

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

Installation and maintenance

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

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 may therefore be changed without notice.



For the user's own safety, this variable speed drive must be connected to an approved earth $\frac{1}{\text{---}}$ 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, may also cause the motor to stop. The removal of the causes of the shutdown can lead to restarting, which may 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 may 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.

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SAFETY AND OPERATING INSTRUCTIONS FOR VARIABLE SPEED DRIVES

(In accordance with the low voltage directive 2006/95/EC)

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

1 - General

Depending on their degree of protection, the variable speed drives may contain unprotected live parts, which may 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 documentation.

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 2004/108/EC) are met.

The variable speed drives meet the requirements of the Low Voltage Directive 2006/95/EC. The harmonised 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 documentation supplied with the product.

The 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.

The variable speed drives contain parts which are sensitive to electrostatic stresses and may be easily 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 which 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 documentation.

Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion 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 may 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.

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FOREWORD

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



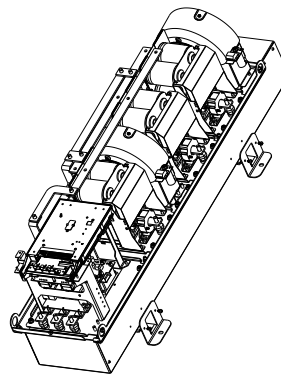
MDX-Powerscreen parameter-setting interface



MDX-KEYPAD



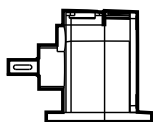
MDX-SOFT Parameter-setting software + PC link cable



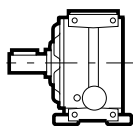
Options

- RFI filter
- Line reactor
- Encoder or resolver input
- Additional I/O
- Communication options (MDX-PROFIBUS, MDX-ETHERNET, MDX-MODBUS, etc.)

Gearboxes

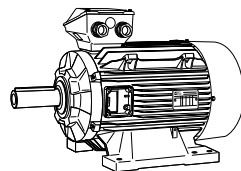


Compabloc
• Axial output
- Helical gears

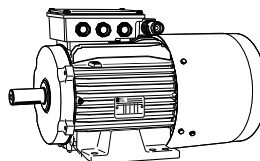


Orthobloc
• Orthogonal output
- Helical bevel gears

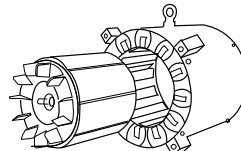
Motors



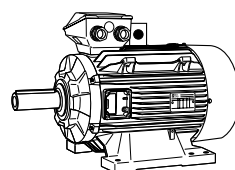
LSES-FLSES motor



LSMV motor

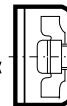


HPM motor



LSRPM motor

Motor options



Axial forced ventilation



Encoder/Sensor



Brake



Radial forced ventilation

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GENERAL INFORMATION


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:

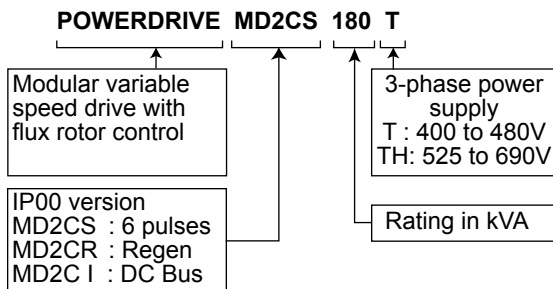
- Induction motors without speed sensor (open loop mode select ) for applications that do not need rated torque control above 1/10th of the rated speed.

- 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 habilitated and trained personnel. A line reactor and a surge protection module must be connected to the drive.**




1.2 - Product designation



1.3 - Environmental characteristics

Characteristic	Level
Protection	IP00
Storage and transport temperature	-30°C to +60°C (see section 7.17.1)
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: <ul style="list-style-type: none"> • 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): <ul style="list-style-type: none"> • Current derating of 1% per additional 100 m <i>E.g. for 1300 m, derate the I_{co} and I_{max} currents by 3%</i> • Operating temperature derating of 0.6°C per 100 m <i>E.g. for 1300 m, the electrical characteristics are maintained for an ambient temperature of [40° - (3 x 0.6°)] = 38.2°C.</i>
Vibrations	In accordance with IEC 60068-2-6 Exposed product: 2 m/s ² (9-200 Hz), 0.6 mm (2-9 Hz) Packaged product: 10m/s ² (9-200 Hz), 3 mm (2-9 Hz)
Shocks	Packaged product: in accordance with IEC 60068-2-29
Atmospheric pressure	700 to 1060 hPa

Nameplate

 MOTEURS LEROY-SOMER 16015 ANGOULEME MADE IN FRANCE	ENTREE - INPUT			
	Ph	V (V)	Hz (Hz)	I(A)
	3	400-480	50/60	295
400V50Hz 480V/60Hz				
	TYPE : POWERDRIVE MD2CS 180T			
	S/N :	 0999999999		

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) .

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GENERAL INFORMATION

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	5% around the rated frequency (50 or 60 Hz)
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 §3.1.1
ROHS conformance	Conforming to standard 2002-95-EC

1.4.1 - Electrical characteristics

I_{co}: Continuous output current.

P_{out}: Output power.

I_{max} (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 3-phase mains supply

Switching frequency = 3 kHz - ambient temperature ≤ 40°C - altitude ≤ 1000 m.

POWERDRIVE MD2CS rating	Heavy duty		Normal duty		I _{max} (60 s) (A)
	P _{out} (kW)	I _{co} (A)	P _{out} (kW)	I _{co} (A)	
60T	45	98	55	112	140
75T	55	122	75	142	175
100T	75	142	90	175	200
120T	90	172	110	212	240
150T	110	220	132	250	312
180T	132	260	160	315	365
220T	160	310	200	400	435
270T	200	380	250	470	530
340T	250	470	315	580	660
400T	315	545	355	640	760
470T	355	670	450	800	940

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525 V to 690 V 3-phase mains supply

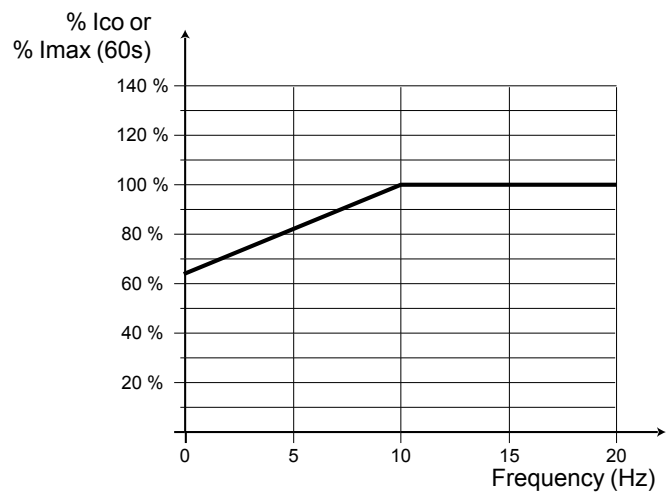
Switching frequency = 3 kHz - ambient temperature $\leq 40^{\circ}\text{C}$ - altitude ≤ 1000 m.

POWERDRIVE MD2CS rating	Heavy duty			Normal duty			I _{max} (60 s) (A)
	Pout at 575 V (kW)	Pout at 690 V (kW)	I _{co} (A)	Pout at 575 V (kW)	Pout at 690 V (kW)	I _{co} (A)	
270TH	160	200	220	200	250	280	308
340TH	200	250	270	250	315	340	378
400TH	250	315	330	315	400	415	465
500TH	315	400	390	400	450	480	545

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 **I_{co}** and **I_{max}** when operating at low motor frequency in continuous operation.



1.4.3 - Line reactor

A line reactor must be connected on terminals L1, L2 and L3 of POWERDRIVE MD2CS.

Line reactor Network 400V 50Hz or 460V 60Hz	POWERDRIVE MD2CS ratings										
	60T	75T	100T	120T	150T	180T	220T	270T	340T	400T	470T
Minimum inductance (mH)	0,26	0,26	0,26	0,26	0,19	0,13	0,078	0,078	0,06	0,06	0,047
Nominal Current (A)	135	135	200	200	230	280	460	460	630	630	790

Line reactor Network 525V à 690V 50 Hz or 60Hz	POWERDRIVE MD2CS ratings			
	270TH	340TH	400TH	500TH
Minimum inductance (mH)	0,19	0,21	0,14	0,14
Nominal Current (A)	230	340	470	470

1.4.4 - Surge protection

For installations susceptible to present high energy transient surges, surge protection module with the following characteristics must be connected between the phases L1, L2 and L3 of the POWERDRIVE MD2CS (see §3), in series with 400V 100A fuses :

- Nominal voltage : 550V
- Nominal unloading current (8/20) μs : 15 kA
- Minimum energy : 300 Joules
- Maximum unloading current (8/20) μs : 30 kA

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GENERAL INFORMATION

1.4.4 - Derating according to the temperature and switching frequency

Ambient temperature $\leq 40^{\circ}\text{C}$ - 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	98	98	98	94	88	112	112	112	108	100
75T	122	122	118	106	96	142	142	133	120	109
100T	142	142	142	130	118	175	175	162	148	134
120T	172	172	166	150	136	220	212	188	170	154
150T	222	220	198	176	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	380	380	380	355	320	470	470	440	400	365
340T	470	470	465	420	380	580	580	525	475	430
400T	545	545	535	480	430	650	640	605	545	490
470T	670	670	640	575	515	800	800	725	650	585
460/480 V mains supply										
60T	98	98	98	90	82	112	112	112	102	93
75T	122	122	110	100	90	142	141	125	112	102
100T	142	142	136	122	112	175	172	154	138	126
120T	172	172	156	140	126	215	200	176	158	144
150T	222	210	186	164	148	255	238	210	186	168
180T	260	260	260	260	235	315	310	305	295	265
220T	310	310	310	295	265	400	395	370	335	300
270T	380	380	370	330	295	470	465	420	375	335
340T	470	470	430	380	340	580	560	485	430	385
400T	545	540	490	430	385	650	610	555	490	435
470T	670	670	585	515	465	800	760	665	585	525
525/690 V mains supply										
270TH	220	220	220			280	280	250		
340TH	270	270	270			340	340	310		
400TH	330	330	330			415	415	380		
500TH	390	390	345			500	480	390		

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.

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Ambient temperature $\leq 50^{\circ}\text{C}$ - 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	98	98	96	88	80	112	112	109	100	92
75T	122	120	108	98	88	142	137	123	111	100
100T	142	142	132	120	110	175	168	150	136	124
120T	172	170	152	138	126	215	192	172	156	142
150T	222	204	182	162	146	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	380	380	360	320	290	470	450	410	365	330
340T	470	470	420	375	340	570	540	475	425	385
400T	545	520	485	430	385	630	590	550	485	435
470T	670	650	575	515	465	780	740	655	585	525
460/480 V mains supply										
60T	98	98	92	82	76	112	112	103	94	86
75T	122	116	102	90	82	142	130	115	103	93
100T	142	142	126	112	100	175	160	142	126	114
120T	172	162	142	128	114	210	184	162	146	130
150T	222	194	170	152	136	254	220	192	172	154
180T	260	260	260	240	215	315	305	295	270	245
220T	310	310	300	270	240	400	385	340	305	270
270T	380	380	340	300	270	470	435	385	340	305
340T	470	450	385	340	305	570	510	435	385	345
400T	545	485	440	385	340	630	550	500	435	385
470T	670	605	525	465	410	780	685	595	525	465
525/690 V mains supply										
270TH	220	210	195			280	240	220		
340TH	270	270	240			340	310	270		
400TH	330	330	300			415	400	340		
500TH	390	365	305			500	415	345		

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.

