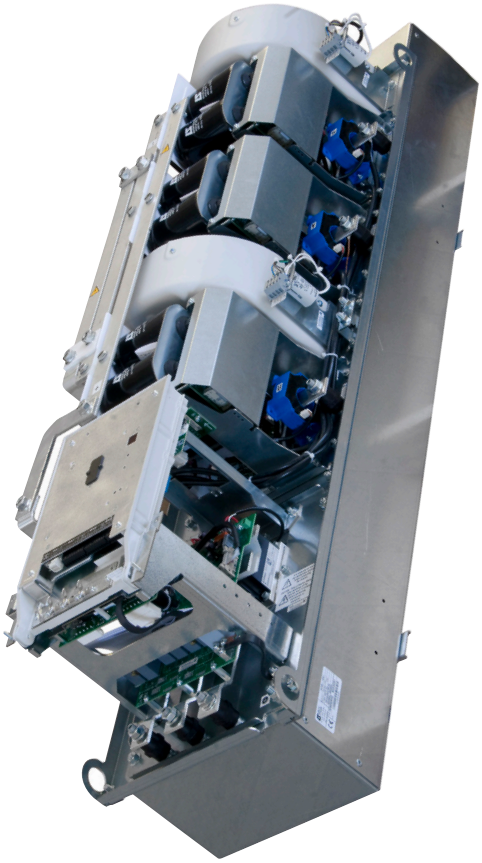
Nidec

All for dreams



Installation guide

POWERDRIVE MD2CS

60T to 570T
270TH to 500TH

High-power IP00
drive solution

Reference : 4946en - 2017.12 / c

LEROY-SOMER™

NOTE

LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document is therefore liable to be changed without notice.

WARNING

For the user's own safety, this variable speed drive must be connected to an approved earth (⏚ terminal).
If accidentally starting the installation is likely to cause a risk to personnel or the machines being driven, it is essential to comply with the power connection diagrams recommended in this manual.

The variable speed drive is fitted with safety devices which, in the event of a problem, control stopping and thus stop the motor. The motor itself can become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, can also cause the motor to stop. The removal of the causes of the shutdown can lead to restarting, which could be dangerous for certain machines or installations.
In such cases, it is essential that the user takes appropriate precautions against the motor restarting after an unscheduled stop.

The variable speed drive is designed to be able to supply a motor and the driven machine above its rated speed.
If the motor or the machine are not mechanically designed to withstand such speeds, the user could be exposed to serious danger resulting from their mechanical deterioration.
Before programming a high speed, it is important that the user checks that the installation can withstand it.

The variable speed drive which is the subject of this manual is designed to be integrated in an installation or an electrical machine, and can under no circumstances be considered to be a safety device. It is therefore the responsibility of the machine manufacturer, the designer of the installation or the user to take all necessary precautions to ensure that the system complies with current standards, and to provide any devices required to ensure the safety of equipment and personnel.

LEROY-SOMER declines all responsibility in the event of the above recommendations not being observed.

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This manual only describes the general features, characteristics and installation of the POWERDRIVE MD2CS. For commissioning, refer to manual ref. 4617.

(In accordance with the low voltage directive 2014/35/EU)

⚠ Throughout the manual, this symbol warns of consequences which can arise from inappropriate use of the drive, since electrical risks can lead to material or physical damage as well as constituting a fire hazard.

1 - General information

Depending on their degree of protection, variable speed drives can contain unprotected live parts, which can be moving or rotating, as well as hot surfaces, during operation.
Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel and equipment.
For further information, consult the manual.
All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364, CENELEC HD 384 or DIN VDE 0100, as well as national specifications for installation and accident prevention).
In these basic safety instructions, qualified personnel means persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

2 - Use

Variable speed drives are components designed for integration in installations or electrical machines.
When integrated in a machine, commissioning must not take place until it has been verified that the machine conforms with directive 2006/42/EC (Machinery Directive). It is also necessary to comply with standard EN 60204, which stipulates in particular that electrical actuators (which include variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches.
Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2014/30/EC) are met.
The variable speed drives meet the requirements of the Low Voltage Directive 2014/35/EU. The harmonized standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.
The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage

All instructions concerning transportation, storage and correct handling must be observed.
The climatic conditions specified in the technical manual must be observed.

4 - Installation

The installation and cooling of equipment must comply with the specifications in the manual supplied with the product.
Variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts.
Variable speed drives contain parts that are sensitive to electrostatic stresses and can easily be damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!).

5 - Electrical connection

When work is performed on variable speed drives that are powered up, the national accident prevention regulations must be respected.
The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fused circuit-breaker, connection of protective conductor). More detailed information is given in the manual.
Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct laying of cables and conductors, are given in the documentation supplied with the variable speed drives. These instructions must be followed in all cases, even if the variable speed drive carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation

Installations in which variable speed drives are to be integrated must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations, such as the law on technical equipment, accident prevention regulations, etc. Modifications to the variable speed drives using control software are permitted.
Active parts of the device and the live power connections must not be touched immediately after the variable speed drive is powered down, as the capacitors could still be charged. In view of this, the warnings fixed to the variable speed drives must be observed.
Permanent magnet motors generate electrical energy while they are rotating, even when the drive is switched off. In this case, the drive continues to be powered by the motor terminals. If the load is capable of turning the motor, a switching device must be provided upstream of the motor to isolate the drive during maintenance operations.
During operation, all doors and protective covers must be kept closed.

7 - Servicing and maintenance

Refer to the manufacturer's documentation.
See the Maintenance section in this document.

This manual is to be given to the end user.

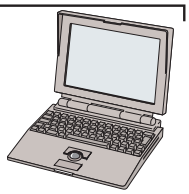
This manual describes the installation of **POWERDRIVE MD2CS** variable speed drives. It also gives details of all its options and extensions which the user may choose to suit his requirements.

POWERDRIVE MD2CS

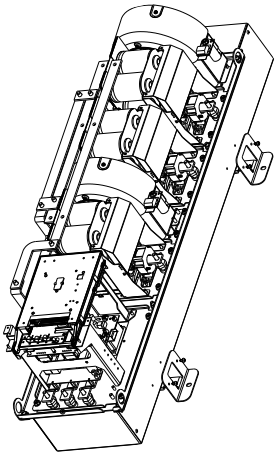
Parameter setting

MDX-Powerscreen parameter-setting interface

MDX-KEYPAD



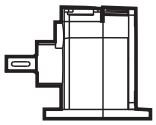
MDX-SOFT Parameter-setting software + PC link cable



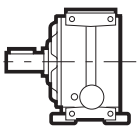
Options

- Line choke
- RFI filter
- Encoder or resolver input
- Additional I/O
- Datalogger
- Fieldbus communication modules
- HMI or Keypad

Gearboxes

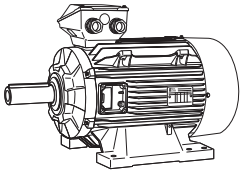


Compabloc
• Axial output
- Helical gears

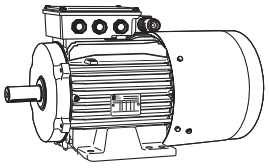


Orthobloc
• Orthogonal output
- Helical bevel gears

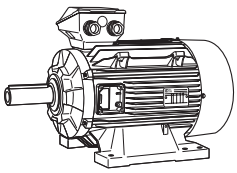
Motors



IMfinity® motor
LSES-FLSES

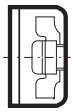


LSMV motor



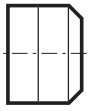
Dyneo® motor
LSRPM-PLSRPM

Motor options



Axial forced ventilation

Encoder/Sensor



Brake

Radial forced ventilation

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1 - GENERAL INFORMATION

1.1 - General

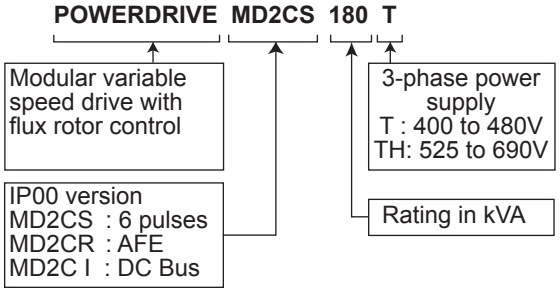
The **POWERDRIVE MD2CS** is a variable speed drive with very high performance levels that can be used to control:
- Induction motors without speed sensor (open loop mode select) for applications that do not need rated torque control above 1/10th of the rated speed.
- Asynchronous or synchronous permanent magnet motors with virtual speed feedback (flux vector mode with software sensor function) for applications that require rated torque control from 1/20th of the rated speed.

Combined with the MDX-ENCODER option, the **POWERDRIVE MD2CS** is a drive that can also be used to control asynchronous or synchronous magnet machines for applications that require very high dynamic performances, torque control from zero speed or high speed accuracy (closed loop vector mode with speed feedback).

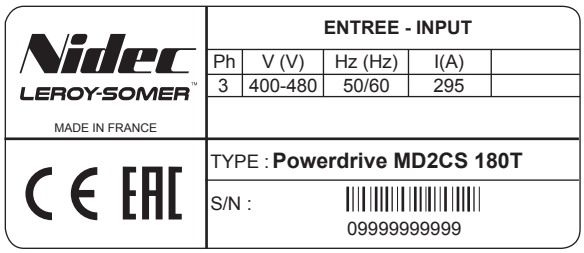
The performance of **POWERDRIVE MD2CS** is compatible with use in all 4 quadrants of the torque/speed plane with the braking module option.

POWERDRIVE MD2CS drives are IP00 protection products, designed to be installed in a cabinet with limit access to only habilited and trained personnel. A line reactor and a surge protection module must be connected to the drive.

1.2 - Product designation



Nameplate



I(A) = maximum input current for 400 V mains supply, in normal duty

The nameplate can be found at the bottom right-hand side of the product (front view).

1.3 - Environmental characteristics

Characteristic	Level
Protection	IP00
Storage and transport temperature	-30°C to +60°C (see section 7.1)
Ambient operating temperature (outside the cabinet)	-10°C to +40°C, up to +50°C with derating (see section 1.4.4)
Classification of environmental conditions	In accordance with IEC 60721-3-3: • Biological classification in accordance with class 3B1 • Classification as regards chemically active substances in acc. with class 3C2 • Classification as regards mechanically active substances in acc. with class 3S2
Relative humidity	In accordance with IEC 60068-2-56 < 90% non condensing
Altitude	≤ 1000 m without derating > 1000 m up to 4000 m maximum (as required): • Current derating of 1% per additional 100 m *E.g. for 1300 m, derate the Ico and Imax currents by 3%* • Operating temperature derating of 0.6°C per 100 m *E.g. for 1300 m, the electrical characteristics are maintained for an ambient temperature of [40°- (3 x 0.6°)] = 38.2°C.*
Vibrations	In accordance with IEC 60068-2-6 • Exposed product: 2 m/s² (9-200 Hz), 0.6 mm (2-9 Hz) • Packaged product: 10 m/s² (9-200 Hz), 3 mm (2-9 Hz)
Shocks	Packaged product: in accordance with IEC 60068-2-29
Atmospheric pressure	700 to 1060 hPa

1.4 - Electrical characteristics

All work relating to installation, commissioning and maintenance must be carried out by experienced, qualified personnel.

1.4.1 - General characteristics

Characteristic	Level
Power supply voltage	3-phase mains supply: 400 V -10% to 480 V +10% ("T" ratings) or 525 V -10% to 690 V +10% ("TH" ratings)
Phase voltage imbalance	< 2%
Input frequency	«T» ratings: 50 or 60 Hz ± 5% «TH» ratings: 50 Hz ± 5%
Maximum number of power-ups per hour (power)	20
Output frequency range	0 to 590 Hz
Forced ventilation and auxiliary power supply power and voltage	refer to §3.13.1.1
ROHS conformance	Conforming to standard 2002-95-EC

1.4.1 - Electrical characteristics

Ico: Continuous output current.
Pout: Output power.
Imax (60s): Maximum output current, available for 60 seconds every 600 seconds.
Heavy duty: For heavy-duty constant torque machines (presses, grinders, hoisting, etc) and all applications where significant inertia has to be accelerated quickly (centrifuges, translation of travelling cranes, etc).
Normal duty: For normal-duty constant torque or centrifugal torque machines (fans, compressors, etc).

CAUTION: In its factory setting, the drive operates with a switching frequency of 3 kHz.

400 V to 460 V 3-phase supply
Switching frequency = 3 kHz - ambient temperature ≤ 40°C - altitude ≤ 1,000 m.

Rating	Heavy duty			Normal duty			Imax (60 s) (A)
	Pout at 400 V (kW) (1)	Pout at 460 V (HP) (1)	Ico (A)	Pout at 400 V (kW) (1)	Pout at 460 V (HP) (1)	Ico (A)	
60T	45	60	92	55	75	112	130
75T	55	75	118	75	100	142	165
100T	75	100	142	90	125	175	200
120T	90	125	170	110	150	212	240
150T	110	150	220	132	175	250	312
180T	132	175	260	160	200	315	365
220T	160	200	310	200	300	400	435
270T	200	300	375	250	350	470	530
340T	250	350	470	315	450	580	660
400T	315	450	540	355	500	650	760
470T	355	500	670	450	600	800	940
570T	400	600	750	500	650	880	1050

(1) Motor winding voltage

525 V to 690 V 3-phase supply

Switching frequency = 3 kHz - ambient temperature ≤ 40°C (35°C with IP54 option) - altitude ≤ 1000 m.

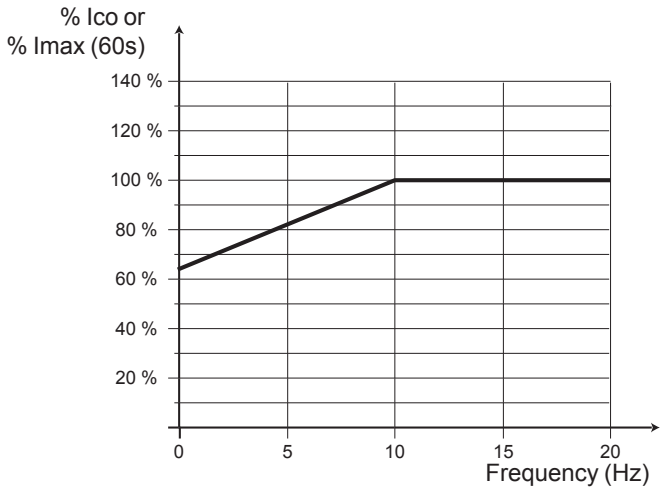
Rating POWERDRIVEMD2CS	Heavy duty			Normal duty			Imax (60s) (A)
	Pout at 575 V (HP) (1)	Pout at 690 V (kW) (1)	Ico (A)	Pout at 575 V (HP) (1)	Pout at 690 V (kW) (1)	Ico (A)	
270TH	200	200	220	250	250	280	308
340TH	250	250	270	300	300	340	378
400TH	300	300	335	400	400	415	465
500TH	400	400	390	500	500	470	545

(1) Motor winding voltage

1.4.2 - Derating at low frequency

Measuring the temperature of the power bridges in conjunction with thermal modelling of the IGBTs protects the **POWERDRIVE MD2CS** against overheating.

At low motor frequencies, IGBT modules are subject to tough temperature cycling, which may reduce their life time. To prevent this risk, the curve opposite indicates the derating for output currents ***Ico*** and ***Imax*** when operating at low motor frequency in continuous operation.



1.4.3 - Line reactor

The Powerdrive MD2CS is intended to be used with a line reactor connected on terminals L1, L2, L3 (see § 3.1.3)

Line reactor Network 400V 50Hz or 460V 60Hz	POWERDRIVE MD2CS ratings											
	60T	75T	100T	120T	150T	180T	220T	270T	340T	400T	470T	570T
Minimum inductance (mH)	0,26	0,26	0,26	0,26	0,19	0,13	0,078	0,078	0,055	0,055	0,045	0.035
Nominal Current (A)	135	135	200	200	230	280	460	460	650	650	800	912

Line reactor Network 525V to 690V 50 Hz or 60Hz	POWERDRIVE MD2CS ratings			
	270TH	340TH	400TH	500TH
Minimum inductance (mH)	0,21	0,21	0,14	0,14
Nominal Current (A)	340	340	480	480

With the minimum inductance values of the above table the total current harmonic distortion (THD) on the line feeding the drive is less than 35% (normal duty use). If a lower current harmonic level is requested, MD2CS 340T to 570T and MD2CS 270TH to 500TH offer the possibility to insert an additional Dc choke between terminals Lc1 and Lc2. In normal use Lc1 and Lc2 need to be linked by the cables included in the drive package.

1.4.4 - Surge protection

For electrical systems that present high overvoltage transients, surge protection devices have to be connected between each line phases and the ground as recommended in section 3

Protection device characteristics:

- Nominal voltage : 550V
- Minimum energy : 300 Joules
- Nominal unloaded current : 15 kA

1.4.5 - Derating according to the temperature and switching frequency

Ambient temperature ≤ 40°C - altitude ≤ 1000 m.

