

4948 en - 2013.09 / a



POWERDRIVE MD2R

Regenerative variable speed drive

Installation and maintenance

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

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NOTE

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



For the user's own safety, this variable speed drive must be connected to an approved earth $\frac{1}{2}$ 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.

This manual only describes the general features, characteristics and installation of the POWERDRIVE MD2R. For commissioning, refer to manual ref. 4617.

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SAFETY AND OPERATING INSTRUCTIONS FOR VARIABLE SPEED DRIVES (In accordance with the low voltage directive 2006/95/EC)

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

1 - General

Depending on their degree of protection, the variable speed drives may contain unprotected live parts, which may be moving or rotating, as well as hot surfaces, during operation.

Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel and equipment.

For further information, consult the documentation.

All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364, CENELEC HD 384 or DIN VDE 0100, as well as national specifications for installation and accident prevention).

In these basic safety instructions, qualified personnel means persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

2 - Use

Variable speed drives are components designed for integration in installations or electrical machines.

When integrated in a machine, commissioning must not take place until it has been verified that the machine conforms with directive 2006/42/EC (Machinery Directive). It is also necessary to comply with standard EN 60204, which stipulates in particular that electrical actuators (which include variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches.

Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2004/108/EC) are met.

The variable speed drives meet the requirements of the Low Voltage Directive 2006/95/EC. The harmonised standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage

All instructions concerning transportation, storage and correct handling must be observed.

The climatic conditions specified in the technical manual must be observed.

4 - Installation

The installation and cooling of equipment must comply with the specifications in the documentation supplied with the product.

The variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts.

The variable speed drives contain parts which are sensitive to electrostatic stresses and may be easily damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!).

5 - Electrical connection

When work is performed on variable speed drives which are powered up, the national accident prevention regulations must be respected.

The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fused circuit-breaker, connection of protective conductor). More detailed information is given in the documentation.

Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion of cables and conductors, are given in the documentation supplied with the variable speed drives. These instructions must be followed in all cases, even if the variable speed drive carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation

Installations in which variable speed drives are to be integrated must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations, such as the law on technical equipment, accident prevention regulations, etc. Modifications to the variable speed drives using control software are permitted.

Active parts of the device and the live power connections must not be touched immediately after the variable speed drive is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to the variable speed drives must be observed.

Permanent magnet motors generate electrical energy while they are rotating, even when the drive is switched off. In this case, the drive continues to be powered by the motor terminals. If the load is capable of turning the motor, a switching device must be provided upstream of the motor to isolate the drive during maintenance operations.

During operation, all doors and protective covers must be kept closed.

7 - Servicing and maintenance

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

This manual is to be given to the end user.



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FOREWORD

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





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GENERAL INFORMATION

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 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



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/s ² (9-200 Hz), 0.6 mm (2-9 Hz) Packaged product: 10m/s ² (9-200 Hz), 3 mm (2-9 Hz)
Shocks	Packaged product: in accordance with IEC 60068-2-29
Atmospheric pressure	700 to 1060 hPa



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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 +10% ("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. L'exploitant 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 $\leq 40^{\circ}\text{C}$ (35°C with an option IP54) - altitude $\leq 1000 \text{ m}$.

POWERDRIVE	Maximum line		Heavy duty			Normal duty				
MD2 rating	current I _∟ (A)	Pout at 400V (1) (kW)	Pout at 460V (1) (HP)	lco (A)	Pout at 400V (1) (kW)	Pout at 460V (1) (HP)	Ico (A)	(A)		
60T	112	45	60	98	55	75	112	140		
75T	141	55	75	122	75	100	141	175		
100T	172	75	100	142	90	125	172	200		
120T	200	90	125	172	110	150	200	240		
150T	238	110	150	210	132	175	238	312		
180T	310	132	175	260	160	250	310	365		
220T	380	160	250	310	200	300	395	435		
270T	465	200	300	380	250	350	465	530		
340T	570	250	350	470	315	450	570	660		
400T	620	300	400	540	350	500	625	760		
470T	750	350	500	670	400	600	760	940		
600T	980	500		815	550		980	1140		
750T	1180	550		1000	675		1180	1400		
900T	1360	675		1200	750		1360	1725		
1100T	1650	750		1455	900		1650	2050		
1400T	2000	900		1765	1100		2000	2485		

(1) motor winding voltage.



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POWERDRIVE MD2R xxxTH

Inverter switching frequency = 3 kHz - Active rectifier in factory settings Ambient temperature $\leq 40^{\circ}$ C (35° C avec option IP54) - altitude ≤ 1000 m.

		Heavy duty				Normal duty			
POWERDRIVE MD2 rating	Maximum line current	Pout at 575V (1) (kW)	Pout at 690V (1) (kW)	lco (A)	Pout at 575V (1) (kW)	Pout at 690V (1) (kW)	lco (A)	Imax (60s) (A)	
270TH	280	160	200	220	200	250	280	308	
340TH	340	200	250	270	250	315	340	378	
400TH	415	250	315	330	315	400	415	465	
500TH	415	315	400	390	400	450	480	545	
600TH	580	400	450	455	450	550	580	638	
750TH	730	450	550	570	550	700	730	800	
900TH	830	550	700	715	700	850	880	1000	
1200TH	1120	700	850	880	850	1100	1120	1230	
1500TH	1245	850	1100	1060	1100	1200	1300	1485	

(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.