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MECHANICAL INSTALLATION

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

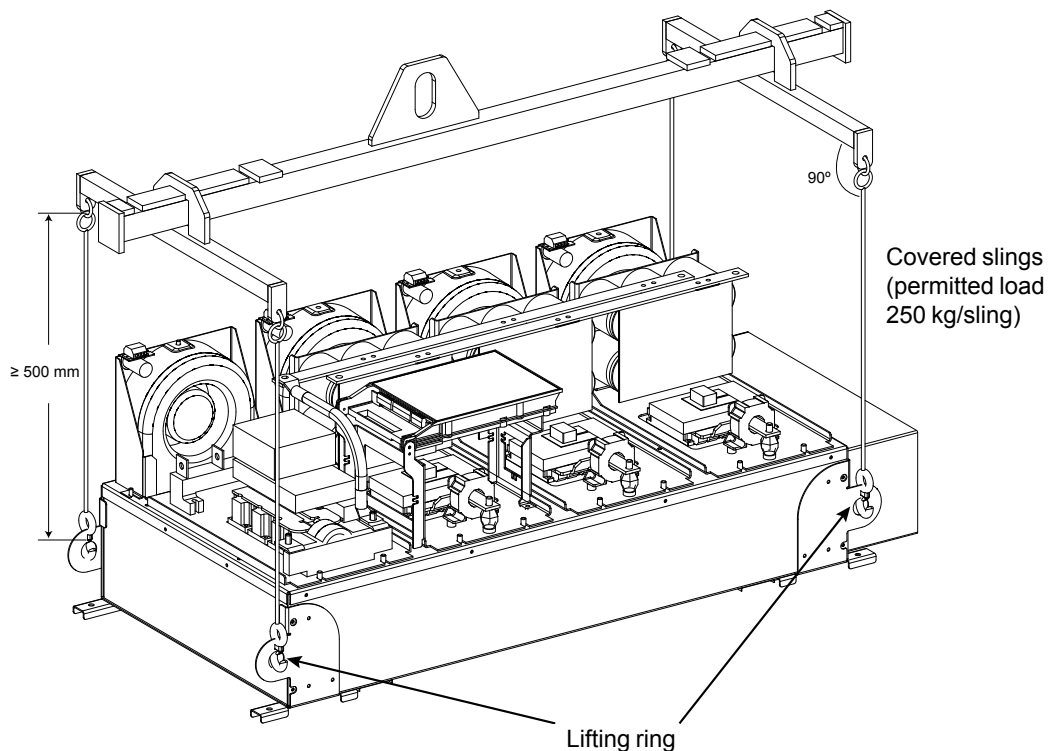
2.2 - Handling

! 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.



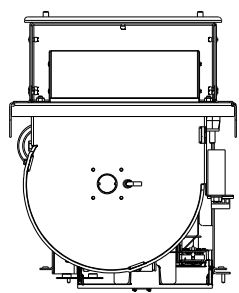
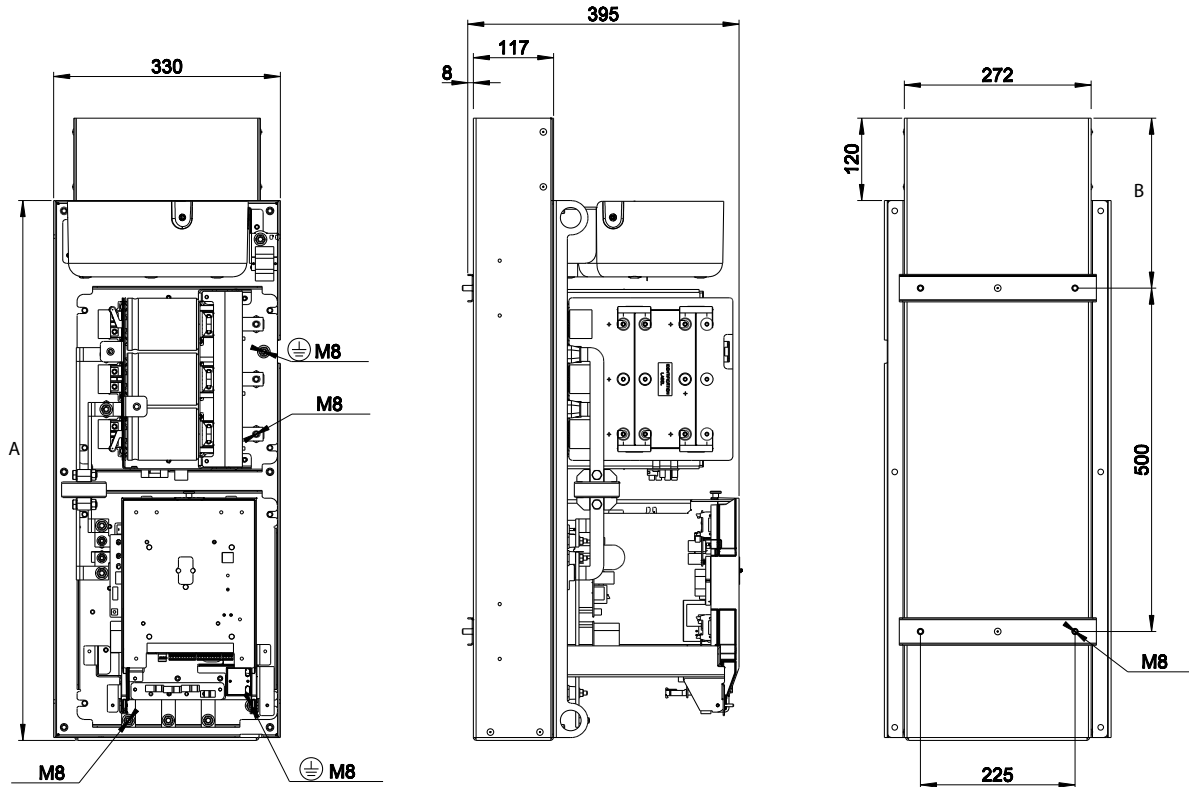
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MECHANICAL INSTALLATION

2.3 - Dimensions and weight

2.3.1 - Drive ratings 60T to 150T



Dimensions in mm

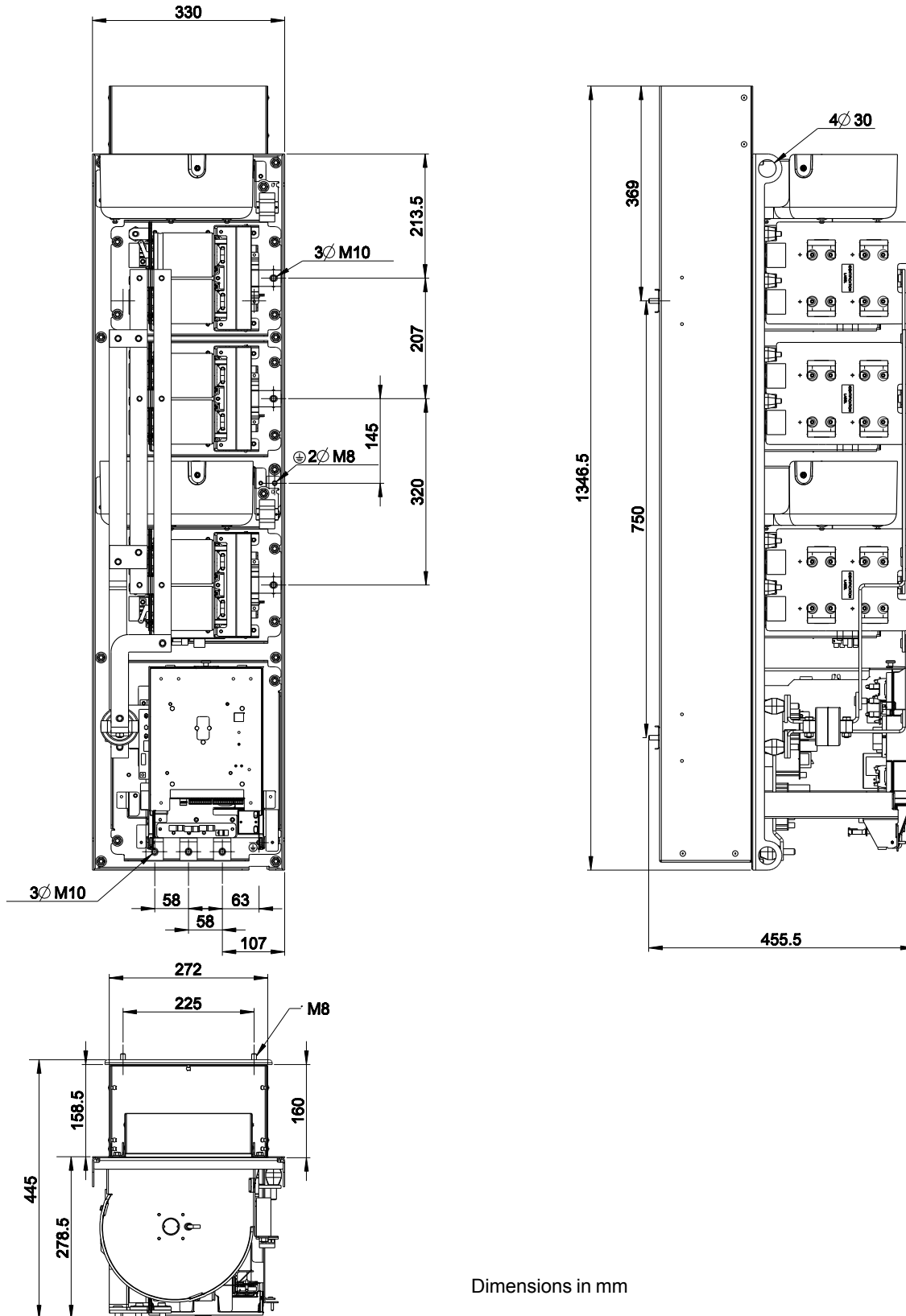
POWERDRIVE MD2CS rating	60T	75T	100T	150T
A (mm)	836		786	
B (mm)	210.5		247.5	
Weight (kg)	40		45	

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

MECHANICAL INSTALLATION

2.3.2 - Drive ratings 180T to 270T



Dimensions in mm

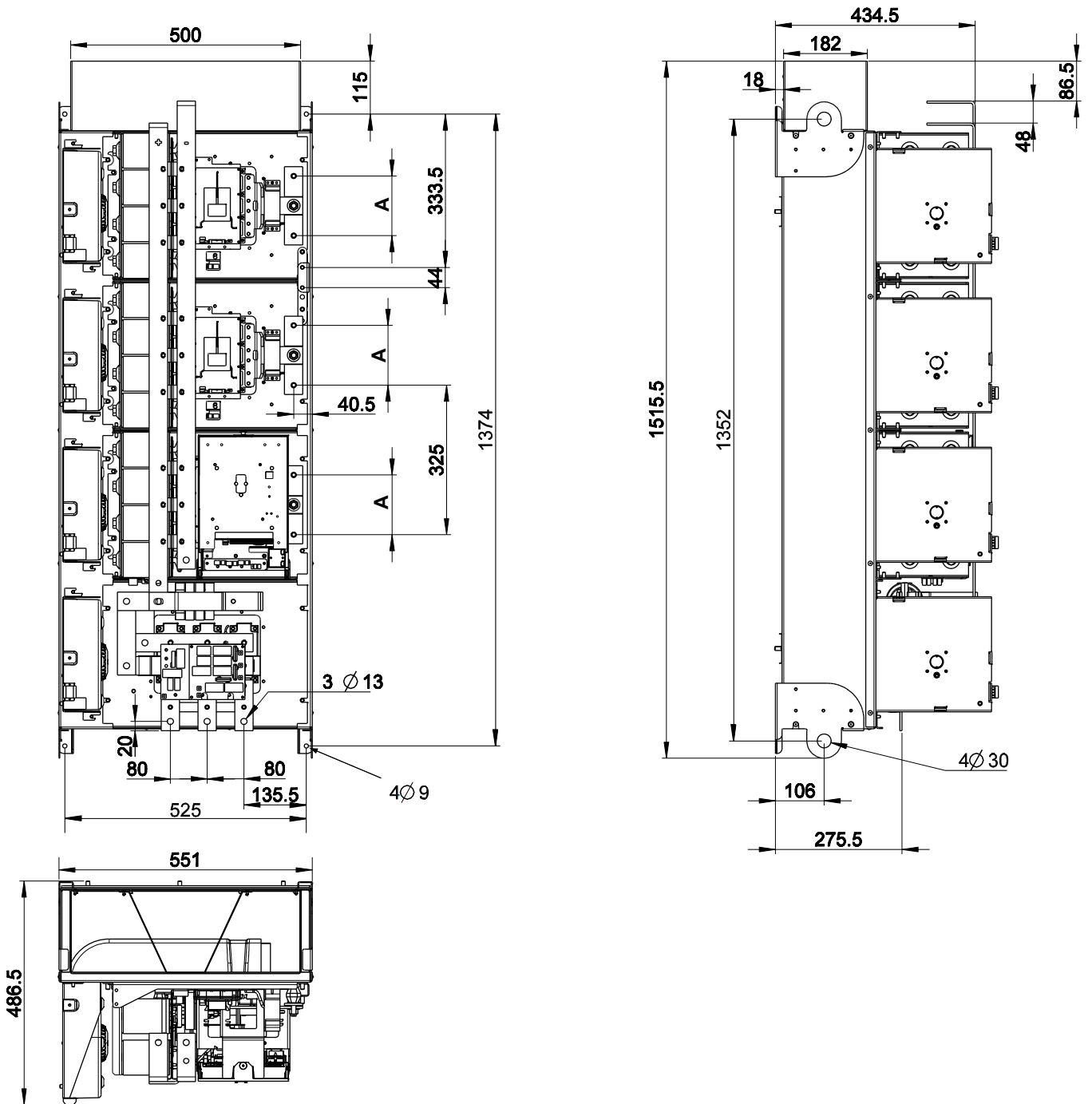
POWERDRIVE MD2CS rating	180T	220T	270T
Weight (kg)	76		

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

MECHANICAL INSTALLATION

2.3.3 - Drive ratings 340T to 470T and 270TH to 500TH



Dimensions in mm

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

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

MECHANICAL INSTALLATION

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 habilitated 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.