POWERDRIVE MD2CS rating	Ico (A)									
	Heavy duty					Normal duty				
	2 kHz	3 kHz	4 kHz	5 kHz	6 kHz	2 kHz	3 kHz	4 kHz	5 kHz	6 kHz
400 V mains supply										
60T	92	92	92	92	88	112	112	112	108	100
75T	118	118	118	106	96	142	142	133	120	109
100T	142	142	142	130	118	175	175	162	148	134
120T	170	170	165	150	135	220	212	188	170	154
150T	220	220	195	175	160	260	250	224	200	182
180T	260	260	260	260	250	315	315	310	305	285
220T	310	310	310	310	285	400	400	385	355	325
270T	375	375	375	350	320	470	470	440	400	365
340T	470	470	460	415	380	580	580	525	475	430
400T	540	540	530	480	430	650	650	605	545	490
470T	670	670	640	570	515	800	800	725	650	585
570T	750	750	660			915	880	750		
460/480 V mains supply										
60T	92	92	92	90	82	112	112	112	102	93
75T	118	118	110	100	90	142	142	125	112	102
100T	142	142	136	122	112	175	172	154	138	126
120T	170	170	155	140	125	215	200	176	158	144
150T	220	210	185	160	145	255	238	210	186	168
180T	260	260	260	260	230	315	310	305	295	265
220T	310	310	310	295	265	400	395	370	335	300
270T	375	375	370	330	295	470	465	420	375	335
340T	470	470	425	380	340	580	560	485	430	385
400T	540	535	490	430	380	650	610	555	490	435
470T	670	660	585	515	460	800	750	665	585	525
570T	750	715	630			890	815	715		
525/690 V mains supply										
270TH	220	220	220			280	280	250		
340TH	270	270	270			340	340	310		
400TH	335	335	290			415	415	330		
500TH	390	390	305			500	470	350		

For intermediate switching frequencies (3.5 - 4.5 - 5.5 kHz), the available current value will be the average of the upper frequency and lower frequency currents.

Ambient temperature ≤ 50°C - altitude ≤ 1000 m.

POWERDRIVE MD2CS rating	Ico (A)									
	Heavy duty					Normal duty				
	2 kHz	3 kHz	4 kHz	5 kHz	6 kHz	2 kHz	3 kHz	4 kHz	5 kHz	6 kHz
400 V mains supply										
60T	90	90	90	85	80	112	112	109	100	92
75T	115	115	105	95	85	142	135	123	111	100
100T	140	140	130	120	110	175	168	150	136	124
120T	170	170	150	135	125	215	192	172	156	142
150T	220	205	180	160	145	255	232	206	184	166
180T	260	260	260	255	230	315	315	305	290	260
220T	310	310	310	285	260	400	390	360	325	295
270T	375	375	360	320	290	470	450	410	365	330
340T	470	470	415	375	340	570	540	475	425	385
400T	540	520	485	425	380	630	590	550	485	435
470T	670	650	575	515	460	780	740	655	585	525
570T	750	685	630			890	780	715		
460/480 V mains supply										
60T	90	90	90	80	75	112	112	103	94	86
75T	115	115	100	90	80	142	130	115	103	93
100T	140	140	125	110	100	175	160	142	126	114
120T	170	160	140	125	115	210	184	162	146	130
150T	220	190	170	150	135	254	220	192	172	154
180T	260	260	260	235	215	315	305	295	270	245
220T	310	310	300	265	235	400	385	340	305	270
270T	375	375	340	300	265	470	435	385	340	305
340T	470	450	380	340	305	570	510	435	385	345
400T	540	485	440	380	340	630	550	500	435	385
470T	670	600	525	460	410	780	685	595	525	465
570T	740	650	570			840	740	650		
525/690 V mains supply										
270TH	220	210	190			280	240	220		
340TH	270	270	235			340	310	270		
400TH	335	335	300			415	400	340		
500TH	390	365	290			500	415	330		

For intermediate switching frequencies (3.5 - 4.5 - 5.5 kHz), the available current value will be the average of the upper frequency and lower frequency currents.

2 - MECHANICAL INSTALLATION

• It is the responsibility of the owner or user of the POWERDRIVE MD2CS to ensure that the installation, operation and maintenance of the drive and its options comply with legislation relating to the safety of personnel and equipment and with the current regulations of the country of use.

• POWERDRIVE MD2CS drives must be installed in an environment free from conducting dust, corrosive fumes, gases and fluids, and condensation (class 2 according to IEC 664.1). The drive must not be installed in hazardous areas unless it is in an appropriate enclosure. In this case, the installation must be approved.

• In atmospheres where condensation may form, install a heating system (to be switched off when the drive is operating). It is advisable to control the heating system automatically.

• Prevent access by unauthorised personnel.

2.1 - Checks upon receipt

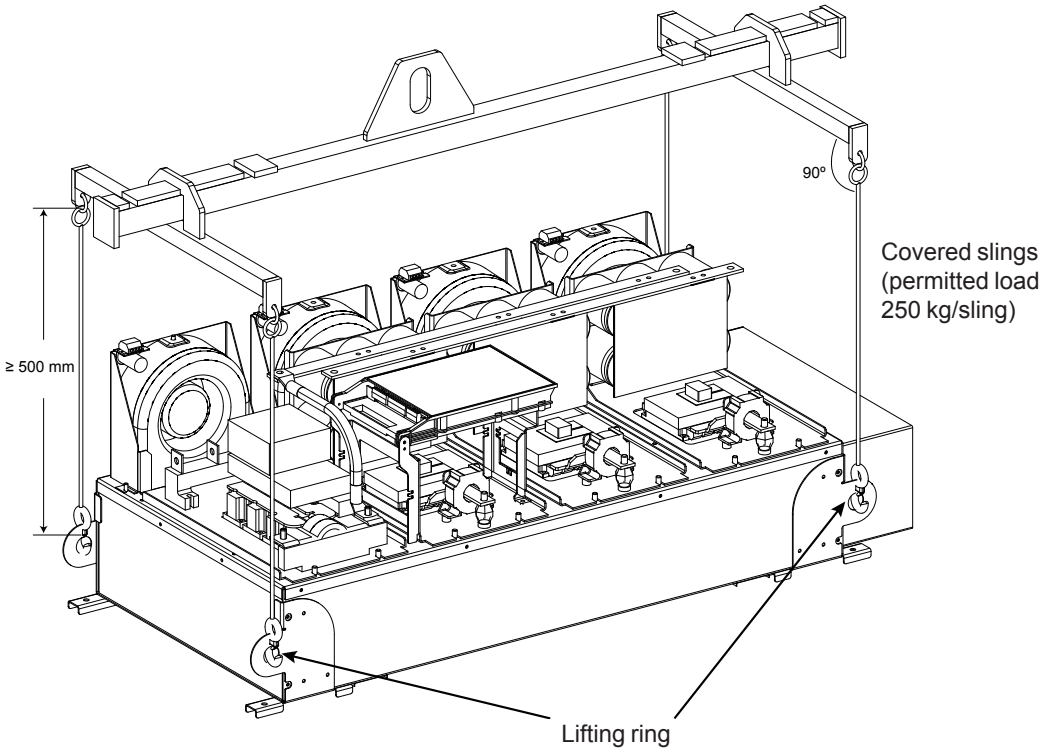
Before installing the **POWERDRIVE MD2CS,** check that:
- The drive has not been damaged during transport
- The information on the nameplate is compatible with the power supply

2.2 - Handling

• Check that the handling equipment is suitable for the weight to be handled.

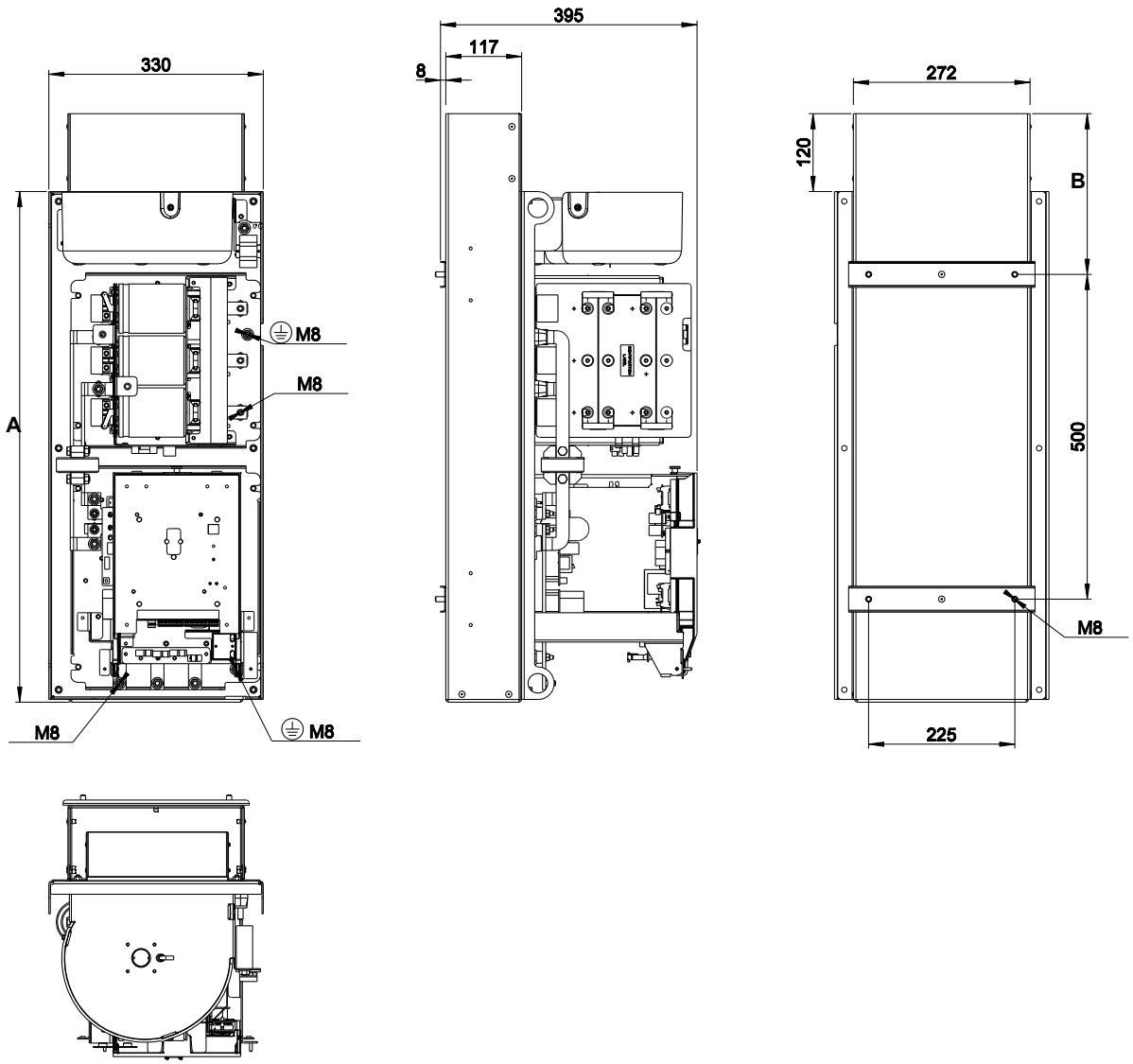
• The POWERDRIVE MD2CS has 2 lifting rings at the top and bottom of the chassis. For how to handle the drive, follow the instructions below.

To handle the drive, use a lifting bar with the characteristics shown on the diagram.
The drive must be handled horizontally.



2.3 - Dimensions and weight

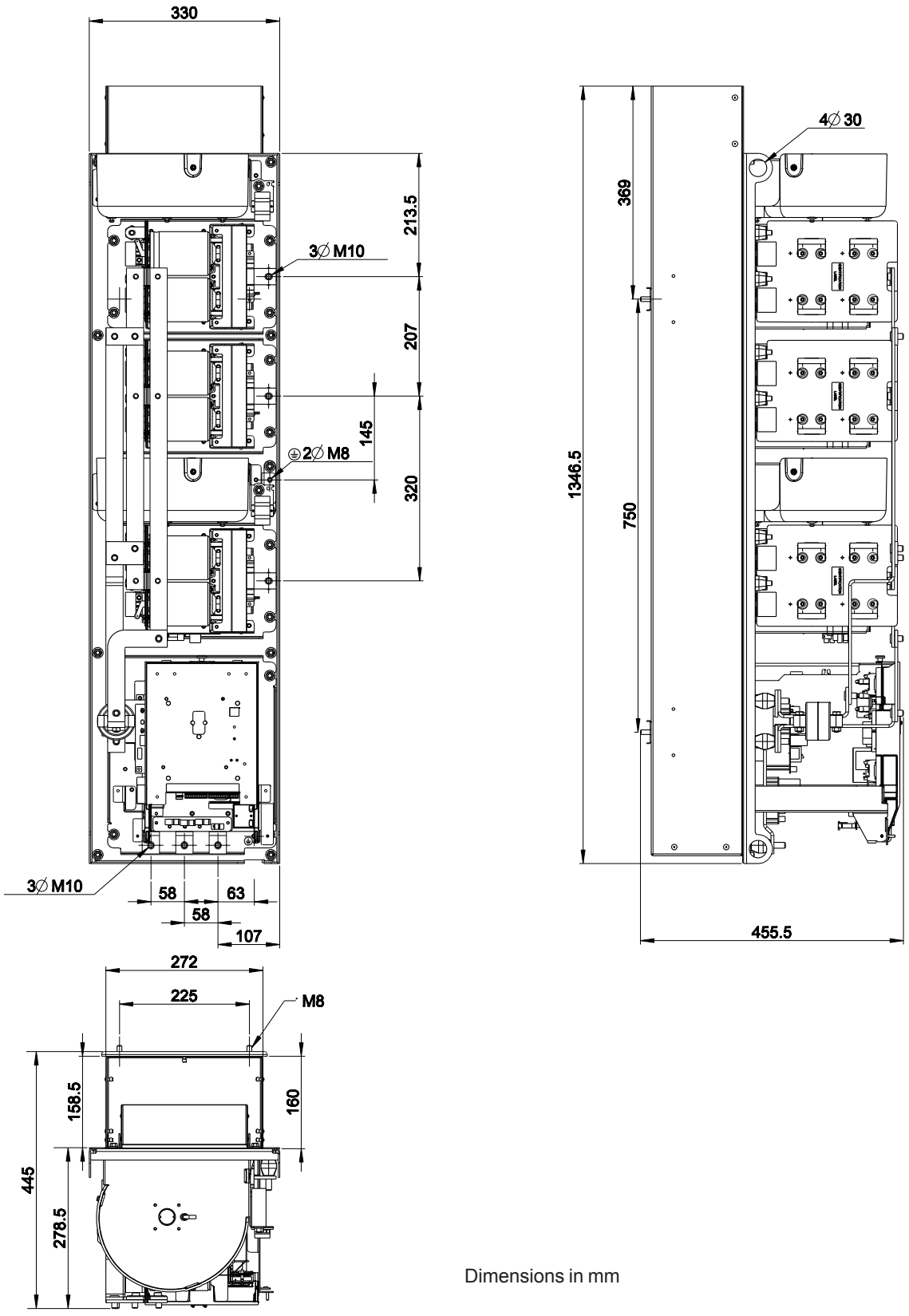
2.3.1 - Drive ratings 60T to 150T



Dimensions in mm

POWERDRIVE MD2CS rating	60T	75T	100T	120T	150T
A (mm)	716		786		
B (mm)	210.5		247.5		
Weight (kg)	40		45		

