



## *Installation guide*

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# ***Powerdrive MD2MS***

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*60T to 270T*

High power wall mount variable speed  
drive solution

Reference : 5114en-2023.07 / e

**LEROY-SOMER<sup>TM</sup>**

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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.

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

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**This manual only describes the general features, characteristics and installation of the Powerdrive MD2MS. For commissioning, refer to manual ref. 4617.**

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

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

### 1 - General

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

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

For further information, consult the documentation.

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

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

### 2 - Use

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

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

Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2014/30/EC) are met.

The variable speed drives meet the requirements of the Low Voltage Directive 22014/35/EU. The harmonised standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

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

### 3 - Transportation, storage

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

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

### 4 - Installation

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

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

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

### 5 - Electrical connection

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

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

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

### 6 - Operation

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

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

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

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

### 7 - Servicing and maintenance

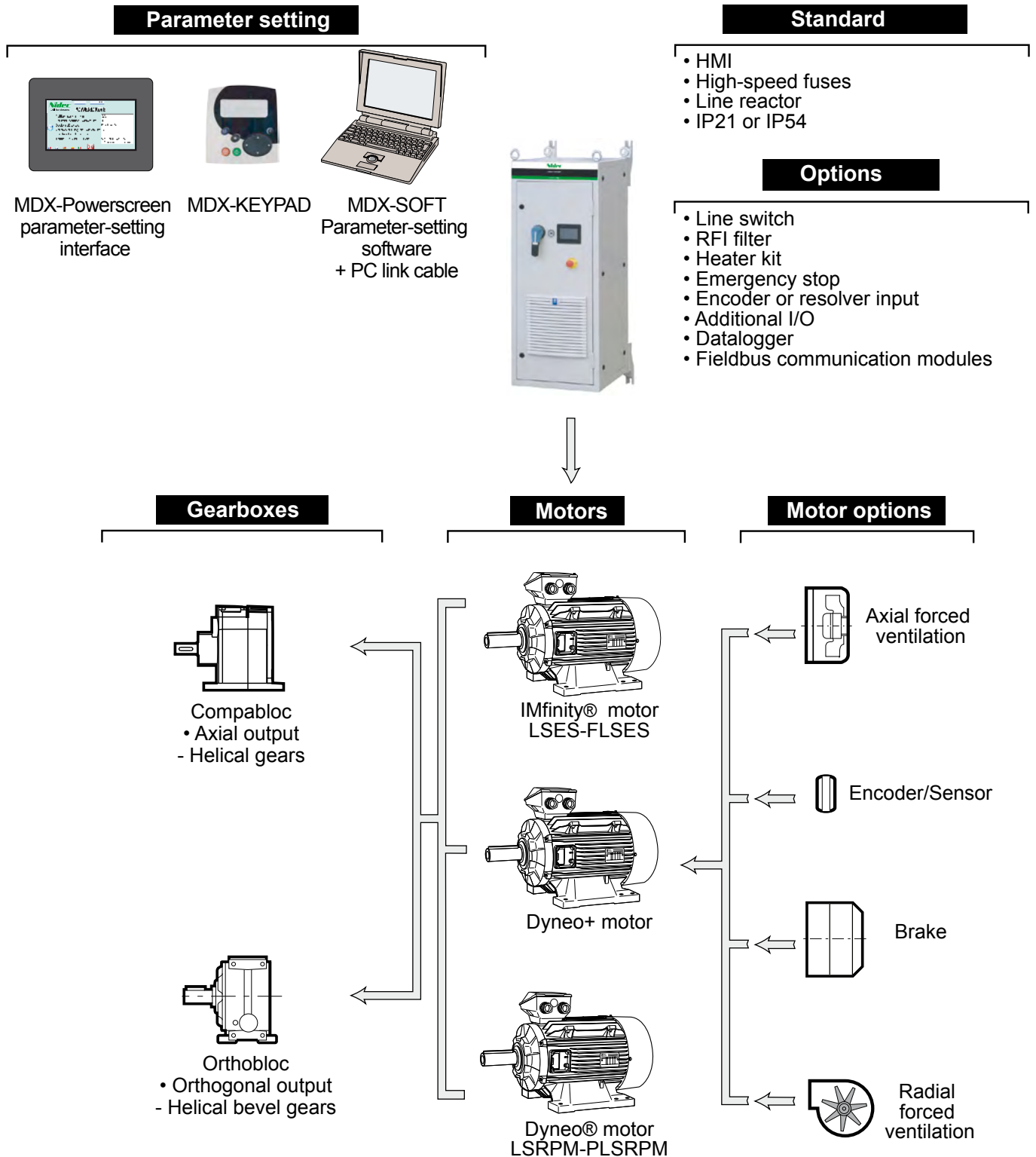
Refer to the manufacturer's documentation.

See the Maintenance section in this document.

**This manual is to be given to the end user.**

This manual describes the installation of Powerdrive MD2MS variable speed drives. It also gives details of all its options and extensions which the user may choose to suit his requirements.

## Powerdrive MD2MS





|   |           |
|---|-----------|
| <b>1 - GENERAL INFORMATION .....</b>  | <b>7</b>  |
| 1.1 - General.....  | 7         |
| 1.2 - Product designation .....   | 7         |
| 1.3 - Environmental characteristics.....                                    | 7         |
| 1.4 - Electrical characteristics .....                                      | 8         |
| 1.4.1 - General characteristics.....  | 8         |
| 1.4.2 - Electrical characteristics.....                                     | 8         |
| 1.4.3 - Derating at low frequency.....                                      | 8         |
| 1.4.4 - Standard equipments .....   | 8         |
| 1.4.5 - Derating according to the temperature and switching frequency ..... | 9         |
| <b>2 - MECHANICAL INSTALLATION .....</b>                                    | <b>10</b> |
| 2.1 - Checks upon receipt .....   | 10        |
| 2.2 - Handling .....  | 10        |
| 2.3 - Installation recommendations .....                                    | 10        |
| 2.4 - Drive losses .....  | 10        |
| 2.5 - Drive ventilation flow rates and noise levels .....                   | 10        |
| 2.6 - Dimensions and weight.....  | 11        |
| 2.6.1 - Drive ratings 60T to 150T .....                                     | 11        |
| 2.6.2 - Drive ratings 180T to 270T .....                                    | 12        |
| <b>3 - CONNECTIONS .....</b>  | <b>13</b> |
| 3.1 - Power connections .....   | 13        |
| 3.1.1 - Cables input .....  | 13        |
| 3.1.2 - Characteristics of connection terminals .....                       | 13        |
| 3.1.3 - Electronics and forced ventilation power supply .....               | 13        |
| 3.1.4 - Location of power terminal blocks.....                              | 14        |
| 3.1.5 - Cables and fuses.....   | 16        |
| 3.2 - Control terminal block location .....                                 | 18        |
| 3.2.1 - Control terminal block characteristics.....                         | 18        |
| 3.2.2 - Factory configuration of control terminal blocks.....               | 20        |
| 3.3 - STO-1/STO-2 inputs: Safe Torque Off function .....                    | 21        |
| 3.3.1 - Single channel locking (SIL1 - PLb).....                            | 21        |
| 3.3.2 - Double channel locking (SIL3 - PLe).....                            | 21        |
| <b>4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE .....</b>               | <b>22</b> |
| 4.1 - Low-frequency harmonics.....  | 22        |
| 4.2 - Radio-frequency interference: Immunity .....                          | 22        |
| 4.2.1 - General .....   | 22        |
| 4.2.2 - Standards.....  | 22        |
| 4.2.3 - Recommendations .....   | 22        |
| 4.3 - Radio-frequency interference: Emission .....                          | 22        |
| 4.3.1 - General .....   | 22        |
| 4.3.2 - Standards.....  | 22        |
| 4.4 - Mains supply .....  | 23        |
| 4.4.1 - General .....   | 23        |
| 4.4.2 - Mains transient overvoltages.....                                   | 23        |
| 4.4.3 - Unbalanced power supply .....                                       | 23        |
| 4.4.4 - Ground connections .....  | 23        |
| 4.5 - Basic precautions for installation .....                              | 24        |
| 4.5.1 - Wiring inside the cabinet product.....                              | 24        |
| 4.5.2 - Wiring outside the cabinet product.....                             | 24        |
| 4.6 - Electromagnetic compatibility (EMC).....                              | 25        |