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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

	Ico (A)									
Rating			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 s	upply			- -			~			
60T	98	98	98	90	82	112	112	112	102	93
75T	122	122	110	100	90	142	141	125	112	102
100T	142	142	136	122	112	175	172	154	138	126
120T	172	172	156	140	126	215	200	176	158	144
150T	222	210	186	164	148	255	238	210	186	168
180T	260	260	260	260	250	315	310	310	305	285
220T	310	310	310	310	285	400	395	385	355	325
270T	380	380	380	355	320	470	465	440	400	365
340T	470	470	430	380	340	580	570	485	430	385
400T	545	540	490	430	385	650	625	555	490	435
470T	670	670	585	515	465	800	760	665	585	525
750T	1000	1000	910	810	730	1220	1180	1030	920	830
900T	1230	1200	1050	960	875	1430	1360	1190	1090	990
1100T	1465	1455	1285	1135	1040	1700	1650	1460	1290	1180
1400T	1775	1765	1560	1400	1260	2100	2000	1770	1590	1430
525 / 690V mains su	pply									
270TH	220	220	220			280	280	250		
340TH	270	270	270			340	340	310		
400TH	330	330	330			415	415	380		
500TH	390	390	345			500	480	390		
600TH	455	455	455			580	580	520		
750TH	570	570	570			730	730	700		
900TH	715	715	660			900	880	750		
1200TH	880	880	880			1150	1120	1020		
1500TH	1060	1060	970			1350	1300	1100		

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



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

	Ico (A)									
Rating			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 s	400V / 460V mains supply									
60T	98	98	92	82	76	112	112	103	94	86
75T	122	116	102	90	82	142	130	115	103	93
100T	142	142	126	112	100	175	160	142	126	114
120T	172	162	142	128	114	210	184	162	146	130
150T	222	194	170	152	136	254	220	192	172	154
180T	260	260	260	255	230	315	315	305	290	260
220T	310	310	310	285	260	400	390	360	325	295
270T	380	380	360	320	290	470	450	410	365	330
340T	470	450	385	340	305	570	510	435	385	345
400T	545	485	440	385	340	630	550	500	435	385
470T	670	605	525	465	410	780	685	595	525	465
600T	815	750	660	590	530	930	850	750	670	600
750T	1000	935	795	715	645	1150	1060	900	810	730
900T	1200	1100	925	835	765	1360	1250	1050	950	870
1100T	1430	1320	1135	995	910	1620	1500	1290	1130	1030
1400T	1735	1605	1375	1235	1100	1970	1820	1560	1400	1250
525 / 690V mains su	pply									
270TH	220	210	195			280	240	220		
340TH	270	270	240			340	310	270		
400TH	330	330	300			415	400	340		
500TH	390	365	305			500	415	345		
600TH	455	455	395			570	525	450		
750TH	570	570	540			740	730	610		
900TH	715	690	545			890	780	620		
1200TH	880	880	865			1120	1120	980		
1500TH	1060	1060	900			1320	1220	1020		

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



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GENERAL INFORMATION

1.5 - Synoptiques du POWERDRIVE MD2R

- POWERDRIVE MD2R are composed of :
- AAFE rectifier
- An inverter connected to the motor
- A sinus filter
- A DC bus preloading device

A Control boards which exchange data by a hight speed serial link

A single 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.







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MECHANICAL INSTALLATION

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 $% \left({{{\bf{n}}_{\rm{s}}}} \right)$

2.2 - Handling

• The centre of gravity may be high up and / or offcentre, 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.

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MECHANICAL INSTALLATION

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.

2.5 - 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.

2.4 - 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.

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MECHANICAL INSTALLATION

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 o	ptions (-O)		
Rating	Width W (mm)	Load break switch	Width W (mm)		
60T to 150T	600	√	600		
180T to 270T	1200	✓	1200		
340T to 470T	1800	\checkmark	1800		
600T to 900T	3600	✓	3600		
270TH to 500TH	1800	√	1800		
600TH to 900TH	3600	✓	3600		
1100T & 1400T 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

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POWERDRIVE MD2R

Regenerative variable speed drive

MECHANICAL INSTALLATION

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 470T	1500
600T to 900T	2800
1100T to 1400T	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	2,3
75T	3,2
100T	3,8
120T	4,6
150T	5,5
180T	6,7
220T	8,4
270T	10,5
340T	13,2
400T	14,7
470T	16,8
600T	21,0
750T	28,5
900T	31,5
1100T	37,8
1400T	46,2
270TH	10,8
340TH	13,5
400TH	17,2
500TH	19,4
600TH	23,7
750TH	30,0
900TH	36,5
1200TH	47,0
1500TH	52,0

2.8.1 - Drive ventilation flow rates and noise levels

Rating	Forced ventilation flow rates (m³/hr)	Noise level with IP21 (dBA)
60T and 75T	180	78
100T to 150T	360	78
180T to 270T	1080	80
340T to 470T	2500	80
600T	1080	82
750T to 900T	5000	83
1100T	2160	85
1400T	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.

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

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 circuitbreaking 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.

3.1 - Location of terminal blocks

3.1.1 - Location of the fuse boards

Fuse and external power supply board

Suivant le calibre, le POWERDRIVE MD2R peut comporter une ou plusieurs cartes fusible identiques :

- 60T à 150T : 1 board
- 180T to 470T & 270TH to 500TH : 2 boards
- 600T to 900T & 600TH to 900TH : 4 boards
- 1100T and 1400T & 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

• 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 circuitbreaking 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.

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 1400T 270TH to 1500TH, please refer to §3.1.4 to located fuse board

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

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). (bornier PX4).