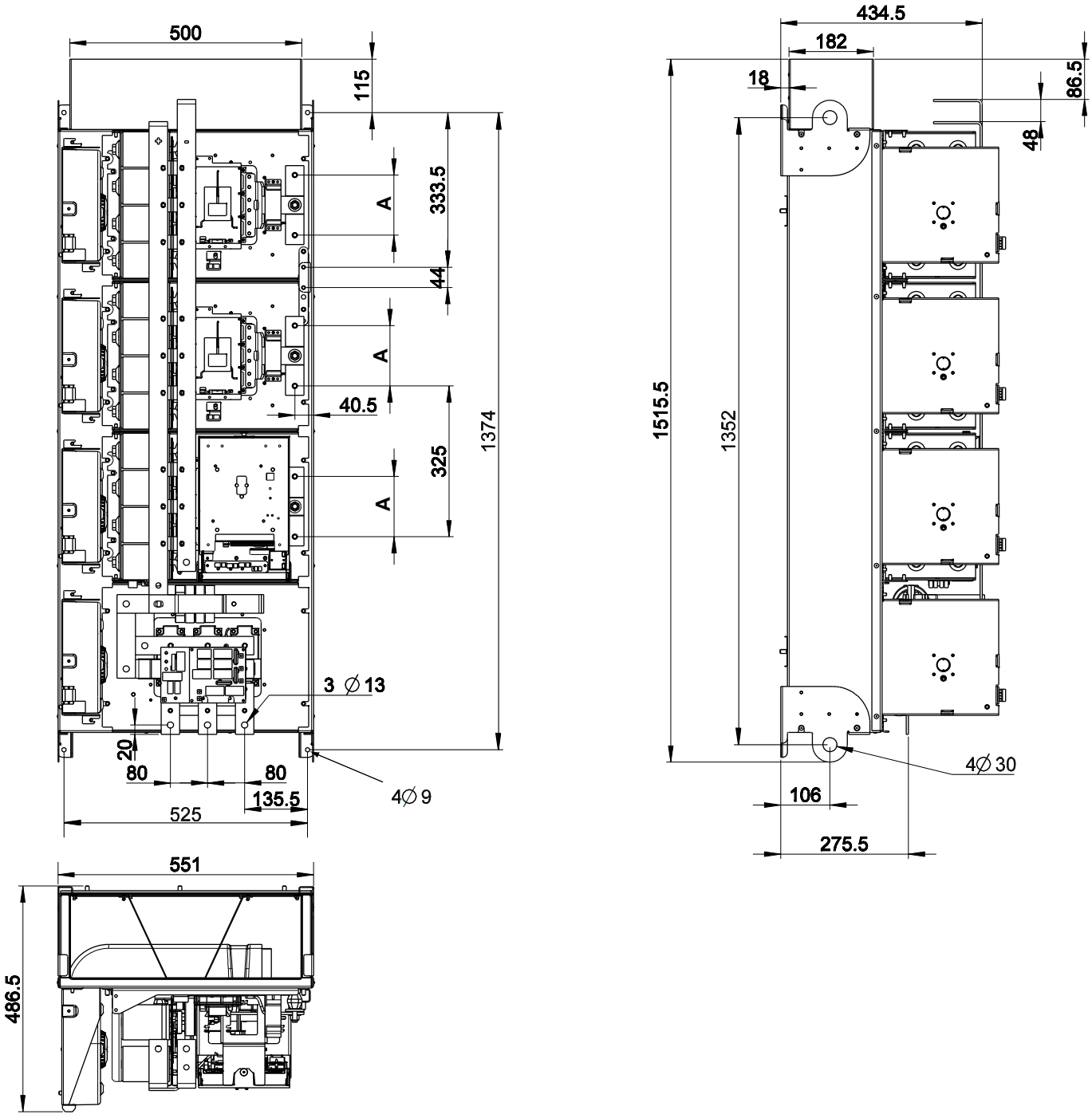
2.3.2 - Drive ratings 180T to 270T



Dimensions in mm

POWERDRIVE MD2CS rating	180T	220T	270T
Weight (kg)	76		

2.3.3 - Drive ratings 340T to 570T and 270TH to 500TH



Dimensions in mm

POWERDRIVE MD2CS rating	340T	400T	470T	570T	270TH	340TH	400TH	500TH
Côte A	130		52	52	52	52	52	52
Weight (kg)	134	134	145	145	145	145	145	145

2.4 - Installation

2.4.1 - General

POWERDRIVE MD2CS drives are IP00 protection products, designed to be installed in a cabinet with limit access to only habilited and trained personnel.

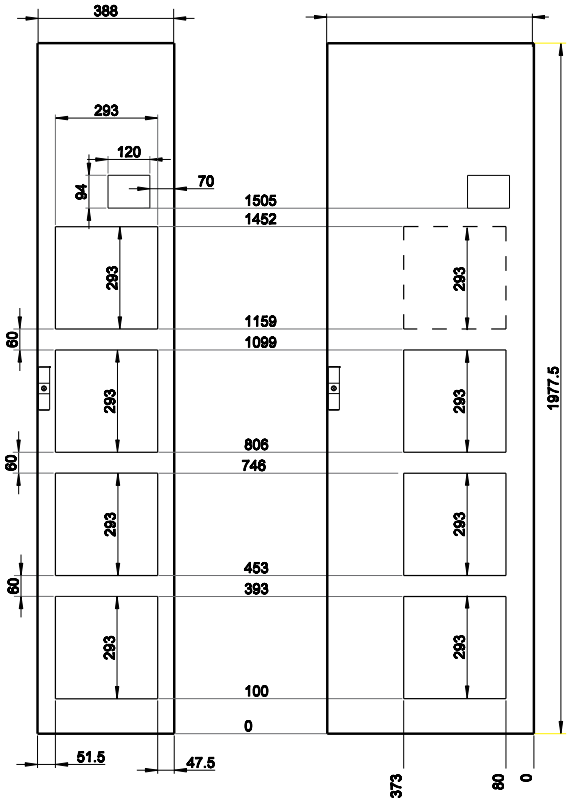
POWERDRIVE MD2CS drives must be installed in a clean environment, away from conducting dust, corrosive gas and dripping water.

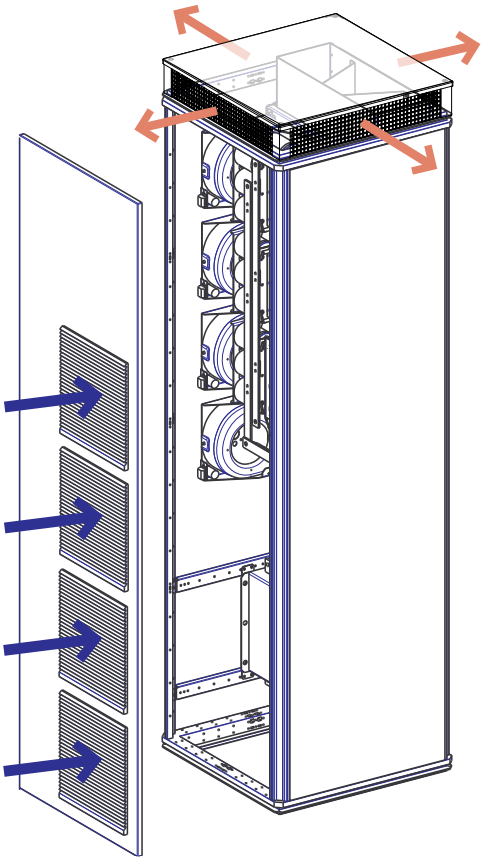
Implementations presented in this document are given as an indication. It is imperative to respect the cooling conditions of the product.
To allow proper circulation of air, 250mm minimum must be maintained between the top of the cabinet and the ceiling. If several POWERDRIVE MD2CS are installed side by side, each drive must have at least the surfaces of air inlet and outlet indicated below.

WARNING:
To ensure correct operation of the drive, it is essential to follow the instructions given below.

2.4.2 - Air flow

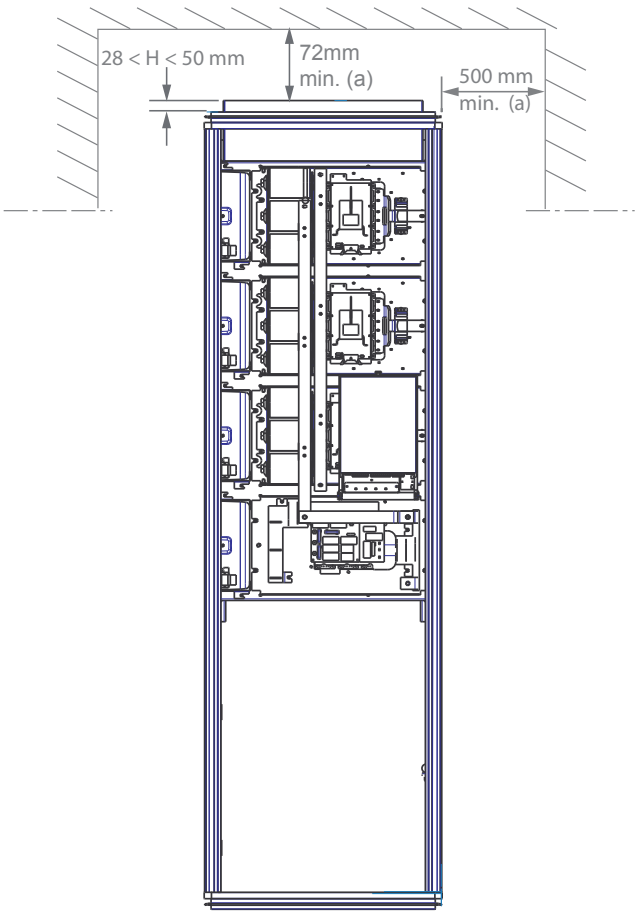
Comply with the min./max. dimensions of the ventilation grids given on the diagrams below (applicable to a single drive).
Ensure that the air intakes and outlets on the cabinet are never obstructed, and that the filters on the ventilation grids permit the air flow rate defined in section 2.6 (recommended filters: Rittal SK3362 or equivalent).
Depending on the degree of protection of the cabinet (e.g. IP21, IP54, etc), check that the air flow circulates normally and that the flow rate is high enough.
If ventilation grids are placed on air outlet, the free space has to be at least the indicated surface.





POWERDRIVE MD2CS rating	Minimum air intakes surface Filters exemples	Minimum air oulet surface
60T to 150T	3 filters 290x290mm	32 x 10^3 mm²
180T to 270T	4 filters 290x290mm	44 x 10^3 mm²
340T to 570T **270TH to 500TH**	4 filters 290x290mm	91 x 10^3 mm²

To ensure correct operation of the drive, it is essential to respect dimensions below.



(a): Distance between the roof of the cabinet and an obstacle (e.g. wall, etc). Several cabinets can be assembled together (ensure that the air is extracted correctly).

2.4.3 - Temperature

Do not place the drive above a heat source or another drive.

For surrounding temperature of 40°C or 50°C, the delta between the internal temperature of the cabinet and the ambient temperature outside the cabinet must not be greater than 5°C.
For example, for an ambient temperature of 40°C outside the cabinet, the internal temperature in the cabinet should be no more than 45°C. If this is not the case with the POWERDRIVE MD2CS's own ventilation, add ventilation on the cabinet roof (e.g. for a cabinet 600x600, add further ventilation of at least 225 m3/hr).

The optional braking resistor must be located outside the cabinet, but as close as possible.

2.5 - Drive losses

Losses according to the switching frequency

Rating	Losses (kW)				
	2 kHz	3 kHz	4 kHz	5 kHz	6 kHz
60T	1.5	1.6	1.6	1.7	1.7
75T	1.9	2.0	2.0	1.9	1.8
100T	2.3	2.4	2.4	2.3	2.2
120T	2.9	2.9	2.8	2.7	2.6
150T	3.4	3.5	3.3	3.1	3.1
180T	4.1	4.4	4.6	4.8	4.8
220T	5.3	5.5	5.7	5.6	5.4
270T	6.2	6.5	6.5	6.3	6.1
340T	7.6	8.0	7.7	7.4	7.2
400T	8.6	9.0	8.9	8.5	8.2
470T	10.5	11.1	10.6	10.2	9.8
570T	12.0	12.2	11.0	-	-
270TH	6.4	6.7	6.6	-	-
340TH	7.7	8.1	8.2	-	-
400TH	9.4	9.9	8.8	-	-
500TH	11.4	11.2	9.3	-	-

Note: The values given above correspond to operation in normal duty and the reactor losses are included.

2.6 - Drive ventilation flow rates and noise levels

POWERDRIVE MD2CS rating	Forced ventilation flow rates (m^3/hr)	Noise level (dBA)
60T and 75T	600	75
100T to 150T	600	75
180T to 270T	1200	77
340T to 570T	1500	77
270TH to 500TH	1500	77

3 - CONNECTIONS

• All connections work must be performed by qualified electricians in accordance with the laws in force in the country in which the drive is installed. This includes earthing to ensure that no directly accessible part of the drive can be at the mains voltage or any other voltage which may be dangerous.
• The drive must be supplied through an approved circuit-breaking device so that it can be powered down safely.
• The drive power supply must be protected against overloads and short-circuits.
• Check that the voltage and current of the drive, the motor and the mains supply are compatible.
• The voltages on the connections of the mains supply, the motor, the braking resistor or the filter may cause fatal electric shocks.
• Only one permanent magnet motor can be connected to the drive output. It is recommended to install a circuit-breaking device between the permanent magnet motor and the drive output to eliminate the risk of hazardous voltage feedback when performing maintenance work.
• See also the recommendations in section 7.

3.1 - Power connections

3.1.1 - Electronics and forced ventilation power supply

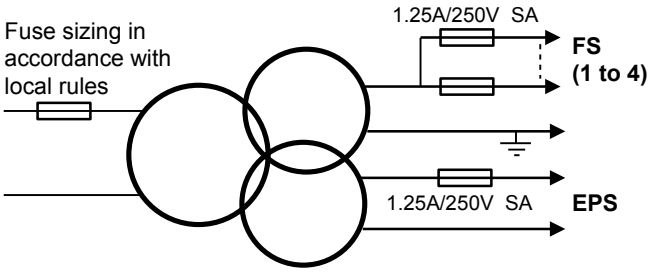
The control electronics and forced ventilation units are supplied through a single-phase transformer whose primary is connected to terminals L1-L2 of the power supply.

The neutral of the electronics power supply must not be connected to earth

- **Electrical characteristics:**

	Voltage	Maximum power
Electronics power supply (EPS)	230 V isolated	100 VA
Forced ventilation (FS)	230 V connected to earth	60T to 150T: P = 300VA 180T to 270T: P = 500 VA 340T to 570T: P = 1200 VA 270TH to 500TH: P = 1200 VA

Recommended schematic :



3.1.2 - Characteristics of connection terminals

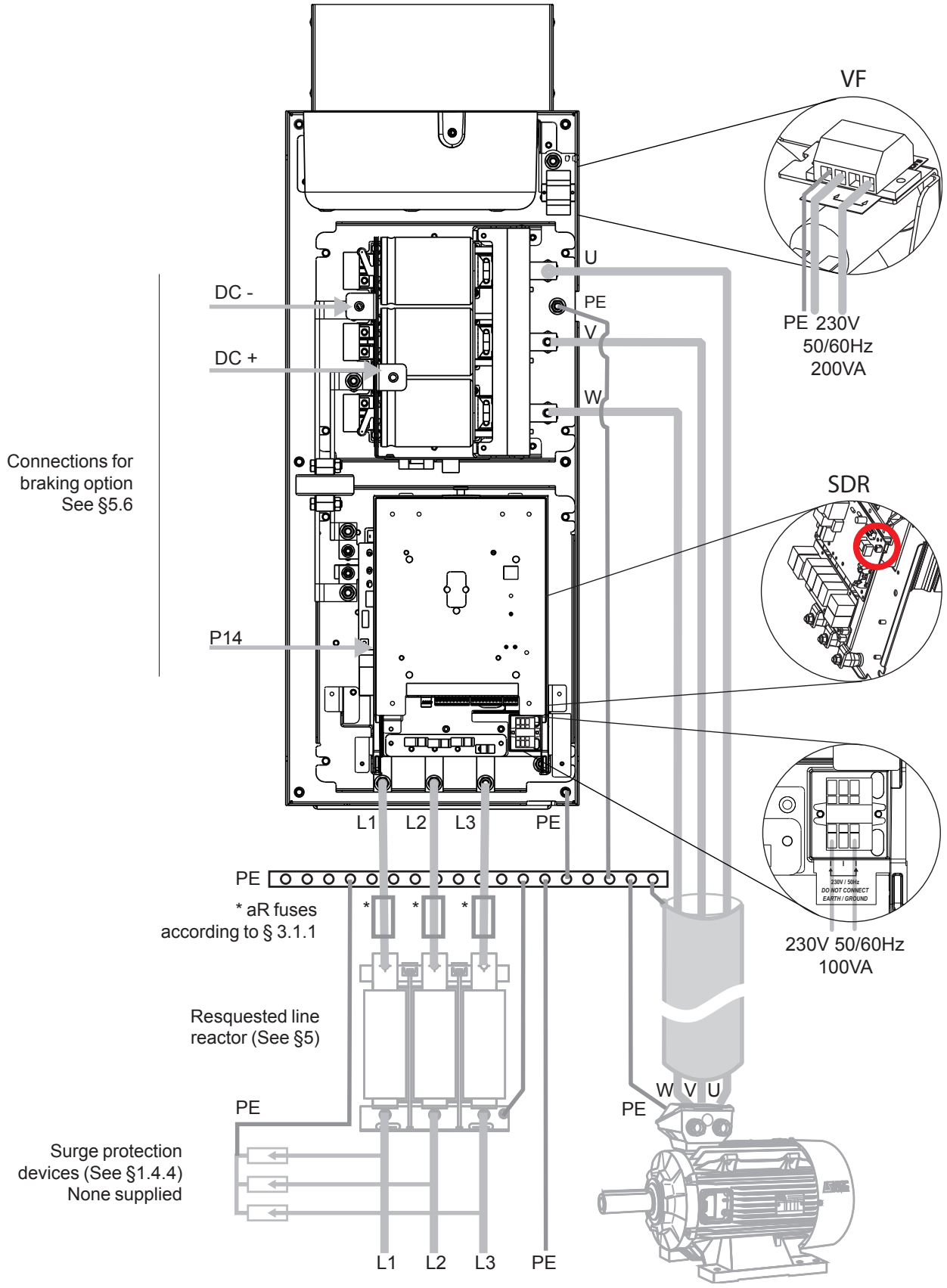
Refs.	Functions/connections	Type of connection and tightening torque		
		60T to 150T	**180T to 270T**	**340T to 570T 270TH to 500TH**
L1, L2, L3	Mains power supply	M8 bolt - 12 Nm	M10 screw bolt - 20 Nm	
U, V, W	Motor outputs			
PE	Earth	M8 bolt - 12 Nm		M8 bolts - 12 Nm
P4, P5 (see §4.4)	EMC commoning link	Torx screws Ø20 - 4 Nm		
-	Control block (1)	Spring terminal block		
DC +, DC -	Optionnal braking transistor	blot M10, 20Nm		
DC +, BR				
P14 (see §5.5)		14 points HE10 connector		
SDR	Rectifier enable input	Connector		-
VF	Forced ventilations	Spring terminal block		

Do not exceed the indicated maximum tightening torque.

