Nidec

All for dreams

Installation guide

POWERDRIVE MD2R

60T to 1700T
270TH to 1500TH

Low Harmonics Active Front End
high-power free-standing
drive solution

Reference : 4948en - 2017.11 / d

LEROY-SOMER™

NOTE

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

CAUTION

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

The variable speed drive is fitted with safety devices which, in the event of a problem, control stopping and thus stop the motor. The motor itself can become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, 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 MD2R. For commissioning, refer to manual ref. 4617.

SAFETY AND OPERATING INSTRUCTIONS FOR VARIABLE SPEED DRIVES

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

⚠ 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 2014/30/EC) are met.
The variable speed drives meet the requirements of the Low Voltage Directive 2014/35/EU. 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.

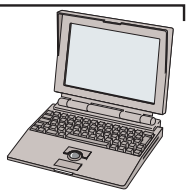
This manual is to be given to the end user.

This manual describes the installation of **POWERDRIVE MD2R** variable speed drives. It also gives details of all its options and extensions which the user may choose to suit his requirements.

POWERDRIVE MD2R

Parameter setting

MDX-Powerscreen parameter-setting interface



MDX-SOFT Parameter-setting software + PC link cable

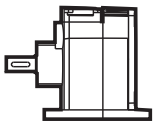
Standard

- HMI
- High-speed fuses
- RFI filter
- LCL harmonics filter

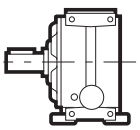
Options

- Line switch
- Heater kit
- Emergency stop
- Encoder or resolver input
- Additional I/O
- Datalogger
- Fieldbus communication modules
- IP54 Protection

Gearboxes

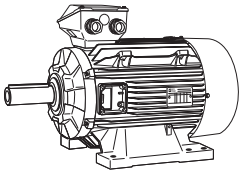


Compabloc
• Axial output
- Helical gears

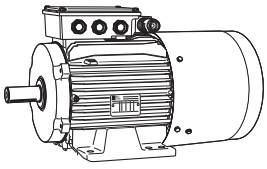


Orthobloc
• Orthogonal output
- Helical bevel gears

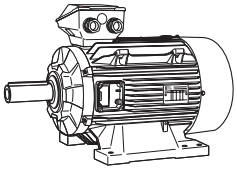
Motors



IMfinity® motor
LSES-FLSES

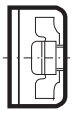


LSMV motor



Dyneo® motor
LSRPM-PLSRPM

Motor options



Axial forced ventilation

Encoder/Sensor

Brake

Radial forced ventilation

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1 - GENERAL INFORMATION

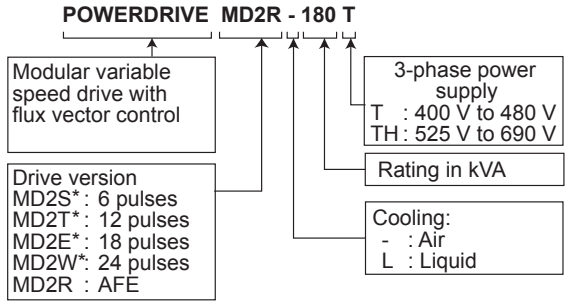
1.1 - General

The **POWERDRIVE MD2R** is a variable speed drive with active rectifier allowing to feed back the braking energy of electrical machine to the mains (operation in the 4 quadrant of the torque/speed map) and/or to limit the harmonic level of the power line. (< 5% typique).
The high efficiency performance of the **POWERDRIVE MD2R** can drive :
- 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 MD2R** 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 **POWERDRIVE MD2R** allows also controlling the level of the reactive current of the power line.
With IP54 protection (optional), installation is possible directly on the machine itself in harsh environments.

1.2 - Product designation



(*) See the corresponding installation manual

Depending on the options installed, a suffix (-B or -O) is added to the product commercial designation.
See section 2.6 Dimensions.

Nameplate

Nidec LEROY-SOMER MADE IN FRANCE	**ENTREE - INPUT**				
	Ph	V (V)	Hz (Hz)	I(A)	
	3	400-480	50/60	295	
	Alim auxiliaire 2x500VA				
CE EAC	TYPE : **Powerdrive MD2R 180T**				
	S/N : 09999999999				

I(A) = maximum continuous current on mains supply

The nameplate can be found inside the cabinet door at the top (another copy can be found on the outside of the cabinet, at the top on the right-hand side).

1.3 - Environmental characteristics

Characteristic	Level
Protection	IP21 (IP54 as an option)
Storage and transport temperature	-30°C to +60°C (see section 7.2)
Ambient operating temperature (outside the cabinet)	-10°C to +40°C, up to +50°C with derating (see section 1.4.4)
Classification of environmental conditions	In accordance with IEC 60721-3-3: • Biological classification in accordance with class 3B1 • Classification as regards chemically active substances in acc. with class 3C2 • Classification as regards mechanically active substances in acc. with class 3S2
Relative humidity	In accordance with IEC 60068-2-56 < 90% non condensing
Altitude	≤ 1000 m without derating > 1000 m up to 4000 m maximum (as required): • Current derating of 1% per additional 100 m *E.g. for 1300 m, derate the Ico and Imax currents by 3%* • Operating temperature derating of 0.6°C per 100 m *E.g. for 1300 m, the electrical characteristics are maintained for an ambient temperature of [40°- (3 x 0.6°)] = 38.2°C.*
Vibrations	In accordance with IEC 60068-2-6 Exposed product: 2 m/s² (9-200 Hz), 0.6 mm (2-9 Hz) Packaged product: 10m/s² (9-200 Hz), 3 mm (2-9 Hz)
Shocks	Packaged product: in accordance with IEC 60068-2-29
Atmospheric pressure	700 to 1060 hPa

1.4 - Electrical characteristics

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

1.4.1 - General characteristics

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

1.4.2 - Electrical characteristics

I_L : Maximum line current allowed. The user which uses the POWERDRIVE MD2R for controlling the reactive current of the mains needs check that the global current of the line (active and reactive) does not exceed I_L.
Ico: Continuous output current.
Pout: Output power.
Imax (60s): Maximum output current, available for 60 seconds every 600 seconds.
Heavy duty: For heavy-duty constant torque machines (presses, grinders, hoisting, etc) and all applications where significant inertia has to be accelerated quickly (centrifuges, translation of travelling cranes, etc).
Normal duty: For normal-duty constant torque or centrifugal torque machines (fans, compressors, etc).

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

POWERDRIVE MD2R xxxT
Inverter switching frequency = 3 kHz - Active rectifier in factory settings
Ambient temperature ≤ 40°C (35°C with an option IP54) - altitude ≤ 1000 m.

POWERDRIVE MD2 rating	Maximum line current I_L (A)	Heavy duty			Normal duty			Imax (60s) (A)
		Pout at 400V (1) (kW)	Pout at 460V (1) (HP)	Ico (A)	Pout at 400V (1) (kW)	Pout at 460V (1) (HP)	Ico (A)	
60T	112	45	60	92	55	75	112	130
75T	142	55	75	118	75	100	142	165
100T	172	75	100	142	90	125	172	200
120T	200	90	125	170	110	150	200	240
150T	238	110	150	210	132	175	238	312
180T	310	132	175	260	160	200	310	365
220T	395	160	200	310	200	300	395	435
270T	465	200	300	375	250	350	465	530
340T	560	250	350	470	315	450	560	660
400T	610	315	450	535	355	500	610	760
470T	750	355	500	660	450	600	750	940
570T	815	400	600	715	500	650	815	1050
600T	1050	450	650	865	550	700	1050	1210
750T	1140	550	800	990	675	900	1140	1390
900T	1410	675	900	1225	800	1000	1410	1720
1100T	1530	800	1000	1345	900	1250	1530	1930
1400T	2110	900	1250	1850	1200	1500	2110	2590
1700T	2290	1200	1500	2015	1350	1700	2290	2890

(1) motor winding voltage.

POWERDRIVE MD2R xxxTH
Inverter switching frequency = 3 kHz - Active rectifier in factory settings
Ambient temperature ≤ 40°C (35°C avec option IP54) - altitude ≤ 1000 m.

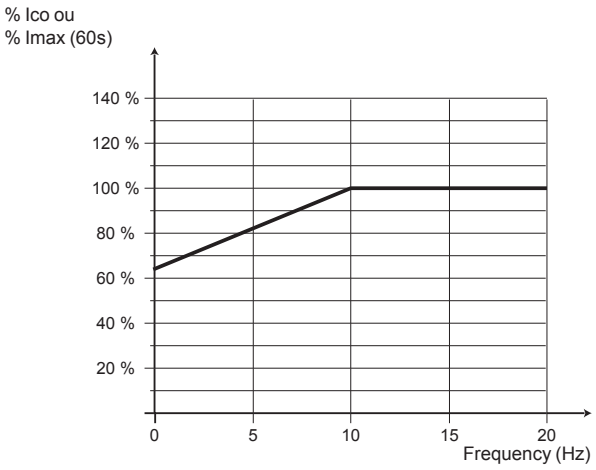
POWERDRIVE MD2 rating	Maximum line current	Heavy duty			Normal duty			Imax (60s) (A)
		Pout at 575V (1) (kW)	Pout at 690V (1) (kW)	Ico (A)	Pout at 575V (1) (kW)	Pout at 690V (1) (kW)	Ico (A)	
270TH	280	200	200	220	250	250	280	310
340TH	340	250	250	270	300	315	340	380
400TH	415	300	315	335	400	400	415	470
500TH	415	400	400	390	500	450	470	550
600TH	580	450	450	490	600	550	630	690
750TH	730	600	550	615	700	700	780	860
900TH	830	700	700	720	900	850	880	1010
1200TH	1120	900	850	900	1000	1100	1180	1260
1500TH	1245	1000	1100	1075	1250	1250	1320	1510

(1) motor winding voltage.

1.4.3 - Derating at low frequency

Measuring the temperature of the power bridges in conjunction with thermal modelling of the IGBTs protects the **POWERDRIVE MD2R** against overheating.

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



1.4.4 - Derating according to the temperature and switching frequency form motor inverter

Ambient temperature ≤ 40°C (≤ 35°C with IP54 option) - altitude ≤ 1000 m

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
400V / 460V mains supply										
60T	92	92	92	90	82	112	112	112	102	93
75T	118	118	110	100	90	142	142	125	112	102
100T	142	142	136	122	112	175	172	154	138	126
120T	170	170	155	140	125	215	200	176	158	144
150T	220	210	185	160	145	255	238	210	186	168
180T	260	260	260	260	230	315	310	305	295	265
220T	310	310	310	295	265	400	395	370	335	300
270T	375	375	370	330	295	470	465	420	375	335
340T	470	470	425	380	340	580	560	485	430	385
400T	540	535	490	430	380	650	610	555	490	435
470T	670	660	585	515	460	800	750	665	585	525
570T	750	715	630	-	-	890	815	715	-	-
600T	865	865	800	705	635	1090	1050	910	800	720
750T	990	990	915	810	715	1220	1140	1040	920	810
900T	1225	1225	1100	960	860	1500	1410	1250	1090	980
1100T	1375	1345	1180	-	-	1670	1530	1340	-	-
1400T	1850	1850	1645	-	-	2250	2110	1870	-	-
1700T	2065	2015	1770	-	-	2500	2290	2010	-	-
525 / 690V mains supply										
270TH	220	220	220	-	-	280	280	250	-	-
340TH	270	270	270	-	-	340	340	310	-	-
400TH	335	335	290	-	-	415	415	330	-	-
500TH	390	390	305	-	-	500	470	350	-	-
600TH	490	490	490	-	-	630	630	580	-	-
750TH	615	615	545	-	-	780	780	620	-	-
900TH	720	720	570	-	-	940	880	650	-	-
1200TH	900	900	825	-	-	1180	1180	940	-	-
1500TH	1075	1075	860	-	-	1410	1320	980	-	-

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.
With IP54 protection, for an ambiant température of 40°C, the available current value will be average of current at 35°C et 45°C.
Tables only available for a synchronous rectifier in factory settings

Ambient temperature ≤ 50°C (≤ 45°C with IP54 option) - altitude ≤ 1000 m.

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
400V / 460V mains supply										
60T	90	90	90	80	75	112	112	103	94	86
75T	115	115	100	90	80	142	130	115	103	93
100T	140	140	125	110	100	175	160	142	126	114
120T	170	160	140	125	115	210	184	162	146	130
150T	220	190	170	150	135	254	220	192	172	154
180T	260	260	260	235	215	315	305	295	270	245
220T	310	310	300	265	235	400	385	340	305	270
270T	375	375	340	300	265	470	435	385	340	305
340T	470	450	380	340	305	570	510	435	385	345
400T	540	485	440	380	340	630	550	500	435	385
470T	670	600	525	460	410	780	685	595	525	465
570T	740	650	570	-	-	870	765	672	-	-
600T	865	835	715	635	565	1070	950	810	720	640
750T	990	905	825	715	635	1180	1030	940	810	720
900T	1225	1125	975	860	765	1460	1280	1110	980	870
1100T	1375	1225	1075	-	-	1570	1390	1220	-	-
1400T	1850	1700	1470	-	-	2190	1930	1670	-	-
1700T	2065	1830	1610	-	-	2360	2080	1830	-	-
525 / 690V mains supply										
270TH	220	210	190	-	-	280	240	220	-	-
340TH	270	270	235	-	-	340	310	270	-	-
400TH	335	335	300	-	-	415	400	340	-	-
500TH	390	365	290	-	-	500	415	330	-	-
600TH	490	490	440	-	-	630	580	500	-	-
750TH	615	615	555	-	-	780	750	630	-	-
900TH	720	685	545	-	-	940	780	620	-	-
1200TH	900	900	835	-	-	1170	1120	950	-	-
1500TH	1075	1030	820	-	-	1410	1170	930	-	-

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.
With IP54 protection, for an ambiant température of 40°C, the available current value will be average of current at 35°C et 45°C.
With IP54 protection and ambiant température of 50°C, apply a coefficient of 0.98 on the above listed currents.

