 6V22/30	internal	1 x BR 22R	33 kW	7.0 kW
30	MX pro 6V30/37	internal	1 x BR 22R	45 kW	7.0 kW
37	MX pro 6V37/45	internal	2 x BR 22R <sup>3.)</sup>	56 kW	14 kW
45	MX pro 6V45/55	internal	2 x BR 22R <sup>3.)</sup>	68 kW	14 kW
55	MX pro 6V55/75	internal	2 x BR 22R <sup>3.)</sup>	83 kW	14 kW
75	MX pro 6V75/90	internal	3 x BR 22R <sup>3.)</sup>	113 kW	21 kW
90	MX pro 6V90/110	internal	3 x BR 22R <sup>3.)</sup>	135 kW	21 kW
110	MX pro 6V110/132	internal	1 x BR 4R	165 kW	34 kW
132	MX pro 6V132/160	internal	1 x BR 4R	200 kW	34 kW
160	MX pro 6V160/200	internal	1 x BR 4R	240 kW	34 kW
200	MX pro 6V200/250	BU 6V450	2 x BR 4R <sup>3.)</sup>	300 kW	68 kW
250	MX pro 6V250/315	BU 6V450	2 x BR 4R <sup>3.)</sup>	375 kW	68 kW
315	MX pro 6V315/400	BU 6V450	2 x BR 4R <sup>3.)</sup>	475 kW	68 kW
400	MX pro 6V400/500	BU 6V900	3 x BR 4R <sup>3.)</sup>	600 kW	102 kW
500	MX pro 6V500/630	BU 6V900	3 x BR 4R <sup>3.)</sup>	750 kW	102 kW
630	MX pro 6V630/800	BU 6V900	4 x BR 4R <sup>3.)</sup>	945 kW	136 kW

<sup>1.)</sup> Resistors in serial connection

<sup>2.)</sup> Resistors in serial/parallel connection

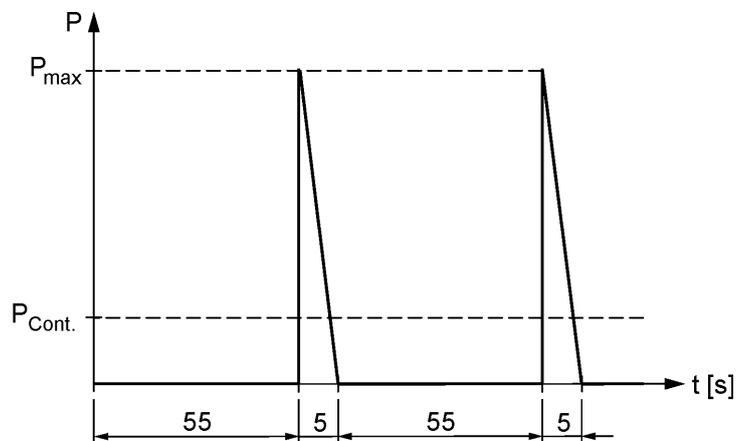
<sup>3.)</sup> Resistors in parallel connection

Typical braking power and cycles for long travel applications

P<sub>max</sub>.....Maximum braking power

P<sub>Cont.</sub> .....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 >pDRIVE< *MX pro* have a function to inhibit short output voltage pulses. The function can be activated by means of parameter B3.32 "Vmot optimization", 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 >pDRIVE< *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 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 >pDRIVE< *AMF*.

Especially in case of big motors with middle up to high motor cable lengths the option >pDRIVE< *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:

>pDRIVE< 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

>pDRIVE< 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

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

>pDRIVE< options	MX pro 6V2,2/3,0...45/55	MX pro 6V55/75...630/800	Type of motor cable
<b>C3 (EN 55011 - class A group 2)</b>			
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
<b>C4 (EMC concept)</b>			
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 >pDRIVE< AMF makes sense from motor cable lengths of 10 m.

When an output motor filter >pDRIVE< 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 <sub>PEAK</sub>
10 m	1000 V/μm	1250 V
50 m	850 V/μm	1350 V
100 m	480 V/μm	1400 V
200 m	400 V/μm	1500 V
300 m	350 V/μm	1550 V
400 m	350 V/μm	1600 V
> 400 m	350 V/μm	max. 1800 V

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## Wiring remarks for power and control cables

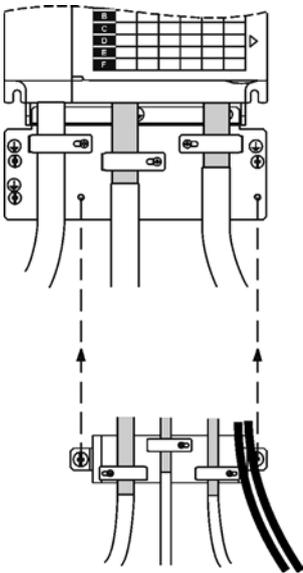
Take the control wiring separately from the mains cables, motor cables and any other power cables. The control wiring should be screened and should not exceed 20 m.



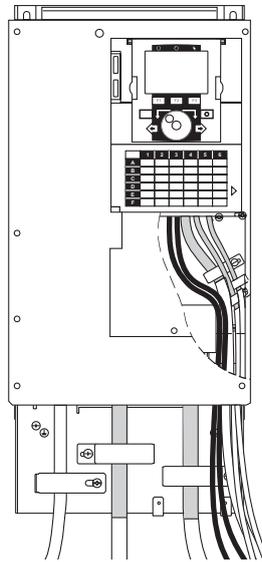
If crossings with power cables cannot be prevented, take them with 90° angle.

All >pDRIVE< 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.

>pDRIVE< MX eco & pro 4V0,75...4V18



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



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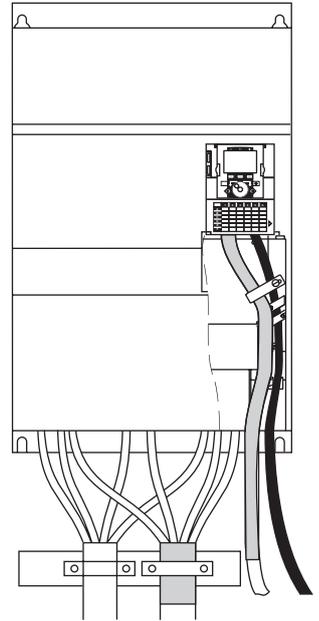
The total height of the inverter alters when using the EMC plate corresponding to this additional element.

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

For the leading-in of the control wires the >pDRIVE< 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 >pDRIVE< RFI is established via a well-conductive mounting plate. Alternatively the terminal box option >pDRIVE< TER-BOX can be used.



## Control terminals

The frequency inverters >pDRIVE< 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 >pDRIVE< IO11 and >pDRIVE< IO12 are available. The same option card can be plugged in only one time per unit.



The inverters >pDRIVE< 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 equip-ment	Option >pDRIVE< IO11	Option >pDRIVE< 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
<b>Inputs</b>					
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
<b>Outputs</b>					
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 whole electronics is separated from the power part according to EN 50178 PELV (Protective-Extra-Low-Voltage) in compliance with "Protective separation" by double insulation.

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

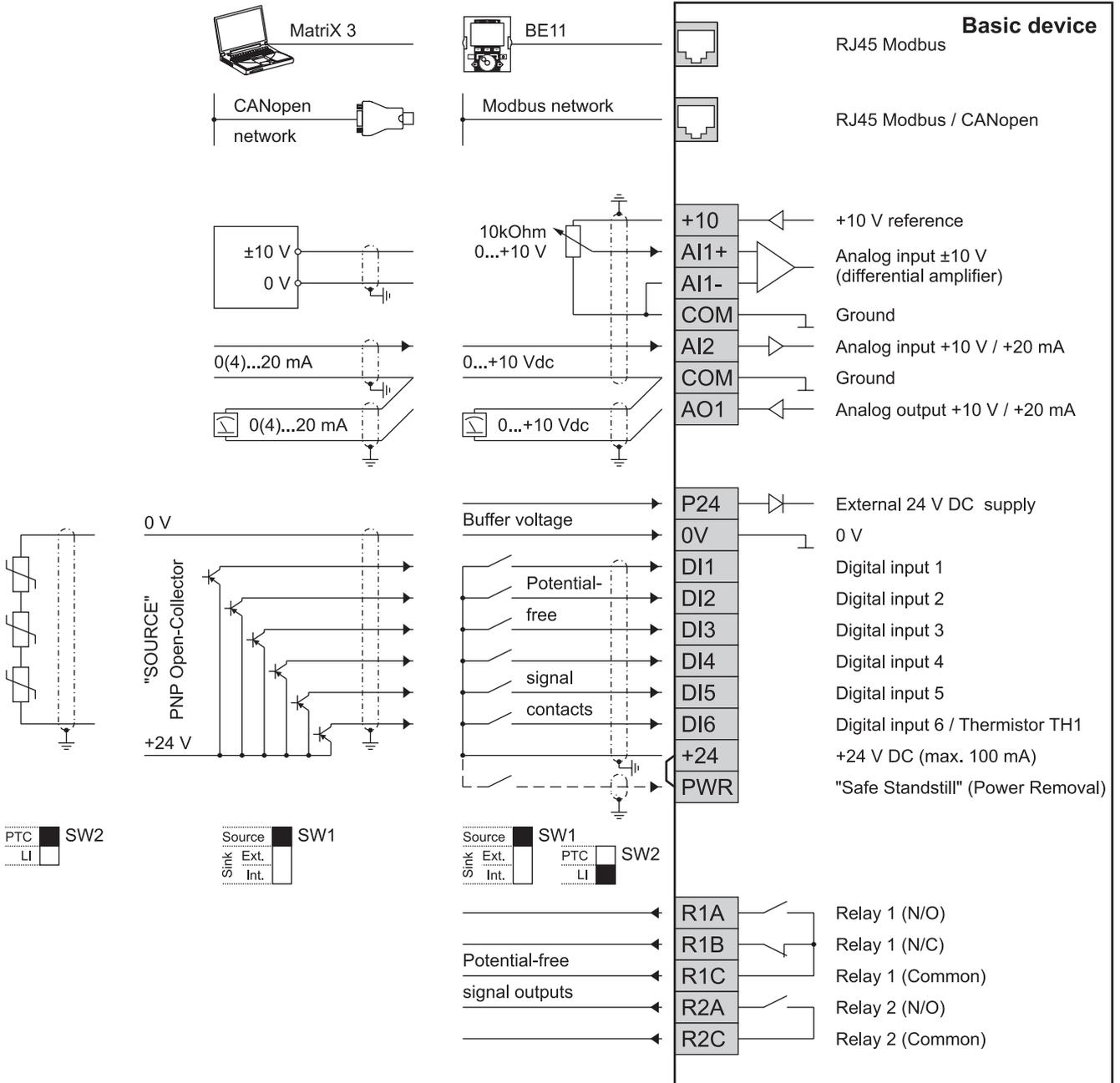


Keep the maximum cable length of 15 m for the wiring of the safety input PWR "Safe standstill".

# 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.

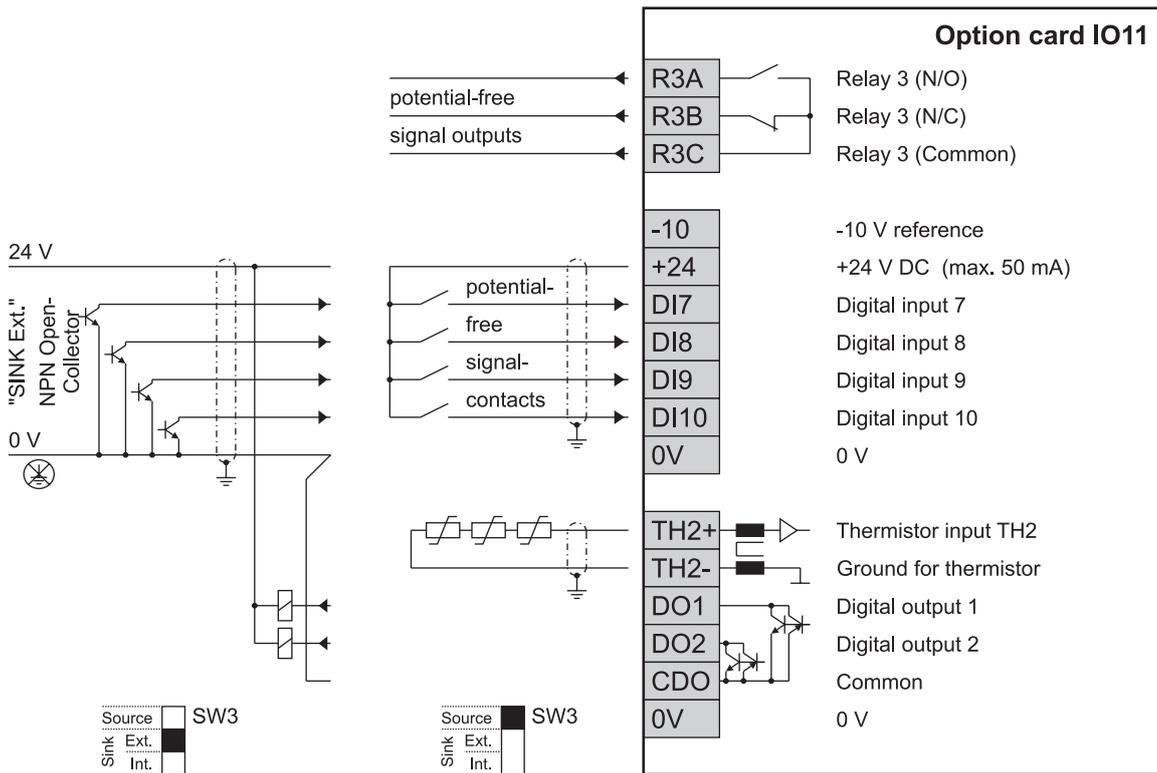
The inverters >pDRIVE< MX pro are equipped with a built-in interface for control via Modbus. In addition to the external wiring (connection to the T-pieces in the bus line) only the adjustment of few parameters is necessary.

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 201.

## Control terminals of option card IO11



The terminal extension *>pDRIVE< 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 201.

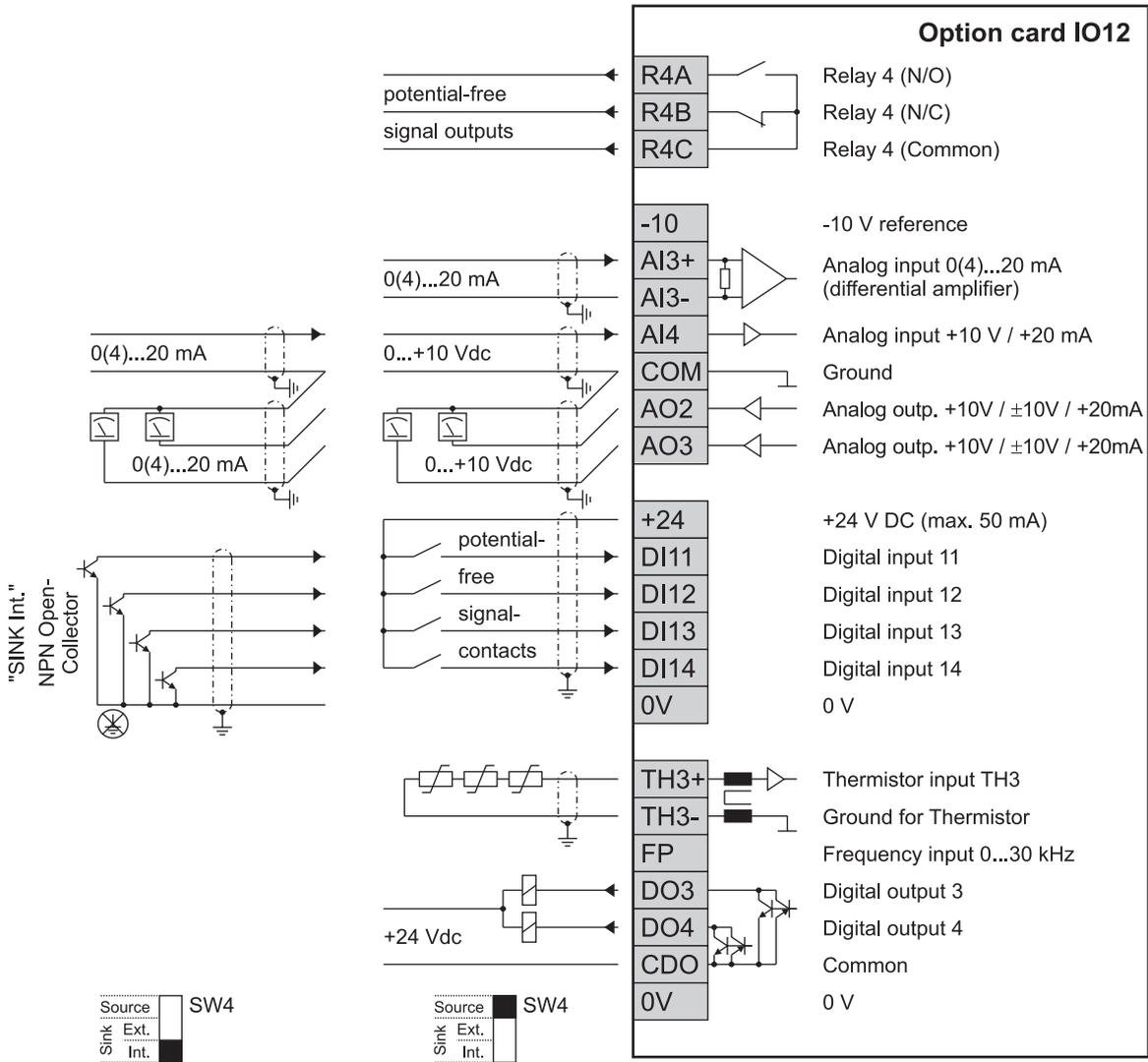


All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

## Control terminals of option card IO12

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The terminal extension *>pDRIVE< IO12* can be plugged in addition or as an alternative to the option *>pDRIVE< 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.

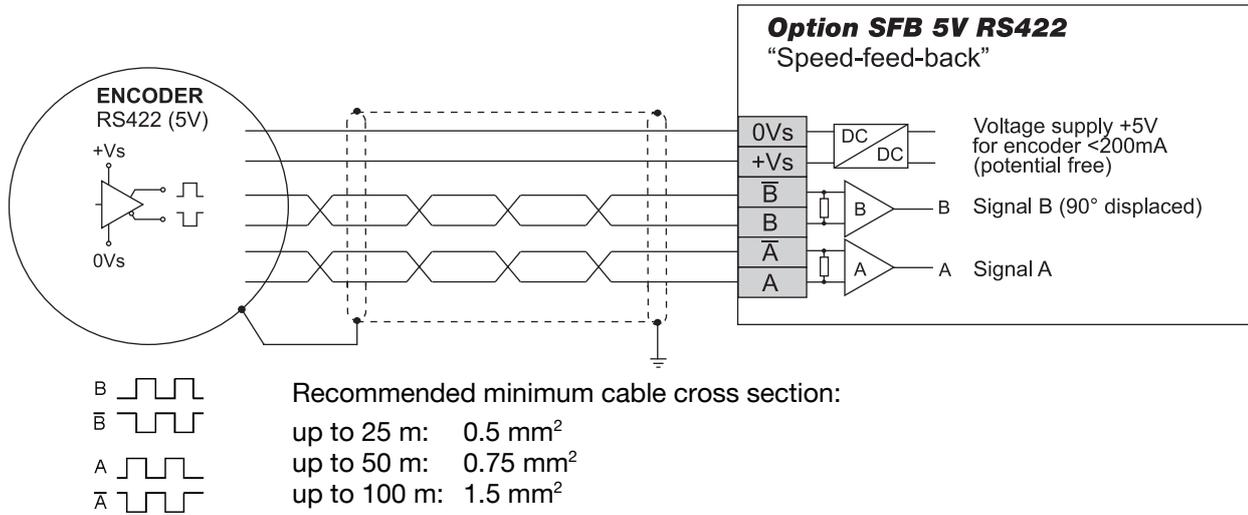


All inductivities like relays, contactors, etc. have to be equipped with an overvoltage protective circuit.

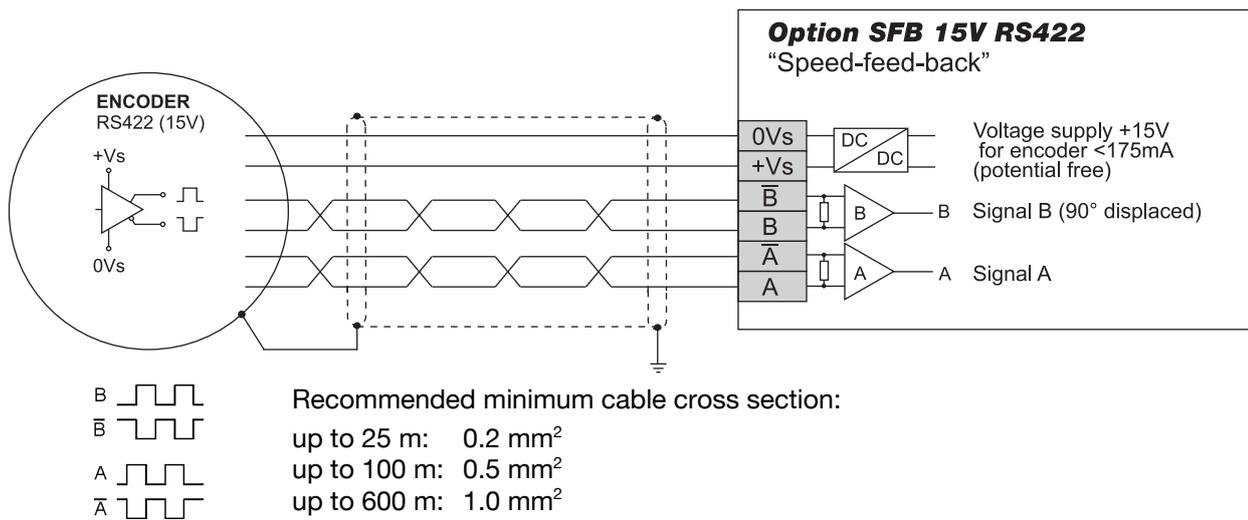
**Control terminals of the option cards >pDRIVE< SFB**

The option cards >pDRIVE< 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.

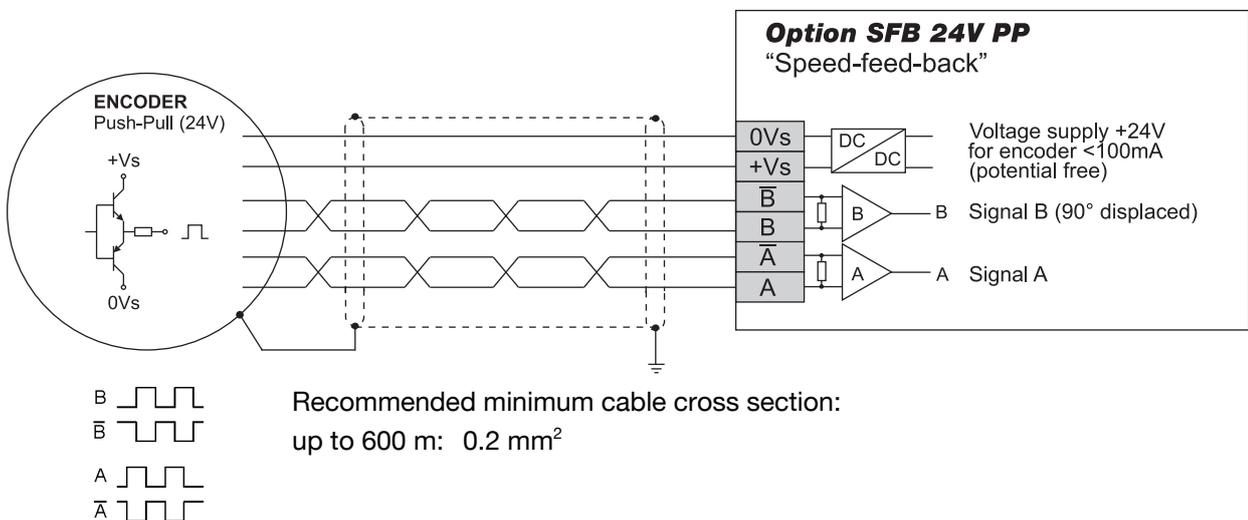
**>pDRIVE< SFB 5V RS422**



**>pDRIVE< SFB 15V RS422**



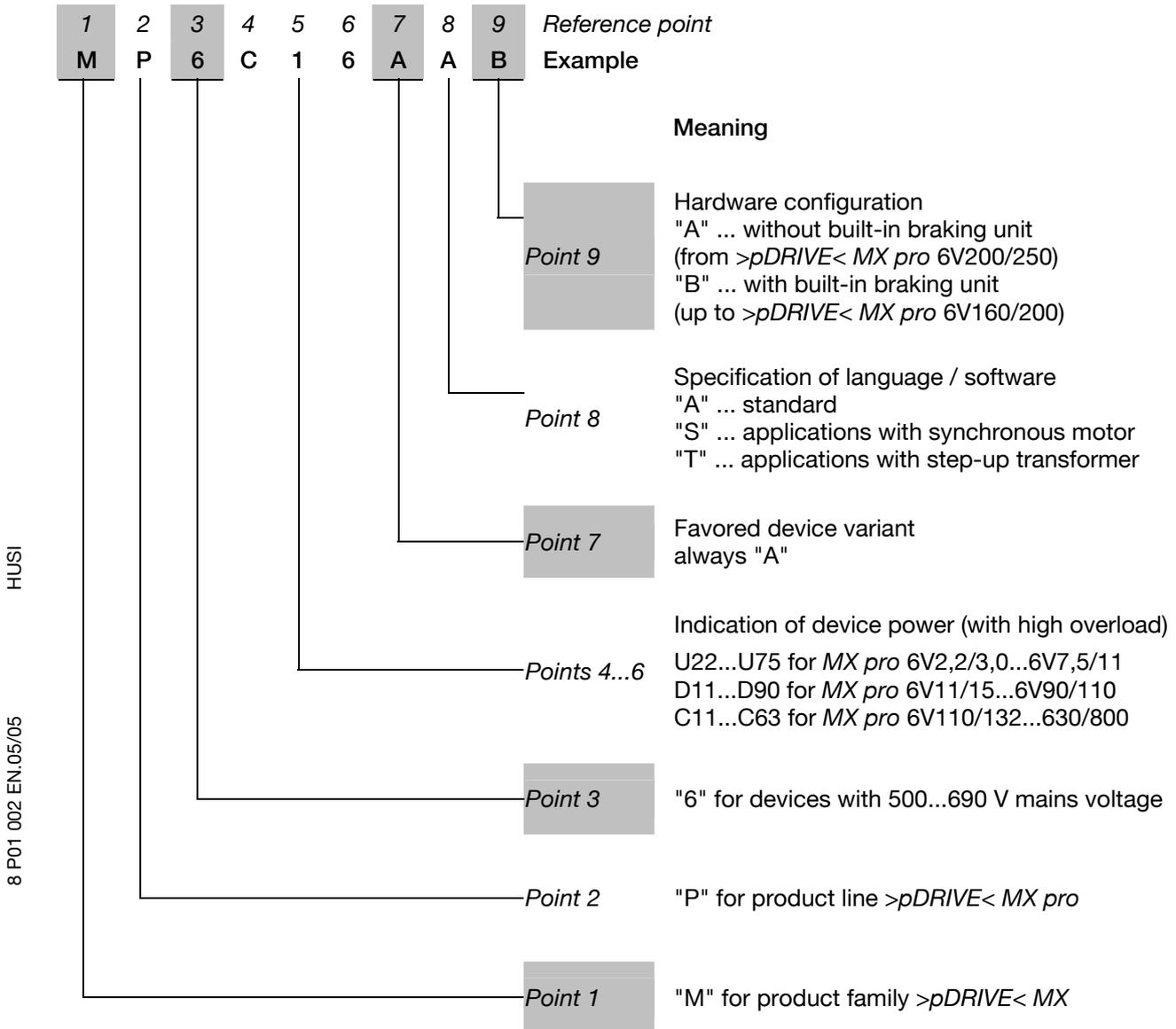
**>pDRIVE< SFB 24V PP**



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# Purchase order

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



Options for the inverter device must be ordered additionally. The respective order numbers are given in chapter "Options", as from page 189.

## Documentation

The documentation of the >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< MX pro 4V	8 P01 325 DE 8 P01 325 EN	Technical data, valid standards, mounting, connection, ambient conditions
Mounting instructions for >pDRIVE< MX pro 6V	8 P01 329 DE 8 P01 329 EN	Technical data, valid standards, mounting, connection, ambient conditions
Operating instructions Modbus for >pDRIVE< MX pro	8 P01 333 DE 8 P01 333 EN	Technical data, mode of operation, valid standards, mounting, connection, commissioning
Operating instructions CANopen for >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< 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.pdrive.com](http://www.pdrive.com).

## Available options for >pDRIVE< MX pro 6V inverters

To enlarge the field of applications for the frequency inverters >pDRIVE< 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
<b>Operating options</b>			
>pDRIVE< BE11	8 P01 100/A...G	Matrix operating panel affords optimal operating comfort by means of the matrix philosophy	Page 190
>pDRIVE< DMK11	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 192
>pDRIVE< DMK11-IP65	8 P01 121	Transparent IP65 cover for the door mounting kit of the operating panel BE11	
>pDRIVE< CABLE3-BE	8 P01 122	Connecting cable operating panel – inverter with 3 m length	
>pDRIVE< CABLE10-BE	8 P01 123	Connecting cable operating panel – inverter with 10 m length	Page 23
Manual-CD >pDRIVE< MX eco & pro	8 P01 021	This CD-ROM provides the whole documentation of the inverter as well as the PC program Matrix 3	
>pDRIVE< CABLE3-PC	8 P01 124	Connecting cable inverter – PC with 3 m length, incl. RS232/485 interface converter on the computer side	
>pDRIVE< ADAP BLUE	8 P01 126	Bluetooth adapter	
>pDRIVE< RS232/485	8 P01 304	RS232/485 interface converter with supply and active bus connection	
>pDRIVE< MATRIX REMOTE LINK	8 P01 128	Remote maintenance option for analog modem connection or Ethernet network.	
>pDRIVE< ADAP RJ45	8 P01 127	RJ45 F/F adapter is required for the connection of the operating panel BE11 to the connecting cable	
<b>Control options</b>			
>pDRIVE< IO11	8 P01 101	Terminal extension for additional digital inputs and outputs	Page 201
>pDRIVE< IO12	8 P01 102	Terminal extension for additional analog and digital inputs and outputs	
>pDRIVE< SFB 5V RS422	8 P01 110	Extension card for encoder feedback. Supply voltage 5 V / RS422	Page 205
>pDRIVE< SFB 15V RS422	8 P01 111	Extension card for encoder feedback. Supply voltage 15 V / RS422	
>pDRIVE< SFB 24V PP	8 P01 112	Extension card for encoder feedback. Supply voltage 24 V / push-pull	
>pDRIVE< MODBUS T-ADAP 03	8 P01 300	Modbus T-adapter with 0.3 m connecting cable	Page 197
>pDRIVE< MODBUS T-ADAP 1	8 P01 301	Modbus T-adapter with 1 m connecting cable	
>pDRIVE< MODBUS RC	8 P01 302	Bus termination RC	
>pDRIVE< MODBUS SPLITTER	8 P01 303	Divides the Modbus signal into eight further channels	
>pDRIVE< MODBUS PLUG	8 P01 305	RJ45 connector IP20 with quick-connecting technology	Page 199
>pDRIVE< ADAP CAN	8 P01 125	RJ45/Sub-D adapter for the connection of the inverter to a CANopen fieldbus network	
>pDRIVE< CANOPEN PLUG	8 P01 307	Connector for the CANopen network	
>pDRIVE< PBO11	8 P01 103	Option card for control of the inverter via Profibus DP	Page 200
>pDRIVE< PROFIBUS PLUG	8 P01 306	Connector for the Profibus network	

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## Options depending on the power

Designation	Order number	Brief description	Reference
<b>Options depending on the power</b>			
>pDRIVE< TRAFO-BOX	See following allocation table	Fan supply transformer to provide 3AC 400V out of 500...600 V or 690 V mains supply	Page 241
>pDRIVE< NDU		Three-phase choke to reduce the mains current harmonics to THD I ≤ 48 %	Page 216
>pDRIVE< FPK		Mounting kit to install a DC choke or line reactor behind the inverter	Page 220
>pDRIVE< BU		External braking unit for >pDRIVE< MX pro 6V200/250 to 6V630/800.	Page 225
>pDRIVE< BR		Braking resistor for short deceleration time or short-time dynamic loads	Page 229
>pDRIVE< AMF		Output motor filter enables the use of the inverter with long motor cables and limits the voltage peaks in the motor	Page 233
>pDRIVE< 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 237
>pDRIVE< TER-BOX		Terminal box which is attached at the bottom of the inverter for mechanical support and connection of the motor cable screen	Page 243
>pDRIVE< FLANGE		Flange mounting kit to install the inverter in flange mounting technology (heat sink outside the cubicle)	Page 246
>pDRIVE< RMK		Mounting kit in order to replace the old >pDRIVE< MX basic & plus devices without anew drilling	Page 252

Allocation table for options depending on the power

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>pDRIVE<	Option >pDRIVE< RFI	Option >pDRIVE< NDU	Option *) >pDRIVE< FPK	Option >pDRIVE< TRAFO-BOX
MX pro 6V2,2/3,0	–	NDU 10 8 P01 238	FPK 240x420 8 P01 465	–
MX pro 6V3,0/4,0	–	NDU 10 8 P01 238	FPK 240x420 8 P01 465	–
MX pro 6V4,0/5,5	–	NDU 10 8 P01 238	FPK 240x420 8 P01 465	–
MX pro 6V5,5/7,5	–	NDU 23 8 P01 239	FPK 240x420 8 P01 465	–
MX pro 6V7,5/11	–	NDU 23 8 P01 239	FPK 240x420 8 P01 465	–
MX pro 6V11/15	–	NDU 23 8 P01 239	FPK 240x420 8 P01 465	–
MX pro 6V15/18	–	NDU 23 8 P01 239	FPK 240x420 8 P01 465	–
MX pro 6V18/22	–	NDU 40 8 P01 220	FPK 240x420 8 P01 465	–
MX pro 6V22/30	–	NDU 40 8 P01 220	FPK 240x420 8 P01 465	–
MX pro 6V30/37	–	NDU 70 8 P01 221	–	–
MX pro 6V37/45	–	NDU 70 8 P01 221	–	–
MX pro 6V45/55	–	NDU 70 8 P01 221	–	–
MX pro 6V55/75	–	NDU 100 8 P01 222	–	–
MX pro 6V75/90	–	NDU 160 8 P01 223	–	–
MX pro 6V90/110	RFI 6V220-TN 8 P01 298	NDU 160 8 P01 223	–	TRAFO-BOX 330 8 P01 480
MX pro 6V110/132	RFI 6V220-TN 8 P01 298	NDU 160 8 P01 223	–	TRAFO-BOX 330 8 P01 480
MX pro 6V132/160	RFI 6V220-TN 8 P01 298	NDU 230 8 P01 236	–	TRAFO-BOX 330 8 P01 480
MX pro 6V160/200	RFI 6V220-TN 8 P01 298	NDU 230 8 P01 236	–	TRAFO-BOX 330 8 P01 480
MX pro 6V200/250	RFI 6V430-TN 8 P01 299	NDU 280 8 P01 226	–	TRAFO-BOX 585 8 P01 481
MX pro 6V250/315	RFI 6V430-TN 8 P01 299	NDU 450 8 P01 237	–	TRAFO-BOX 585 8 P01 481
MX pro 6V315/400	RFI 6V430-TN 8 P01 299	NDU 450 8 P01 237	–	TRAFO-BOX 585 8 P01 481
MX pro 6V400/500	2 x RFI 6V430-TN 2 x 8 P01 299	2 x NDU 315 2 x 8 P01 227	–	TRAFO-BOX 1100 8 P01 482
MX pro 6V500/630	2 x RFI 6V430-TN 2 x 8 P01 299	2 x NDU 450 2 x 8 P01 237	–	TRAFO-BOX 1100 8 P01 482
MX pro 6V630/800	2 x RFI 6V430-TN 2 x 8 P01 299	2 x NDU 450 2 x 8 P01 237	–	TRAFO-BOX 1100 8 P01 482

\*) The option >pDRIVE< FPK can be used for mounting the option >pDRIVE< NDU behind the inverter.

>pDRIVE<	Option >pDRIVE< BU	Option >pDRIVE< BR Hoist	Option >pDRIVE< BR Long-travel	Option >pDRIVE< AMF
<i>MX pro 6V2,2/3,0</i>	Integrated braking unit	2 x BR 120R 2 x 8 P01 263	2 x BR 120R 2 x 8 P01 263	AMF 48-1 8 P01 141
<i>MX pro 6V3,0/4,0</i>	Integrated braking unit	2 x BR 120R 2 x 8 P01 263	2 x BR 120R 2 x 8 P01 263	AMF 48-1 8 P01 141
<i>MX pro 6V4,0/5,5</i>	Integrated braking unit	2 x BR 50R 2 x 8 P01 264	2 x BR 50R 2 x 8 P01 264	AMF 48-1 8 P01 141
<i>MX pro 6V5,5/7,5</i>	Integrated braking unit	2 x BR 50R 2 x 8 P01 264	2 x BR 50R 2 x 8 P01 264	AMF 48-1 8 P01 141
<i>MX pro 6V7,5/11</i>	Integrated braking unit	2 x BR 30R 2 x 8 P01 265	2 x BR 30R 2 x 8 P01 265	AMF 48-1 8 P01 141
<i>MX pro 6V11/15</i>	Integrated braking unit	2 x BR 30R 2 x 8 P01 265	2 x BR 30R 2 x 8 P01 265	AMF 48-1 8 P01 141
<i>MX pro 6V15/18</i>	Integrated braking unit	4 x BR 50R 4 x 8 P01 264	4 x BR 50R 4 x 8 P01 264	AMF 48-1 8 P01 141
<i>MX pro 6V18/22</i>	Integrated braking unit	1 x BR 24R 1 x 8 P01 274	1 x BR 22R 1 x 8 P01 275	AMF 90-1 8 P01 142
<i>MX pro 6V22/30</i>	Integrated braking unit	1 x BR 24R 1 x 8 P01 274	1 x BR 22R 1 x 8 P01 275	AMF 90-1 8 P01 142
<i>MX pro 6V30/37</i>	Integrated braking unit	1 x BR 24R 1 x 8 P01 274	1 x BR 22R 1 x 8 P01 275	AMF 90-1 8 P01 142
<i>MX pro 6V37/45</i>	Integrated braking unit	2 x BR 24R 2 x 8 P01 274	2 x BR 22R 2 x 8 P01 275	AMF 90-1 8 P01 142
<i>MX pro 6V45/55</i>	Integrated braking unit	2 x BR 24R 2 x 8 P01 274	2 x BR 22R 2 x 8 P01 275	AMF 90-1 8 P01 142
<i>MX pro 6V55/75</i>	Integrated braking unit	2 x BR 24R 2 x 8 P01 274	2 x BR 22R 2 x 8 P01 275	AMF 215-3 8 P01 143
<i>MX pro 6V75/90</i>	Integrated braking unit	3 x BR 24R 3 x 8 P01 274	3 x BR 22R 3 x 8 P01 275	AMF 215-3 8 P01 143
<i>MX pro 6V90/110</i>	Integrated braking unit	3 x BR 24R 3 x 8 P01 274	3 x BR 22R 3 x 8 P01 275	AMF 215-3 8 P01 143
<i>MX pro 6V110/132</i>	Integrated braking unit	1 x BR 4R2 1 x 8 P01 276	1 x BR 4R 1 x 8 P01 277	AMF 215-3 8 P01 143
<i>MX pro 6V132/160</i>	Integrated braking unit	1 x BR 4R2 1 x 8 P01 276	1 x BR 4R 1 x 8 P01 277	AMF 320-3 8 P01 144
<i>MX pro 6V160/200</i>	Integrated braking unit	1 x BR 4R2 1 x 8 P01 276	1 x BR 4R 1 x 8 P01 277	AMF 320-3 8 P01 144
<i>MX pro 6V200/250</i>	BU 6V450 8 P01 278	2 x BR 4R2 2 x 8 P01 276	2 x BR 4R 2 x 8 P01 277	AMF 480-3 8 P01 145
<i>MX pro 6V250/315</i>	BU 6V450 8 P01 278	2 x BR 4R2 2 x 8 P01 276	2 x BR 4R 2 x 8 P01 277	AMF 480-3 8 P01 145
<i>MX pro 6V315/400</i>	BU 6V450 8 P01 278	2 x BR 4R2 2 x 8 P01 276	2 x BR 4R 2 x 8 P01 277	AMF 760-3 8 P01 146
<i>MX pro 6V400/500</i>	BU 6V900 8 P01 279	3 x BR 4R2 3 x 8 P01 276	3 x BR 4R 3 x 8 P01 277	AMF 760-3 8 P01 146
<i>MX pro 6V500/630</i>	BU 6V900 8 P01 279	3 x BR 4R2 3 x 8 P01 276	3 x BR 4R 3 x 8 P01 277	AMF 1190-3 8 P01 147
<i>MX pro 6V630/800</i>	BU 6V900 8 P01 279	4 x BR 4R2 4 x 8 P01 276	4 x BR 4R 4 x 8 P01 277	AMF 1190-3 8 P01 147

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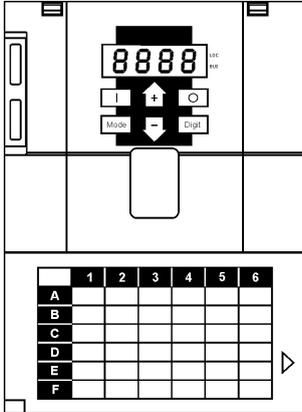
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>pDRIVE<	Option >pDRIVE< SMF	Option >pDRIVE< TER-BOX	Option >pDRIVE< FLANGE	Option >pDRIVE< RMK
<i>MX pro 6V2,2/3,0</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	–
<i>MX pro 6V3,0/4,0</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	–
<i>MX pro 6V4,0/5,5</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	RMK BG-A,B/6V 8 P01 474
<i>MX pro 6V5,5/7,5</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	RMK BG-A,B/6V 8 P01 474
<i>MX pro 6V7,5/11</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	RMK BG-A,B/6V 8 P01 474
<i>MX pro 6V11/15</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	RMK BG-A,B/6V 8 P01 474
<i>MX pro 6V15/18</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	RMK BG-1/15-22 + 6V 8 P01 475
<i>MX pro 6V18/22</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	RMK BG-1/15-22 + 6V 8 P01 475
<i>MX pro 6V22/30</i>	–	TER-BOX 230 8 P01 244	FLANGE 230 x 400 8 P01 184	RMK BG-1/15-22 + 6V 8 P01 475
<i>MX pro 6V30/37</i>	–	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187	–
<i>MX pro 6V37/45</i>	–	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187	–
<i>MX pro 6V45/55</i>	–	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187	–
<i>MX pro 6V55/75</i>	–	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187	–
<i>MX pro 6V75/90</i>	–	TER-BOX 320 8 P01 247	FLANGE 320 x 630 8 P01 187	–
<i>MX pro 6V90/110</i>	SMF 6V240 8 P01 497	TER-BOX 330 8 P01 250	FLANGE 330 x 950 8 P01 190	–
<i>MX pro 6V110/132</i>	SMF 6V240 8 P01 497	TER-BOX 330 8 P01 250	FLANGE 330 x 950 8 P01 190	–
<i>MX pro 6V132/160</i>	SMF 6V240 8 P01 497	TER-BOX 330 8 P01 250	FLANGE 330 x 950 8 P01 190	–
<i>MX pro 6V160/200</i>	SMF 6V240 8 P01 497	TER-BOX 330 8 P01 250	FLANGE 330 x 950 8 P01 190	–
<i>MX pro 6V200/250</i>	SMF 6V460 8 P01 498	TER-BOX 585 8 P01 252	FLANGE 585 x 950 8 P01 192	–
<i>MX pro 6V250/315</i>	SMF 6V460 8 P01 498	TER-BOX 585 8 P01 252	FLANGE 585 x 950 8 P01 192	–
<i>MX pro 6V315/400</i>	SMF 6V460 8 P01 498	TER-BOX 585 8 P01 252	FLANGE 585 x 950 8 P01 192	–
<i>MX pro 6V400/500</i>	SMF 6V900 8 P01 499	TER-BOX 1100 8 P01 254	–	–
<i>MX pro 6V500/630</i>	SMF 6V900 8 P01 499	TER-BOX 1100 8 P01 254	–	–
<i>MX pro 6V630/800</i>	SMF 6V900 8 P01 499	TER-BOX 1100 8 P01 254	–	–



# Options

## Operating options



The >pDRIVE< 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)

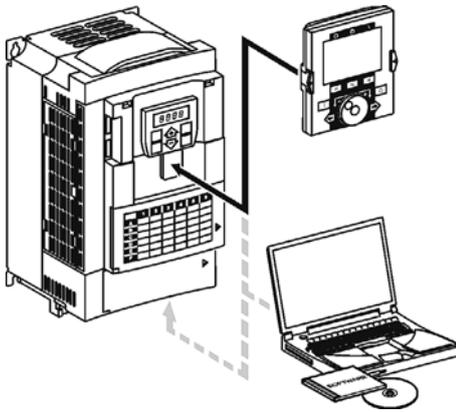
**RJ45 interface next to control terminals** can be used for:

- Matrix operating panel BE11 in the door mounting kit DMK11 <sup>1)</sup>  
(connected via the connecting cable CABLE 3-BE or CABLE 10-BE)  
or
- Matrix 3 PC program (via connecting cable CABLE 3-PC) <sup>1)</sup>  
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)

<sup>1)</sup> The parameters in matrix field D6 for adjusting the Modbus must be set to the factory setting !