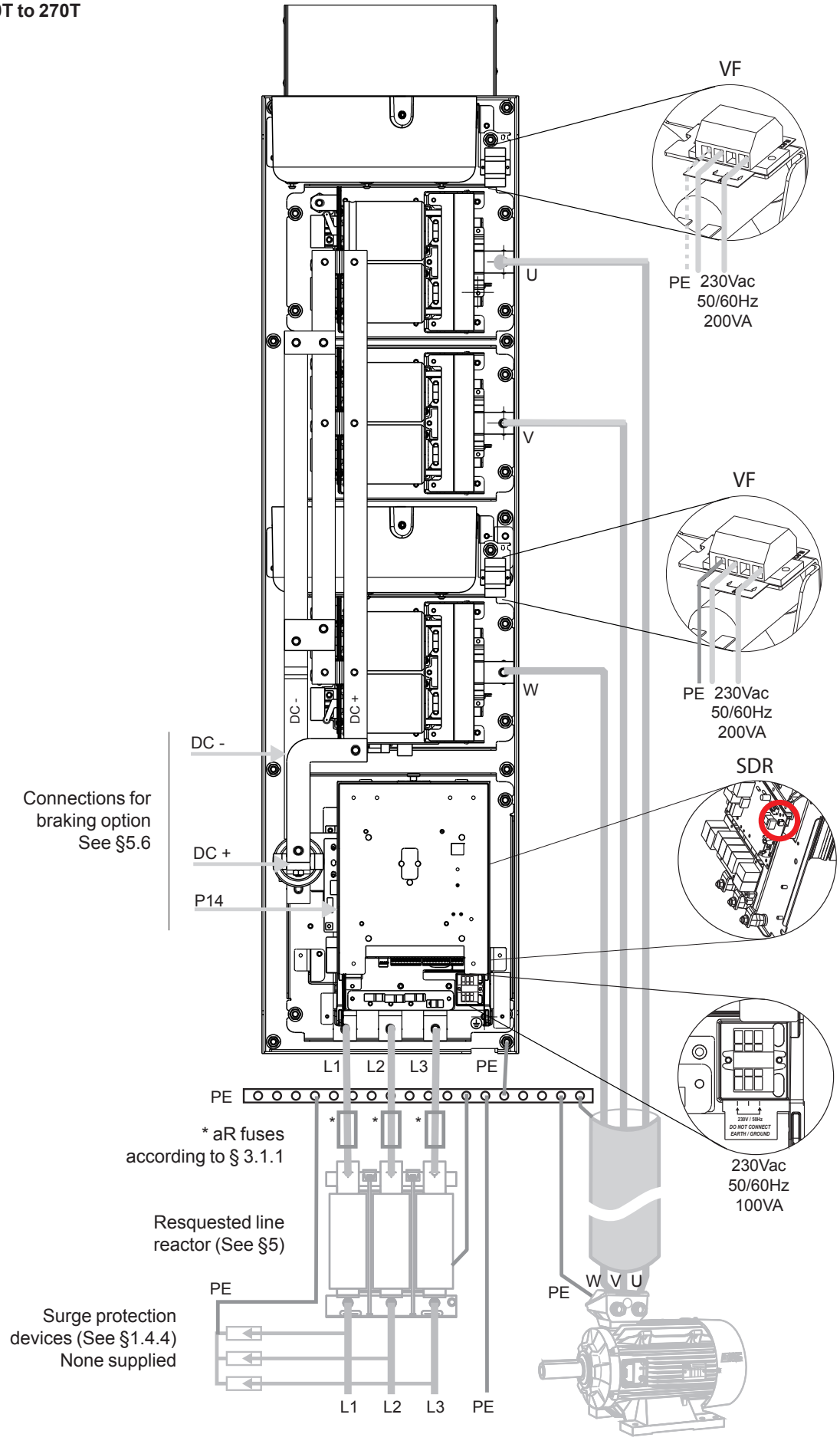
(1) The neutral of the electronics power supply must not be connected to earth

3.1.3 - Location of power terminal blocks and recommanded cabling

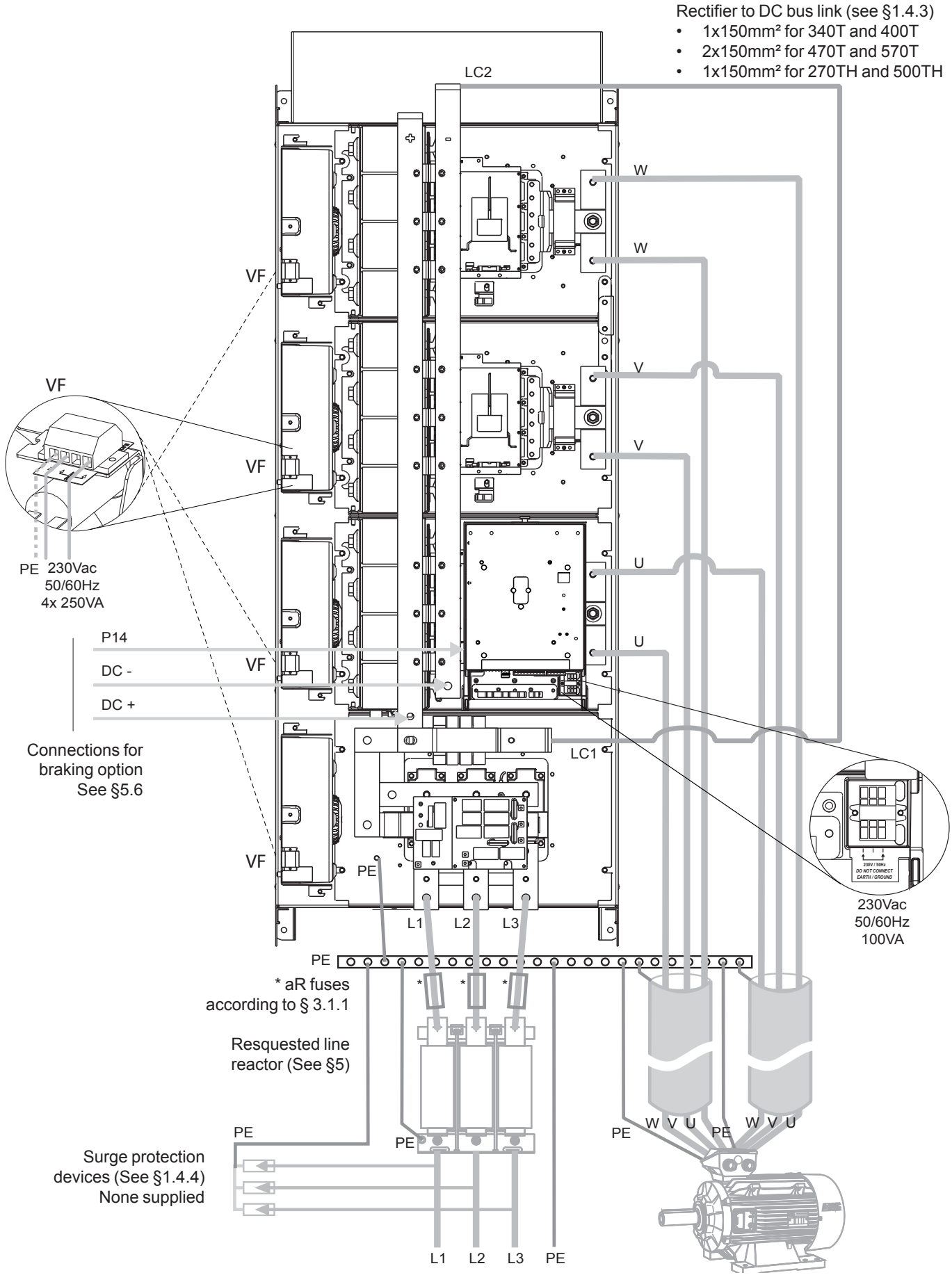
3.1.3.1 - Ratings 60T to 150T



3.1.3.2 - Ratings 180T to 270T



3.1.3.3 - Ratings 340T to 570T and 270TH to 500TH



3.1.4 - Cables and fuses

• It is the responsibility of the user to connect and provide protection for the POWERDRIVE MD2CS in accordance with the current legislation and regulations in the country of use. This is particularly important with regard to the size of the cables, the type and rating of fuses, the earth or ground connection, powering down, acknowledging trips, isolation and protection against overcurrents.

• The installation must have a short circuit current (Isc) > 20 I_L at the point of drive connection.

• This table is given for information only, and must under no circumstances be used in place of the current standards.

I_L: Maximum line current **Ico:** Continuous output current

POWERDRIVE rating		AC supply									Motor	
		400 V - 50 Hz				460/480 V - 60 Hz						
		I_L (A)	Fuses (1)		Cable cross-section (mm²) (2) (4)	I_L (A)	Fuses (1)			Cable cross-section (mm²) (2) (4)	Ico (A)	Cable cross-section (mm²) (3) (4)
			Gg type	aR type (IEC &UL)			Gg type	aR type	Class J (UL)			
60T	Heavy	85	100	160	3x35 + PE	75	100	125	125	3x35 + PE	92	3x35 + PE
	Normal	105	125	200	3x35 + PE	90	125	160	150	3x35 + PE	112	3x35 + PE
75T	Heavy	105	125	200	3x35 + PE	90	125	160	150	3x35 + PE	118	3x35 + PE
	Normal	140	160	250	3x50 + PE	120	160	200	200	3x35 + PE	142	3x50 + PE
100T	Heavy	140	160	250	3x50 + PE	120	160	250	200	3x50 + PE	142	3x50 + PE
	Normal	170	200	315	3x70 + PE	150	200	250	225	3x70 + PE	175	3x70 + PE
120T	Heavy	170	200	315	3x70 + PE	150	200	250	225	3x70 + PE	170	3x70 + PE
	Normal	205	250	350	3x95 + PE	180	200	315	250	3x70 + PE	212	3x95 + PE
150T	Heavy	205	250	400	3x95 + PE	180	200	315	250	3x70 + PE	220	3x95 + PE
	Normal	245	315	450	3x120 + PE	210	250	350	300	3x95 + PE	250	3x120 + PE
180T	Heavy	245	315	500	3x120 + PE	210	250	400	300	3x95 + PE	260	3x150 + PE
	Normal	295	315	500	3x150 + PE	240	315	450	400	3x120 + PE	315	3x185 + PE
220T	Heavy	295	315	550	3x150 + PE	240	315	450	400	3x120 + PE	310	3x185 + PE
	Normal	370	400	630	3x240 + PE	360	400	550	500	3x240 + PE	400	3x240 + PE
270T	Heavy	370	400	700	3x240 + PE	360	400	700	500	3x240 + PE	375	3x240 + PE
	Normal	460	500	800	2x[3x150 + PE]	420	500	800	600	2x[3x120 + PE]	470	2x[3x150 + PE]
340T	Heavy	460	500	800	2x[3x150 + PE]	420	500	800	600	2x[3x120 + PE]	470	2x[3x150 + PE]
	Normal	580	630	1000	2x[3x185 + PE]	535	630	1000	--	2x[3x185 + PE]	580	2x[3x185 + PE]
400T	Heavy	580	630	1000	2x[3x185 + PE]	535	630	1000	--	2x[3x185 + PE]	540	2x[3x185 + PE]
	Normal	650	800	1100	2x[3x240 + PE]	595	630	1000	--	2x[3x185 + PE]	650	2x[3x240 + PE]
470T	Heavy	650	800	1250	2x[3x240 + PE]	595	630	1000	--	2x[3x185 + PE]	670	2x[3x240 + PE]
	Normal	825	1000	1400	4x[3x120 + PE]	710	800	1250	--	4x[3x95 + PE]	800	4x[3x120 + PE]
570T	Heavy	735	1000	1400	4x[3x120 + PE]	710	800	1250		4x[3x95 + PE]	750	4x[3x120 + PE]
	Normal	915	1000	1600	4x[3x150 + PE]	770	1000	1400		4x[3x120 + PE]	880	4x[3x150 + PE]

POWERDRIVE rating		Mains power supply 525 V					Motor	
		I_L (A)	Fuses (1)			Cable cross-section (mm²) (3)	Ico (A)	Cable cross-section (mm²) (4)
			Gg type	aR type	Class J (UL)			
270TH	Heavy	210	250	400	300	3x95 + PE(1)	220	3x95 + PE(1)
	Normal	260	315	450	350	3x120 + PE(1)	280	3x150 + PE(1)
340TH	Heavy	260	315	500	350	3x120 + PE(1)	270	3x150 + PE(1)
	Normal	330	400	550	450	3x185 + PE(1)	340	3x185 + PE(1)
400TH	Heavy	325	400	630	450	3x185 + PE(1)	335	3x185 + PE(1)
	Normal	415	400	700	500	2x[3x120 + PE(1)]	415	2x[3x120 + PE(1)]
500TH	Heavy	415	400	700	500	2x[3x120 + PE(1)]	390	2x[3x120 + PE(1)]
	Normal	470	500	800	600	2x[3x150 + PE(1)]	470	2x[3x150 + PE(1)]

Note: The line current value I_L is a typical value which depends on the source impedance.

(1) The aR semi-conductor fuses do not protect the drive power supply line. They must be combined with an overload protection device (gG fuses, C type circuit-breaker, etc.) suitable for the installation configuration and located at the start of the line.

(2) The recommended AC supply cable cross-sections have been determined for single-core cable with a maximum length of 20 m. For longer cables, take line drops due to the length into account.

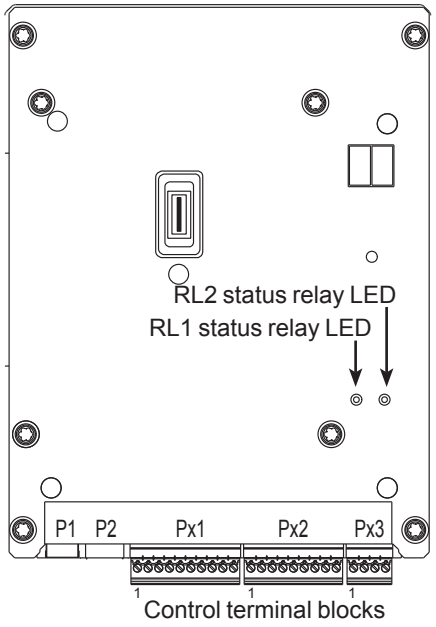
(3) The motor cable cross-sections are given for information only for a current corresponding to the value of the Ico current at 3 kHz in normal duty, a maximum length of 50 m, output frequency less than 100 Hz and an ambient temperature of 40°C. **The recommended motor cables are shielded multicore type**. The values supplied are typical values.
Example: Cable cross-section of 2 x [3 x 150 + PE] corresponds to 2 cables each consisting of 3 phase conductors (cross-section 150 mm²) + earth conductors (see below).

(4) The earth (PE) conductor cross-section cannot be less than half the cross-section of a live conductor, with the same material used. Example: The earth conductor cross-section for a live conductor 2x 240 mm² must be:
- 2x 120 mm²
- 2 x (3 x 40 mm2) when the earth conductor is divided by 3 (see above figure)

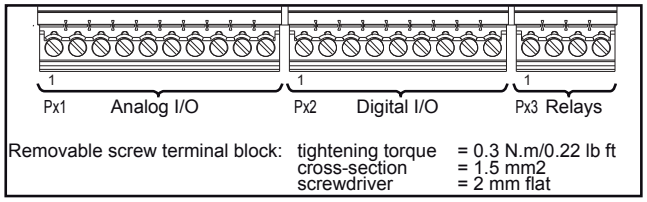
3.2 - Connection of the control

• The POWERDRIVE MD2CS inputs have a positive logic configuration. Using a drive with a control system which has a different control logic may cause unexpedted starting of the motor.
• The POWERDRIVE MD2CS control circuit is isolated from the power circuits by single insulation. Its electronic 0V is connected to the connection terminal on the outer protective conductor (earth terminal). The installer must ensure that the external control circuits are isolated against any human contact.
• If the control circuits need to be connected to circuits complying with SELV safety requirements, additional insulation must be inserted to maintain the SELV classification (see EN 61140).