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

• Electrical characteristics :

	Ratings	Volta	ge
Primary	т	400V±10% / 50Hz ou 460-480V ±10% / 60Hz	
	TH	525-690V±5	5% / 50Hz
	Voltage	Maximum power	
Secondary 1 (Electronics power supply)	230 V isolated	100\	/A
Secondary 2 (Forced ventilation and auxiliaries power supply)	230 V connected to earth	60T to 75T : 100T to 150T : 180T to 270T : 340T to 470T : 600T to 900T : 1100T to 1400T : 270TH to 500TH : 600TH to 900TH : 1200TH to 1500TH P = 6x 1200VA	P = 300VA P = 500VA P = 2x500VA P = 2x1200VA P = 4x 1200VA P = 6x 1200VA P = 2x 1200VA P = 4x 1200VA P = 4x 1200VA

· Disconnection of forced ventilation units

The fuse board described in section 3.1.1. enables the user to switch off the power supply to the drive forced ventilation units momentarily, if preheating resistors are used in the cabinet for example.

To disconnect the fans, remove the jumper connecting terminals P7 and P8 and connect a normally closed contact (230 V/7 A on resistive load). A closed contact allows the ventilation units to operate, an open delayed contact cuts off their power supply (delay 10 minutes for ambiant temperature up to 40° C, otherwise 30 minutes).

Connection exemple:

Example of associated settings:

16.02 = 10.02 (Timer 1 source = Drive active) # 16.03 = 1 (OFF timer) # 16.04 = 1 (minute) # 16.05 = 20 (if T \le 40 ° C) or 30 (if T > 40 ° C) # 8.26 = 16.01 (DO1 assigned to Timer 1) # 8.16 = 1 (Invert DO1)

Refer to the commissioning manual (ref. 4617) for more details on **POWERDRIVE MD2R** settings.

3.1.3 - Characteristics of connection terminals

		Type of connection and tightening torque				
Refs.	Functions / connections	100T à 150T	180T à 270T	340T à 1400T 270TH à 1500TH		
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

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

3.1.4 - Location of power terminal blocks and fuse boards

2

80

right side

(1) Inverter control board (motor) with control terminal block

2) Synchronous rectifier control board

) 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

PF

Front side of the power terminal block

right side

D PE

INSTALLATION AND MAINTENANCE

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POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

Rating 340T to 470T and 270TH to 500TH

Front side of the power terminal block

right side

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

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

Front side of the power terminal block

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

3.1.4 - Cables and fuses

• It is the responsibility of the user to connect and provide protection for the POWERDRIVE 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, 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.: Maximum line current

I,: Maximum	line current
E	

		Motor				
Rating	1	Fu	ses	Cable	lco	Cable
	(Å)	gG (1)	Class J (UL)	Cross-section (mm ²) (3)	(A)	Cross-Section (mm²) (4)
60T	112	125	150	3x50 +25	112	3x50 + 25
75T	141	160	200	3x70 + 35	141	3x70 + 35
100T	172	200	225	3x95 + 50	172	3x95 + 50
120T	200	250	250	3x120 + 70	200	3x120 + 70
150T	238	315	300	3x150 + 70	238	3x150 + 70
180T	310	315	400	3x240 +120	315	3x240 +120
220T	380	400	500	2x(3x95 + 50)	400	2x(3x95+50)
270T	465	500	600	2x(3x150 + 95)	470	2x(3x150+95)
340T	570	630	-	2x(3x185 + 95)	560	2x(3x185+95)
400T	620	800	-	2x(3x240 + 120)	610	2x(3x240+120)
470T	750	1000	-	3x(3x185 + 95)	760	3x(3x185 + 95)
600T	980	1250	-	4x(3x150 + 95)	960	4x(3x150 + 95)
750T	1180	1600	-	3x(3x240 + 120)	1160	3x(3x240 + 120)
900T	1360	1600	-	4x(3x240 + 120)	1360	4x(3x240 + 120)
1100T	1650	2000	-	4x(3x240 + 120)	1650	4x(3x240 + 120)
1400T	2000	2500	-		2000	

	Main power supply 525V		Main power supply 690V			Motor		
Rating	І _∟ (А)	Fuses Gg (1)	Cable cross-section (mm²) (3)	l (Å)	Fuses Gg (1)	Cable cross-section (mm²) (3)	lco(A)	Cable cross-section (mm²) (4)
270TH	280	315	3x120 + 70	265	315	3x120 + 70	280	3x150 + 70
340TH	340	400	3x150 + 70	320	400	3x150 + 70	340	3x240 +120
400TH	415	400	3x240 +120	390	400	3x240 +120	415	2x(3x120+70)
500TH	415	500	3x240 +120	470	500	3x240 +120	480	2x(3x150+95)
600TH	580	630	2x(3x150+95)	545	630	2x(3x150+95)	580	2x(3x185+95)
750TH	730	800	2x(3x240 + 120)	685	800	2x(3x240 + 120)	730	2x(3x240+120)
900TH	830	1000	3x(3x185 + 95)	845	1000	3x(3x185 + 95)	900	3x(3x185 + 95)
1200TH	1120	1250	3x(3x185 + 95)	1050	1250	3x(3x185 + 95)	1120	3x(3x240 + 120)
1500TH	1245	1600	3x(3x240 + 120)	1265	1600	3x(3x240 + 120)	1300	4x(3x240 + 120)

(1) gG fuse or equivalent solution (fuses connected in parallel, preferably C type circuit-breaker, etc)

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

(4) The motor cable cross-sections are given for information only for a current corresponding to the value of the lco current at 3 kHz, a maximum length of 50 m, output frequency less than 100 Hz and an ambient temperature of 40°C. **The recommended motor cables are shielded multicore type** (see section 4.5.2). The values supplied are typical values.