## Matrix operating panel BE11

Utmost ease of use is provided by means of the matrix operating panel >pDRIVE< BE11. It is plugged at the front side of the device and adapts itself ergonomically into the device design.



Designation:	Option >pDRIVE< BE11/A
Order number:	8 P01 100/A
Designation:	Option >pDRIVE< BE11/B
Order number:	8 P01 100/B
Designation:	Option >pDRIVE< BE11/C
Order number:	8 P01 100/C
Designation:	Option >pDRIVE< BE11/D
Order number:	8 P01 100/D
Designation:	Option >pDRIVE< BE11/E
Order number:	8 P01 100/E
Designation:	Option >pDRIVE< BE11/G
Order number:	8 P01 100/G

### 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 >pDRIVE< BE11 is plugged at the front side of the inverter, it affects the total depth of the device (see chapter "Technical data", as from page 139).

All language-dependent texts in the >pDRIVE< 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 chosen language is kept when the matrix operating panel is connected to another inverter.

Language	Languages contained in the matrix operating panel					
	BE11/A	BE11/B	BE11/C	BE11/D	BE11/E	BE11/G
German	✓	–	–	✓	–	–
English	✓	✓	✓	✓	✓	✓
Bosnian	–	–	–	✓	–	–
Bulgarian	–	–	–	–	✓	–
Chinese	–	–	–	–	–	●
Estonian	–	–	●	–	–	–
French	✓	–	–	–	–	–
Greek	–	–	–	–	●	–
Italian	✓	–	–	–	–	–
Korean	–	–	–	–	–	✓
Croatian	–	–	–	✓	–	–
Latvian	–	–	●	–	–	–
Lithuanian	–	–	✓	–	–	–
Polish	–	✓	–	–	–	–
Russian	–	–	✓	–	✓	–
Serbian	–	–	–	✓	–	–
Slovak	–	✓	–	–	–	–
Spanish	✓	–	–	–	–	–
Czech	–	✓	–	–	–	–
Turkish	–	–	–	–	✓	–
Hungarian	–	✓	–	–	–	–

✓... available

●... in process



The set language can be changed later by means of parameter B1.01.

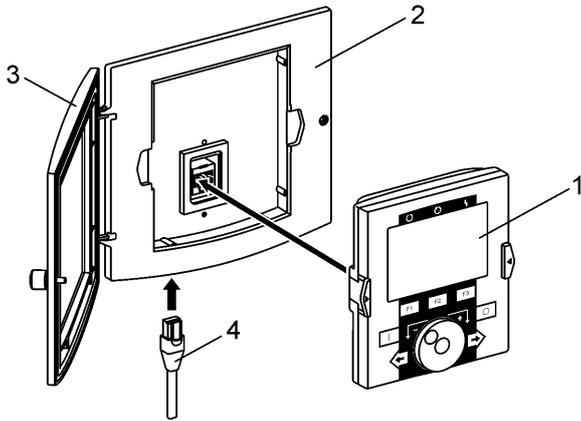


If the software versions do not correspond between device and operating panel, it can happen that individual parameter texts are missing. In this case the respective Matrix code or the line number is displayed.

## Door mounting kit DMK11

The door mounting kit >pDRIVE< 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.

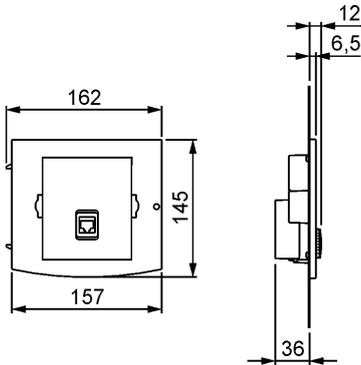
An additional "IP65 transparent cover" protects the made device settings against unintentional modifications whereas the operating state can be still read off.



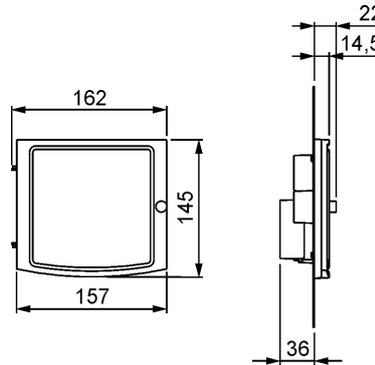
- 1 Option matrix operating panel >pDRIVE< BE 11
- 2 Door mounting kit  
Designation: Option >pDRIVE< DMK11  
Order number: 8 P01 120
- 3 IP65 transparent cover  
Designation: Option >pDRIVE< DMK11-IP65  
Order number: 8 P01 121
- 4 Connecting cable operating panel – inverter  
3 m length:  
Designation: Option >pDRIVE< CABLE3-BE  
Order number: 8 P01 122  
10 m length:  
Designation: Option >pDRIVE< CABLE10-BE  
Order number: 8 P01 123

### Dimensions in mm

Door mounting kit DMK11

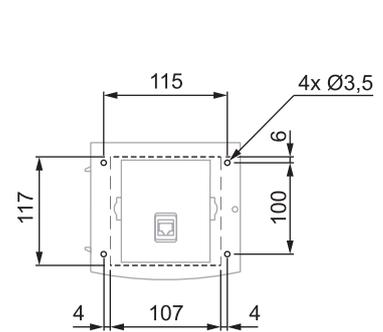


IP65 transparent cover DMK11-IP65



### Drilling plan

117 x 107 mm cut-out

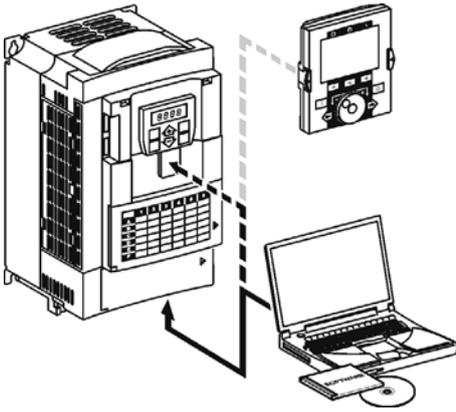


Thickness of sheet metal:  
1.5...3 mm



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 computer software Matrix 3.0 makes a further step towards the improvement of the user-friendliness of the >pDRIVE< MX eco & pro devices.

Based on the familiar Windows-surface and the well proven functions of the Matrix 2.0 PC software, it offers numerous tools for considerable quicker commissioning and for the safe archiving of the parameter 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 23.

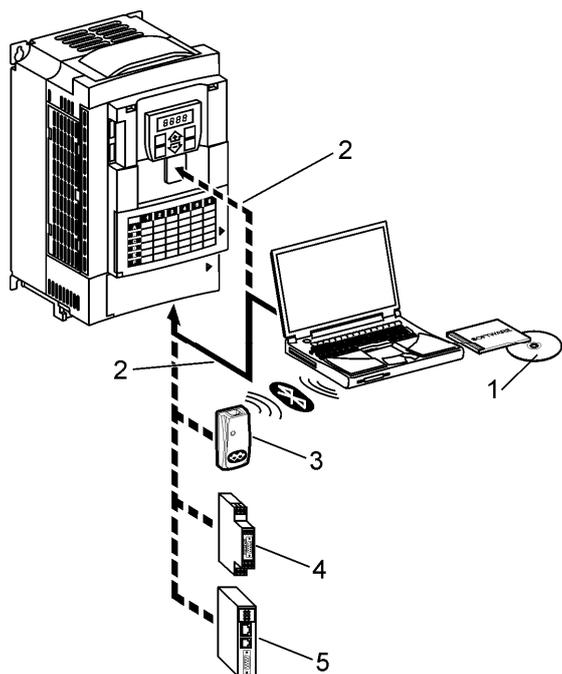
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### Specification of the operating system

Specification	Minimal system requirements	Recommended system requirements
IBM compatible PC	Pentium 2, 500 MHz	Pentium 3, 1 GHz
Operating system	Microsoft 2000 (SP3), XP	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 >pDRIVE< CABLE 3-PC is not identical to the cable option >pDRIVE< CABLE 3-BE or 10-BE! An alternate use is not possible.

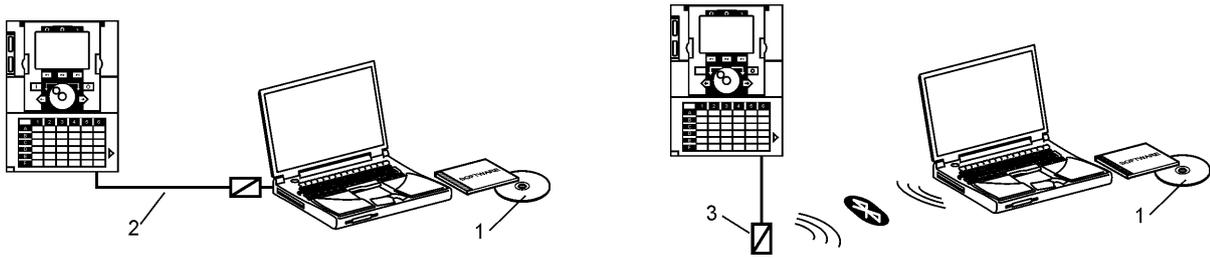


The connecting cable for the PC can be connected to the front of the inverter or to RJ45 plug next to the terminals, alternatively. In this case, the parameters in matrix field D6 for adjusting the Modbus must be set to the factory setting.

**Possible connection variants**

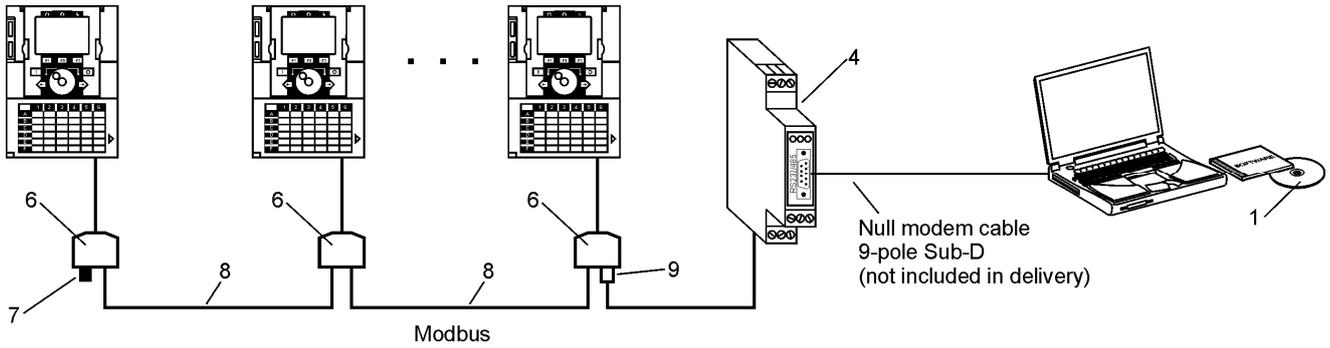
**Connection with a device:**

The connection with a device can be realized alternatively using the interface cable or by wireless (Bluetooth).



**Bus structure with active interface converter:**

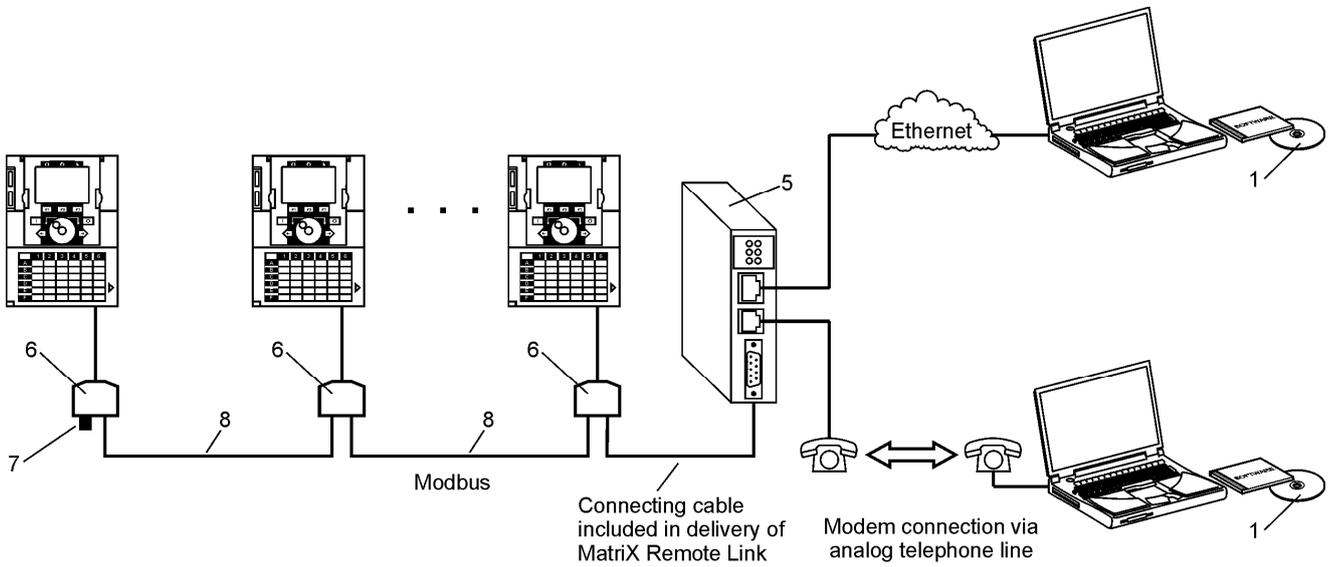
When a computer should be connected to several inverters, this is possible using the Modbus connection of the inverter group and an active interface converter.



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**Remote maintenance route via an analog modem connection or via Ethernet:**

When the option >pDRIVE< *Matrix Remote Link* is used instead of the interface converter, remote maintenance of the inverter group is also possible via modem or Ethernet.



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Components:

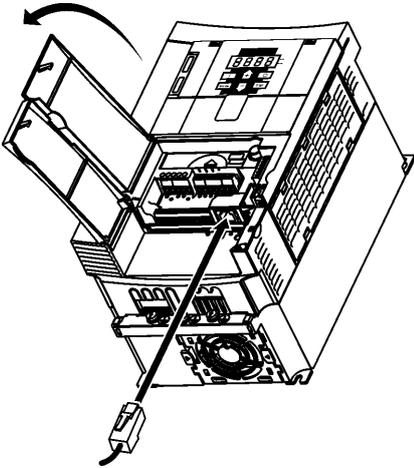
No.	Designation	Description
1	Manual-CD >pDRIVE< MX eco & pro Order number: 8 P01 021	This CD-ROM is attached to each inverter and includes the whole documentation of the inverter as well as the PC program Matrix 3. The program is also provided on our homepage <a href="http://www.pdrive.com">www.pdrive.com</a> for free download.
2	Option >pDRIVE< CABLE 3-PC Order number: 8 P01 124	Connecting cable to the inverter, length: 3 m, incl. RS232/485 interface converter on the computer side
3	Option >pDRIVE< ADAP BLUE Order number: 8 P01 126	Bluetooth adapter incl. 15 cm connecting cable. The computer must have a Bluetooth interface !
4	Option >pDRIVE< RS232/485 Order number: 8 P01 304	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 >pDRIVE< 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 >pDRIVE< MODBUS T-ADAP 03 Order number: 8 P01 300	Modbus T-adapter with 0.3 m connecting cable
7	Option >pDRIVE< MODBUS T-ADAP 10 Order number: 8 P01 301	Modbus T-adapter with 1 m connecting cable
	Option >pDRIVE< MODBUS RC Order number: 8 P01 302	Bus termination RC
8	Option >pDRIVE< CABLE 3-BE Order number: 8 P01 122	Pre-assembled RJ45-connecting cable 3 m
9	Option >pDRIVE< CABLE 10-BE Order number: 8 P01 123	Pre-assembled RJ45 connecting cable 10 m
	Option >pDRIVE< MODBUS PLUG Order number: 8 P01 305	RJ45 connector IP20 with quick-connecting technology

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# Control options

## Fieldbus Modbus



The frequency inverters *>pDRIVE< 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  $R = 120 \Omega$  and  $C = 1 \text{ nF}$  for each bus segment
- RJ45 port: screened, pin assignment 4, 5, 8
- No galvanic isolation

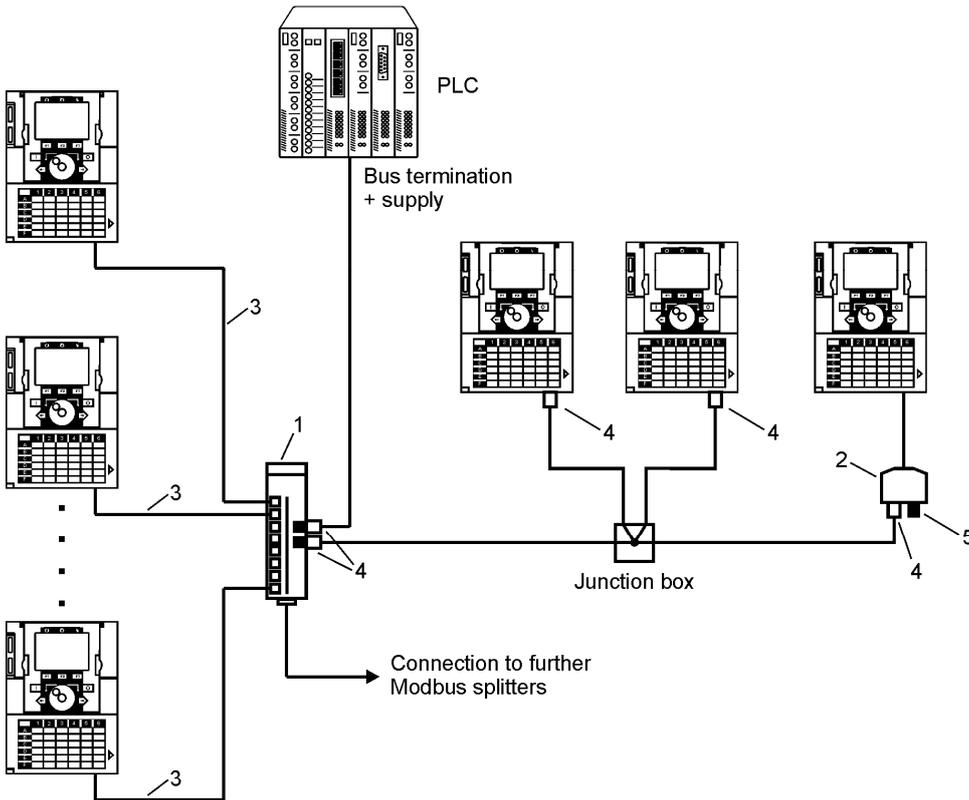


The Modbus interface cannot be used at the same time as the ADAP-CAN option!



More information on the Modbus network and a precise description of the Modbus parameters can be found in the Modbus operating instructions.

Example for a Modbus network:



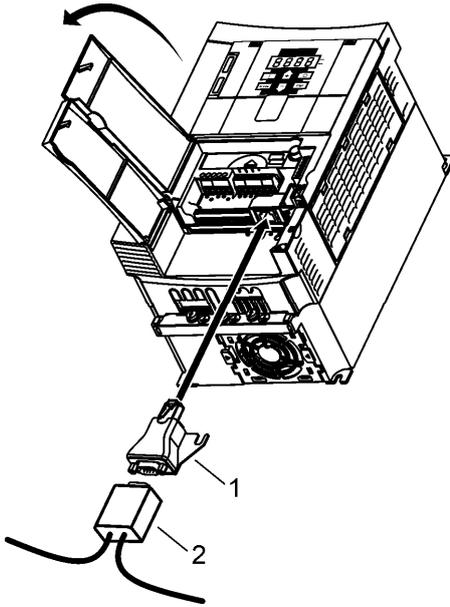
Required components:

No.	Designation	Description
1	Option >pDRIVE< MODBUS SPLITTER Order number: 8 P01 303	Divides the Modbus signal into eight additional channels using a star configuration. Several Modbus splitters can be connected parallel. Suited for mounting on a top-hat rail.
2	Option >pDRIVE< MODBUS T-ADAP 03 Order number: 8 P01 300	Modbus T-adapter with 0.3 m connecting cable
	Option >pDRIVE< MODBUS T-ADAP 10 Order number: 8 P01 301	Modbus T-adapter with 1 m connecting cable
3	Option >pDRIVE< CABLE 3-BE Order number: 8 P01 122	Pre-assembled RJ45 connecting cable 3 m
	Option >pDRIVE< CABLE 10-BE Order number: 8 P01 123	Pre-assembled RJ45 connecting cable 10 m
4	Option >pDRIVE< MODBUS PLUG Order number: 8 P01 305	RJ45 connector IP20 with quick-connecting technology
5	Option >pDRIVE< MODBUS RC Order number: 8 P01 302	Bus termination RC

Further recommended Modbus components

Cable LAPPKABEL, UNITRONIC® BUS FD P LD, 2x2 x0.22

## Fieldbus adapter ADAP-CAN for CANopen



All >pDRIVE< 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 >pDRIVE< ADAP CAN

Order number: 8 P01 125

2 CANopen plug

Designation: Option >pDRIVE< CANOPEN PLUG

Order number: 8 P01 307

### Technical data:

- Max. 32...126 subscribers (according to the CAN controller used)
- Bus cable: screened, twisted two-wire line
- Bus terminating resistor:  $R = 120 \Omega$  (108...132  $\Omega$ )
- SUB-D port according to ISO 11898
- CAN interface according to CiA DS 102
- No galvanic isolation

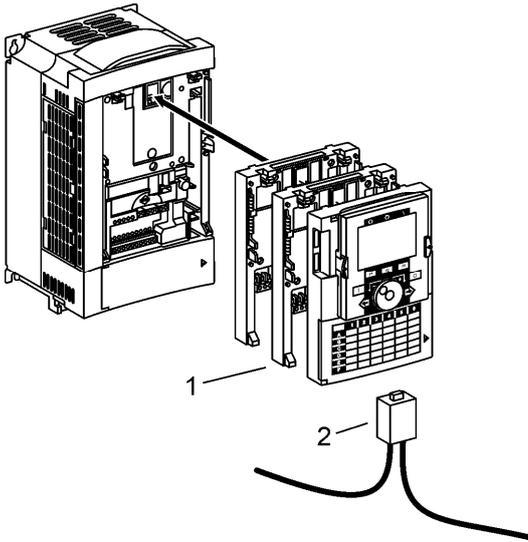


The ADAP-CAN option cannot be used at the same time as the Modbus interface!



More information on the CANopen network and a precise description of the CANopen parameters can be found in the CANopen operating instructions.

## Fieldbus card PBO11 for Profibus DP



The option card *>pDRIVE< PBO11* is completely provided by the inverter software and works as DP slave according to the PROFIDRIVE specification.

### 1 Profibus option card

Designation: Option *>pDRIVE< PBO11*

Order number: 8 P01 103

### 2 Profibus plug (straight) with switchable terminating resistor

Designation: Option *>pDRIVE< PROFIBUS PLUG*

Order number 8 P01 306

### 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<sup>2</sup>)
- 187.5 kBit/s baud rate at max. 1000 m cable length (cable type A, 0.34 mm<sup>2</sup>)
- 500 kBit/s baud rate at max. 400 m cable length (cable type A, 0.34 mm<sup>2</sup>)
- 1.5 MBit/s baud rate at max. 200 m cable length (cable type A, 0.34 mm<sup>2</sup>)
- 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.pdrive.com](http://www.pdrive.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 *>pDRIVE< MX eco & pro* can be equipped at most with 2 option cards (terminal extension and/or field bus).

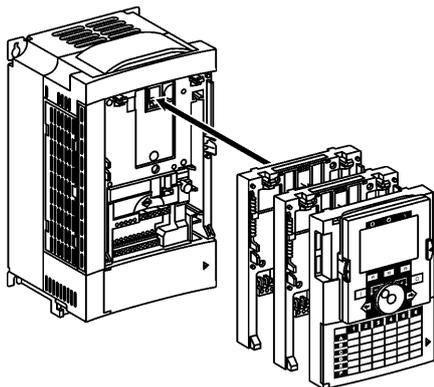


In order to address an inverter via fieldbus also during mains cut-off (line contactor control, disconnecting switch, ...) the *>pDRIVE< MX eco & pro* has to be supplied with an external 24 V buffer voltage.



More information on the Profibus network and a precise description of the Profibus parameters can be found in the Profibus operating instructions.

## Terminal extension IO11 and IO12



The frequency inverters >pDRIVE< 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 >pDRIVE< IO11 and >pDRIVE< IO12 are available. Both option card can be installed, but the same card cannot be plugged twice

Designation: Option >pDRIVE< IO11  
Order number: 8 P01 101

Designation: Option >pDRIVE< IO12  
Order number: 8 P01 102

### Listing of all control terminals

Control terminals		Standard equip-ment	Option >pDRIVE< IO11	Option >pDRIVE< 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
<b>Inputs</b>					
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
<b>Outputs</b>					
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 >pDRIVE< MX eco & pro can be equipped at most with 2 option cards (terminal extension and/or field bus).

## 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 Δθ = 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 Δθ = 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 Δθ = 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)	– <i>Selector switch SW2 at LI (factory setting):</i> Digital input DI6, same data as with DI1 up to DI5 – <i>Selector switch SW2 at PTC:</i> 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)	– <i>Selector switch SW1 in position Source or Sink Int.:</i> +24 V DC (min. 21 V, max. 27 V), short-circuit proof max. 100 mA (incl. all options) – <i>Selector switch SW1 in position Sink Ext.:</i> 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)
R2A R2C	Relay output 2 (R2A N.O. contact)	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.

Max. connection cross-section: 1.5 mm<sup>2</sup> (AWG16), 0.25 Nm (2.5 mm<sup>2</sup> (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".

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 ±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
+24	Sampling voltage for digital inputs (Sink/Source-switching with selector switch SW3)	– <i>Selector switch SW3 in position Source or Sink Int.:</i> +24 V DC (min. 21 V, max. 27 V), short-circuit proof max. 50 mA (for basic device and options) – <i>Selector switch SW3 in position Sink Ext.:</i> 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 kΩ, reaction time 2 ms ±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 kΩ, threshold value 3 kΩ, Disengaging value 1.8 kΩ, 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
DO2	Digital output DO2 (Usage can be parameterized)	Switching capacity max. 200 mA at 12...30 VDC Reaction time: 2 ms ±0.5 ms
CDO	Common	Reference potential of the digital outputs
0 V	Ground	0 V general use

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Max. connection cross-section: 1.5 mm<sup>2</sup> (AWG16), 0.25 Nm (2.5 mm<sup>2</sup> (AWG14), 0.6 Nm for relay terminals)

\*) Screen the wiring and lay the cables separate from the motor cable !

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 Δθ = 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 Δθ = 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
AO3	Analog output AO3	Resolution 10 Bits, reaction time 5 ms ±1 ms, accuracy ±1 % at Δθ = 60 °C (140 °F), linearity ±0.2 %
+24	Sampling voltage for digital inputs (Sink/Source-switching with selector switch SW4)	– <i>Selector switch SW4 in position Source or Sink Int.:</i> +24 V DC (min. 21 V, max. 27 V), short-circuit proof max. 50 mA (for basic device and options) – <i>Selector switch SW4 in position Sink Ext.:</i> 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
DO4	Digital output DO4 (Usage can be parameterized)	Switching capacity max. 200 mA at 12...30 VDC Reaction time: 2 ms ±0.5 ms
CDO	Common	Reference potential of the digital outputs
0 V	Ground	0 V general use

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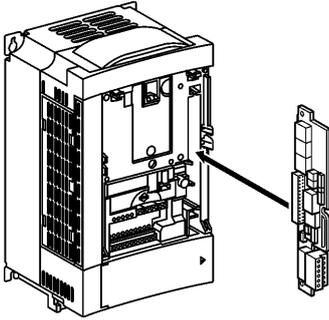
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Max. connection cross-section: 1.5 mm<sup>2</sup> (AWG16), 0.25 Nm (2.5 mm<sup>2</sup> (AWG14), 0.6 Nm for relay terminals)

\*) 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 >pDRIVE< MX pro!



There are three different options available:

Designation: *Option >pDRIVE< SFB 5V RS422*  
Order number: 8 P01 110

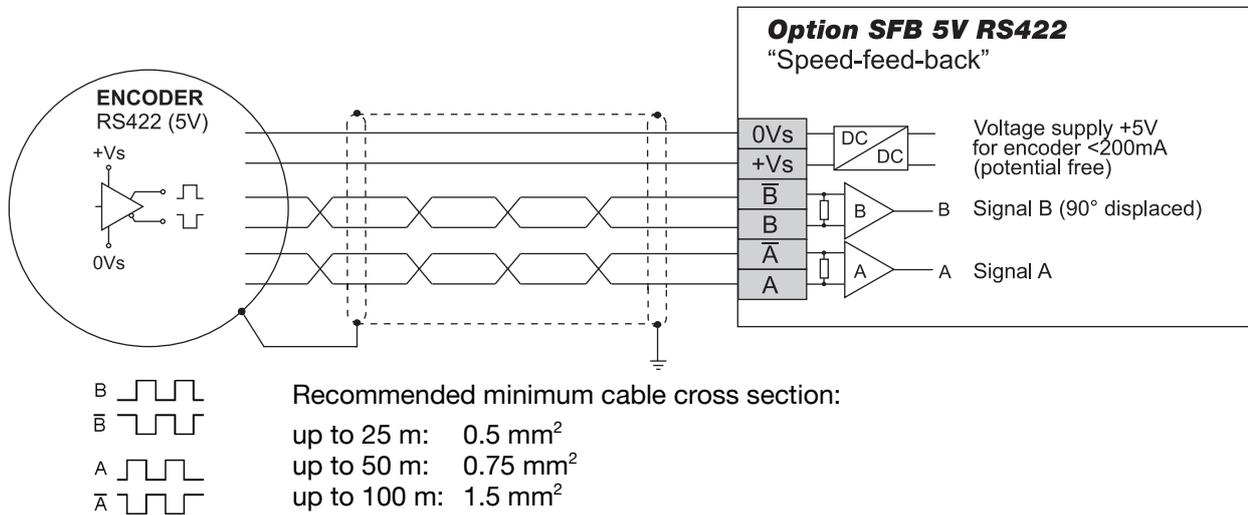
Designation: *Option >pDRIVE< SFB 15V RS422*  
Order number: 8 P01 111

Designation: *Option >pDRIVE< SFB 24V PP*  
Order number: 8 P01 112

### Specification >pDRIVE< SFB 5V RS422

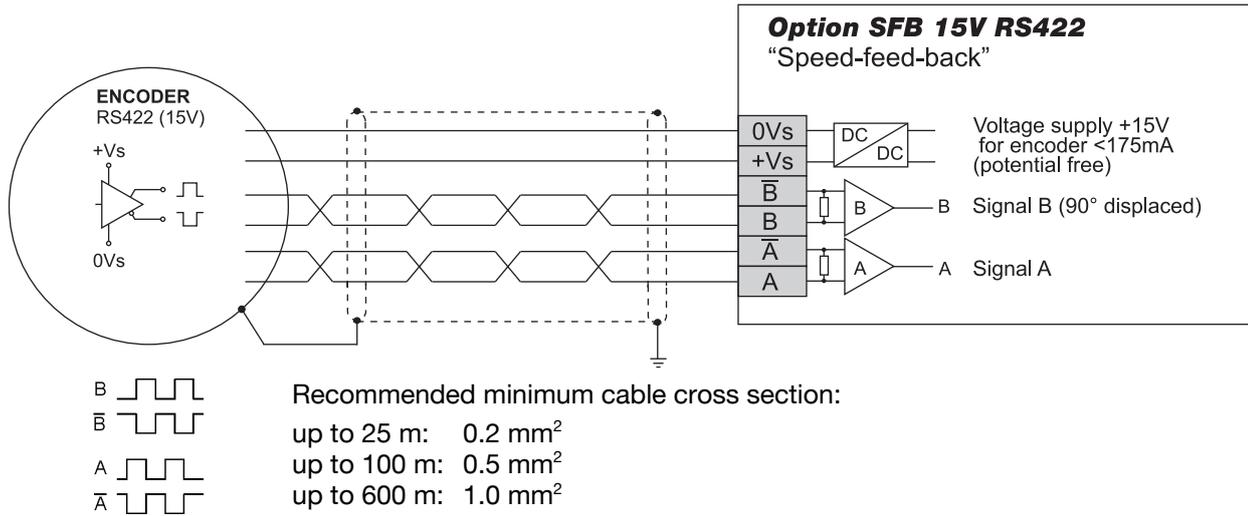
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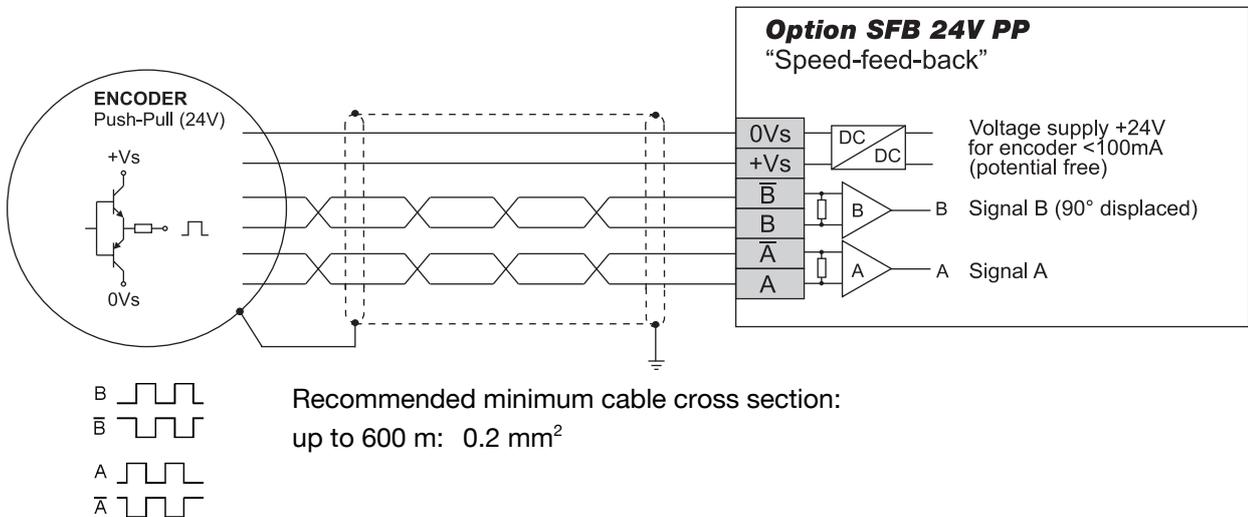
Terminal	Designation	Specification
0Vs +Vs	Voltage supply of the encoder	max. 200 mA at 5 V DC (max. 5.5 V), protected against short-circuit and overload
$\overline{B}$ B	Incremental logic inputs (90° displaced to signal A)	Max. 5,000 pulses / rotation Min. 100 pulses / rotation
$\overline{A}$ A	Incremental logic inputs	Max. 300 kHz

Specification >pDRIVE< SFB 15V RS422



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
B̄ B	Incremental logic inputs (90° displaced to signal A)	Max. 5,000 pulses / rotation Min. 100 pulses / rotation
Ā A	Incremental logic inputs	Max. 300 kHz

Specification >pDRIVE< SFB 24V PP



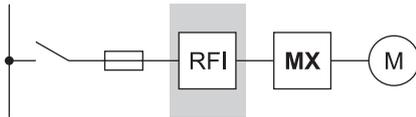
Terminal	Designation	Specification
0Vs +Vs	Voltage supply of the encoder	max. 100 mA at 24 V DC (max. 25 V), protected against short-circuit and overload
B̄ B	Incremental logic inputs (90° displaced to signal A)	Max. 5,000 pulses / rotation Min. 100 pulses / rotation
Ā A	Incremental logic inputs	Max. 300 kHz State 0 if < 1.5 V State 1 if > 11.5 and < 25 V

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# External options

## Radio frequency interference filter RFI



The *>pDRIVE< MX* frequency inverters include a radio frequency interference filter for use in industrial environments which is built-in as standard.

For *>pDRIVE< 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 *>pDRIVE< MX eco & pro 4V0,75...4V4,0* and category C3 "Use in industrial environments" for all inverters from 5.5 kW.

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 *>pDRIVE< RFI* is required. These filters are connected at the mains side of the inverter.

For all *>pDRIVE< MX pro 6V* this filter complies with the specifications of category C3 "Use in industrial environments".



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 filters *>pDRIVE< RFI* 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 *>pDRIVE< RFI* suitable for the chosen inverter.

- MX eco 4V: page 73 ff
- MX pro 4V: page 130 ff
- MX pro 6V: page 183 ff



The allowed lengths of motor cables are given in the tables on the following pages:

- MX eco 4V: page 62
- MX pro 4V: page 118
- MX pro 6V: page 171

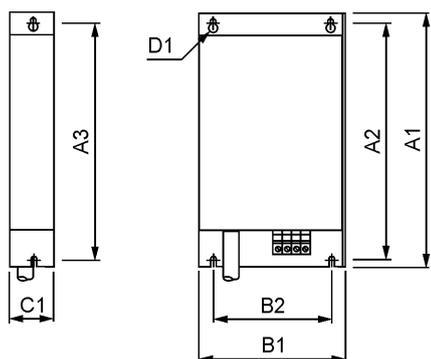
	General technical data
Operating voltage RFI 480	3AC 380 V -15 % ... 480 V +10 %
Operating voltage RFI 6V	3AC 500 V -15 % ... 690 V +10 %
Nominal frequency	50/60 Hz ±5 %
Overload capability	150 % for 60 s per 10 min, 200 % for 2 s
Ambient temperature	-10...+50 °C (up to 60 °C with derating)
Storage temperature	-40...+70 °C
Altitude	0...1000 m (up to 3000 m with derating, but max. 2000 m for "Corner grounded networks")
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 >pDRIVE< 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 connection between the screen connection of the motor cable and the inverter.

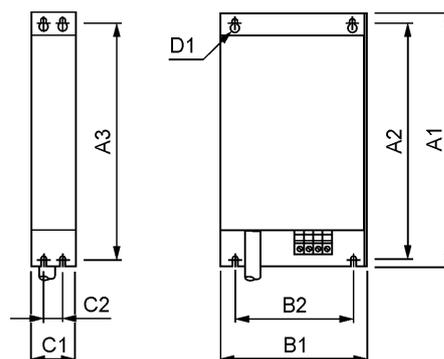
	Option >pDRIVE<			
	RFI 480/12-TN	RFI 480/26-TN	RFI 480/35-TN	RFI 480/46-TN
Order number	8 P01 280	8 P01 281	8 P01 282	8 P01 283
Nominal current	12 A	26 A	35 A	46 A
Maximum leakage current	7 mA	8 mA	7 mA	14 mA
Continuous leakage current	3 mA	3 mA	3 mA	3 mA
Protection degree	IP20, top side IP41			
Losses	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 $\varnothing$ 4.5 mm / 2 x $\varnothing$ 4.5 mm	4 x $\varnothing$ 4.5 mm / 2 x $\varnothing$ 4.5 mm	4 x $\varnothing$ 5.5 mm / 2 x $\varnothing$ 5.5 mm	4 x $\varnothing$ 5.5 mm / 2 x $\varnothing$ 5.5 mm
Connection terminal	max. 4 mm <sup>2</sup>	max. 6 mm <sup>2</sup>	max. 10 mm <sup>2</sup>	max. 16 mm <sup>2</sup>
Connection PE terminal	max. 4 mm <sup>2</sup>	max. 6 mm <sup>2</sup>	max. 10 mm <sup>2</sup>	max. 16 mm <sup>2</sup>

	Option >pDRIVE<			
	RFI 480/72-TN	RFI 480/90-TN	RFI 480/92-TN	RFI 480/180-TN
Order number	8 P01 284	8 P01 285	8 P01 286	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 $\varnothing$ 6.6 mm / 2 x $\varnothing$ 6.6 mm	4 x $\varnothing$ 6.6 mm / 4 x $\varnothing$ 6.6 mm	4 x $\varnothing$ 6.6 mm / 4 x $\varnothing$ 6.6 mm	4 x $\varnothing$ 9 mm / 4 x $\varnothing$ 9 mm
Connection terminal	max. 50 mm <sup>2</sup>	max. 50 mm <sup>2</sup>	max. 50 mm <sup>2</sup>	max. 150 mm <sup>2</sup>
Connection PE terminal	max. 50 mm <sup>2</sup>	max. 50 mm <sup>2</sup>	max. 50 mm <sup>2</sup>	max. 150 mm <sup>2</sup>

>pDRIVE< RFI 480/12-TN up to RFI 480/72-TN



>pDRIVE< RFI 480/90-TN up to RFI 480/180-TN

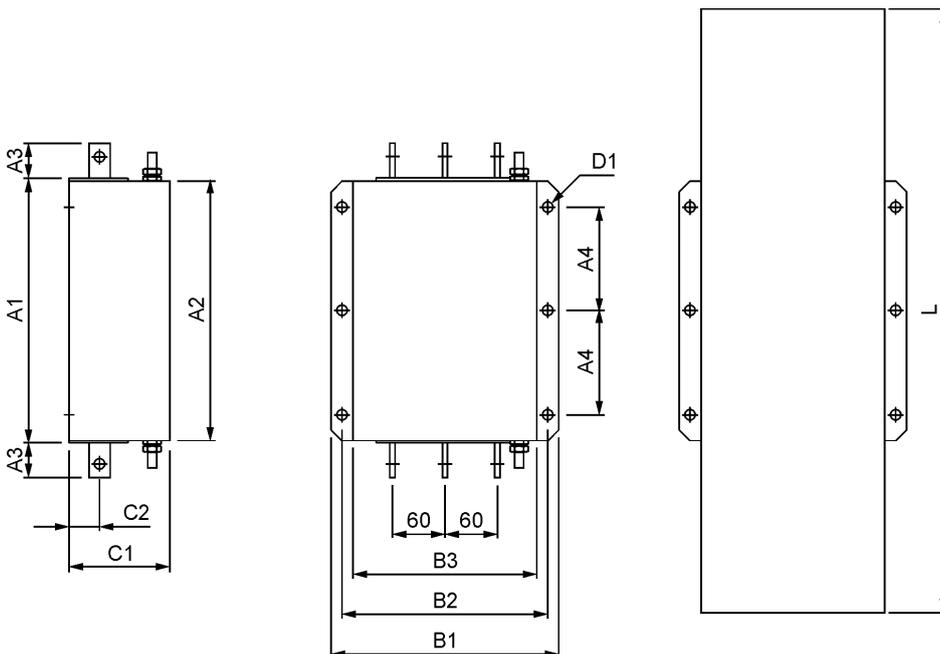


	Option >pDRIVE<		
	RFI 480/300-TN	RFI 480/600-TN	RFI 480/800-TN
Order number	8 P01 288	8 P01 289	8 P01 290
Nominal current	300 A	580 A	740 A
Maximum leakage current	350 mA	350 mA	350 mA
Continuous leakage current	3 mA	3 mA	3 mA
Protection degree	IP00, with protection against contact		
Losses	60 W	125 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 $\varnothing$ 12 mm	6 x $\varnothing$ 12 mm	6 x $\varnothing$ 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
Connection PE	M12	M12	M12

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>pDRIVE< RFI 480/300-TN up to RFI 480/800-TN

8 P01 002 EN.05/05

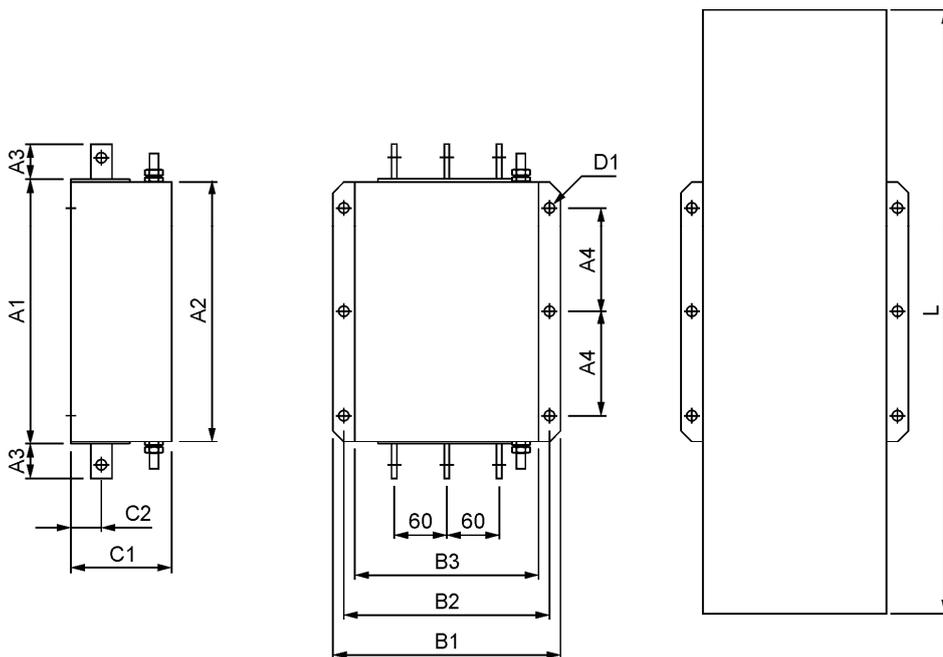


The filters option >pDRIVE< RFI 480/300-TN...480/800-TN as well as RFI 6V must be mounted with a well-conductive and large surface connection between the screen connection of the motor cable and the inverter. This well HF connection is determining for the radio interference suppression of the drive.