Tables only available for a synchronous rectifier in factory settings

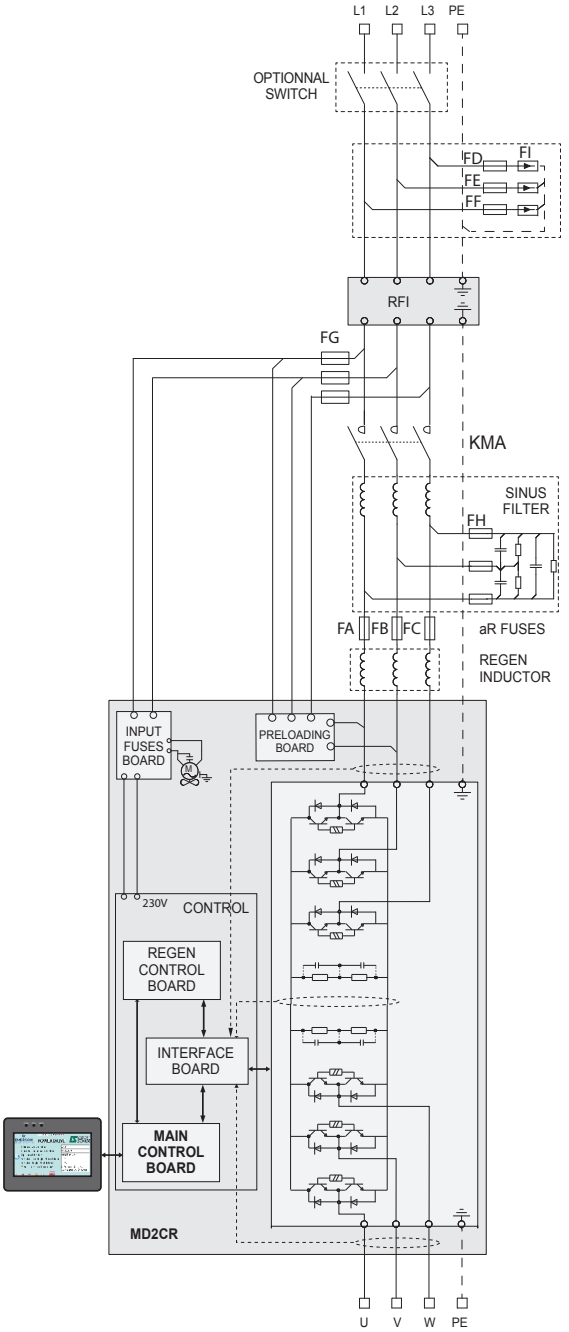
1.5 - POWERDRIVE MD2R synoptics

POWERDRIVE MD2R are composed of :

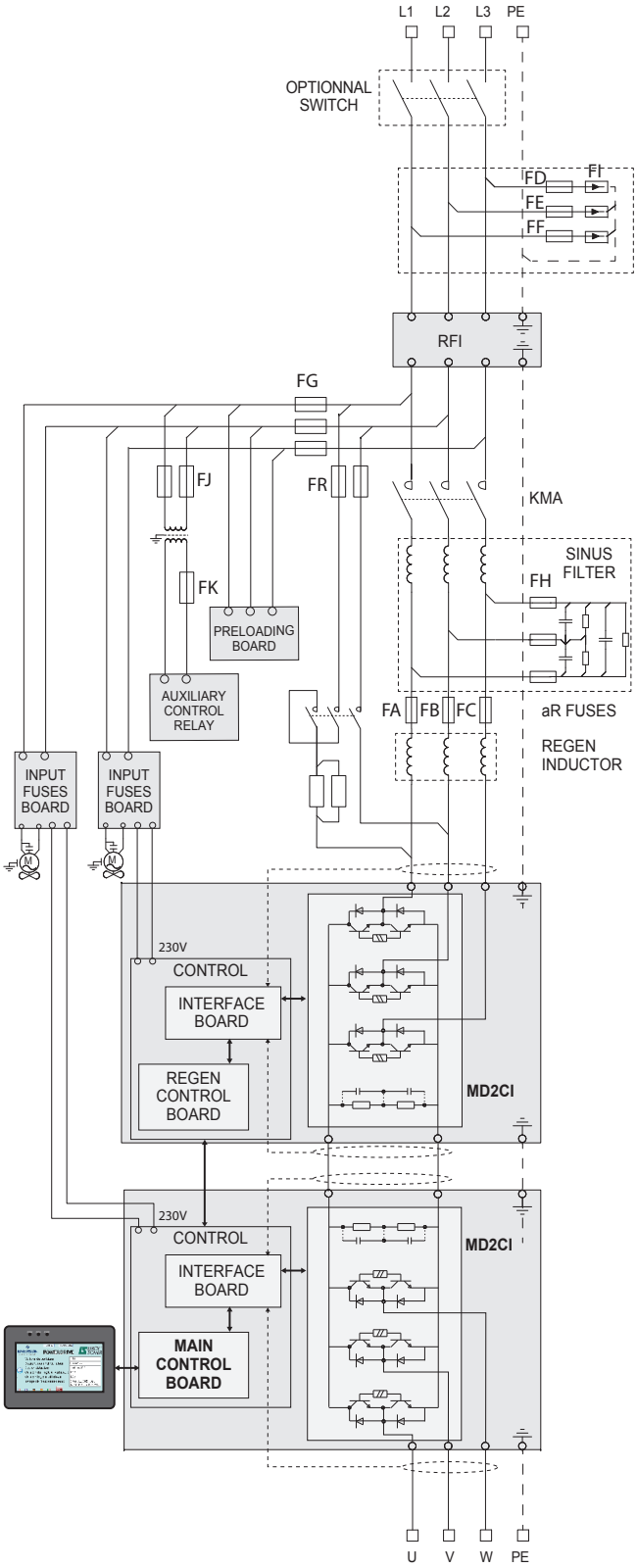
- AFE rectifier
- Inverter connected to the motor
- Sinus filter
- DC bus preloading device
- PCB with 32 bit Microcontroller
- HMI

The HMI should be plugged on the control board located over the motor's inverter. It gives access to all parameters of the inverter as well as the useful ones of the synchronous rectifier. The user wirred interfaces (inputs and outputs wirred) as well as the described options on the § 5.2 should be plugged on the inverter.

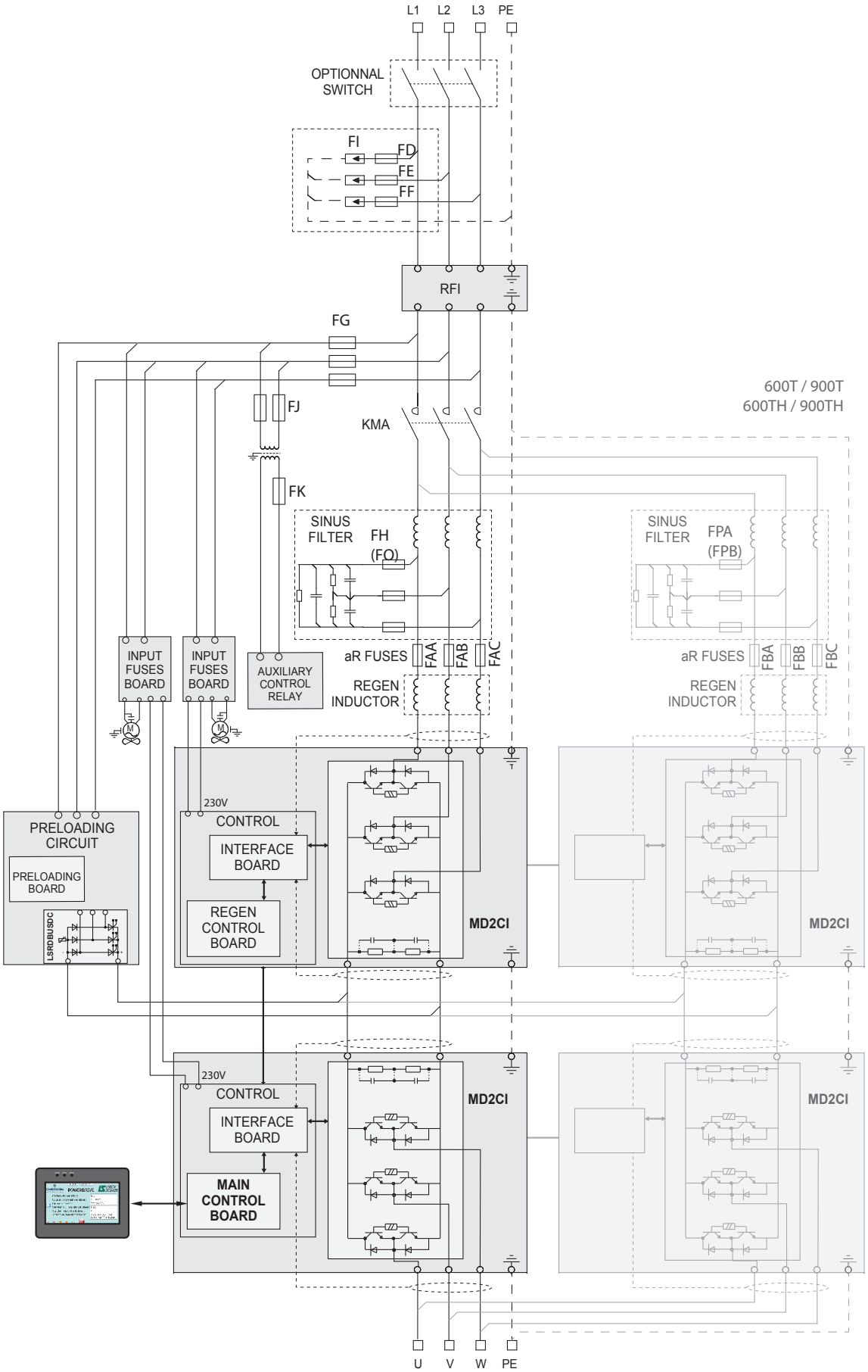
- **POWERDRIVE MD2R 60T to 150T**



- **POWERDRIVE MD2R 180T to 270T**



- **POWERDRIVE MD2R 340T to 900T**
  and POWERDRIVE MD2R 270TH to 900TH



2 - MECHANICAL INSTALLATION

• It is the responsibility of the owner or user of the POWERDRIVE MD2R 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 MD2R drives must be installed in an environment free from conducting dust, corrosive fumes, gases and fluids, dripping water and any source of 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.

• Prevent access by unauthorised personnel.

2.1 - Checks upon receipt

Make sure that the cabinet has been transported vertically, as otherwise it could be damaged.

Before installing the **POWERDRIVE MD2R,** check that:
- The drive has not been damaged during transport
- The information on the nameplate is compatible with the power supply

2.2 - Handling

• The centre of gravity may be high up and / or off-centre, so beware of the risk of the cabinet tipping over.

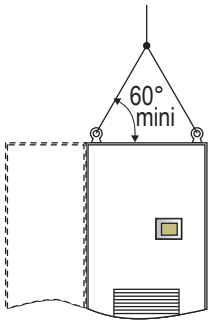
• Check that the handling equipment is suitable for the weight to be handled.

• The lifting accessories provided are limited solely to handling the cabinet. If subsequent handling operations are carried out, always check that these lifting accessories are in good condition.

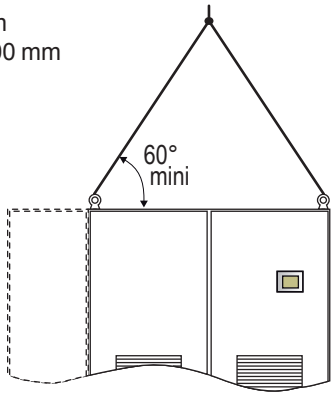
The cabinet must be handled without the IP21 or IP54 roof in place.
IP21 **POWERDRIVE MD2R** versions are supplied with the roof assembled. Before handling the cabinet, follow the procedure described in section 2.3 . For handling, follow the instructions below, and then re-fit the roof.
IP54 **POWERDRIVE MD2R** versions are supplied with the lifting rings or rails assembled. When handling the cabinet, follow the instructions below, depending on the cubicle width, as indicated below. After handling, assemble the roof as described in section .

Above 2400 mm wide (W), a baseplate 100 mm high is installed as standard to ensure the rigidity of all the cabinets.

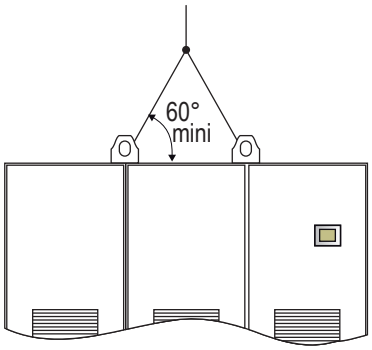
L = 600 mm
or 600 + 400 mm



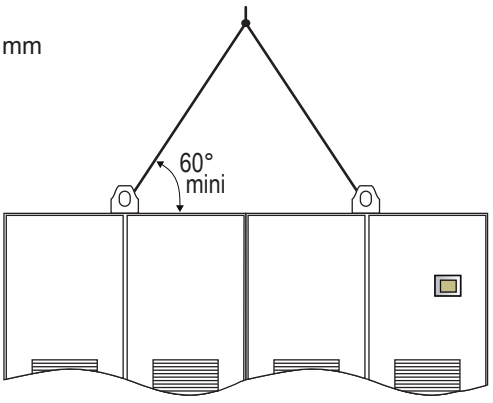
L = 2x 600 mm
or 2x 600 + 400 mm



L = 3x 600 mm



L = 4x 600 mm

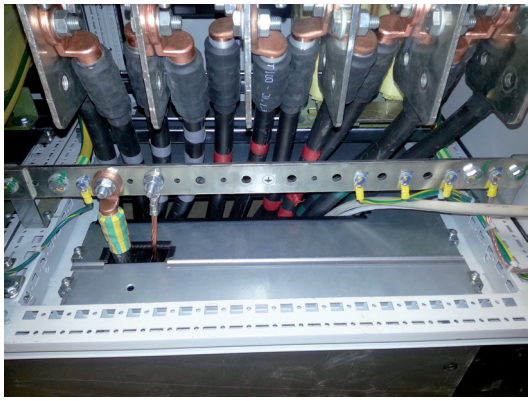


2.3 - Installation recommendations

The drives must be installed away from conducting dust, corrosive gas, dripping water and any source of condensation. Prevent access by unauthorised personnel. POWERDRIVE MD2R must not be installed near flammable materials.

Ensure that hot air is not being recycled via the air inlets by leaving sufficient free space above the **POWERDRIVE MD2R** or providing a means of evacuating the hot air expelled by the product. If necessary, add a suction hood. Never obstruct the drive ventilation grilles; the air intake filters must be cleaned and changed regularly.