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

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

3.2.1 - Control terminal block location

Control terminal block

666666666			<u>\$\$\$</u> \$
Px1 Analog I/O	Px2 Digital I/O		Relays
Removable screw terminal block:	tightening torque cross-section screwdriver	= 0.3 N. = 1.5 m = 2 mm	.m/0.22 lb ft m2 flat

3.2.2 - Control terminal block characteristics 3.2.2.1 - PX1 terminal block characteristics

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

2	Al1+	Differentia	Differential analog input 1 (+)		
3	Al1-	Differentia	l analog input 1 (-)		
Factory s	etting		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		non mode	± 24 V/0 V		
Input impedance			> 100 kΩ		
Resolution			11 bits + sign		
Sampling period			2 ms		
Input filter bandwidth			~ 200 Hz		

4	Al2+	Differential analog input 2 (+)		
5	Al2-	Differentia	l analog input 2 (-)	
Factory s	etting		0-20 mA speed reference	
Input type			Unipolar current (0 to 20 mA, 4 to 20 mA, 20 to 0 mA, 20 to 4 mA)	
Absolute maximum current		ırrent	30 mA	
Voltage range in common mode		non mode	± 24 V/0 V	
Input imp	edance		100 Ω	
Resolution			12 bits	
Sampling period			2 ms	
Input filte	out filter bandwidth		~ 200 Hz	

0V 6

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

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R Regenerative variable speed drive

CONNECTIONS

8 AO1	Analog o	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 s	etting		No assignment	
Sampling	period		2 ms	
		Thermal	sensor input	
Voltage ra	ange		± 10 V	
Trip thres	hold		> 3.3 kΩ	
Reset threshold			< 1.8 kΩ	
	Digital input			
Туре			Digital input in positive logic	
Voltage range			0 to + 24 V	
Absolute maximum voltage range		ltage	0 V to + 35 V	
Thresholds			0:<5V 1:>13V	

100VAnalog circuit common 0 VThe 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	
+24 VDC		+24 VDC user output	
Output current		100 mA	
Accuracy		± 5%	
Protection		Current limiting and setting to tr mode	p

2	DO1	Digital ou	Digital output	
Factory setting			Zero speed	
Characteristic			Open collector	
Absolute maximum voltage		oltage	+ 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		oltage	+ 30 V
Thresholds			0:<5V 1:>13V
Response time			< 20 ms

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

(1)For the **POWERDRIVE MD2R** with software version 5.0 or 5.10, the DI5 input is setted to "RESET" button located on the front of the cabinet.

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
		rent	1 A - 250 VAC, inductive load
			2 A - 30 VDC, resistive load

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

Note: When the RL1 or RL2 relay is activated, the corresponding status LED on the control board lights up (see diagram in section 3.2.1).

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

CONNECTIONS

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	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	Reset		
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

3.2.3.1 - 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)

3.2.3.2 - 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 Al1+, Al1-
0	1	Current speed reference (4-20 mA) on analog input Al2+, Al2-
1	0	Preset reference 2
1	1	Spd.05 (01.22) to be set

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

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

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CONNECTIONS

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

The STO-1 and STO-2 inputs are safety inputs that can be used to disable the drive output so no torque at the motor shaft is provided.

They are independent of one another. They are created by simple hardware not connected to the microcontroller. They acts on two different stages of the IGBT output bridge control. To enable the drive, the STO-1 and STO-2 inputs must be connected to the +24V source.

The opening of, at minimum, one of the inputs locks the output bridge.

These 2 inputs can be used in conjunction to create a "Safe Torque Off" function with a logic combining 2 separate channels.

In this configuration, the "Safe Torque Off" function is guaranteed with a very high level of integrity in conformity with standards:

- EN 61800-5-2

- EN/ISO 13849-1: 2006; PLe

- IEC/EN 62061: 2005; SIL3

(CETIM approval no. CET0047520)

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

The STO-1 and STO-2 inputs are compatible with self-tested logic outputs in controllers such as PLCs, for which the test pulse lasts for 1 ms maximum.

If the data sent by the 2 inputs is not identical, this generates a drive trip. The RL1 relay opens and the drive indicates a "t.r./63" trip on the drive 2-digit display or "STO input inconsistency" trip on the parameter-setting interface.

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

• The STO-1/STO-2 inputs are safety components which must be incorporated in the complete system dedicated to machine safety. As for any installation, the complete machine must be subject to a risk analysis. The integrator must determine the safety category which the installation must comply with.

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

If braking needs to be a machine safety function, it must be provided by an electromechanical solution since the dynamic braking by the drive function is not considered as a secure disable function.

• The STO-1/STO-2 inputs do not provide the electrical isolation function. Prior to any work carry out on tre drive/installation, the power supply must therefore be switched of an approved isolating device (isolator, switch, etc).

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)

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

GENERAL EMC - HARMONICS - MAINS INTERFERENCE

4 - GENERAL EMC - HARMONICS -MAINS INTERFERENCE

The power structure of frequency inverters leads to the occurrence of two types of 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 be complied with according to the type of environment the drive is installed in. In some cases, it may be necessary to add an external RFI filter (see section 4.6).

4.4 - Mains supply

4.4.1 - General

Each industrial power supply has its own intrinsic characteristics (short-circuit capability, voltage value and fluctuation, phase imbalance, etc) and supplies equipment some of which can distort its voltage either permanently or temporarily (notches, voltage dips, overvoltage, etc). The quality of the mains supply has an impact on the performance and reliability of electronic equipments, especially variable speed drives.

The **POWERDRIVE 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.

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

GENERAL EMC - HARMONICS - MAINS INTERFERENCE

4.4.2 - Mains transient overvoltages

There are numerous sources of overvoltages on an electrical installation:

Connection/disconnection of banks of power factor correction capacitors

• High-power thyristor-controlled equipment (oven, DC drive, etc)

Results of lighning

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

Connecting power factor correction capacitors in parallel on the drive power supply line when the drive is running can generate transient overvoltages that are likely to trip the drive safety devices, or even damage it in extreme cases.