3.2.1 - Control terminal block location



Control terminal block



3.2.2 - Control terminal block characteristics

3.2.2.1 - PX1 terminal block characteristics

1	**10V**	+10 V internal analog source
Accuracy		± 2%
Maximum output current		10 mA

2	**AI1+**	Differential analog input 1 (+)
3	**AI1-**	Differential analog input 1 (-)

Factory setting	0-10V speed reference
Input type	± 10 V differential bipolar analog voltage (for common mode, connect terminal 3 to terminal 6)
Absolute maximum voltage range	± 36 V
Voltage range in common mode	± 24 V/0 V
Input impedance	> 100 kΩ
Resolution	11 bits + sign
Sampling period	2 ms
Input filter bandwidth	~ 200 Hz

4	**AI2+**	Differential analog input 2 (+)
5	**AI2-**	Differential analog input 2 (-)

Factory setting	4-20 mA speed reference
Input type	Unipolar current (0 to 20 mA, 4 to 20 mA, 20 to 0 mA, 20 to 4 mA)
Absolute maximum current	30 mA
Voltage range in common mode	± 24 V/0 V
Input impedance	100 Ω
Resolution	12 bits
Sampling period	2 ms
Input filter bandwidth	~ 200 Hz

6	**0V**	Analog circuit common 0 V
The 0 V on the electronics is connected to the metal ground of the drive		

7	**AI3**	Analog input 3

Factory setting	No assignment
Input type	± 10 V bipolar analog voltage in common mode or unipolar current (0 to 20 mA, 4 to 20 mA)
Resolution	11 bits + sign
Sampling period	2 ms
Input filter bandwidth	~ 200 Hz
Voltage range in common mode	± 24 V/0 V
Voltage mode	
Input impedance	> 50 kΩ
Absolute maximum voltage range	± 30 V
Current mode	
Input impedance	100 Ω
Absolute maximum current	30 mA

8	AO1	Analog output
Factory setting		4-20 mA motor current signal
Output type		Bipolar analog voltage in common mode or unipolar current in common mode
Resolution		13 bits
Sampling period		2 ms
Voltage mode		
Voltage range		± 10 V
Load resistance		1 kΩ minimum
Current mode		
Current range		0 to 20 mA, 4 to 20 mA
Load resistance		500 Ω maximum

9	DI1 PTC	Digital input 1 or PTC thermal sensor
Factory setting		No assignment
Sampling period		2 ms
Thermal sensor input		
Voltage range		± 10 V
Trip threshold		> 3.3 kΩ
Reset threshold		< 1.8 kΩ
Digital input		
Type		Digital input in positive logic
Voltage range		0 to + 24 V
Absolute maximum voltage range		0 V to + 35 V
Thresholds		0 : < 5 V 1 : > 13 V

10	0V	Analog circuit common 0 V
The 0 V on the electronics is connected to the metal ground of the drive		

3.2.2.2 - PX2 terminal block characteristics

1 9	+24V ref	+24 VDC user output or +24 VDC external input
+24 VDC user output		
Output current		100 mA
Accuracy		± 5%
Protection		Current limiting and setting to trip mode

+24 VDC external input	
Rated voltage	24 VDC
Minimum operating voltage	22 V
Absolute maximum voltage	28 V
Recommended power	50 W
Recommended fuse	2.5 A
An external power supply connected to the +24V Ref terminal is used to maintain the control power supply in the event of mains loss.	

2	DO1	Digital output
Factory setting		Zero speed
Characteristic		Open collector
Absolute maximum voltage		+ 30 V/0 V
Overload current		150 mA

3	STO-1	Drive enable input 1 (Safe Torque Off function)
6	STO-2	Drive enable input 2 (Safe Torque Off function)
Input type		Positive logic only
Absolute maximum voltage		+ 30 V
Thresholds		0 : < 5 V 1 : > 13 V
Response time		< 20 ms

4	DI2	Digital input 2
5	DI3	Digital input 3
7	DI4	Digital input 4
8	DI5	Digital input 5
DI2 factory setting		Selection of speed reference
DI3 factory setting		
DI4 factory setting		Run FWD/Stop input
DI5 factory setting		Run reverse/Stop input
Type		Digital inputs in positive logic
Voltage range		0 to + 24 V
Absolute maximum voltage range		0 to + 35 V
Thresholds		0 : < 5 V 1 : > 13 V

3.2.2.3 - PX3 terminal block characteristics

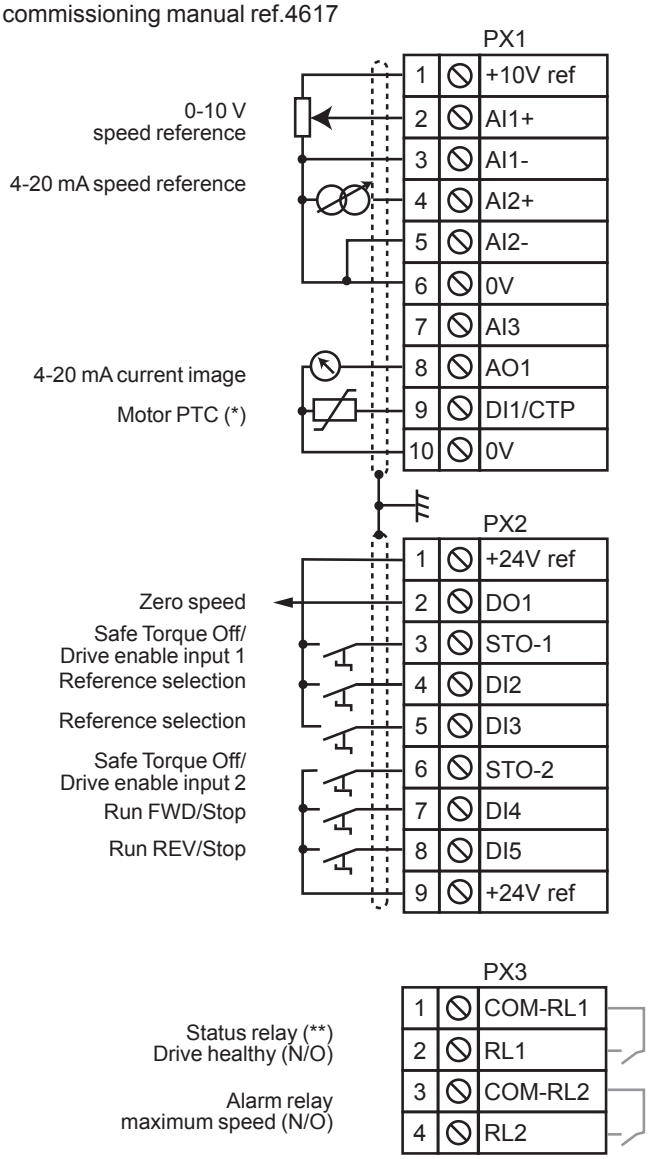
1	COM-RL1	N/O (normally open) relay output
2	RL1	
3	COM-RL2	N/O (normally open) relay output
4	RL2	
Factory setting RL1		Drive status relay
Factory setting RL2		Maximum speed alarm
Voltage		250 VAC
Maximum contact current		2 A - 250 VAC, resistive load
		1 A - 250 VAC, inductive load
		2 A - 30 VDC, resistive load

• Provide a fuse or other overcurrent protection in the relay circuit.

Note: When the RL1 or RL2 relay is activated, the corresponding status LED on the control board lights up.

3.2.3 - Factory configuration of control terminal blocks

Nota : For more details on the parameters, please refer to the commissioning manual ref.4617



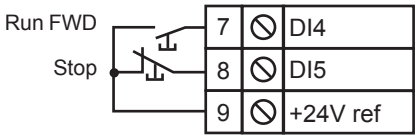
Note: This configuration has been obtained from a drive with factory settings (default parameter settings).
The STO-1 and STO-2 inputs must be closed before giving a run command.

(*) If the motor thermal sensor needs to be connected to DI1/ PTC, set **Mtr.06 (05.70)** = Drive terminal (1).

(**) If the 2 STO inputs are not in the same status, the relay RL1 opens.

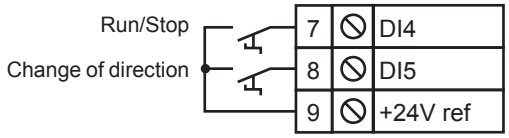
• Modification of the Run/Stop control logic

- For "3-wire" control (jog Run/Stop):



List of parameters to set:
Ctr.06 (06.04) = Run Latched (1)
I/O.10 (08.25) = **06.39** Stop (DI5 terminal)

- For Run/Stop control with change of direction:



List of parameters to set:
Ctr.06 (06.04) = Run Fwd/Rev (2)
I/O.09 (08.24) = **06.34** Run/Stop (DI4 terminal)
I/O.10 (08.25) = **06.33** Fwd/Reverse (DI5 terminal)

• Selection of the reference via digital inputs:

DI2	DI3	Selection
0	0	Voltage speed reference (0-10 V) on analog input AI1+, AI1-
0	1	Current speed reference (4-20 mA) on analog input AI2+, AI2-
1	0	Preset reference 2 **Spd.05 (01.22)** to be set
1	1	

3.3 - STO-1/STO-2 inputs: Safe Torque Off function

The STO-1 and STO-2 inputs are safety inputs that can be used to disable the drive output so no torque at the motor shaft is generated.
They are independent of one another. They are created by simple hardware not connected to the microcontroller. They act on two different stages of the IGBT output bridge control.
To enable the drive, the STO-1 and STO-2 inputs must be connected to the +24V source.
The opening of a minimum of one input locks the output bridge.

These 2 inputs can be used in conjunction to create a "Safe Torque Off" function with a logic combining 2 separate channels.
In this configuration, the "Safe Torque Off" function is guaranteed with a very high level of integrity in conformity with standards:

- EN 61800-5-2
- EN/ISO 13849-1: 2006; PLe
- IEC/EN 62061: 2005; SIL3

(CETIM approval no. CET0047520)

This built-in function enables the drive to act as a contactor that switches off the motor power, allowing a deceleration in a free wheel mode. This corresponds to an uncontrolled stop in accordance with stop category 0 og IEC 60204-1.

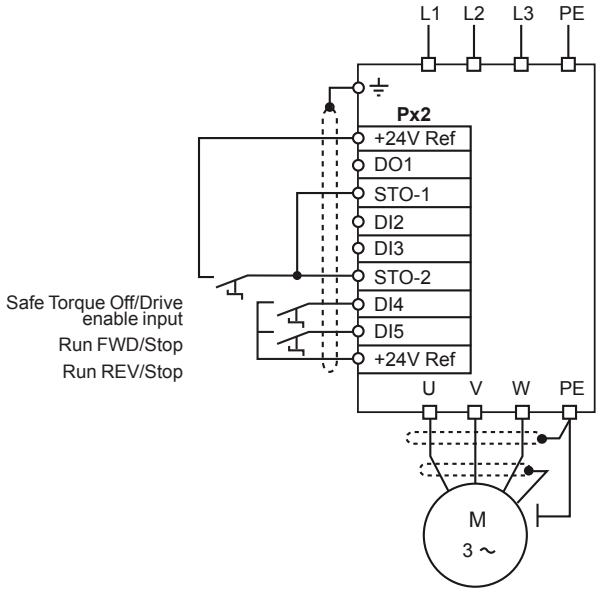
The STO-1 and STO-2 inputs are compatible with self-tested logic outputs in controllers such as PLCs, for which the test pulse lasts for 1 ms maximum.
If the data sent by the 2 inputs are not identical, this generates a drive trip. The RL1 relay opens and the drive indicates a "t.r./63" trip on the drive 2-digit display or "STO input inconsistency" trip on the parameter-setting interface.

For correct use, the power and control connection diagrams described in the following paragraphs must be adhered to.

⚠ • The STO-1/STO-2 inputs are safety components which must be incorporated in the complete system dedicated to machine safety. As for any installation, the complete machine must be subject to a risk analysis. The integrator must determine the safety category which the installation must comply with.
• The STO-1 and STO-2 inputs, when open, lock the drive, so the dynamic braking function is no longer available. If a braking function is required before the drive secure disable lock is applied, a time-delayed safety relay must be installed to activate the locking automatically after the end of braking.
If braking needs to be a machine safety function, it must be provided by an electromechanical solution since the dynamic braking by the drive function is not considered as a secure disable function.
• The STO-1/STO-2 inputs do not provide the electrical isolation function. Prior to any work carried out on the drive / installation, the power supply must therefore be switched of through an approved isolating device (isolator, switch, etc).
• The line switch integrated as an option in the drive does not isolate the drive input busbars. During the installation and maintenance phases, make sure that the power supply line is disrupted.

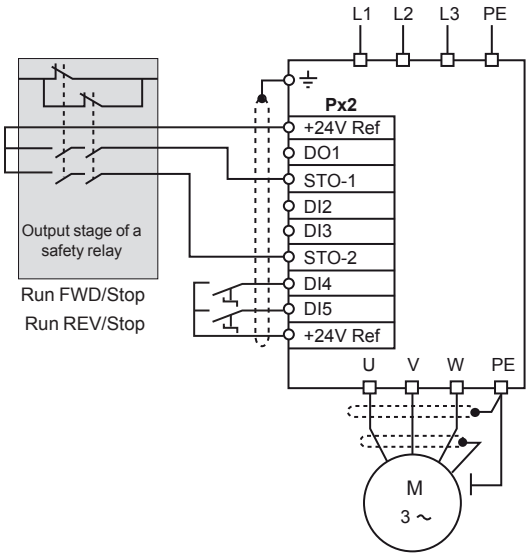
3.3.1 - Single channel locking (SIL1 - PLb)

3-phase AC power supply, in accordance with safety standard IEC/EN 62061: 2005 and EN/ISO 13849-1: 2006 - Single channel locking (SIL1 - PLb).



3.3.2 - Double channel locking (SIL3 - PLe).

3-phase AC power supply, in accordance with safety standard IEC/EN 62061: 2005 and EN/ISO 13849-1: 2006 - Double channel locking (SIL3 - PLe)



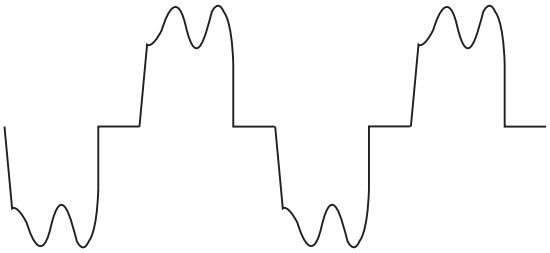
4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE

The power structure of frequency inverters leads to the occurrence of two types of phenomenom :
- Low-frequency harmonics fed back to the mains supply
- Emission of radio-frequency signals (RFI)

These are independent phenomena. They have different consequences on the electrical environment.

4.1 - Low-frequency harmonics

The rectifier, at the head of the frequency inverter, generates a non-sinusoidal AC line current.



3-phase rectifier line current consumption.

This current carries harmonics with number 6n ± 1.
Their amplitudes depend on the impedance of the mains supply upstream the rectifier bridge, and on the structure of the DC bus downstream the rectifier bridge.
The more inductive the mains supply and the DC bus, the more these harmonics are reduced.
They only affect the quality of the mains supply for loads on frequency inverters of several hundred kVA, if these loads represent more than a quarter of the total load on a site.
In the above conditions:

- These harmonics have virtually no effect on the electrical energy consumption level.
- The associated temperature rises in transformers and motors directly connected to the mains supply are negligible.

It is very rare for these low-frequency harmonics to cause interference on sensitive equipment.

4.2 - Radio-frequency interference: Immunity

4.2.1 - General

The immunity level of a device is defined by its ability to operate in an environment which is contaminated by external elements or by its electrical connections.

4.2.2 - Standards

Each device must undergo a series of standard tests (European standards) and meet a minimum requirement in order to be declared as compliant with the variable speed drive standards (EN 61800-3).

4.2.3 - Recommendations

An installation consisting exclusively of devices which comply with the standards concerning immunity is very unlikely to be subject to a risk of interference.

4.3 - Radio-frequency interference: Emission

4.3.1 - General

In order to limit motor losses and obtain a low level of motor noise, frequency inverters use high-speed switches (transistors, semi-conductors) which switch high voltages (> 550 V) at high frequencies (several kHz).
As a result, they generate radio-frequency (R.F.) signals which may disturb operation of other equipments or distort measurements taken by sensors:

- Due to high-frequency leakage currents which escape to earth via the stray capacity of the drive/motor cable and through the motor via the metal structures which support it.
- By conduction or feedback of R.F. signals on the power supply cable: conducted emissions
- By direct radiation near to the mains supply power cable or the drive/motor cable: radiated emissions.

These phenomena are of direct interest to the user.
The frequency range concerned (radio frequency) does not affect the energy distribution company.

4.3.2 - Standards

Standard EN 61800-3 defines the maximum emission levels to comply with according to the type of environment the drive is installed in. In some cases, it may be necessary to add an external RFI filter (see section 4.6).