After connecting the power, reposition the cable bush plates at the back of the cabinet and fill any gaps with expanding foam.



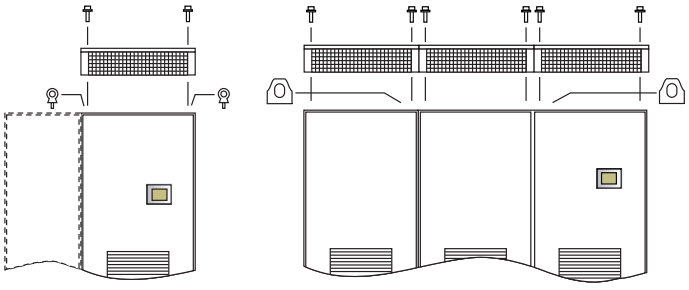
2.4 - Removing and re-fitting the IP21 roof

- **Dismantling**

1 - Remove the M12 screws.
2 - Remove the roof(s).
3 - Screw in the 4 lifting rings or the 2 lifting rails with the M12 screws at the places indicated (tightening torque = 20 N.m).

- **Re-fitting**

Follow the reverse procedure.



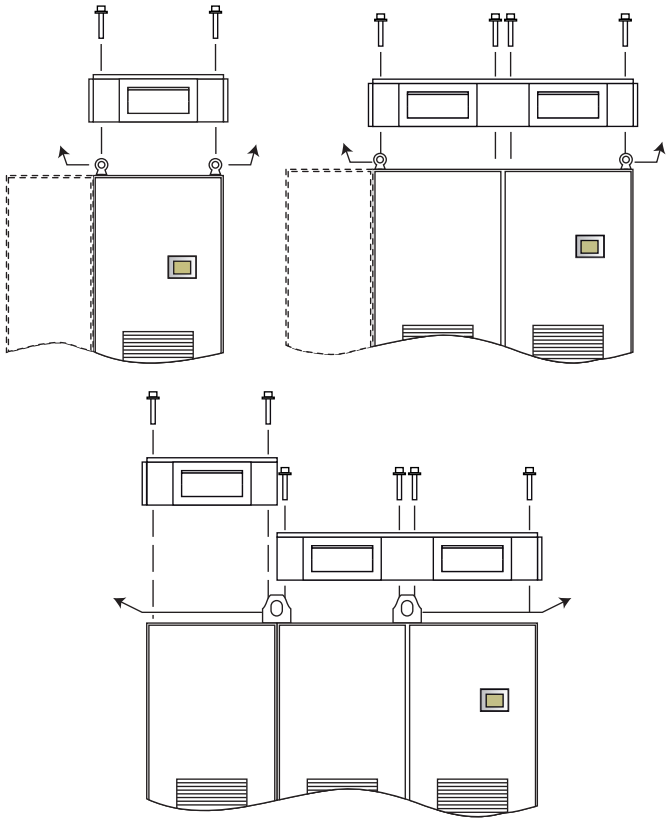
2.5 - Assembly and dismantling of the IP54 roof

- **Assembly:**

1 - Dismantle the 4 lifting rings or the 2 lifting rails.
2 - Open up the roof assembly as shown in the diagrams below. The side panels with no vent should be mounted facing one another; the rear of the drive will have no vent.
3 - Insert the specially supplied M12 screws through the roof assembly and tighten.
4 - Adjust the roof assembly to optimise sealing.
5 - Finally tighten the fixing screws (tightening torque: 20 N.m).

- **Removal, if necessary:**

Follow the reverse procedure.



2.6 - Dimensions

The cabinet-mounted **POWERDRIVE MD2R** solution is obtained by assembling cabinet modules 600 mm wide and 600 mm deep.
The table below gives the product **width (W** in mm) depending on the options incorporated:

	W/o options (-B)	With options (-O)	
Rating	**Width W (mm)**	**Load break switch**	**Width W (mm)**
60T to 150T	**600**	✓	**600**
180T to 270T	**1200**	✓	**1200**
340T to 570T	**1800**	✓	**1800**
600T to 1100T	**3600**	✓	**3600**
270TH to 500TH	**1800**	✓	**1800**
600TH to 900TH	**3600**	✓	**3600**
1400T to 1700T 1200TH to 1500 TH	Please Consult Leroy-Somer		

The following options can be incorporated into the **POWERDRIVE MD2R** without affecting its dimensions:

- MD-AU1 emergency stop
- Communication modules
- Additional I/O modules
- Speed feedback modules

The table below gives the product **height (H)** depending on the options incorporated:

Option	Height H (mm)
POWERDRIVE MD2R standard	2100
IP21 protection	+ 0
IP54 protection	+ 100
base 100mm	+ 100
base 200mm	+ 200
base for width ≥ 2400mm (1)	+ 100

(1) Above 2400 mm long (L), a base 100 mm high should be installed as standard to ensure the rigidity of all the cabinets. Cables cannot be run through this base (please consult LEROY-SOMER).

For more precise information depending on the options chosen, use the Leroy-Somer configurator:
http://configurateurls.leroy-somer.com/login_en.php

2.7 - Weight

The values indicated in the table below are maximum net weights.

Rating	Maximum weight (kg)
60T and 75T	350
100T to 150T	400
180T to 270T	900
340T to 570T	1500
600T to 1100T	2800
1400T to 1700T	Please Consult Leroy-Somer
270TH to 500TH	1500
600TH to 900 TH	2500
1200TH and 1500 TH	Please Consult Leroy-Somer

2.8 - Drive losses

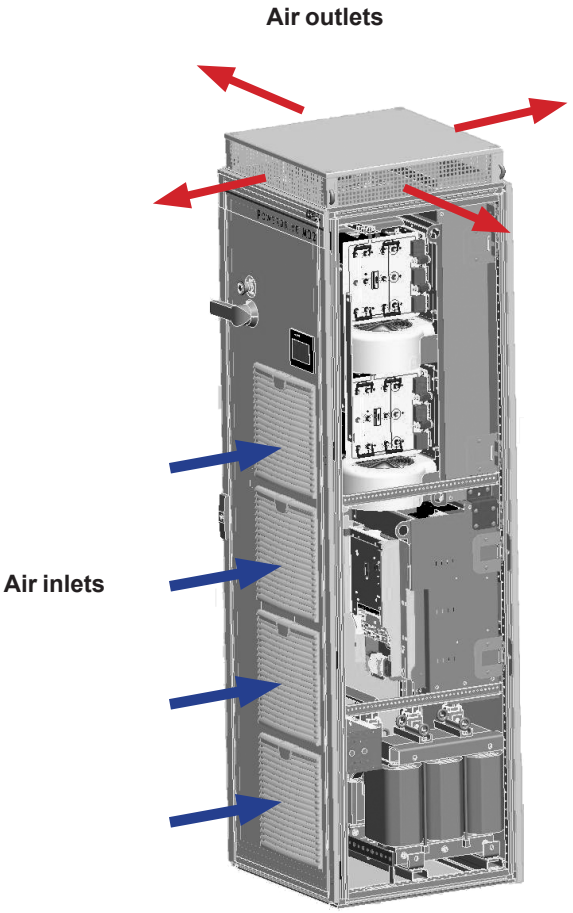
Rating	Maximum thermal dissipation (kW)
60T	2.5
75T	3.2
100T	3.8
120T	4.6
150T	5.5
180T	7
220T	8.6
270T	10.4
340T	12.8
400T	14.2
470T	17.8
570T	19.8
600T	23.1
750T	26.9
900T	32.3
1100T	36.2
1400T	48.5
1700T	54.2
270TH	11.4
340TH	13.8
400TH	17.3
500TH	20.7
600TH	26.6
750TH	31.7
900TH	38.1
1200TH	48.6
1500TH	55.2

2.9 - Drive ventilation flow rates and noise levels

Rating	Forced ventilation flow rates (m^3/hr)	Noise level with IP21 (dBA)
60T and 75T	600	78
100T to 150T	1200	78
180T to 270T	1800	80
340T to 570T	2500	80
600T to 1100T	5000	83
1400T to 1700T	7500	85
270TH to 500TH	2500	80
600TH to 900TH	5000	83
1200TH to 1500TH	7500	85

Air can exit on all sides of the roof. The cabinet can be installed with one side only against a wall. Under no circumstance must the difference between the internal temperature of the cabinet and the ambient temperature outside the cabinet exceed 5°C.

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



3 - CONNECTIONS

• All connection 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 via an approved circuit-breaking device so that it can be powered down safely.
• The optional isolator supplied with the drive does not isolate the drive input busbars. It must without fail be associated with a circuit-breaking device in the switchboard.
• 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. The protective plates supplied with the drive must always be installed correctly to protect the user against direct electric shocks.
• Only one permanent magnet motor can be connected to the drive output. It is advisable 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.

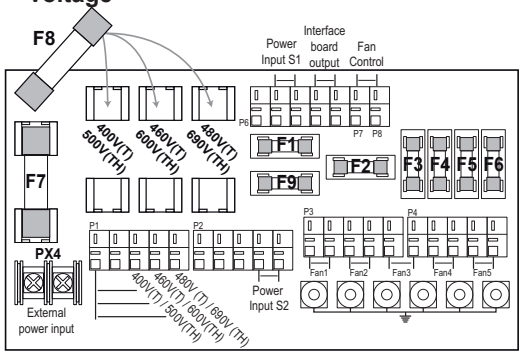
3.1 - Location of terminal blocks

3.1.1 - Location of the fuse boards

Depending on rating, **POWERDRIVE MD2R** may include one or more identical fuses boards :
- 60T à 150T : 1 board
- 180T to 570T & 270TH to 500TH : 2 boards
- 600T to 1100T & 600TH to 900TH : 4 boards
- 1400T and 1700T & 1200TH and 1500TH : 6 boards

The fuse board location is specified in §3.1.4

Position the F8 fuse according to the mains supply voltage



• On **POWERDRIVE MD2R** 60T to 150T, the fuse board is located over the chassis.
• On **POWERDRIVE MD2R** 180T to 270T : the fuse board is located on the side of the drive's chassis. To reach the fuse board, undo the 2 screws of the control terminal block to tip it forwards.
• On **POWERDRIVE MD2R** 340T to 1700T 270TH to 1500TH, please refer to §3.1.4 to located fuse board

3.1.2 - Electronics and forced ventilation power supply

The control electronics and forced ventilation units are supplied through a single-phase transformer which primary is connected to terminals L1-L2 of the power supply. If necessary, this transformer can be supplied with an external power source (PX4 terminal block on fuse board).

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

- **Electrical characteristics :**

	Ratings	Voltage
Primary	T	400V±10% / 50Hz ou 460-480V ±10% / 60Hz
	TH	525-690V±5% / 50Hz

	Voltage	Maximum power
Secondary 1 (Electronics power supply)	230 V isolated	100VA
Secondary 2 (Forced ventilation and auxiliaries power supply)	230 V connected to earth	60T to 75T : P = 300VA 100T to 150T : P = 500VA 180T to 270T : P = 2x500VA 340T to 570T : P = 2x1200VA 600T to 900T : P = 4x 1200VA 1400T to 1700T : P = 6x 1200VA 270TH to 500TH : P = 2x 1200VA 600TH to 900TH : P = 4x 1200VA 1200TH to 1500TH : P = 6x 1200VA

3.1.3 - Characteristics of connection terminals

Refs.	Functions / connections	Type of connection and tightening torque	
		60T to 270T	Other ratings
L1, L2, L3, ou R, S, T	Mains power supply	M10 screw bolt - 20Nm	
U , V, W	Motor outputs		
PE	Earth	M10 bolt - 20Nm	M8 bolts - 12Nm
BR1, BR2	Braking resistor (1)	M8 screw bolt - 12Nm	
P4, P5	EMC Commoning link	Torx screws Ø20 - 4Nm	
-	Control block(2)	Spring terminal block	

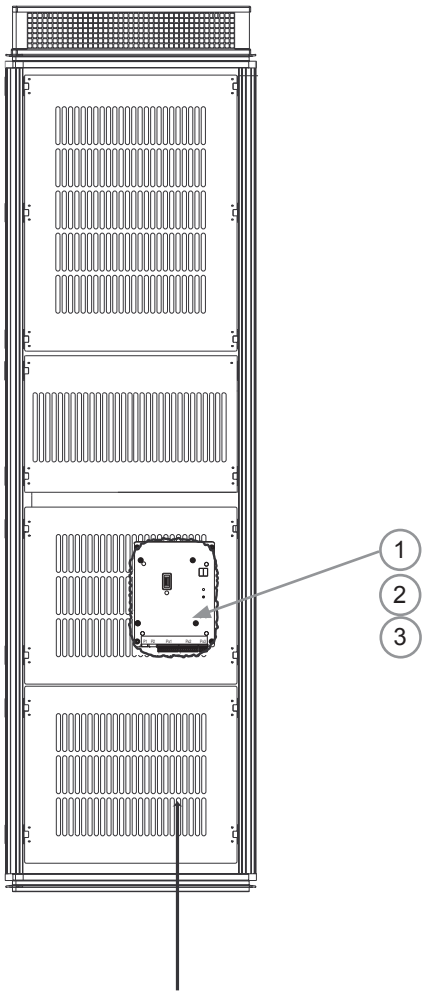
Do not exceed the indicated maximum tightening torque.

(1) If the optional braking transistor is already installed
(2) The neutral of the electronics power supply must not be connected to earth.