If banks of power factor correction capacitors are used on the power supply line, make sure that:

• The threshold between steps is low enough to avoid causing overvoltage on the line

The capacitors are not permanently connected

4.4.2.2 - Presence of commutation notches on the line

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

4.4.3 - Unbalanced power supply

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

Additional mains chokes can be installed upstream of a **POWERDRIVE MD2R** supplied by an unbalanced mains in order to reduce the current imbalance factor (see characteristics in section 5.4).

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.

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

GENERAL EMC - HARMONICS - MAINS INTERFERENCE

4.5 - Basic precautions for installation

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

4.5.1 - Wiring inside the cabinet

- Do not run the control cables and the power cables in the same cable ducts.

- For control cables, use shielded twisted cables.

4.5.2 - Wiring outside the cabinet

4.5.2.1 - Control wiring

If control cable should be running outside the cabinet, use 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.

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

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

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

- In the second industrial environment, the shielded motor power supply cable can be replaced by a 3-core + earth cable placed in a fully enclosed metal conduit (metal cable duct for example). This metal conduit must be mechanically connected to the electrical cabinet and the structure supporting the motor.

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

- There is no need to shield the power supply cables between the mains supply and the drive.

- Isolate the power cables from the control cables. The power cables must intersect the other cables at an angle of 90°.

- Isolate sensitive elements (probes, sensors, etc) from metal structures which may be shared by the motor support.

- The motor cables and network power cables should not routed side by side in the same channel to reduce proximity couplings

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GENERAL EMC - HARMONICS - MAINS INTERFERENCE

4.6 - Electromagnetic compatibility (EMC)

CAUTION:

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

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

Emission			
Standard	Description	Category	Conformity conditions
Standard			Standard
EN 61800-3	Variable speed drive standards	C3	Conforming - Cable length < 100 m - Switching frequency < 6 kHz

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

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).

Connection to the drive

• P1 connector

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

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

• P2 terminal block

This is a standard RS485/RS422 terminal block which is used to connect a parameter-setting interface (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 - Parameter setting

5.1.1 - MDX-Powerscreen

General

The POWERSCREEN interface is a touch screen which can be used to access various menus to setup and supervise the drive. 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
А	4.3" touch screen
В	Touch-sensitive button to access the main menu
С	"COM" LED, indicates the state of the communication with the drive. Off: no communication Flashing: communicating
D	"CPU" LED, indicates the status of the interface CPU
E	"PWR" LED, indicates the state of the interface power supply
F	Touch-sensitive buttons for language selection (can take a few minutes to load)

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R Regenerative variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

Architecture

From the welcome screen, press the button to access the main page of the parameter-setting interface, consisting of 5 touch-sensitive buttons:

- **Information**: Can be used to obtain information very quickly about the drive, the fieldbus option, the parameter-setting interface, and can also be used to select the language.

- **Read mode**: Is used to display the status of the drive when stopped or in operation, as well as its main measurement data points.

- **Parameter setting**: Used for reading and/or modification of all the drive parameters, as well as to set the date and time on the display.

- **Trip history**: Gives a quick overview of the last 10 drive trips.

- (): This button is accessible on all screens in factory-set configuration and is used to give a stop command (can be disabled).

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

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

5.1.2 - MDX-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.leroy-somer.com/

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

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PARAMETER-SETTING INTERFACE AND OPTIONS

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:

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

5.2.1 - Fieldbus modules

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

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

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

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

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

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

CAUTION:

Do not break the cut-out part.

A MDX-Fieldbus option can never take the MDX-**ENCODER terminal block.**

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

5.2.2 - Speed feedback option

5.2.2.1 - MDX-ENCODER

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

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

5.3.2.2 - General

Use a shielded cable for connection, and connect the shield over 360° using the grounding bracket (see section 5.2.4).

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

• Terminals 0 and 0\ are not used.

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

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

Connection terminal blocks

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

Α			
A \	Encoder channel connection		
В			
B\			
Maximum frequency	ו /	500 kHz	

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POWERDRIVE MD2R

Regenerative variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

Connection of an incremental encoder

MDX-ENCODER wiring

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

Wiring an encoder to a LEROY-SOMER asynchronous motor

12-pin connector encoder side (male plug)		MDX-Encoder terminals
Ref.	Description	Description
1	0V	-
2	+5V or +15V	+
3	А	A
4	В	В
5	0	Х
6	A١	A۱
7	B\	B/
8	0\	Х
9	х	X
10	x	X
11	Shielding	Bracket
12	х	Х

Connection of an incremental encoder with commutation channels

MDX-ENCODER wiring

-	Encoder power supply 0 V		
+	5 V or 15 V power supply depending on encoder characteristics. Set Mtr.12 (03.36)		
Α			
A \	Encoder channel connection		
В			
B\			
0	Netwood		
0\			
U			
U\			
V	Connection of commutation channels		
V١	Connection of commutation channels		
w			
W\			

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

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

12-pin connector		MDX-Encoder	
encoder side (male plug)		terminals	
Ref.	Description	Description	
1	х	Х	
2	х	х	
3	х	х	
4	U	U	
5	U\	U\	
6	V	V	
7	V	V	
8	W	W	
9	W	W١	
10	А	А	
11	0	х	
12	0/	х	
13	A١	A١	
14	В	В	
15	B\	B\	
16	+5V or +15V	+	
17	0V	-	
*	Shielding (*)	Bracket	

(*) to be connected to connector housing.