|   |           |
|---|-----------|
| <b>5 - PARAMETER-SETTING INTERFACE AND OPTIONS.....</b> | <b>26</b> |
| 5.1 - Drive setting interfaces .....                    | 26        |
| 5.1.1 - MDX-KEYPAD.....                                 | 26        |
| 5.1.2 - MDX-Powerscreen .....                           | 27        |
| 5.1.3 - MDX-SOFT .....                                  | 27        |
| 5.1.4 - Special settings .....                          | 27        |
| 5.2 - Add-on options.....                               | 28        |
| 5.2.1 - Fieldbus modules .....                          | 28        |
| 5.2.2 - Speed feedback options .....                    | 28        |
| 5.2.3 - Additionnal I/O options .....                   | 28        |
| 5.3 - Electrical protections.....                       | 29        |
| 5.3.1 - Line switch.....                                | 29        |
| 5.3.2 - Emergency stop .....                            | 29        |
| 5.4 - Heater kit .....                                  | 29        |
| 5.5 - RFI filters .....                                 | 29        |
| 5.6 - MD2MBASE support.....                             | 29        |
| <b>6 - TRIPS - DIAGNOSTICS .....</b>                    | <b>30</b> |
| 6.1 - Safety notice .....                               | 30        |
| 6.2 - Alarms .....                                      | 30        |
| 6.3 - Tripping on a safetrip.....                       | 30        |
| <b>7 - MAINTENANCE .....</b>                            | <b>34</b> |
| 7.1 - Storage .....                                     | 34        |
| 7.2 - Replacing products .....                          | 34        |
| 7.3 - List of spare parts.....                          | 35        |
| 7.3.1 - First emergency kit .....                       | 35        |
| 7.3.2 - Electronic PCB .....                            | 35        |
| 7.3.3 - Front panel mounted parts.....                  | 35        |
| 7.3.4 - Remote control fuses.....                       | 36        |
| 7.3.5 - Power input high speed fuses (Key 20):.....     | 36        |
| 7.3.6 - Power modules.....                              | 36        |
| 7.3.7 - Other parts .....                               | 36        |

# 1 - GENERAL INFORMATION

## 1.1 - General

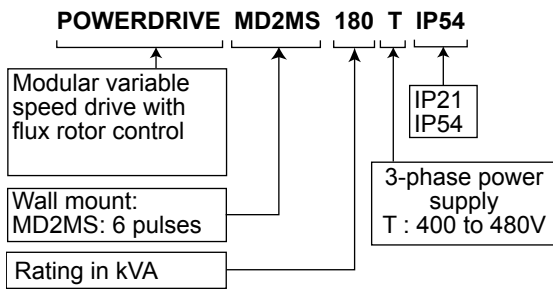
The **Powerdrive MD2MS** is a variable speed drive with very high performance levels that can be used to control:

- Induction motors without speed sensor (open loop mode select  for applications that do not need rated torque above 1/10<sup>th</sup> of the rated speed.
- Induction or synchronous permanent magnet motors with virtual speed feedback (flux vector mode with software sensor function  for applications that require rated torque from 1/20<sup>th</sup> of the rated speed.




Combined with the MDX-ENCODER option, the **Powerdrive MD2MS** is a drive that can also be used to control induction or synchronous permanent magnet machines for applications that require very high dynamic performances, rated torque from zero speed or high speed accuracy (closed loop vector mode with speed feedback ).

**MD2MS IP21** enclosure version is designed for installations without cabinet, in electrical room. The **MD2MS IP54** enclosure version enables installation directly close to the machine in harsh environments.

## 1.2 - Product designation



### Nameplate

|   |  |   |         |      |
|---|--|---|---------|------|
| <br>MADE IN FRANCE | <b>ENTREE - INPUT</b>                    |   |         |      |
|   | Ph                                       | V (V)   | Hz (Hz) | I(A) |
|   | 3  | 400-480   | 50/60   | 295  |
|                    | TYPE : <b>Powerdrive MD2MS 180T IP54</b> |   |         |      |
|   | S/N :                                    | <br>0999999999 |         |      |

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

The nameplate can be found at the top on the right-hand side.

## 1.3 - Environmental characteristics

| Characteristic   | Level  |
|--|--|
| <b>Protection</b>  | IP21 or IP 54  |
| <b>Storage and transport temperature</b>                   | -30°C to +60°C (see section 7.17.1)  |
| <b>Ambient operating temperature (outside the cabinet)</b> | -10°C to +40°C, up to +50°C with derating (see section 1.4.5)  |
| <b>Classification of environmental conditions</b>          | In accordance with IEC 60721-3-3: <ul style="list-style-type: none"> <li>• Biological classification in accordance with class 3B1</li> <li>• Classification as regards chemically active substances in acc. with class 3C2</li> <li>• Classification as regards mechanically active substances in acc. with class 3S2</li> </ul>   |
| <b>Relative humidity</b>                                   | In accordance with IEC 60068-2-56<br>< 90% non condensing  |
| <b>Altitude</b>  | ≤ 1000 m without derating<br>> 1000 m up to 4000 m maximum (as required): <ul style="list-style-type: none"> <li>• Current derating of 1% per additional 100 m<br/><i>E.g. for 1300 m, derate the I<sub>co</sub> and I<sub>max</sub> currents by 3%</i></li> <li>• Operating temperature derating of 0.6°C per 100 m<br/><i>E.g. for 1300 m, the electrical characteristics are maintained for an ambient temperature of [40° - (3 x 0.6°)] = 38.2°C.</i></li> </ul> |
| <b>Vibrations</b>  | In accordance with IEC 60068-2-6 <ul style="list-style-type: none"> <li>• Exposed product: 2 m/s<sup>2</sup> (9-200 Hz), 0.6 mm (2-9 Hz)</li> <li>• Packaged product: 10m/s<sup>2</sup> (9-200 Hz), 3 mm (2-9 Hz)</li> </ul>   |
| <b>Shocks</b>  | Packaged product: in accordance with IEC 60068-2-29  |
| <b>Atmospheric pressure</b>                                | 700 to 1060 hPa  |

## 1.4 - Electrical characteristics

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

### 1.4.1 - General characteristics

| Characteristic                               | Level  |
|--|--|
| Power supply voltage                         | 3-phase mains supply: 400 V -10% to 480 V +10% |
| Phase voltage imbalance                      | < 2%   |
| Input frequency                              | 5% around the rated frequency (50 or 60 Hz)    |
| Maximum number of power-ups per hour (power) | 20   |
| Output frequency range                       | 0 to 590 Hz                                    |
| ROHS conformance                             | Conforming to standard 2002-95-EC              |

**⚠** For an operation with IT (ungrounded), please follow instructions on §4.4.3

### 1.4.2 - Electrical characteristics

**I<sub>co</sub>**: Continuous output current.

**P<sub>out</sub>**: Output power.

**I<sub>max</sub> (60s)**: Maximum output current, available for 60 seconds every 600 seconds.

**Heavy duty**: For heavy-duty constant torque machines (presses, grinders, hoisting, etc) and all applications where significant inertia has to be accelerated quickly (centrifuges, translation of travelling cranes, etc).