The protective cover which is delivered with the inverter prevents an unintended contact with the terminals.

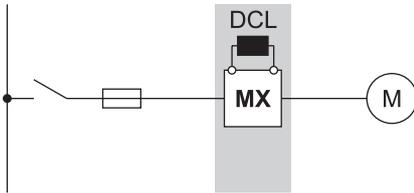
	Option >pDRIVE<	
	RFI 6V220-TN	RFI 6V430-TN
Order number	8 P01 298	8 P01 299
Nominal current	220 A	430 A
Maximum leakage current	450 mA	450 mA
Continuous leakage current	5 mA	5 mA
Protection degree	IP00, with protection against contact	
Losses	45 W	90 W
Weight	14 kg	18 kg
Dimension A1	306 mm	306 mm
Dimension A2	300 mm	300 mm
Dimension A3	40 mm	95 mm
Dimension A4	120 mm	120 mm
Dimension B1	260 mm	260 mm
Dimension B2	235 mm	235 mm
Dimension B3	210 mm	210 mm
Dimension C1	135 mm	135 mm
Dimension C2	65 mm	65 mm
Protective cover L	800 mm	800 mm
Fixing D1	6 x Ø 12 mm	6 x Ø 12 mm
Connection bar	25 x 6 mm 1 x M10	30 x 8 mm 2 x M10
Connection PE	M12	M12

>pDRIVE< RFI 6V220-TN and RFI 6V430-TN



## DC choke DCL

The DC choke reduces the mains current harmonics and thus it reduces the total mains current.



>pDRIVE< 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 >pDRIVE< 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 an external choke is absolutely necessary and it is always recommended to reduce to current harmonics.

Using the option >pDRIVE< DCL or >pDRIVE< DCL-BOX 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  $\geq 1.8\%$

Additionally, please observe depending on the size of the device:

- >pDRIVE< MX eco & pro 4V0,75...4V15  
The use of the option >pDRIVE< DCL is required if the mains short-circuit current is 5...35 kA.
- >pDRIVE< MX eco & pro 4V18...4V75  
The use of the option >pDRIVE< DCL is required if the mains short-circuit current is 22...35 kA.
- >pDRIVE< MX eco & pro 4V from 90 kW  
The option >pDRIVE< 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.

If the option >pDRIVE< 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  $\geq 120$  is required.



Please use the allocation table on page 73 ff or 130 ff for selection of the option >pDRIVE< DCL or DCL-BOX suitable for the chosen inverter.

General technical data option >pDRIVE< 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

Typical current harmonics if the DC choke >pDRIVE< DCL is used at 400 V, 50 Hz

>pDRIVE< MX eco	P <sub>N</sub> [kW]	I <sub>cc</sub> [kA]	I <sub>N</sub> [A]	H1 [A]	Harmonics at nominal load [%]																THD
					H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	
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

>pDRIVE< MX pro	P <sub>N</sub> [kW]	I <sub>cc</sub> [kA]	I <sub>N</sub> [A]	H1 [A]	Harmonics at nominal load [%]																THD
					H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	
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
4V160/200	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
4V200/250	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
4V250/315	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
4V315/400	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
4V400/500	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
4V500/630	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	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 *>pDRIVE< DCL* is available as an external option for the devices *>pDRIVE< 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.

For low-power devices also a mounting kit *>pDRIVE< FPK* is available in order to install the DC choke behind the inverter (see chapter "Footprint kit FPK", page 220).

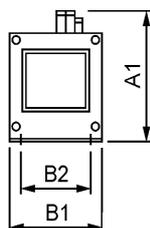
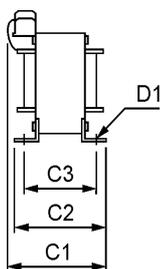
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	Option <i>&gt;pDRIVE&lt;</i>				
	DCL 2	DCL 4	DCL 8	DCL 11	DCL 14
Order number	8 P01 200	8 P01 201	8 P01 202	8 P01 203	8 P01 204
Nom. current (therm.) @50°C	2.25 A	4.3 A	8 A	10.7 A	14.3 A
Nominal inductivity	18 mH	10 mH	6.8 mH	3.9 mH	3.2 mH
Losses	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 Ø 3.5 mm	4 x Ø 3.5 mm	4 x Ø 5.5 mm	4 x Ø 5.5 mm	4 x Ø 5.5 mm
Connection to inverter	Terminal max. 2.5 mm <sup>2</sup>	Terminals max. 2.5 mm <sup>2</sup>			
Recommended cable	1.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>
Connection PE	Terminal max. 10 mm <sup>2</sup>	Terminal max. 10 mm <sup>2</sup>	Terminal max. 10 mm <sup>2</sup>	Terminal max. 10 mm <sup>2</sup>	Terminal max. 10 mm <sup>2</sup>

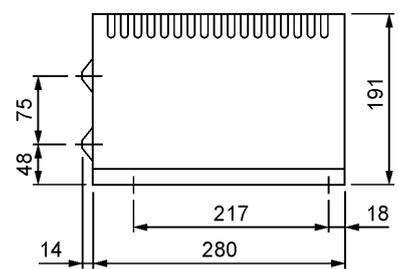
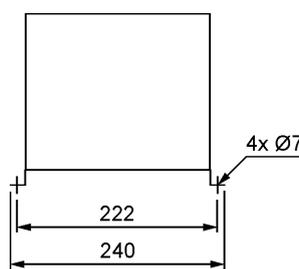
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	Option <i>&gt;pDRIVE&lt;</i>				
	DCL 19	DCL 27	DCL 44	DCL 85	DCL 171
Order number	8 P01 205	8 P01 206	8 P01 207	8 P01 208	8 P01 209
Nom. current (therm.) @50°C	19.2 A	27.4 A	44 A	84.5 A	171 A
Nominal inductivity	2.2 mH	1.6 mH	1.2 mH	0.52 mH	0.22 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 Ø 5.5 mm	4 x Ø 5.5 mm	4 x Ø 5.5 mm	4 x Ø 7 mm	4 x Ø 7 mm
Connection to inverter	Terminals max. 4 mm <sup>2</sup>	Terminals max. 6 mm <sup>2</sup>	Terminals max. 10 mm <sup>2</sup>	Terminals max. 35 mm <sup>2</sup>	Ø 7 mm
Recommended cable	2.5 mm <sup>2</sup>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	35 mm <sup>2</sup>	70 mm <sup>2</sup>
Connection PE	Terminal max. 10 mm <sup>2</sup>	Terminal max. 10 mm <sup>2</sup>	Terminal max. 10 mm <sup>2</sup>	Terminal max. 16 mm <sup>2</sup>	Terminal max. 35 mm <sup>2</sup>

*>pDRIVE< DCL 2 up to DCL 85*



*>pDRIVE< DCL 171*



The *>pDRIVE< DCL-BOX* is an option for *pDRIVE< MX eco & pro* inverters from 90 kW which has to be 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 DC box and in the inverter is designed in protection degree IP54.

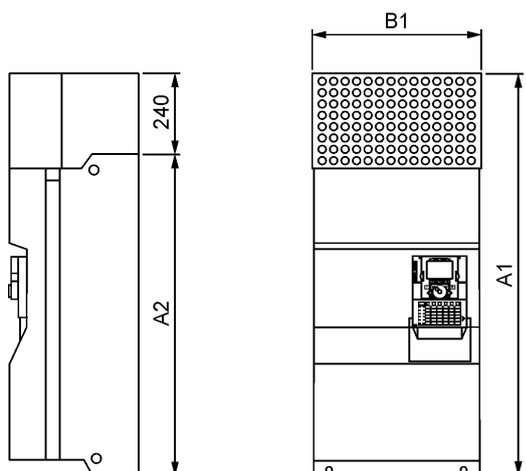
General technical data option <i>&gt;pDRIVE&lt; DCL-BOX</i>	
Operating voltage	400...850 V DC
Overload capability	125 % for 60 s per 10 min, 135 % for 2 s
Ambient temperature	-10...+50 °C (up to 60 °C with derating)
Storage temperature	-25...+70 °C
Altitude	0...1000 m (up to 3000 m with derating)
Vibration 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

	Option <i>&gt;pDRIVE&lt; DCL-BOX</i>					
	240	290	350	490	570	700
Order number	8 P01 210	8 P01 211	8 P01 212	8 P01 213	8 P01 214	8 P01 215
Nom. current (therm.) @50°C	243 A	290 A	351 A	486 A	574 A	702 A
Nominal current (magn.)	380 A	471 A	558 A	760 A	840 A	1116 A
Nominal inductivity	210 µH	150 µH	138 µH	105 µH	95 µH	69 µH
Losses	205 W	210 W	270 W	345 W	390 W	495 W
Weight	24 kg	32 kg	36 kg	53 kg	67 kg	67 kg
Dimension A1	920 mm	1022 mm	1190 mm	1190 mm	1190 mm	1190 mm
Dimension A2	680 mm	782 mm	950 mm	950 mm	950 mm	950 mm
Dimension B1	320 mm	360 mm	340 mm	440 mm	595 mm	595 mm
Fixing D1	4x Ø 11.5 mm	4x Ø 11.5 mm	4x Ø 11.5 mm	4x Ø 11.5 mm	4x Ø 11.5 mm	4x Ø 11.5 mm

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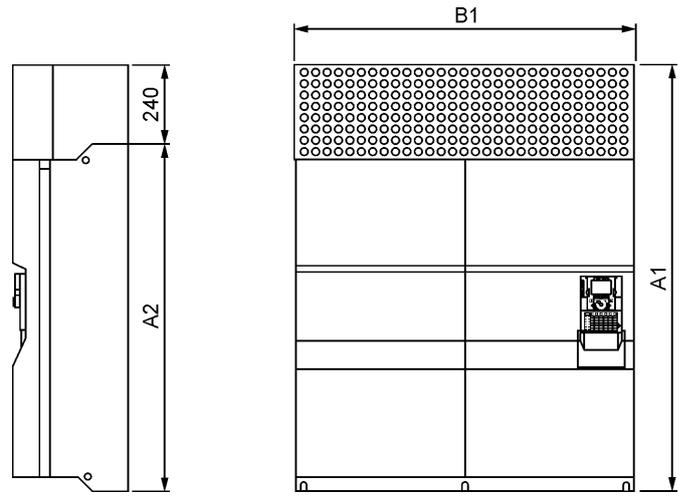
8 P01 002 EN.05/05

*>pDRIVE< DCL-BOX 240 up to DCL-BOX 700*



	Option >pDRIVE< DCL-BOX		
	860	1160	1400
Order number	8 P01 216	8 P01 217	8 P01 218
Nom. 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 Ø 11.5 mm	8x Ø 11.5 mm	8x Ø 11.5 mm

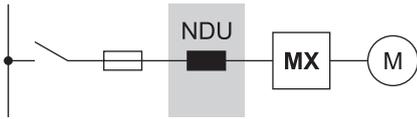
>pDRIVE< DCL-BOX 860 up to DCL-BOX 1400



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8 P01 002 EN.05/05

## Line reactor NDU



The option *>pDRIVE< NDU* can be used to reduce the mains current harmonics.

For *>pDRIVE< MX eco 4V & pro 4V* this option is available from 15 kW. 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 an external choke is absolutely necessary and it is always recommended to reduce to current harmonics.

The option *>pDRIVE< NDU* is available for all *>pDRIVE< 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 an external choke is absolutely necessary and it is always recommended to reduce to current harmonics.

Using the option *>pDRIVE< 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  $\geq 1.8\%$
- in case of mains short-circuit currents up to 100 kA
- in case of *>pDRIVE< 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 *>pDRIVE< NDU* suitable for the chosen inverter.

- MX eco 4V: page 73 ff
- MX pro 4V: page 130 ff
- MX pro 6V: page 183 ff



The power allocation already includes the current decrease according to the respective maximum ambient temperature of the inverters.

The option >pDRIVE< 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.

For low-power devices also a mounting kit >pDRIVE< FPK is available in order to install the line reactor behind the inverter (see chapter "Footprint kit FPK", page 220).

General technical data	
Operating voltage	3AC 380 V -15 % ... 690 V +10 %
Nominal frequency	50/60 Hz ±5 %
Overload capability	NDU 40...160: 150 % for 60 s per 10 min, 200 % for 2 s NDU 195...760: 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 if the line reactor >pDRIVE< NDU is used at 400 V, 50 Hz

>pDRIVE< MX eco	P <sub>N</sub> [kW]	I <sub>cc</sub> [kA]	I <sub>N</sub> [A]	H1 [A]	Harmonics at nominal load [%]																
					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

>pDRIVE< MX pro	P <sub>N</sub> [kW]	I <sub>cc</sub> [kA]	I <sub>N</sub> [A]	H1 [A]	Harmonics at nominal load [%]																THD
					H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	
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

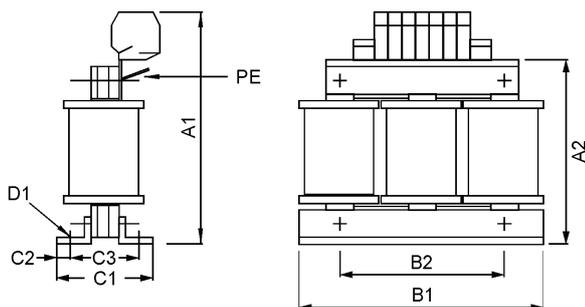
Typical current harmonics if the line reactor >pDRIVE< NDU is used at 690 V, 50 Hz

>pDRIVE< MX pro	P <sub>N</sub> [kW]	I <sub>cc</sub> [kA]	I <sub>N</sub> [A]	H1 [A]	Harmonics at nominal load [%]																THD
					H5	H7	H11	H13	H17	H19	H23	H25	H29	H31	H35	H37	H41	H43	H47	H49	
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

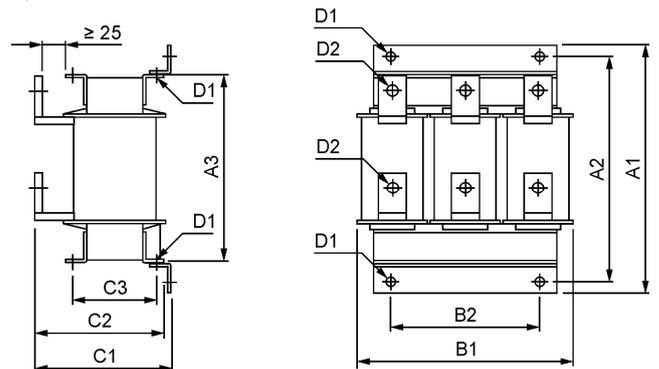
	Option >pDRIVE<								
	NDU 10	NDU 23	NDU 40	NDU 70	NDU 100	NDU 160	NDU 195	NDU 230	NDU 235
Order number	8 P01 238	8 P01 239	8 P01 220	8 P01 221	8 P01 222	8 P01 223	8 P01 224	8 P01 236	8 P01 225
Nom. current (therm.) @40°C	10.5 A	23 A	40 A	70 A	100 A	160 A	195 A	230 A	235 A
Nom. current (magn.)	20 A	44 A	78 A	130 A	180 A	320 A	370 A	405 A	445 A
Nom. inductivity	2.8 (1.6) mH	1.3 (0.5) mH	739 µH	454 µH	350 µH	220 µH	155 µH	230 µH	120 µH
Losses	18 W	27 W	120 W	140 W	185 W	220 W	230 W	330 W	240 W
Weight	3 kg	6.3 kg	21 kg	24 kg	25 kg	28 kg	30 kg	79 kg	35 kg
Dimension A1	147 mm	175 mm	240 mm	240 mm	240 mm	305 mm	330 mm	440 mm	380 mm
Dimension A2	104 mm	132 mm	205 mm	205 mm	205 mm	275 mm	300 mm	400 mm	350 mm
Dimension A3	–	–	180 mm	180 mm	180 mm	240 mm	260 mm	340 mm	300 mm
Dimension B1	125 mm	155 mm	180 mm	180 mm	180 mm	280 mm	280 mm	385 mm	320 mm
Dimension B2	100 mm	130 mm	100 mm	100 mm	100 mm	200 mm	200 mm	300 mm	225 mm
Dimension C1	65 mm	90 mm	100 mm	140 mm	170 mm	210 mm	210 mm	265 mm	210 mm
Dimension C2	8 mm	10 mm	90 mm	130 mm	160 mm	200 mm	200 mm	245 mm	200 mm
Dimension C3	45 mm	56 mm	60 mm	80 mm	100 mm	125 mm	125 mm	150 mm	150 mm
Fixing D1	5 x 8 mm	8 x 12 mm	∅ 7 mm	∅ 7 mm	∅ 7 mm	∅ 9 mm	∅ 9 mm	∅ 13 mm	∅ 9 mm
Connection D2	Terminal max. 4 mm <sup>2</sup>	Terminal max. 10 mm <sup>2</sup>	∅ 7 mm	∅ 7 mm	∅ 9 mm	∅ 9 mm	∅ 11 mm	∅ 13 mm	∅ 11 mm
Recomm. cable	1.5 mm <sup>2</sup>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	35 mm <sup>2</sup>	70 mm <sup>2</sup>	95 mm <sup>2</sup>	95 mm <sup>2</sup>	95 mm <sup>2</sup>
Connection PE	M4	M4	M6	M6	M8	M10	M10	M12	M10

	Option >pDRIVE<								
	NDU 280	NDU 315	NDU 365	NDU 450	NDU 475	NDU 540	NDU 620	NDU 650	NDU 760
Order number	8 P01 226	8 P01 227	8 P01 228	8 P01 237	8 P01 230	8 P01 231	8 P01 232	8 P01 233	8 P01 234
Nom. current (therm.) @40°C	280 A	315 A	365 A	450 A	475 A	540 A	620 A	650 A	760 A
Nom. current (magn.)	530 A	570 A	685 A	770 A	850 A	1025 A	1180 A	1150 A	1350 A
Nom. inductivity	98 µH	85 µH	66 µH	100 µH	60 µH	38 µH	26 µH	38 µH	32 µH
Losses	260 W	280 W	280 W	495 W	320 W	320 W	320 W	320 W	450 W
Weight	40 kg	46 kg	43 kg	90 kg	70 kg	55 kg	60 kg	62 kg	82 kg
Dimension A1	380 mm	380 mm	380 mm	440 mm	380 mm	380 mm	380 mm	440 mm	440 mm
Dimension A2	350 mm	350 mm	350 mm	400 mm	350 mm	350 mm	350 mm	400 mm	400 mm
Dimension A3	300 mm	300 mm	300 mm	340 mm	300 mm	300 mm	300 mm	310 mm	340 mm
Dimension B1	320 mm	320 mm	320 mm	385 mm	320 mm	320 mm	320 mm	360 mm	385 mm
Dimension B2	225 mm	225 mm	225 mm	300 mm	225 mm	225 mm	225 mm	300 mm	300 mm
Dimension C1	210 mm	210 mm	250 mm	305 mm	250 mm	250 mm	250 mm	250 mm	275 mm
Dimension C2	200 mm	200 mm	230 mm	295 mm	230 mm	230 mm	230 mm	230 mm	250 mm
Dimension C3	150 mm	150 mm	150 mm	190 mm	150 mm	150 mm	150 mm	150 mm	125 mm
Fixing D1	∅ 9 mm	∅ 9 mm	∅ 11 mm	∅ 13 mm	∅ 11 mm	∅ 11 mm	∅ 13 mm	∅ 13 mm	∅ 13 mm
Connection D2	∅ 11 mm	∅ 11 mm	∅ 13 mm	2x ∅13mm	2x ∅13mm				
Connection PE	M10	M10	M12						

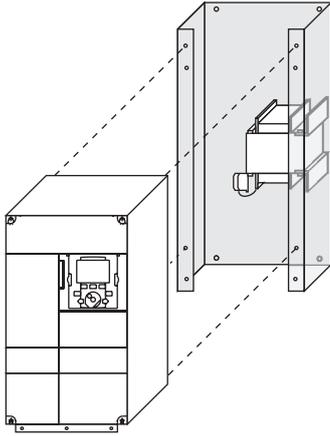
>pDRIVE< NDU 10 ... 23



>pDRIVE< NDU 40 ... 760



## Footprint kit FPK



The option >pDRIVE< FPK provides the possibility to install an additional DC choke >pDRIVE< DCL or line reactor >pDRIVE< NDU behind the frequency inverter.

This option is available for following frequency inverters:

- >pDRIVE< MX eco & pro 4V from 0.7...37 kW in combination with option >pDRIVE< DCL
- >pDRIVE< MX pro 6V2,2/3,0...6V22/30 in combination with option >pDRIVE< NDU

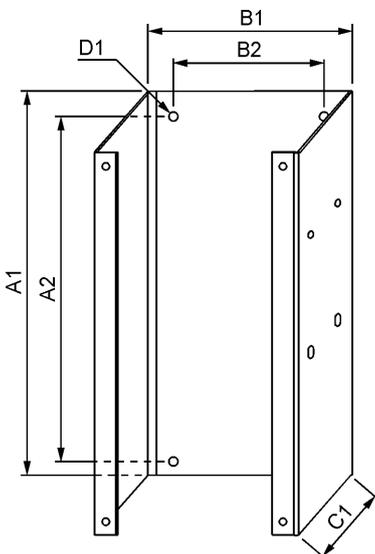
Please use the allocation table for selection of the option >pDRIVE< FPK suitable for the chosen inverter:



- MX eco 4V: page 73 ff.
- MX pro 4V: page 130 ff.
- MX pro 6V: page 183 ff.

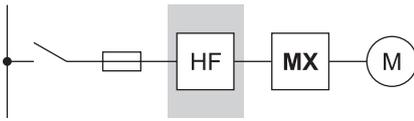
General technical data	
Design	Mounting kit made of galvanised sheet steel
Protection degree	Depending on the respective choke

	Option >pDRIVE< FPK					
	155x260	175x295	210x295	230x400	240x420	240x550
Order number	8 P01 461	8 P01 462	8 P01 463	8 P01 464	8 P01 465	8 P01 466
Weight	2 kg	2.2 kg	2.2 kg	3.1 kg	3.9 kg	4.6 kg
Dimension A1	260 mm	295 mm	295 mm	400 mm	420 mm	550 mm
Dimension A2	240 mm	275 mm	275 mm	380 mm	400 mm	530 mm
Dimension B1	155 mm	195 mm	210 mm	230 mm	240 mm	240 mm
Dimension B2	135 mm	135 mm	140 mm	160 mm	200 mm	150 mm
Dimension C1	80 mm	80 mm	80 mm	90 mm	105 mm	105 mm
Dimension D1	6.6 mm	6.6 mm	6.6 mm	6.6 mm	6.6 mm	6.6 mm



The individual mounting kits may differ marginally from the illustration. Some of them are also designed of two parts.

## Mains current harmonic filter HF



By using a harmonic filter, the mains current harmonics caused by the inverter are largely suppressed. The total current harmonic is reduced at the >pDRIVE< HF-A filters according to the values below.

The use of the option >pDRIVE< HF is recommendable especially for drives in residential environments.

The option >pDRIVE< HF is connected on the mains-side of the inverter.

The mains current harmonic filters >pDRIVE< HF are equipped with a built-in temperature sensor (thermoclick opens at overload). 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").

The >pDRIVE< HF filters are equipped with a fan for forced cooling. Its supply occurs internally from the applied mains voltage.



The integration of the function "Line contactor control" and therefore the installation of a line contactor in front of the mains current harmonic filter is especially recommended. In this way the absorption of reactive power is prevented when the inverter is locked.



The additional use of a DC choke >pDRIVE< DCL or a line reactor >pDRIVE< NDU will further reduce the current harmonics.



Please use the allocation table on page 73 ff or 130 ff for selection of the option >pDRIVE< HF suitable for the chosen inverter.



Detailed data for the mounting of the mains current harmonic filter can be found in the Planning and Mounting instructions of the >pDRIVE< HF filters. It contains detailed connection examples and information about wiring.



The filters >pDRIVE< HF are not qualified for nongrounded (IT) mains!

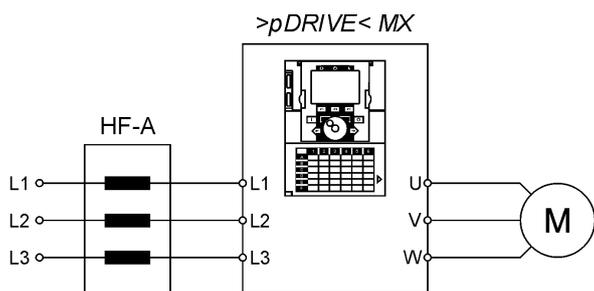
Typical current harmonics when using the >pDRIVE< HF-A harmonic-filters at 400V, 50Hz:

>pDRIVE< frequency inverter		I <sub>cc</sub> [kA]	Total harmonics THDI		
			>pDRIVE< HF-A	>pDRIVE< HF-A + >pDRIVE< DCL	>pDRIVE< HF-A + >pDRIVE< NDU
MX eco 4V4,0	MX pro 4V4,0	5	22 %	11 %	-
MX eco 4V5,5	MX pro 4V5,5	22	22 %	12 %	-
MX eco 4V7,5	MX pro 4V7,5	22	22 %	12 %	-
MX eco 4V11	MX pro 4V11	22	21 %	12 %	-
MX eco 4V15	MX pro 4V15	22	21 %	12 %	12 %
MX eco 4V18	MX pro 4V18	22	15 %	11 %	10 %
MX eco 4V22	MX pro 4V22	22	15 %	12 %	11 %
MX eco 4V30	MX pro 4V30	22	14 %	11 %	10 %
MX eco 4V37	MX pro 4V37	22	13 %	10 %	10 %
MX eco 4V45	MX pro 4V45	22	13 %	9 %	7 %
MX eco 4V55	MX pro 4V55	22	11 %	8 %	7 %
MX eco 4V75	MX pro 4V75	22	14 %	10 %	9 %
MX eco 4V90	-	35	19 %	9 %	9 %
MX eco 4V110	MX pro 4V90/110	35	20 %	9 %	9 %
MX eco 4V132	MX pro 4V110/132	35	16 %	9 %	8 %
MX eco 4V160	MX pro 4V132/160	50	20 %	9 %	8 %
MX eco 4V200	MX pro 4V160/200	50	19 %	9 %	10 %
MX eco 4V250	MX pro 4V200/250	50	20 %	9 %	9 %
MX eco 4V315	MX pro 4V250/315	50	18 %	9 %	8 %
MX eco 4V355	-	50	17 %	8 %	8 %
MX eco 4V400	MX pro 4V315/400	50	20 %	8 %	8 %
MX eco 4V500	MX pro 4V400/500	50	15 %	8 %	8 %
MX eco 4V630	MX pro 4V500/630	50	15 %	8 %	9 %

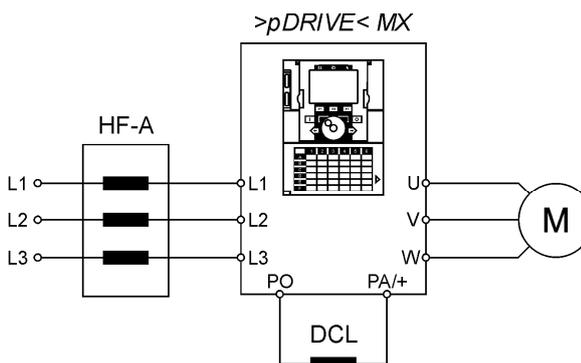


The stated values assume a maximum mains voltage distortion of 2 %.

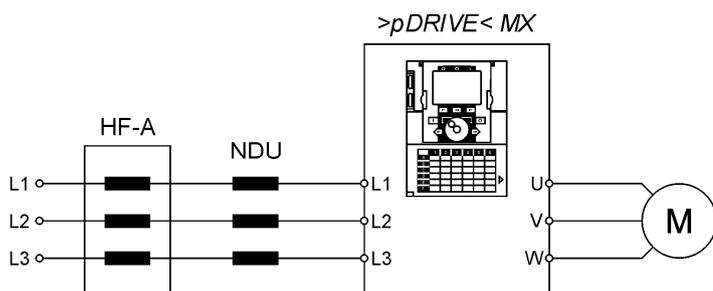
>pDRIVE< HF-A:



>pDRIVE< HF-A + >pDRIVE< DCL:



>pDRIVE< HF-A + >pDRIVE< NDU:



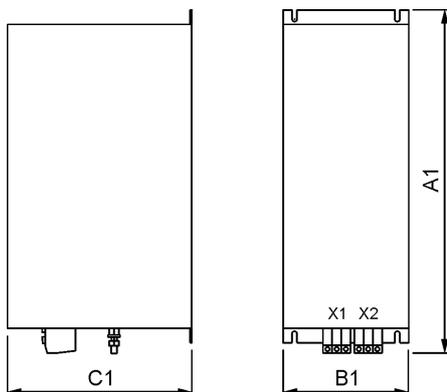
General technical data of option >pDRIVE< HF	
Operating voltage	for 3AC 380 V -15 % ... 415 V +10 %; for TT, TN mains
Mains frequency	50 Hz $\pm$ 5 %
Overload capability	150 % for 60 s per 10 min, 165 % for 2 s
Efficiency	98.5...99.5 %
cos $\varphi$	0.85 capacitive at 75 % $I_N$ 0.95 capacitive at 100 % $I_N$ 1.0 capacitive at 150 % $I_N$
Signal output	opens at "thermal overload"; 250 V AC, 10 A max.
Ambient temperature	+5...+40°C, up to 55°C with derating of 3 % per 1°C
Storage temperature	-25...+70°C
Altitude	1000 m, up to 4000 m with derating of 5 % per 1000 m
Humidity class	F without condensation (5...85% relative humidity ) according to 3K3
Pollution degree	2
Cooling	forced, by integrated fan
Protection degree	IP20
Approvals	CE, GOST

	Option >pDRIVE<						
	HF-A 4V7	HF-A 4V13	HF-A 4V18	HF-A 4V24	HF-A 4V30	HF-A 4V50	HF-A 4V70
Order number	8 P01 400	8 P01 401	8 P01 402	8 P01 403	8 P01 404	8 P01 405	8 P01 406
Nominal current	10 A	19 A	26 A	35 A	43 A	72 A	101 A
Losses (max.)	110 W	205 W	280 W	380 W	460 W	780 W	1090 W
Cooling air	200 m <sup>3</sup> /h						
Weight	19 kg	21 kg	22 kg	34 kg	38 kg	56 kg	69 kg
Dimension A1	453 mm	453 mm	453 mm	600 mm	600 mm	840 mm	840 mm
Dimension A2	-	-	-	698 mm	698 mm	938 mm	938 mm
Dimension B1	165 mm	165 mm	165 mm	302 mm	302 mm	302 mm	302 mm
Dimension C1	242 mm	242 mm	242 mm	220 mm	220 mm	220 mm	220 mm
Connection	16 mm <sup>2</sup>	16 mm <sup>2</sup>	16 mm <sup>2</sup>	50 mm <sup>2</sup>	50 mm <sup>2</sup>	50 mm <sup>2</sup>	50 mm <sup>2</sup>

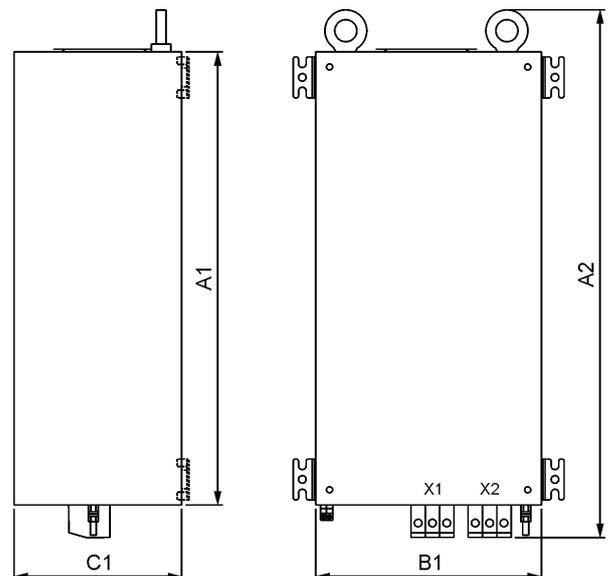
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>pDRIVE< HF-A 4V7...4V18



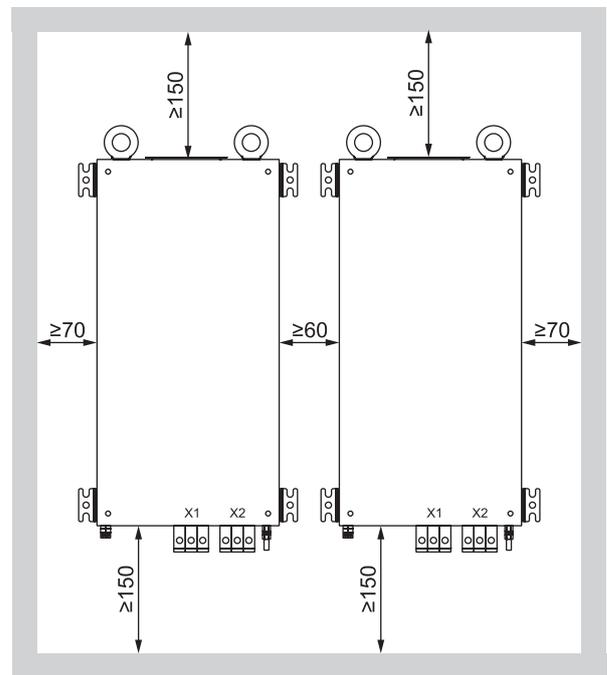
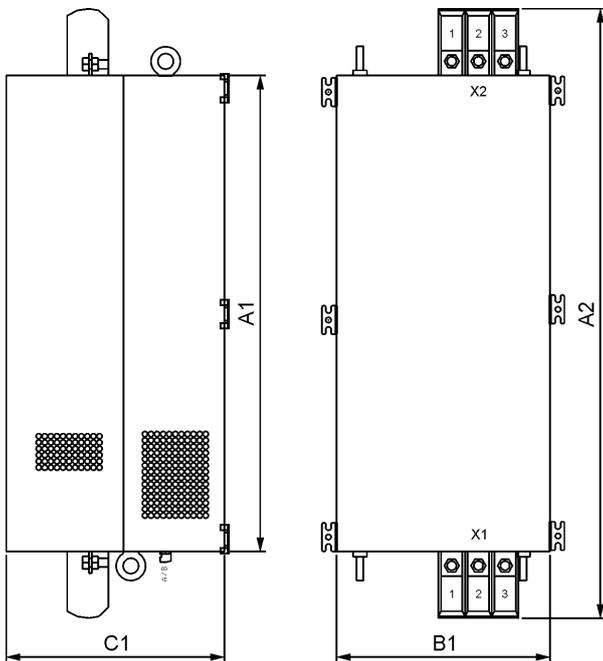
>pDRIVE< HF-A 4V24...4V100



	Option >pDRIVE<					
	HF-A 4V100	HF-A 4V125	HF-A 4V150	HF-A 4V200	HF-A 4V225	HF-A 4V255
Order number	8 P01 407	8 P01 408	8 P01 409	8 P01 410	8 P01 411	8 P01 412
Nominal current	144 A	180 A	217 A	289 A	325 A	370 A
Losses (max.)	1550 W	1940 W	2340 W	3120 W	3500 W	3950 W
Cooling air	200 m <sup>3</sup> /h	700 m <sup>3</sup> /h				
Weight	97 kg	103 kg	112 kg	135 kg	155 kg	180 kg
Dimension A1	840 mm	830 mm	830 mm	900 mm	900 mm	1070 mm
Dimension A2	938 mm	1046 mm	1046 mm	1152 mm	1152 mm	1322 mm
Dimension B1	302 mm	345 mm	345 mm	406 mm	406 mm	406 mm
Dimension C1	220 mm	390 mm	390 mm	409 mm	409 mm	409 mm
Connection	50 mm <sup>2</sup>	M12	M12	M16	M16	M16

>pDRIVE< HF-A 4V125...4V255

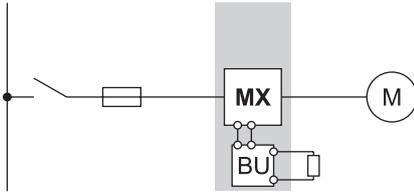
Required minimum distances



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## Braking unit BU



The use of the option  $\text{>pDRIVE< BU}$  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  $\text{>pDRIVE< MX pro}$ . 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  $\text{>pDRIVE< MX pro}$  from 4V200/250 and 6V200/250; smaller types of the  $\text{>pDRIVE< MX pro}$  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 must be integrated into the mains disconnection mechanism.

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If the braking function is activated, it acts as soon as the  $\text{>pDRIVE< MX pro}$  is in "Ready" or "Run" state, but not in case of "Trip".

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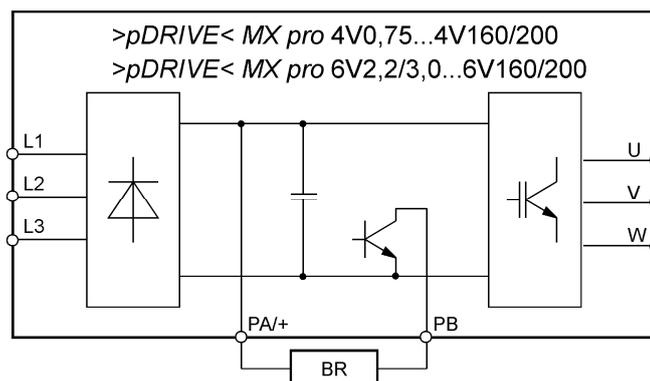
The braking unit requires the following connecting lines:

- 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

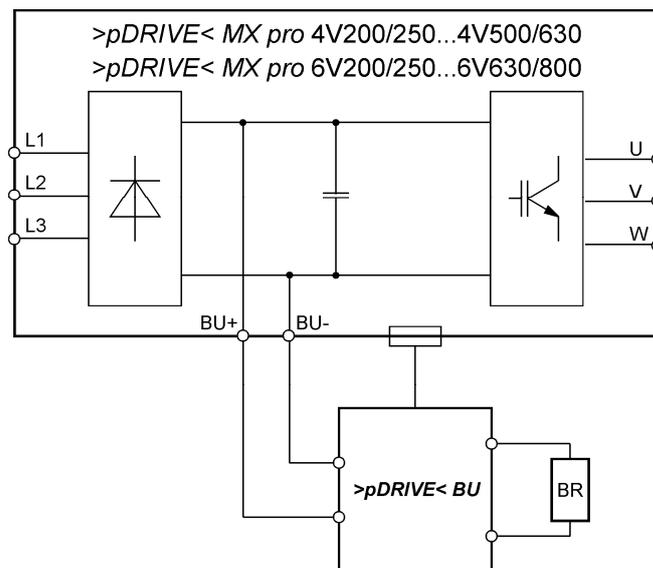


Ground the braking unit at the bolts marked with "PE" with at least 10 mm<sup>2</sup>.

The frequency inverters  $\text{>pDRIVE< MX pro 4V0,75...4V160/200}$  and  $\text{>pDRIVE< MX pro 6V2,2/3,0...6V160/200}$  have a built-in braking transistor. It is thus only necessary to connect an external braking resistor BR and to activate the braking function.



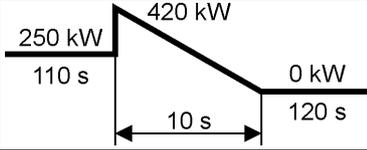
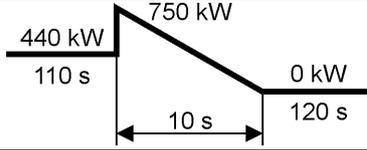
In case of the inverters >pDRIVE< MX pro 4V200/250...4V500/630 and >pDRIVE< MX pro 6V200/250...6V630/800 the braking unit is designed as an external option. It is supplied, controlled and monitored by the inverter as if it were integrated. An operation without an inverter or on a device other than the 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 at 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 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, UL, CSA, GOST

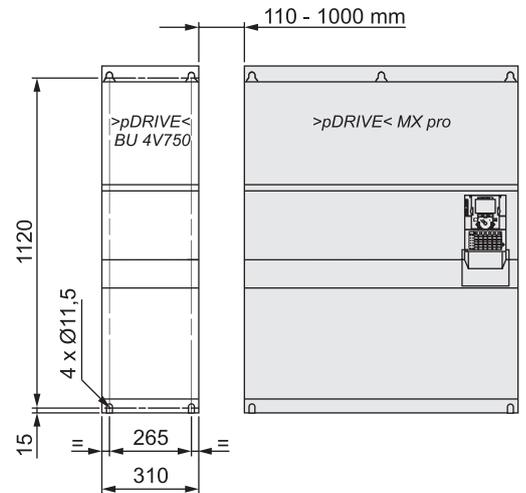
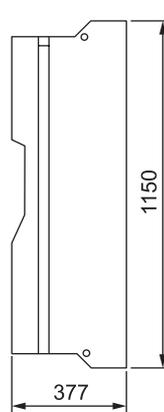
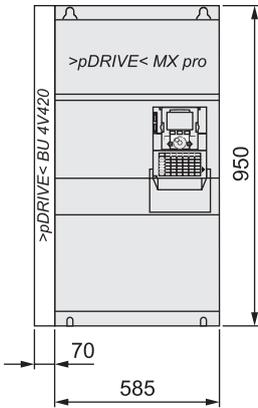
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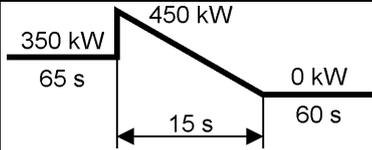
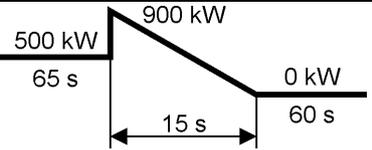
8 P01 002 EN.05/05

	>pDRIVE< BU 4V420	>pDRIVE< BU 4V750
Order number	8 P01 260	8 P01 261
Peak braking power	420 kW	750 kW
Max. continuous braking power	200 kW	400 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 <sub>N</sub>	550 W	1050 W
Volume of cooling air	100 m <sup>3</sup> /h	600 m <sup>3</sup> /h
Weight	30 kg	70 kg
Installation	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 DC connections.

>pDRIVE BU 4V420

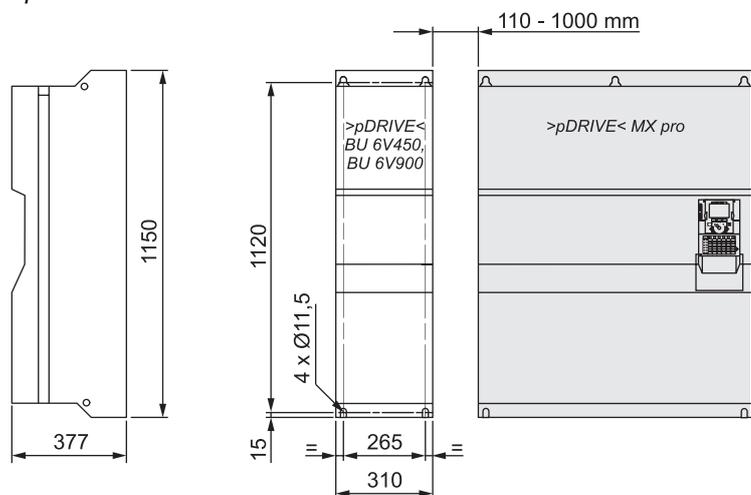
>pDRIVE< BU 4V750



	>pDRIVE< BU 6V450	>pDRIVE< BU 6V900
Order number	8 P01 278	8 P01 279
Peak braking power	450 kW	900 kW
Max. continuous braking power	300 kW	400 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 <sub>N</sub>	650 W	1500 W
Volume of cooling air	600 m <sup>3</sup> /h	600 m <sup>3</sup> /h
Weight	70 kg	70 kg
Installation	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.

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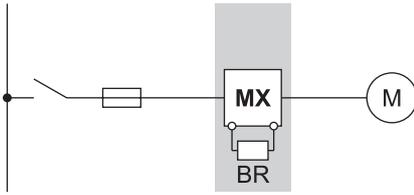
>pDRIVE< BU 6V450 and BU 6V900



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## 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:

- >pDRIVE< MX pro 4V0,75...4V160/200
- >pDRIVE< MX pro 6V2,2/3,0...6V160/200

An external braking unit >pDRIVE< BU is required for

- >pDRIVE< MX pro from 4V200/250
- >pDRIVE< MX pro from 6V200/250

When allocating the braking resistors >pDRIVE< BU 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

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The surface of the resistor may reach up to 250°C. Thus it should be mounted on non-combustible material.