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R Regenerative variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

5.2.2.2 - MDX-RESOLVER

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

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

• General

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

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

Use a single twisted pair cable, shielded pairs with an outer shield for the connection.

Connect the shield over 360 ° at both ends (grounding bracket supplied with the option).

Connection terminal blocks

MDX-RESOLVER wiring

1	Resolver	LOW
2	excitation	HIGH
Characte	eristic	10 kHz sine wave signal
		Transformer ratio (03.58):
		4 : 1 = 5.2 Vrms
Rated vo	oltage	3 : 1 = 3.8 Vrms
	0	2 : 1 = 2.6 Vrms
		1 : 1 = 1.3 Vrms
Max. cui	rrent	80 mA (EXC HIGH)
3	х	
4	х	
5		Channel A output
6	Encoder	Channel /A output
7	simulation	Channel B output
8		Channel /B output
01		RS 485 differential voltage
Characte	eristic	(A and /A, B and /B)
9	х	
10	х	
11		SIN HIGH
12	Decelverinnute	SIN LOW
13	Resolver inputs	COS HIGH
14		COS LOW
Characteristic		2 Vrms sine wave signal (max)
Frequency		10 kHz
15	х	

5.2.3 - MDX-I/O TIMER option

• General:

- The MDX-I/O TIMER option is used to:
- Increase the number of drive inputs and outputs
- Access the drive configuration: WEB server function
- Back up and restore the drive parameter settings (via PC)
- Save parameters for a period of time (including an SD type memory card): Data logger function

Detail of the features :

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

Connection

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

5.2.4 - Option installation

5.2.4.1 - grounding bracket

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

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R Regenerative variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

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

Remove the black plastic protective cover from the drive control board (connector protection) (1).

Align the option over the drive connector (2). The option connector is located on the underside of the housing. Press gently until it clicks into place.

Screw the option onto the control board of the motor inverter with the supplied screws (3). Do not exceed a maximum tightening torque of 2 N.m.

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

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

In this case, 2 devices are needed:

MDX-RESOLVER

CM Fieldbus module

CM-MODBUS, CM-CAN-OPEN or **CM-PROFIBUS** or

CM-ETHERNET or **CM-ETHERNET-IP**

On the MDX-Speed feedback option: remove the plastic knock-out (4)

Insert the back of the CM-Fieldbus housing into the space freed up (5) and screw tight (6) (2x Torx 8 screws)

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

Install the MDX-Speed feedback with the fieldbus module on the POWERDRIVE MD2R, as shown in section 5.2.4.2.

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R Regenerative variable speed drive

PARAMETER-SETTING INTERFACE AND OPTIONS

5.2.4.4 - MDX-I/O TIMER option

The MDX-I/O Timer option is installed on the control board of the **POWERDRIVE MD2R'** motor inverter; if a MDX-Speed feedback and/or MDX-Fieldbus option needs to be added, it should be installed on the MDX-I/O TIMER option.

To install the module, follow the instructions below:

1 - Remove the black plastic protective cover from the drive control board (connector protection).

2 - Screw the four spacers supplied with the option onto the control block (tightening torque 2 N.m).

3 - Align the optional module over the drive control board connector (the optional module connector is located on the underside of the housing) then press gently until it is fully in place.

4 - Screw the module onto the control board with the four screws supplied, using a maximum tightening torque of 2N.m.
5 - If you wish, an additional optional module can be added (e.g. MDX-ENCODER). Remove the black plastic protective cover on the MDX-I/O TIMER, undo the screws inserted in step 4. Align the additional optional module over the MDX-I/O TIMER board connector (the additional module

connector is located on the underside of the housing) then press gently until it is fully in place.

Then screw the module back onto the MDX-I/O TIMER board using the four screws removed

previously (2 N.m).

6- To remove modules, follow the same procedure in reverse.

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PARAMETER-SETTING INTERFACE AND OPTIONS

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 POWERDRIVE MD2R, in а are detailed on the LEROY-SOMER configurator: http://configurateurls.leroy-somer.com

5.3.1 - Load break switch

The **POWERDRIVE MD2R** can be installed with a three pole swicth. This option allows isolating the drive from the mains during maintenance operations.

• Fully visualised breaking with panel mounting lockable handle (manually operated, padlock not provided)

Conformity to standards IEC/EN 60947 3

The QS3P switch is necessarily associated with semiconductor aR fuses in compliance with table § 3.1.5.

Characteristics at 40 ° C in category AC21

 I_{th} = Thermal current

	Switch			
POWERDRIVEMD2R rating	Reference	l _{th} @ 400V (A)	l _{th} @ 690V (A)	Number of operations
150T to 150T	QS3P_250A	250	250	10 000
180T & 220T	0828 4004	400	400	F 000
270TH & 340TH	Q35F_400A	400	400	5 000
270T & 340T	0820 6204	630	630	5 000
400TH to 600TH	Q33F_030A			
400T	0630 8004	000	000	2 000
750TH	Q33F_000A	000	000	3 000
470T to 600T	QS3P_1000A	1000	800	3 000
750T	082D 1250A	1250	1000	4 000
900TH	Q33F_1250A	1250	1000	4 000
900T	QS3P_1600A	1600	1000	4 000
1100T	QS3P_1800A	1800	1000	4 000
1400T	Consult Loroy Sama		r	
1200TH to 1500TH				

5.3.2 - Fuse combination switch

The **POWERDRIVE MD2R** can be installed with a 3 poles gG fuses combination switch in compliance with Table 3.1.5.

This option allows ensuring the protection of the drive when this one is connected to a secure line that is not dedicated to him.