**Normal duty**: For normal-duty constant torque or centrifugal torque machines (fans, compressors, etc).

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

#### 400 V 3-phase mains supply

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

| Calibre | Surcharge maximum                |                                  |                     | Surcharge réduite                |                                  |                     | I <sub>max</sub> (60s) (A) |
|---------|----------------------------------|----------------------------------|---------------------|----------------------------------|----------------------------------|---------------------|----------------------------|
|         | P <sub>mot</sub> à 400V (kW) (1) | P <sub>mot</sub> à 460V (HP) (1) | I <sub>sp</sub> (A) | P <sub>mot</sub> à 400V (kW) (1) | P <sub>mot</sub> à 460V (HP) (1) | I <sub>sp</sub> (A) |                            |
| 60T     | 45                               | 60                               | 92                  | 55                               | 75                               | 112                 | 130                        |
| 75T     | 55                               | 75                               | 118                 | 75                               | 100                              | 142                 | 165                        |
| 100T    | 75                               | 100                              | 142                 | 90                               | 125                              | 175                 | 200                        |
| 120T    | 90                               | 125                              | 170                 | 110                              | 150                              | 212                 | 240                        |
| 150T    | 110                              | 150                              | 220                 | 132                              | 175                              | 250                 | 312                        |
| 180T    | 132                              | 175                              | 260                 | 160                              | 200                              | 315                 | 365                        |
| 220T    | 160                              | 200                              | 310                 | 200                              | 300                              | 400                 | 435                        |
| 270T    | 200                              | 300                              | 375                 | 250                              | 350                              | 470                 | 530                        |

(1) Motor winding voltage

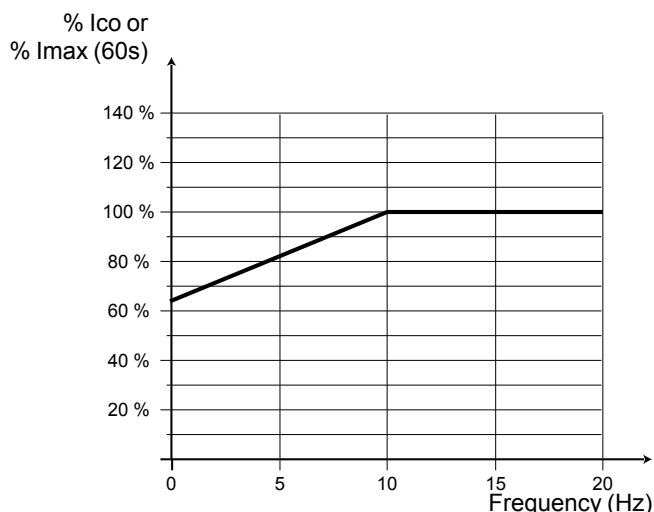
### 1.4.3 - Derating at low frequency

Measuring the temperature of the power modules in conjunction with thermal modelling of the IGBTs protects the **Powerdrive MD2MS** against overheating.

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

### 1.4.4 - Standard equipments

**Powerdrive MD2MS** is equipped as standard with a line reactor, a surge protection and high speed fuses.





### 1.4.5 - Derating according to the temperature and switching frequency

Ambient temperature  $\leq 40^{\circ}\text{C}$  - altitude  $\leq 1000$  m.

| Rating                        | Ico (A)    |       |       |       |       |             |       |       |       |       |
|-------------------------------|------------|-------|-------|-------|-------|-------------|-------|-------|-------|-------|
|                               | Heavy duty |       |       |       |       | Normal duty |       |       |       |       |
|                               | 2 kHz      | 3 kHz | 4 kHz | 5 kHz | 6 kHz | 2 kHz       | 3 kHz | 4 kHz | 5 kHz | 6 kHz |
| <b>400 V mains supply</b>     |            |       |       |       |       |             |       |       |       |       |
| 60T                           | 92         | 92    | 92    | 92    | 88    | 112         | 112   | 112   | 108   | 100   |
| 75T                           | 118        | 118   | 118   | 106   | 96    | 142         | 142   | 133   | 120   | 109   |
| 100T                          | 142        | 142   | 142   | 130   | 118   | 175         | 175   | 162   | 148   | 134   |
| 120T                          | 170        | 170   | 165   | 150   | 135   | 220         | 212   | 188   | 170   | 154   |
| 150T                          | 220        | 220   | 195   | 175   | 160   | 260         | 250   | 224   | 200   | 182   |
| 180T                          | 260        | 260   | 260   | 260   | 250   | 315         | 315   | 310   | 305   | 285   |
| 220T                          | 310        | 310   | 310   | 310   | 285   | 400         | 400   | 385   | 355   | 325   |
| 270T                          | 375        | 375   | 375   | 350   | 320   | 470         | 470   | 440   | 400   | 365   |
| <b>460/480 V mains supply</b> |            |       |       |       |       |             |       |       |       |       |
| 60T                           | 92         | 92    | 92    | 90    | 82    | 112         | 112   | 112   | 102   | 93    |
| 75T                           | 118        | 118   | 110   | 100   | 90    | 142         | 142   | 125   | 112   | 102   |
| 100T                          | 142        | 142   | 136   | 122   | 112   | 175         | 172   | 154   | 138   | 126   |
| 120T                          | 170        | 170   | 155   | 140   | 125   | 215         | 200   | 176   | 158   | 144   |
| 150T                          | 220        | 210   | 185   | 160   | 145   | 255         | 238   | 210   | 186   | 168   |
| 180T                          | 260        | 260   | 260   | 260   | 230   | 315         | 310   | 305   | 295   | 265   |
| 220T                          | 310        | 310   | 310   | 295   | 265   | 400         | 395   | 370   | 335   | 300   |
| 270T                          | 375        | 375   | 370   | 330   | 295   | 470         | 465   | 420   | 375   | 335   |

Ambient temperature  $\leq 50^{\circ}\text{C}$  - altitude  $\leq 1000$  m.