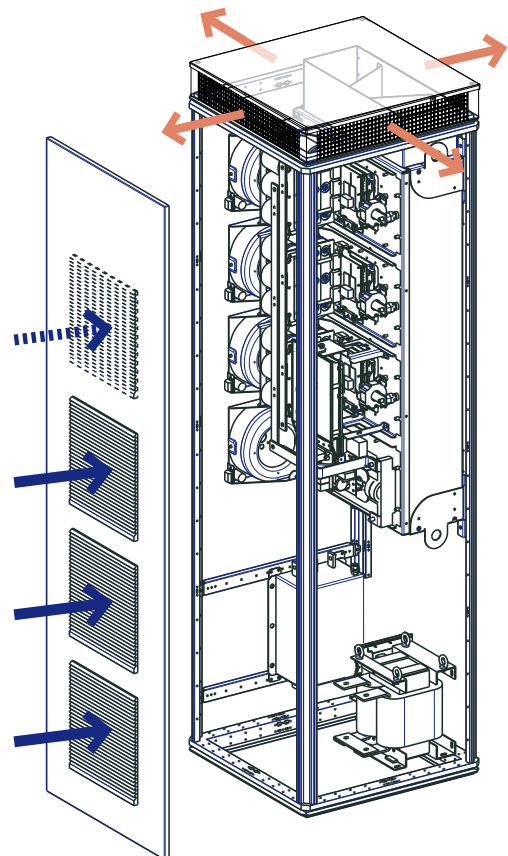
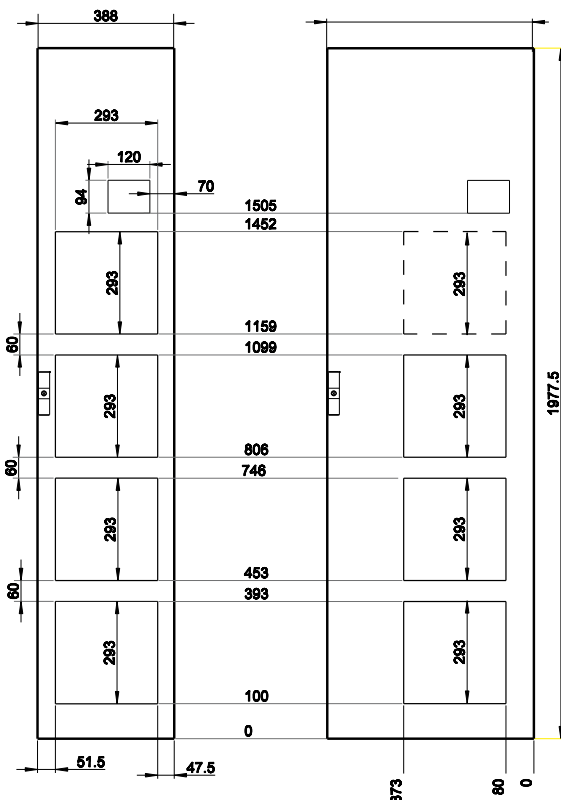
2.4.2 - Air flow

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.



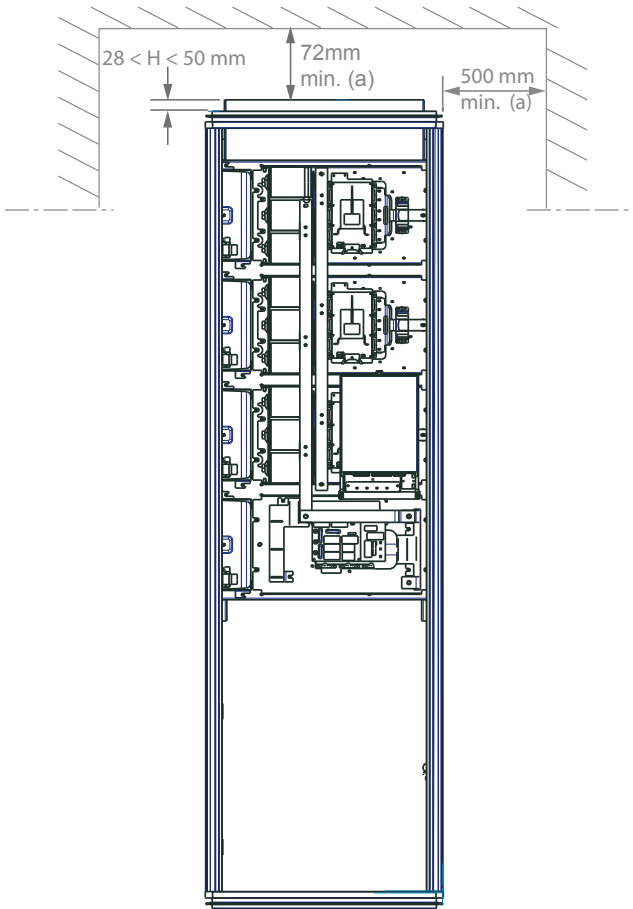
POWERDRIVE MD2CS rating	Minimum air intakes surface Filters exemples	Minimum air outlet surface
60T to 150T	3 filters 290x290mm	32 x 10 ³ mm ²
180T to 270T	4 filters 290x290mm	44 x 10 ³ mm ²
340T to 470T 270TH to 500TH	3 filters 290x290mm	91 x 10 ³ mm ²

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

MECHANICAL INSTALLATION

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.

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	1,7	1,9	2,1	2,1	2,1
75T	2,0	2,2	2,2	2,1	2,1
100T	2,4	2,6	2,4	2,4	2,3
120T	2,8	2,8	2,6	2,6	2,4
150T	3,2	3,5	3,3	3,1	3,1
180T	3,8	4,2	4,5	4,7	4,5
220T	4,9	5,4	5,6	5,5	5,2
270T	5,7	6,3	6,5	6	5,7
340T	7,4	7,9	8,5	8,3	8,1
400T	8,6	9,1	9,8	9,6	9,3
470T	10,8	11,2	11,8	11,5	11,2
270TH	5,6	6,0	6,2		
340TH	9,2	9,7	9,7		
400TH	8,7	9,4	9,4		
500TH	10,5	11,3	11,2		

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 470T	1700	77
270TH to 500TH	1700	77

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

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 need to be supplied through a single-phase external power source (terminal on control bloc).

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

- **Electrical characteristics:**

	Voltage	Maximum power
Electronics power supply	230 V isolated	100 VA
Forced ventilation and auxiliaries power supply	230 V connected to earth	60T to 150T: P = 300 VA 180T to 270T: P = 500 VA 340T to 470T: P = 1200 VA 270TH to 500TH: P = 1200 VA

3.1.2 - Characteristics of connection terminals

Refs.	Functions/connections	Type of connection and tightening torque		
		60T to 150T	180T to 270T	340T to 470T 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)				
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

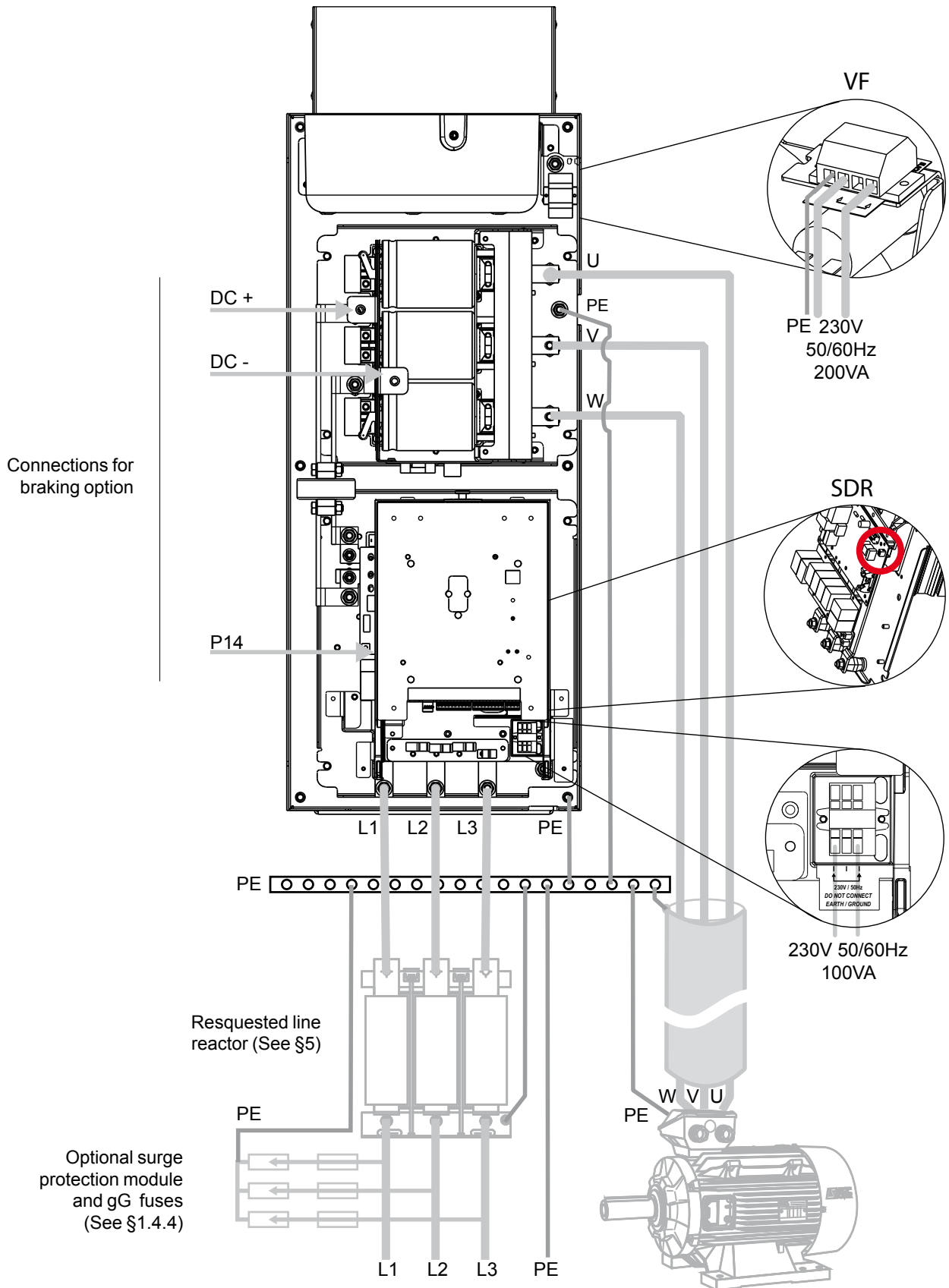
POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