The braking resistors BR 200R to BR 30R protect the inverter, the braking unit and the lines. In case of an overload, an internal shut-down takes place (as in case of a fuse). The braking resistor must be exchanged afterwards.



The braking resistors BR 200R to BR 30R are designed for air self-cooling at vertical mounting (or horizontal with cooling fins pointing upwards).



The unhindered air flow may not be impaired by other devices or casing parts!



Please use the planning information on page 111 ff or the allocation table for selection of the >pDRIVE< BR:

- MX pro 4V: page 130 ff
- MX pro 6V: page 183 ff

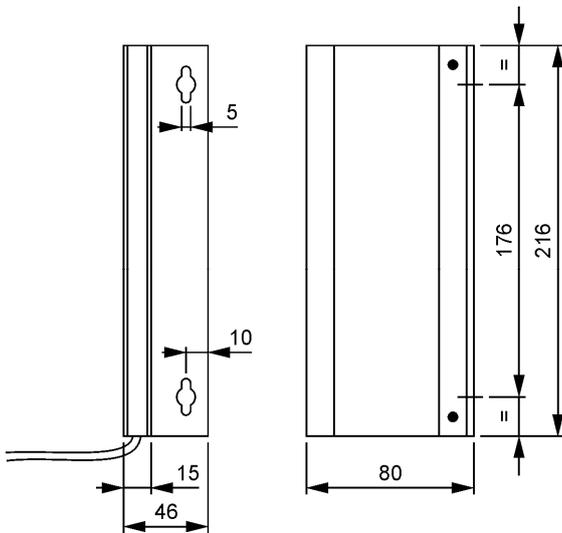
8 P01 002 EN.05/05

General technical data	
Operating voltage	max. 1100 V DC
Design	BR 200R, BR 120R, BR 50R, BR 30R: compact resistors (welded) BR 24R ... BR 2R1: Steel-grid fixed resistors in a sheet metal case
Approvals	CE, <sub>c</sub> UR <sub>US</sub> , GOST

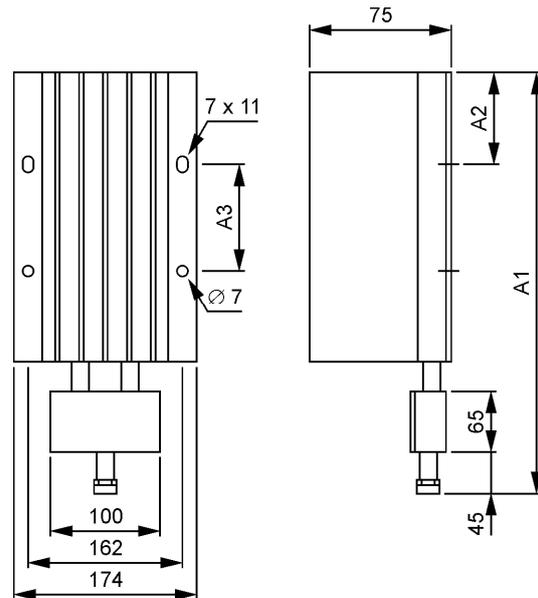
	Option >pDRIVE<			
	BR 200R *)	BR 120R	BR 50R	BR 30R
Order number	8 P01 262	8 P01 263	8 P01 264	8 P01 265
Resistance	200 Ω	120 Ω	50 Ω	30 Ω
Continuous power	0.25 kW	1.0 kW	1.5 kW	2.0 kW
Peak power @ 680 V DC	2.3 kW	3.9 kW	9.3 kW	15.4 kW
Peak power @ 785 V DC	3.1 kW	5.1 kW	12.3 kW	20.5 kW
Peak power @ 975 V DC	–	7.9 kW	19.0 kW	31.7 kW
Peak power @ 1075 V DC	–	9.6 kW	23.1 kW	38.5 kW
Duty cycle at 120 s cycle @680V / 785V / 975V / 1075V	6 / 5 / – / – %	18 / 13 / 8 / 6 %	10 / 7 / 5 / 4 %	8 / 6 / 4 / 3 %
Set value of thermal relay	1.1 A	2.9 A	5.5 A	8.2 A
Protection degree	IP65	IP66	IP66	IP66
Dimension A1	–	260 mm	410 mm	610 mm
Dimension A2	–	28 mm	78 mm	178 mm
Dimension A3	–	110 mm	160 mm	160 mm
Connection cross-section	1.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>
Connection	Cable 1.5 mm <sup>2</sup> Length: 500 mm	Terminal max. 2.5 mm <sup>2</sup>	Terminal max. 2.5 mm <sup>2</sup>	Terminal max. 2.5 mm <sup>2</sup>
Weight	0.6 kg	3.0 kg	5.5 kg	9.0 kg

\*) only for MX pro 4V

>pDRIVE< BR 200R



>pDRIVE< BR 120R ... 30R



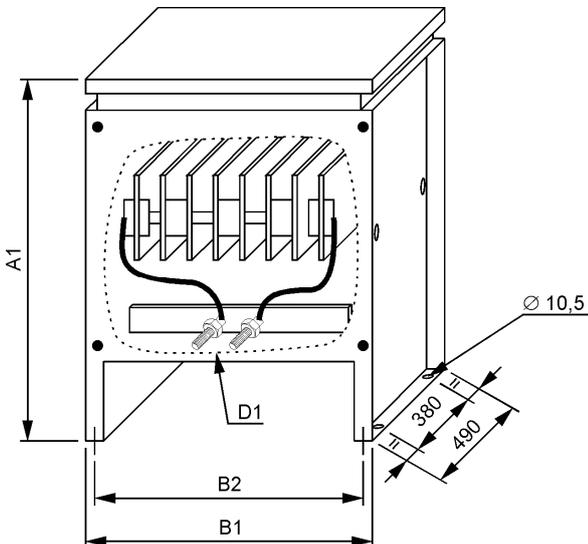
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	Option >pDRIVE<			
	BR 15R	BR 12R	BR 10R	BR 8R
Order number	8 P01 266	8 P01 267	8 P01 268	8 P01 269
Resistance	15 Ω	12 Ω	10 Ω	8 Ω
Continuous power	8.5 kW	4.0 kW	14 kW	7.0 kW
Peak power @ 680 V DC	31 kW	39 kW	46 kW	58 kW
Peak power @ 785 V DC	41 kW	51 kW	62 kW	77 kW
Peak power @ 975 V DC	63 kW	79 kW	95 kW	119 kW
Peak power @ 1075 V DC	77 kW	96 kW	116 kW	144 kW
Duty cycle at 120 s cycle @680V / 785V / 975V / 1075V	19 / 14 / 8 / 6 %	6 / 4 / 3 / 2 %	22 / 15 / 9 / 7 %	7 / 5 / 3 / 3 %
Set value of thermal relay	24 A	18 A	37 A	30 A
Protection degree	IP23	IP23	IP23	IP23
Dimension A1	520 mm	520 mm	520 mm	520 mm
Dimension B1	595 mm	395 mm	795 mm	395 mm
Dimension B2	570 mm	370 mm	770 mm	370 mm
Connection cross-section	6 mm <sup>2</sup>	4 mm <sup>2</sup>	16 mm <sup>2</sup>	6 mm <sup>2</sup>
Connection D1	M8	M6	M8	M6
Weight	32 kg	23 kg	48 kg	26 kg

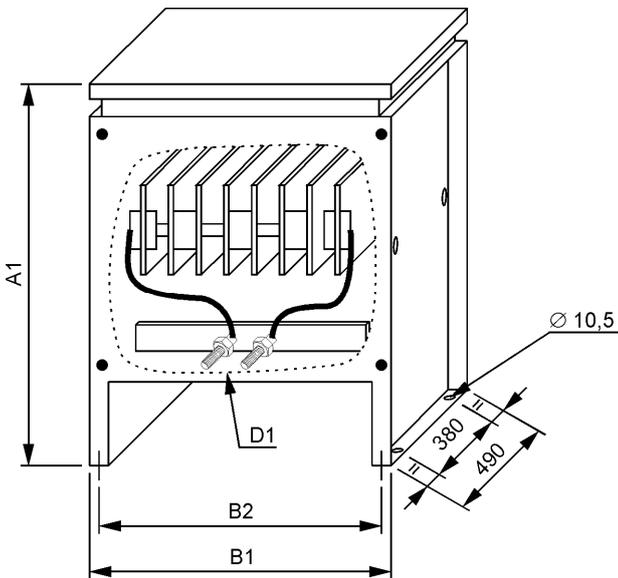
	Option >pDRIVE<			
	BR 6R	BR 3R5	BR 3R3	BR 2R1
Order number	8 P01 270	8 P01 271	8 P01 272	8 P01 273
Resistance	15 Ω	12 Ω	10 Ω	8 Ω
Continuous power	8.5 kW	4.0 kW	14 kW	7.0 kW
Peak power @ 680 V DC	31 kW	39 kW	46 kW	58 kW
Peak power @ 785 V DC	41 kW	51 kW	62 kW	77 kW
Peak power @ 975 V DC	63 kW	79 kW	95 kW	119 kW
Peak power @ 1075 V DC	77 kW	96 kW	116 kW	144 kW
Duty cycle at 120 s cycle @680V / 785V / 975V / 1075V	19 / 14 / 8 / 6 %	6 / 4 / 3 / 2 %	22 / 15 / 9 / 7 %	7 / 5 / 3 / 3 %
Set value of thermal relay	24 A	18 A	37 A	30 A
Protection degree	IP23	IP23	IP23	IP23
Dimension A1	520 mm	520 mm	770 mm	1100 mm
Dimension B1	995 mm	995 mm	995 mm	995 mm
Dimension B2	970 mm	970 mm	970 mm	970 mm
Connection cross-section	16 mm <sup>2</sup>	16 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>
Connection D1	M8	M8	M10	M10
Weight	61 kg	61 kg	101 kg	138 kg

## &gt;pDRIVE&lt; BR 15R...2R1



	Option >pDRIVE<			
	BR 24R	BR 22R	BR 4R2	BR 4R
Order number	8 P01 274	8 P01 275	8 P01 276	8 P01 277
Resistance	24 Ω	22 Ω	4.2 Ω	4.0 Ω
Continuous power	12 kW	7.0 kW	66 kW	34 kW
Peak power @ 680 V DC	19 kW	21 kW	110 kW	116 kW
Peak power @ 785 V DC	26 kW	28 kW	147 kW	154 kW
Peak power @ 975 V DC	40 kW	43 kW	226 kW	238 kW
Peak power @ 1075 V DC	48 kW	53 kW	275 kW	289 kW
Duty cycle at 120 s cycle @680V / 785V / 975V / 1075V	55 / 38 / 22 / 17 %	25 / 17 / 10 / 8 %	52 / 36 / 21 / 16 %	21 / 15 / 9 / 7 %
Set value of thermal relay	48 A	30 A	177 A	90 A
Protection degree	IP23	IP23	IP23	IP23
Dimension A1	520 mm	520 mm	1100 mm	770 mm
Dimension B1	595 mm	395 mm	995 mm	795 mm
Dimension B2	570 mm	370 mm	970 mm	770 mm
Connection cross-section	16 mm <sup>2</sup>	6 mm <sup>2</sup>	95 mm <sup>2</sup>	35 mm <sup>2</sup>
Connection	M6	M6	M10	M10
Weight	36 kg	26 kg	138 kg	86 kg

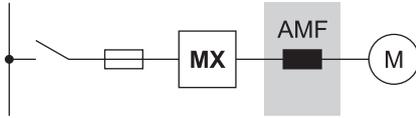
>pDRIVE< BR 24R...4R



## Output motor filter AMF

At the output of a voltage source frequency inverter there is a pulsed voltage with a pulse frequency of 2...16 kHz (MX pro 6V: 2...6 kHz) and a slew rate of more than 10 kV/μs.

The use of the option *>pDRIVE< 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 *>pDRIVE< AMF* suitable for the chosen inverter:



- MX eco 4V: page 73 ff
- MX pro 4V: page 130 ff
- MX pro 6V: page 183 ff

Additionally observe the information of the respective inverter range to guarantee trouble-free operation:



- MX eco 4V: page 62
- MX pro 4V: page 118
- MX pro 6V: page 171

The option *>pDRIVE< AMF* is connected at the output side of the inverter into the connection to the motor.

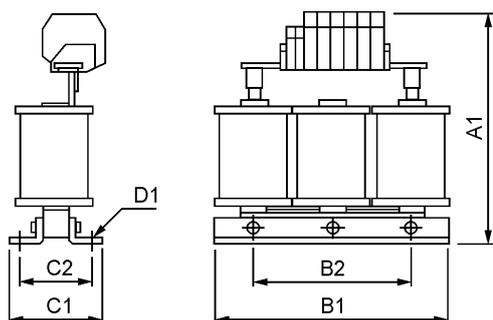
The filters *>pDRIVE< AMF* 215-3 up to 1190-3 have to be installed vertically to ensure sufficient cooling. Furthermore observe the required distance to other devices and case parts.

	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

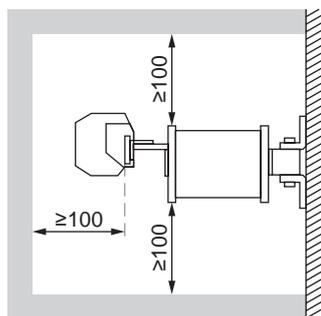
The >pDRIVE< AMF 12-1...90-1 have a built-in temperature sensor (thermoclick opens at temperatures > 125°C). This sensor has to be integrated to the trip message circuit of the whole drive or to the inverter (e.g. digital input for "External fault").

	Option >pDRIVE<		
	AMF 12-1	AMF 48-1	AMF 90-1
Order number	8 P01 140	8 P01 141	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 mm <sup>2</sup>	Terminal max. 16 mm <sup>2</sup>	M8
Connection PE	Terminal max. 10 mm <sup>2</sup>	Terminal max. 16 mm <sup>2</sup>	M8

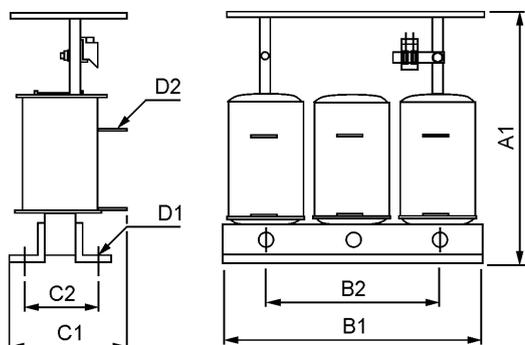
>pDRIVE< AMF 12-1 and AMF 48-1



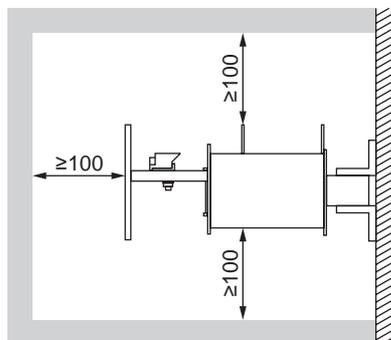
Required minimum distances



>pDRIVE< AMF 90-1



Required minimum distances



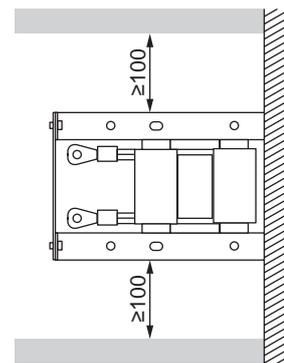
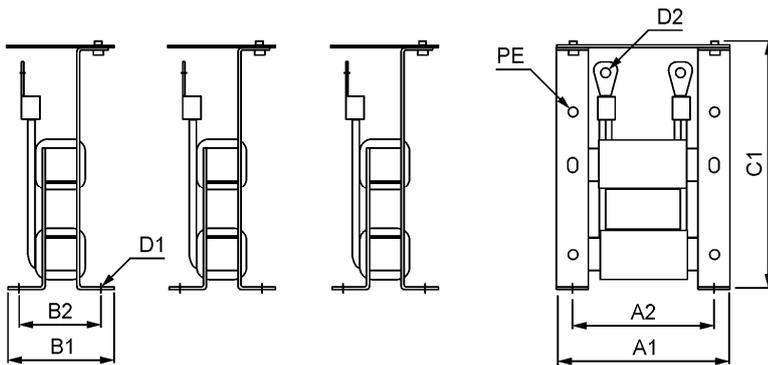
For better effect and cooling the >pDRIVE< AMF 215-3...1190-3 consist of 3 single-phase chokes. Each has to be connected with one motor phase.

	Option >pDRIVE<				
	AMF 215-3	AMF 320-3	AMF 480-3	AMF 760-3	AMF 1190-3
Order number	8 P01 143	8 P01 144	8 P01 145	8 P01 146	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

>pDRIVE< AMF 215-3 and AMF 320-3

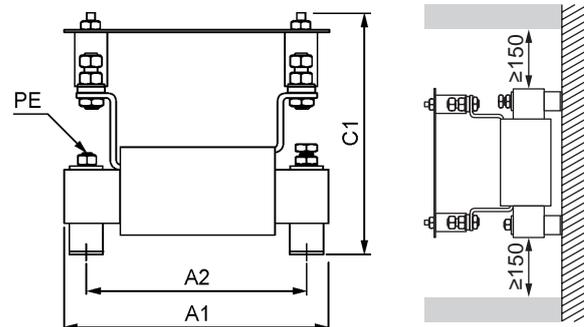
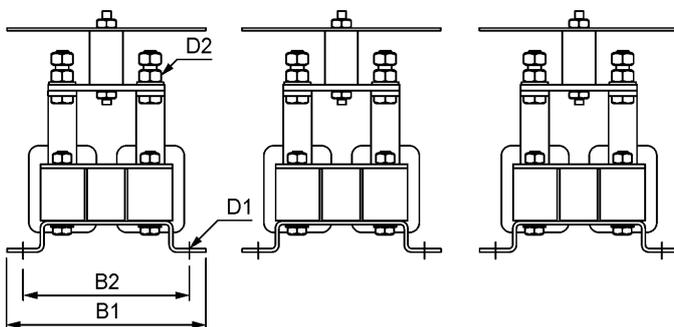
Required minimum distances

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>pDRIVE< AMF 480-3, AMF 760-3 and AMF 1190-3

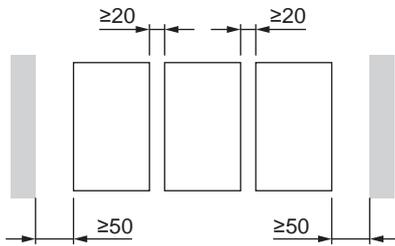
Required min. distances



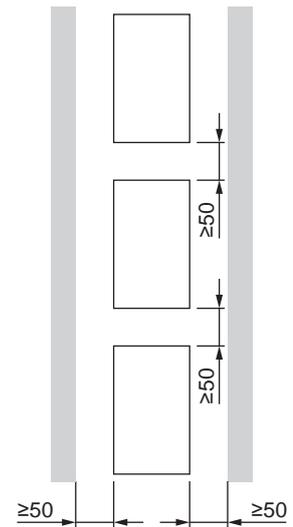
The filters AMF 215-3...1190-3 consist of 3 single-phase chokes.

During installation observe the free space above and below as well as the required minimum distance between the three components.

*Arrangement side by side*



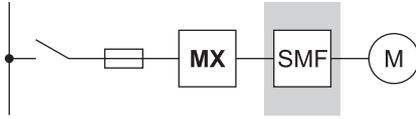
*Arrangement on top of each other*



## Sinus motor filter SMF

The use of the option *>pDRIVE< SMF* is recommended:

- in case of *>pDRIVE< MX eco & pro* standard drives in order to arise nearly sinusoidal motor voltage. Therefore, additional noises at the motor are totally prevented.
- for *>pDRIVE< MX eco & pro* standard drives in the power range  $\leq 75$  kW to observe the EMC directive in case of unshielded motor cables.
- as alternative to the option *>pDRIVE< AMF* in case of long motor cables
- for *>pDRIVE< MX pro ...-MV* inverters and step-up transformers for medium voltage motors up to 6 kV.



The option *>pDRIVE< 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 *>pDRIVE< SMF* is absolutely necessary.

For standard drives the use of the option *>pDRIVE< 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 *>pDRIVE< 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 *>pDRIVE< SMF* suitable for the chosen inverter.



- MX eco 4V: page 73 ff
- MX pro 4V: page 130 ff
- MX pro 6V: page 183 ff

The allowed lengths of motor cables are given in the tables on the following pages:



- MX eco 4V: page 62
- MX pro 4V: page 118
- MX pro 6V: page 171

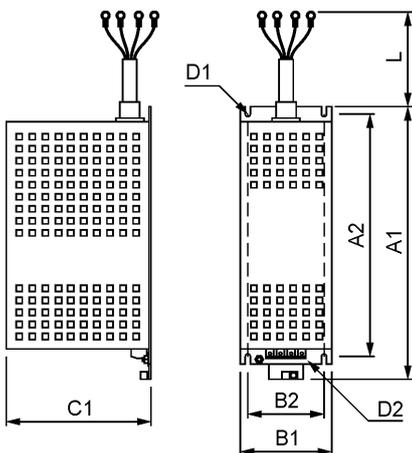
General technical data	
Operating voltage	MX eco & pro 4V: 3AC 0...480 V MX pro 6V: 3AC 0...690 V
Operating frequency	0...100 Hz
Pulse frequency	>pDRIVE< MX eco & pro: 4 kHz (corresponding setting at the inverter necessary) >pDRIVE< MX pro ...-MV: 3 kHz (400 V), 2.5 kHz (690 V)
Overload capability	150 % 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

	Option >pDRIVE<					
	SMF 480/11	SMF 480/16	SMF 480/33	SMF 480/66	SMF 480/95	SMF 480/180
Order number	8 P01 148	8 P01 149	8 P01 150	8 P01 151	8 P01 152	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 mm <sup>2</sup>	Terminal 6 mm <sup>2</sup>	Terminal 10 mm <sup>2</sup>	Terminal 25 mm <sup>2</sup>	Terminal 50 mm <sup>2</sup>	Terminal 150 mm <sup>2</sup>

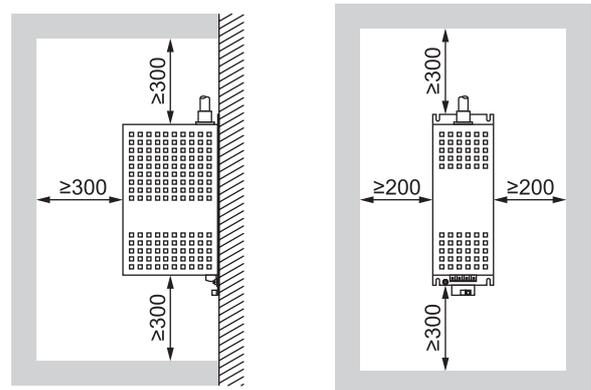
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>pDRIVE< SMF 480/11 to 480/180



Required minimum distances



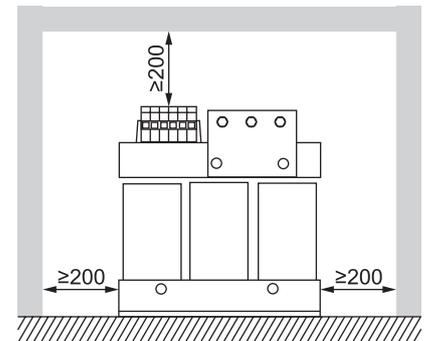
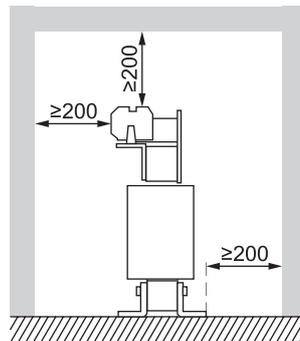
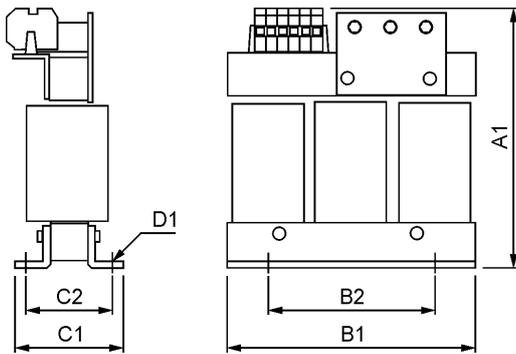
	Option >pDRIVE<				
	SMF 480/200	SMF 480/300	SMF 480/400	SMF 480/600	SMF 480/1200
Order number	8 P01 154	8 P01 155	8 P01 156	8 P01 157	8 P01 158
Nominal current @50°C	200 A	300 A	400 A	600 A	1200 A
Protection degree	IP00				
Losses	945 W	1360 W	1900 W	2370 W	5150 W
Weight	130 kg	165 kg	190 kg	235 kg	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 mm <sup>2</sup>	∅ 11 mm	∅ 11 mm	∅ 11 mm	4 x ∅ 11 mm

>pDRIVE< SMF 480/200

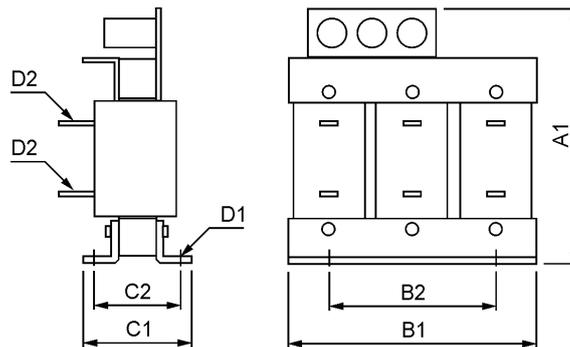
Required minimum distances

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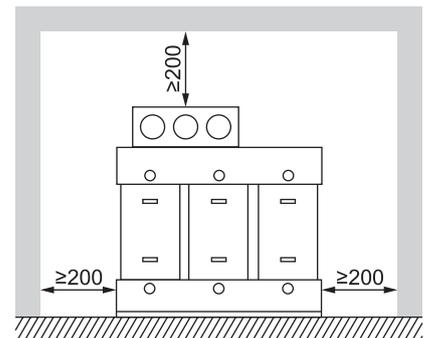
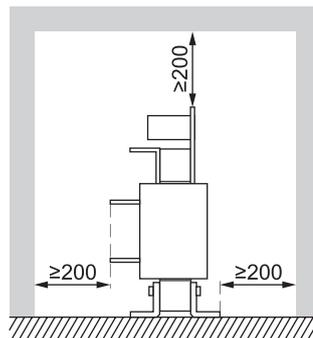
8 P01 002 EN.05/05



>pDRIVE< SMF 480/300 to 480/1200

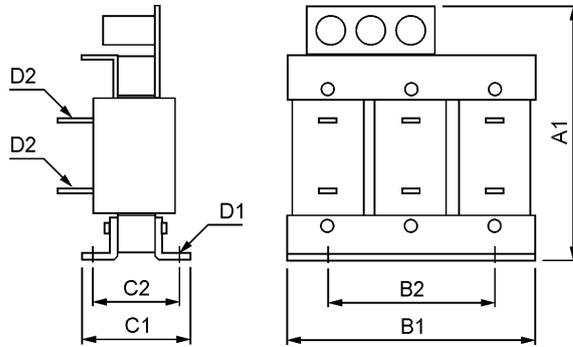


Required minimum distances

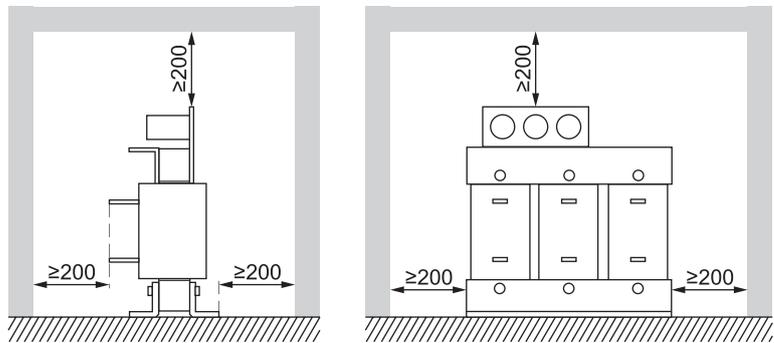


	Option >pDRIVE<		
	SMF 6V240	SMF 6V460	SMF 6V900
Order number	8 P01 497	8 P01 498	8 P01 499
Nominal current @50°C	240 A	460 A	900 A
Protection degree	IP00		
Losses	1500 W	2800 W	4810 W
Weight	210 kg	300 kg	400 kg
Dimension A1	700 mm	870 mm	1150 mm
Dimension B1	420 mm	480 mm	600 mm
Dimension B2	370 mm	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

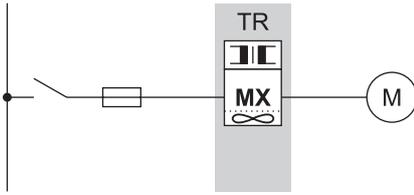
>pDRIVE< SMF 6V240...6V900



Required minimum distances



## Transformer TRAF0-BOX



The option transformer box *>pDRIVE< TRAF0-BOX* is required to supply the internal blower(s) if there is no 3 AC 400...480 V auxiliary voltage available.



This option is required for *>pDRIVE< 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.

The *>pDRIVE< TRAF0-BOX* is an option for *>pDRIVE< MX pro 6V90/110* and higher which has to be installed at the top of the inverter. It has to be connected to the plug X2 with the inverter. The *>pDRIVE< TRAF0-BOX* needs the air flow of the inverter for cooling but simultaneously it increases the protection degree of the top of the drive to IP31. The cooling air channel in the *>pDRIVE< TRAF0-BOX* and the inverter is designed in protection degree IP54.



Please use the allocation table on page 183 ff for selection of the option *>pDRIVE< TRAF0-BOX* suitable for the chosen inverter.

HUSI

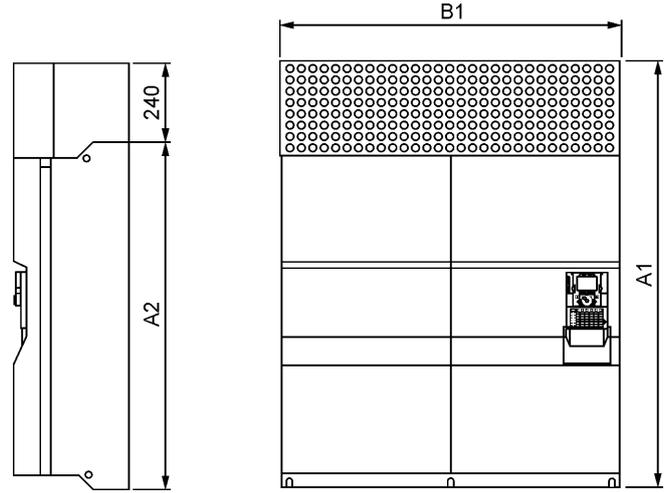
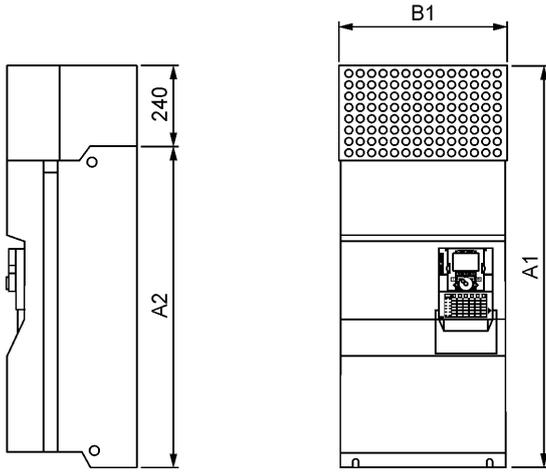
8 P01 002 EN.05/05

	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	

	Option >pDRIVE< TRAFO-BOX		
	330	585	1100
Order number	8 P01 480	8 P01 481	8 P01 482
Power	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 Ø 11.5 mm	4x Ø 11.5 mm	8x Ø 11.5 mm

>pDRIVE< TRAFO-BOX 330 and 585

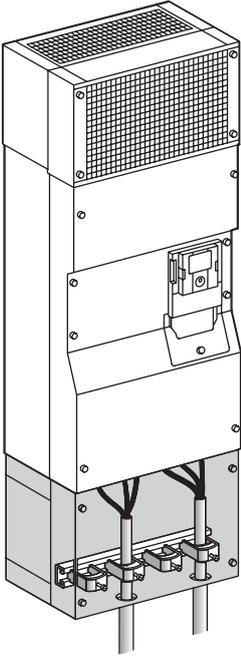
>pDRIVE< TRAFO-BOX 1100



HUSI

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## Terminal box TER-BOX



The terminal box option >pDRIVE< 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 >pDRIVE< 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.

HUSI

Please use the allocation table for selection of the option >pDRIVE< TER-BOX suitable for the chosen inverter.



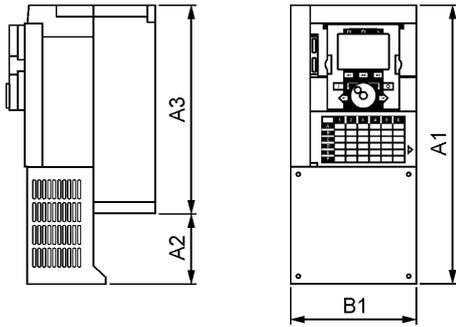
- MX eco 4V: page 73 ff
- MX pro 4V: page 130 ff
- MX pro 6V: page 183 ff

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	General technical data	
<b>Design</b>	Connection box made of galvanised, well-conductive sheet steel	
<b>Protection degree</b>	TER-BOX 130 ... 320:	IP21
	TER-BOX 310 ... 1100:	IP31 (IP54 for air channel)
<b>Cable entry</b>	TER-BOX 130 ... 320:	cable glands
	TER-BOX 310 ... 1100:	rubber seal, fixing of the cables inside by means of cable clamps
<b>Air inflow for cooling air of control part</b>	TER-BOX 130 ... 320:	sideways, (50 mm distance sideways necessary)
	TER-BOX 310 ... 1100:	front (no distance sideways necessary)
<b>Air inflow for cooling air of power part</b>	TER-BOX 130 ... 320:	behind the terminal box
	TER-BOX 310 ... 1100:	through the air channel of the terminal box

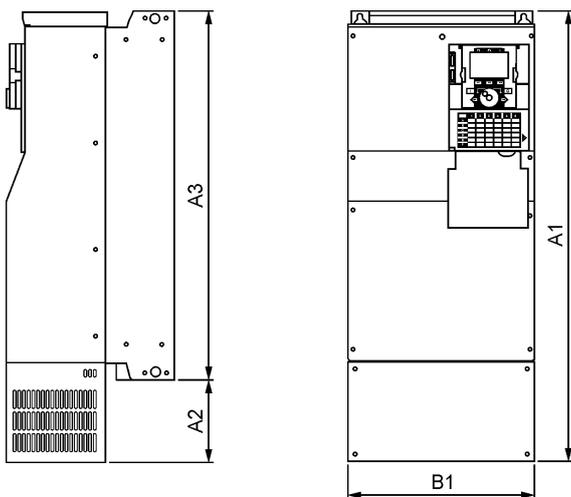
	Option >pDRIVE<				
	TER-BOX 130	TER-BOX 155	TER-BOX 175	TER-BOX 210	TER-BOX 230
Order number	8 P01 240	8 P01 241	8 P01 242	8 P01 243	8 P01 244
Weight	1.3 kg	1.5 kg	1.8 kg	2 kg	2.8 kg
Dimension A1	345 mm	365 mm	410 mm	410 mm	510 mm
Dimension A2	115 mm	105 mm	115 mm	115 mm	110 mm
Dimension A3	230 mm	260 mm	295 mm	295 mm	400 mm
Dimension B1	130 mm	155 mm	175 mm	210 mm	230 mm

>pDRIVE< TER-BOX 130...230



	Option >pDRIVE<		
	TER-BOX 240	TER-BOX 241	TER-BOX 320
Order number	8 P01 245	8 P01 246	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

>pDRIVE< TER-BOX 240, 241 and 320



The options >pDRIVE< 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. Therefore, a minimum distance sideways of 300 mm is necessary.

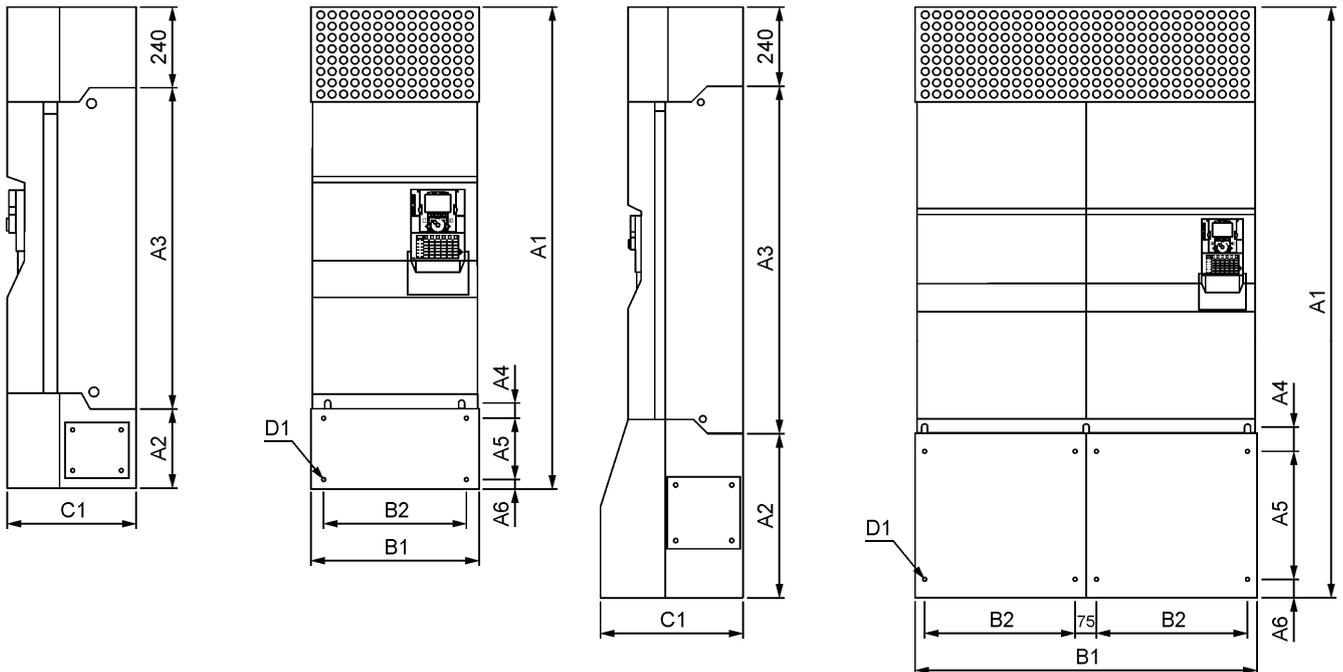
	Option >pDRIVE<			
	TER-BOX 310	TER-BOX 350	TER-BOX 330	TER-BOX 430
Order number	8 P01 248	8 P01 249	8 P01 250	8 P01 251
Weight	10 kg	12 kg	12 kg	15 kg
Dimension A1 *)	1140 mm	1322 mm	1505 mm	1565 mm
Dimension A2	220 mm	300 mm	315 mm	375 mm
Dimension A3	680 mm	782 mm	950 mm	950 mm
Dimension A4	75 mm	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 Ø 11.5 mm	4 x Ø 11.5 mm	4 x Ø 11.5 mm	4 x Ø 11.5 mm

	Option >pDRIVE<		
	TER-BOX 585	TER-BOX 880	TER-BOX 1100
Order number	8 P01 252	8 P01 253	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 Ø 11.5 mm	4 x Ø 11.5 mm	8 x Ø 11.5 mm

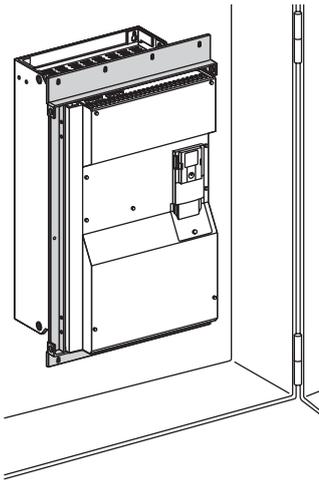
\*) Dimension A1 is the total height of the device including option >pDRIVE< DCL-BOX or >pDRIVE< TRAFO-BOX.

>pDRIVE< TER-BOX 310...880

>pDRIVE< TER-BOX 1100



## 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 cooling unit

In case of *>pDRIVE< MX eco & pro* inverters from 90 kW the DC chokes or fan transformer 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.

Please use the allocation table for selection of the option *>pDRIVE< FLANGE* suitable for the chosen inverter.

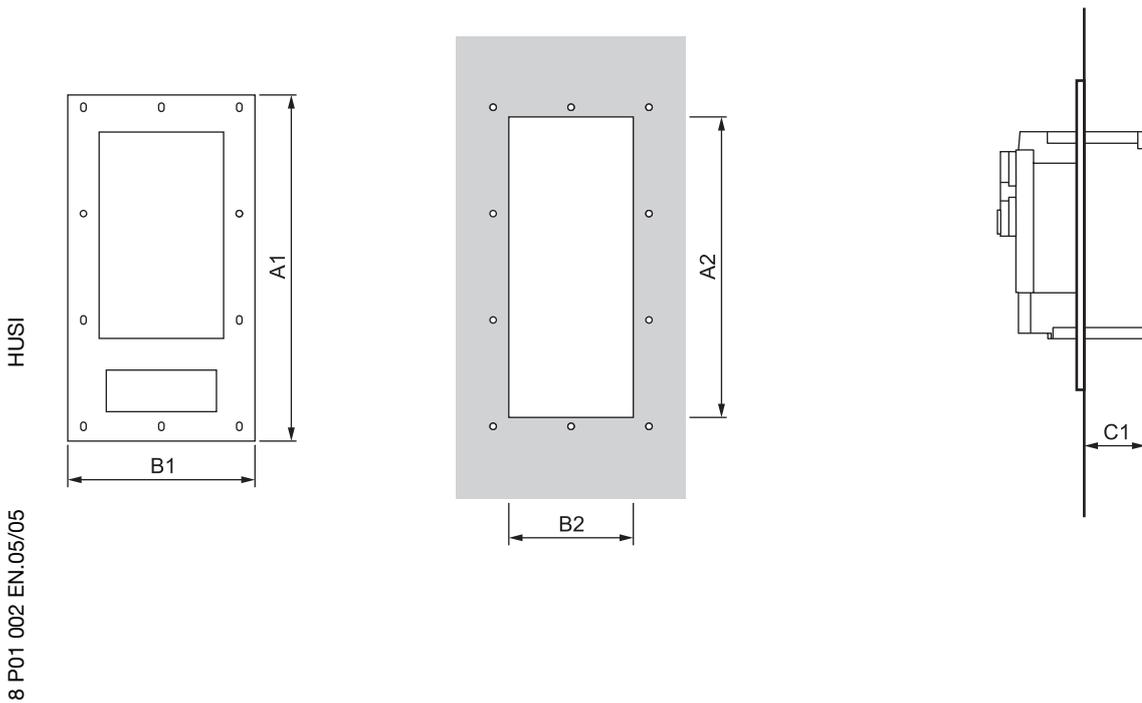


- MX eco 4V: page 73 ff
- MX pro 4V: page 130 ff
- MX pro 6V: page 183 ff

	General technical data
Design	Flange mounting kit made of compact sheet steel and glued gaskets
Protection degree outside	IP54
Protection degree inside	IP20 / IP00

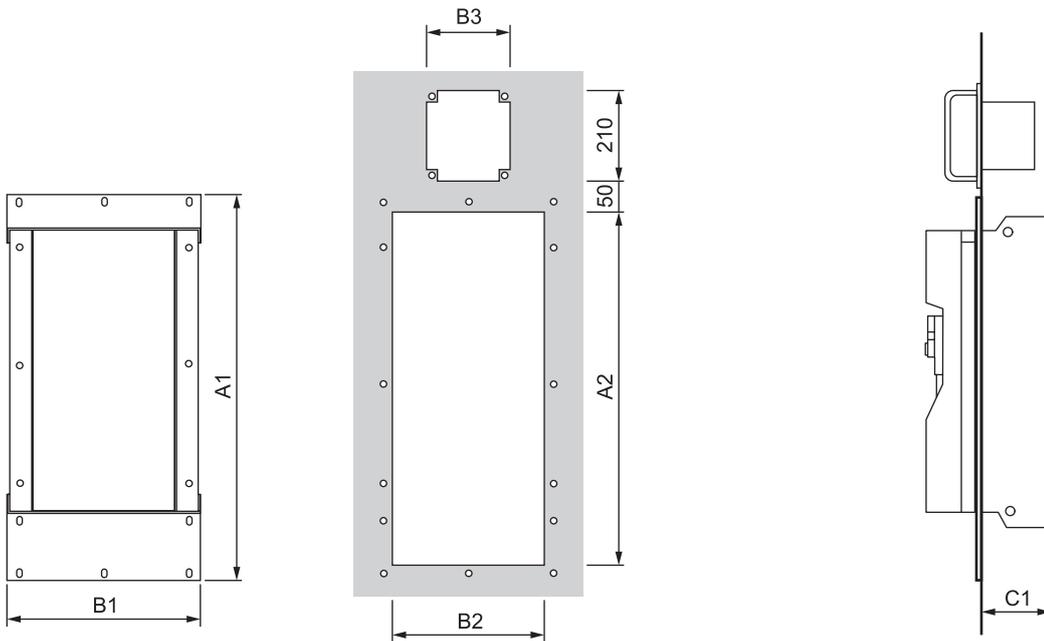
	Option >pDRIVE< FLANGE							
	130x230	155x260	175x295	210x295	230x400	240x420	240x550	320x630
Order number	8 P01 180	8 P01 181	8 P01 182	8 P01 183	8 P01 184	8 P01 185	8 P01 186	8 P01 187
Weight	2.7 kg	3.1 kg	3.7 kg	4.6 kg	4.9 kg	3.9 kg	4.2 kg	4.9 kg
Dimension A1	397 mm	430 mm	465 mm	482 mm	585 mm	650 mm	768 mm	838 mm
Dimension A2	350 mm	385 mm	420 mm	440 mm	540 mm	600 mm	720 mm	790 mm
Dimension B1	222 mm	250 mm	267 mm	302 mm	325 mm	340 mm	340 mm	420 mm
Dimension B2	170 mm	198 mm	215 mm	250 mm	270 mm	280 mm	280 mm	360 mm
Dimension C1	60 mm	70 mm	70 mm	90 mm	90 mm	105 mm	105 mm	105 mm

>pDRIVE< FLANGE 130x230...320x630



	Option >pDRIVE< FLANGE					
	310x680	350x780	330x950	430x950	585x950	660x950
Order number	8 P01 188	8 P01 189	8 P01 190	8 P01 191	8 P01 192	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

>pDRIVE< FLANGE 310x680...660x950

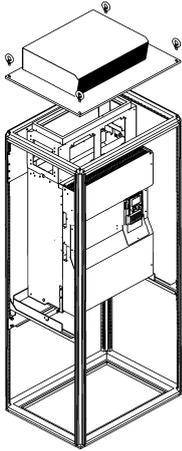


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 The number and dimensions of the necessary fixing threads are given in the mounting instructions. It also contains extensive information about dimensioning of the cubicle surface, filter fans or cooling unit.