| Rating                        | Ico (A)    |       |       |       |       |             |       |       |       |       |
|-------------------------------|------------|-------|-------|-------|-------|-------------|-------|-------|-------|-------|
|                               | Heavy duty |       |       |       |       | Normal duty |       |       |       |       |
|                               | 2 kHz      | 3 kHz | 4 kHz | 5 kHz | 6 kHz | 2 kHz       | 3 kHz | 4 kHz | 5 kHz | 6 kHz |
| <b>400 V mains supply</b>     |            |       |       |       |       |             |       |       |       |       |
| 60T                           | 90         | 90    | 90    | 85    | 80    | 112         | 112   | 109   | 100   | 92    |
| 75T                           | 115        | 115   | 105   | 95    | 85    | 142         | 135   | 123   | 111   | 100   |
| 100T                          | 140        | 140   | 130   | 120   | 110   | 175         | 168   | 150   | 136   | 124   |
| 120T                          | 170        | 170   | 150   | 135   | 125   | 215         | 192   | 172   | 156   | 142   |
| 150T                          | 220        | 205   | 180   | 160   | 145   | 255         | 232   | 206   | 184   | 166   |
| 180T                          | 260        | 260   | 260   | 255   | 230   | 315         | 315   | 305   | 290   | 260   |
| 220T                          | 310        | 310   | 310   | 285   | 260   | 400         | 390   | 360   | 325   | 295   |
| 270T                          | 375        | 375   | 360   | 320   | 290   | 470         | 450   | 410   | 365   | 330   |
| <b>460/480 V mains supply</b> |            |       |       |       |       |             |       |       |       |       |
| 60T                           | 90         | 90    | 90    | 80    | 75    | 112         | 112   | 103   | 94    | 86    |
| 75T                           | 115        | 115   | 100   | 90    | 80    | 142         | 130   | 115   | 103   | 93    |
| 100T                          | 140        | 140   | 125   | 110   | 100   | 175         | 160   | 142   | 126   | 114   |
| 120T                          | 170        | 160   | 140   | 125   | 115   | 210         | 184   | 162   | 146   | 130   |
| 150T                          | 220        | 190   | 170   | 150   | 135   | 254         | 220   | 192   | 172   | 154   |
| 180T                          | 260        | 260   | 260   | 235   | 215   | 315         | 305   | 295   | 270   | 245   |
| 220T                          | 310        | 310   | 300   | 265   | 235   | 400         | 385   | 340   | 305   | 270   |
| 270T                          | 375        | 375   | 340   | 300   | 265   | 470         | 435   | 385   | 340   | 305   |

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

## 2 - MECHANICAL INSTALLATION

**!** • It is the responsibility of the owner or user of the **Powerdrive MD2MS** 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 MD2MS** drives must be installed in an environment free from conducting dust, corrosive fumes, gases and fluids, and condensation (class 2 according to IEC 664.1). The drive must not be installed in hazardous areas unless it is in an appropriate enclosure. In this case, the installation must be approved.

- In atmospheres where condensation may form, use the heater option (to be switched off when the drive is operating). It is advisable to control the heating system automatically.

- Prevent access by unauthorised personnel.

- **Powerdrive MD2MS** can be mounted on a wall or a metal structure. Ensure that the selected support for the installation and fixation mode are suitable with the mass of **Powerdrive MD2MS**.

### 2.1 - Checks upon receipt

Before installing the **Powerdrive MD2MS**, check that:

- The drive has not been damaged during transport
- The information on the nameplate is compatible with the power supply

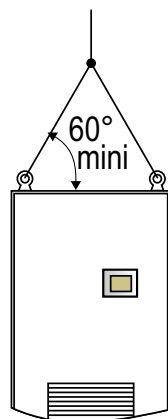
### 2.2 - Handling

**!** • The centre of gravity may be high up and / or 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 **POWERDRIVE MD2MS** has 2 lifting rings at the top and bottom of the chassis. For how to handle the drive, follow the instructions below.

- 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.



### 2.3 - Installation recommendations

Ensure that hot air is not being recycled via the air inlets by leaving sufficient free space below (400mm) or on each side (150mm) of the **Powerdrive MD2MS** or providing a means of evacuating the hot air exhausted by the product. If necessary, add a suction duct. 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 bottom of the cabinet and fill any gaps with expanding foam.

### 2.4 - Drive losses

Losses according to the switching frequency

| Ratings | Losses (kW) |       |       |       |       |
|---------|-------------|-------|-------|-------|-------|
|         | 2 kHz       | 3 kHz | 4 kHz | 5 kHz | 6 kHz |
| 60T     | 1,5         | 1,6   | 1,6   | 1,7   | 1,7   |
| 75T     | 1,9         | 2,0   | 2,0   | 1,9   | 1,8   |
| 100T    | 2,3         | 2,4   | 2,4   | 2,3   | 2,2   |
| 120T    | 2,9         | 2,9   | 2,8   | 2,7   | 2,6   |
| 150T    | 3,4         | 3,5   | 3,3   | 3,1   | 3,1   |
| 180T    | 4,1         | 4,4   | 4,6   | 4,8   | 4,8   |
| 220T    | 5,3         | 5,5   | 5,7   | 5,6   | 5,4   |
| 270T    | 6,2         | 6,5   | 6,5   | 6,3   | 6,1   |

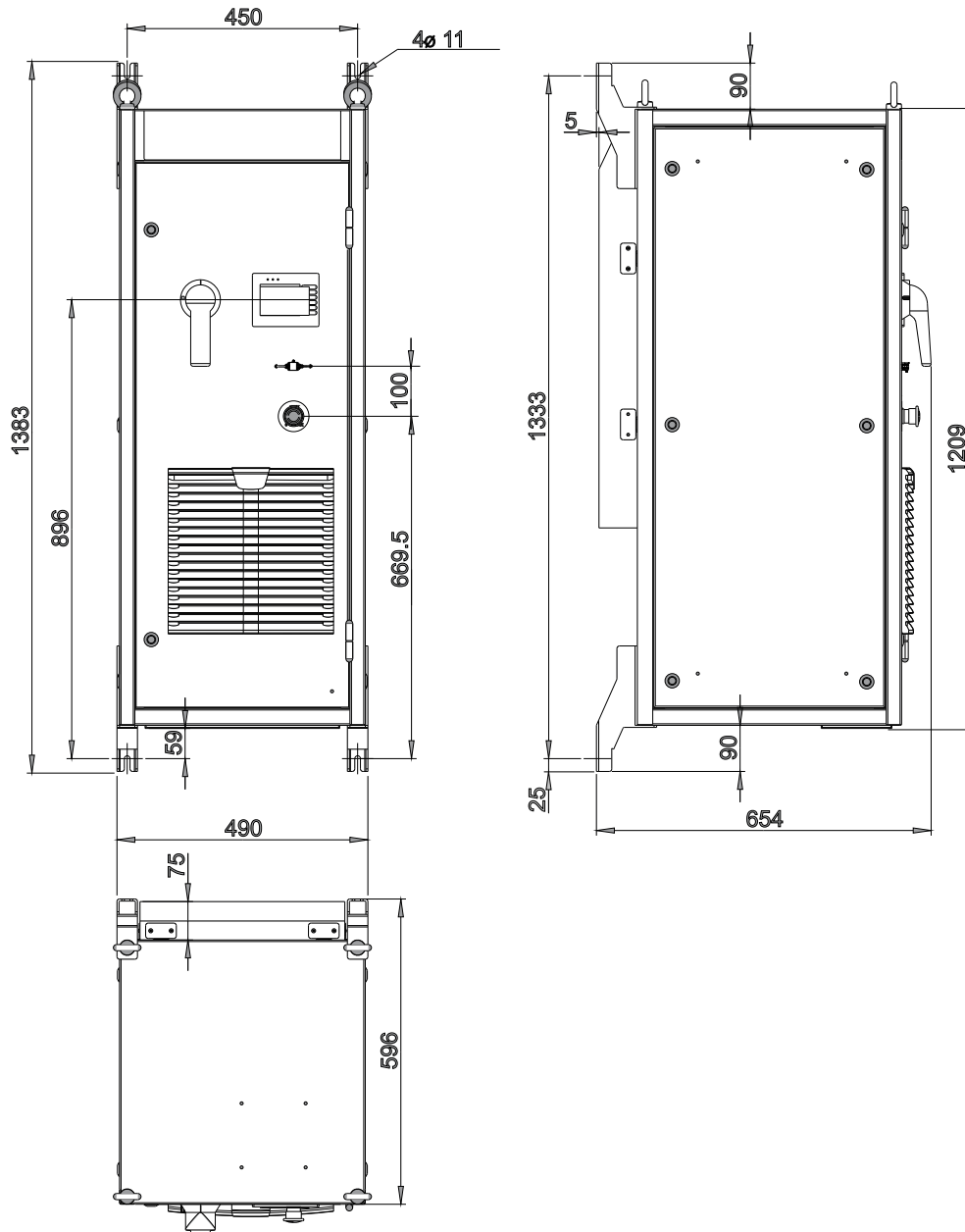
**Nota :** The values given above correspond to operation in normal duty and the choke losses are included.