3.1.3 - Location of power terminal blocks

3.1.3.1 - Ratings 60T to 150T

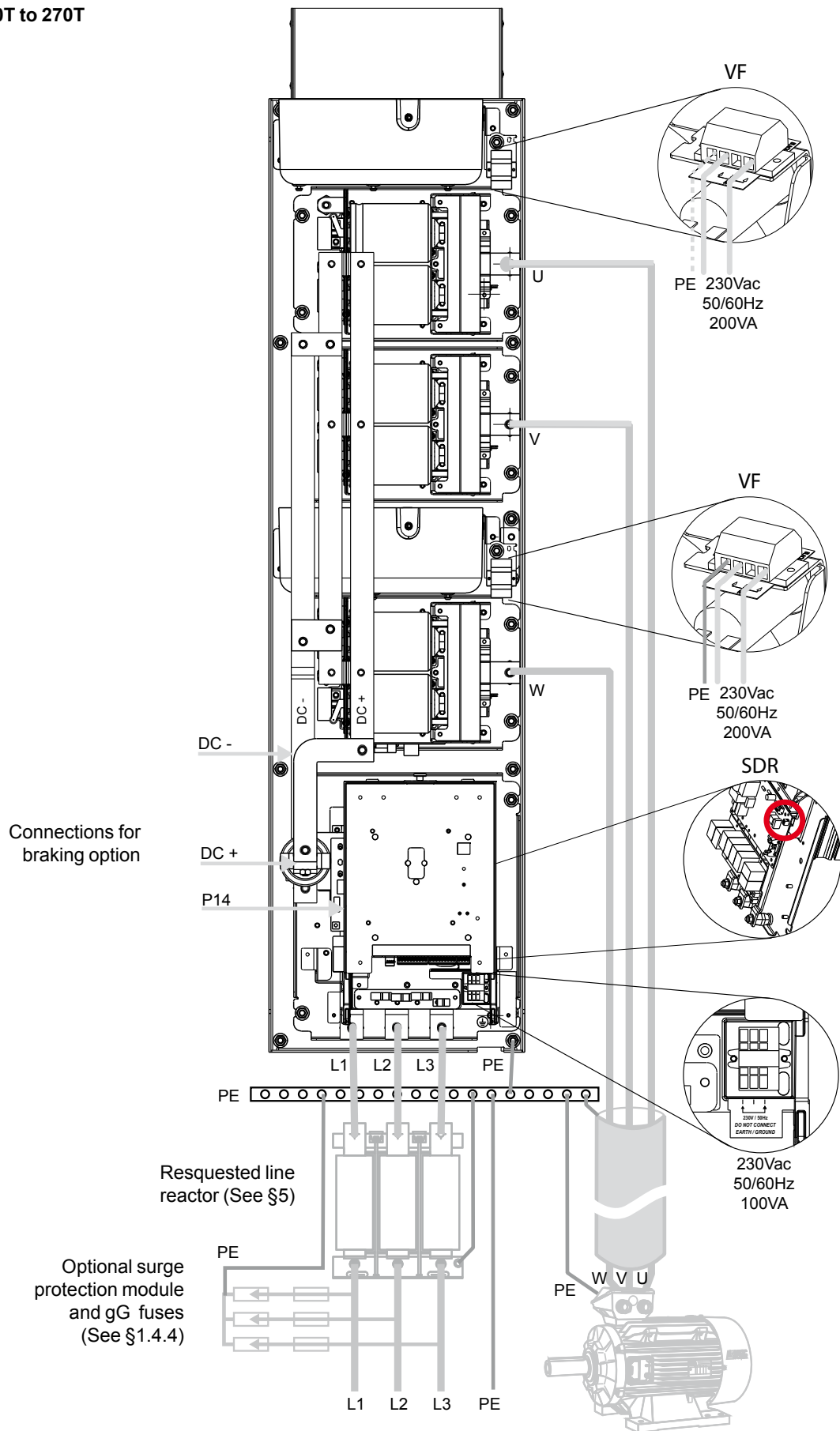


POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

3.1.3.2 - Ratings 180T to 270T

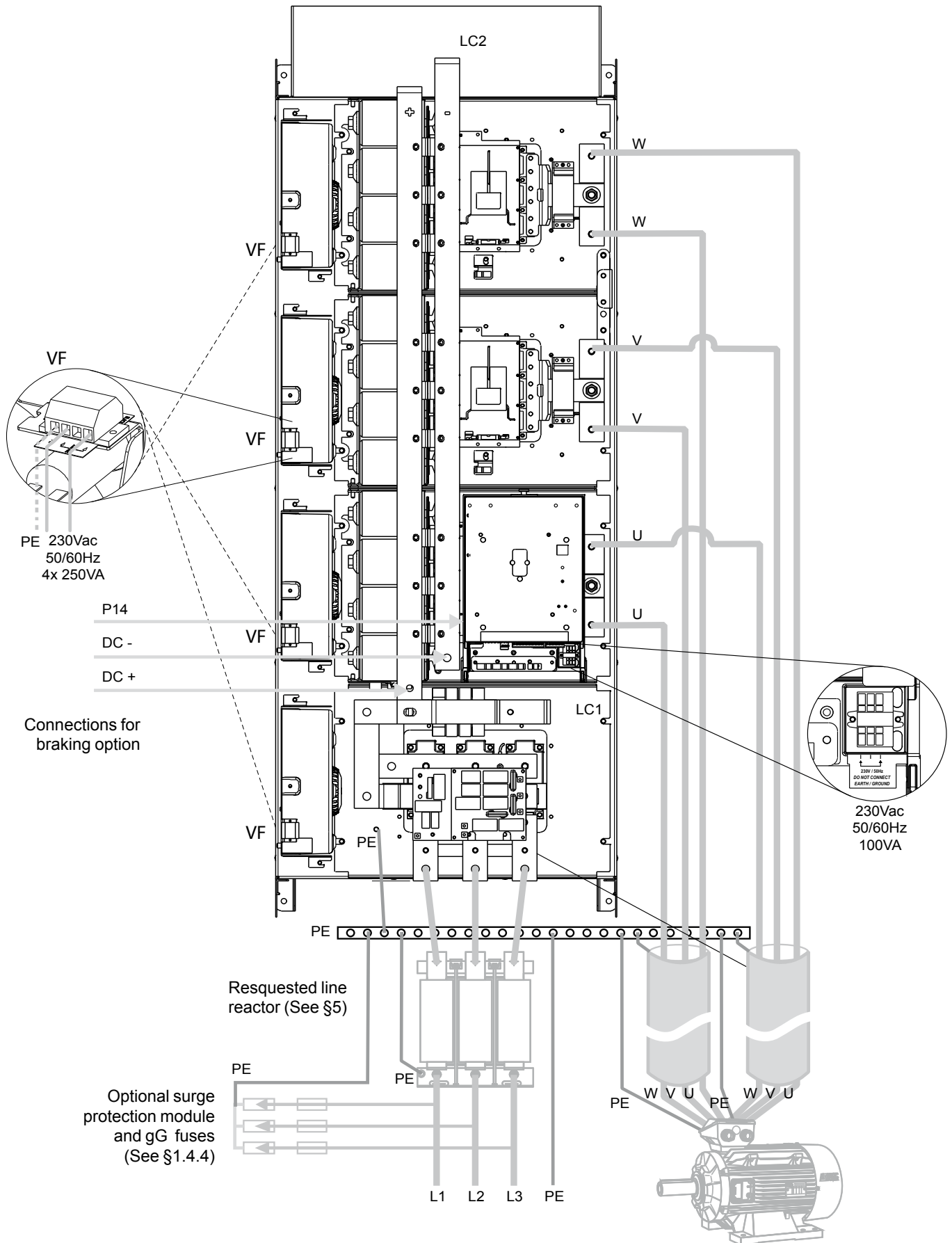


POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

3.1.3.3 - Ratings 340T to 470T and 270TH to 500TH



POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

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 (I_{sc}) > 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

I_{co} : Continuous output current

POWERDRIVE rating	Mains power supply								Motor		
	400 V - 50 Hz				460/480 V - 60 Hz						
	I_L (A)	Fuses		Cable cross-section (mm ²) (3)	I_L (A)	Fuses			Cable cross-section (mm ²) (3)	I_{co} (A)	Cable cross-section (mm ²) (4)
Gg type (1)		aR type (2)	Gg type (1)			Class J (UL)	aR type (2)				
60T	105	125	200	3x50 + 25	95	125	150	200	3x35 + 16	112	3x50 + 25
75T	140	160	250	3x70 + 35	125	160	200	250	3x70 + 35	142	3x70 + 35
100T	170	200	315	3x95 + 50	150	200	225	250	3x70 + 35	175	3x95 + 50
120T	198	250	350	3x120 + 70	175	200	250	315	3x95 + 50	215	3x120 + 70
150T	245	315	450	3x150 + 70	215	250	300	350	3x120 + 70	260	3x150 + 70
180T	295	315	500	3x240 + 120	255	315	400	450	3x185 + 90	305	3x240 + 120
220T	370	400	630	2x(3x95 + 50)	320	400	500	550	3x240 + 120	380	2x(3x95+50)
270T	460	500	800	2x(3x150 + 95)	405	500	600	700	2x(3x120 + 70)	470	2x(3x150+95)
340T	580	630	1000	2x(3x185 + 95)	495	630	--	800	2x(3x150 + 95)	580	2x(3x185+95)
400T	650	800	1100	2x(3x240 + 120)	560	630	--	900	2x(3x185 + 95)	630	2x(3x240+120)
470T	790	1000	1400	3x(3x185 + 95)	700	800	--	1250	2x(3x240 + 120)	800	3x(3x185 + 95)

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

POWERDRIVE rating	Mains power supply							Motor		
	525 V				690 V			I _{co} (A)	Cable cross-section (mm ²) (4)	
	I _L (A)	Fuses (1)		Cable cross-section (mm ²) (3)	I _L (A)	Fuses (1)				
Gg type (1)		aR type (IEC&UL) (2)	Gg type (1)			aR type (IEC&UL) (2)				
270TH	250	315	450	3x120 + 70	265	315	450	3x120 + 70	280	3x150 + 70
340TH	305	400	550	3x150 + 70	320	400	550	3x150 + 70	340	3x240 + 120
400TH	370	400	700	3x240 + 120	390	400	700	3x240 + 120	415	2x(3x120+70)
500TH	445	500	800	3x240 + 120	470	500	800	3x240 + 120	500	2x(3x150+95)

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

(1) gG fuse or equivalent solution (fuses connected in parallel, preferably C type circuit-breaker, etc). This protection must always be connected in series with aR semi-conductor fuses.

(2) Semiconductor aR fuses do not ensure the protection of the drive power supply line and must always be associated with a protection device against overload, localized at the head of the line.

(3) The recommended mains cable cross-sections have been determined for single-core cable with a maximum length of 20 m. For longer cables, take line voltage drops into consideration due to large cable length.

(4) The motor cable cross-sections are given for information only for a current corresponding to the value of the I_{co} current at 3 kHz, 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** (see section 4.5.2). The values supplied are typical values.

Example: Cable cross-section of 3 x (3 x 185 + 95) corresponds to 3 cables each consisting of 3 phase conductors (cross-section 185 mm²) + earth conductors (cross-section 95 mm²).



POWERDRIVE MD2CS

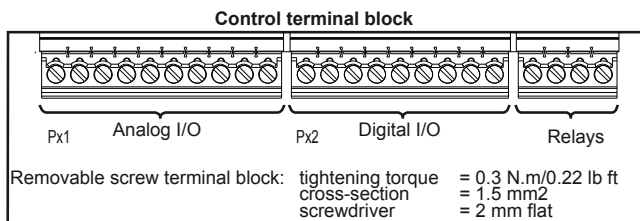
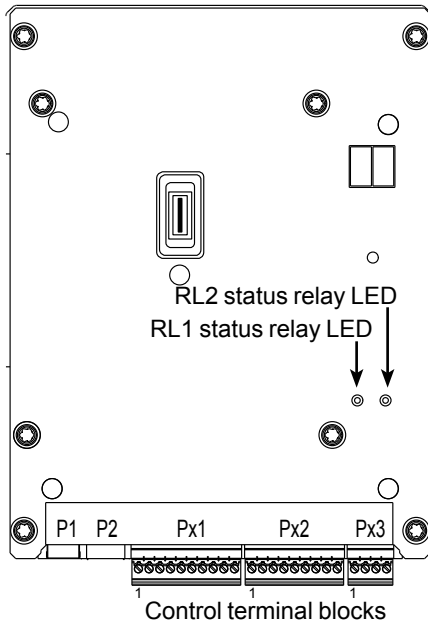
Chassis-mounted variable speed drive

CONNECTIONS

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 unwanted 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 conforming to SELV safety requirements, additional insulation must be inserted to maintain the SELV classification (see EN 61140).

3.2.1 - Control terminal block location



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		0-20 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

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

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

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 (see diagram in section 3.2.1).