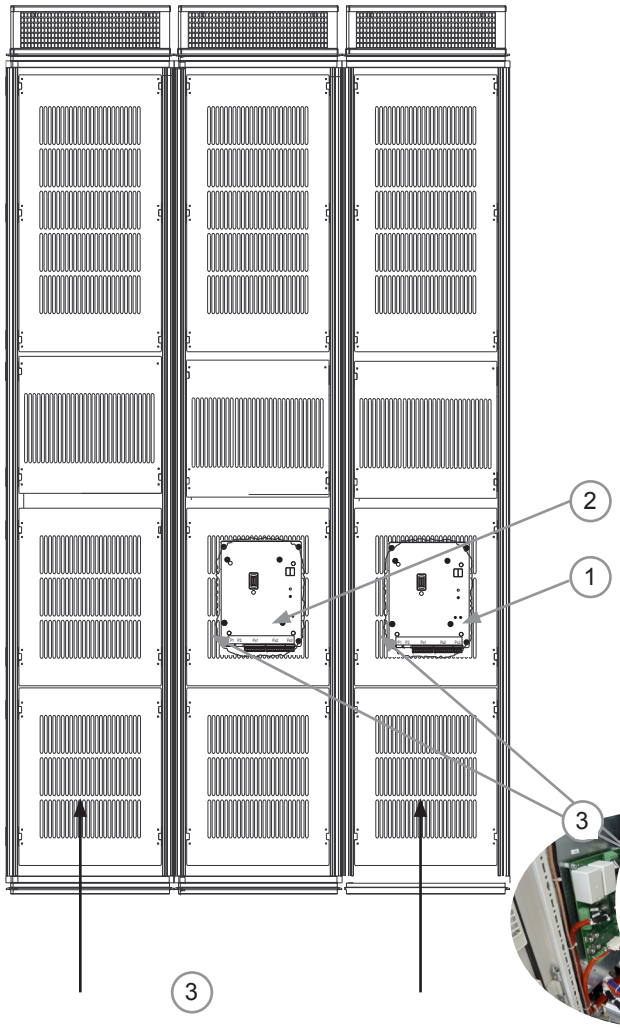
3.1.4 - Location of power terminal blocks and fuse boards

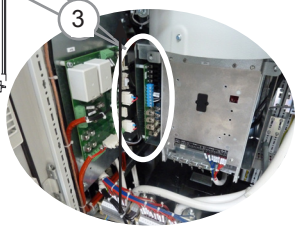
1. Inverter control board (motor) with control terminal block
2. Synchronous rectifier control board
3. Fuse board and external power supply (included in the chassis oh the product from 60T to 270T)

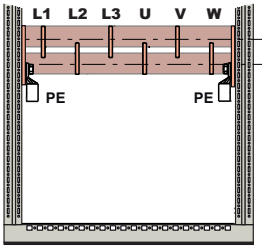
Rating 60T to 150T



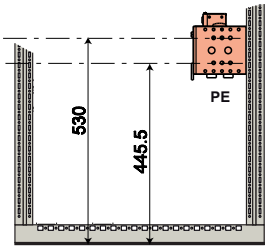
Rating 180T to 270T



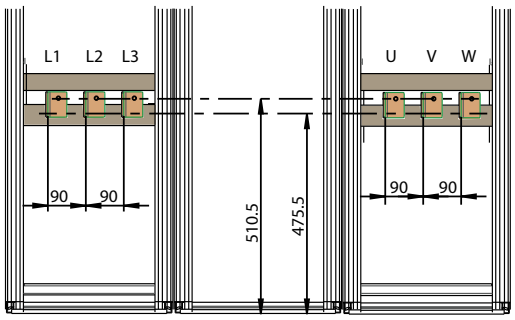




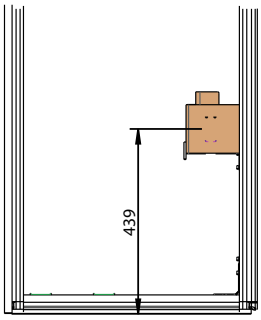
Front side of the power terminal block



right side

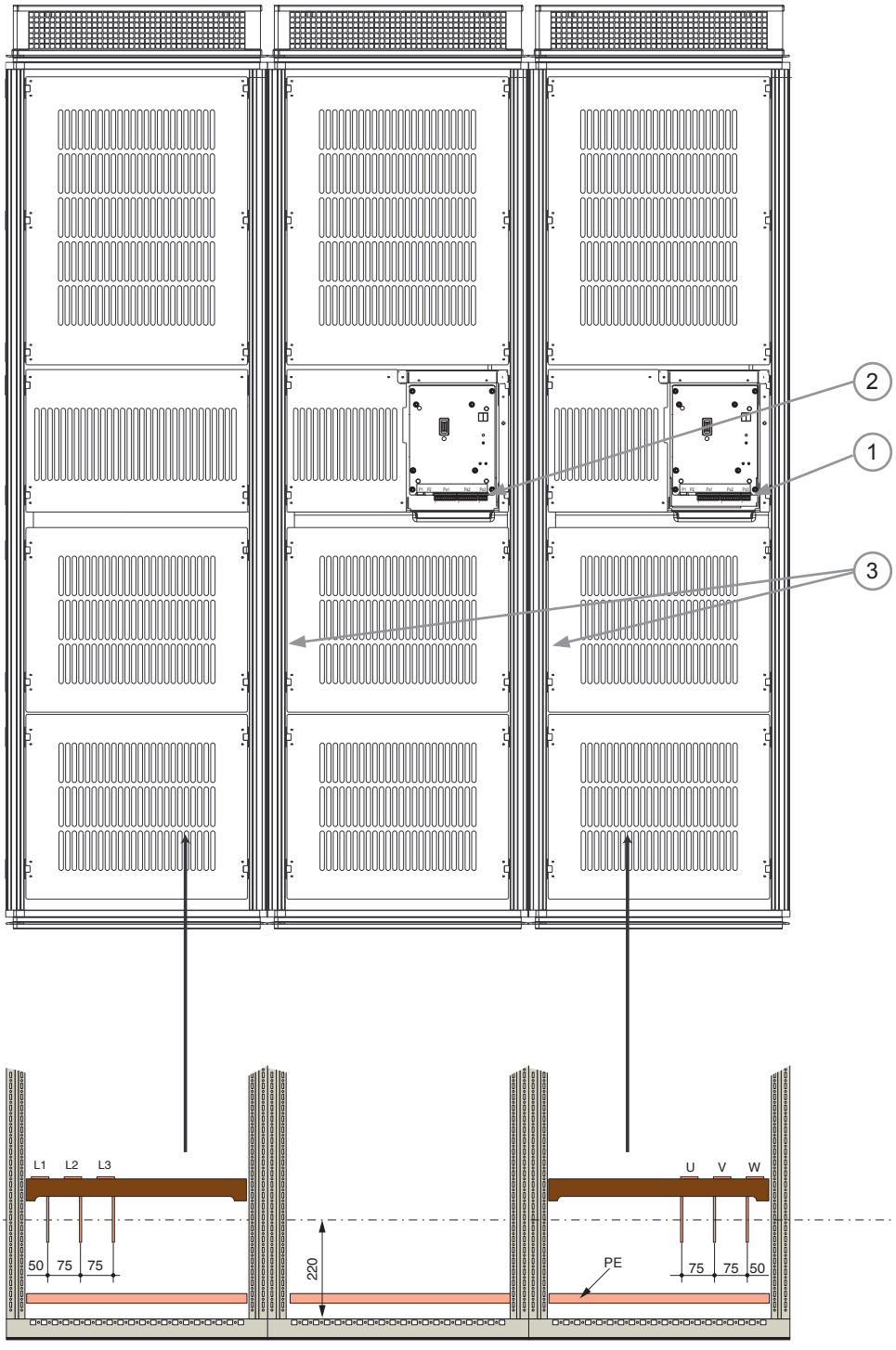


Front side of the power terminal block

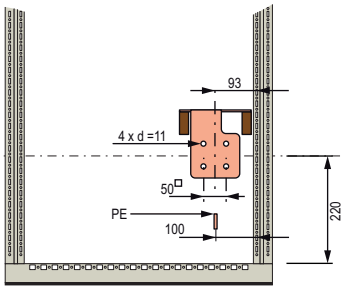


right side

Rating 340T to 570T and 270TH to 500TH

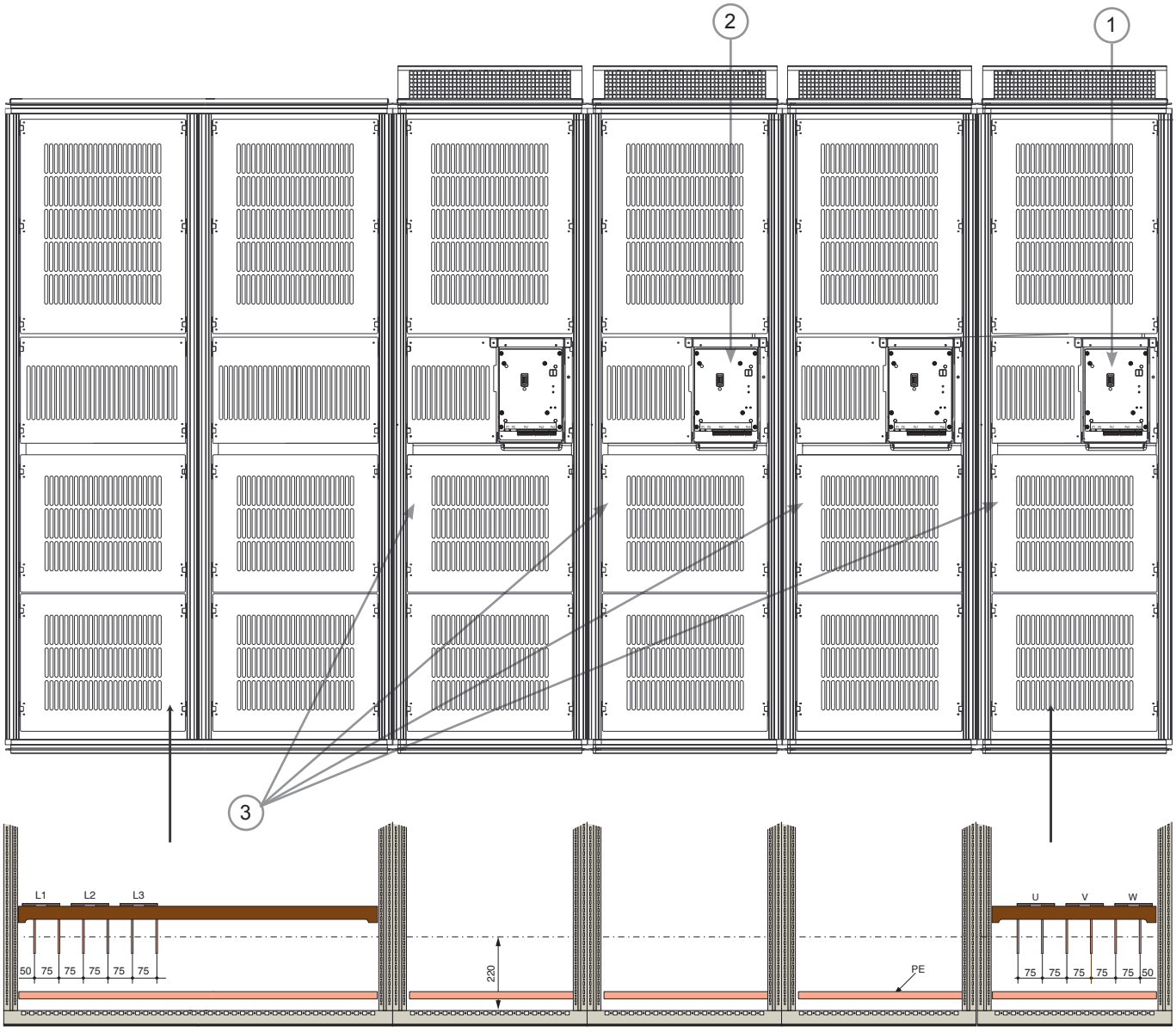


Front side of the power terminal block

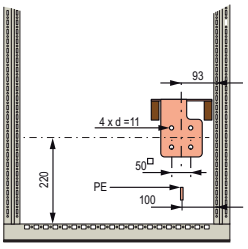


right side

Rating 600T to 1100T and 600TH to 900TH



Front side of the power terminal block



Right side

3.1.4 - Cables and fuses

• It is the responsibility of the user to connect and provide protection for the POWERDRIVE MD2R in accordance with the current legislation and regulations in the country of use. This is particularly important with regard to the size of the cables, the type and rating of fuses, the earth or ground connection, powering down, acknowledging trips, isolation and protection against overcurrents.

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

• The POWERDRIVE MD2R are internal equipped with fuses aR. It is necessary to associated those fuses to an additional protection system located at the power supply start (fuses Gg, circuit breaker, etc.)

• This table is given for information only, and must under no circumstances be used in place of the current standards.
I_L : Maximum line current **Ico:** Continuous output current

Rating	Main power supply 400V à 480V				Motor	
	I_L (A)	Fuses		Cable Cross-section (mm^2) (3)	Ico (A)	Cable Cross-Section (mm^2) (4)
		gG (1)	Class J (UL)			
60T	**112**	125	150	3x35 + PE	112	3x35 + PE
75T	142	160	200	3x50 + PE	142	3x50 + PE
100T	172	200	225	3x70 + PE	172	3x70 + PE
120T	200	200	250	3x95 + PE	200	3x95 + PE
150T	238	250	300	3x120 + PE	238	3x120 + PE
180T	310	315	400	3x185 + PE	310	3x185 + PE
220T	395	400	500	3x240 + PE	395	3x240 + PE
270T	465	500	600	2x[3x150 + PE]	465	2x[3x150 + PE]
340T	560	630	-	2x[3x185 + PE]	560	2x[3x185 + PE]
400T	610	630	-	2x[3x240 + PE]	610	2x[3x240 + PE]
470T	750	800	-	4x[3x120 + PE]	750	4x[3x120 + PE]
570T	815	1000	-	4x[3x120 + PE]	815	4x[3x120 + PE]
600T	1050	1000	-	4x[3x185 + PE]	1050	4x[3x185 + PE]
750T	1140	1250	-	4x[3x240 + PE]	1140	4x[3x240 + PE]
900T	1410	1600	-		1410	
1100T	1530	1800	-		1530	
1400T	2110	2000	-		2110	
1700T	2290	2000	-		2290	

Rating	Main power supply 575V/60Hz - 690V/50Hz			Motor	
	I_L (A)	Fuses Gg (1)	Cable cross-section (mm²) (3)	Ico(A)	Cable cross-section (mm²) (4)
270TH	280	315	3x150 + PE	280	3x150 + PE
340TH	340	400	3x185 + PE	340	3x185 + PE
400TH	415	400	2x[3x120 + PE]	415	2x[3x120 + PE]
500TH	470	500	2x[3x150 + PE]	470	2x[3x150 + PE]
600TH	630	630	2x[3x185 + PE]	630	2x[3x185 + PE]
750TH	780	800	4x[3x120 + PE]	780	4x[3x120 + PE]
900TH	880	1000	4x[3x150 + PE]	880	4x[3x150 + PE]
1200TH	1180	1250	4x[3x240 + PE]	1180	4x[3x240 + PE]
1500TH	1320	1600		1320	