 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 >pDRIVE< CMK is used for an optimal mounting of the frequency inverter in a Rittal TS8 cubicle. This option is suitable for >pDRIVE< MX eco & pro 4V from 90 kW.

There are three different types available:

- IP23 prepared for line reactor >pDRIVE< NDU or DC choke >pDRIVE< DCL-BOX
- IP54 with filter fan
- IP54 with separated air flow

>pDRIVE< 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

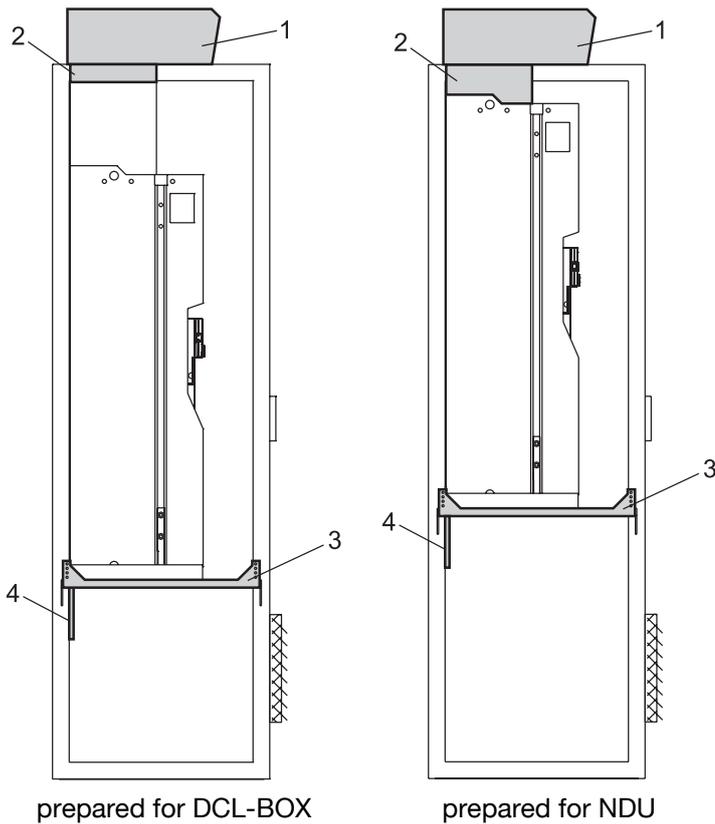
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The cubicle dimensions mentioned above must be observed in order to guarantee the fitting accuracy of the cubicle mounting kit.

Option >pDRIVE< CMK-IP23



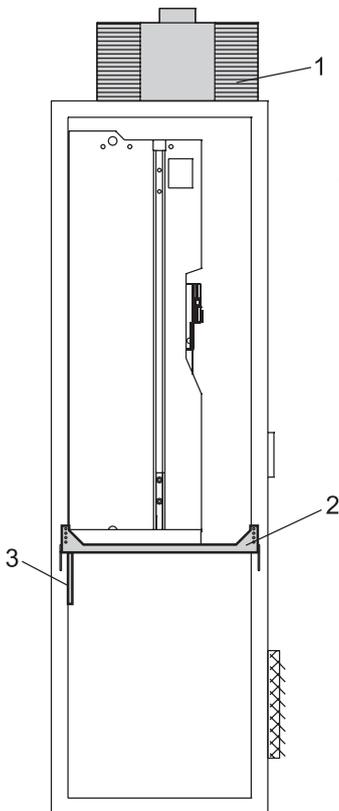
This mounting kit allows the built-in of the frequency inverter in Rittal TS8 cubicles according to protection degree IP23. In this case the input of the cooling air takes place by the cubicle door and the output through the top of the cubicle. The internal fan of the frequency inverter makes sure that 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 >pDRIVE< CMK-IP54FL



In case of protection degree IP54 with filter fans the cooling air inlet takes place through the filter in the cubicle door and the air outlet through the fan at the top of the cubicle. This type of the cubicle mounting kit requires the line reactor >pDRIVE< NDU!

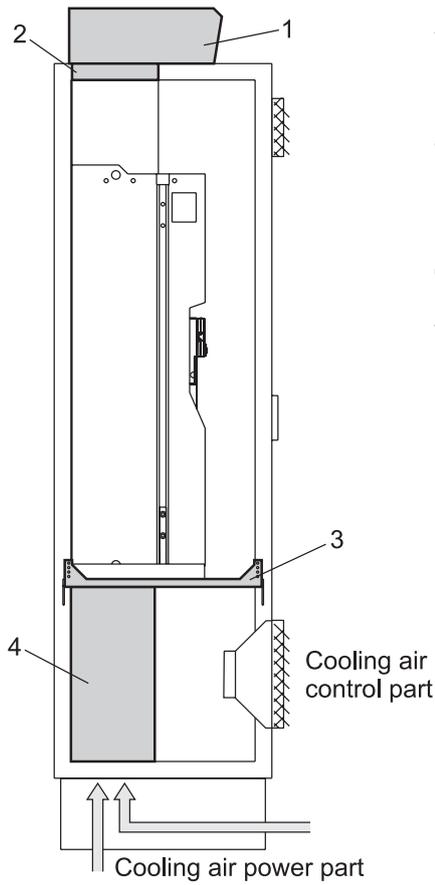
This kit contains the following parts:

- 1. Filter fan
- 2. Support with guide track
- 3. Bracket
- + Fixing material

Specification of the filter fan:

- Volume of air flow: 1200 m<sup>3</sup>/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

Option >pDRIVE< 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 DC choke >pDRIVE< DCL-BOX!

This kit contains the following parts:

1. Cover hood
  2. Air guide
  3. Support with guide track
  4. Air channel
- + Fixing material

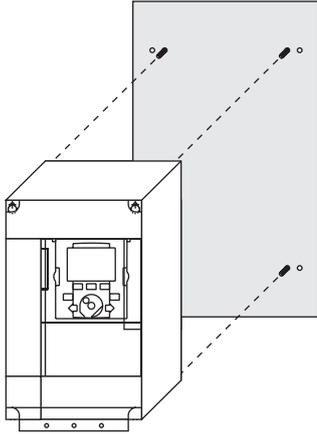
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The information about the losses, the dimensioning of the fans (necessary volume of cooling air) and the dimensions of the air inlet and outlet will be found in the mounting instructions of the respective inverter.

## Replacement kit RMK



By using the option *>pDRIVE< RMK existing >pDRIVE< MX basic & plus* devices can be replaced by the new product line *>pDRIVE< MX eco & pro* without anew drilling.

Following devices can be replaced easily with this option:

- *>pDRIVE< MX basic 15/18...55/75* in 400 V design
- *>pDRIVE< MX plus 04...55/75* in 400 V design
- *>pDRIVE< MX plus 04...22/30* in 500 V design

### Allocation table

Old existing device	Recommended replacement device	Combinable choke	Replacement kit	RMK order number
<b>400 V mains voltage</b>				
MX plus 04	MX eco/pro 4V4,0	Existing FDR	RMK BG-A/4,0	8 P01 470
MX plus 05	MX eco/pro 4V5,5	Existing FDR	RMK BG-A/5,5	8 P01 471
MX plus 07	MX eco/pro 4V7,5	Existing FDR	RMK BG-B/7,5	8 P01 472
MX plus 11	MX eco/pro 4V11	Existing FDR	RMK BG-B/11	8 P01 473
MX basic/plus 15/18	MX eco/pro 4V15	NDU 40 or DCL 44	RMK BG-1/15-22 +6V	8 P01 475
MX basic/plus 18/22	MX eco/pro 4V18	NDU 40 or DCL 44	RMK BG-1/15-22 +6V	8 P01 475
MX basic/plus 22/30	MX eco/pro 4V22	NDU 70 or DCL 85	RMK BG-1/15-22 +6V	8 P01 475
MX basic/plus 30/37	MX eco/pro 4V30	NDU 70 or DCL 85	RMK BG-1/30-37	8 P01 476
	MX eco/pro 4V37	NDU 100 or DCL 85	RMK BG-1/30-37	8 P01 476
MX basic/plus 37/45	MX eco/pro 4V45	NDU 100	RMK BG-2/45	8 P01 477
MX basic/plus 45/55	MX eco/pro 4V55	NDU 160	RMK BG-2/55-75	8 P01 478
MX basic/plus 55/75	MX eco/pro 4V75	NDU 160	RMK BG-2/55-75	8 P01 478
<b>500 V mains voltage</b>				
MX plus 04	MX pro 6V4.0/5.5	Existing FDR	RMK BG-A,B/6V	8 P01 474
MX plus 05	MX pro 6V5.5/7.5	Existing FDR	RMK BG-A,B/6V	8 P01 474
MX plus 07	MX pro 6V7.5/11	Existing FDR	RMK BG-A,B/6V	8 P01 474
MX plus 11	MX pro 6V11/15	Existing FDR	RMK BG-A,B/6V	8 P01 474
MX basic/plus 15/18	MX pro 6V15/18	NDU 23	RMK BG-1/15-22 +6V	8 P01 475
MX basic/plus 18/22	MX pro 6V18/22	NDU 40	RMK BG-1/15-22 +6V	8 P01 475
MX basic/plus 22/30	MX pro 6V22/30	NDU 40	RMK BG-1/15-22 +6V	8 P01 475

You may also use the allocation table for selection of the option *>pDRIVE< RMK* suitable for the chosen inverter:



- MX eco 4V: page 73 ff.
- MX pro 4V: page 130 ff.
- MX pro 6V: page 183 ff.

General technical data

Design Mounting kit made of galvanised sheet steel

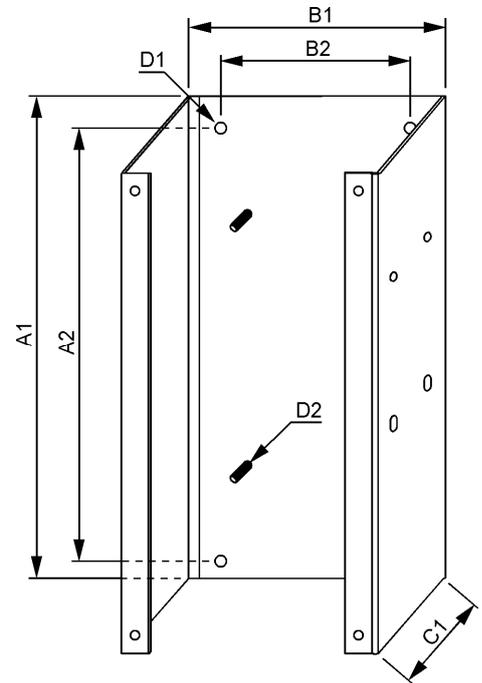
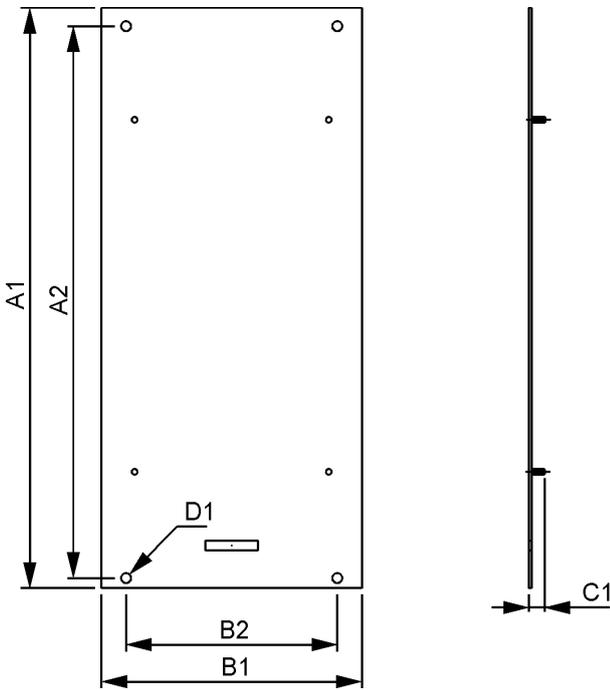
Option >pDRIVE< RMK

	BG-A/4,0	BG-A/5,5	BG-B/7,5	BG-B/11	BG-A,B/6V	BG-1/ 15-22 + 6V	BG-1/ 30-37	BG-2/45	BG-2/55-75
Order number	8 P01 470	8 P01 471	8 P01 472	8 P01 473	8 P01 474	8 P01 475	8 P01 476	8 P01 477	8 P01 478
Weight	1.2 kg	1.2 kg	1.6 kg	1.6 kg	2.3 kg	4.7 kg	6.1 kg	4.6 kg	4.8 kg
Dimension A1	410 mm	410 mm	410 mm	410 mm	420 mm	500 mm	546 mm	815 mm	865 mm
Dimension A2	390 mm	475 mm	529 mm	714 mm	714 mm				
Dimension B1	185 mm	185 mm	240 mm	240 mm	240 mm	240 mm	240 mm	350 mm	350 mm
Dimension B2	150 mm	150 mm	200 mm	200 mm	200 mm	195 mm	206 mm	310 mm	310 mm
Dimension C1	12 mm	12 mm	12 mm	12 mm	30 mm	150 mm	205 mm	22 mm	22 mm
Dimension D1	7 mm	8 mm	8 mm	10 mm	10 mm				
Dimension D2	-	-	-	-	-	-	-	M8	M8

>pDRIVE< RMK BG-A, BG-B & BG-2

>pDRIVE< RMK BG-A,B/6V & BG-1

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The individual mounting kits may differ marginally from the illustration. Some of them are also designed of two parts.



# Functions

The >pDRIVE< MX eco & pro inverters include numerous standard functions for optimal performance in the shortest time as well as specific functions 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 21).

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		✓	✓	Switching of the set of parameters for two different system tasks	Page 258
2nd set of motor data		✓	✓	Switching the motor parameters between two motors	Page 259
Skip frequencies		✓	✓	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		-	✓	Settings for braking unit and braking resistor	Page 262
Braking mode		✓	✓	Motor braking as economical alternative to a braking unit	Page 263
CANopen	<b>CANopen</b>	✓	✓	Configuration for coupling with a CANopen network	Page 199
Data Logger (statistic)		✓	✓	Recording of three channels for statistical evaluations	Page 264
DC-brake		-	✓	Switchable DC-brake	Page 265
DC holding brake		✓	✓	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	$\frac{P1}{P2}$	-	✓	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		-	✓	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		✓	✓	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 for crane		-	✓	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	<b>Modbus</b>	✓	✓	Configuration for coupling with a Modbus network	Page 197
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

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		✓	✓	Configuration for coupling with a Profibus network	Page 200
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 that is proportional to an adjustable constant or a selectable analog value	Page 307
Safe Standstill		✓	✓	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		✓	✓	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		✓	✓	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		✓	✓	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		✓	✓	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 >pDRIVE< MX eco & pro description of functions.



## 2nd Set of application parameters

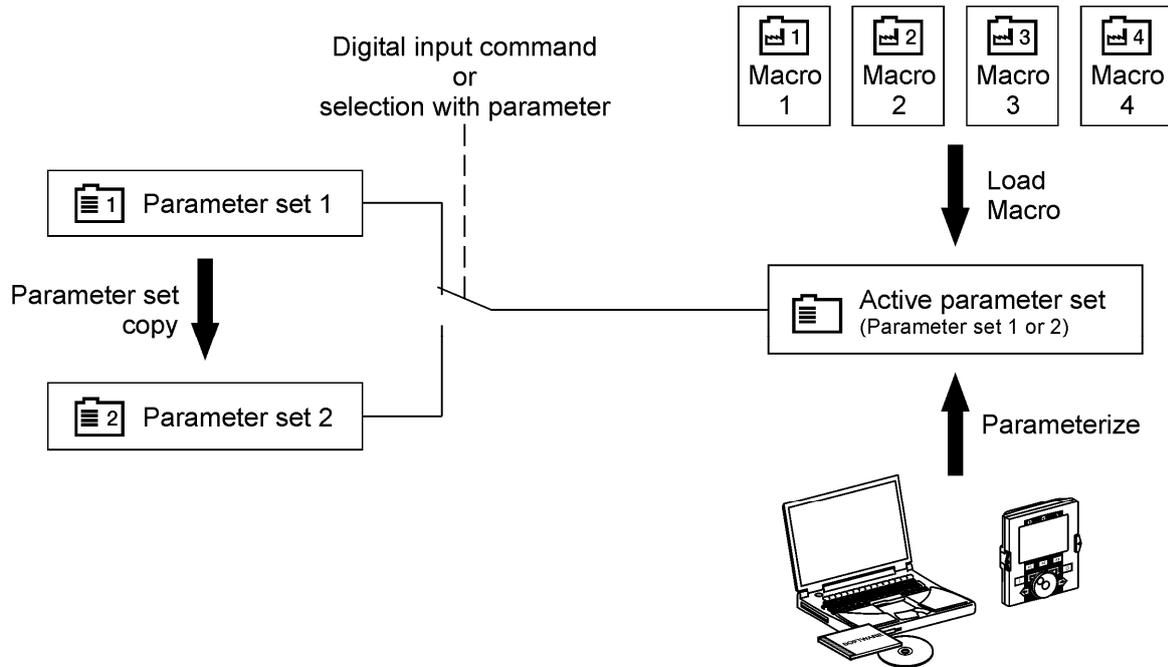
MX eco

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.



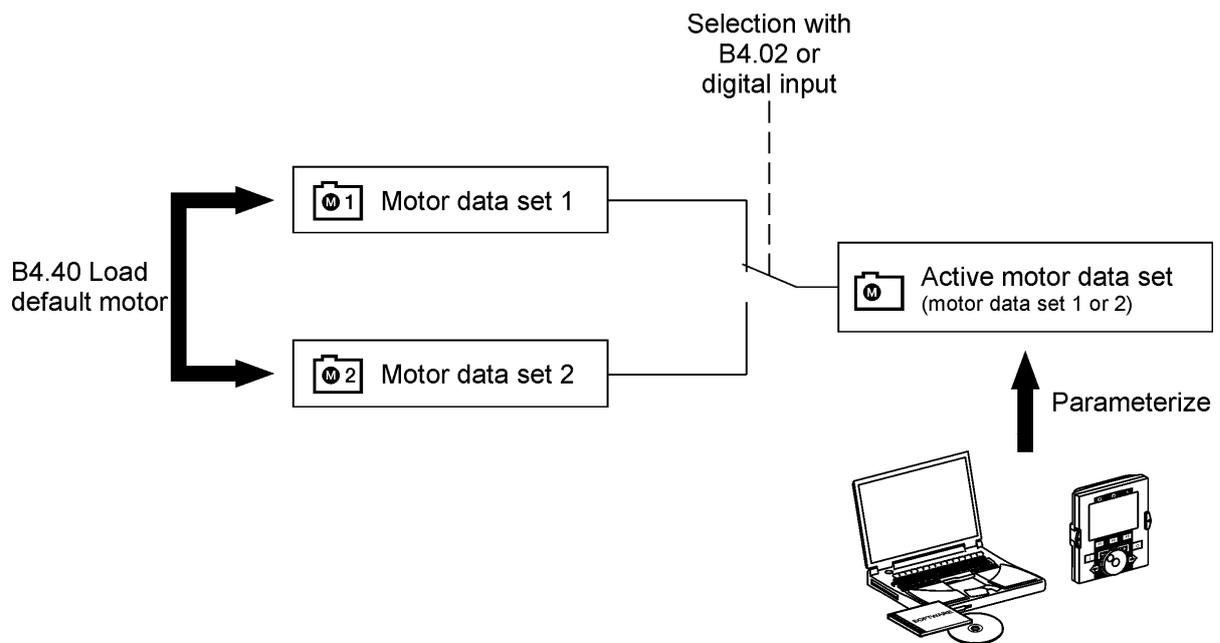
## 2nd Set of motor data

MX eco

MX pro

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 >pDRIVE< 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.



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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 if the drive state changes to "Ready".



A digital output function is available for confirmation of the active motor.

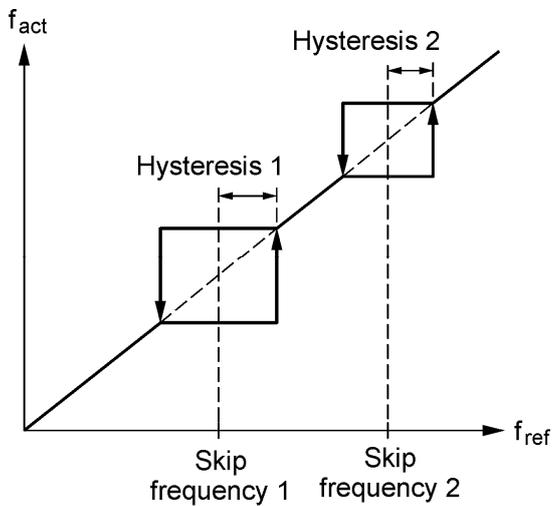


If a recognition of wire break of the signal outputs is necessary, two outputs are required instead of one.

## Skip frequencies

MX eco   
 MX pro

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 device changes to the operating state "Trip". A given start command is inhibited.
3 .. Fast stop	A deceleration occurs with very short ramp time. After reaching speed zero the device changes to the operating state "Trip". A given start command is inhibited. 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 >pDRIVE< MX pro !

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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

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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. "3 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 !



## BE11 monitoring

MX eco

MX pro

The removable matrix operating panel  $\text{>pDRIVE< BE11}$  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  $\text{>pDRIVE< DMK11}$ , removing the BE11 may lead to loss of control. For this case, the function "BE11 monitoring" must be activated.



## Braking unit

MX eco

MX pro

The frequency inverters  $\text{>pDRIVE< MX pro 4V \& 6V}$  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 Brake mode is set to "4 .. Braking unit".

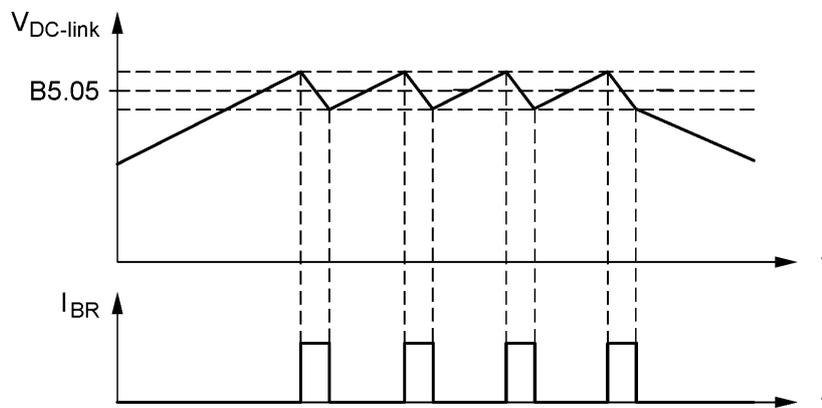
### External braking unit

If a  $\text{>pDRIVE< MX pro}$  without built-in braking unit is coupled by the DC link with devices with built-in and activated braking unit, parameter B5.01 Brake 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 ( $P_{\text{MAX}} = \text{BU braking level}^2 / R$ ).

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.

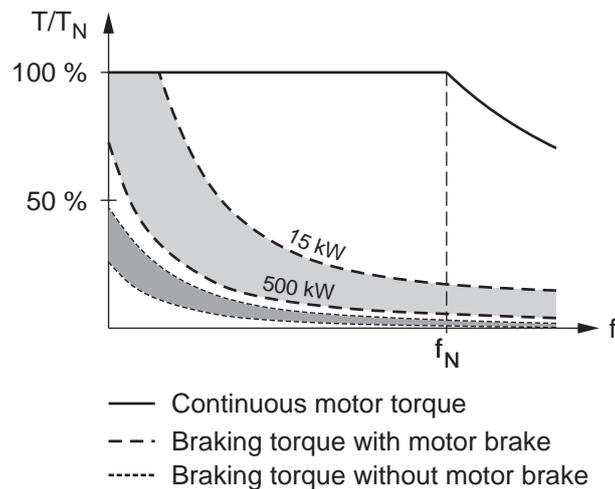
By means of the three possible settings motor braking A-B-C, the braking action for the respective operating case can be empirically optimised.



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.



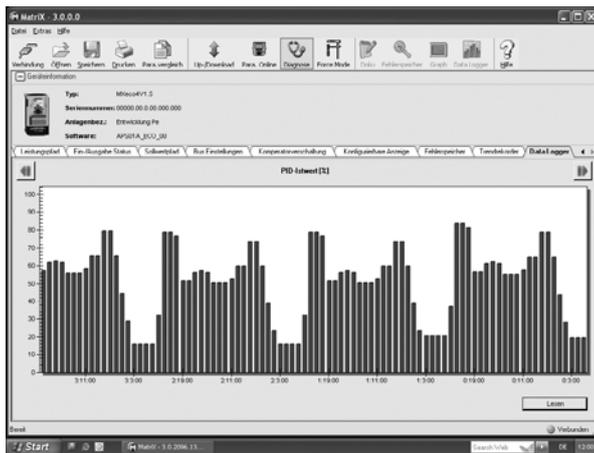
At the shutdown of fan drives the quadratic decreasing load torque acts in addition to the motor braking torque. The deceleration time can be typically reduced to 1/4 of the deceleration time with free wheeling.



## 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 *>pDRIVE< 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 saveable 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) 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:

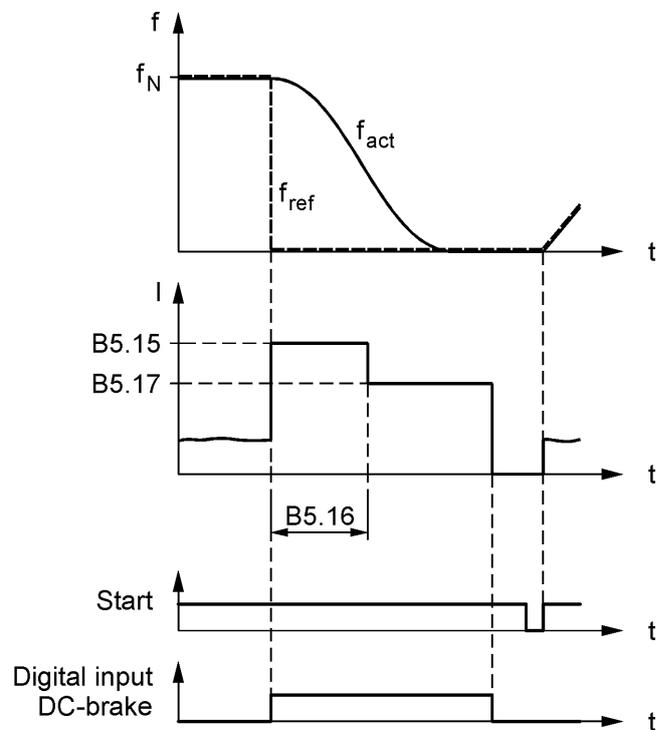
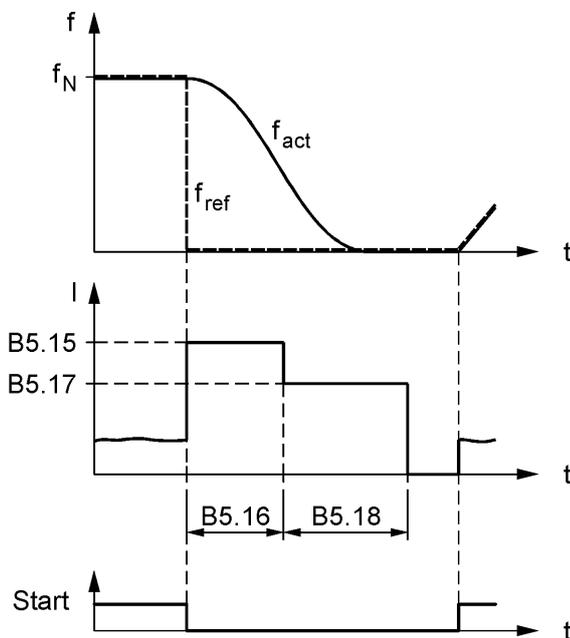
- By means of the digital input function "DC-brake"
- B3.24 Stop mode is set to "5 .. DC-brake"
- E3.01 Reaction at a trip is set to "4 .. DC-brake"

*Activation of the DC brake in case of a stop or trip*

*Activation depending on the digital input "DC-brake"*

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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.



## 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,...



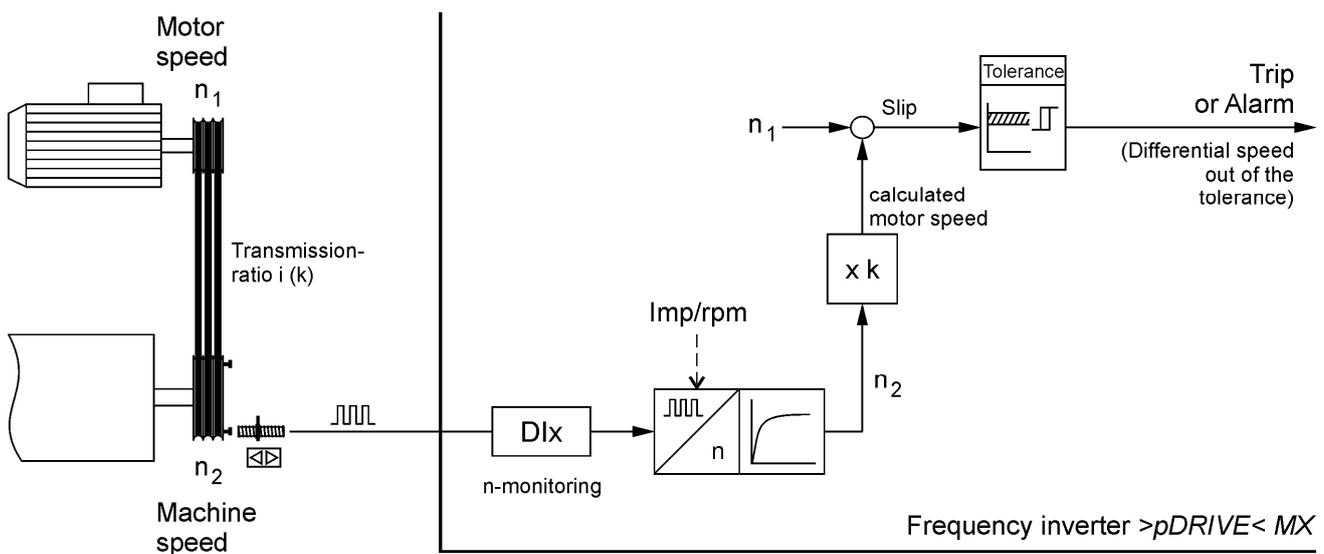
## Speed monitoring

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 >pDRIVE< 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**

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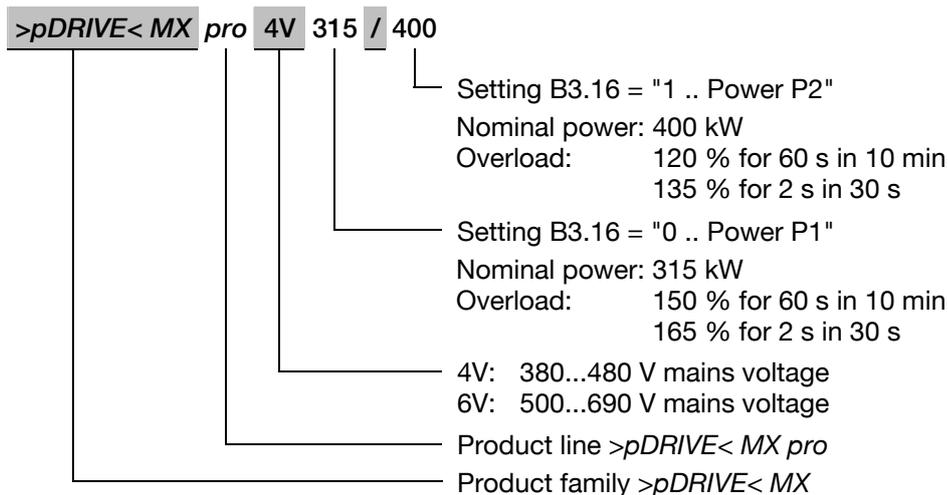
The frequency inverters >pDRIVE< MX pro 4V from type 4V90/110 as well as the devices of the >pDRIVE< MX pro 6V range are equipped with a dual rating function.

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 of "1 .. Power P2").

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

### Example



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## **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.



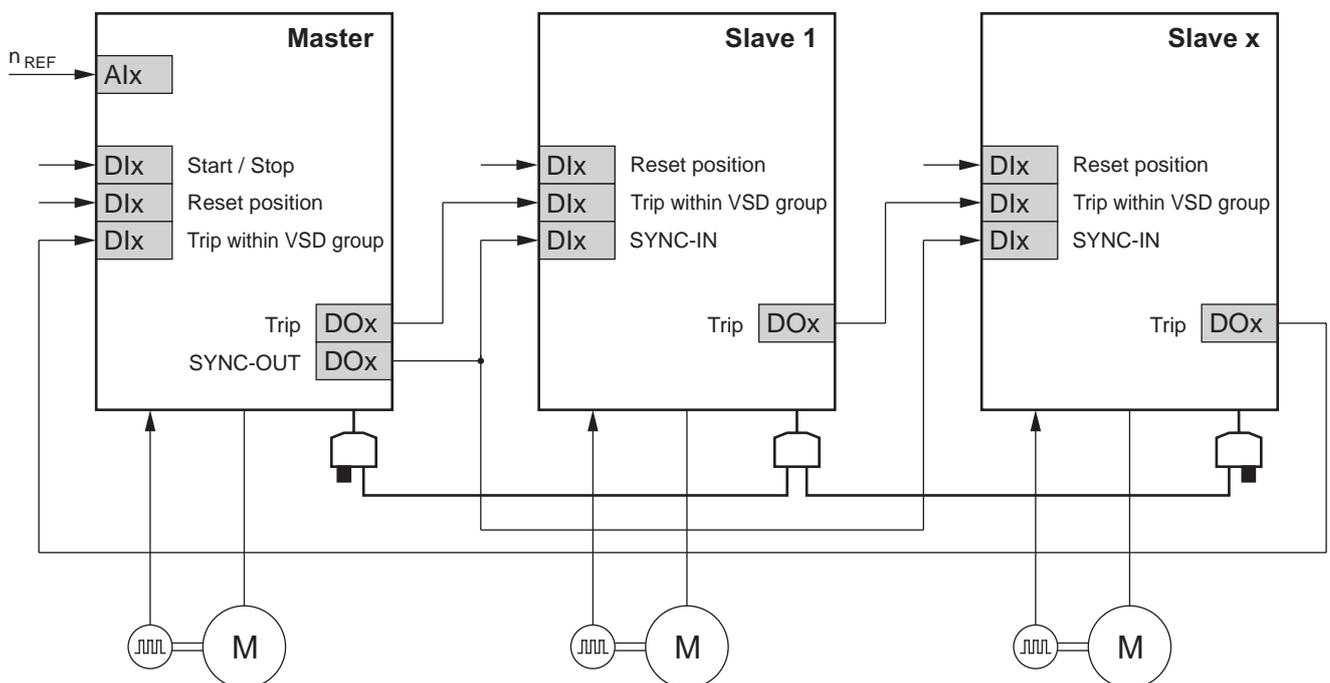
In this context, it should also always be checked if the drive cannot be completely switched off in low load situations by using the standby mode (see function "Standby Mode", page 322).

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.



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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).

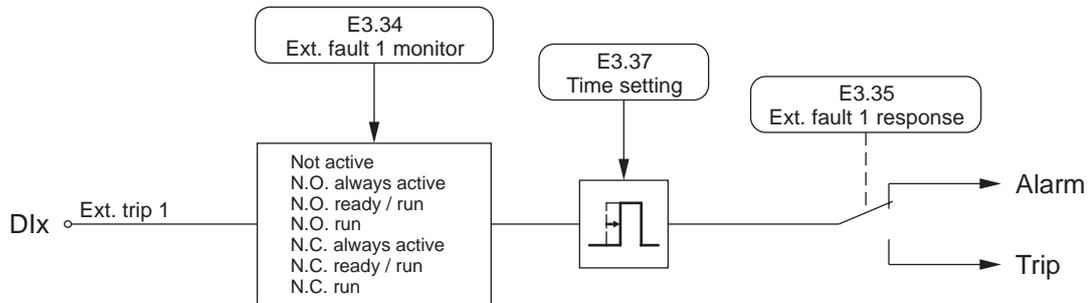
If the function of the electric shaft should be activated/deactivated during the process, this can be realized by using the 2nd parameter set. Even in this case the position values of all drives have to be set to zero before giving the start command !

## 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 .. - $\Delta t$ - 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 - $\Delta t$ - 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 .. - $\Delta t$ - fault	After the adjustable delay a fault shut-down with a free editable text message (E3.38) takes place.

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## Catch on the fly

MX eco   
MX pro

The frequency inverters of the >pDRIVE< 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 >pDRIVE< 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 >pDRIVE< MX eco & pro can be additionally adapted to the requirements of the application without installing an external control logic.

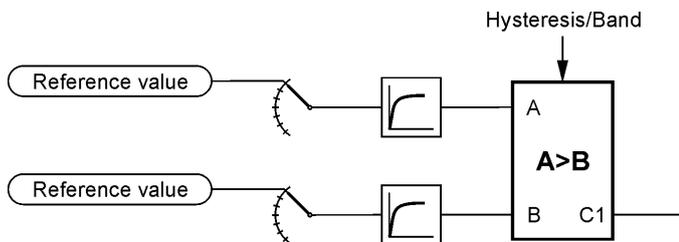
In addition to external components, extensive planning, mounting, checking and documentation are also omitted as they are covered by the inverter electronics and the parameter documentation.

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.

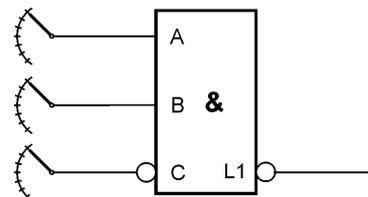
The biggest advantage is the simple handling by means of the inverter parameterization. Required functions are simply described and programmed by means of only few basic modules and usage of the standard available analog and digital in- and outputs in the inverter, processing of the reference value, computing functions, counters etc.

Following functional units are available:

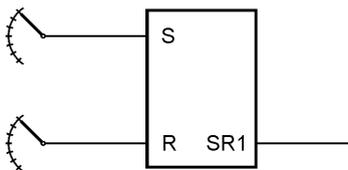
### Comparator



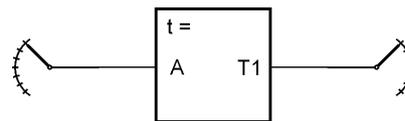
### Logic module



### 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.	<ul style="list-style-type: none"> <li>– Comparison "A &gt; B", "A &lt; B", "A = B" and "A &lt;&gt; B"</li> <li>– Adjustable hysteresis or band width</li> <li>– Adjustable filter for both input signals</li> <li>– Comparison with fixed reference value or analog size</li> </ul>
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.	<ul style="list-style-type: none"> <li>– Logical functions "and", "Or", "equal" and "unequal"</li> <li>– Negation of the input possible</li> <li>– Inverting the function</li> <li>– Automatic adaptation of functions when using only 2 inputs</li> </ul>
Storage element	2	Flip-flop storage element with set- and reset- input Control inputs like for logic modules	<ul style="list-style-type: none"> <li>– Prioritized setting or deleting selectable</li> </ul>
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	<ul style="list-style-type: none"> <li>– Selectable time functions "ON delayed", "OFF delayed", "ON &amp; OFF delayed" and pulse output</li> <li>– Extensible adjustable time range</li> </ul>
Alarm logic module	1	Allows a logical operation of up to 6 free selectable alarm messages for free further use within the function blocks.	<ul style="list-style-type: none"> <li>– Logical functions "and", "Or"</li> </ul>
Trip logic module	1	Allows a logical operation of up to 6 free selectable trip messages for free further use within the function blocks.	<ul style="list-style-type: none"> <li>– Logical functions "and", "Or"</li> </ul>
Positioning module	1	Interpretation of the position value to create up to 4 positions/zones for free further use within the function blocks.	<ul style="list-style-type: none"> <li>– Defining position zones by entry of begin and end value possible</li> </ul>



The "Positioning module" function is only supported by >pDRIVE< 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.

## 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 !

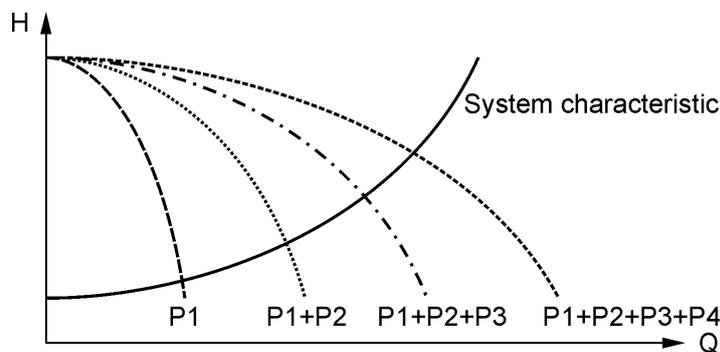
The required functions for cascade operation such as the switching point determination for tailor-made connection and disconnection of individual cascade drives, permanent monitoring of operation up to recording occur by means of the standard function in the *>pDRIVE<* MX eco.



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.

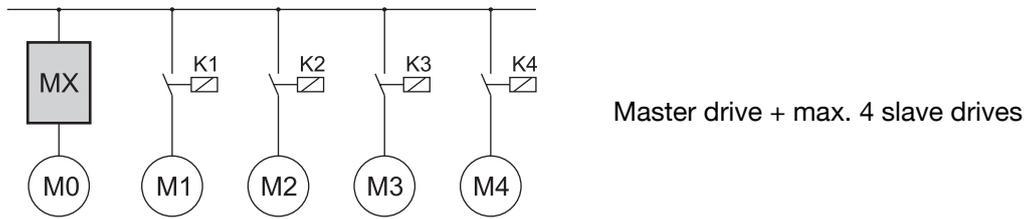
The range of applications is principally not only limited to pumps. Compressors, air conditioning and refrigerating devices can also be operated in this way.



The principal conception of the electrical design of the cascade occurs according to system-relevant factors.