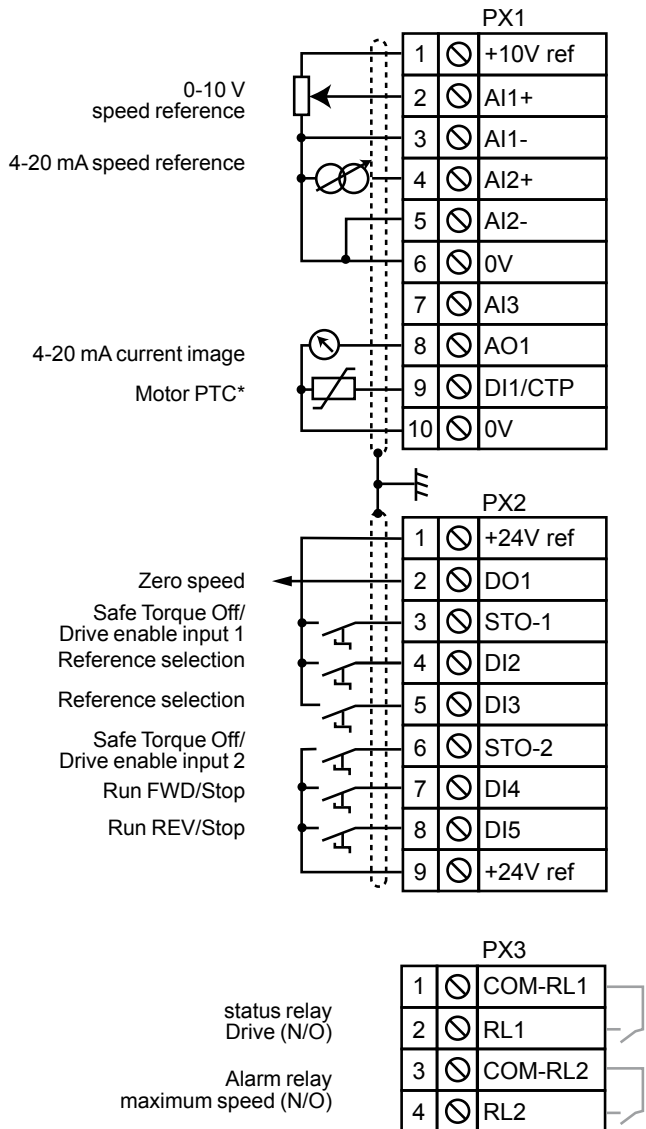
POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

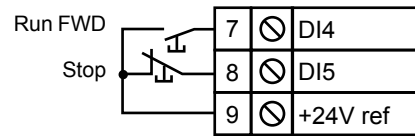
3.2.3 - Factory configuration of control terminal blocks

Note: For details of the parameters, refer to the commissioning manual, ref. 4617.



• **Modification of the Run/Stop control logic**

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

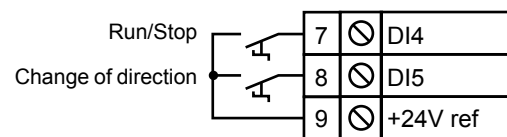


List of parameters to adjust:

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 adjust:

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
1	1	Spd.05 (01.22) to be set

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).

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

CONNECTIONS

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 provided.

They are independent of one another. They are created by simple hardware not connected to the microcontroller. They acts 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, at minimum, one of the inputs 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; PL_e
- IEC/EN 62061: 2005; SIL3

(CETIM approval no. CET0047520)

In a safety system, this built-in function enables the drive to act as a substitute for a contactor so the motor can run in freewheel mode.

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 is 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.

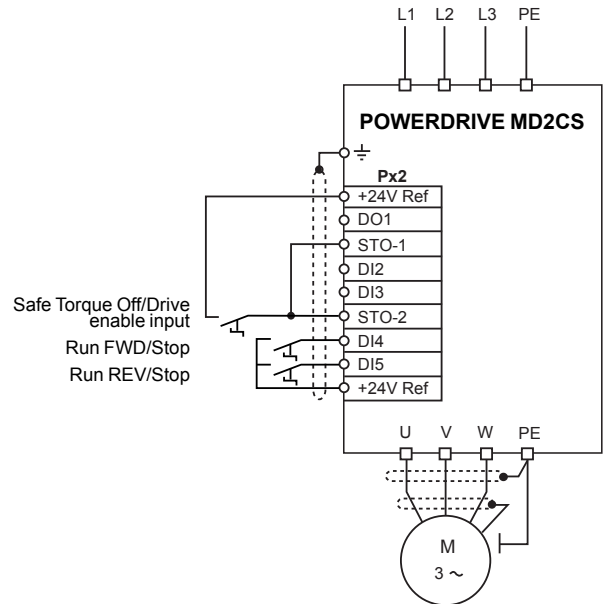
• The STO-1 and STO-2 inputs, when open, lock the drive, so the dynamic braking function is no longer available. If a braking function is required before the drive secure disable lock is applied, a time-delayed safety relay must be installed to activate the locking automatically after the end of braking.

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 carry out on the drive/installation, the power supply must therefore be switched of an approved isolating device (isolator, switch, etc).

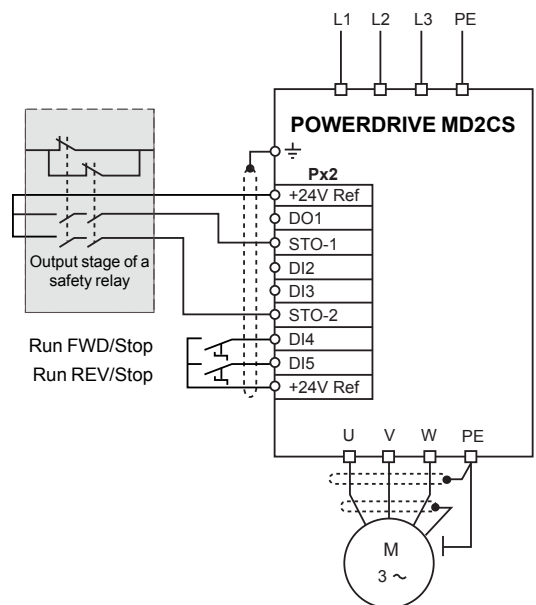
3.3.1 - Single channel locking (SIL1 - PL_b)

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



3.3.2 - Double channel locking (SIL3 - PL_e).

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



POWERDRIVE MD2CS

Chassis-mounted variable speed drive

GENERAL EMC - HARMONICS - MAINS INTERFERENCE

4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE

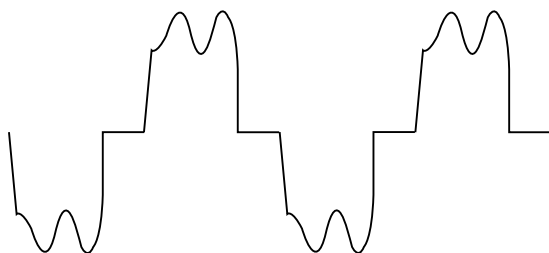
The power structure of frequency inverters leads to the occurrence of two types of phenomenon :

- 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 $6n \pm 1$.

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 be complied 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.

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

GENERAL EMC - HARMONICS - MAINS INTERFERENCE

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 $2 \times$ mains V_{rms} . 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.

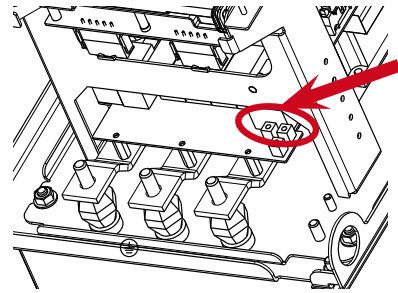
4.4.3 - Unbalanced power supply

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.

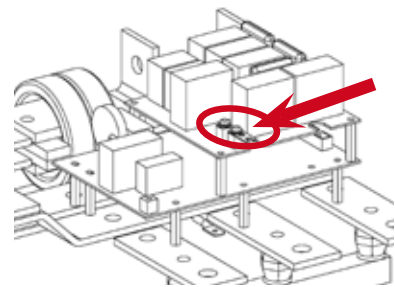
Additional mains chokes can be installed upstream of a **POWERDRIVE MD2CS** supplied by an unbalanced mains in order to reduce the current imbalance factor (see characteristics in section 5.4).

Neutral IT point connection

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



POWERDRIVE MD2CS 60 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.

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

GENERAL EMC - HARMONICS - MAINS INTERFERENCE

4.5 - Basic precautions for installation

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

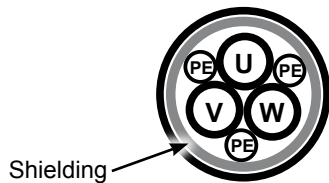
4.5.1 - Wiring inside the cabinet

- Do not run the control cables and the power cables in the same cable ducts.
- For control cables, use shielded twisted cables.

4.5.2 - Wiring outside the cabinet

- **Connect the motor earth terminal directly to that of the drive.**

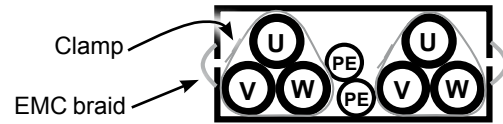
It is recommended that a shielded symmetrical cable is used: three phase conductors and three PE conductors arranged symmetrically.



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

- The shield 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.

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

GENERAL EMC - HARMONICS - MAINS INTERFERENCE

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			

Emission				
Standard	Description	Category	Conformity conditions	
			Standard(2)	With external RFI filter(1) (2)
EN 61800-3	Variable speed drive standards	C1	-	-
		C2	-	Conforming - Cable length < 20 m - Switching frequency < 4 kHz
		C3	Conforming - Cable length < 100 m - Switching frequency < 4 kHz	Conforming - Cable length < 100 m - Switching frequency < 6 kHz

(1) See §5.4

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

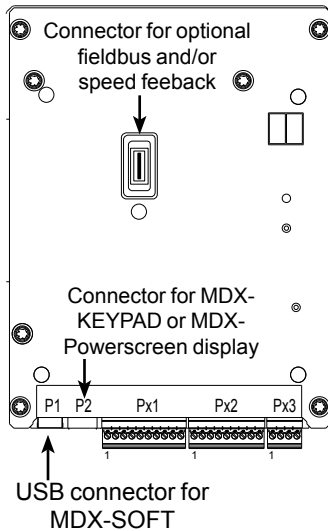
POWERDRIVE MD2CS

Chassis-mounted variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

5 - PARAMETER-SETTING INTERFACE AND OPTIONS

• Connection to the drive



• P1 connector

This connector is a slave type B 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 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.

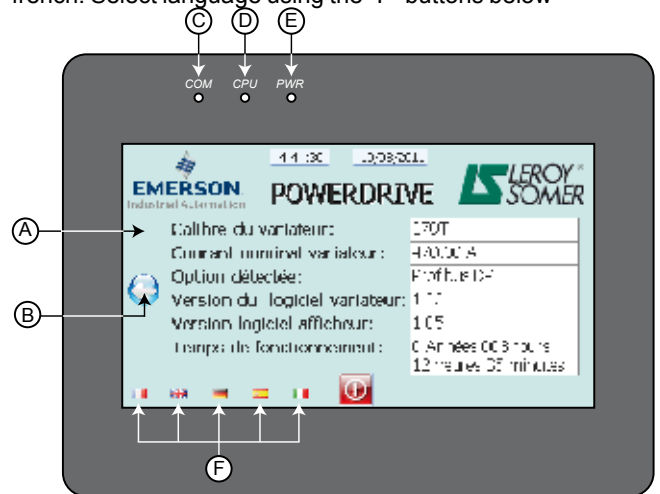
5.1 - Parameter setting

5.1.1 - 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

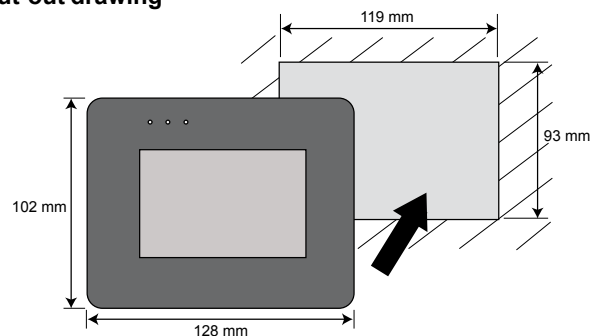


Ref.	Function
A	4.3" touch screen
B	Touch-sensitive button to access the main menu
C	"COM" LED, indicates the state of the communication with the drive. Off: no communication Flashing: communicating
D	"CPU" LED, indicates the status of the interface CPU
E	"PWR" LED, indicates the state of the interface 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





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PARAMETER-SETTING INTERFACE AND OPTIONS

• 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 measurement data points.
- **Parameter setting:** Used for reading and/or modification of all the drive parameters, as well as to set 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.


5.1.2 - MDX-KEYPAD

5.2.3.1 - General

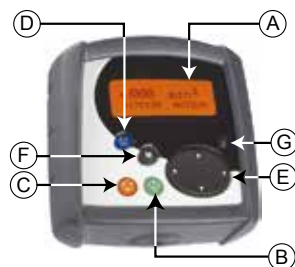
This keypad, which is remote from the drive, makes easy the setting of the **POWERDRIVE MD2CS** and provides access to all parameters. Its LCD display, consisting of one line of 12 characters and 2 lines of 16 characters, offers text which can be displayed in 4 languages (English, French, German and 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: <ul style="list-style-type: none"> - 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	 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.