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

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

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

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

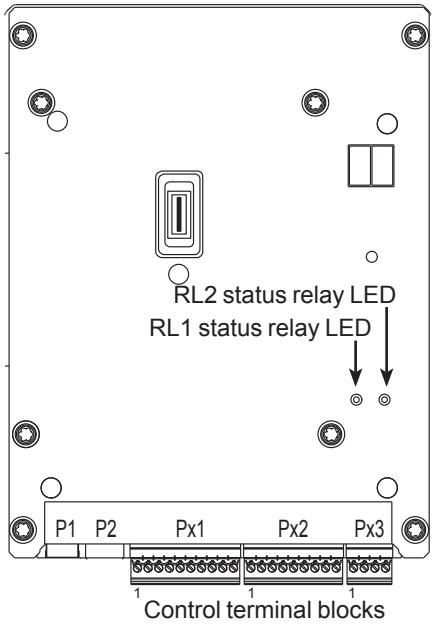
(4) The earth (PE) conductor cross-section cannot be less than half the cross-section of a live conductor, with the same material used. Example: The earth conductor cross-section for a live conductor 2x 240 mm² must be:
- 2x 120 mm²
- 2 x (3 x 40 mm2) when the earth conductor is divided by 3 (see above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

(5) For the POWERDRIVE MD2R 600T/750T/900T/1100T/1400T/1700T:
- The cables for each of the motor U/V/W phases must be distributed symmetrically over the U/V/W connection plates in each drive cabinet
- The incoming line cables must be distributed symmetrically over the L1/L2/L3 connection plates in each drive cabinet

3.2 - Connection of the control

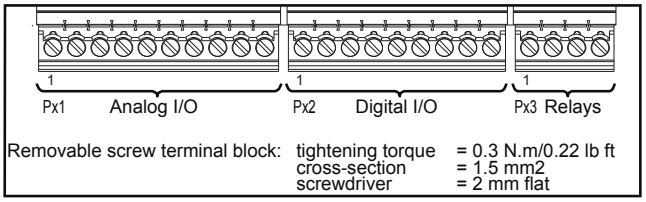
• The POWERDRIVE MD2R inputs have a positive logic configuration. Using a drive with a control system which has a different control logic may cause unexpedted starting of the motor.
• The POWERDRIVE MD2R control circuit is isolated from the power circuits by single insulation. Its electronic 0V is connected to the connection terminal on the outer protective conductor (earth terminal). The installer must ensure that the external control circuits are isolated against any human contact.
• If the control circuits need to be connected to circuits complying with SELV safety requirements, additional insulation must be inserted to maintain the SELV classification (see EN 61140).

3.2.1 - Control terminal block location



Control terminal blocks

Control terminal block



Removable screw terminal block: tightening torque = 0.3 N.m/0.22 lb ft
cross-section = 1.5 mm2
screwdriver = 2 mm flat

3.2.2 - Control terminal block characteristics

3.2.2.1 - PX1 terminal block characteristics

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

2	AI1+	Differential analog input 1 (+)
3	AI1-	Differential analog input 1 (-)
Factory setting		0-10V speed reference
Input type		± 10 V differential bipolar analog voltage (for common mode, connect terminal 3 to terminal 6)
Absolute maximum voltage range		± 36 V
Voltage range in common mode		± 24 V/0 V
Input impedance		> 100 kΩ
Resolution		11 bits + sign
Sampling period		2 ms
Input filter bandwidth		~ 200 Hz

4	AI2+	Differential analog input 2 (+)
5	AI2-	Differential analog input 2 (-)
Factory setting		4-20 mA speed reference
Input type		Unipolar current (0 to 20 mA, 4 to 20 mA, 20 to 0 mA, 20 to 4 mA)
Absolute maximum current		30 mA
Voltage range in common mode		± 24 V/0 V
Input impedance		100 Ω
Resolution		12 bits
Sampling period		2 ms
Input filter bandwidth		~ 200 Hz

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

7	AI3	Analog input 3
Factory setting		No assignment
Input type		± 10 V bipolar analog voltage in common mode or unipolar current (0 to 20 mA, 4 to 20 mA)
Resolution		11 bits + sign
Sampling period		2 ms
Input filter bandwidth		~ 200 Hz
Voltage range in common mode		± 24 V/0 V
Voltage mode		
Input impedance		> 50 kΩ
Absolute maximum voltage range		± 30 V
Current mode		
Input impedance		100 Ω
Absolute maximum current		30 mA

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

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

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

3.2.2.2 - PX2 terminal block characteristics

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

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

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

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

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

3.2.2.3 - PX3 terminal block characteristics

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

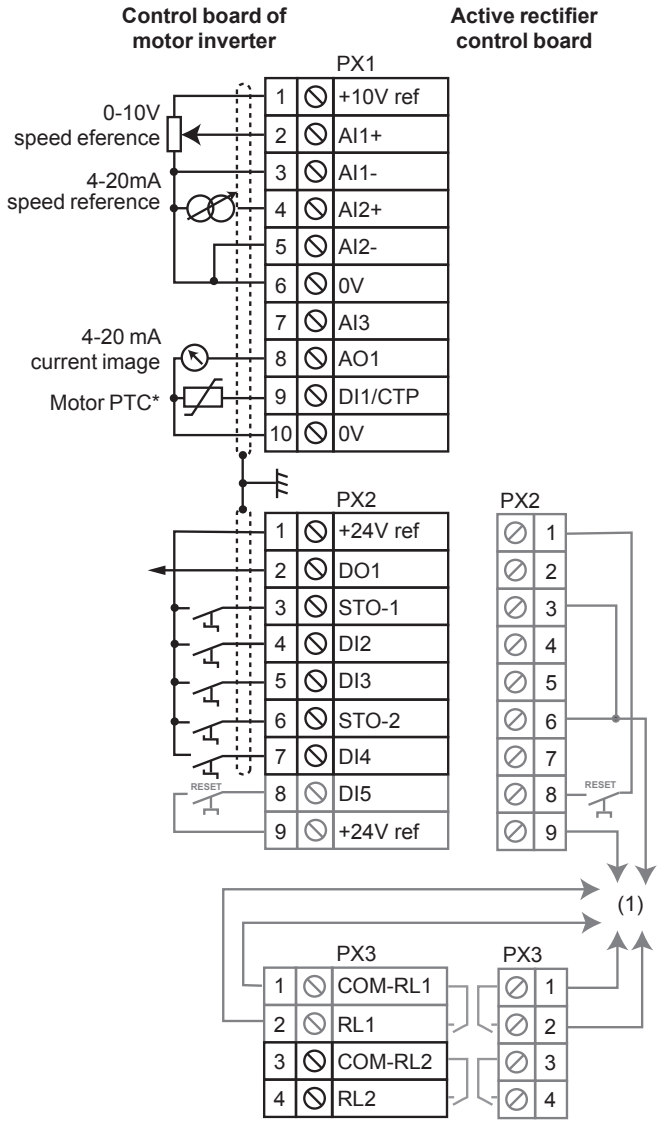
• Provide a fuse or other overcurrent protection in the relay circuit.

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

3.2.3 - Factory configuration of control terminal blocks

POWERDRIVE MD2R include two modules control :

- An AFE rectifier module. No connection to be done on this module (Internal connections only)
- A motor inverter module. All the control connections should be done on this module.



(1) internal connection within the **POWERDRIVE MD2R**

Inverter - motor connections	
DO1	Zero speed
STO-1	Safe Torque Off 1 / Drive enabled input 1
DI2	Reference selection 2
DI3	Reference selection 3
STO-2	Safe Torque Off 2 / Drive enabled input 2
DI4	Run FWD/Stop
DI5	Run REV/Stop
RL2	Maximum speed alarm relay(N/O)

This setting is obtain from a drive in " factory setting " (default parameter) and modifications as mentionned below.

Nota : For more details on the parameters, please refer to the commissioning manual ref.4617 **Specific setting of the active rectifier's control block:**

- **05.19** (High stability modulation) = **Enabled**
- **06.43** (Run/Stop source) = **Terminals**
- **08.24** (DI4 input destination) = **0000**
- **10.75** (Powered by DC bus) = Yes
- **11.66** (Communication type between drives) = **Rectifier of Regen**

Set-up of the automatic run mode :

- **09.04** (Logic function 1 Source 1) = **10.01** (drive healthy)
- **09.06** (Logic function1 Source 2) = **18.40** (Start order for the Regen)
- **09.10** (Logic function 1 output destination) = **06.30** (Run Forward)

3.2.3.1 - Specific setting of the control inverter:

- **02.04** (Deceleration ramp mode select) = **Fixed ramp**
- **06.43** (Run/Stop source) = **Terminals** (1)
- **06.61** (Delay before start) = **5** (sec)
- **10.75** (Powered by DC bus) = **Yes**
- **11.66** (Communication type between drives) = **Regen Inverter**
- **18.26** (Regen rated current) = indicate the value of the parameter ***11.32 (Drive current rating)***

Inverter locked setting for active rectifier trips

- **09.04** (Logic function 1 source 1) = **10.01** (Drive healthy)
- **09.06** (Logic function 1 source 2) = **18.21** (Regen healthy)
- **09.10** (Logic function 1 output destination) = **06.15** (Drive output enabled)

Nota : STO-1 and STO-2 inputs of the motor inverter should be closed prior to give a run command.

(*) If motor thermal sensor should be connected on DI1/CTP, then set **Mtr.06 (05.70)** = Drive terminal (1).

• Selection of the reference via digital inputs:

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

(1) Run command via keypad isn't possible with **POWERDRIVE MD2R**

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

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

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

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

(CETIM approval no. CET0047520)

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

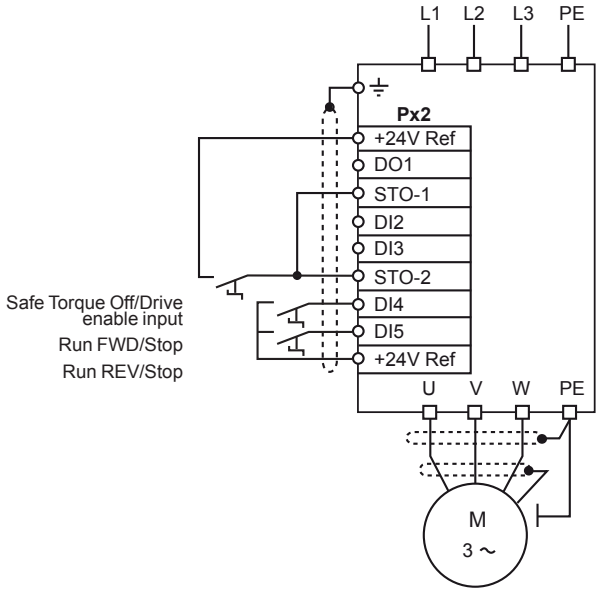
The STO-1 and STO-2 inputs are compatible with self-tested logic outputs in controllers such as PLCs, for which the test pulse lasts for 1 ms maximum.
If the data sent by the 2 inputs are not identical, this generates a drive trip. The RL1 relay opens and the drive indicates a "t.r./63" trip on the drive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

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

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

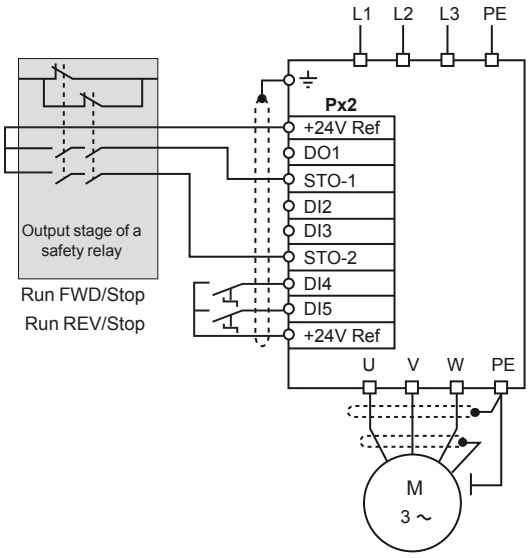
3.3.1 - Single channel locking (SIL1 - PLb)

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



3.3.2 - Double channel locking (SIL3 - PLe).

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



4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE

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

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

4.1 - Low-frequency harmonics

The **POWERDRIVE MD2R** allows to limit the harmonics distortion below than 5% .

4.2 - Radio-frequency interference: Immunity

4.2.1 - General

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

4.2.2 - Standards

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

4.2.3 - Recommendations

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

4.3 - Radio-frequency interference: Emission

4.3.1 - General

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

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

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

4.3.2 - Standards

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

4.4 - Mains supply

4.4.1 - General

Each industrial power supply has its own intrinsic characteristics (short-circuit capability, voltage value and fluctuation, phase imbalance, etc) and supplies equipment some of which can distort its voltage either permanently or temporarily (notches, voltage dips, overvoltage, etc). The quality of the mains supply has an impact on the performance and reliability of electronic equipments, especially variable speed drives.
The **POWERDRIVE MD2R** is designed to operate with mains supplies typical of industrial sites throughout the world. However, for each installation, it is important to know the characteristics of the mains supply in order to carry out corrective measures in the event of abnormal conditions.

4.4.2 - Mains transient overvoltages

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

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

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

4.4.2.2 - Presence of commutation notches on the line

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

4.4.3 - Unbalanced power supply

Similar to what is observed on an electric motor, the line current imbalance of a drive operating on an unbalanced mains supply may be several times the value of the voltage imbalance measured on the power supply. A highly unbalanced mains supply (>2%) associated with a low mains impedance may result in a high level of stress on the components at the input stage of a drive.

4.4.4 - Ground connections

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

4.5 - Basic precautions for installation

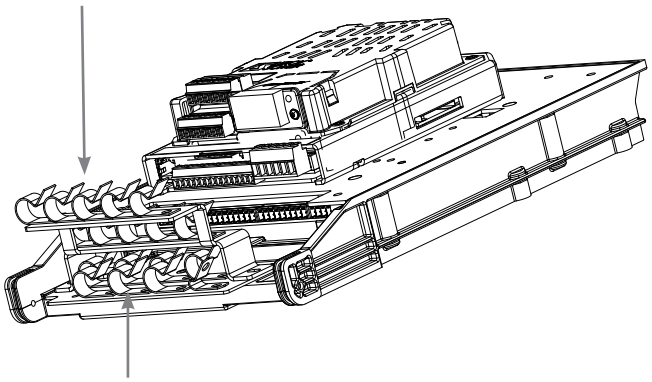
These should be taken into account when wiring the **POWERDRIVE MD2R** and the external components. In each paragraph, they are listed in decreasing order of effect on correct operation of the installation.