Overcurrent protection

Switching capacity > 100kA

• Fuses fusion contacts integrated in the safety chain locking (STO-1/STO-2)

• Double breakdown by phase (upstream and downstream the fuse).

• Fully visualised breaking with panel mounting lockable handle (manually operated, padlock not provided)

Compliance with standards IEC/EN 60947 3

A fuse combinaison switch is larger than a switch. The size of a **POWERDRIVE MD2R** equipped with this option will be generally wider (Contact Leroy-Somer.).

The switch may be associated with semiconductor aR fuses in accordance with table § 3.1.5 to effectively protect the **POWERDRIVE MD2R** against short-circuit.

5.3.3 - Circuit Breaker

A 3 poles braker is available for **POWERDRIVE MD2R**. This option will protect the drive when this one is connected to a secure line that is not dedicated to him.

Overcurrent protection

• Fully visualised breaking with panel mounting lockable handle (manually operated, padlock not provided)

- Compliance with standards IEC/EN 60947 3
- Electric actuator

The 3 poles circuit breaker can be associated with semiconductor aR fuses in accordance with table § 3.1.5 to efficiently protect the **POWERDRIVE MD2R** against short-circuit.

5.3.4 - Emergency stop

MD-AU 1 : SIL1 / PLb protection

MD-AU 1 protection included wired emergency stop on the STO inputs (in accordance with § 3.3.1) and mounted on the front door.

• SIL3 / PLe protection

POWERDRIVE MD2R is SIL3 / PLe compliant by incorporating a safety relay for double locking channel. Contact Leroy-Somer.

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POWERDRIVE MD2R

Regenerative variable speed drive

TRIPS - DIAGNOSTICS

6 - TRIPS - DIAGNOSTICS

6.1 - Safety notice

The user must not attempt to repair the drive himself, nor perform diagnostics other than those listed in this section. If the drive malfunctions, it should be returned to LEROY-SOMER via your usual contact.

6.2 - Alarms

Alarms may appear during drive operation.

These alarms are for information only, in order to warn the user: the drive continues to operate but may trigger a safetrip if no corrective action is taken.

On the drive control board, 2 LED displays indicate alternately "A.L." and a number that can be used to identify the alarm by means of the table below (this number corresponds to the value of parameter **10.97**).

Code	No.	Meaning	
	1 to 4	User alarm 1 (10.54) to User alarm 4 (10.54)	
	6	Motor overload (10.17)	
A.L.	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

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. POWERDRIVE MD2 only: 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.	

INSTALLATION AND MAINTENANCE

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Regenerative variable speed drive

TRIPS - DIAGNOSTICS

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 MD-TF option used. 	
		This trip cannot	be reset for a period of 10 seconds.	
5	IIMBALANCED	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		 Check the encoder wiring. Check the encoder connections. 	
15	TUNE V Encod	During the autotune phase, one of the encoder U, V or W commutation channels		
16	TUNE W Encod	is not present	• Change the encoder.	
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. 	

INSTALLATION AND MAINTENANCE

POWERDRIVE MD2R

Regenerative variable speed drive

TRIPS - DIAGNOSTICS

No.	Parameter- setting interface name	Reason for trip	Solution	
24	Motor PTC	Opening of the PTC input of the PX1 terminal block or T1 and T2 inputs of the MDX-ENCODER option	 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	Al2 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	oncor the input wining and source.	
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		
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	• See 10 38	
48	User 8	User trip 8 triggered by the serial link 10.38 = 48		
49	User 9	User trip 9 triggered by the serial link 10.38 = 49		
50	User 10	User trip 10 triggered by the serial link 10.38 = 50		

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TRIPS - DIAGNOSTICS

No.	Parameter- setting interface name	Reason for trip	Solution	
51	DO2 MDX-I/O TIMER over Id	The DO2 output load current (MDX-I/O TIMER option) is >200 mA	Check that DO2 is not short-circuited.	
52	DO3 MDX-I/O TIMER over Id	The DO3 output load current (MDX-I/O TIMER option) is >200 mA	Check that DO3 is not short-circuited.	
53	MDX-I/O TIMER link	Communication problem between the drive and the MDX-I/O TIMER option	Check the MDX-I/O TIMER option mounting.	
54	Internal serial link	Communication problem between the drives	Check the setting of 11.66 .	
55	Unstable DC bus	The drive DC bus oscillates significantly	Check the balancing of the mains phases.Check that all 3 mains phases are present.	
56	IGBT V	Internal protection of phase V IGBTs		
57	IGBT W	Internal protection of phase W IGBTs	 Check the motor and cable insulation. Run power diagnostics. 	
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. 	
59	IGBT W overheating	Overheating of phase W IGBTs	 If the trip appears at frequencies lower than 10 Hz, che that the current levels depending on the frequency have be complied with. Check that the switching frequency 05.18 is compati with the motor current level. 	
60	Diagnostic	Problem detected during the control and interface boards test, the power test or during the self-test	 d • 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	³ 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 TIMER over Id	The 24 V load current is too high	Check the MDX-I/O TIMER option I/O wiring.	
70	4 mA loss on MDX-IO TIMER Al4	Loss of the current reference on analog input AI4 of the MDX-I/O TIMER option	Check the input wiring and source of the MDX-I/O TIMER	
71	4 mA loss on MDX-IO TIMER AI5	Loss of the current reference on analog input AI5 of the MDX-I/O TIMER option		
101	AC mains loss	Loss of AC supply	 Check the input fuses Check the quality of the power supply (voltage dips) 	
102	Rectifier	Not used		

POWERDRIVE MD2R

Regenerative variable speed drive

MAINTENANCE

7 - MAINTENANCE

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

• When a trip detected by the drive causes the motor to stop, fatal residual voltages remain on the terminals and in the drive.