### 2.5 - Drive ventilation flow rates and noise levels

| Powerdrive MD2MS rating | Forced ventilation flow rates (m <sup>3</sup> /hr) | Noise level (dBA) |
|-------------------------|--|-------------------|
| 60T to 150T             | 350  | 72                |
| 180T to 270T            | 700  | 74                |

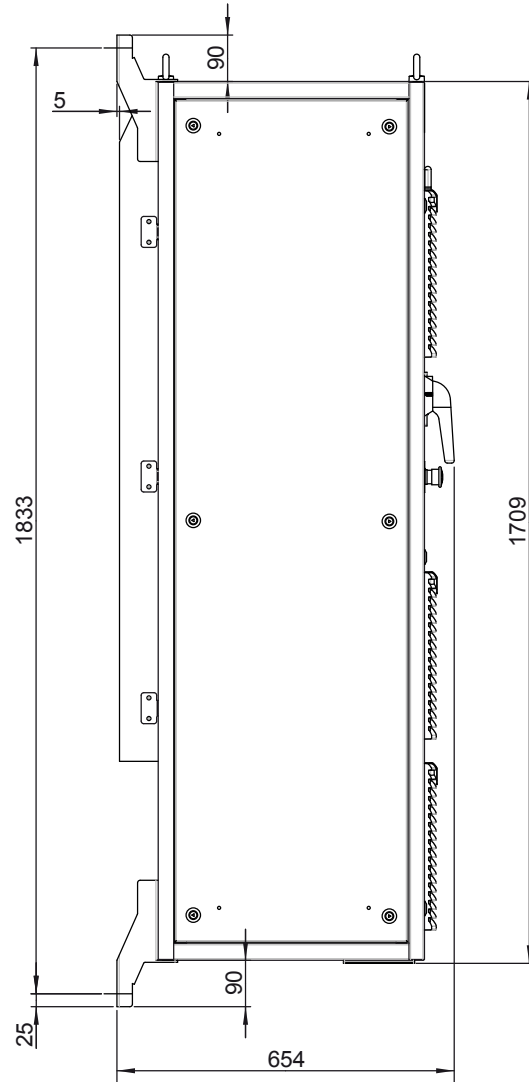
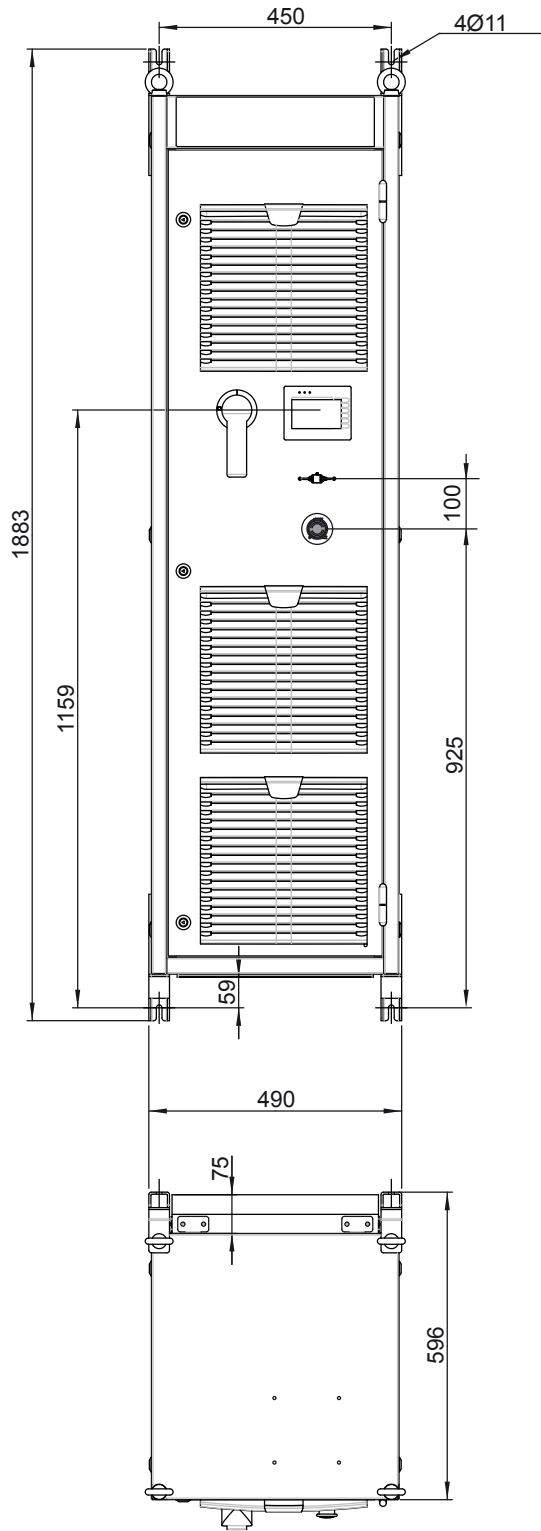
## 2.6 - Dimensions and weight

### 2.6.1 - Drive ratings 60T to 150T



| Ratings<br>Powerdrive MD2MS | Weight<br>(kg) |
|-----------------------------|----------------|
| 60T                         | 140            |
| 75T                         | 140            |
| 100T                        | 140            |
| 120T                        | 190            |
| 150T                        | 190            |

2.6.2 - Drive ratings 180T to 270T



| Ratings<br>Powerdrive MD2MS | Weight<br>(kg) |
|-----------------------------|----------------|
| 180T                        | 200            |
| 220T                        | 240            |
| 270T                        | 240            |

### 3 - CONNECTIONS

**⚠** • All connections work must be performed by qualified electricians in accordance with the laws in force in the country in which the drive is installed. This includes earthing to ensure that no directly accessible part of the drive can be at the mains voltage or any other voltage which may be dangerous.

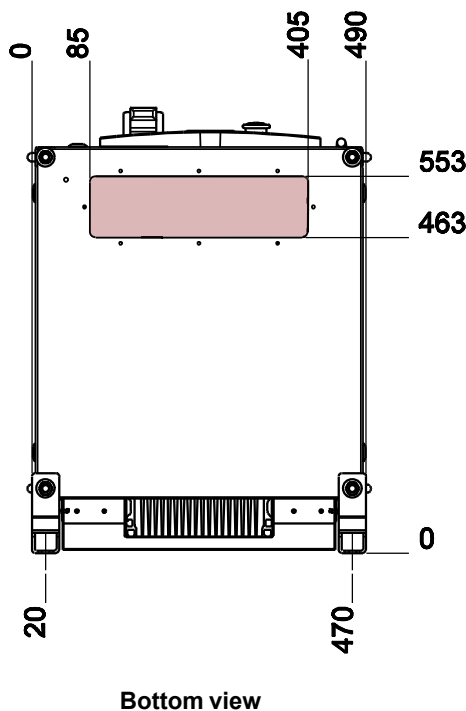
- The drive must be supplied through an approved circuit-breaking device so that it can be powered down safely.
- The line switch integrated as an option in the drive does not isolate the drive input busbars. During the installation and maintenance phases, make sure that the power supply line is disrupted.
- The drive power supply must be protected against overloads and short-circuits.
- Check that the voltage and current of the drive, the motor and the mains supply are compatible.
- The voltages on the connections of the mains supply, the motor, the braking resistor or the filter may cause fatal electric shocks.
- Only one permanent magnet motor can be connected to the drive output. It is recommended to install a circuit-breaking device between the permanent magnet motor and the drive output to eliminate the risk of hazardous voltage feedback when performing maintenance work.
- Follow also the recommendations in section 7.