4.5.1 - Wiring inside the cabinet

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

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

Grounding bracket
of the options



Grounding bracket

4.5.2 - Wiring outside the cabinet

4.5.2.1 - Control wiring

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

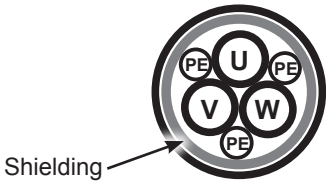
4.5.2.2 - Power wiring

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

Never use shielded single-core cables

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

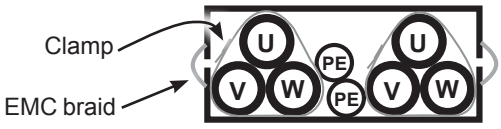
The shield must be connected at both ends: drive end and motor end (connected round the whole circumference).



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

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

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



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

4.6 - Electromagnetic compatibility (EMC)

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

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

Emission			
Standard	**Description**	**Category**	**Conformity conditions**
			Standard
EN 61800-3	Variable speed drive standards	C3	Conforming - Cable length < 50 m - Switching frequency < 6 kHz

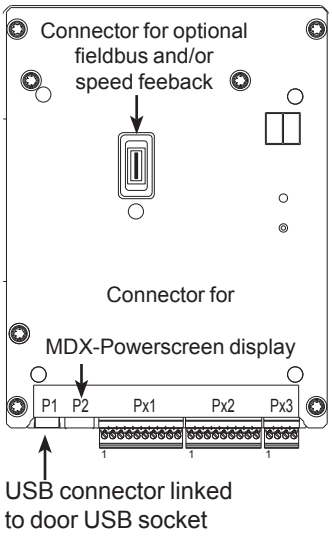
5 - PARAMETER-SETTING INTERFACE AND OPTIONS

POWERDRIVE MD2R includes two control modules :
- A module for actif rectifier.
- A module for motor inverter.

The HMI is connected to the motor inverter module, but it can be connected to the active rectifier module for its initial setup (P2 connector of the active rectifier control board).

5.1 - Parameter setting interfaces

5.1.1 - Location of the drive connectors / ports



◦ **P1 connector**

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

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

◦ **P2 terminal block**

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

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

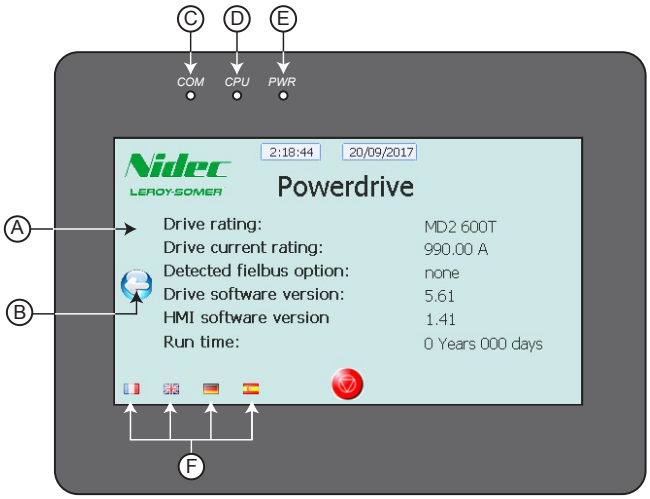
Check that control circuits are powered down before disconnecting the programming interface from the P2 connector.

5.1.2 - MDX-Powerscreen

- **General**

The POWERSCREEN interface is a touch screen which can be used to access various menus to setup and supervise the drive. It is installed as standard on the **POWERDRIVE MD2R.**

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)

- **Architecture**

From the welcome screen, press the  button to access the main page of the parameter-setting interface, consisting of 5 touch-sensitive buttons:
- Information: Can be used to obtain information very quickly about the drive, the fieldbus option, the parameter-setting interface, and can also be used to select the language.
- Read mode: Is used to display the status of the drive when stopped or in operation, as well as its main operating data.
- Parameter setting: Used for reading and/or modifying all the drive parameters, as well as setting the date and time on the display.
- 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.**MDX-SOFT**
The MDX-SOFT enables parameter setting or supervision of the **POWERDRIVE MD2R** 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 MD2R, use an "MDX-USB Isolator" isolated USB cable.

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

POWERDRIVE MD2R can be set via the USB connector, even if the drive is not powered.
Attention. In this case, options modules will not be powered and settings will not be saved. To make an option module setting / backup , it is necessary to provide an auxiliary power supply.

Special settings

Refer to the installation manual of (ref. 4617) for details on settings.

- **Clogged filter alarm**

POWERDRIVE MD2R has an "overtemperature" alarm (# 10.18) which warns the user when the internal temperature of the product reaches 60°C or when a power module overheats.
To set a different alarm treshold, you can use the following settings:
Using comparator 3:
#12.63 = 7.55 (source = control board temperature)
#12.64 = 60 (threshold = 60 ° C)
#12.65 = 2°C (hysteresis)
#12.65 = 0
To display information on the HMI of the drive:
#12.67 = 10.54 (User Alarm 1)
To adress information to a digital output (eg. DO1)
 # 8.26 = 12.61 (DO1 assigned to comparator 3)

Reminder: **POWERDRIVE MD2R** filters are washable and must be kept clean. See § 7 - Maintenance

5.2 - Add-on options

The control board of the **POWERDRIVE MD2R'** motor inverter is designed to be plugged with various optional modules. Several options can be combined:

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

5.2.1 - Fieldbus modules

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

MDX option: option to be fitted to the control board

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

Association table :

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

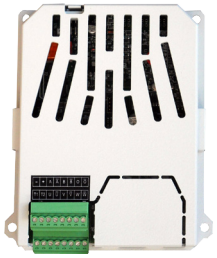
Fieldbus modules can be used to communicate with the corresponding networks respective. They can be integrated in and are supplied by the drive.

The following fieldbus are available on **POWERDRIVE MD2R** :

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

For more details, consult the specific documentations.

5.2.2 - Speed feedback options



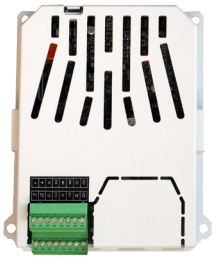
Two options are available to manage the motor speed feedback. :

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

For more details, consult the specific documentations.

5.2.3 - Additionnal I/O options

Two options are available to increase the **POWERDRIVE MD2R** number of inputs and outputs **:**



MDX-I/O LITE

MDX-I/O M2M

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

For more details, consult the specific documentations.

5.3 - Electrical protections

In the factory, a switching device can be integrated as an option to the **POWERDRIVE MD2R**.

⚠ The optional power switch integrated to the drive doesn't isolate the input busbars of the drive. During the installation and maintenance operation ensure that the supply line is open.

References and size of the options below, mounted in a **POWERDRIVE MD2R**, are detailed in the Leroy-Somer Configurator : http://configurateurls.leroy-somer.com

5.3.1 - Line switch

A 3-pole switch is available for the POWERDRIVE MD2R. This option is used to isolate the motor from the AC supply during maintenance operations.

- Fully visible break with padlockable handle on the front of the drive cabinet (can be turned manually, padlock not supplied)
- Conforming to standard IEC/EN 60947-3

The QS3P switch must **always** be included in aR semi-conductor fuse kits, in accordance with the table in section 3.1.5.

Characteristics at 40°C in category AC21
I_{th} = thermal current

POWERDRIVE MD2R rating	Switch			
	Reference	I_{th} @ 400V (A)	I_{th} @ 690V (A)	Number of operations
100T to 150T	**QS3P_250A**	250	250	10 000
180T & 220T	**QS3P_400A**	400	400	5 000
270TH & 340TH				
270T & 340T	**QS3P_630A**	630	630	5 000
400TH to 600TH				
400T	**QS3P_800A**	800	800	3 000
750TH				
470T to 570T	**QS3P_1000A**	1000	800	3 000
750T	**QS3P_1250A**	1250	1000	4 000
900TH				
900T	**QS3P_1600A**	1600	1000	4 000
1100T	**QS3P_1800A**	1800	1000	4 000
1400T & 1700T	Contact your local technical support.			
1200TH to 1800TH				

.

5.3.2 - Emergency stop

- **MD2-AU1: SIL1/PLb protection device**

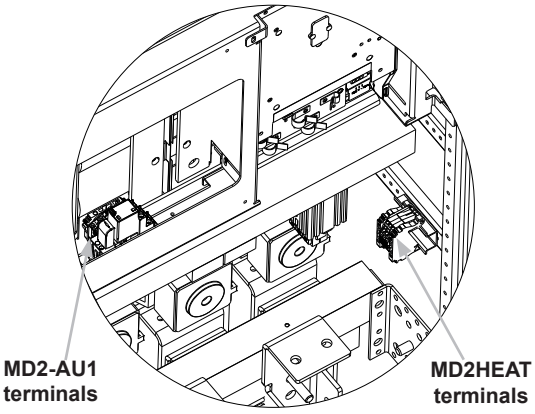
The MD2-AU1 protection device consists of an emergency stop wired on the STO inputs and mounted on the front.

- **SIL3/PLe protection device**

The **POWERDRIVE MD2R** can be made compatible with SIL3/PLe by incorporating a safety relay for double channel locking.
Contact LEROY-SOMER.

5.4 - Heater kit

To prevent condensation in the **POWERDRIVE MD2R** a self-limited temperature heater is available as an option.
The intaller must provide ~230V single phase protection (fuse rating indicated below) and ensure its control (the module must be turned off when the drive is in operation).

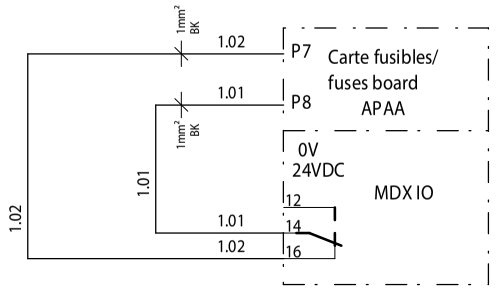


5.5 - MD2 fans control kit

The internal wiring schemes for the MD2 fan control kit is illustrated on the next page.

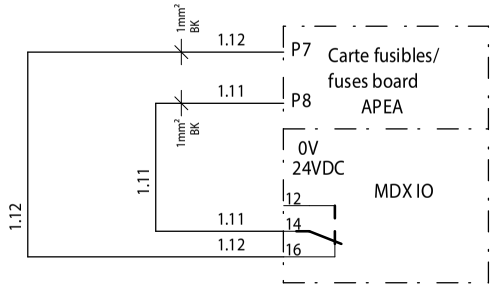
60-150T
180-570T

MONTEE SUR APC/APA
CARTE REDRESSEUR



180-570T

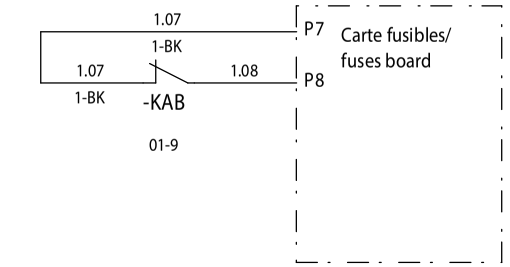
MONTEE SUR APE
CARTE ONDULEUR



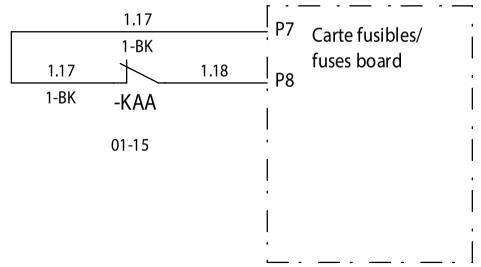
MONTE SUR L'APAx CARTE REDRESSEUR

MONTE SUR L'APEx CARTE ONDULEUR

APAC



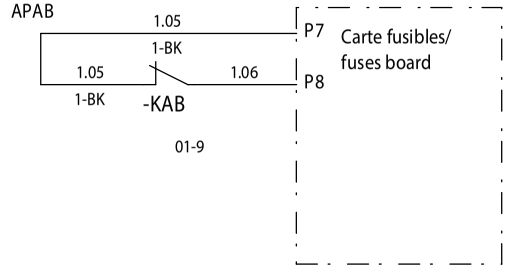
APAC



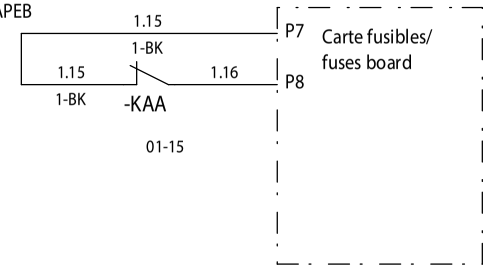
CABLAGE

1700T 1500TH
1400T 1200TH
1100T

APAB

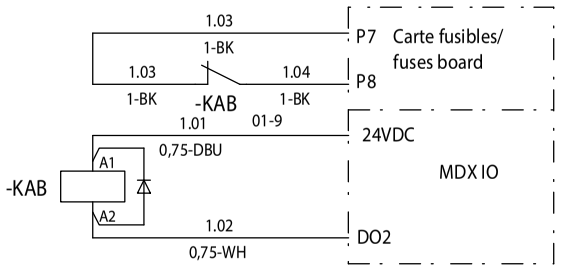


APEB



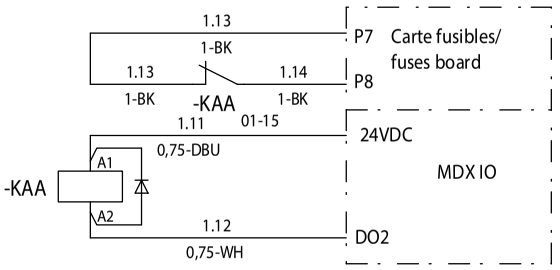
1700T 1500TH
1400T 1200TH
1100T 900TH
900T 750TH
750T 600TH
600T

APAA



b 01-10
b 01-10
b 01-10

APEA



b 01-16
b 01-16
b 01-16

1700T 1500TH
1400T 1200TH
1100T 900TH
900T 750TH
750T 600TH
600T 500TH
570T 400TH
470T 340TH
400T 270TH
340T

6 - TRIPS - DIAGNOSTICS

6.1 - Safety notice

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

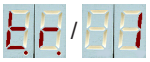
6.2 - Alarms

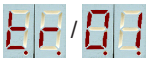
Alarms may appear during drive operation.
These alarms are for information only, in order to warn the user: the drive continues to operate but may trigger a safetrip if no corrective action is taken.
The HMI displays a page «active trips» where «ALARM» appears at the top of the screen. All alarms shown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

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

6.3 - Tripping on a safetrip

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


: indicates trip no. 1


: indicates trip no. 101

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

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

Nota : If motor inverter is disabled without any trips appearing on the HMI, check the trips state on active rectifier (**18.24**). The trip's messages for parameter **18.24** are identical than those explained in the board below

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

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

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

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

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

7 - MAINTENANCE

• All work relating to installation, commissioning and maintenance must be carried out by experienced, qualified personnel.
• When a trip detected by the drive causes the motor to stop, fatal residual voltages remain on the terminals and in the drive.
• The drive stop function does not protect against high voltages on the terminal blocks.
• Before carrying out any work on the drive or the motor, disconnect and padlock the isolating switch in the switchboard.
• The line switch integrated as an option in the drive does not isolate the drive input busbars. During the installation and maintenance phases, make sure that the power supply line is disrupted.
• 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.