• The drive stop function does not protect against high voltages on the terminal blocks.

• Before carrying out any work on the drive or the motor, disconnect and padlock the isolating switch in the switchboard.

• The mains switchgear 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
Doorfiltoro	Clean	3 months
Door millers	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 - simply ask your usual LEROY-SOMER contact.

7.2 - Replacing products

CAUTION:

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

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7.3 - List of spare parts

Input protection board (See § 3.1.1)

Board reference:

"T" rating: PEF28ANE000A "TH" rating: PEF280NL000A

• Protection fuses for the forced ventilation units :

Fuse	Size	Туре	Value	LS code
F2				
F3				
F4	5 x 20	SA	1.25A/250V	PEL001FA004
F5				
F6				

• Protection fuses for the control electronics (all ratings):

Fuse	Size	Туре	Value	LS code
F1	5 x 20	64	1.254/2501/	
F9	5 x 20	- SA	1.25A/250V	FELUUIFAUU4

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

• Protection fuses for the transformer primary :

Rating	Fuse	Size	Туре	Value	LS code
т	F7	10 x 20		44/5001/	
	F8	10 x 30	awi/ATQ	4AV500V	PEL004FA000
T 11	F7	10 × 20	aM	4A/690V	PEL004FA005
IH	F8	10 x 38			

· Motor output bar fuse

Board reference:

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

Rating	Fuse	Size	Туре	Value	LS code
Т	F1 - F2 - F3	6 x 32	U _R	2 A/660 V	PEL002FU004
TH		6 x 32	U _R	4A/690V	PEL004FU003

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

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

Control protection fuses (key FG, FJ, FK § 1.5)

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

• Surge suppressors (key FD, FE, FF, FI § 1.5)

Surge suppressors		Rating	Value	LS code
		Т	15kV 8/20µs / 500V	PEL500EC001
	ΓΕ, ΓΓ	TH	/ 690V	PEL690EC003
Fuse	Rating	Size	Value	LS code

ruse	Rating	Size	value	LS code
ELv2	Т	22 x 58	gF - 125A / 500V	PEL125FG001
FI X3	TH	22 x 58	Ur - 100A/ V	PEL100FU000

Charging resistor protection fuses (key FR § 1.5)

Ratings 180T to 270T only

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

INSTALLATION AND MAINTENANCE

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7.4 - Location of the POWERDRIVE MD2R components, integrated in the POWERDRIVE cabinet : • Ratings 340T to 470T and 270TH to

Ratings 60T à 150T (1 rectifier & inverter module)

Ratings 180T to 270T (1 MD2Cl rectifier module and 1 MD2Cl inverter module)

• Ratings 340T to 470T and 270TH to 500TH (1 MD2CI rectifier et 1 MD2CI inverter module)

Ratings 600T to 900T and 600TH to 900TH (2 MD2CI rectifier modules et 2 MD2CI inverter modules) Ratings 1100T & 1400T et 1200TH & 1500TH (3 MD2CI rectifier modules et 3 MD2CI inverter modules)

Les éléments 3, 4, 5, 10, 11 et 12 sont intégrés dans l'armoire et sont indépendants du châssis MD2CI.

Ref.	Description			
1	Active Rectifier unit			
2	Motor Inverter unit			
3	Motor inverter Control block			
4	Distribution board			
5	Customisation board			
6	DC bus measurement board			
7	Assembled ventilated frame			
8	Forced ventilation unit			
9	Mounting foot			
10	Motor inverter Control block			
11	Transformer			
12	Input protection board			

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

	Sinus filter fuses				Active rectifier fuses	
Ratings	FH x3 FHA x3	FO x3 FHB x3	FP x3 FPA x3	FPB x3	FA, FB, FC FAA, FAB, FAC	FQ, FR, FS FBA, FBB, FBC
60T						
75T	PEL063FG000				PEL250FU005	
100T		-	-	-		
120T						
150T					PEL450FU000	
180T	PEL080FG000		_	-	PEL500FU001	_
220T	PEL100FG000	-			PEL630FU004	
270T	PEL100FG000				PEL800FU003	
340T	PEL063FG000	PEL063FG000			PEL999FU000	
400T	PEL080FG000	PEL080FG000	-		PEL999FU015	
470T	PEL100FG000	PEL100FG000		-	PEL999FU006	
600T	PEL080FG000	PEL080FG000	PEL080FG000		PEL999FU005	PEL999FU005
750T	PEL080FG000	PEL080FG000	PEL080FG000	PEL080FG000	PEL999FU000	PEL999FU000
900T	PEL100FG000	PEL100FG000	PEL100FG000	PEL100FG000	PEL999FU015	PEL999FU015
1100T			Consult Le	roy-Somer		
1400T	Consult Leroy-Somer					
270TH	PEL050FG000	PEL050FG000	-		PEL450FU000	
340TH	Consult Leroy-Somer				PEL630FU000	
400TH	PEL050FG000	PEL050FG000	PEL050FG000	-	PEL700FU002	_
500TH	Consult Leroy-Somer					
600TH	PEL050FG000	PEL050FG000	PEL050FG000	PEL050FG000	PEL500FU001	PEL500FU001
750TH						
900TH	Consult Loray Samar					
1200TH	Consult Leroy-Somer					
1500TH						

Sinus filter fuses characteristics :

LS code	Size	Туре	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	Т33	630A/690V
PEL700FU002	Т33	700A/660V
PEL800FU003	Т33	800A/690V
PEL999FU000	Т33	1000A/690V
PEL999FU005	T33	1600A/660V
PEL999FU006	T33	1400A / 660V
PEL999FU015	T33	1100A/690V

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

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