4.4 - Mains supply

4.4.1 - General

Each industrial power supply has its own intrinsic characteristics (short-circuit capability, voltage value and fluctuation, phase imbalance, etc) and supplies equipment some of which can distort its voltage either permanently or temporarily (notches, voltage dips, overvoltage, etc). The quality of the mains supply has an impact on the performance and reliability of electronic equipments, especially variable speed drives.
The **POWERDRIVE MD2CS** is designed to operate with mains supplies typical of industrial sites throughout the world. However, for each installation, it is important to know the characteristics of the mains supply in order to carry out corrective measures in the event of abnormal conditions.

4.4.2 - Mains transient overvoltages

There are numerous sources of overvoltages on an electrical installation:
- Connection/disconnection of banks of power factor correction capacitors
- High-power thyristor-controlled equipment (oven, DC drive, etc)
- Results of lightning

4.4.2.1 - Connection/disconnection of a bank of power factor correction capacitors

Connecting power factor correction capacitors in parallel on the drive power supply line when the drive is running can generate transient overvoltages that are likely to trip the drive safety devices, or even damage it in extreme cases.
If banks of power factor correction capacitors are used on the power supply line, make sure that:
- The threshold between steps is low enough to avoid causing overvoltage on the line
- The capacitors are not permanently connected

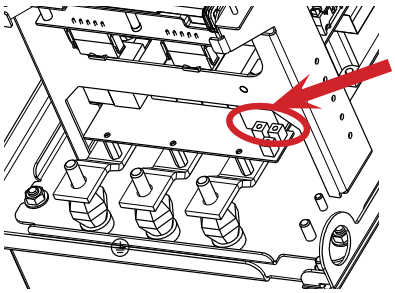
4.4.2.2 - Presence of commutation notches on the line

When high-power thyristor-controlled equipment is connected on the same line as the drive, it is essential to ensure that the harmonics generated by the commutation notches do not excessively distort the mains voltage and do not create voltage peaks with amplitude higher than 2 x mains Vrms. If this is the case, it is essential to take corrective measures by inserting a choke in the line supplying the thyristor-controlled equipment or by moving the drive power supply line to another source.

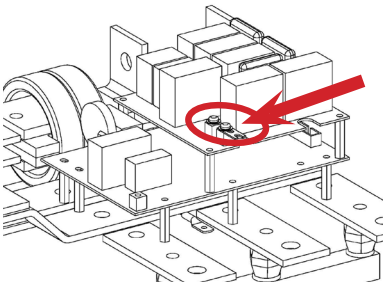
4.4.3 - Unbalanced power supply

Similar to what is observed on an electric motor, the line current imbalance of a drive operating on an unbalanced mains supply may be several times the value of the voltage imbalance measured on the power supply. A highly unbalanced mains supply (>2%) associated with a low mains impedance may result in a high level of stress on the components at the input stage of a drive.
Additional mains chokes can be installed upstream of a **POWERDRIVE MD2CS** supplied by an unbalanced mains in order to reduce the current imbalance factor (see characteristics in section "Line reactors").

Neutral IT point connection
For IT power supplies, open the commoning link connecting the EMC capacitors to earth as indicated below.



POWERDRIVE MD2CS 60T to 270T



Other POWERDRIVE MD2CS ratings

4.4.4 - Ground connections

The equipotential earth bonding of some industrial sites is not always observed. This lack of equipotentiality leads to leakage currents which flow via the earth cables (green/yellow), the machine chassis, the pipework, etc, and also via the electrical equipment. In some extreme cases, these currents can trip the drive.
It is essential that the earth network is designed and implemented by the installation supervisor so that its impedance is as low as possible, so as to distribute the fault currents and high-frequency currents without them passing through electronic equipment.
Metal grounds must be mechanically connected to each other with the largest possible electrical contact area. Under no circumstances can the earth connections designed to protect people, by linking metal grounds to earth via a cable, serve as a substitute for the ground connections (see IEC 61000-5-2).
The immunity and radio-frequency emission level are directly linked to the quality of the ground connections.

4.5 - Basic precautions for installation

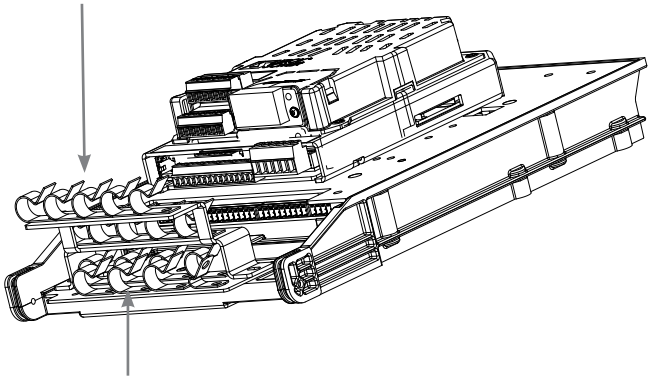
These should be taken into account when wiring the **POWERDRIVE MD2CS** and the external components. In each paragraph, they are listed in decreasing order of effect on correct operation of the installation.

4.5.1 - Wiring inside the cabinet

- Separate as far as possible control cables and power cables (Do not run them in the same cable ducts).
- For control cables, use shielded twisted cables and connect the shield to the grounding bracket..

The bracket for connecting the option shielding is supplied with each option. To attach it, screw the bracket, placing it on top of the control cable shielding clamps (the shielding clamp furthest to the right should be removed).

Grounding bracket
of the options



Grounding bracket

4.5.2 - Wiring outside the cabinet

4.5.2.1 - Control wiring

If the control cable needs to run outside the cabinet, use a shielded cable and connect the shield to the grounding bracket.

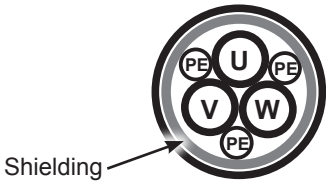
4.5.2.2 - Power wiring

• Connect the motor earth terminal directly to that of the drive.

Never use shielded single-core cables

Use shielded 3-core cables with symmetrical conductors for protective earthing as indicated below.

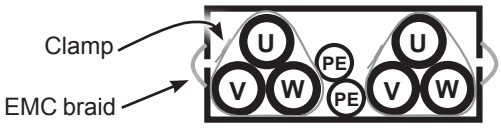
The shield must be connected at both ends: drive end and motor end (connected round the whole circumference).



A separate PE protective conductor is mandatory if the conductivity of the cable shielding is less than 50% of the conductivity of the phase conductor.

- The shielding must be connected at both ends: drive end and motor end (connected round the whole circumference).
- In the second industrial environment, the shielded motor power supply cable can be replaced by a 3-core + earth cable placed in a fully enclosed metal conduit (metal cable duct for example). This metal conduit must be mechanically connected to the electrical cabinet and the structure supporting the motor.

If the conduit consists of several pieces, these should be interconnected by braids to ensure earth continuity. The cables must be positioned and held in a cloverleaf formation in the conduit.



- There is no need to shield the power supply cables between the mains supply and the drive.
- Isolate the power cables from the control cables. The power cables must intersect the other cables at an angle of 90°.
- Isolate sensitive elements (probes, sensors, etc) from metal structures which may be shared by the motor support.
- The motor cables and network power cables should not be routed side by side in the same channel to reduce proximity couplings.

4.6 - Electromagnetic compatibility (EMC)

CAUTION:
Conformity of the drive is only assured when the mechanical and electrical installation instructions described in this manual are adhered to.

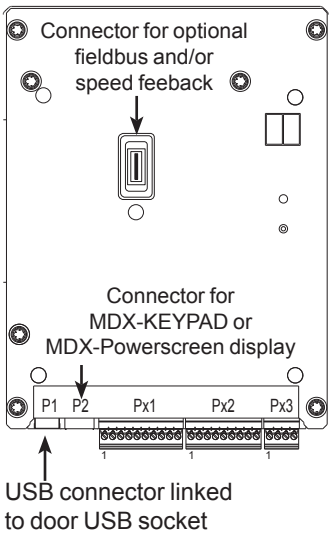
Immunity			
Standard	**Description**	**Application**	**Conformity**
IEC 61000-4-2	Electrostatic discharges	Product casing	Level 3 (industrial)
EN 61000-4-2			
IEC 61000-4-3	Immunity standards for radiated radio-frequency	Product casing	Level 3 (industrial)
EN 61000-4-3			
IEC 61000-4-4	Bursts of fast transients	Control cable	Level 4 (industrially hardened)
EN 61000-4-4		Power cable	Level 3 (industrial)
IEC 61000-4-5	Shock waves	Power cables	Level 4
EN 61000-4-5			
IEC 61000-4-6	Generic immunity standards for conducted radio-frequency	Control and power cables	Level 3 (industrial)
EN 61000-4-6			
EN 50082-2	Generic immunity standards for the industrial environment	-	Conforming
IEC 61000-6-2			
EN 61000-6-2			
EN 61800-3	Variable speed drive standards	Conforming to the first and second environment	
IEC 61800-3			
EN 61000-3			

(2) POWERDRIVE MD2CS and CEM filter mounted on a metallic plate. Shielded motor cables, fixed with clamp on the metallic plate.

5 - PARAMETER-SETTING INTERFACE AND OPTIONS

5.1 - Optionnal Parameter setting interfaces

5.1.1 - Location of the drive connectors / ports



◦ **P1 connector**

This connector is a slave type B USB connector linked to door USB socket, and is used to communicate via PC using the MDX-SOFT software.

In conformity with standard EN 60950, the USB link can only be used via a device that provides isolation of 4 kV (MDX-USB isolator option).

◦ **P2 terminal block**

This is a standard RS485/RS422 terminal block which is used to connect a parameter-setting interface (MDX Powerscreen, MDX Keypad) or to communicate via Modbus RTU.

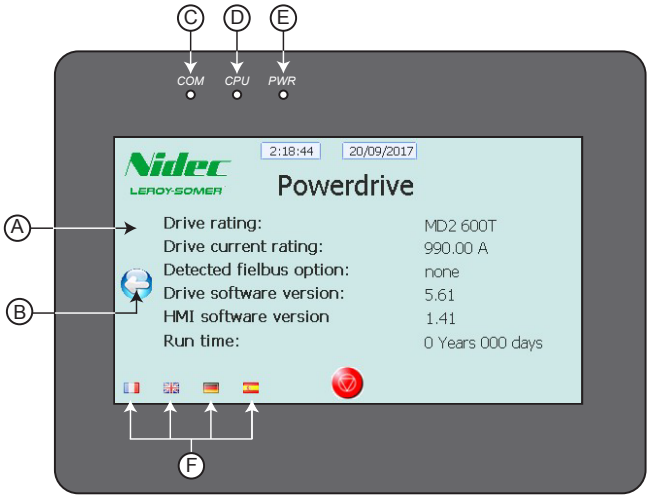
Terminals	Description
1	0V
2	Rx\, Tx\
3	Rx, Tx
4	24V

Check that control circuits are powered down before disconnecting the programming interface from the P2 connector.

5.1.2 - MDX-Powerscreen

- **General**

The POWERSCREEN interface is a touch screen which can be used to access various menus to setup and supervise the drive.
After the loading phase following the power-up of the drive, the parameter-setting interface displays the screen below in french. Select language using the "F" buttons below

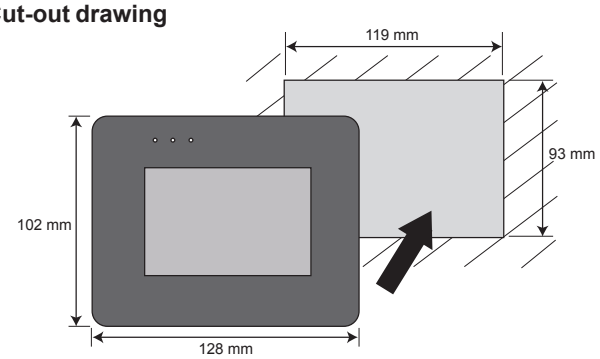


Ref.	Function
A	4.3" touch screen
B	Touch-sensitive button to access the main menu
C	"COM" LED, indicates the state of the communication with the drive. Off: no communication Flashing: communicating
D	"CPU" LED, indicates the status of the interface CPU
E	"PWR" LED, indicates the state of the interface power supply
F	Touch-sensitive buttons for language selection (can take a few minutes to load)

- **Installation**

The interface is flush-mounted in the front of a cabinet (IP65/ NEMA 4 mounting). It is fixed by 4 screws (tightening 2 Nm).

Cut-out drawing



- **Architecture**

From the welcome screen, press the button to access the main page of the parameter-setting interface, consisting of 5 touch-sensitive buttons:
- Information: Can be used to obtain information very quickly about the drive, the fieldbus option, the parameter-setting interface, and can also be used to select the language.
- Read mode: Is used to display the status of the drive when stopped or in operation, as well as its main operating data.
- Parameter setting: Used for reading and/or modifying all the drive parameters, as well as setting the date and time on the display.
- Control via keypad: Gives direct access to motor control via the touch screen (Run/Stop, direction of rotation, speed reference). These screen parameters can be set using the Parameter setting/Parameter setting via the keypad menu. Control via the keypad is disabled in factory-set configuration.
- Trip history: Gives a quick overview of the last 10 drive trips.
- : This button is accessible on all screens in factory-set configuration and is used to give a stop command (can be disabled).

At any time and regardless of the screen displayed, the button can be used to return to previous pages, as far as the interface main page.

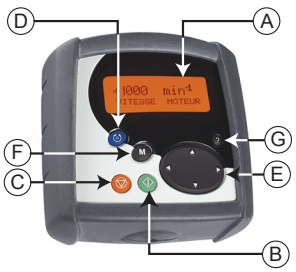
For further information, see the commissioning manual ref. 4617.

5.1.3 - MDX-KEYPAD

- **General**

This keypad, which is remote from the drive, makes easy the setting of the **POWERDRIVE MD2CS** and provides access to all parameters. Its LCD display, consisting of one line of 12 characters and 2 lines of 16 characters, offers text which can be displayed in 4 languages (English, French, German and Spanish).
The MDX-KEYPAD has 2 main functions:
- A read mode for **POWERDRIVE MD2CS** supervision and diagnostics
- An access mode to all the **POWERDRIVE MD2CS** parameters in order to optimise settings or configure special applications.

As soon as it is switched on, the MDX-KEYPAD is set to read mode. The buttons are used to scroll through the all parameters required for supervision and diagnostics:
- Motor current
- Motor frequency
- Motor voltage
- Analog I/O levels
- Digital I/O states
- Logic function states
- Timer



Ref.	Function
A	3-line backlit LCD display indicating: - The drive operating status and its main data - The main adjustment parameters via a "**Quick parameter setting**" menu - All the drive parameters via 21 "**Advanced parameter setting**" menus (access via a code)
B	Green button for run command if control via the keypad is enabled. See "**Keypad set up**".
C	Red button for drive reset or to give a stop command if control via the keypad is enabled. See parameters **Ctr.05 (6.43)** and **06.12**.
D	Blue button for change of direction of rotation if control via the keypad is enabled. See parameter **Ctr.05 (6.43)**.
E	Navigation button (, , ,) for moving through the various menus and changing the contents of parameters.
F	M button for saving and changing the mode (display, read, set parameters).
G	"**?**" button not used.

For more information, see the commissioning manual ref. 4617. This manual describes configuration using the MDX-Powerscreen parameter-setting interface, but the commissioning procedure also applies to the MDX-KEYPAD.

- **Installation**

The MDX-KEYPAD does not require any special installation. At the power off, simply connect it via its 1.5 metre cable (supplied with the keypad), on P2 connector.

MDX-SOFT

The MDX-SOFT enables parameter setting or supervision of the **POWERDRIVE MD2CS** from a PC. Numerous functions are available:
- Fast commissioning
- File saving
- Comparison of 2 files or one file with the factory settings
- Printing of a complete file or differences compared to the factory settings
- Supervision
- Diagnostics

To connect the PC to the POWERDRIVE MD2CS, use an "MDX-USB Isolator" isolated USB cable.

This software can be downloaded from the web at the following address: http://www.emersonindustrial.com/

POWERDRIVE MD2CS can be set via the USB connector, even if the drive is not powered.
Attention. In this case, options modules will not be powered and settings will not be saved. To make an option module setting / backup , it is necessary to provide an auxiliary power supply.

5.2 - Add-on options

The control board is designed to be plugged with various optional modules. Several options can be combined:

- Fieldbus (see section 5.2.1)
- Speed feedback (see section 5.2.2)
- Additionnal I/O (see section 5.2.3)

5.2.1 - Fieldbus modules

Depending on the configuration of the speed feedback and inputs/outputs optional modules, two types of fieldbus are proposed:

MDX option: option to be fitted to the control board

CM module: compact module to be integrated in an existing MDX board

Association table :

Main option	Filedbus	
	MDX version	CM version
None		
MDX-ENCODER		X
MDX-RESOLVER		X
MDX-I/O Lite		X
MDX I/O M2M	X	
MDX-ENCODER + MDX I/O M2M		X
MDX-RESOLVER + MDX I/O M2M		X

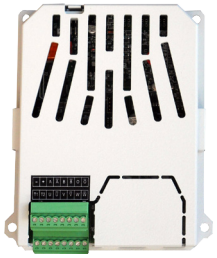
Fieldbus modules can be used to communicate with the corresponding networks respective. They can be integrated in and are supplied by the drive.