There are very few maintenance and repair operations to be performed by the user on **POWERDRIVE MD2R** 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. The door filters must be checked and changed regularly depending on their state.

- **Preventive maintenance**

Device	Action	Frequency
Door filters (10µm)	Clean (1)	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 MD2R** incorporates aluminium electrolytic capacitors.
If the drive has been stored for more than 12 months, it must therefore be switched on for 5 hrs at the rated operating voltage, and this operation must be repeated every 6 months.
If the drive has been stored for more than 36 months, the capacitors must be reformed.
This consists of gradually applying a DC voltage to the banks of capacitors, until voltage values close to the rated voltages are achieved, while ensuring that the dissipated power does not exceed the maximum values authorised by the manufacturer.
An instruction sheet is available - please contact your local technical support.

7.2 - Replacing products

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

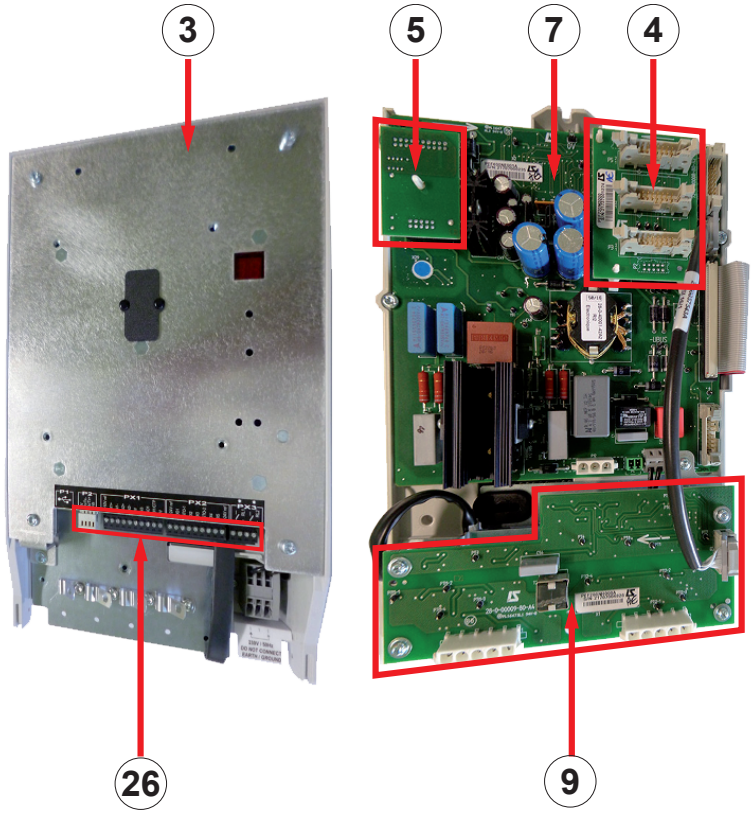
7.3 - List of spare parts

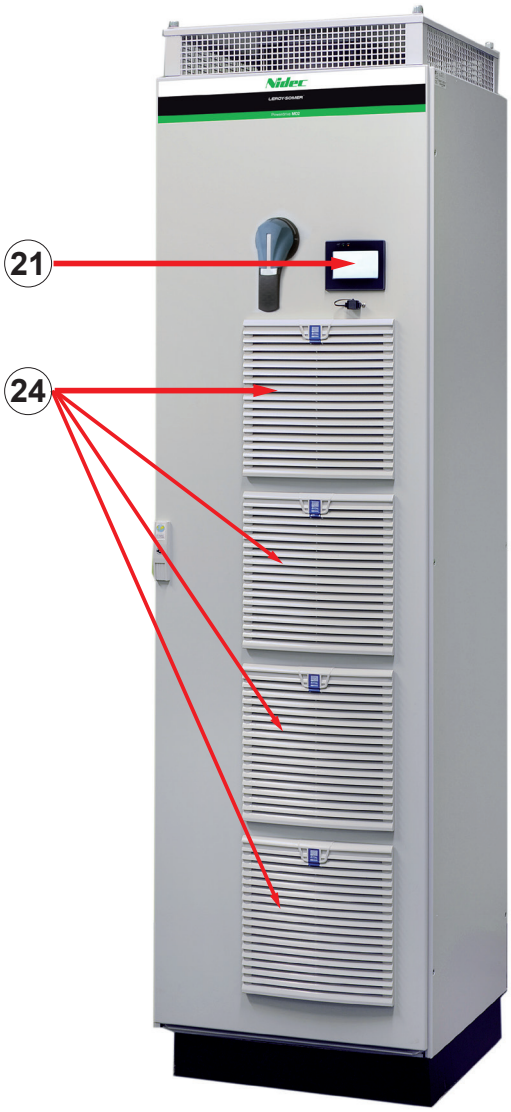
7.3.1 - First emergency kit

Ratings	LS Code
MD2R 60T	KITSPMD2R60T
MD2R 75T	KITSPMD2R75T
MD2R 100T	KITSPMD2R100T
MD2R 120T	KITSPMD2R120T
MD2R 150T	KITSPMD2R150T
MD2R 180T	KITSPMD2R180T
MD2R 220T	KITSPMD2R220T
MD2R 270T	KITSPMD2R270T
MD2R 340T	KITSPMD2R340T
MD2R 400T	KITSPMD2R400T
MD2R 470T	KITSPMD2R470T
MD2R 570T	KITSPMD2R570T
MD2R 600T	KITSPMD2R600T
MD2R 750T	KITSPMD2R750T
MD2R 900T	KITSPMD2R900T
Other ratings	Consult LS

Each kit is composed of the following parts :

Key	Description	Qty
2	Inverter module (60T to 570T)	1
	Inverter module (600T to 900T)	2
3	Control board	1
7	Interface board	1
20	high speed fuses kit	1
24	Set of 5 filter cartridges	1
25	control fuses kit	1
30	Cooling fan	1
31	Top panel fan	1
33	Preload board	1
34	Preload resistor (60T to 270T)	2
33	Preload module (340T to 900T)	1





7.3.2 - Electronic PCB

Key	Description	LS code
3	Control board	PEF400NB000A
4	Distribution board Ratings 60T to 150T	PEF190NE000A
	Distribution board ratings 180T to 270T	PEF720NG000
5	Rating indentification Board	Consult. LS
6	DC bus sensing board	PEF720NH000
7	Interface board	PEF400NE002A
9	Voltage sensing Board	PEF280NH000A
26	Control board terminal blocs	KITCTRLTERM
29	Parallelisation board ratings 600T to 900T	PEF28ENA001A
33	Preload board (all ratings)	PEF280NF000A
	Preload Module ratings 340T to 900T	LSRDBUSDC

7.3.3 - Front panel mounted parts

Key	Description	LS code
21	HMI : MDX POWERSCREEN	RDKITIHMMD0SPR2
24	Enclosure Outlet filter	VEN323FV000
	Set of 5 filter cartridges	40018862

7.3.4 - Other parts

Key	Description	Qty	LS code
27	Transformer 60T to 270T	1	TRF750MA003
	Transformer 340T to 570T	2	TRF115MA001
	Transformer 600T to 900T	4	
28	Surge suppressor	3	PEL500EC001
30	Cooling fan 60T to 150T	2	BLOCVF3MDVIR
	Cooling fan 180T to 270T	6	
	Cooling fan 340T to 570T	6	BLOCVF340A400
	Cooling fan 600T to 900T	12	
31	Top panel fan 60T to 150T	1	BLOCVFTOIT
	Top panel fan 270T to 570T	3	
	Top panel fan 600T to 900T	4	

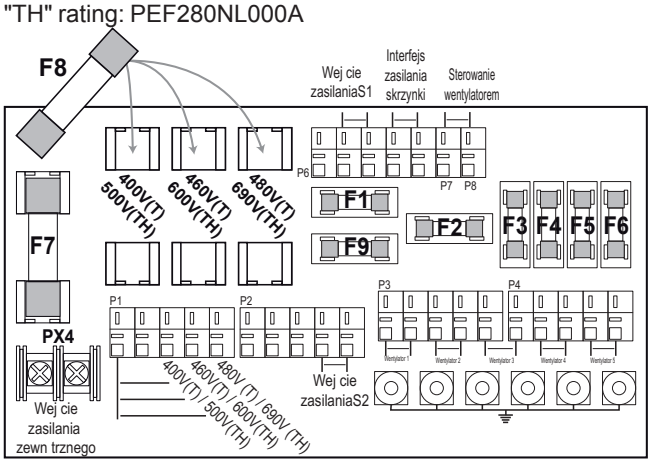
7.3.5 - Power modules, Line contactors, SF capacitors, Power high speed fuse

Rating	Power modules (Key 2)		Line contactor (key 35)		Sinus filter capacitors (key 36)		Power input high speed fuses kit (Key 20)	
	Qty	LS Code	Qty	LS Code	Qty	LS Code	Qty	LS Code
MD2R 60T	2	RDMPOA	1	CPU115CS009	3	CDS015LL001	1	EDA200LF001
MD2R 75T	2	MPOC	1	CPU115CS009	3	CDS015LL001	1	EDA250LF000
MD2R 100T	2	RDMPOD	1	CPU115CS009	3	CDS020LL002	1	EDA315FU001
MD2R 120T	2	MPOE	1	CPU150CS003	3	CDS033LL001	1	EDA350LF000
MD2R 150T	2	RDMPOF	1	CPU150CS003	3	CDS033LL001	1	EDA450LF000
MD2R 180T	6	MPOG	1	CPU265CS002	3	CDS040LL001	1	EDA500LF001
MD2R 220T	6	MPOH	1	CPU330CS001	3	CDS040LL001	1	EDA630LF000
MD2R 270T	6	RDMPOI	1	CPU400CS002	3	CDS050LL001	1	EDA800LF000
MD2R 340T	6	LSPPI	1	CPU500CS002	6	CDS040LL001	1	EDA999LF005
MD2R 400T	6	LSPPJ	1	CPU500CS002	6	CDS040LL001	1	EDA999LF015
MD2R 470T	6	LSPPN	1	CPU750CS002	6	CDS050LL001	1	EDA999LF001
MD2R 570T	6	LSPPR	1	CPU750CS002	6	CDS066LL001	1	EDA999LF003
MD2R 600T	12	LSPPI	1	CPU750CS002	9	CDS040LL001	2	EDA999LF005
MD2R 750T	12	LSPPJ	1	CPU860CS001	9	CDS040LL001	2	EDA999LF015
MD2R 900T	12	LSPPN	1	CPU999CS001	9	CDS050LL001	3	EDA999LF001

7.3.6 - Remote control fuses

- **Input protection board (See § 3.1.1)**

Board reference:
"T" rating: PEF28ANE000A
"TH" rating: PEF280NL000A



◦ **Protection fuses for the forced ventilation units :**

Fuse	Size	Type	Value
F2 to F6	5 x 20	SA	1.25A/250V

◦ **Protection fuses for the control electronics (all ratings):**

Fuse	Size	Type	Value
F1	5 x 20	SA	1.25A/250V
F9			

Note: F9 is used only on ratings 100T to 150T

◦ **Protection fuses for the transformer primary :**

Rating	Fuse	Size	Type	Value
T	F7	10 x 38	aM/ATQ	4A/500V
	F8			
TH	F7	10 x 38	aM	4A/690V
	F8			

- **Motor output bar fuse**

Board reference:
- Ratings 340T to 1400T : PEF240NK000
- Ratings 270T to 1500TH : PEF240NU102A

Rating	Fuse	Size	Type	Value
T	F1 - F2 - F3	6 x 32	U_R	2 A/660 V
TH		6 x 32	U_R	4A/690V

- **Fuse on the DC bus sensing board (Key 6)**

These fuses are under the capacitor blocks of the power bridges, above the control block.