5.1.3 - 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.leroy-somer.com/>

POWERDRIVE MD2CS

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PARAMETER-SETTING INTERFACE AND OPTIONS

5.2 - Add-on options

The **POWERDRIVE MD2CS** control board is designed to be plugged with various optional modules. Several options can be combined:

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

5.2.1 - Fieldbus modules

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

Two types of options are offered (with the same functionality):

- MDX option: option to be fitted to the control board (white)
- CM module: compact module to be integrated in an existing MDX board (grey)

Option / Module	Fieldbus
MDX-PROFIBUS CM-PROFIBUS	Profibus DP V1
MDX-MODBUS CM-MODBUS	Modbus RTU on RS485/232
MDX-ETHERNET CM-MODBUS	Modbus TCP on Ethernet
MDX-PROFINET CM-PROFINET	ProfiNet
MDX-ETHERNET-IP CM-ETHERNET-IP	EtherNet/IP

⚠ • Check that the optional module is in good condition: never install a damaged module in the drive.

• Before installing or removing the option, or when it is necessary to disconnect the cables connected to it, it is essential for the drive to be switched off.

CAUTION:

- Do not break the cut-out part.
- A MDX-Fieldbus option can never take the MDX-ENCODER terminal block.

For more information, refer to the manuals for the relevant options available on www.leroy-somer.com.

5.2.2 - Speed feedback option

5.2.2.1 - MDX-ENCODER

The MDX-ENCODER option is used to manage the motor speed feedback. It manages incremental encoders with or without commutation channels.

⚠ Before installing or removing the MDX Speed feedback option, or when it is necessary to disconnect the cables connected to the option, it is essential for the drive to be switched off.

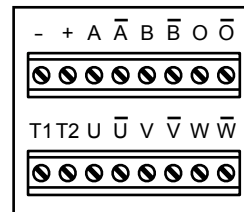
5.3.2.2 - General

- Use a shielded cable for connection, and connect the shield over 360° using the grounding bracket (see section 5.2.4).
- The MDX-Encoder module can manage the motor PTC thermal probe via terminals T1 and T2. In this case, some parameters need to be set. Refer to parameter **Mtr.06 (05.70)** in the commissioning manual ref. 4617.
- Terminals 0 and 0\ are not used.

Note: LEROY-SOMER offers optional connection cables. For more information, please get in touch with your usual LEROY-SOMER contact.

CAUTION: The encoder cable shielding must always be connected to the grounding bracket supplied with the option.

- Connection terminal blocks



+	Power supply
-	
Rated voltage	5V ± 10% - Output current 300mA
	15V ± 10% - Output current 200mA

A	Encoder channel connection
A\	
B	
B\	
Maximum frequency	500 kHz

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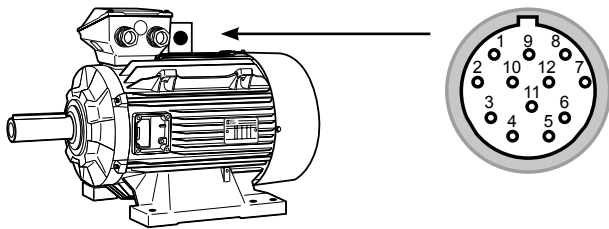
PARAMETER-SETTING INTERFACE AND OPTIONS

• **Connection of an incremental encoder**

MDX-ENCODER wiring

-	Encoder power supply 0 V
+	5 V or 15 V power supply depending on encoder characteristics. Set Mtr.12 (03.36)
A	Encoder channel connection
A\	
B	
B\	
0	Not used
0\	

Wiring an encoder to a LEROY-SOMER asynchronous motor



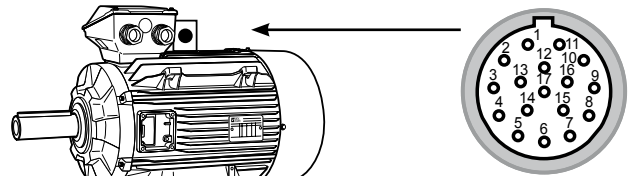
12-pin connector encoder side (male plug)		MDX-Encoder terminals
Ref.	Description	Description
1	0V	-
2	+5V or +15V	+
3	A	A
4	B	B
5	0	x
6	A\	A\
7	B\	B\
8	0\	x
9	x	x
10	x	x
11	Shielding	Bracket
12	x	x

• **Connection of an incremental encoder with commutation channels**

MDX-ENCODER wiring

-	Encoder power supply 0 V
+	5 V or 15 V power supply depending on encoder characteristics. Set Mtr.12 (03.36)
A	Encoder channel connection
A\	
B	
B\	
0	Not used
0\	
U	Connection of commutation channels
U\	
V	
V\	
W	
W\	

Wiring an encoder to a LEROY-SOMER Dyneo® synchronous motor



Use one twisted cable per pair (U,U\; V,V\, etc).
The thermal sensor is connected in the terminal box.

12-pin connector encoder side (male plug)		MDX-Encoder terminals
Ref.	Description	Description
1	x	x
2	x	x
3	x	x
4	U	U
5	U\	U\
6	V	V
7	V\	V\
8	W	W
9	W\	W\
10	A	A
11	0	x
12	0\	x
13	A\	A\
14	B	B
15	B\	B\
16	+5V or +15V	+
17	0V	-
*	Shielding (*)	Bracket

(*) to be connected to connector housing.

POWERDRIVE MD2CS

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PARAMETER-SETTING INTERFACE AND OPTIONS

5.2.2.2 - MDX-RESOLVER

The MDX-RESOLVER option is used to manage the motor speed feedback. It manages 2 to 8 poles resolvers.

! Before installing or removing the MDX Speed feedback option, or when it is necessary to disconnect cables from the option, it is essential for the drive to be switched off.

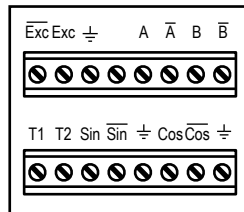
• **General**

• The MDX-RESOLVER module can manage the motor PTC thermal probe via terminals T1 and T2. In this case, some parameters need to be set. Refer to parameter **Mtr.06 (05.70)** in the commissioning manual ref. 4617.

Note: LEROY-SOMER offers optional connection cables. For more information, please get in touch with your usual LEROY-SOMER contact.

! Use a single twisted pair cable, shielded pairs with an outer shield for the connection. Connect the shield over 360 ° at both ends (grounding bracket supplied with the option).

• **Connection terminal blocks**



• **MDX-RESOLVER wiring**

1	Resolver excitation	LOW
2	Resolver excitation	HIGH
Characteristic		10 kHz sine wave signal
Rated voltage		Transformer ratio (03.58): 4 : 1 = 5.2 Vrms 3 : 1 = 3.8 Vrms 2 : 1 = 2.6 Vrms 1 : 1 = 1.3 Vrms
Max. current		80 mA (EXC HIGH)
3	x	
4	x	
5	Encoder simulation	Channel A output
6		Channel /A output
7		Channel B output
8		Channel /B output
Characteristic		RS 485 differential voltage (A and /A, B and /B)
9	x	
10	x	
11	Resolver inputs	SIN HIGH
12		SIN LOW
13		COS HIGH
14		COS LOW
Characteristic		2 Vrms sine wave signal (max)
Frequency		10 kHz
15	x	

5.2.3 - MDX-I/O TIMER option

• **General:**

The MDX-I/O TIMER option is used to:

- Increase the number of drive inputs and outputs
- Access the drive configuration: WEB server function
- Back up and restore the drive parameter settings (via PC)
- Save parameters for a period of time (including an SD type memory card): Data logger function

Detail of the features :

- 2 analog inputs (including a differential analog input)
- 1 KTY temperature sensor input
- 1 analog output
- 4 digital inputs
- 2 digital outputs
- 2 programmable relays
- 1 internal clock
- year, month, day, hours, minutes, seconds backup mode
- 1 Ethernet port on RJ45 connector

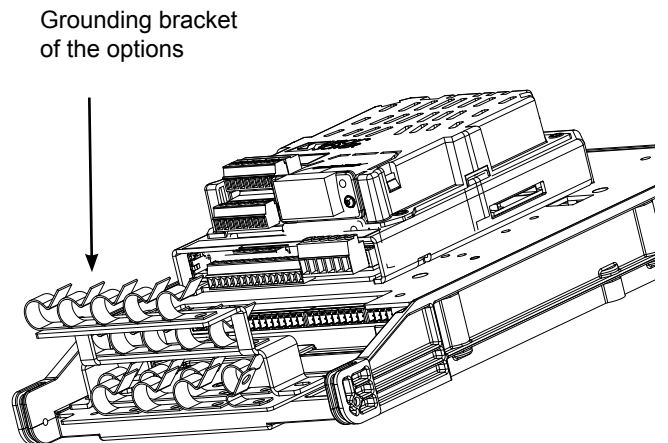
• **Connection**

Please consult the specific documentation for the MDX-I/O TIMER.

5.2.4 - Option installation

5.2.4.1 - grounding bracket

- To connect the option to the drive control board connector, remove the black plastic protective cover.
- 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 the right should be removed).



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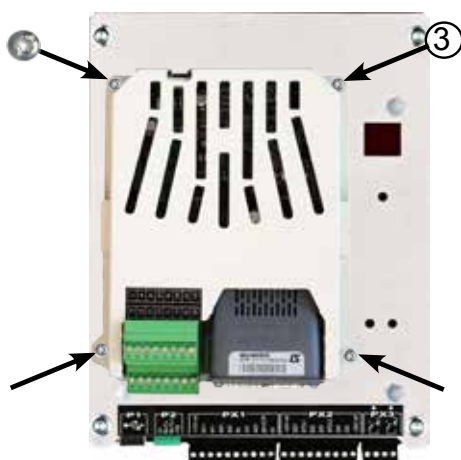
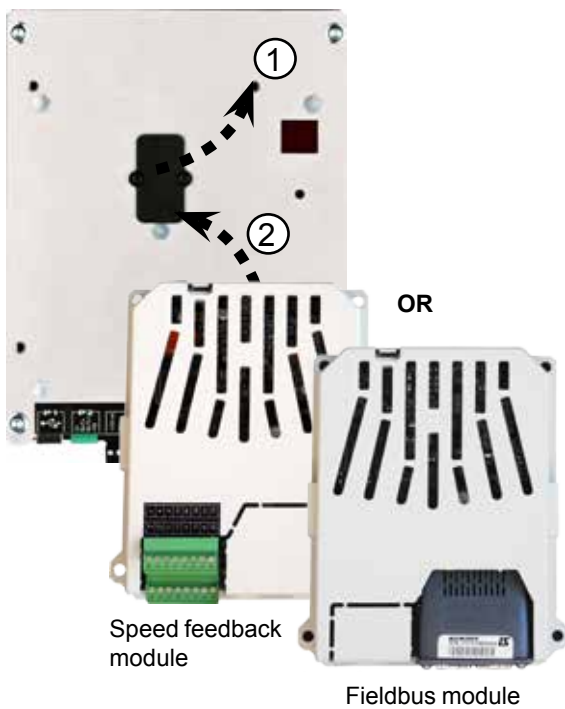
Chassis-mounted variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

5.2.4.2 - MDX-Speed feedback or MDX-Fieldbus option

Note: In the case of the use of one of these modules with MDX-I / O TIMER module refer directly to §.5.2.4.4

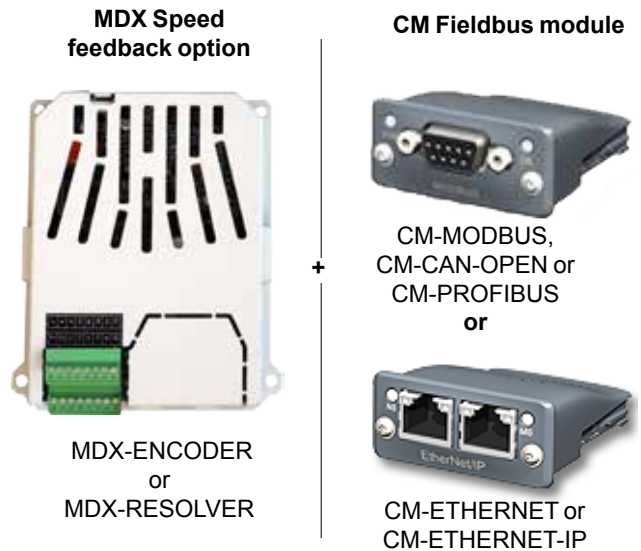
- Remove the black plastic protective cover from the drive control board (connector protection) (1).
- Align the option over the drive connector (2). The option connector is located on the underside of the housing. Press gently until it clicks into place.
- Screw the option onto the control board with the supplied screws (3). Do not exceed a maximum tightening torque of 2 N.m.