The following fieldbus are available on **POWERDRIVE MD2CS** :

- **MDX/CM-MODBUS** : Modbus RTU (RS485/232)
- **MDX/CM-ETHERNET** : Modbus TCP (Ethernet)
- **MDX/CM-ETHERNET-IP** : EtherNet/IP
- **MDX/CM-PROFIBUS** : Profibus DP V1
- **MDX/CM-PROFINET** : ProfiNet

For more details, consult the specific documentations.

5.2.2 - Speed feedback options



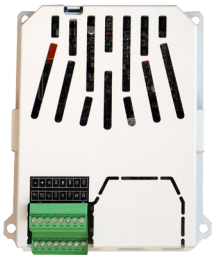
Two options are available to manage the motor speed feedback. :

- **MDX-ENCODER:** The MDX-ENCODER option is used to It manages incremental encoders with or without commuation channels (up to 500kHz).
- **MDX-RESOLVER:** The MDX-RESOLVER option is used to manage 2 to 8 poles resolvers.

For more details, consult the specific documentations.

5.2.3 - Additionnal I/O options

Two options are available to increase the **POWERDRIVE MD2CS** number of inputs and outputs **:**



MDX-I/O LITE

MDX-I/O M2M

Fonctions	MDX-I/O Lite	MDX-I/O M2M
Analog input (V, mA)	-	1
Differential analog input (V, mA)	1	1
Analog ouputs (V, mA)	2	1
Motor thermistor KTY84-130 or PT100	1	1
Digital inputs	2	4
Digital outputs	1	2
Assignable relay	1	2
Drive forced fan's management	✓	✓
Real time clock	-	✓
Ethernet connection : • WEB pages: drive configuration and status • 2 Programmable emails • Configuration backup & restoration	-	✓
Datalogger	-	✓

For more details, consult the specific documentations.

5.4 - RFI filters

5.4.1 - General

The use of RFI filters contributes to a reduction in the emission levels of radio-frequency signals (See §4.6).
Depending on the drive used, install the RFI filter recommended in the table below between the mains and the drive input.

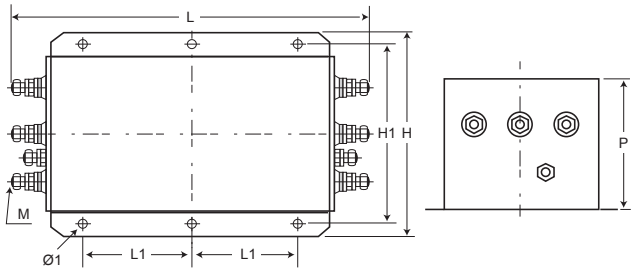
The cable length does not exceed 1m, the RFI filter must be integrated on a backplate connected to the earth.

Rating	RFI filter			
	Reference	Irated at 40°C (A)	Leakage current (mA)	Losses (W)
60T to 100T	**FN 3359 HV-180**	197	<6	34
120T and 150T	**FN 3359 HV-250**	250	<6	49
270TH	**FN 3359 HV-320**	350	<6	19
180T and 220T	**FN 3359 HV-400**	438	<6	29
340TH				
270T to 400T	**FN 3359 HV-600**	657	<6	44
400TH to 500TH				
470T and 570T	**FN 3359 HV-1000**	1095	<6	60

CAUTION:
The specific design of these filters makes it possible to connect to IT power supplies. The installer should, however, ensure that insulation supervision systems dedicated to these installations are suitable for monitoring electrical equipment that may contain electronic variable speed drives.

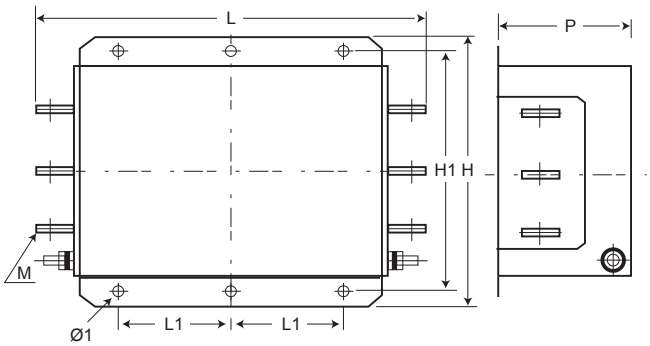
5.4.2 - Weight and dimensions

- **FN 3359 HV-180 and FN 3359 HV-250**



Type	Dimensions (mm)							Weight (kg)
	L	L1	H	H1	D	Ø1	M	
FN 3359 HV-180	360	120	210	185	120	12	M10	6.5
FN 3359 HV-250	360	120	230	205	125	12	M10	7

- **FN 3359 HV-320 to FN 3359 HV-2500**



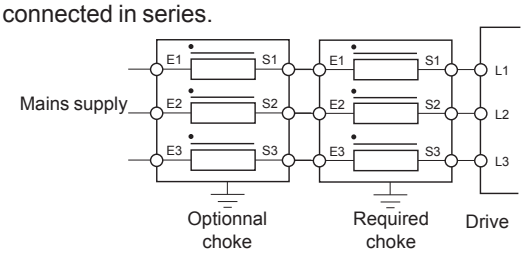
Type	Dimensions (mm)							Weight (kg)
	L	L1	H	H1	D	Ø1	M	
FN 3359 HV-320	386	120	260	235	115	12	M12	10.5
FN 3359 HV-400	386	120	260	235	115	12	M12	10.5
FN 3359 HV-600	386	120	260	235	135	12	M12	11
FN 3359 HV-1000	456	145	280	255	170	12	M12	18

5.5 - Mains chokes

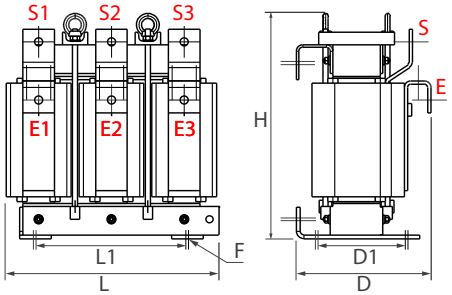
POWERDRIVE MD2CS must be connected to an AC line reactor.

Rating	Choke			
	Reference	Irated (A)	Inductance (µH)	Losses (W)
60T & 75T	135 ST 0.26	135	0.26	150
100T & 120T	200 ST 0.26	200	0.26	220
150T	230 ST 0.19	230	0.19	280
180T	280 ST 0.13	280	0.13	320
220T & 270T	460 ST 0.078	460	0.078	500
340T & 400T	650 ST 0.055	650	0.055	750
470T	800 ST 0.045	800	0.045	850
570T	912 ST 0.035	912	0.035	950
270TH & 340TH	340 ST 0.21	340	0.21	700
400TH & 500TH	480 ST 0.14	480	0.14	800

A second line reactor can be added to reduce the harmonics of the line current. In this case, two identical reactors are connected in series.



- **Weight and dimensions**



Choke	Dimensions (mm)			Fixings (mm)			Weight
	H	L	D	L1	D1	F	kg
135 ST 0.26	237	290	201	250	146	Ø10	30
200 ST 0.26	266	299	237	200	150	Ø10	40
230 ST 0.19	269	304	239	200	158	Ø10	42
280 ST 0.13	290	300	218	225	142	Ø9	34
460 ST 0.078	340	340	220	240	129,5	Ø12,5	50
650 ST 0.055	436	356	258	240	175	2x Ø13	110
800 ST 0.045	468	350	279	250	167	2x Ø13	120
912 ST 0.035	410	420	299	325	228	2x Ø13	85
340 ST 0.21	500	480	335	300	225	Ø12	180
480 ST 0.14	420	440	340	250	200	Ø10	125

5.6 - Associated braking module and resistors

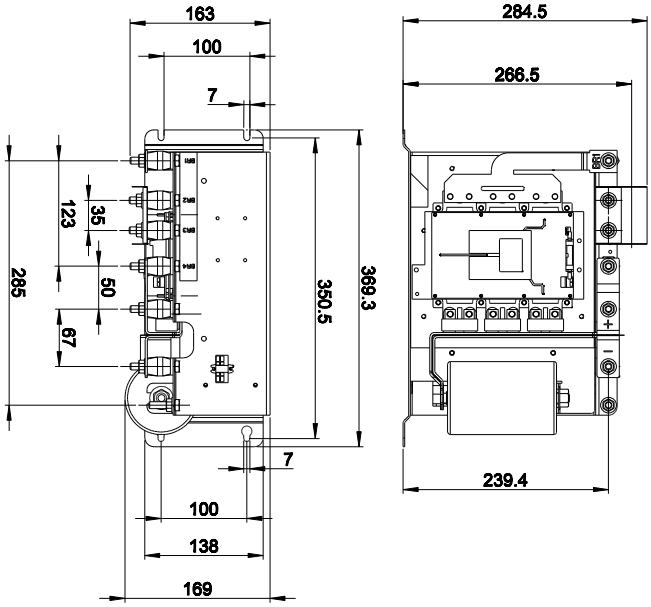
Braking phases occur when energy is sent back from the motor to the drive. Without an additional device, the maximum power that POWERDRIVE MD2CS can absorb is limited to its internal losses. If the application generates significant braking power (inertia slowdown, braking, etc) a device should be added to the standard product consisting in a braking module (MD2TF400 or MD2THF330) and an external RF-MD resistor.

5.6.1 - Braking modules

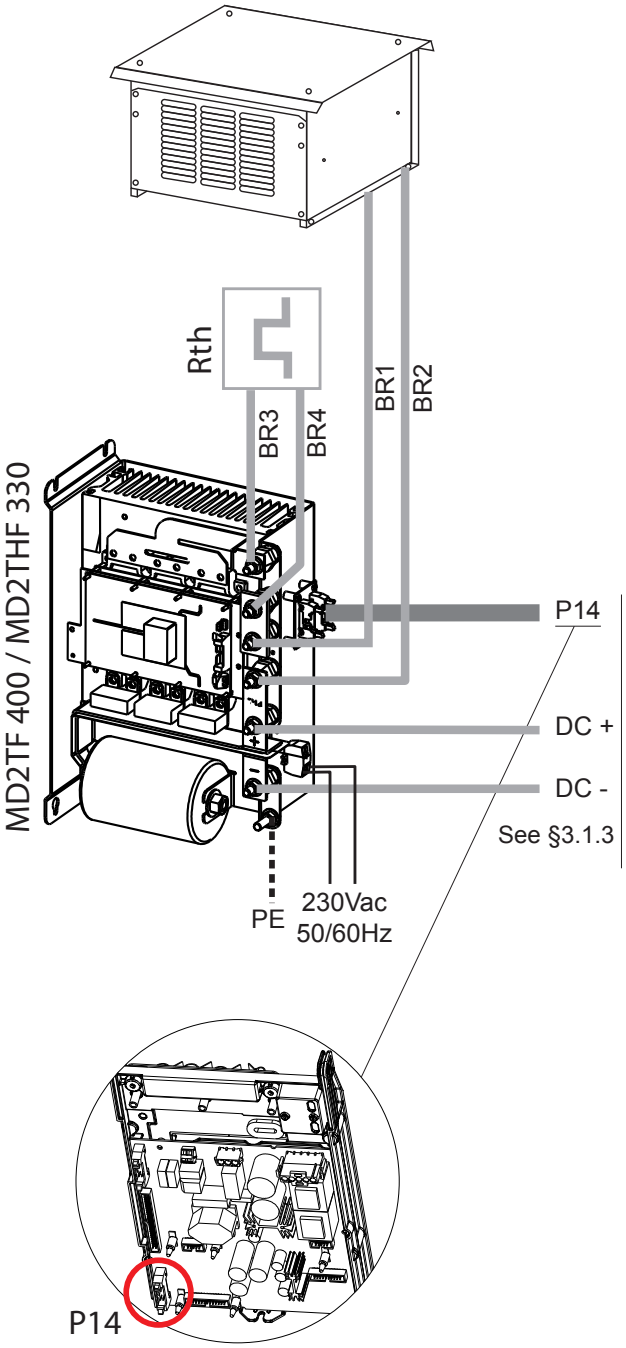
MD2TF transistors consist of an IGBT transistor and a control circuit.

Ratings	T	TH
Braking transistor reference	**MD TF 400**	**MD THF 330**
Peak current (A)	400	330
Continuous current (A)	250	110
Minimum value of the associated resistor (Ω)	1.8	3.5

- **Dimensions**
- **Connexions**



- Connect the braking resistor to the transistor MD2TF400
- Connect a thermal relay Rth (not fitted), set to the stated current for the resistor associated with it.
- Connect the P14 map to the associted connector on the interface board of the drive (tilt the control board to access the interface board).
- Connect DC+ et DC- to the drive DC bus bars with connection clamps (ie Rittal ref. 3457.500).



5.6.2 - Braking resistors

• Before installing a braking resistor, make sure that its presence does not constitute a fire hazard.

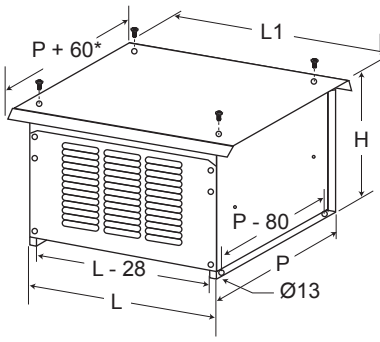
• A braking resistor must be mounted outside the cabinet, as close as possible. Ensure that it is built into an earthed ventilated metal case, to avoid any direct contact.

• The braking resistor must be wired in series with a thermal relay calibrated to the resistor rms current. When the relay trips, the drive must immediately stop and be disconnected from the mains supply.

• Specific information warning of the presence of high temperature must be affixed to the resistor.

• The installation of the braking resistor must not damage neighbouring components with its heat dissipation.

- **Dimensions**



* becomes P + 80 from RF-MD-37500-5 upwards

Protection: IP13

Braking resistor characteristics:

Type	Electrical characteristics							Dimensions (mm)				Weight (kg)
	Resist. value (Ω)	Thermal power (kW)	Rating	Braking transistor kit	Thermal relay	Peak power (kW)	rms current (A)	L	L1	D	H	
RF-MD-27500-10	10	27.5	T	MD2TF400-27500	48 to 65A	51	52	860	890	480	690	66
RF-MD-37500-5	5	37.5	T	MD2TF400-37500	80 to 104A	100	87	960	1140	380	1150	77
RF-MD-55000-5	5	55	T	MD2TF400-55000	95 to 125A	100	105	960	1140	540	1150	105
RF-MD-75000-4	3.5	75	T	MD2TF400-75000	120 to 160A	145	146	1080	1260	680	1150	145
			TH	MD2THF330-75000	120 to 160A	345	146					
RF-MD-110000-3	2.35	110	T	MD2TF400-110000	160 to 220A	220	216	960	1140	740	1520	200

6 - TRIPS - DIAGNOSTICS

6.1 - Safety notice

The user must not attempt to repair the drive himself, nor perform diagnostics other than those listed in this section. If the drive malfunctions, please contact your local technical support.

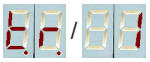
6.2 - Alarms

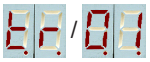
Alarms may appear during drive operation.
These alarms are for information only, in order to warn the user: the drive continues to operate but may trigger a safetrip if no corrective action is taken.
The HMI displays a page «active trips» where «ALARM» appears at the top of the screen. All alarms shown on the console or the configuration interface are listed in the following table.
On the drive control board, 2 LED displays indicate alternately "A.L." and a number that can be used to identify the alarm by means of the table below (this number corresponds to the value of parameter **10.97**).

Code	No.	Meaning
A.L.	1 to 4	User alarm 1 (**10.54**) to User alarm 4 (**10.54**)
	6	Motor overload (**10.17**)
	7	Drive overtemperature (**10.18**)
	8	Microcontroller overoccupancy
	9	Rectifier
	10	Emergency operation (see menu 20)

6.3 - Tripping on a safetrip

If the drive trips, the drive output bridge is inactive, and the drive no longer controls the motor.
When a trip is active, the LEDs present on the control board display alternately "t.r." and a number that can be used to identify the active trip (see left-hand column in the table below). For trips numbered higher than 100, only the last 2 digits are displayed with a point displayed on both LEDs to indicate the hundred.
Example:

 : indicates trip no. 1

 : indicates trip no. 101

After consulting the table, follow the procedure below:
- Make sure that the drive is disabled (STO-1 and STO-2 terminals open)
- Isolate the drive power supply
- Carry out the necessary checks in order to eliminate the reason for the trip
- Activate the STO-1 and STO-2 inputs to clear the trip

The HMI displays an active trip page, where "TRIP" appears at the top of the screen.
All the trips indicated on the keypad or parameter-setting interface are listed in the table below.