#### 3.1 - Power connections

##### 3.1.1 - Cables input

All cables entering or exiting the Powerdrive MD2MS IP54 must pass through a cable gland. For shielded cables, use metal cable glands to ensure the shield continuity.

The bottom plate of the Powerdrive MD2MS comes undrilled.



##### 3.1.2 - Characteristics of connection terminals

| Refs.             | Functions/connections                 | Type of connection and tightening torque |              |
|-------------------|---------------------------------------|--|--------------|
|                   |                                       | 6060T to 150T                            | 180T to 270T |
| L1, L2, L3        | Mains power supply (on choke)         | M10 screw bolt - 20 Nm                   |              |
|                   | Mains power supply with power options | M10 screw bolt - 20 Nm                   |              |
| U, V, W           | Motor outputs                         | M10 screw bolt - 20 Nm                   |              |
| PE                | Earth                                 | M8 bolt - 12 Nm                          |              |
| P4, P5 (see §4.4) | EMC commoning link                    | Torx screws Ø20 - 4 Nm                   |              |

**⚠** Do not exceed the indicated maximum tightening torque.

##### 3.1.3 - Electronics and forced ventilation power supply

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

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

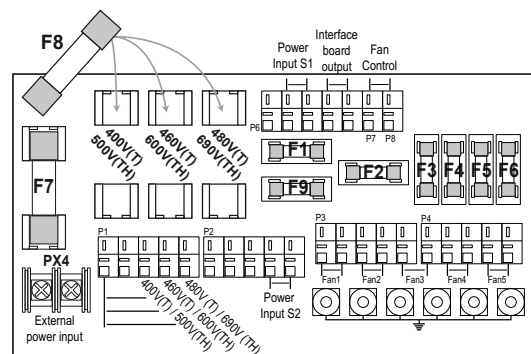
- Electrical characteristics:

|         | Ratings | Voltage                                  |
|---------|---------|--|
| Primary | T       | 400 V ±10%/50 Hz or 460-480 V ±10%/60 Hz |

|   | Voltage                  | Maximum power  |
|---|--------------------------|--|
| Electronics power supply                        | 230 V isolated           | 100 VA   |
| Forced ventilation and auxiliaries power supply | 230 V connected to earth | 60T/60T to 150T : P = 300500 VA<br>180T to 270T : P = 2x500 VA |

- Fuses board :

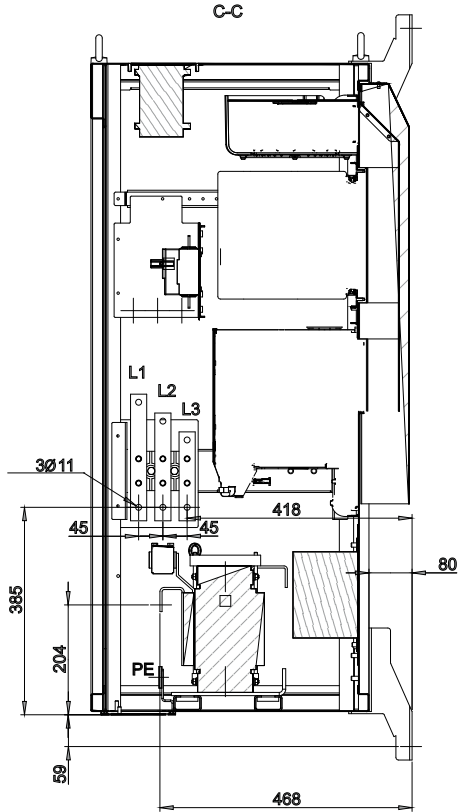
**⚠** Position the F8 fuse according to the mains supply voltage



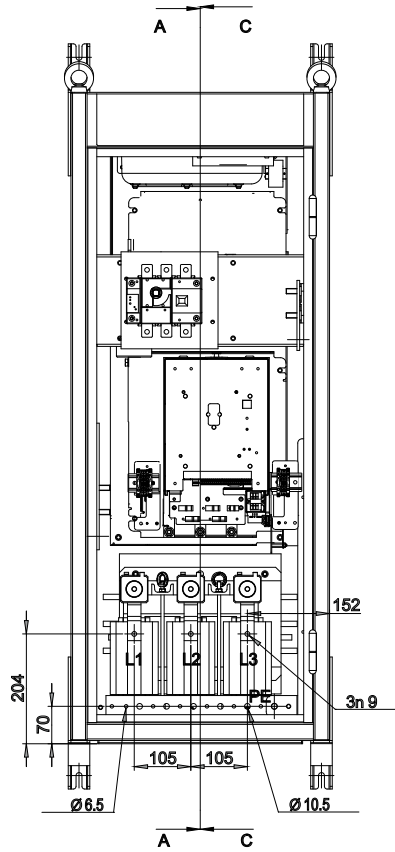
3.1.4 - Location of power terminal blocks