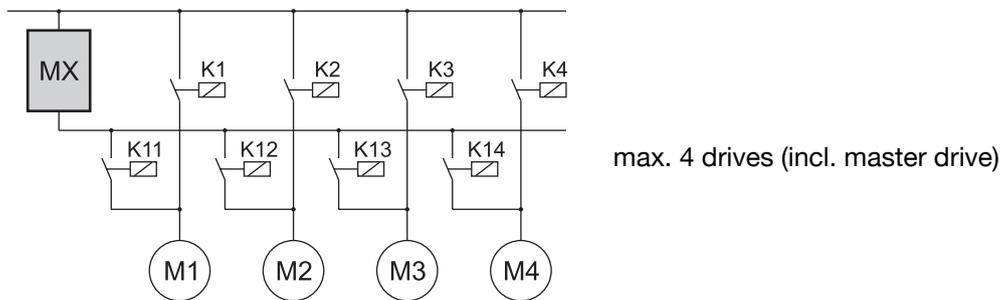
The *>pDRIVE< MX eco* can be used for the control of three typical configurations:

*Setting "1 .. Mains cascade 1"*



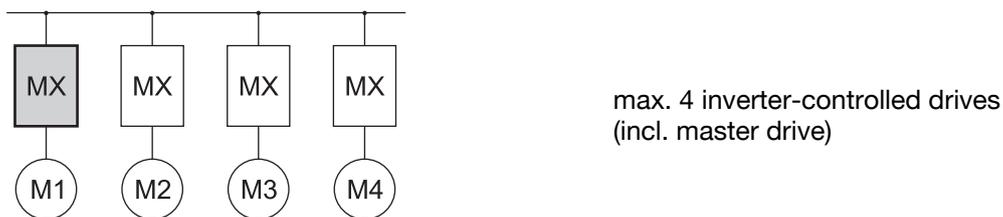
One pump serves as master drive and is operated speed-controlled on the *>pDRIVE< MX eco*. The remaining drives work directly or via softstarters on the supplying mains, controlled by the frequency inverter of the master drive. By using the process control (typical pressure or flow control) in connection 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"*



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"*



All cascade drives are carried out speed-controlled with *>pDRIVE< 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 >pDRIVE< IO11 or >pDRIVE< 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:

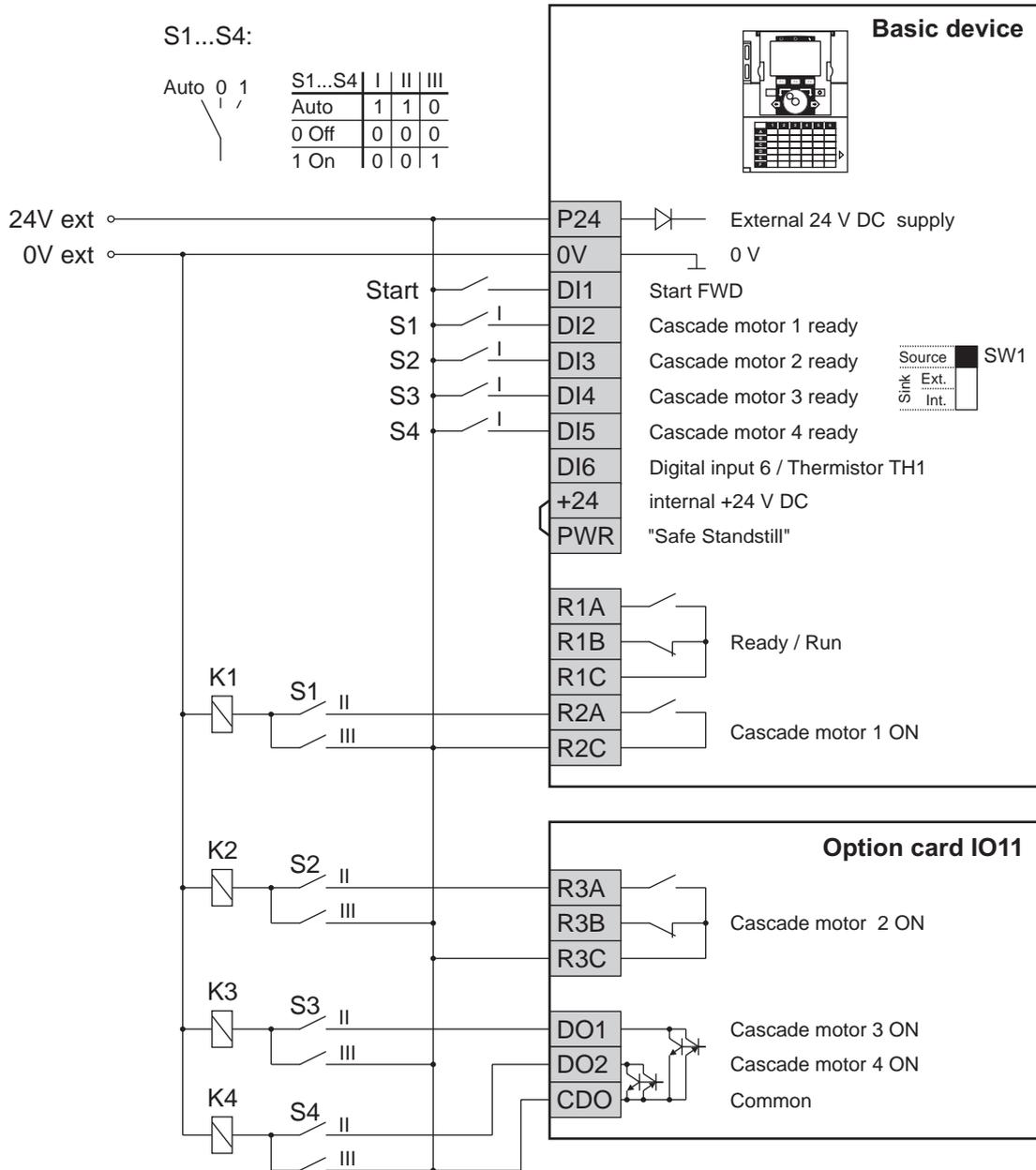
- *Automatic*  
Cascade motors are connected and disconnected by the automatic cascade control
- *Off*  
Drive switched off
- *Manual on*  
Drive is manually connected independent of the cascade control

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

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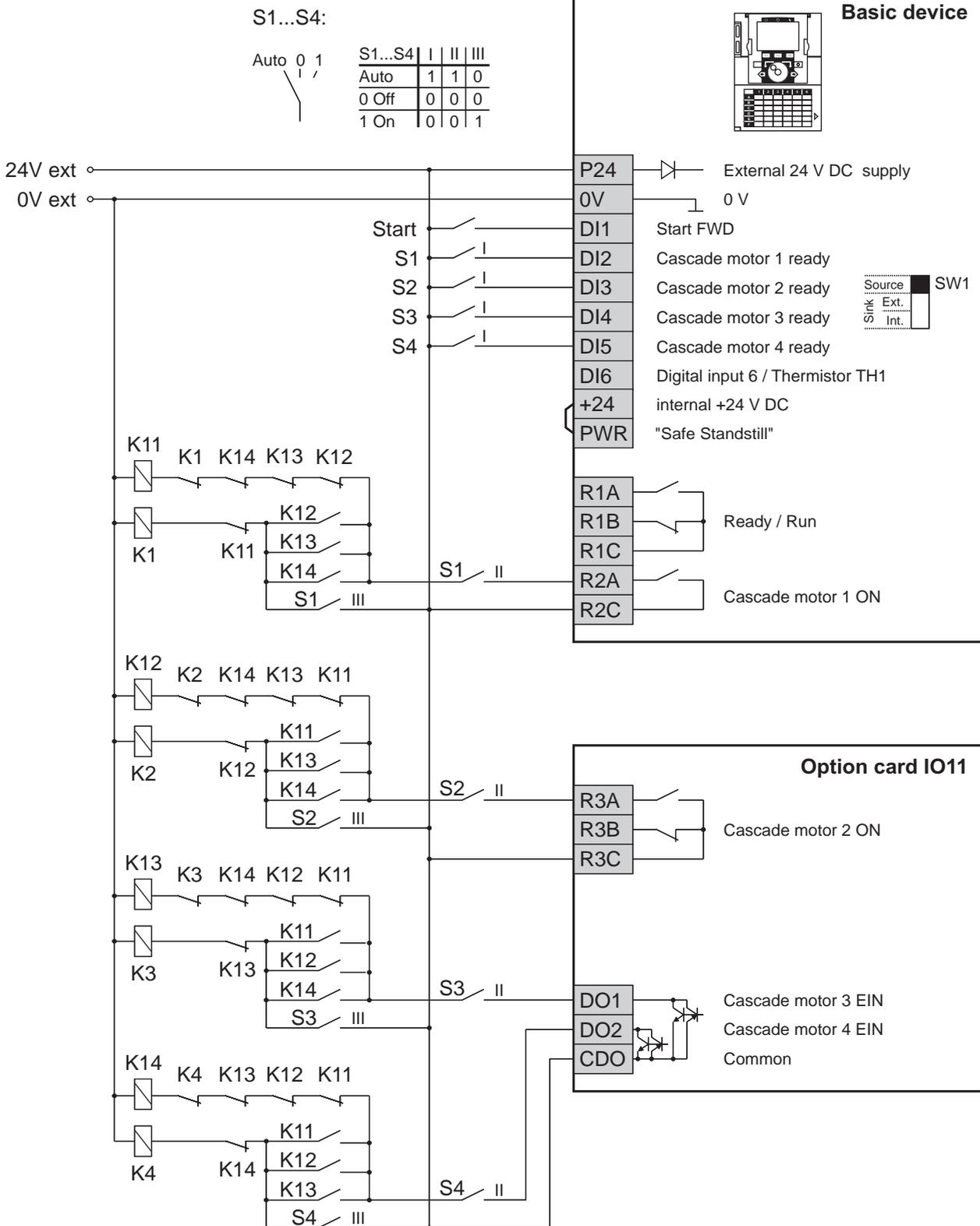


## Schematic diagram!



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 !

## 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!

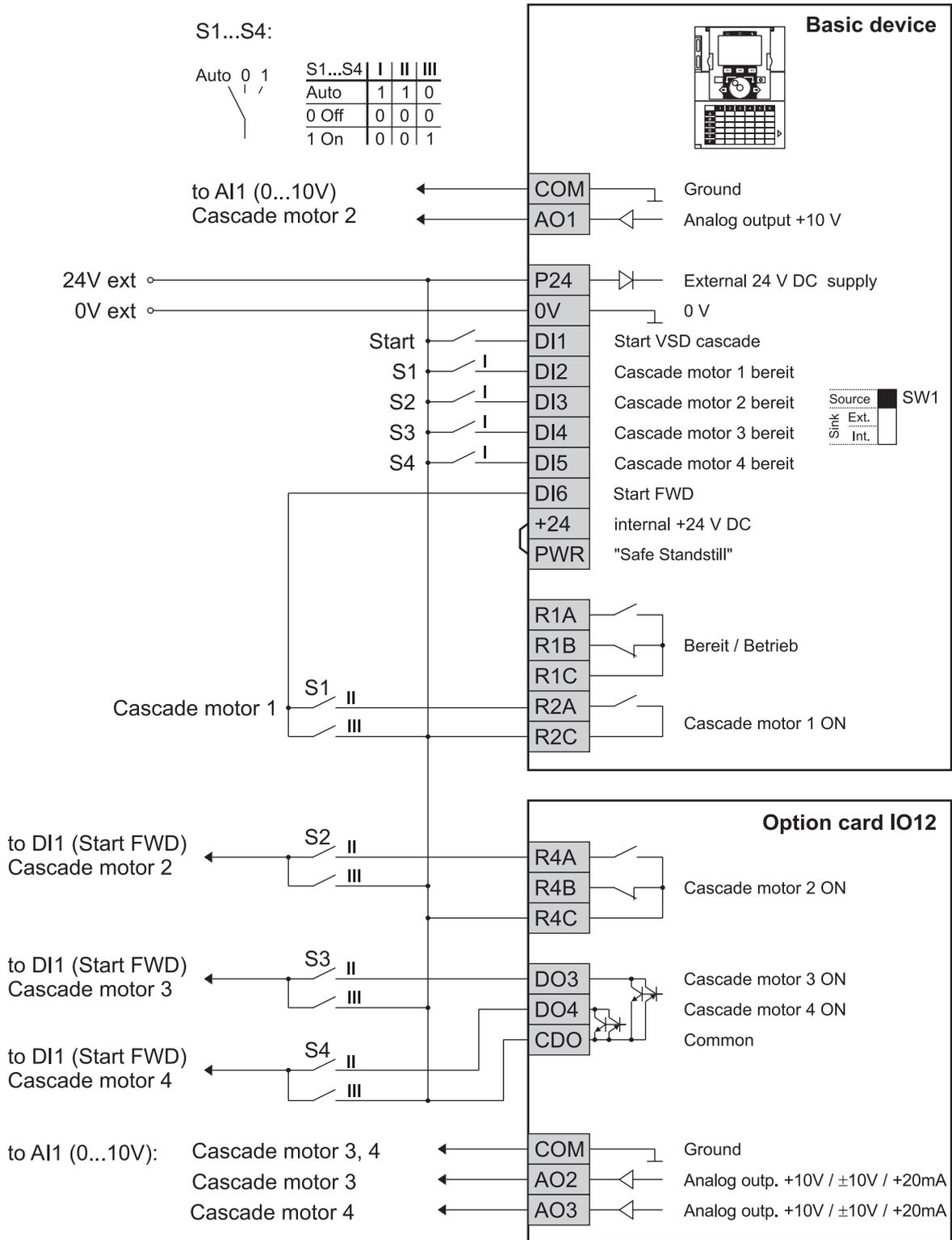


Typically, the switching of the motor contactors cannot occur directly via the inverter output relay or digital outputs. Appropriate auxiliary contactors are to be planned corresponding to the used contactors!

# VSD cascade

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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.

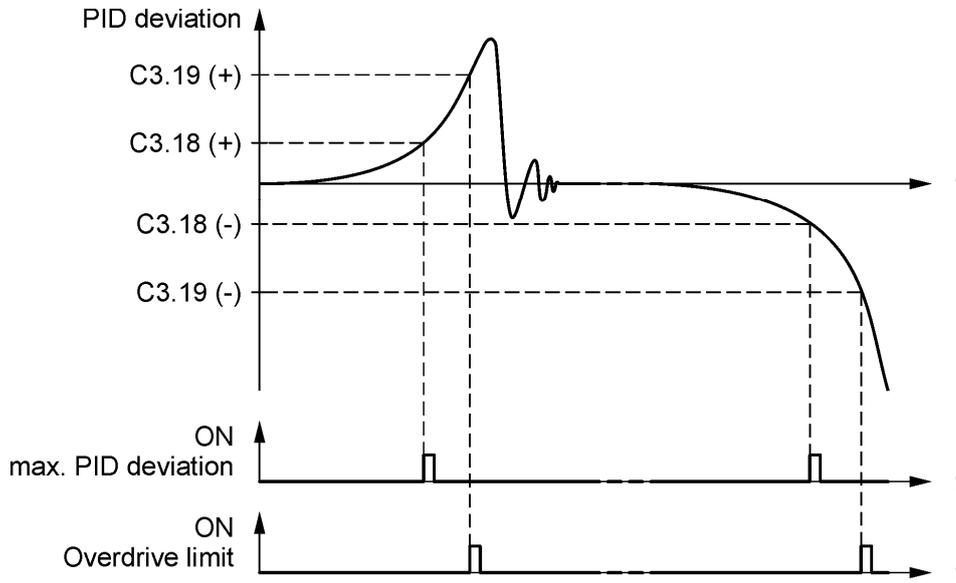
Alternatively to conventional reference values provided by the analog outputs (like described above) also the Modbus master function can be used (details see Modbus operating instructions).

## 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 >pDRIVE< MX pro range offer special functions for crane applications. Not only the basic functions like braking management optimized for hoists and long-travels, but also expanded functions for optimization of the drive for various situations such as expanded safety aspects, optimization of elevator applications,... are available.

The area of application of >pDRIVE< 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 >pDRIVE< LX 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 >pDRIVE< LX is possible.

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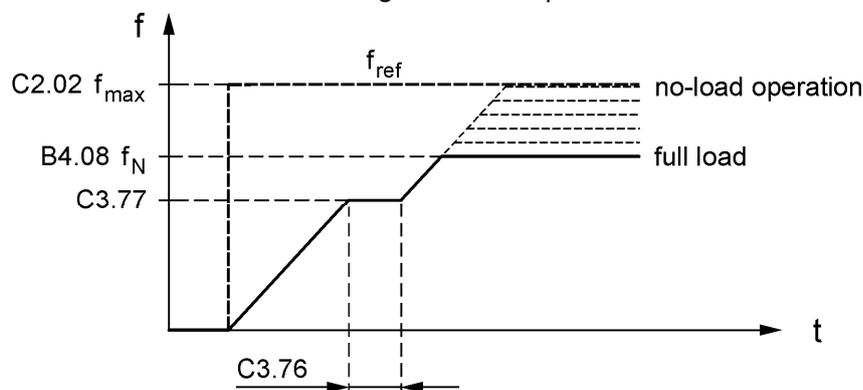
## Fast speed for crane

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

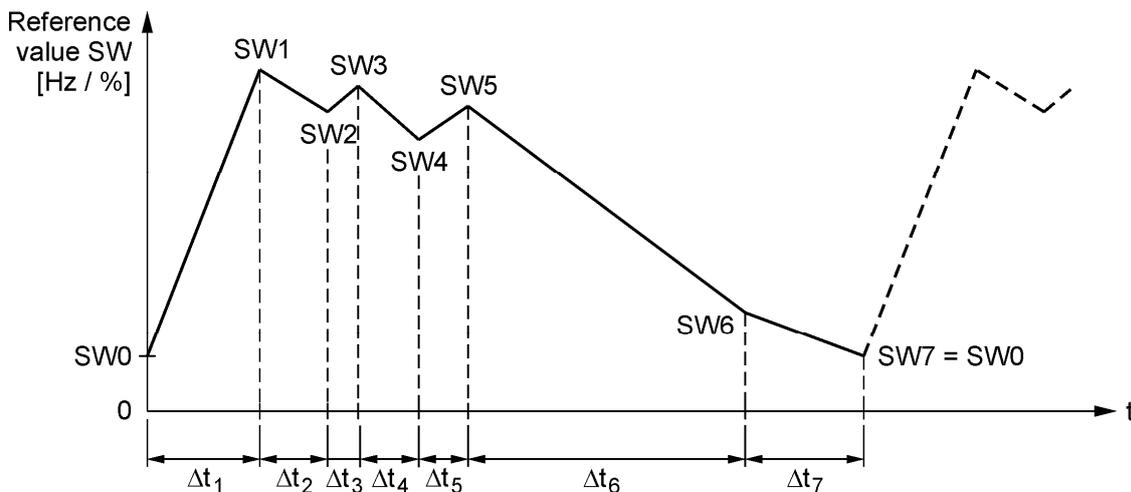
MX pro

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 >pDRIVE< 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  $\Delta t_7$  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**

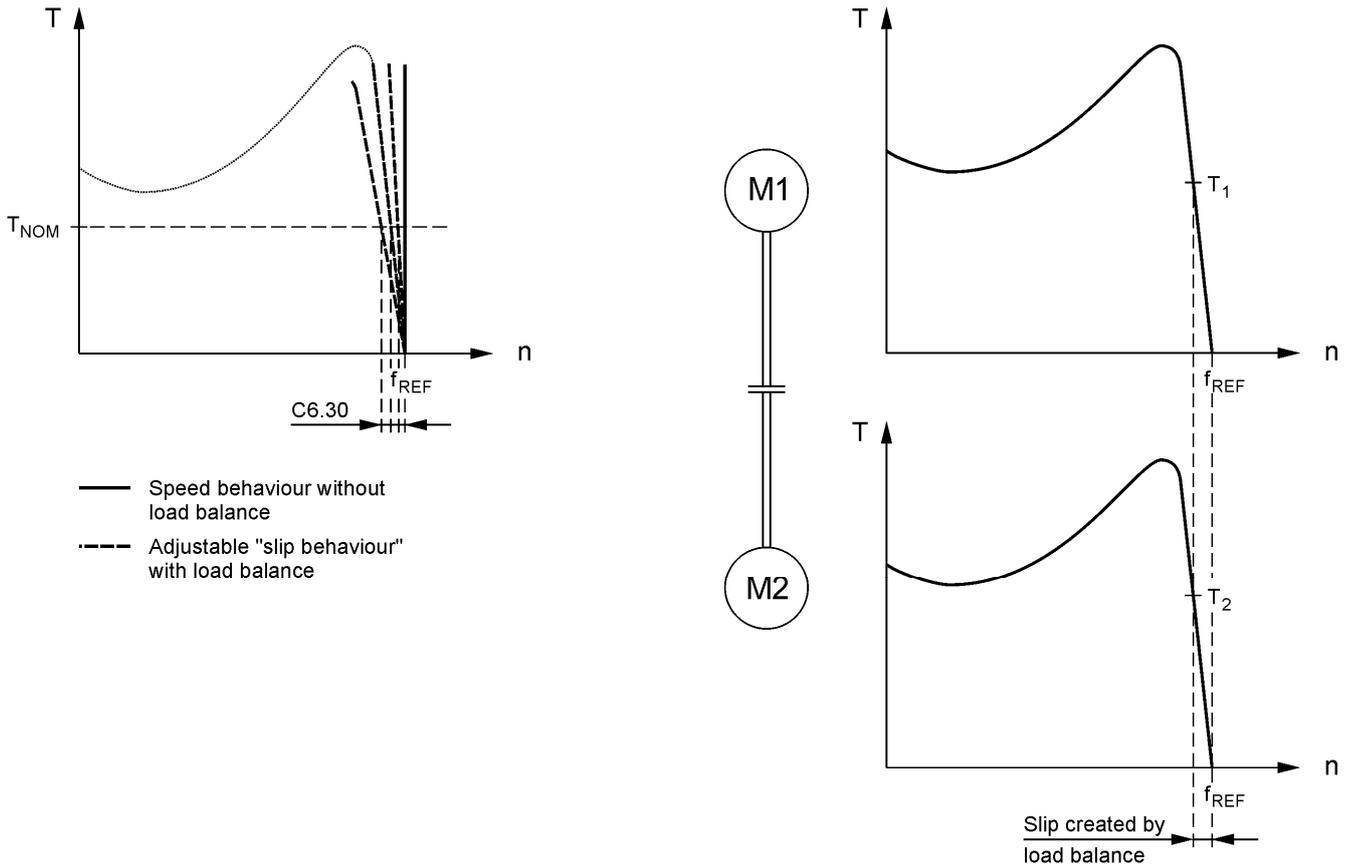
MX eco   
 MX pro

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.

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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 *>pDRIVE< 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:

- *>pDRIVE MX eco & pro 4V0,75...4V75*  
The fan is switched on at a thermal load of > 70 % and switched off again at < 60 %.
- *>pDRIVE MX eco & pro 4V from 90 kW*  
*>pDRIVE 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 presets of the parameters for typical applications of the *>pDRIVE< 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 parameter settings 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**

*>pDRIVE< MX eco:*

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

*>pDRIVE< MX pro:*

Preset parameters for crane drives with braking unit

### **Macro M3**

*>pDRIVE< MX eco:*

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

*>pDRIVE< 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"

**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.

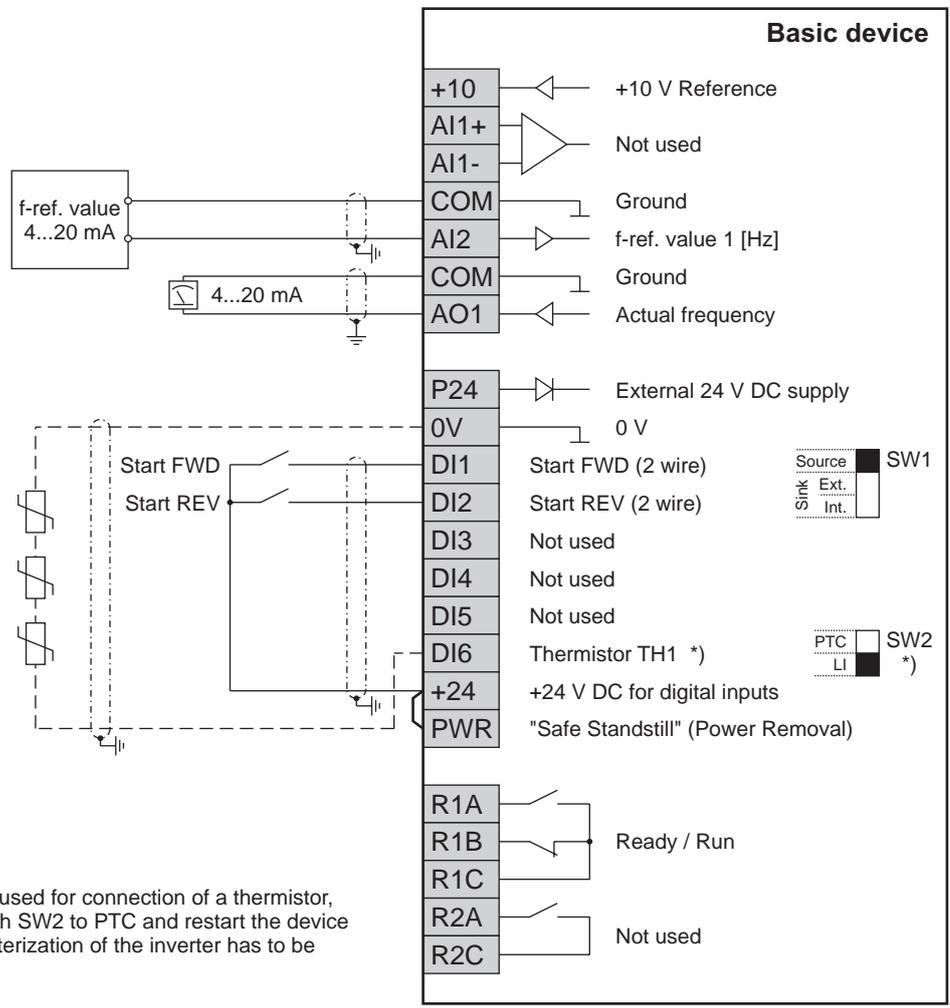


The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the >pDRIVE< MX eco & pro. These can be activated or changed according to requests of the application.



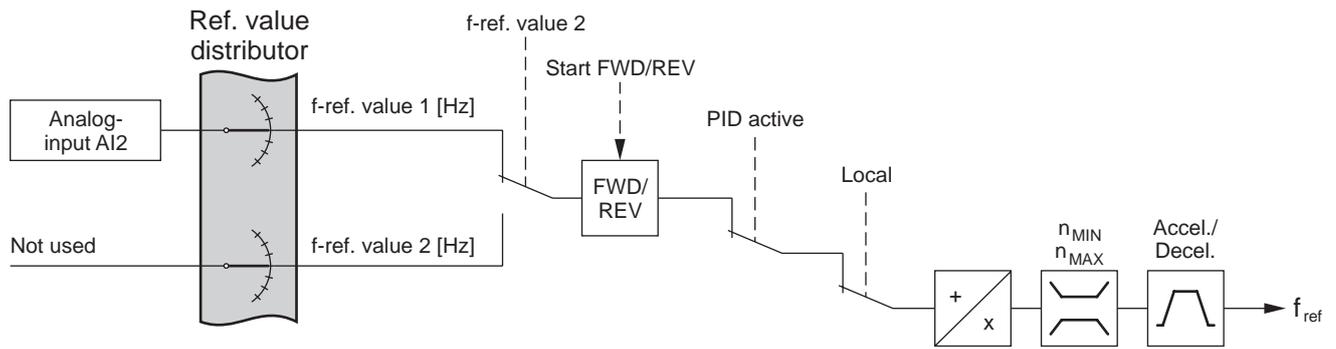
The macro M1 corresponds to the factory setting.

*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.

Reference value path of macro M1



## Macro M2: >pDRIVE< 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.

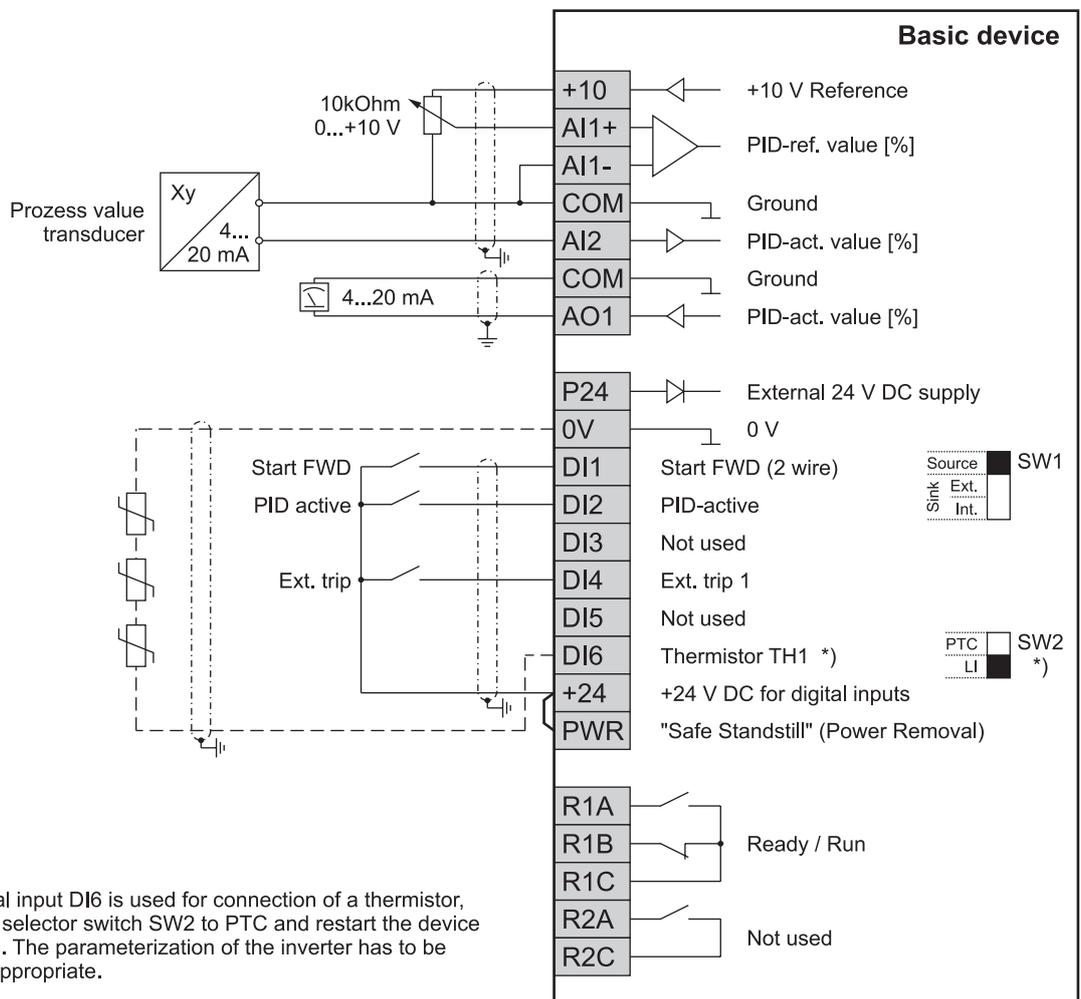


The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the >pDRIVE< MX eco & pro. These can be activated or changed according to requests of the application.

### >pDRIVE< MX eco allocation of terminals for macro M2

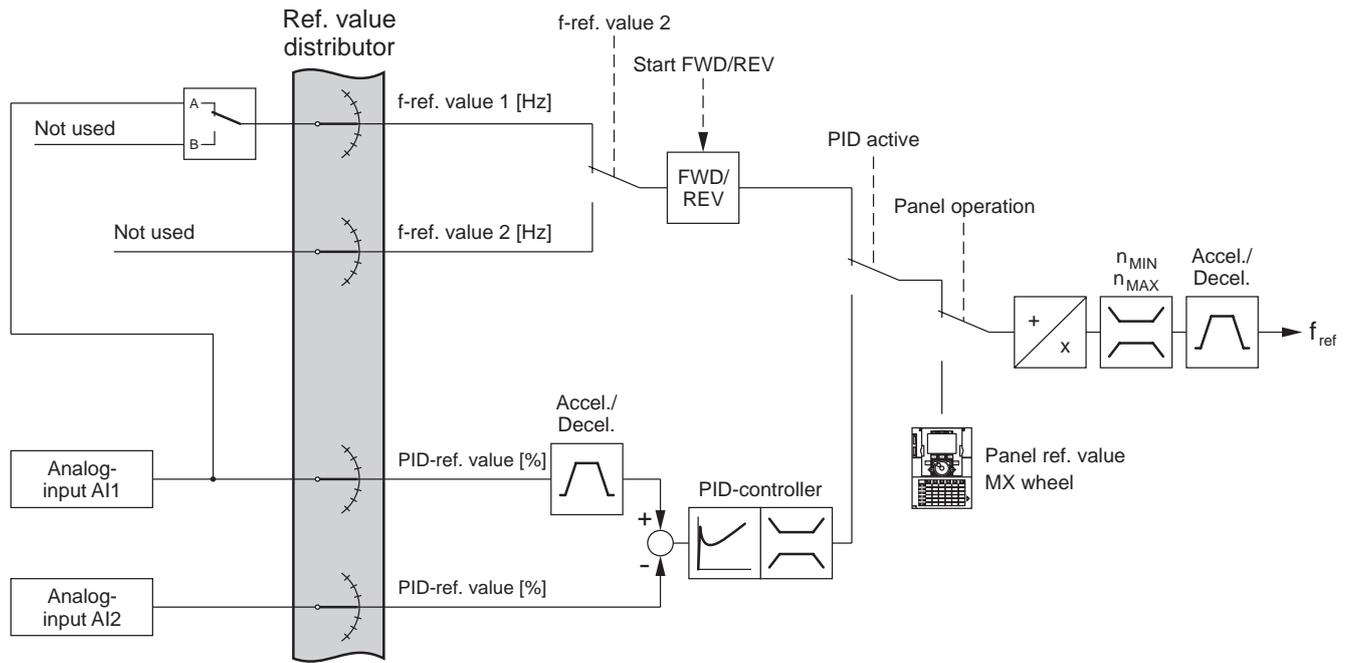
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\*) If the digital input DI6 is used for connection of a thermistor, switch the selector switch SW2 to PTC and restart the device afterwards. The parameterization of the inverter has to be adjusted appropriate.

>pDRIVE< MX eco reference value path of macro M2



## Macro M2: >pDRIVE< 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 >pDRIVE< 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.

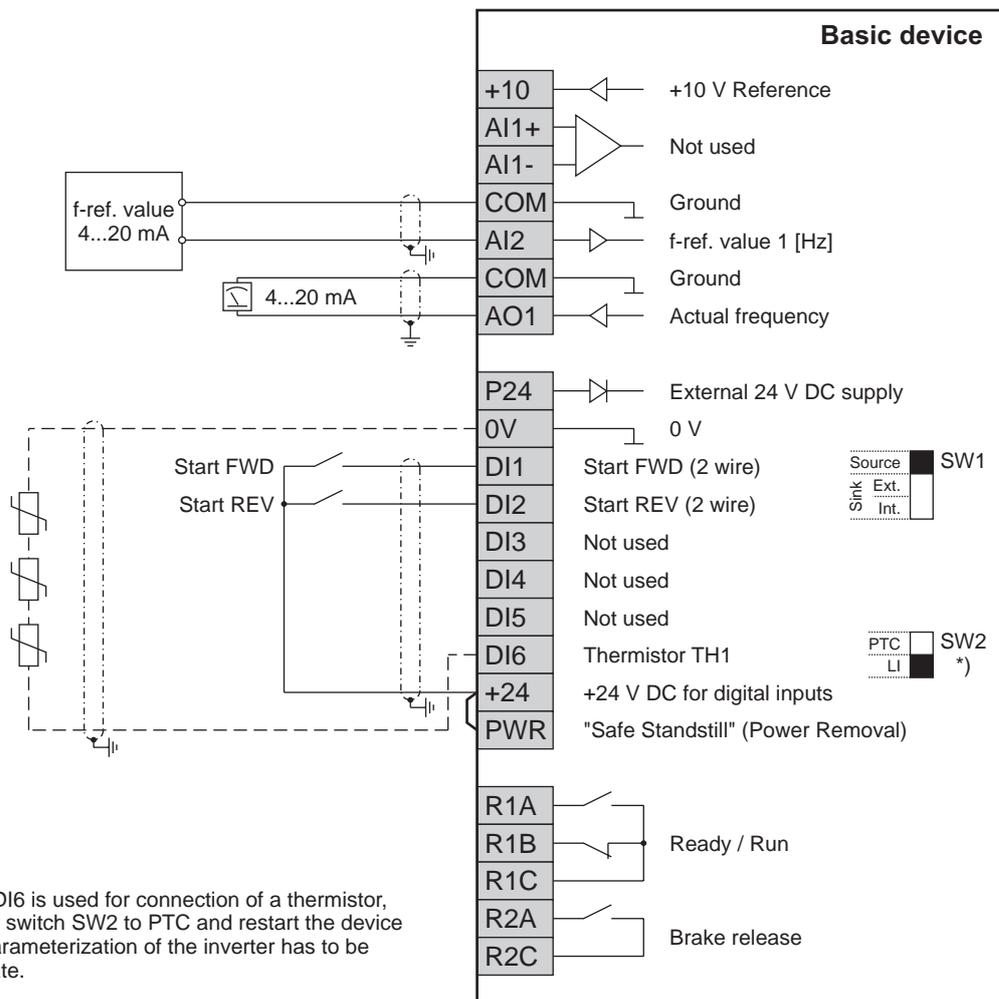


The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the >pDRIVE< MX eco & pro. These can be activated or changed according to requests of the application.

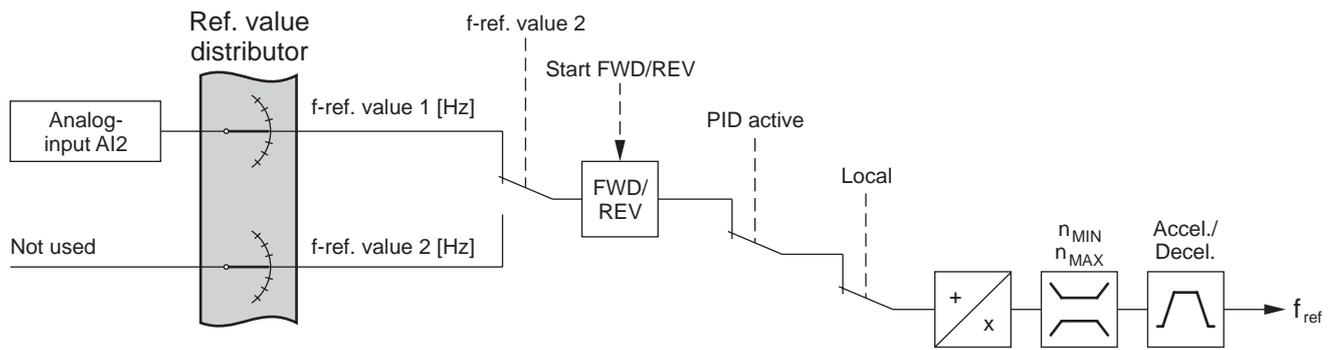
### >pDRIVE< MX pro allocation of terminals for macro M2

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>pDRIVE< MX pro reference value path of macro M2



### Macro M3: >pDRIVE< 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.

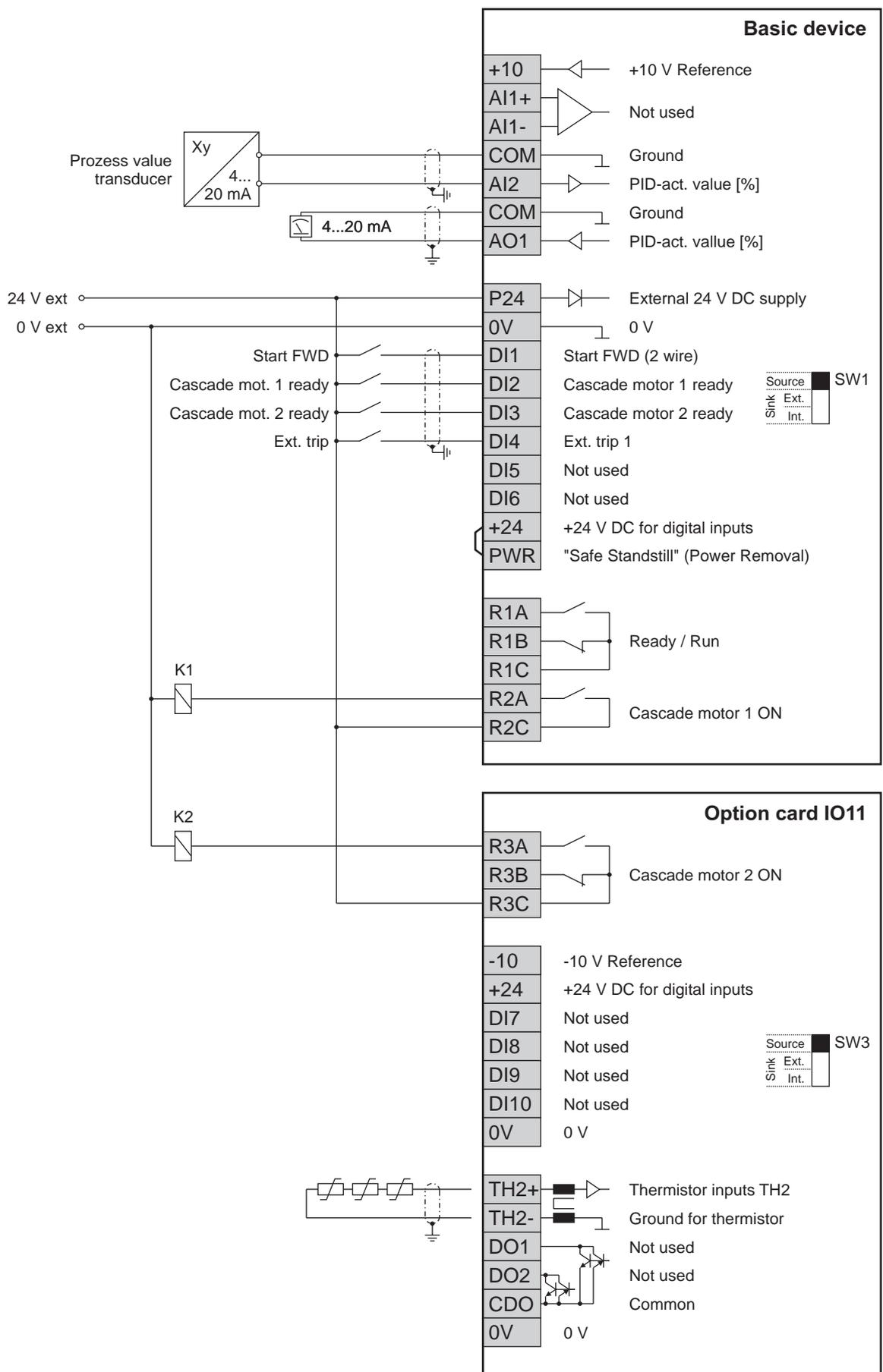
The device is configured according to the design of the "Mains cascade 1" with a speed-controlled master drive and two slave drives. The control of the slave drives occurs through the interpretation of the control deviation of the PID control circuit on the master drive which connects and disconnects 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.

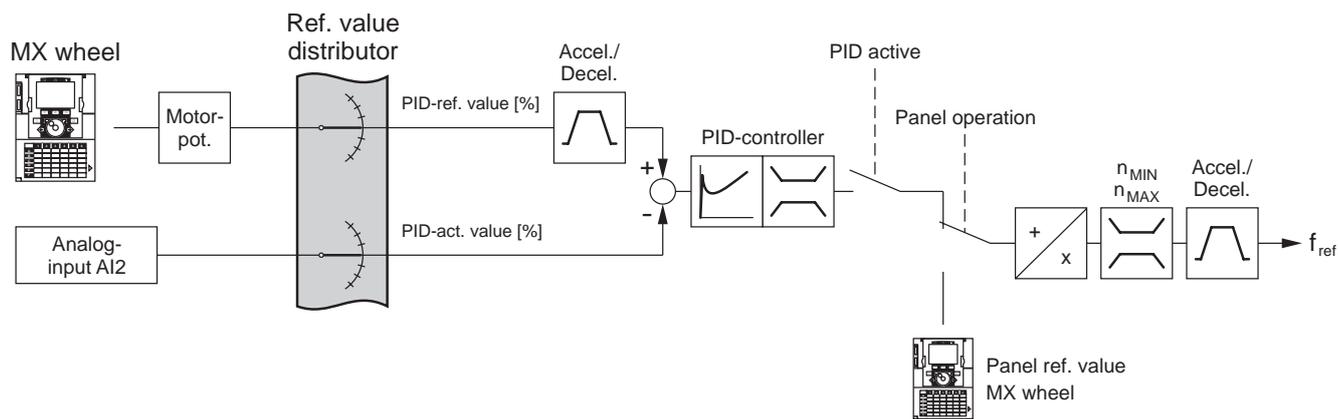
In addition to the closed-loop and open-loop control (via the terminals) a panel control of the device is possible via the Matrix operating panel BE11 or the built-in LED keypad.



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 >pDRIVE< MX eco & pro. These can be activated or changed according to requests of the application.



>pDRIVE< MX eco reference value path of macro M3



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**Macro M3: >pDRIVE< 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).