5.2.4.3 - MDX-Speed feedback option combined with a CM-Fieldbus module

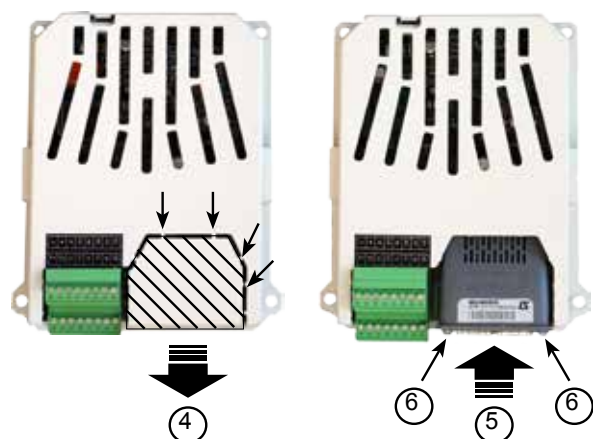
Note: In the case of the use of one of these modules with MDX-I / O TIMER module refer directly to §.5.2.4.4

In this case, 2 devices are needed:



- On the MDX-Speed feedback option: remove the plastic knock-out (4)
- Insert the back of the CM-Fieldbus housing into the space freed up (5) and screw tight (6) (4x Torx 8 screws)

⚠ The CM module must be inserted carefully to avoid damaging the connector.



- Install the MDX-Speed feedback with the fieldbus module on the **POWERDRIVE MD2CS**, as shown in section 5.2.4.2.

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Chassis-mounted variable speed drive

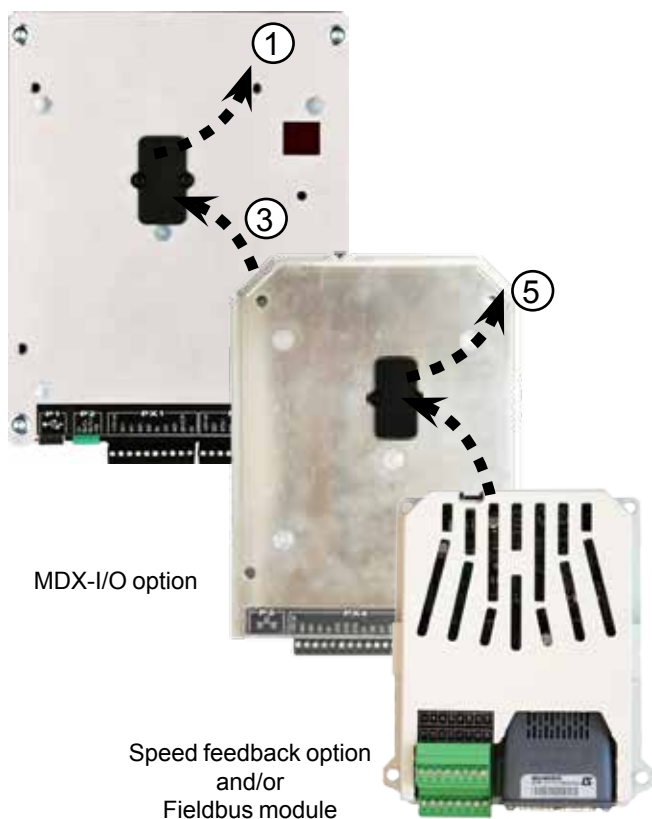
PARAMETER-SETTING INTERFACE AND OPTIONS

5.2.4.4 - MDX-I/O TIMER option

The MDX-I/O Timer option is installed on the control board; if a MDX-Speed feedback and/or MDX-Fieldbus option needs to be added, it should be installed on the MDX-I/O TIMER option.

To install the module, follow the instructions below:

- 1** - Remove the black plastic protective cover from the drive control board (connector protection).
- 2** - Screw the four spacers supplied with the option onto the control block (tightening torque 2 N.m).
- 3** - Align the optional module over the drive control board connector (the optional module connector is located on the underside of the housing) then press gently until it is fully in place.
- 4** - Screw the module onto the control board with the four screws supplied, using a maximum tightening torque of 2N.m.
- 5** - If you wish, an additional optional module can be added (e.g. MDX-ENCODER). Remove the black plastic protective cover on the MDX-I/O TIMER, undo the screws inserted in step 4. Align the additional optional module over the MDX-I/O TIMER board connector (the additional module connector is located on the underside of the housing) then press gently until it is fully in place. Then screw the module back onto the MDX-I/O TIMER board using the four screws removed previously (2 N.m).
- 6**- To remove modules, follow the same procedure in reverse.



POWERDRIVE MD2CS

Chassis-mounted variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

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.



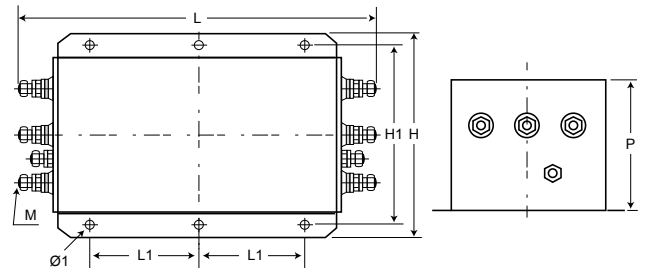
Rating	RFI filter			
	Reference	Irated at 40°C (A)	Leakage current (mA)	Losses (W)
60T to 100T	FN 3359 HV-180	197	<6	34
120T and 150T	FN 3359 HV-250	250	<6	49
270TH	FN 3359 HV-320	350	<6	19
180T and 220T	FN 3359 HV-400	438	<6	29
340TH				
270T to 400T	FN 3359 HV-600	657	<6	44
400TH to 500TH				
470T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

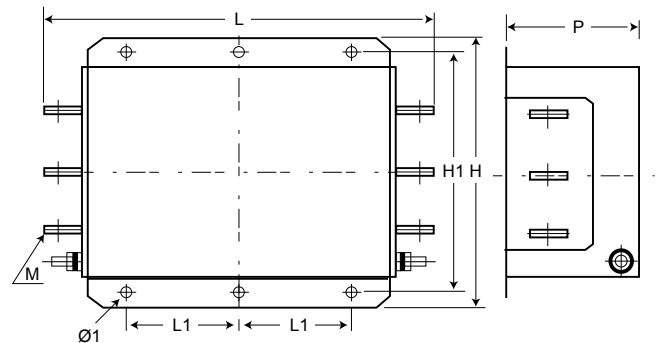
5.4.2 - Weight and dimensions

- **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

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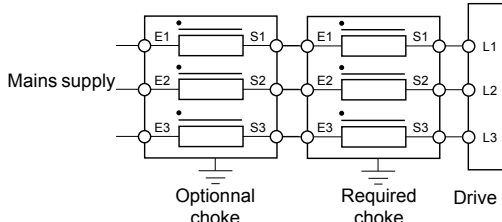
PARAMETER-SETTING INTERFACE AND OPTIONS

5.5 - Mains chokes

POWERDRIVE MD2CS must be connected to an AC line reactor.

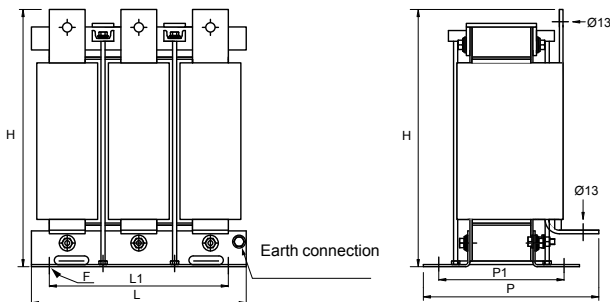


A second line reactor can be added to reduce the harmonics of the line current. In this case, two identical reactors are connected in series.



Rating	Choke			
	Reference	Irated (A)	Inductance (µH)	Losses (W)
60T & 75T	135 ST 0,26	135	0,26	400
100T & 120T	200 ST 0,26	200	0,26	600
150T	230 ST 0,19	230	0,19	360
180T	280 ST 0,13	280	0,13	380
220T & 270T	460 ST 0,078	460	0,078	790
340T & 400T	630 ST 0,06	630	0,060	960
470T	790 ST 0,047	815	0,047	1100
270TH	230 ST 0,19	230	0,19	360
340TH	340 ST 0,21	320	0,15	
400TH & 500TH	470 ST 0,11	470	0,11	

• Weight and dimensions



Choke	Dimensions (mm)			Fixings (mm)			Weight (kg)
	H	L	D	L1	D1	F	
135 ST 0,26	237	290	201	250	146	Ø10x18	30
200 ST 0,26	266	299	237	200	150	Ø10x18	40
230 ST 0,19	269	304	239	200	158	Ø10x18	42
280 ST 0,13	290	300	218	240	182	Ø11x15	34
340 ST 0,21	Consult Leroy-Somer						
460 ST 0,078	356	333	213	240	145	Ø10x18	50
470 ST 0,14	Consult Leroy-Somer						
630 ST 0,06	Consult Leroy-Somer						
790 ST 0,047	440	410	295	253	175	Ø10x18	120

5.6 - Associated braking module and resistors

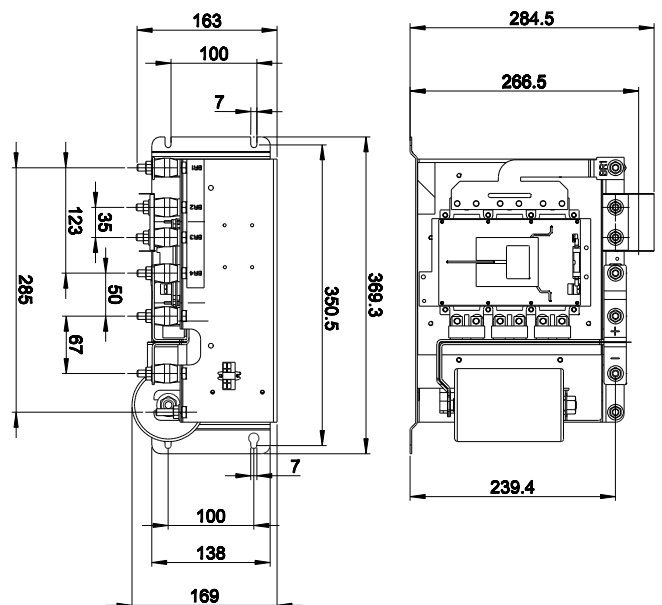
Braking phases occur when energy is sent back from the motor to the drive. Without an additional device, the maximum power that POWERDRIVE MD2CS can absorb is limited to its internal losses. If the application generates significant braking power (inertia slowdown, braking, etc) a device should be added 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**

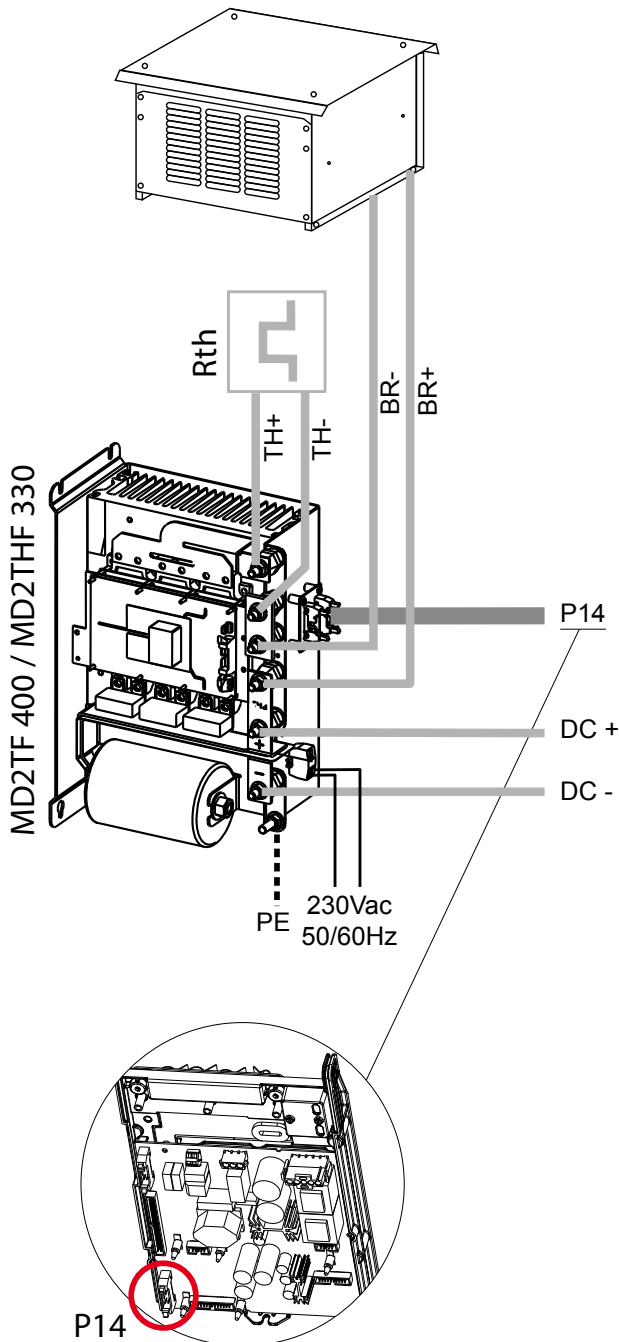


- Connect the braking resistor to the transistor MD2TF400
- Connect a thermal relay Rth (not fitted), set to the stated current for the resistor associated with it.
- Connect the P14 map to the associated connector on the interface board of the drive (tilt the control board to access the interface board).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