3.1.4.1 - Ratings 60T to 150T

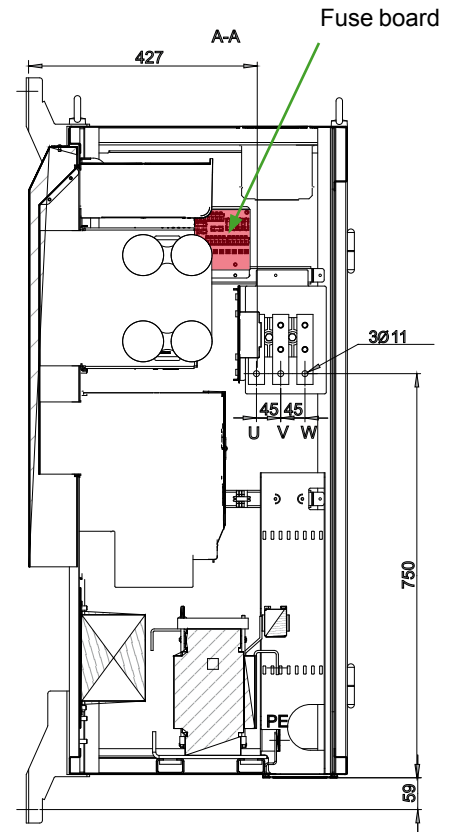
Right side view



Front view



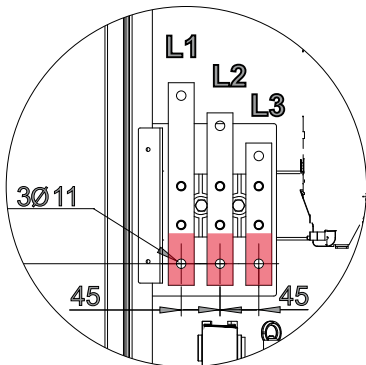
Left side view



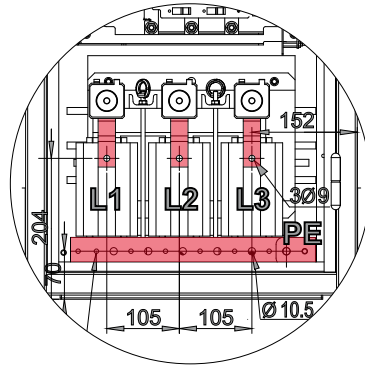
Network Connections

With option

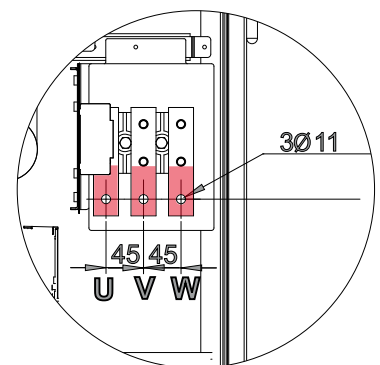
Line switch or RFI filter



Without option

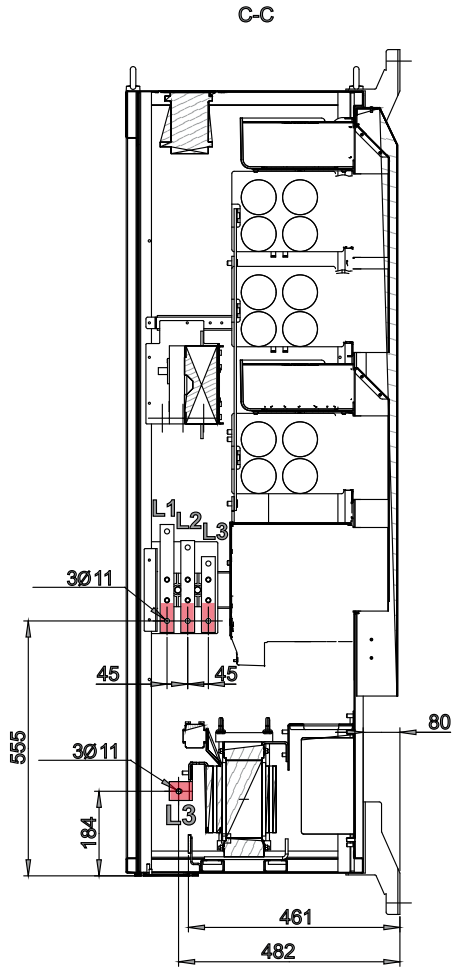


Motor connections

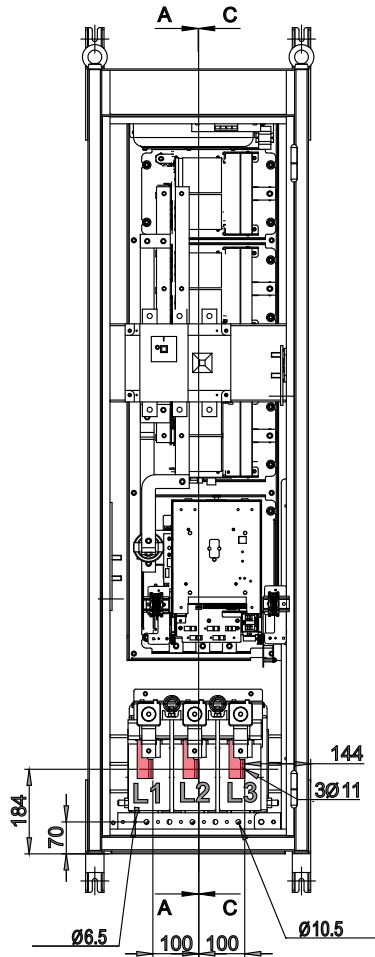


3.1.4.2 - Ratings 180T to 270T

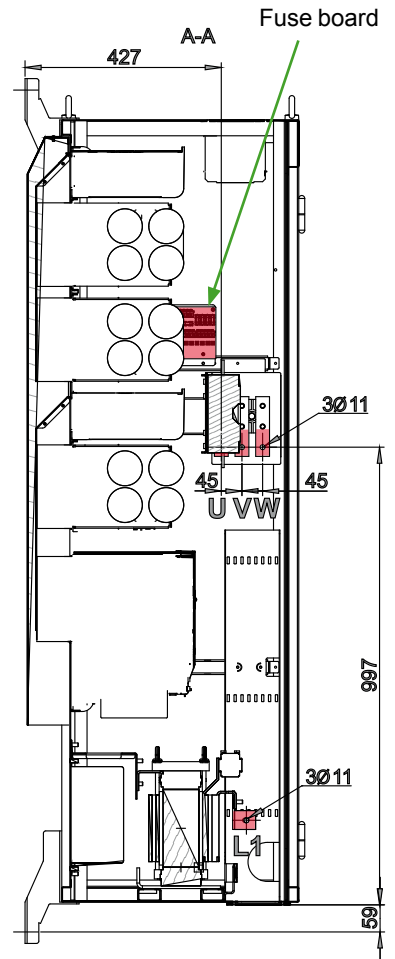
Right side view



Front view

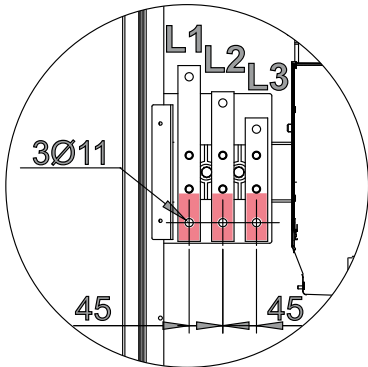


Left side view

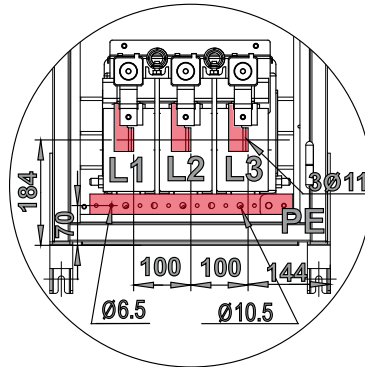


Network Connections

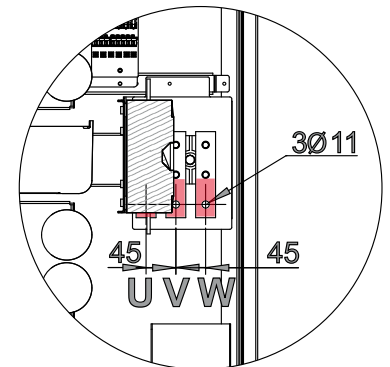
With option  
Switch or RFI filter



Without option



Motor connections



### 3.1.5 - Cables and fuses

**⚠** • It is the responsibility of the user to connect and provide protection for the Powerdrive MD2MS in accordance with the current legislation and regulations in the country of use. This is particularly important with regard to the size of the cables, the type and rating of fuses, the earth or ground connection, powering down, acknowledging trips, isolation and protection against overcurrents.

- The installation must have a short circuit current ( $I_{sc}$ ) > 20  $I_L$  at the point of drive connection.
- This table is given for information only, and must under no circumstances be used in place of the current standards.