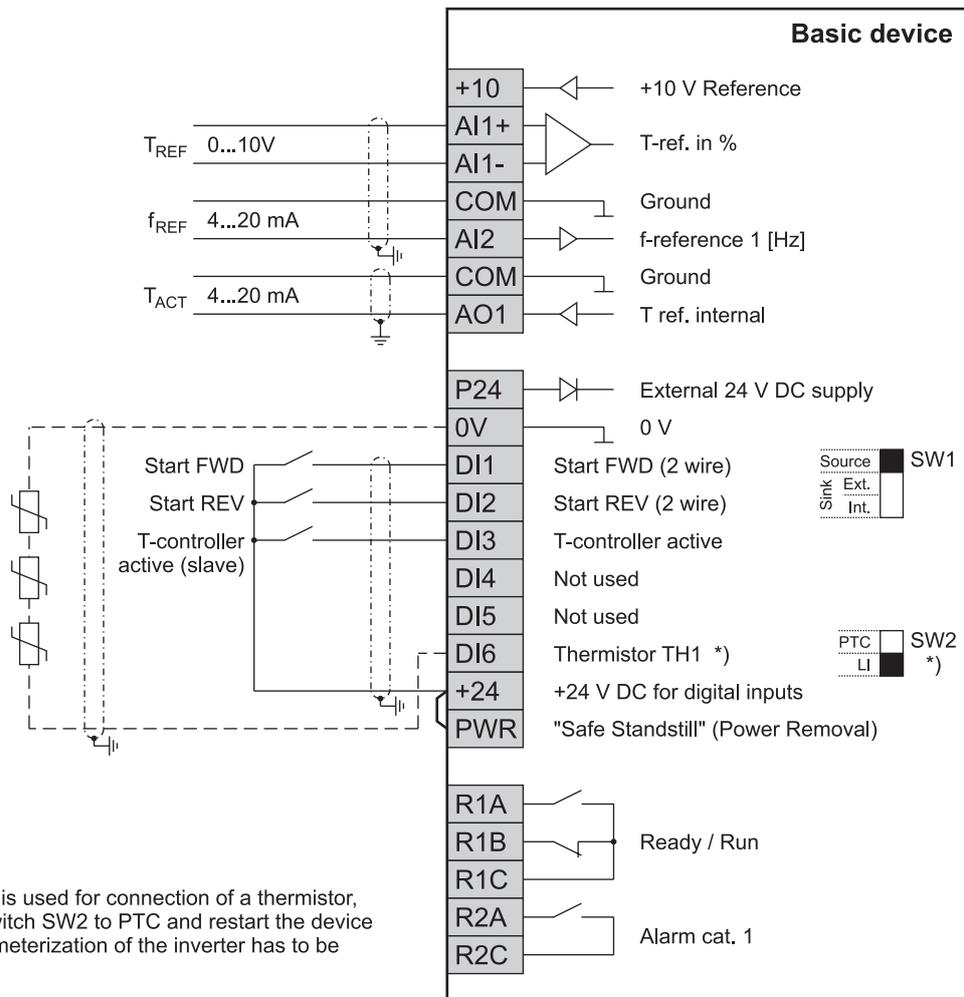


It is also possible to switch between speed and torque control manually using a digital input.

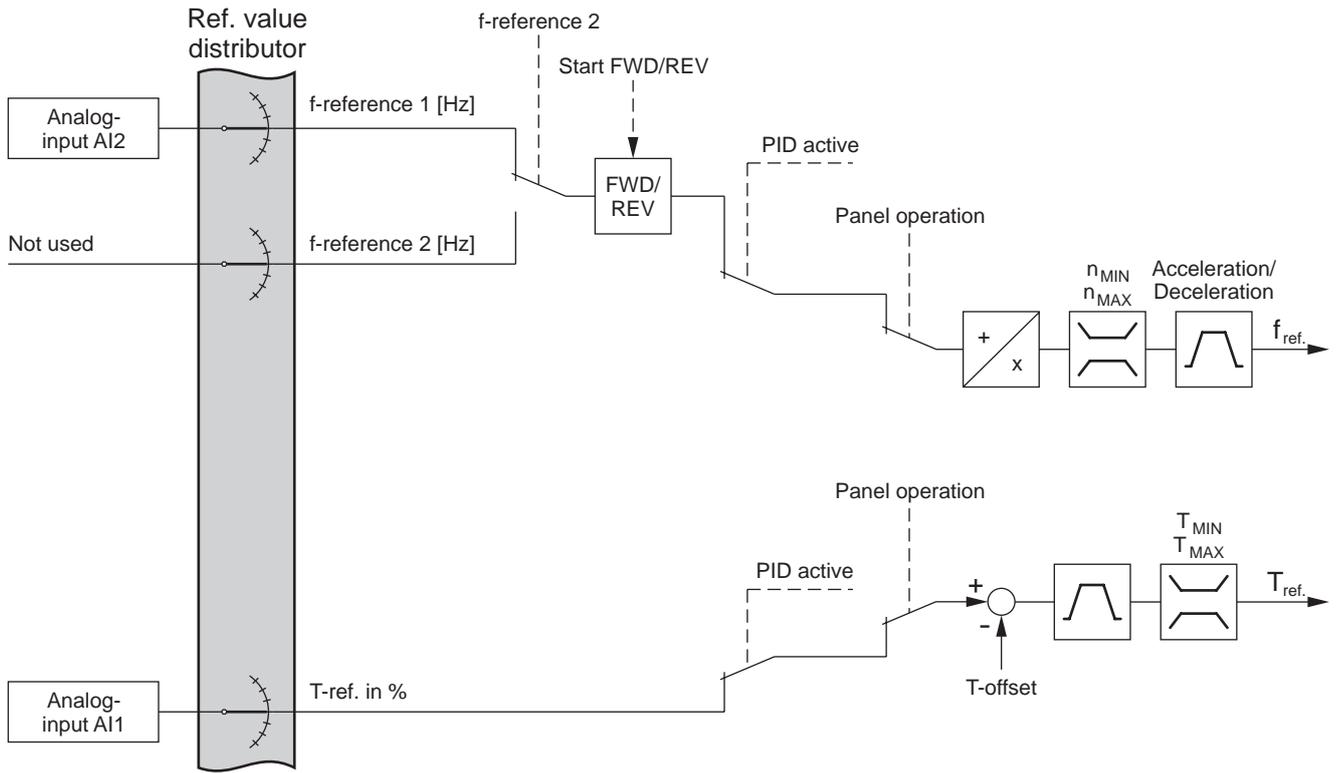


The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the >pDRIVE< MX eco & pro. These can be activated or changed according to requests of the application.

*>pDRIVE< MX pro allocation of terminals for macro M3*

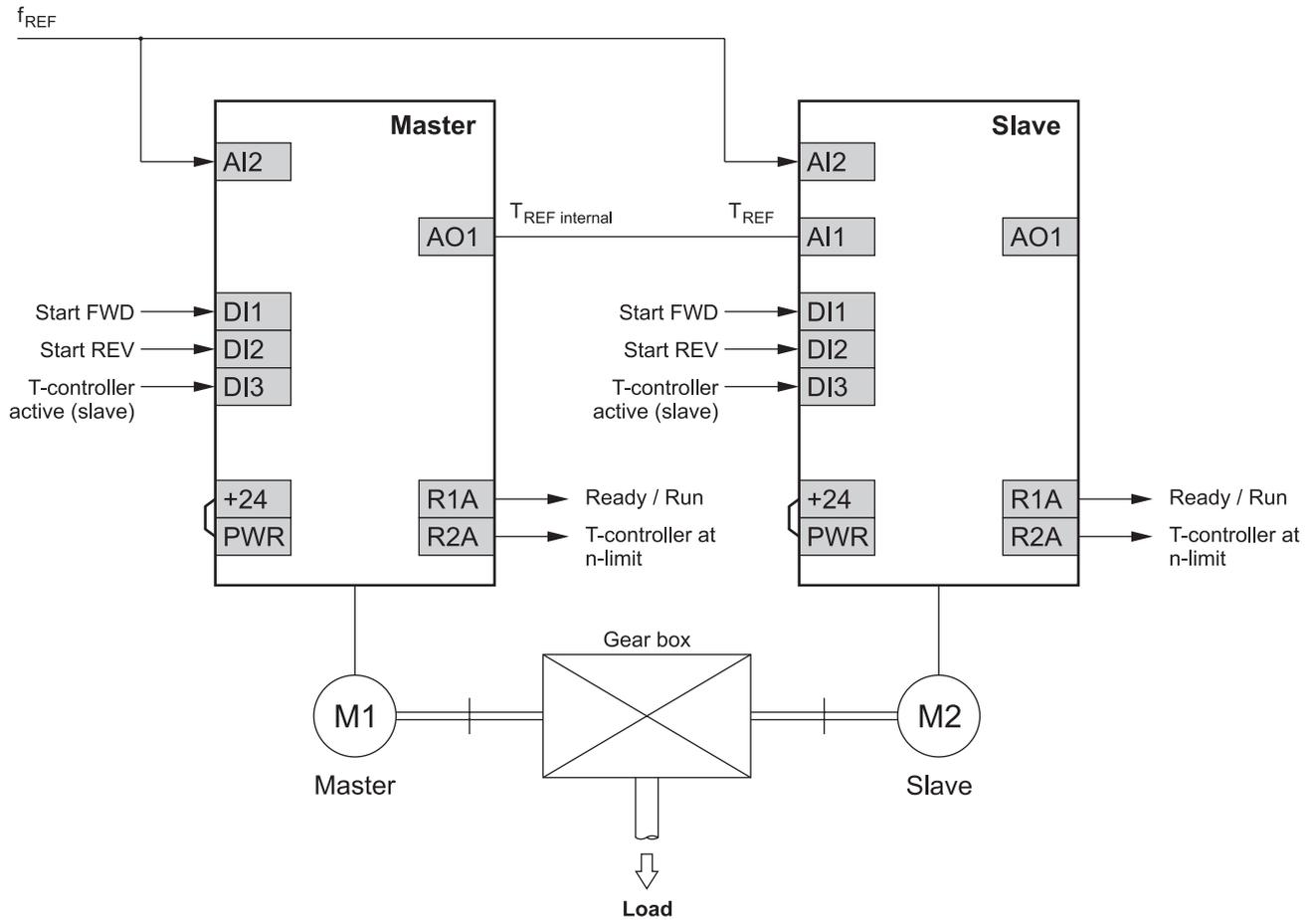


>pDRIVE< MX pro reference value path of macro M3



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>pDRIVE< 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 high 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).

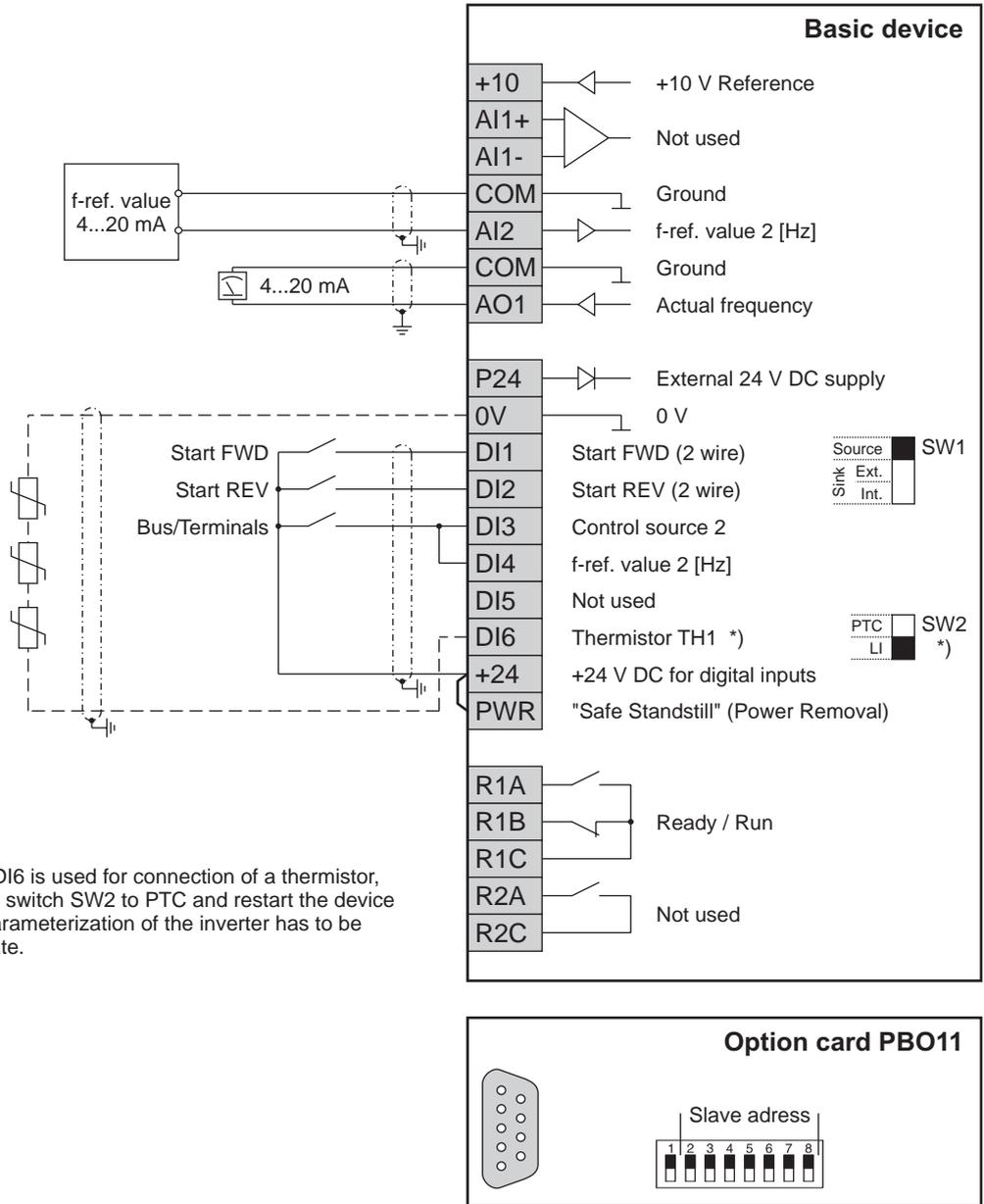


The macro values represent a pre-parameterization of the frequency inverter. Unconfined and independent of the macro setting all functions are always available in the *>pDRIVE< MX eco & pro*. These can be activated or changed according to requests of the application.

Allocation of terminals for macro M4

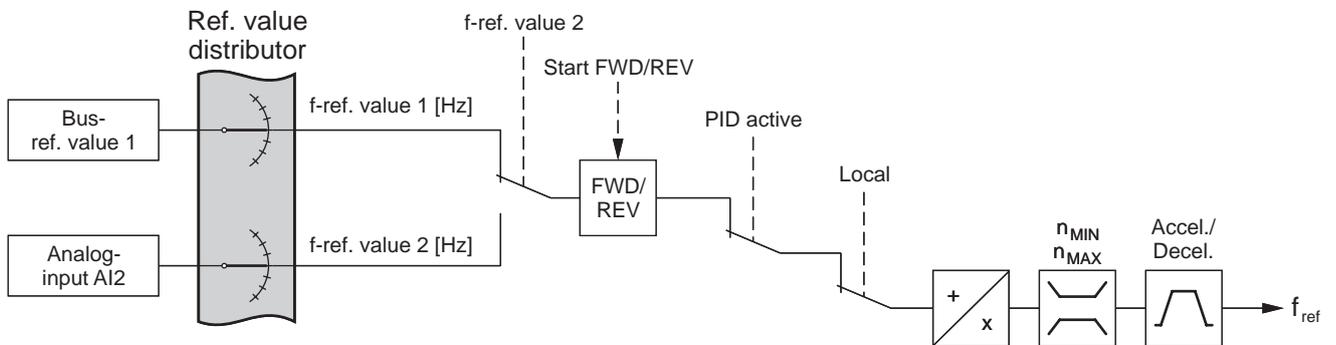
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\*) If the digital input DI6 is used for connection of a thermistor, switch the selector switch SW2 to PTC and restart the device afterwards. The parameterization of the inverter has to be adjusted appropriate.

Reference value path of macro M4



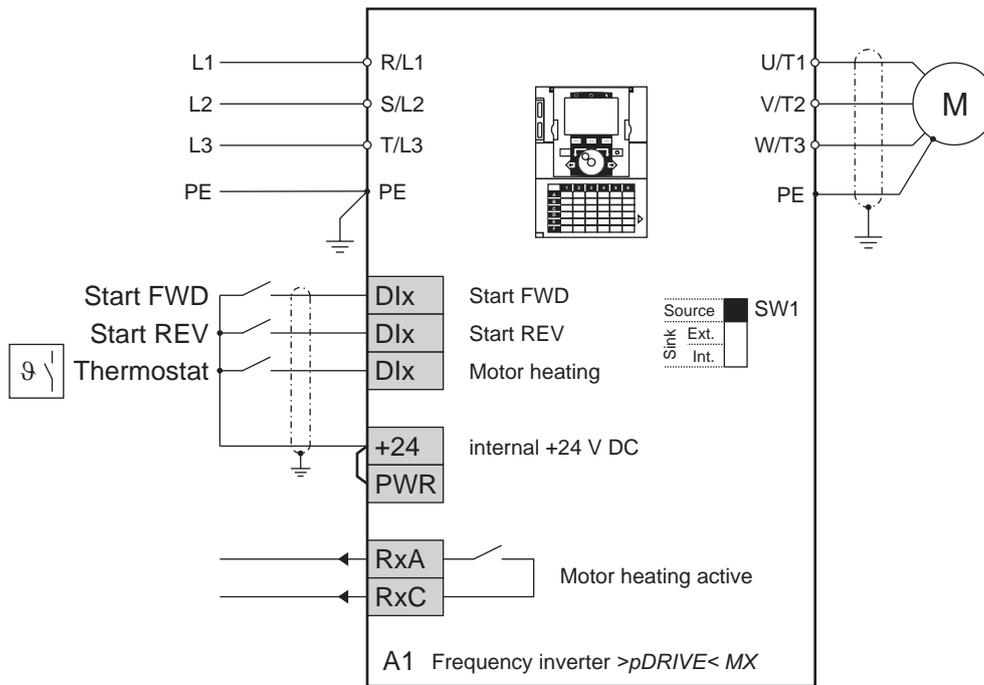


# Motor heating

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

MX eco

MX pro

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 >pDRIVE< MX eco & pro provides a range of different motor control methods.

The selection can be found in the chart mentioned 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, optimized for quadratic loads	Nominal motor data Starting voltage Flux reduction	Simple applications in the range of pumps and blowers
V/f 7 point	In 7 points free configurable 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 <sub>max</sub> field weakening Autotuning	Factory setting, all-purpose field orientated control with very good dynamics (even for multimotor drives)
VC enhanced	Optimized field orientated control without speed feedback	Nominal motor data Starting torque Slip compensation V <sub>max</sub> field weakening Autotuning	Applications with special requests concerning dynamic and starting torque performances, only for single drives e.g. compressor, extruder, conveyor belt,...
VC economy (only MX eco)	Field orientated control without speed feedback optimized for quadratic load	Nominal motor data Starting torque Slip compensation V <sub>max</sub> field weakening Autotuning Flux reduction	Drives with quadratic loads such as centrifugal pumps and fans. The energy consumption is optimized 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 <sub>max</sub> field weakening Autotuning	Applications with special requirements 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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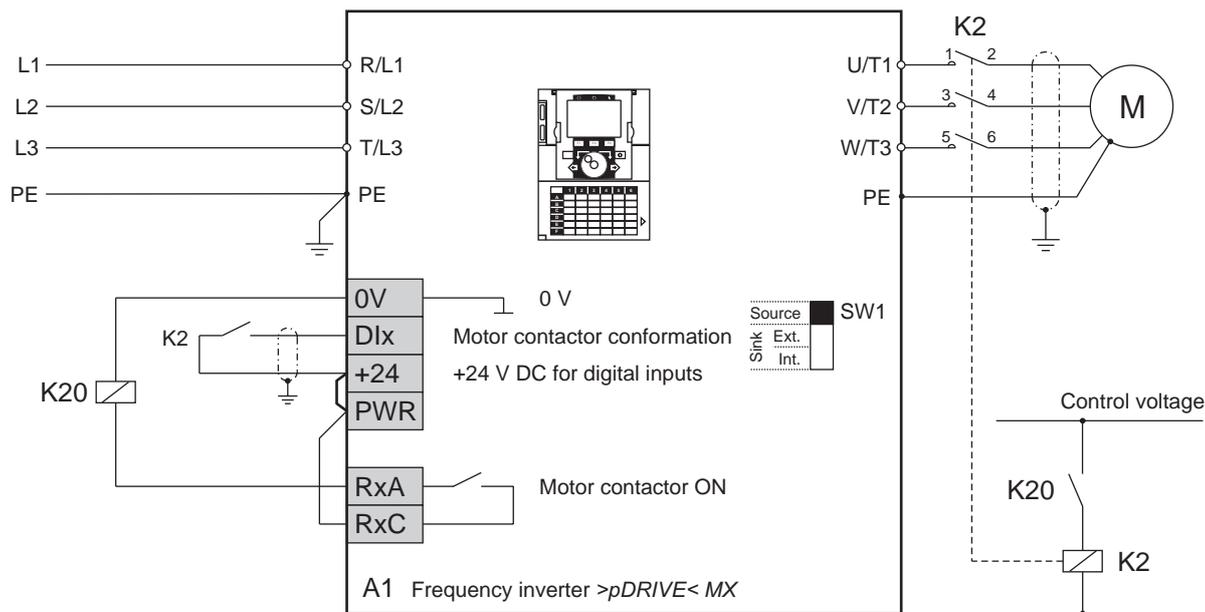
## Motor contactor control

MX eco   
MX pro

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 off 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.

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## Motor overload

MX eco

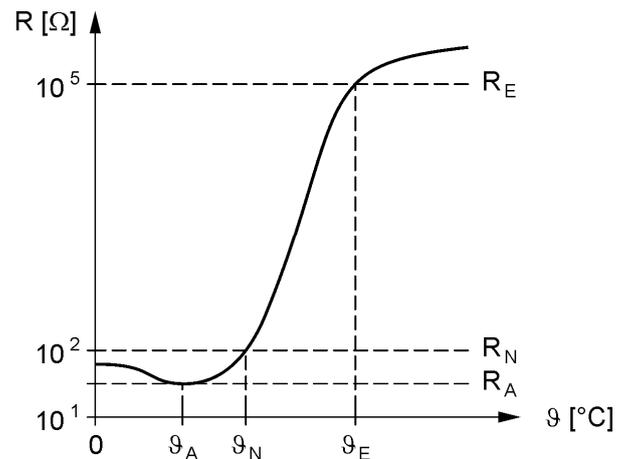
MX pro

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<sup>2</sup>t 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 >pDRIVE< MX eco & pro without an additional evaluation instrument.



Typical resistance behaviour of a PTC thermistor

### Switching points:

Overtemperature trigger	$R_{PTC} > 3 \text{ k}\Omega$
Reset value	$R_{PTC} < 1.8 \text{ k}\Omega$
Short-circuit recognition	$R_{PTC} < 50 \Omega$
Wire break recognition	$R_{PTC} > 100 \text{ k}\Omega$

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 >pDRIVE< IO11	TH2+ TH2+	
TH 3	Option >pDRIVE< IO12	TH3+ TH3+	

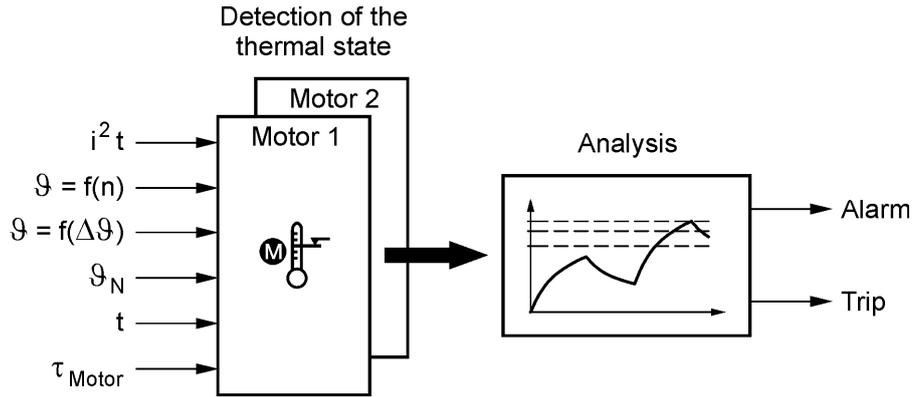


If no PTC thermistor sensors are available on the motor, the protection of the motor can be realized by means of the thermal mathematical motor model.

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.

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.



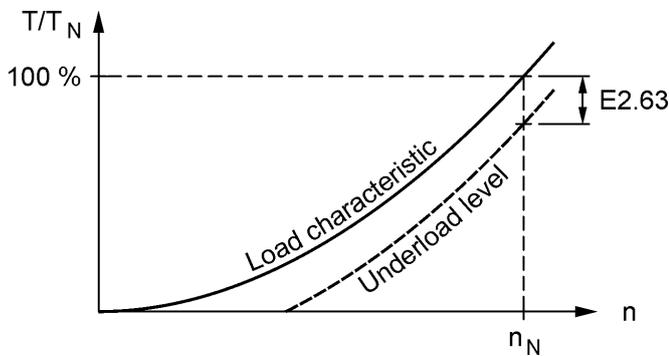
### Motor underload

- MX eco
- MX pro

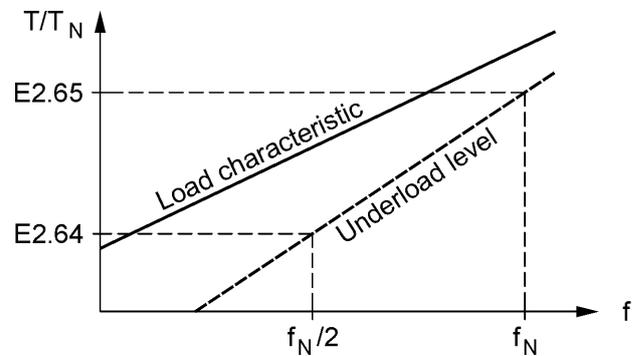
The function underload monitoring checks the mechanical load (torque) with respect to a characteristics in relation to the speed. If a load reduction occurs which is untypical for the speed range, this situation can be process-technically evaluated (e.g. checking the V-belt of a fan, output of a pump, ...).

The reference torque used for monitoring can be switched between quadratic and linear characteristics.

quadratic characteristic



linear characteristic



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### Speed controller

The >pDRIVE< MX pro frequency inverters are equipped with an extremely efficient speed/torque control circuit that 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 >pDRIVE< 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

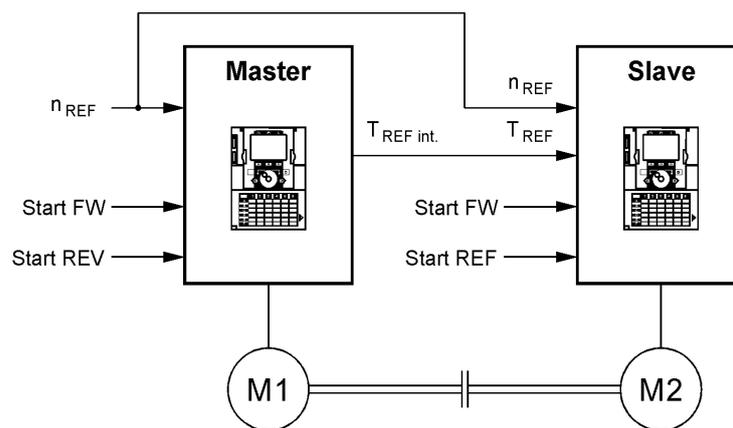
The reference torque supplied to the internal, vector-oriented motor control, is determined by the output of the speed controller in speed-controlled mode. If the drive is operated in a torque-controlled manner, the torque reference signal is switched to the external reference value channel by means 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.



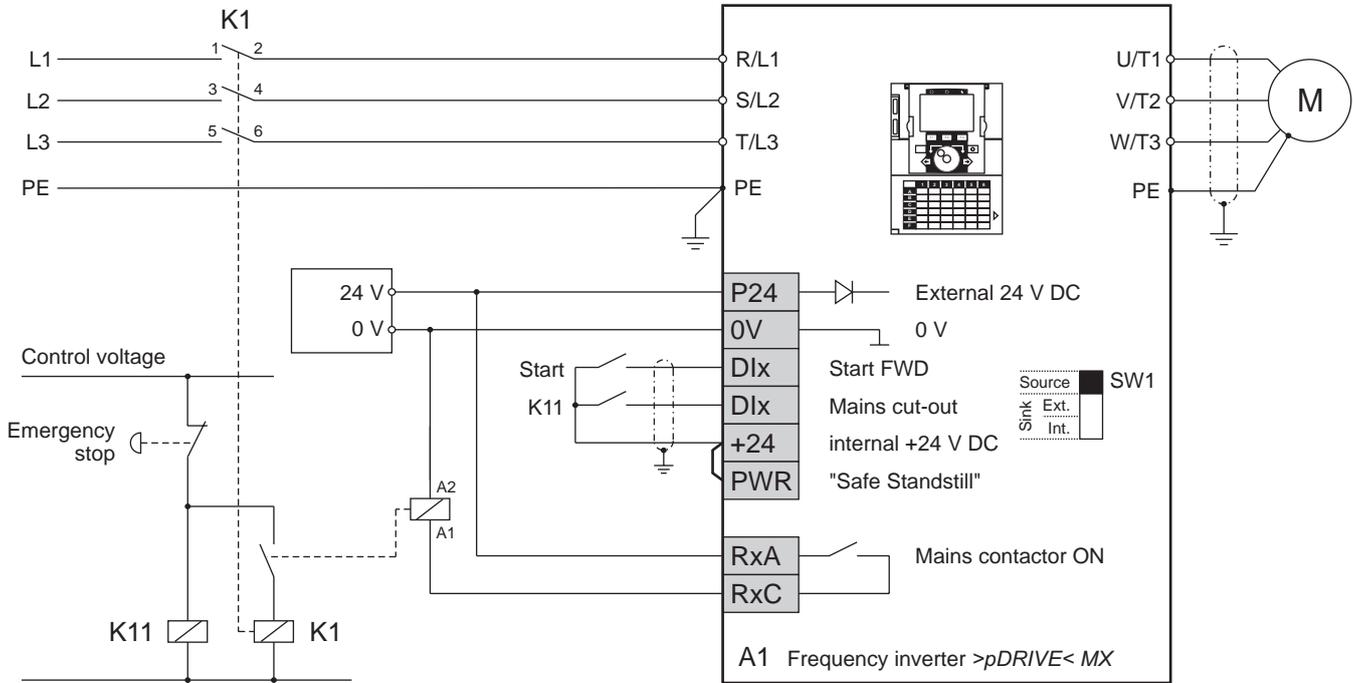
In order to build up a master/slave-coupled drive group, the output signal of the speed controller of the master ( $T_{REF-Internal}$ ) has to be integrated at the slave drives as torque reference value.



# Line contactor control

MX eco   
MX pro

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.

## **Parameter copy**

MX eco   
MX pro

The removable Matrix operating panel *>pDRIVE< 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 which 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 "Copy: Keypad -> MX" the following areas can be selected:

Selection	Function
0 .. abort	Do not start parameter transfer
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)

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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 *>pDRIVE< 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

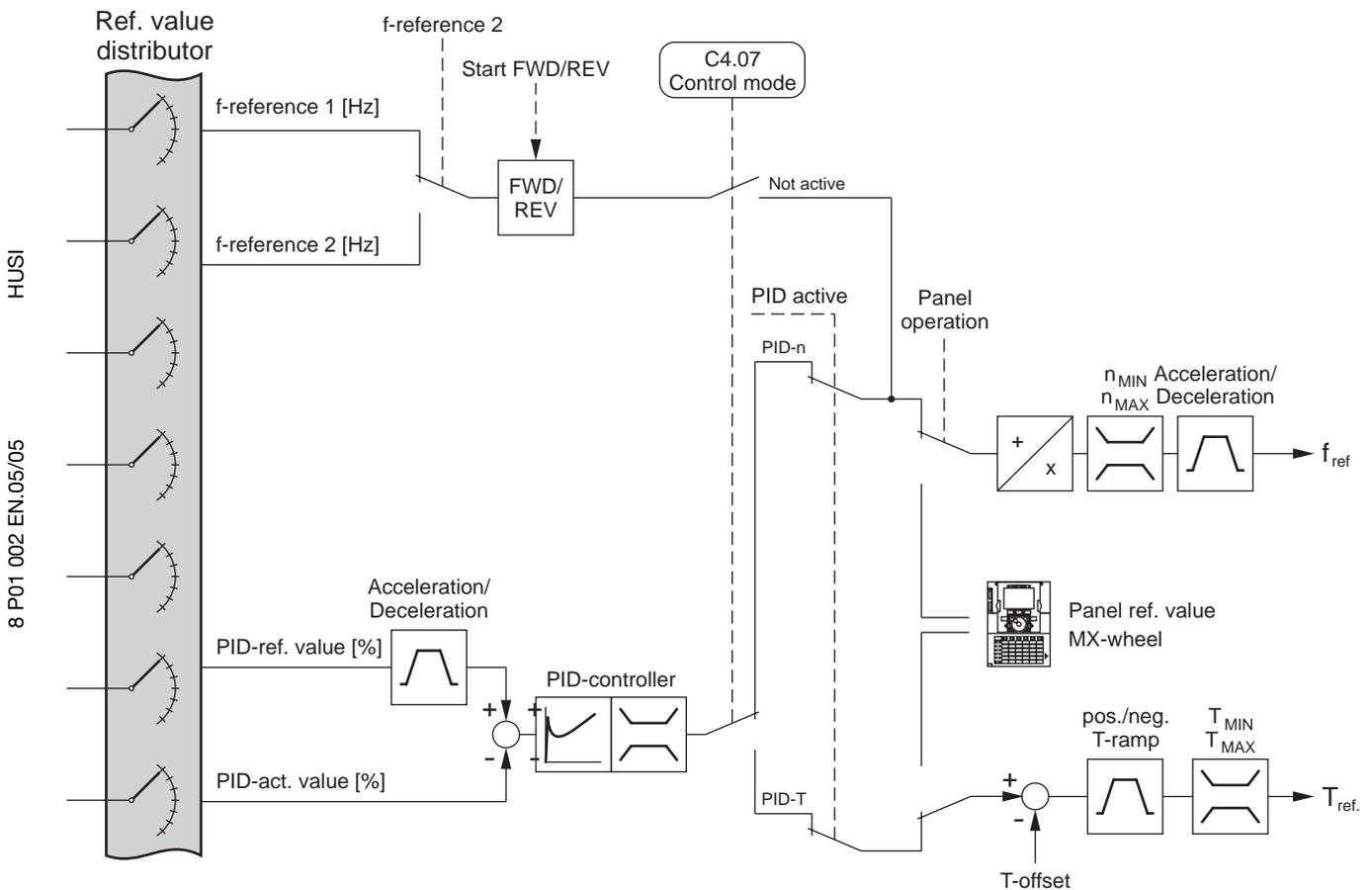
MX eco   
MX pro

The PID controller which is integrated in the >pDRIVE< 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.



The "Torque Control" function is only supported by >pDRIVE< 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)
- StandbymodeOn  
(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".

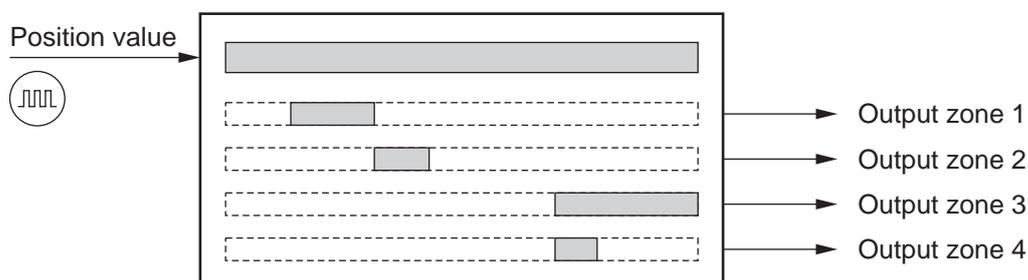


The SFB positioning can be used with all motor control variants (B3.02). It is also possible to combine this function with the final position control (slow down function).

## 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.

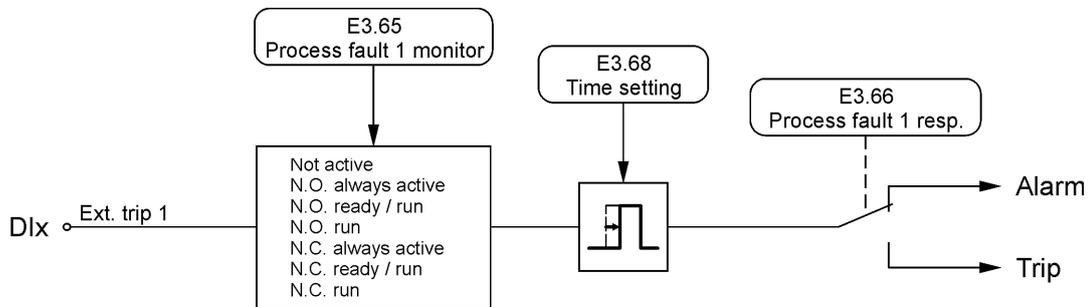


## Process fault

MX eco   
MX pro

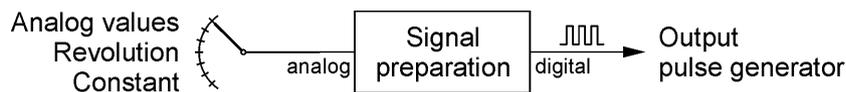
Should signals of the drive or the process be integrated in the inverter protection concept then this occurs with the digital inputs "Process fault 1" to "Process fault 3". The tripping behaviour and the temporal trigger performance are therefore adjustable to the demands of the system.

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.



## Safe standstill

MX eco

MX pro

The >pDRIVE< 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

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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**

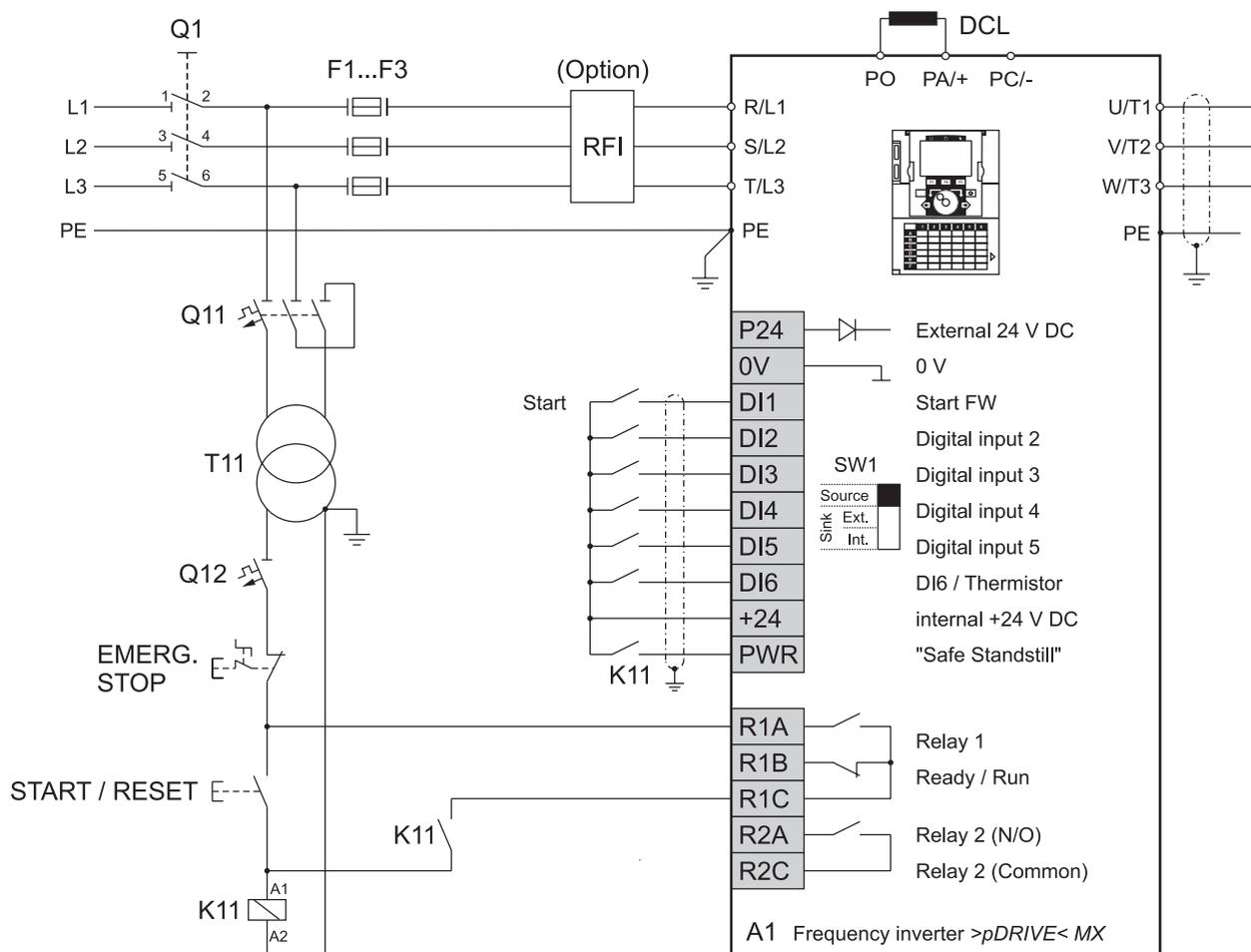


The “Power Removal” safety function must be activated at least once a year for preventive maintenance purposes.

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.



Control of the drive by means of the digital input PWR "Safe Standstill"



- A1..... Frequency inverter >pDRIVE< MX eco or >pDRIVE< 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



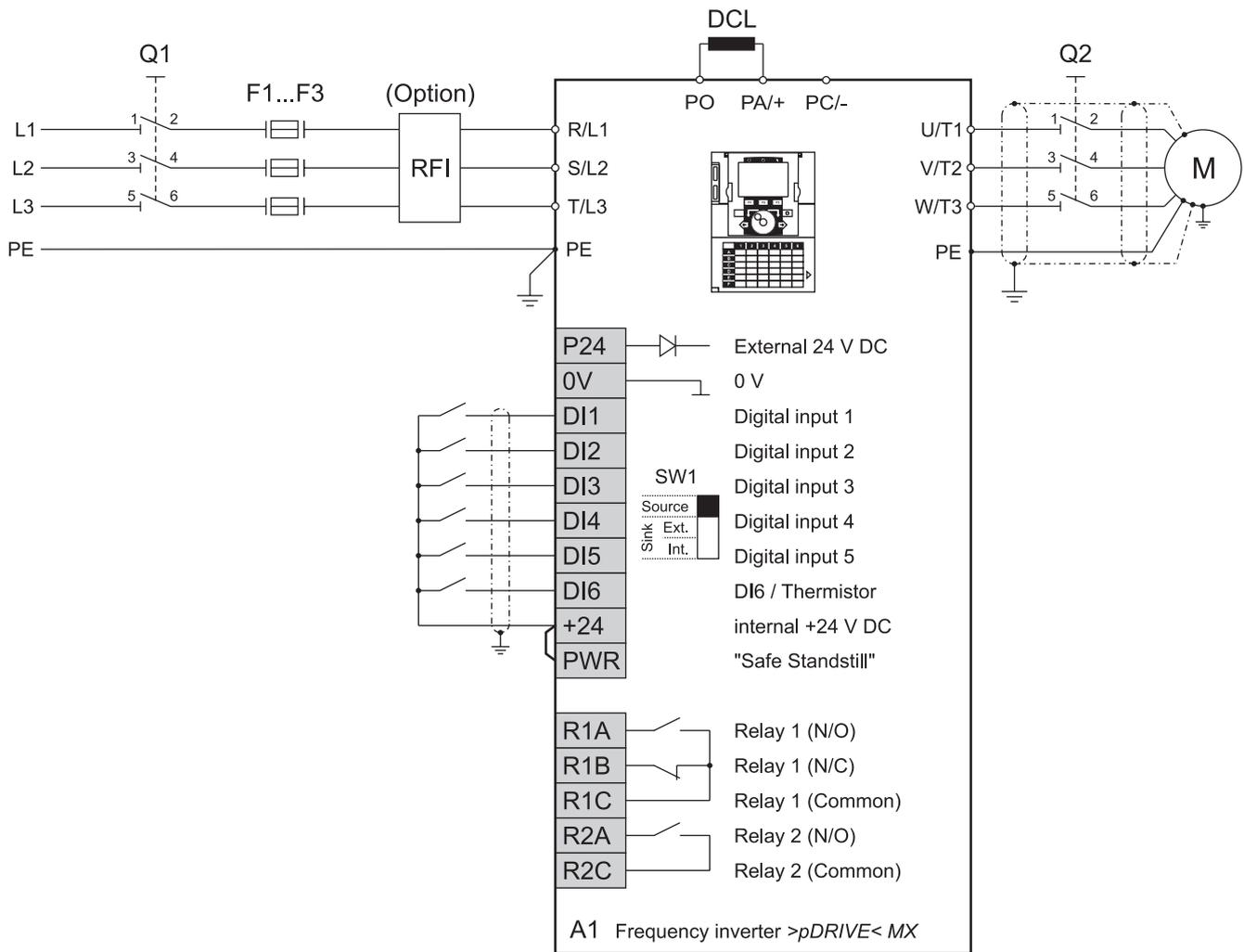
This wiring diagram uses the safety function "Safe Standstill" with impulse inhibit of the >pDRIVE< MX eco & pro by means of the safety input PWR (Power removal). The emergency STOP circuit is monitored by means of the auxiliary relay K11.