Opening and then closing the STO-1/STO-2 drive enable terminals and clear the trip. If the Run FWD or Run reverse terminal is closed at that time, the motor may or may not start immediately, depending on the setting of Ctr.06 (06.04).

No.	Parameter-setting interface name	Reason for trip	Solution
1	**DC UnderVolt**	DC bus undervoltage	• Check the input fuses. • Check the quality of the power supply (voltage dips).
2	**DC over volt**	DC bus overvoltage	• Check that the mains voltage is within the permitted tolerance. • Check the quality of the power supply (commutation notches or transient overvoltages). • Check the motor insulation. • Check that the deceleration mode (**02.04**) is compatible with the application. • If an MD2-TF option is used, check its size, its wiring and the state of the thermal relay.
3	**Over current**	Overcurrent at drive output	• Check the motor insulation. • Check the motor cables (connections and insulation). • Check the quality of the mains supply. • Run power diagnostics.
		This trip cannot be reset for a period of 10 seconds.	

No.	Parameter-setting interface name	Reason for trip	Solution
4	Brak. IGBT	Braking IGBT transistor overcurrent	• Check the braking resistor wiring and insulation level. • Make sure that the resistor ohmic value is compatible with the MD-TF option used.
		This trip cannot be reset for a period of 10 seconds.	
5	I IMBALANCED	Motor current imbalance: vectorial sum of the 3 motor currents is not zero	• Check the motor insulation. • Check the cable insulation.
6	Out Ph. loss of a motor phase	Loss of a motor phase	Check the motor cable and resistance values between motor phases.
7	Overspeed	The speed is greater than (1.3 x **01.06**) or (**01.06** + 1000 rpm)	• Check the drive settings. • When the flying restart function is not being used, check that **06.09** is at "Disabled".
8	Drive overload Ixt	The drive overload level exceeds the conditions defined in section 1.4.2 of the installation manual	• Check the drive is suitable for the motor current cycle. • Check the ambient temperature.
9	IGBT U	Internal protection of phase U IGBTs	• Check the motor and cable insulation. • Run power diagnostics.
10	Th rectifier	Rectifier heatsink temperature too high	• Clean the cabinet dust filters. • Check the drive external and internal fans are working correctly. • Check that the product air inlet temperature is not outside the limits.
11	Encoder rot	The measured position does not vary (only if a feedback speed option is present)	• Check the encoder wiring. • Check that the motor shaft turns.
13	UVW invert	The encoder U, V, W signals are reversed (only if a feedback speed option is present)	Check the conformity of the encoder wiring.
14	TUNE U Encod	During the autotune phase, one of the encoder U, V or W commutation channels is not present	• Check the encoder wiring. • Check the encoder connections. • Change the encoder.
15	TUNE V Encod		
16	TUNE W Encod		
18	AUTOTUNE	A stop command has been given during the autotune phase.	Repeat the autotune procedure (see **05.12**)
19	Brak. resist.	Parameter **10.39** "Braking energy overload accumulator" has reached 100%	• Check the settings of **10.30** and **10.31.** • Check the resistor is compatible with the application requirements.
21	IGBT U overheating	Overheating of phase U IGBTs	• Clean the cabinet dust filters. • Check the drive ventilation units are working correctly. • Check that the product air inlet temperature is not outside the limits. • If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency are complied with. • Check that the switching frequency **05.18** is compatible with the motor current level.

No.	Parameter-setting interface name	Reason for trip	Solution
24	Motor PTC	Opening of the PTC input of the PX1 terminal block or T1 and T2 inputs of the MDX-ENCODER option	• Check the ambient temperature around the motor. • Check that the motor current is less than the stated current. • Check the thermal sensor wiring.
26	Overload + 24V	Overload on the +24 V power supply or digital outputs	Check the I/O wiring.
28	AI2 loss	Loss of the current reference on analog input AI2	Check the input wiring and source.
29	AI3 loss	Loss of the current reference on analog input AI3	
30	COM loss	Loss of communication on the P2 connector serial link	• Check the cable connections. • Check that parameter **11.63** is compatible with the timing of requests from the master.
31	EEPROM	Number of write cycles to EEPROM exceeded (>1,000,000)	• Change the control board. • Check the recurrence of write cycles from the drive controller.
33	Stator resistance	Trip during measurement of the stator resistance	Check the motor wiring.
34	Fieldbus loss	Disconnection of the fieldbus during operation or timing error	• Check the fieldbus connections. • Check that parameter **15.07** is compatible with the timing of requests from the master.
35	STO inputs	Simultaneous opening of both STO (Safe Torque Off) inputs during operation	Check the remote control link.
37	Encoder break	One of the encoder feedback data items is missing	• Check the encoder wiring. • Check the encoder connections.
38	Breakdown	Breakdown of synchronous motor in sensorless closed loop mode	Check the menu **5** parameters are compatible with the values on the motor nameplate
39	Mains synchro	Not used	
41	User 1	User trip 1 triggered by **10.61**.	• See **10.61**.
42	User 2	User trip 2 triggered by **10.63**.	• See **10.63**.
43	User 3	User trip 3 triggered by **10.65**.	• See **10.65**.
44	User 4	User trip 4 triggered by **10.67**.	• See **10.67**.
45	User 5	User trip 5 triggered by the serial link **10.38** = 45	• See **10.38**.
46	User 6	User trip 6 triggered by the serial link **10.38** = 46	
47	User 7	User trip 7 triggered by the serial link **10.38** = 47	
48	User 8	User trip 8 triggered by the serial link **10.38** = 48	
49	User 9	User trip 9 triggered by the serial link **10.38** = 49	
50	User 10	User trip 10 triggered by the serial link **10.38** = 50	
51	DO2 MDX-I/O over Id	The DO2 output load current (MDX-I/O option) is >200 mA	Check that DO2 is not short-circuited.

No.	Parameter-setting interface name	Reason for trip	Solution
52	**DO3 MDX-I/O over Id**	The DO3 output load current (MDX-I/O option) is >200 mA	Check that DO3 is not short-circuited.
53	**MDX-I/O link**	Communication problem between the drive and the MDX-I/O option	Check the MDX-I/O option mounting.
54		Not used	
55	**Unstable DC bus**	The drive DC bus oscillates significantly	• Check the balancing of the mains phases. • Check that all 3 mains phases are present.
56	**IGBT V**	Internal protection of phase V IGBTs	• Check the motor and cable insulation. • Run power diagnostics.
57	**IGBT W**	Internal protection of phase W IGBTs	
58	**IGBT V overheating**	Overheating of phase V IGBTs	• Clean the cabinet dust filters. • Check the drive ventilation units are working correctly. • Check that the product air inlet temperature is not outside the limits. • If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency have been complied with. • Check that the switching frequency **05.18** is compatible with the motor current level.
59	**IGBT W overheating**	Overheating of phase W IGBTs	
60	**Diagnostic**	Problem detected during the control and interface boards test, the power test or during the self-test	• Check that the STO1 and STO2 inputs are closed. • See diagnostic error table.
63	**STO input inconsistency**	The STO1 and STO2 inputs have had a different state for more than 100 ms	Check the remote control link for the STO1 and STO2 inputs.
65	**10V over Id**	Overload on the +10 V power supply	Check the I/O wiring
66	**DO1 over Id**	The DO1 output load current is >200 mA	Check that DO1 is not short-circuited.
67	**Internal ventilation**	Not used	
68	**Motor overcurrent**	The current has exceeded the limit programmed in **05.55**. The load is too high for the setting.	Check that **05.55** is consistent with the application.
69	**24 V MDX-I/O over Id**	The 24 V load current is too high	Check the MDX-I/O option I/O wiring.
70	**4 mA loss on MDX-IO AI4**	Loss of the current reference on analog input AI4 of the MDX-I/O option	Check the input wiring and source of the MDX-I/O option.
71	**4 mA loss on MDX-IO AI5**	Loss of the current reference on analog input AI5 of the MDX-I/O option	
101	**AC mains loss**	Loss of AC supply	• Check the input fuses • Check the quality of the power supply (voltage dips)
102	**Rectifier**	Not used	

7 - MAINTENANCE

• All work relating to installation, commissioning and maintenance must be carried out by experienced, qualified personnel.
• When a trip detected by the drive causes the motor to stop, fatal residual voltages remain on the terminals and in the drive.
• The drive stop function does not protect against high voltages on the terminal blocks.
• Before carrying out any work on the drive or the motor, disconnect and padlock the isolating switch in the switchboard.
• When the drive controls a permanent magnet motor, the isolating switch between the drive and the motor must be open to avoid the risk of motor voltage feedback. If there is no isolating switch, make sure the machine shaft is jammed to prevent it turning while work is carried out.
• After the drive is switched off, the external control circuits can still be active and presents dangerous voltage. Check that these circuits are powered down before working on the control cables.
• Ensure that the DC bus voltage is below 40V before carrying out any work (the control board power-on indicator LED must be off).
• After the drive has been operated, keep away from the heatsink as it may be very hot (70°C).
• After working on the motor, check that the phase order is correct when re-connecting the motor cables.
• Before performing high voltage tests or voltage withstand tests on the motor, switch off the drive and disconnect the motor.

There are very few maintenance and repair operations to be performed by the user on **POWERDRIVE MD2CS** drives. Regular servicing operations are described below.

- **Servicing**

Printed circuits and drive components do not normally require any maintenance. Contact your vendor or the nearest approved repair company in the event of a problem.
CAUTION:
Do not dismantle the printed circuits while the drive is still under warranty, as this immediately makes the warranty null and void.
Do not touch the integrated circuits or the microprocessor with your fingers (ESD risk).
From time to time, with the drive powered down, check that the power connections are correctly tightened.

- **Preventive maintenance**

Device	Action	Frequency
Power connections	Check tightness	1 year

7.1 - Storage

The **POWERDRIVE MD2CS** incorporates aluminium electrolytic capacitors.
If the drive has been stored for more than 12 months, it must therefore be switched on for 5 hrs at the rated operating voltage, and this operation must be repeated every 6 months.
If the drive has been stored for more than 36 months, the capacitors must be reformed.
This consists of gradually applying a DC voltage to the banks of capacitors, until voltage values close to the rated voltages are achieved, while ensuring that the dissipated power does not exceed the maximum values authorised by the manufacturer.
An instruction sheet is available - please contact your local technical support.

7.2 - Replacing products

CAUTION:
Products must be returned in their original packaging or in similar packaging, to prevent them being damaged. Otherwise, replacement under warranty could be refused.

7.3 - List of spare parts

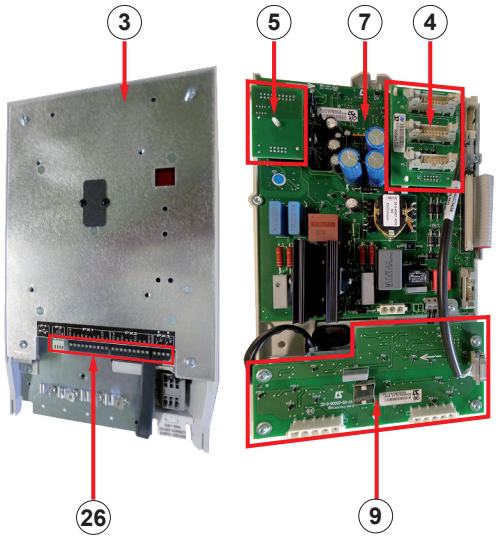
7.3.1 - Electronic PCB

Rep.	Description	LS code
3	Control board	PEF400NB000A
4	Distribution board 60T to 150T	PEF190NE000A
	Distribution board ratings 180T to 570T ratings 270TH to 500TH	PEF720NG000
5	Rating indentification Board	Consult. LS
7	Interface board 60T to 270T	PEF400NE001A
	Interface board 340T to 570T	PEF400NE003A
	Interface board 270TH to 500TH	PEF280NE100A
9	Voltage sensing Board	PEF280NH000A
26	Control board terminal blocs	KITCTRLTERM

7.3.2 - Fuses on the PEF720NH000 DC bus measurement board (key 6)

These fuses are placed under the power bridge capacitor banks, on top of the control block.

Fuse	Size	Type	Value	LS code	Fuse kit
F1	6 x 32	FA	2 A/660 V	PEL002FU004	EDA002LF005
F2					



7.3.3 - Power modules

- **Rectifier module**

Rating	Qty	LS code
60T - 75T	1	MPRB
100T - 120T	1	MPRC
150T	1	RDMPRD
180 T- 220T	1	MPRE
270T	1	RDMPRF
340T - 470T	1	LSRDG
570T	1	LSRDH
270TH to 500TH	1	LSRDG 690V

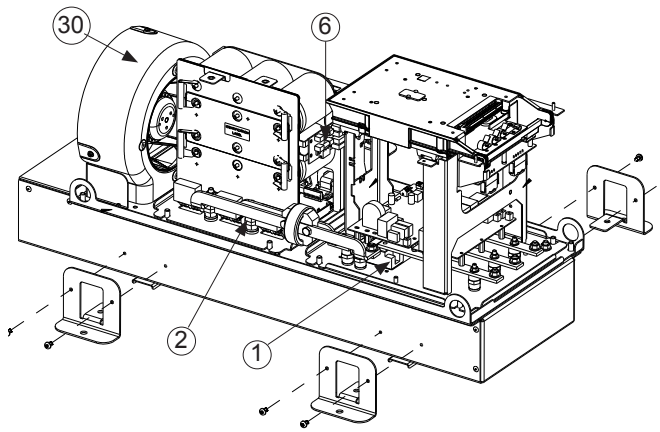
- **Inverter module**

Rating	Qty	LS code
60T	1	RDMPOA
75T	1	MPOC
100T	1	RDMPOD
120T	1	MPOE
150T	1	RDMPOF
180T	3	MPOG
220T	3	MPOH
270T	3	RDMPOI
340T	3	LSPPI
400T	3	LSPPJ
470T	3	LSPPN
570T	3	LSPPR
270TH	3	LSPPL 690V
340TH	3	LSPPM 690V
400TH to 500TH	3	LSPPN 690V

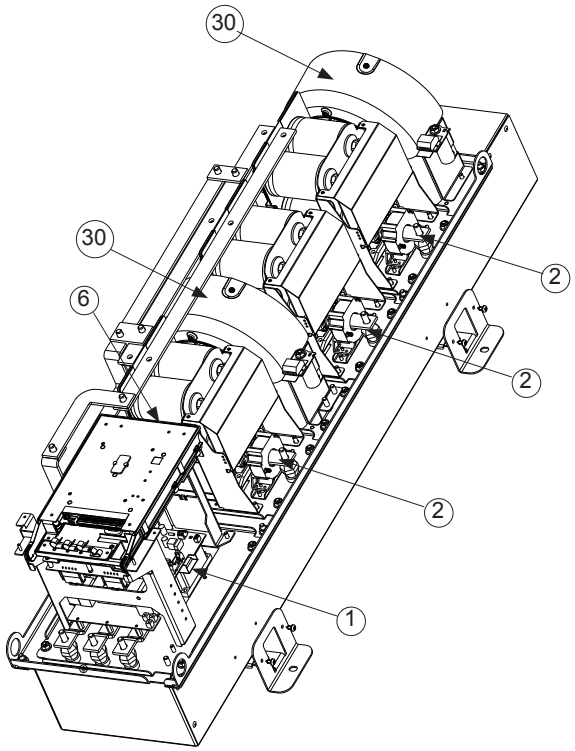
7.3.4 - Other parts

Description	Qty	LS code
100T to 150T fan	1	BLOCVF3MDVIR
180T to 270T fan	2	
340T to 570T fan	4	BLOCVF340A400
270TH to 500TH fan		

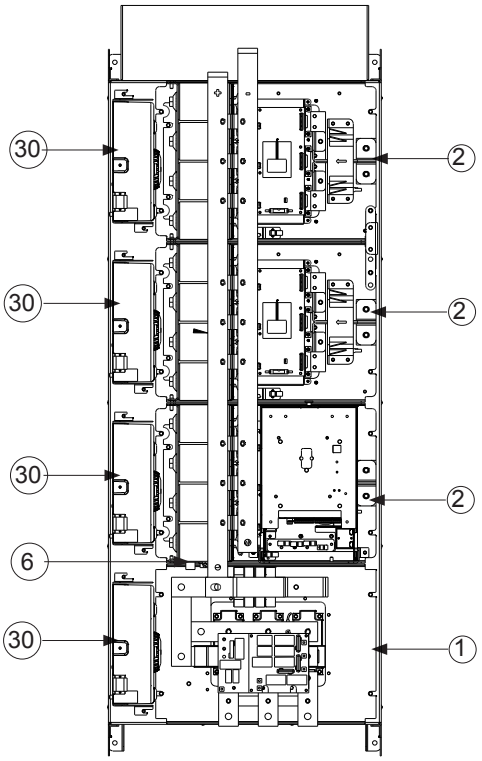
- **Rating 60T to 150T**



- **Rating 180T to 270T**



- **Ratings 340T to 570T & 270TH to 500TH**



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