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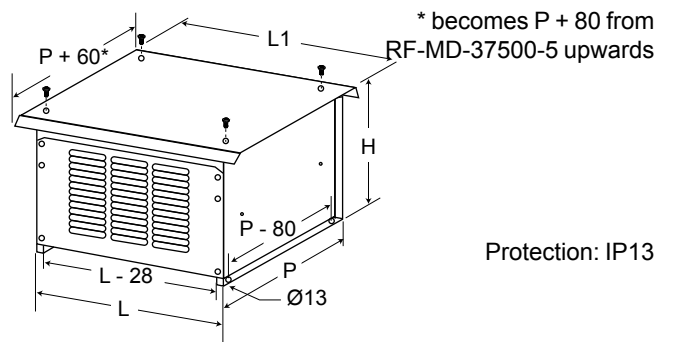
PARAMETER-SETTING INTERFACE AND OPTIONS



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



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 à 65A	51	52	860	890	480	690	66
RF-MD-37500-5	5	37,5	T	MD2TF400-37500	80 à 104A	100	87	960	1140	380	1150	77
RF-MD-55000-5	5	55	T	MD2TF400-55000	95 à 125A	100	105	960	1140	540	1150	105
				MD2TF400-75000	120 à 160A	145	146					
RF-MD-75000-4	3,5	75	T	MD2TF400-75000	120 à 160A	145	146	1080	1260	680	1150	145
				MD2THF330-75000	120 à 160A	345	146					
RF-MD-110000-3	2,35	110	T	MD2TF400-110000	160 à 220A	220	216	960	1140	740	1520	200


POWERDRIVE MD2CS

Chassis-mounted variable speed drive

TRIPS - DIAGNOSTICS

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, it should be returned to LEROY-SOMER via your usual contact.**

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.

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


Note: Boxes in the table with a grey background do not apply to the POWERDRIVE MD2CS.

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	<ul style="list-style-type: none"> • Check the input fuses. • Check the quality of the power supply (voltage dips).
2	DC over volt	DC bus overvoltage	<ul style="list-style-type: none"> • 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. <p>POWERDRIVE MD2 only:</p> <ul style="list-style-type: none"> • Check that the deceleration mode (02.04) is compatible with the application. • If an MD-TF option is used, check its size, its wiring and the state of the thermal relay.
3	Over current	Overcurrent at drive output	<ul style="list-style-type: none"> • 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.			

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

TRIPS - DIAGNOSTICS

No.	Parameter-setting interface name	Reason for trip	Solution
4	Brak. IGBT	Braking IGBT transistor overcurrent	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 $(1.3 \times \mathbf{01.06})$ or $(\mathbf{01.06} + 1000 \text{ rpm})$	<ul style="list-style-type: none"> • Check the drive settings. • When the flying restart function is not being used, check that 06.09 is at "Disabled".
8	Drive overload lxt	The drive overload level exceeds the conditions defined in section 1.4.2 of the installation manual	<ul style="list-style-type: none"> • Check the drive is suitable for the motor current cycle. • Check the ambient temperature.
9	IGBT U	Internal protection of phase U IGBTs	<ul style="list-style-type: none"> • Check the motor and cable insulation. <p>POWERDRIVE MD2 only:</p> <ul style="list-style-type: none"> • Run power diagnostics.
10	Th rectifier	Rectifier heatsink temperature too high	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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%	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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.

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Chassis-mounted variable speed drive

TRIPS - DIAGNOSTICS

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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Change the control board. • Check the recurrence of write cycles from the drive controller.
33	Stator resistance	Trip during measurement of the stator resistance	<ul style="list-style-type: none"> • Check the motor wiring.
34	Fieldbus loss	Disconnection of the fieldbus during operation or timing error	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	The rectifier cannot synchronise with the mains supply (POWERDRIVE FX only)	Check the quality of the power supply (commutation notches present)
41	User 1	User trip 1 triggered by 10.61 .	<ul style="list-style-type: none"> • See 10.61.
42	User 2	User trip 2 triggered by 10.63 .	<ul style="list-style-type: none"> • See 10.63.
43	User 3	User trip 3 triggered by 10.65 .	<ul style="list-style-type: none"> • See 10.65.
44	User 4	User trip 4 triggered by 10.67 .	<ul style="list-style-type: none"> • See 10.67.
45	User 5	User trip 5 triggered by the serial link 10.38 = 45	<ul style="list-style-type: none"> • 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	

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TRIPS - DIAGNOSTICS


No.	Parameter-setting interface name	Reason for trip	Solution
51	DO2 MDX-I/O TIMER over Id	The DO2 output load current (MDX-I/O TIMER option) is >200 mA	Check that DO2 is not short-circuited.
52	DO3 MDX-I/O TIMER over Id	The DO3 output load current (MDX-I/O TIMER option) is >200 mA	Check that DO3 is not short-circuited.
53	MDX-I/O TIMER link	Communication problem between the drive and the MDX-I/O TIMER option	Check the MDX-I/O TIMER option mounting.
54	Internal serial link	Communication problem between the drives	Check the setting of 11.66 .
55	Unstable DC bus	The drive DC bus oscillates significantly	<ul style="list-style-type: none"> • Check the balancing of the mains phases. • Check that all 3 mains phases are present.
56	IGBT V	Internal protection of phase V IGBTs	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	The internal ventilation has stopped working. (POWERDRIVE FX 50T and 100T only)	Get in touch with your usual LEROY-SOMER contact.
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 TIMER over Id	The 24 V load current is too high	Check the MDX-I/O TIMER option I/O wiring.
70	4 mA loss on MDX-IO TIMER AI4	Loss of the current reference on analog input AI4 of the MDX-I/O TIMER option	Check the input wiring and source of the MDX-I/O TIMER option.
71	4 mA loss on MDX-IO TIMER AI5	Loss of the current reference on analog input AI5 of the MDX-I/O TIMER option	
101	AC mains loss	Loss of AC supply	<ul style="list-style-type: none"> • Check the input fuses • Check the quality of the power supply (voltage dips)
102	Rectifier	Loss of rectifier synchronisation with the mains (POWERDRIVE FX only)	Check the quality of the power supply (commutation notches present)

POWERDRIVE MD2CS

Chassis-mounted variable speed drive

MAINTENANCE

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.
- All protective covers must remain in place during tests.
- Before performing high voltage tests or voltage withstand tests on the motor, switch off the drive and disconnect the motor (including speed feedback).

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
Door filters	Clean	3 months
	Replace	2 years
Power connections	Check tightness	1 year
Internal ventilation and in cabinet roof	Replace	5 years
Surge suppressor	Replace	5 years

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 - simply ask your usual LEROY-SOMER contact.

7.2 - Replacing products

CAUTION:

Products must be returned in their original packaging or, if this is not possible, in similar packaging, to prevent them being damaged. Otherwise, replacement under warranty could be refused.

7.3 - List of spare parts

- Fuse on the PEF720NH000 DC voltage pick-up board (ref. 6 next page)

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

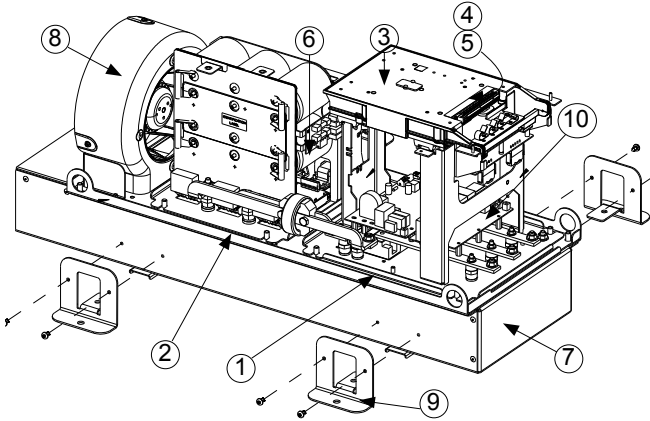
POWERDRIVE MD2CS

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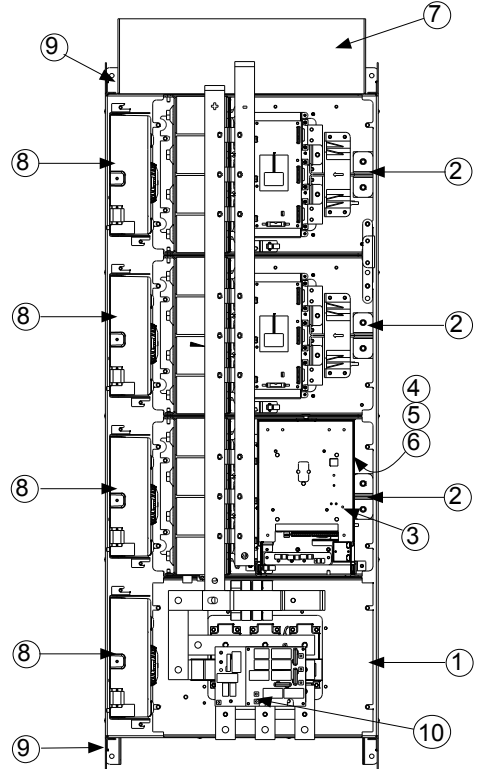
MAINTENANCE

- Location of the POWERDRIVE MD2CS components :

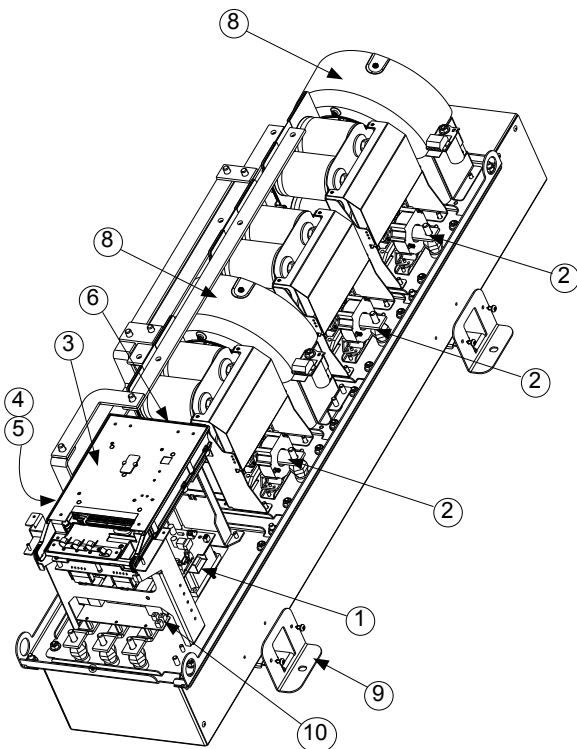
- Rating 60T to 150T



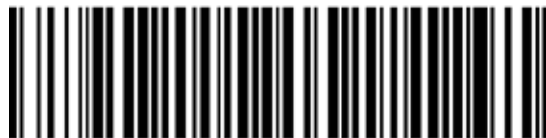
- Ratings 340T to 470T & 270TH to 500TH



- Rating 180T to 270T



Ref.	Description
1	Rectifier unit
2	Inverter unit
3	Control block
4	Distribution board
5	Customisation board
6	DC bus measurement board
7	Assembled ventilated frame
8	Forced ventilation unit
9	Mounting foot
10	EMC commoning link



IMP 297 NO 637



MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

338567258 RCS ANGOULÊME
S.A.S. au capital de 65 800 512 €

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