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.

Control of the drive by means of a motor switch



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A1 ..... Frequency inverter >pDRIVE< MX eco or >pDRIVE< 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.



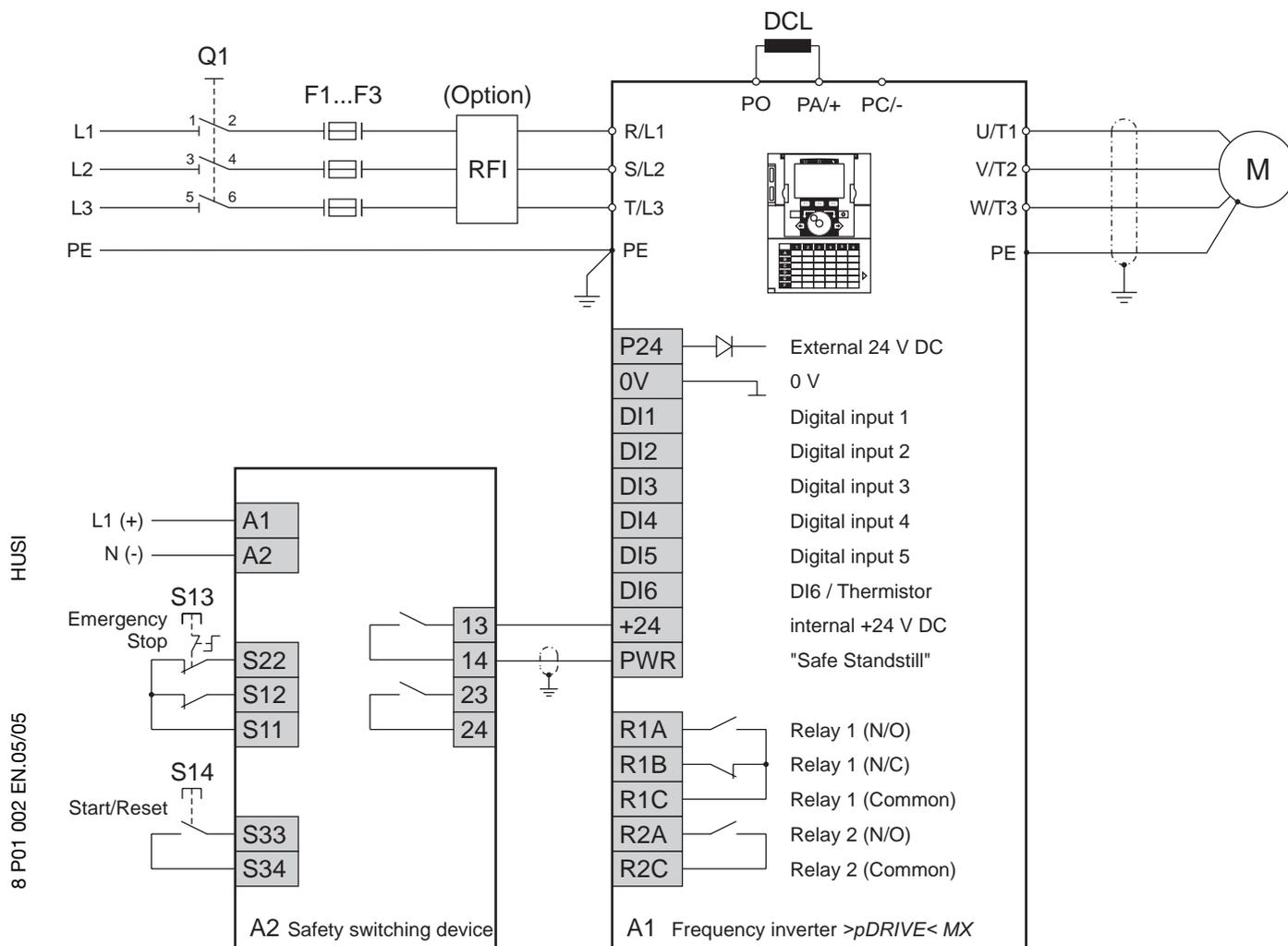
Function, use and limits of the inputs and outputs can be set as required.



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

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).



A1..... Frequency inverter *>pDRIVE< MX eco* or *>pDRIVE< 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 *>pDRIVE< 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.



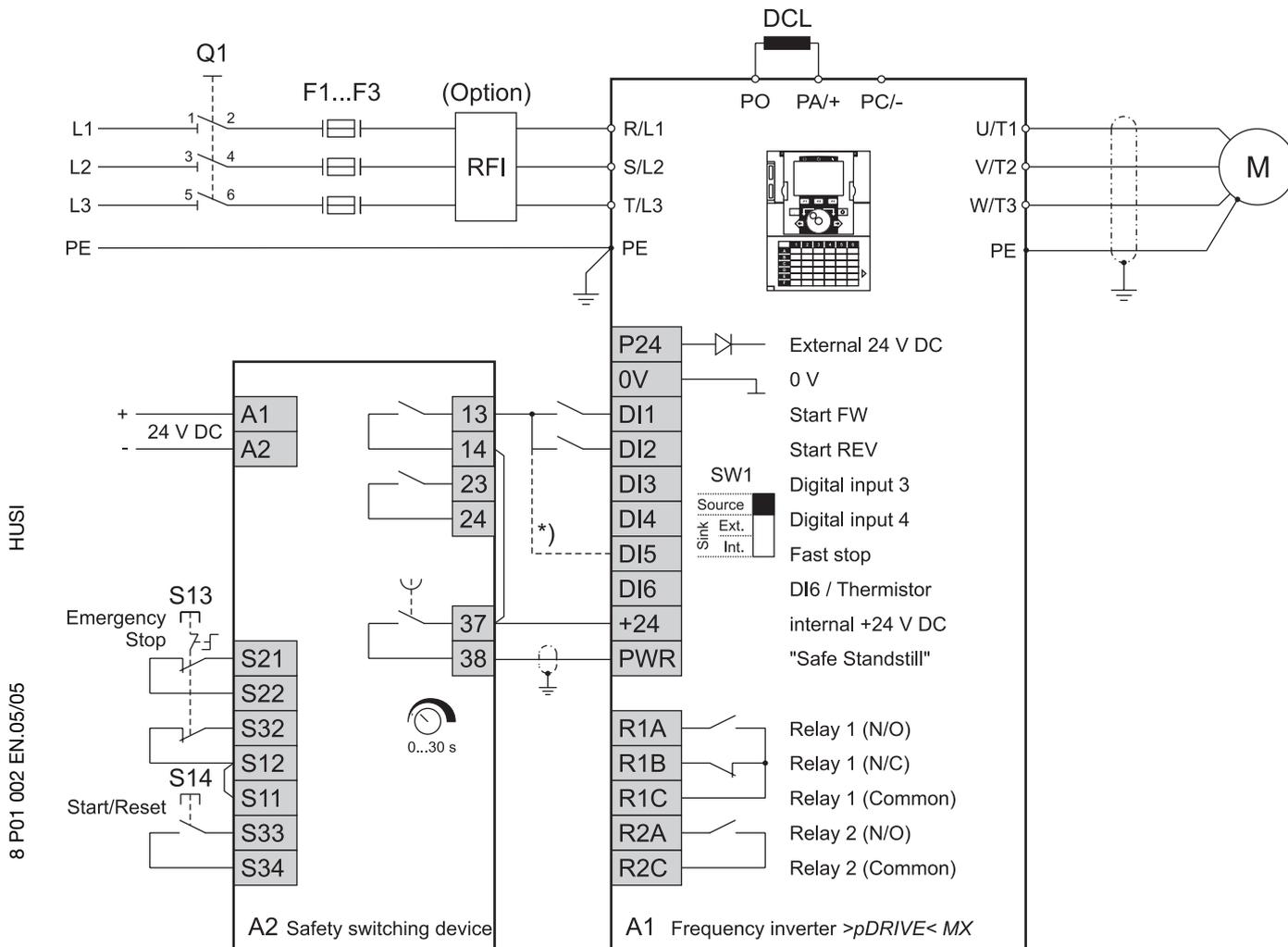
The connection of the safety relay and the input PWR "Safe Standstill" must be a screened coaxial-cable of type RG174/U according to MIL-C17 (company LAPP) or KX3B according to NF C 93-550, outer diameter 2.8 mm with maximum length of 15 m.

It is essential that the screen is grounded.



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

This wiring diagram is typical for drives with long deceleration time (high moment of inertia or low resistive torque).



- A1..... Frequency inverter >pDRIVE< MX eco or >pDRIVE< 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 >pDRIVE< 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.

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

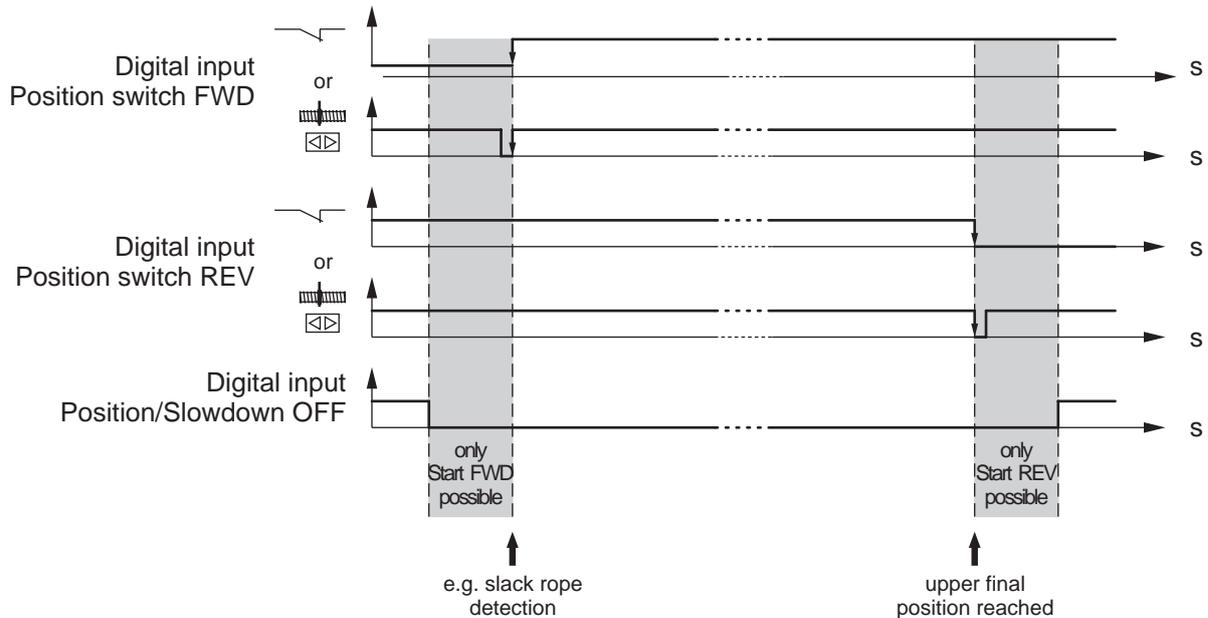
MX eco   
 MX pro

Two special slowdown functions of the >pDRIVE< 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".



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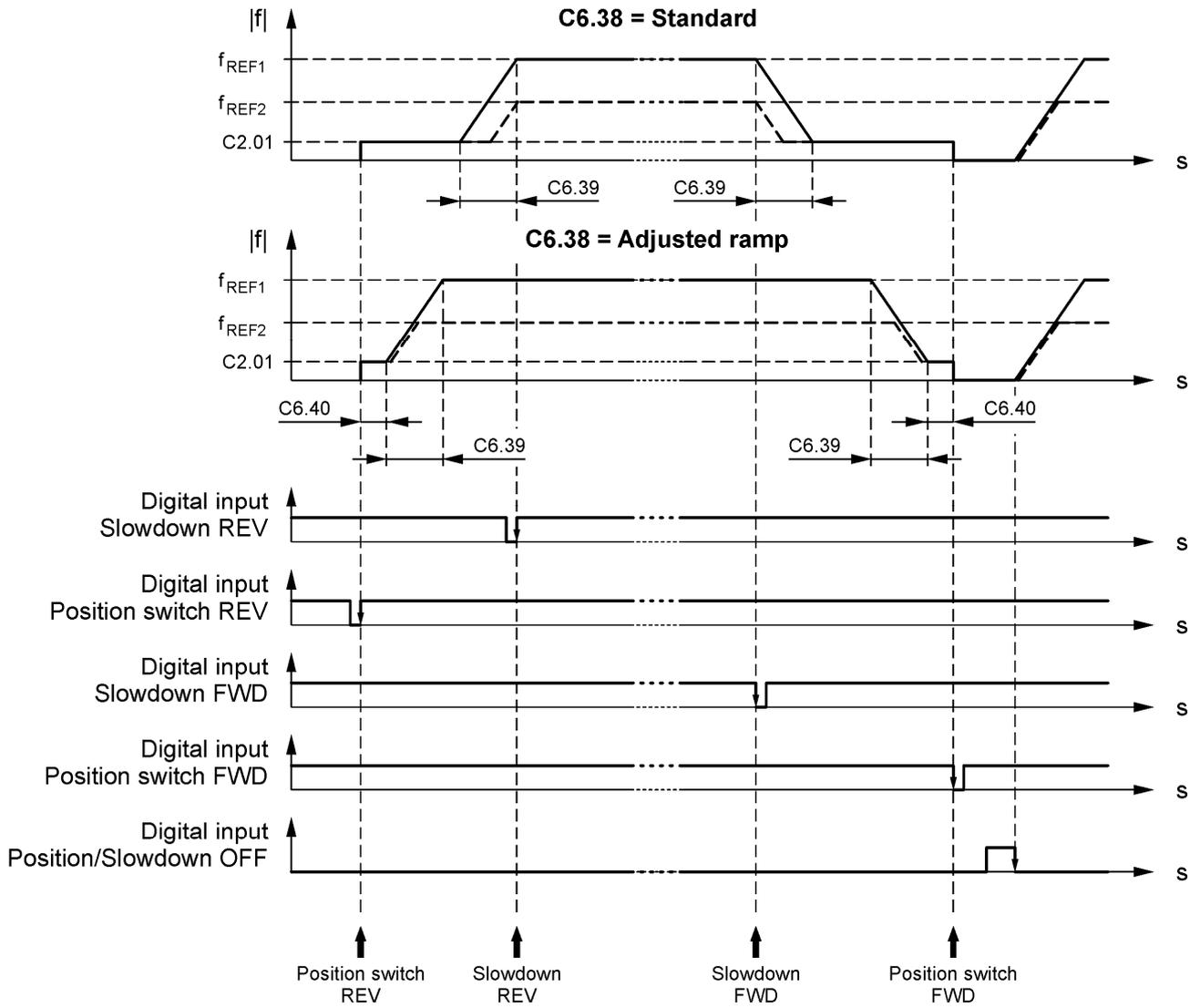
The final position control can also be used without the slowdown function.

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.



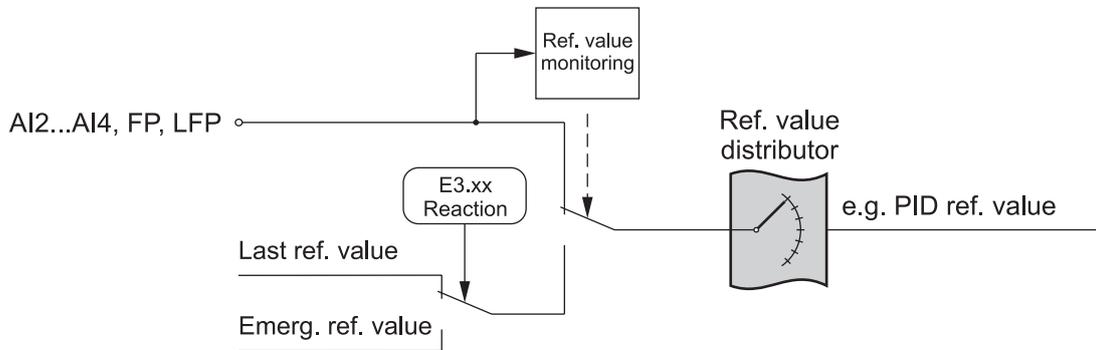
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## 4mA Reference value monitoring

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

The frequency inverters >pDRIVE< 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.

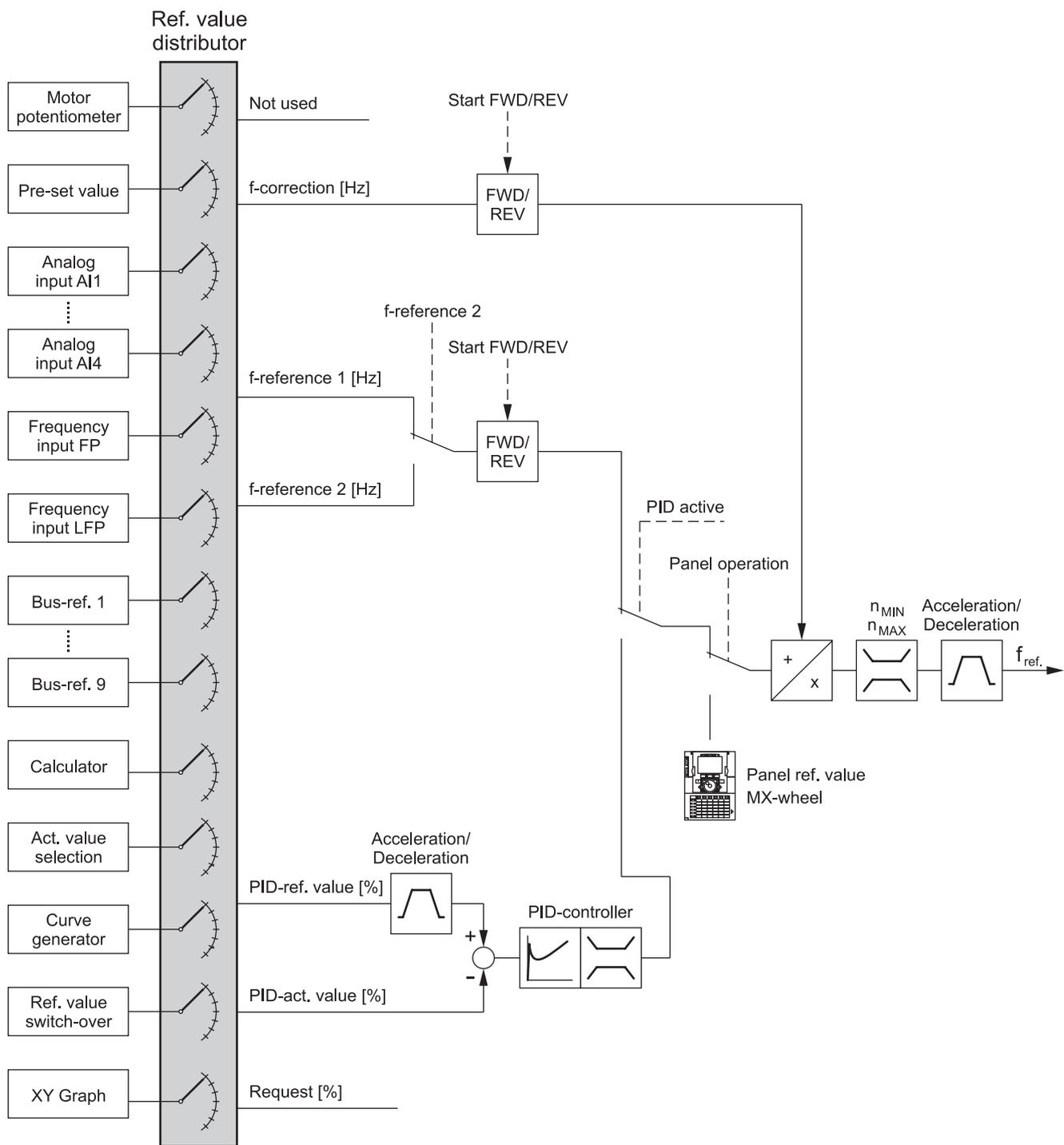
All reference sources can be influenced via corresponding parameterization in their activity and finally can be further used via the reference value distributor.

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 >pDRIVE< 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.

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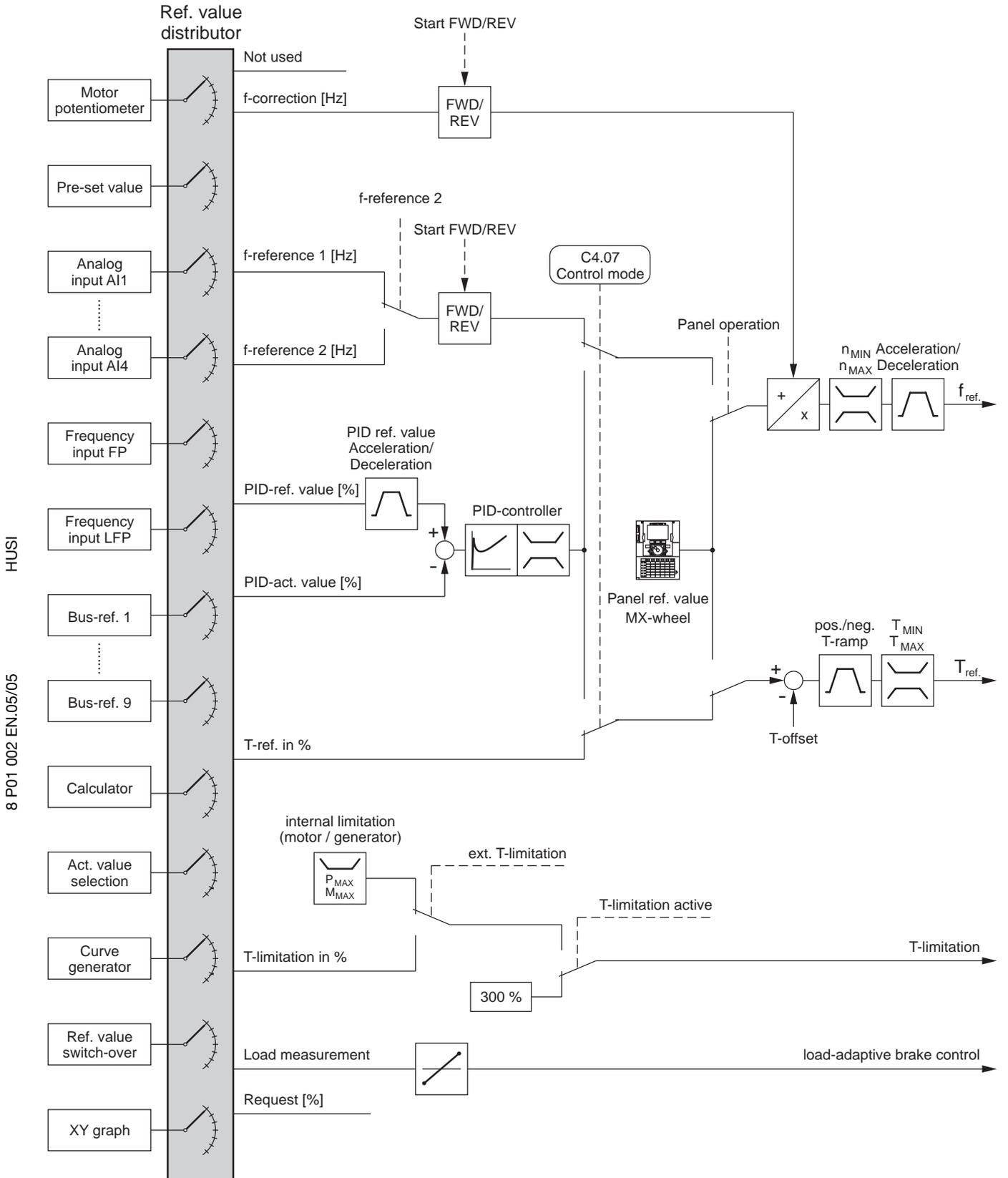
>pDRIVE< MX eco Reference value distributor with all objectives



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>pDRIVE< MX pro Reference value distributor with all objectives



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8 P01 002 EN.05/05

## II 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.

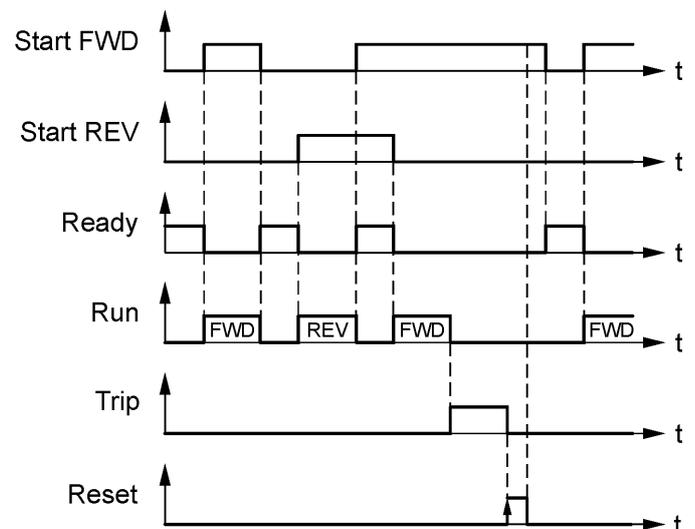
Basically you can differentiate between the panel control with the built-in LED-keypad or the removable Matrix operating panel and the remote control via the terminals or an integrated or optional fieldbus connection.

#### 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.

If 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.



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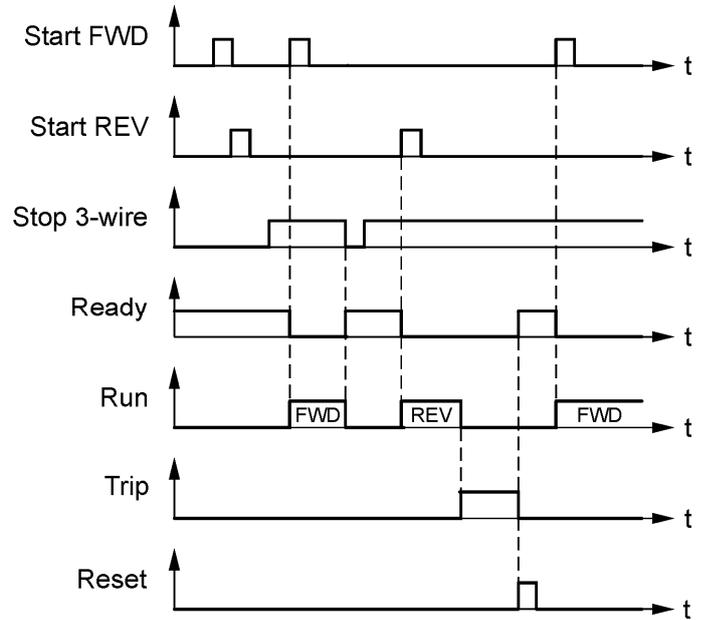
### 3-wire control

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 "Stop (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.

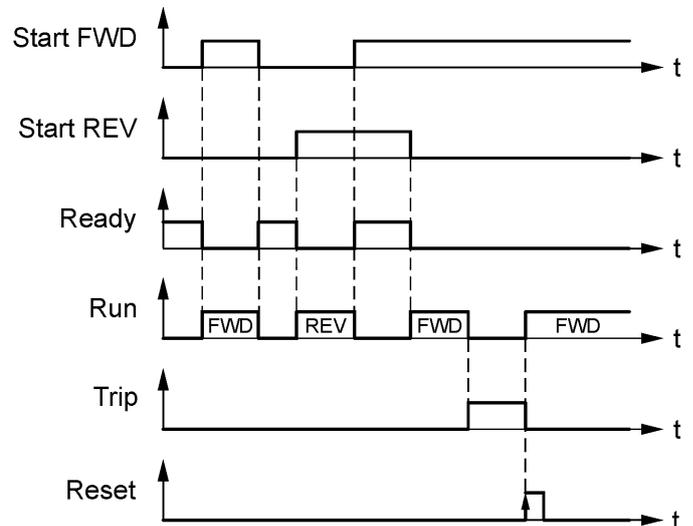


### 2-wire control (level rated)

The level rated 2-wire-control is used when replacing devices of the range *>pDRIVE< MX basic* or *>pDRIVE< MX plus* by a *>pDRIVE< 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.

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

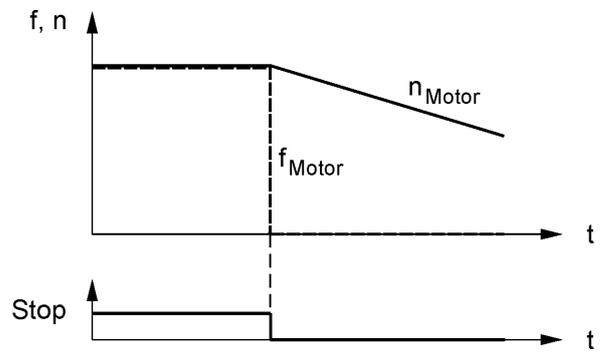
The behaviour of the frequency inverter when the stop command takes effect can be defined by parameter B3.24...B3.26. Therefore it is of no importance from which control source the stop command comes (see function "Control configuration", page 322).



In all cases a further start command leads to a restart of the drive.

**Free wheel**

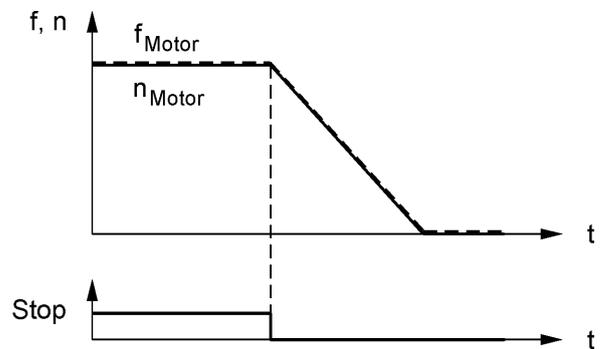
A stop command leads to immediate locking of the output-sided transistor bridge. The motor runs in free wheel without current.



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**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.



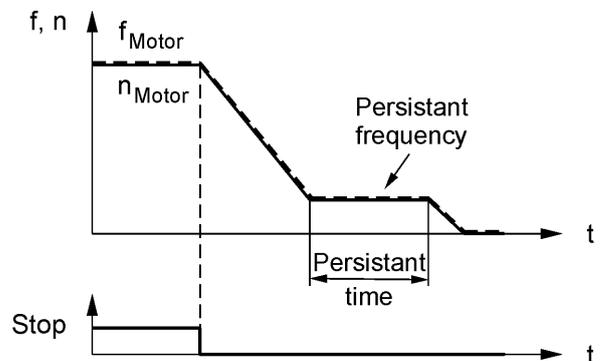
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**Deceleration with persistence**

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.

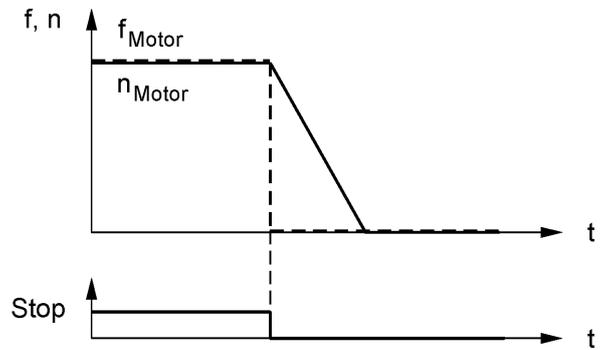
The persistence frequency can also be set below the allowed minimum frequency.



### 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).

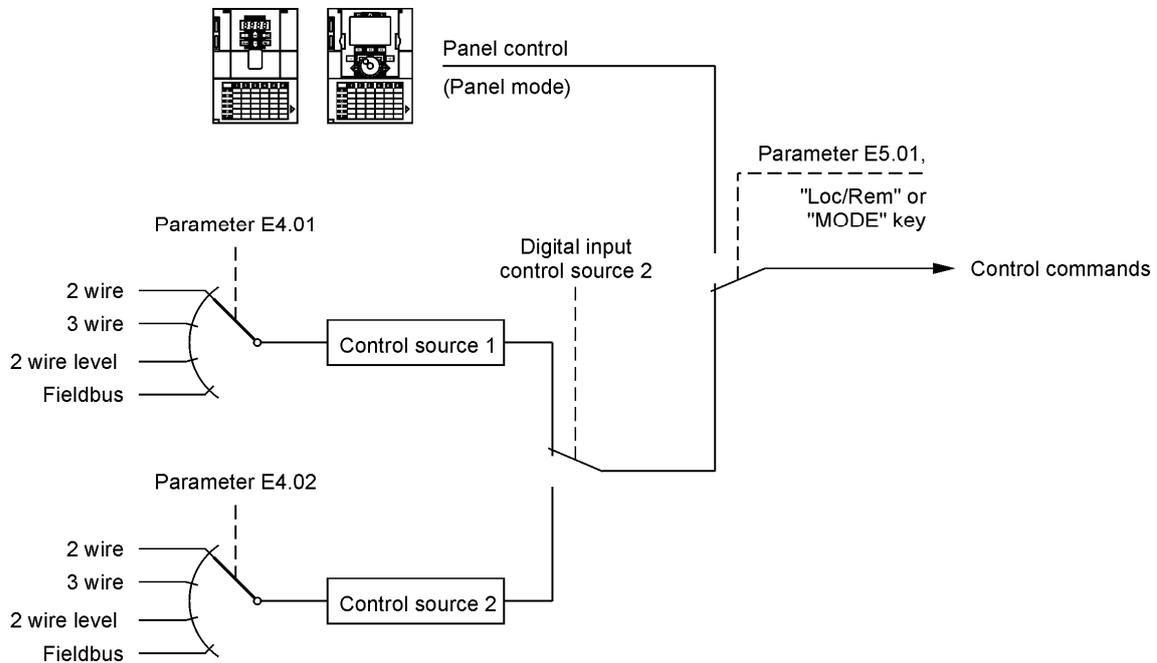


### Switching of the control sources

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.



## 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).

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## Alarm messages

MX eco

MX pro

With the monitoring and protection concept of the >pDRIVE< 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.

## 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"

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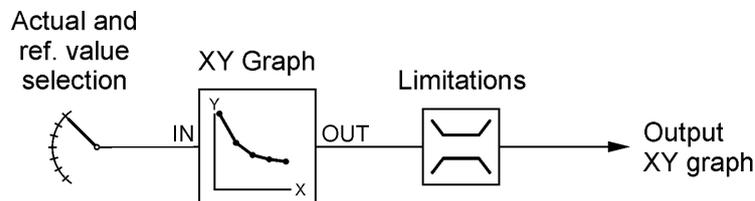


If the counters of operating hours exceed 60.000 hours (approx. 7 years in case of 24 hour operation) the counters are automatically reset and start counting again from zero hours.



## 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

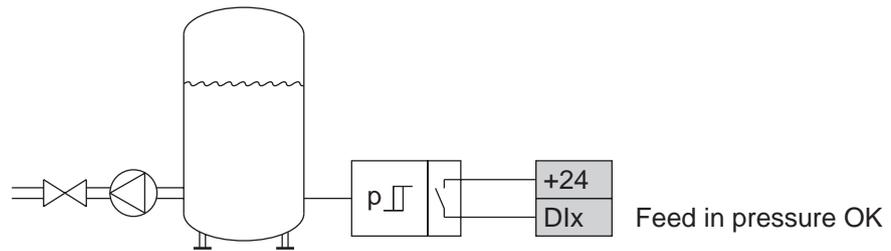
An inflow pressure that is too low can lead to cavitation problems up to dry running of centrifugal pumps. The protection function "Feed-in monitoring" recognises this risk and initiates a corresponding protection method.

The acquisition can occur in two different ways as described subsequently.

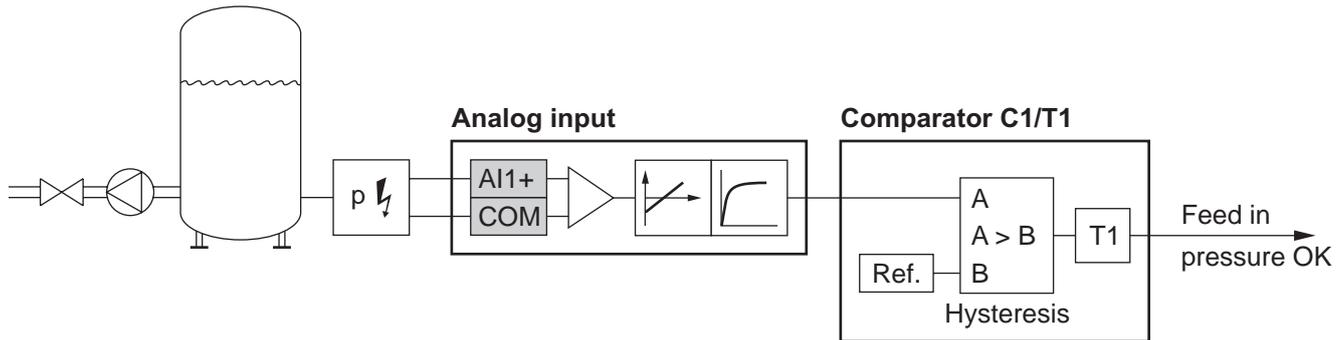
### Pressure monitoring

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.

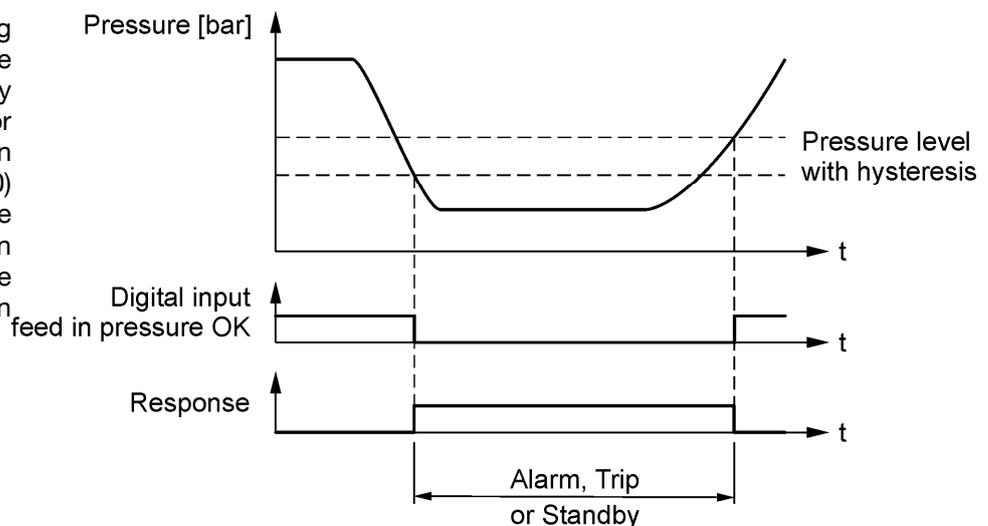
#### Pressure sensor with switching output



#### 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.

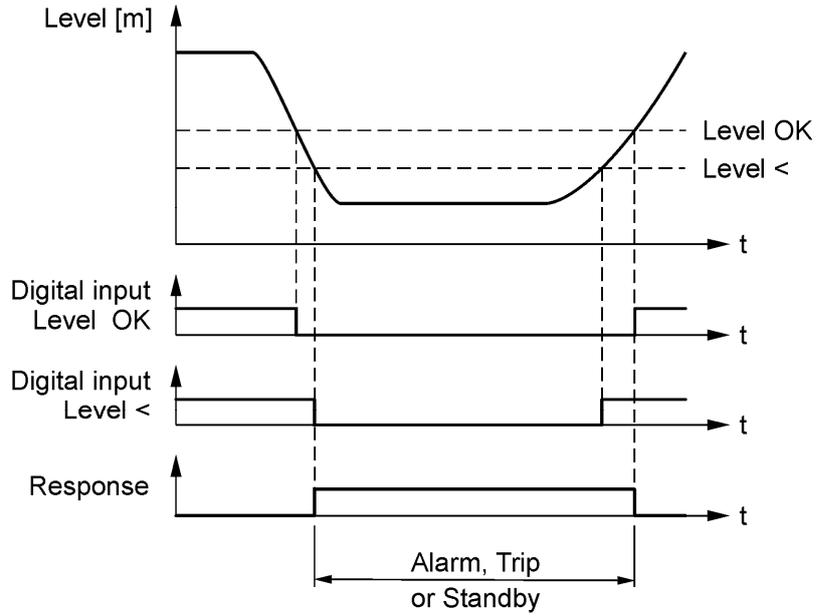
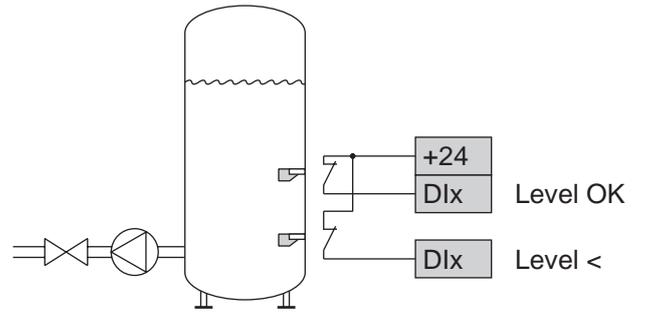


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## Level monitoring

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 <".

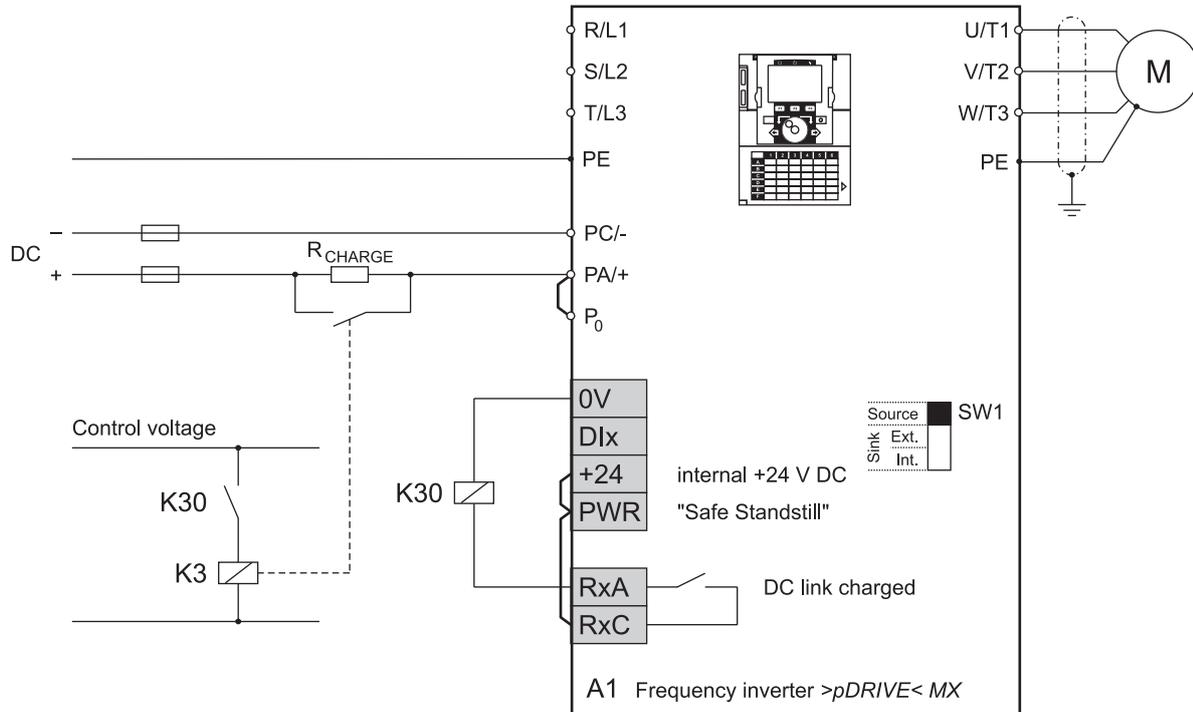


 **DC-supply**

MX eco   
 MX pro

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 or 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 Seller's 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 be 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, Seller's warranty shall be restricted to non-compliance with Buyer's 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 Seller's 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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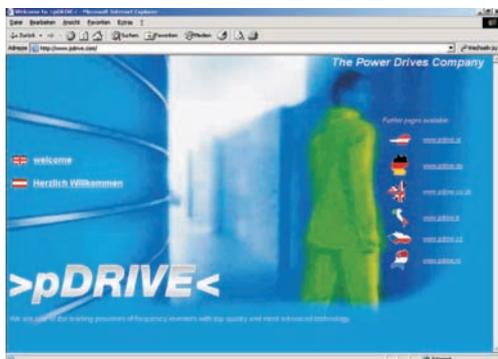
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