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

- **Fuse kit (Key 25)**

All **POWERDRIVE MD2R** control fuses can be order in the kit: **EDA016LF006**. It included the following parts :
- 3 fus. 5X20 1,25A
- 3 fus. AM 10X38 4A
- 3 fus. AM 10X38 6A
- 3 fus. T6X32 2A

7.3.7 - Control protection fuses

(key FG, FJ, FK § 1.5)

Rating	Fuse	Size	Value	LS code
T	FG x3	10 x 38	aM / ATQ - 20A / 500V	PEL020FA000
	FJ x2	10 x 38	aM / ATQ - 4A / 500V	PEL004FA000
	FK x1	10 x 38	gF - 6A / 500V	PEL006FG000
TH	FG x3	22 x 58	aM / ATQ - 16A / 690V	PEL016FA011
	FJ x2	14 x 51	aM / ATQ - 4A / 690V	PEL004FA006
	FK x1	10 x 38	aM / ATQ - 6A / V	PEL006FA000

Note : FJ and FK are not used on ratings 60T à 150T

7.3.8 - Surge suppressors

(key FD, FE, FF, FI § 1.5)

Surge suppressors	Rating	Value	LS code
FD, FE, FF	T	15kV 8/20µs / 500V	PEL500EC001
	TH	/ 690V	PEL690EC003

Fuse	Rating	Size	Value	LS code
FI x3	T	22 x 58	gF - 125A / 500V	PEL125FG001
	TH	22 x 58	Ur - 100A / V	PEL100FU000

7.3.9 - Charging resistor protection fuses

(key FR § 1.5). Ratings 180T to 270T only

Fusible	Taille	Type	Valeur	Code LS
FR x2	14 x 51	aM / ATQ	32A	PEL032FA000

7.3.10 - Sinus filter and active rectifier protection fuses (see § 1.5) :

<table>
<tr><th rowspan="2">Ratings</th><th colspan="4">Sinus filter fuses</th><th colspan="2">Active rectifier fuses</th></tr>
<tr><th>FH x3
FHA x3</th><th>FO x3
FHB x3 (1)</th><th>FP x3
FPA x3 (2)</th><th>FPB x3 (3)</th><th>FA, FB, FC
FAA, FAB, FAC</th><th>FQ, FR, FS
FBA, FBB, FBC</th></tr>
<tr><td>60T</td><td rowspan="5">PEL063FG000</td><td rowspan="5">-</td><td rowspan="5">-</td><td rowspan="5">-</td><td>PEL200FU000</td><td rowspan="13">-</td></tr>
<tr><td>75T</td><td>PEL250FU005</td></tr>
<tr><td>100T</td><td>PEL315FU001</td></tr>
<tr><td>120T</td><td>PEL350FU001</td></tr>
<tr><td>150T</td><td>PEL450FU000</td></tr>
<tr><td>180T</td><td>PEL080FG000</td><td rowspan="3">-</td><td rowspan="3">-</td><td rowspan="3">-</td><td>PEL500FU001</td></tr>
<tr><td>220T</td><td>PEL100FG000</td><td>PEL630FU004</td></tr>
<tr><td>270T</td><td>PEL100FG000</td><td>PEL800FU003</td></tr>
<tr><td>340T</td><td>PEL063FG000</td><td>PEL063FG000</td><td rowspan="4">-</td><td rowspan="5">-</td><td>PEL999FU000</td></tr>
<tr><td>400T</td><td>PEL080FG000</td><td>PEL080FG000</td><td>PEL999FU015</td></tr>
<tr><td>470T</td><td>PEL100FG000</td><td>PEL100FG000</td><td>PEL999FU006</td></tr>
<tr><td>570T</td><td>PEL080FG000</td><td>PEL080FG000</td><td>PEL999FU005</td></tr>
<tr><td>600T</td><td>PEL080FG000</td><td>PEL080FG000</td><td>PEL080FG000</td><td>PEL999FU000</td><td>PEL999FU000</td></tr>
<tr><td>750T</td><td>PEL080FG000</td><td>PEL080FG000</td><td>PEL080FG000</td><td>PEL080FG000</td><td>PEL999FU015</td><td>PEL999FU015</td></tr>
<tr><td>900T</td><td>PEL100FG000</td><td>PEL100FG000</td><td>PEL100FG000</td><td>PEL100FG000</td><td>PEL999FU006</td><td>PEL999FU006</td></tr>
<tr><td>1100T</td><td colspan="6" rowspan="2">Consult Leroy-Somer</td></tr>
<tr><td>1400T</td></tr>
<tr><td>270TH</td><td>PEL050FG000</td><td>PEL050FG000</td><td>-</td><td rowspan="4">-</td><td>PEL450FU000</td><td rowspan="4">-</td></tr>
<tr><td>340TH</td><td colspan="3">Consult Leroy-Somer</td><td>PEL630FU000</td></tr>
<tr><td>400TH</td><td>PEL050FG000</td><td>PEL050FG000</td><td>PEL050FG000</td><td>PEL700FU002</td></tr>
<tr><td>500TH</td><td colspan="3">Consult Leroy-Somer</td><td></td></tr>
<tr><td>600TH</td><td>PEL050FG000</td><td>PEL050FG000</td><td>PEL050FG000</td><td>PEL050FG000</td><td>PEL500FU001</td><td>PEL500FU001</td></tr>
<tr><td>750TH</td><td colspan="6" rowspan="4">Consult Leroy-Somer</td></tr>
<tr><td>900TH</td></tr>
<tr><td>1200TH</td></tr>
<tr><td>1500TH</td></tr>
</table>

Sinus filter fuses characteristics :

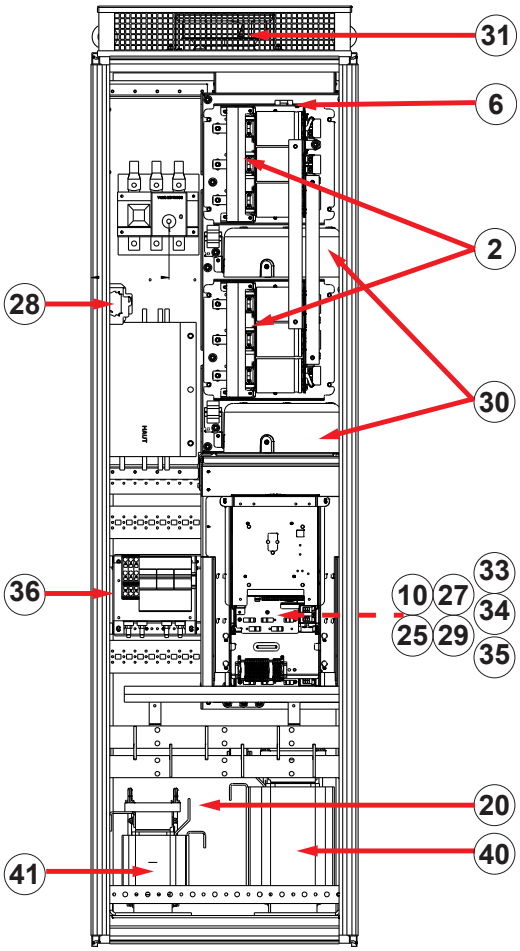
LS code	Size	Type	Value
PEL050FG000	22 x 58	gF	50A /
PEL063FG000	22 x 58	gF	63A /
PEL080FG000	22 x 58	gF	80A /
PEL100FG000	22 x 58	gF	100A / 600V

Active rectifier high speed fuses characteristics :

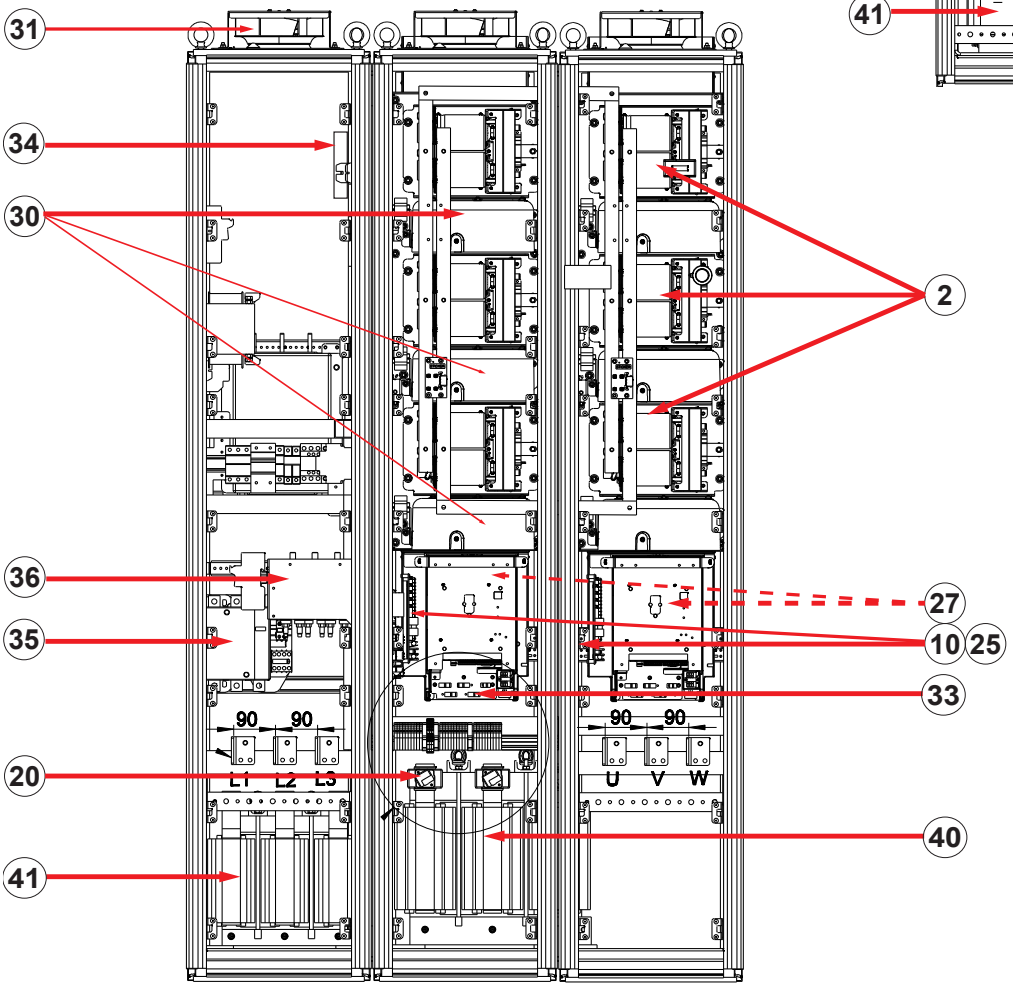
LS code	Size	Value
PEL250FU005	T30	250A / 660V
PEL450FU000	T31	450A / 660V
PEL500FU001	T31	500A / 660V
PEL630FU000	T32	630A / 660V
PEL630FU004	T33	630A / 690V
PEL700FU002	T33	700A / 660V
PEL800FU003	T33	800A / 690V
PEL999FU000	T33	1000A / 690V
PEL999FU005	T33	1600A / 660V
PEL999FU006	T33	1400A / 660V
PEL999FU015	T33	1100A / 690V

7.4 - Location of components, integrated in the POWERDRIVE cabinet

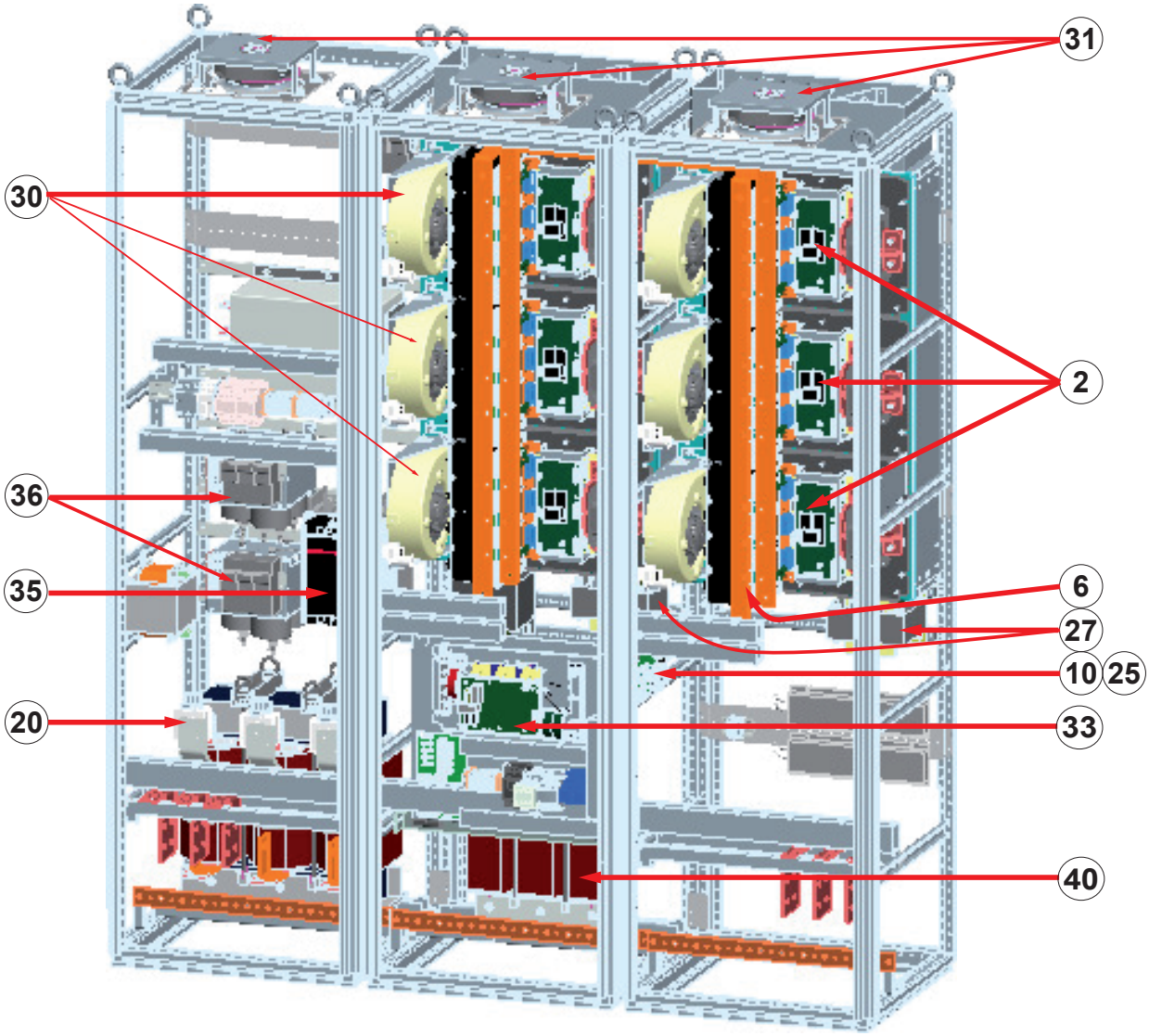
- **Rating 60 to 150T**



- **Rating 180T to 270T**



- **Other Ratings**



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Moteurs Leroy-Somer
Headquarter: Boulevard Marcellin Leroy - CS 10015
16915 ANGOULÊME Cedex 9

Limited company with capital of 65,800,512 €
RCS Angoulême 338 567 258

www.leroy-somer.com