$I_L$ : Maximum line current

$I_{co}$ : Continuous output current

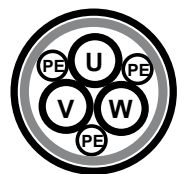
| POWERDRIVE rating | Mains power supply |                   |  |                   |              |     | Motor  |              |  |
|-------------------|--------------------|-------------------|--|-------------------|--------------|-----|--|--------------|--|
|                   | 400 V - 50 Hz      |                   |  | 460/480 V - 60 Hz |              |     |  |              |  |
|                   | $I_L$ (A)          | Gg type fuses (1) | Cable cross-section (mm <sup>2</sup> ) (2) (4) | $I_L$ (A)         | Fuses        |     | Cable cross-section (mm <sup>2</sup> ) (2) (4) | $I_{co}$ (A) | Cable cross-section (mm <sup>2</sup> ) (3) (4) |
| Gg type (1)       |                    |                   |  |                   | Class J (UL) |     |  |              |  |
| 60T               | 85                 | 100               | 3x35 + PE                                      | 75                | 100          | 125 | 3x35 + PE                                      | 92           | 3x35 + PE                                      |
|                   | 105                | 125               | 3x35 + PE                                      | 90                | 125          | 150 | 3x35 + PE                                      | 112          | 3x35 + PE                                      |
| 75T               | 105                | 125               | 3x35 + PE                                      | 90                | 125          | 150 | 3x35 + PE                                      | 118          | 3x35 + PE                                      |
|                   | 140                | 160               | 3x50 + PE                                      | 120               | 160          | 200 | 3x35 + PE                                      | 142          | 3x50 + PE                                      |
| 100T              | 140                | 160               | 3x50 + PE                                      | 120               | 160          | 200 | 3x50 + PE                                      | 142          | 3x50 + PE                                      |
|                   | 170                | 200               | 3x70 + PE                                      | 150               | 200          | 225 | 3x70 + PE                                      | 175          | 3x70 + PE                                      |
| 120T              | 170                | 200               | 3x70 + PE                                      | 150               | 200          | 225 | 3x70 + PE                                      | 170          | 3x70 + PE                                      |
|                   | 205                | 250               | 3x95 + PE                                      | 180               | 200          | 250 | 3x70 + PE                                      | 212          | 3x95 + PE                                      |
| 150T              | 205                | 250               | 3x95 + PE                                      | 180               | 200          | 250 | 3x70 + PE                                      | 220          | 3x95 + PE                                      |
|                   | 245                | 315               | 3x120 + PE                                     | 210               | 250          | 300 | 3x95 + PE                                      | 250          | 3x120 + PE                                     |
| 180T              | 245                | 315               | 3x120 + PE                                     | 210               | 250          | 300 | 3x95 + PE                                      | 260          | 3x150 + PE                                     |
|                   | 295                | 315               | 3x150 + PE                                     | 240               | 315          | 400 | 3x120 + PE                                     | 315          | 3x185 + PE                                     |
| 220T              | 295                | 315               | 3x150 + PE                                     | 240               | 315          | 400 | 3x120 + PE                                     | 310          | 3x185 + PE                                     |
|                   | 370                | 400               | 3x240 + PE                                     | 360               | 400          | 500 | 3x240 + PE                                     | 400          | 3x240 + PE                                     |
| 270T              | 370                | 400               | 3x240 + PE                                     | 360               | 400          | 500 | 3x240 + PE                                     | 375          | 3x240 + PE                                     |
|                   | 460                | 500               | 2x[3x150 + PE]                                 | 420               | 500          | 600 | 2x[3x120 + PE]                                 | 470          | 2x[3x150 + PE]                                 |

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

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

(2) 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.

(3) The motor cable cross-sections are given for information only for a current corresponding to the value of the  $I_{co}$  current at 3 kHz, a maximum length of 50 m, output frequency less than 100 Hz and an ambient temperature of 40°C. **The recommended motor cables are shielded multicore type.** The values supplied are typical values. Example: Cable cross-section of 3 x (3 x 185 + 95) corresponds to 3 cables each consisting of 3 phase conductors (cross-section 185 mm<sup>2</sup>) + earth conductors (cross-section 95 mm<sup>2</sup>).



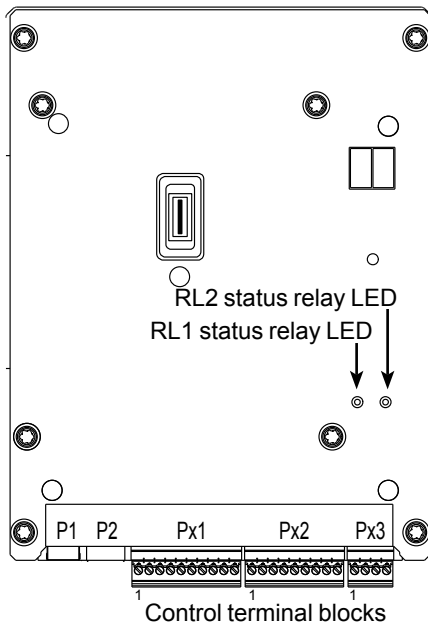
(4) : The PE conductor cross-section must be not less the half of the associated phase conductor cross-section assuming that the same material is used. Example : the minimum PE cross-section for 2 x 240 mm<sup>2</sup> phase conductors should be :  
 - 2 x 120mm<sup>2</sup>  
 - 2 x (3 x 40 mm<sup>2</sup>) when PE conductor is split into 3 individuals (fig. above)Connection of the control.



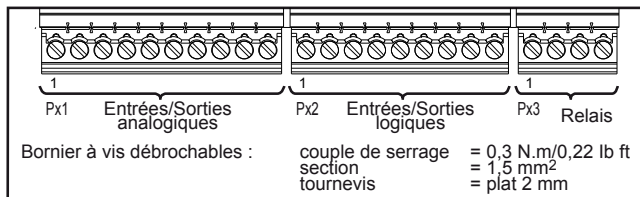


### 3.2 - Control terminal block location

- The Powerdrive MD2MS inputs have a positive logic configuration. Using a drive with a control system which has a different control logic may cause unexpedted starting of the motor.
- The Powerdrive MD2MS control circuit is isolated from the power circuits by single insulation. Its electronic 0V is connected to the connection terminal on the outer protective conductor (earth terminal). The installer must ensure that the external control circuits are isolated against any human contact.
- If the control circuits need to be connected to circuits complying with SELV safety requirements, additional insulation must be inserted to maintain the SELV classification (see EN 61140).



Bornier de contrôle



#### 3.2.1 - Control terminal block characteristics

##### 3.2.1.1 - PX1 terminal block characteristics

|                        |            |                              |
|------------------------|------------|------------------------------|
| <b>1</b>               | <b>10V</b> | +10 V internal analog source |
| Accuracy               |            | ± 2%                         |
| Maximum output current |            | 10 mA                        |

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

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

|  |           |                           |
|--|-----------|---------------------------|
| <b>6</b>   | <b>0V</b> | Analog circuit common 0 V |
| The 0 V on the electronics is connected to the metal ground of the drive |           |                           |

|                              |            |   |
|------------------------------|------------|---|
| <b>7</b>                     | <b>AI3</b> | Analog input 3  |
| Factory setting              |            | No assignment   |
| Input type                   |            | ± 10 V bipolar analog voltage in common mode or unipolar current (0 to 20 mA, 4 to 20 mA) |
| Resolution                   |            | 11 bits + sign  |
| Sampling period              |            | 2 ms  |
| Input filter bandwidth       |            | ~ 200 Hz  |
| Voltage range in common mode |            | ± 24 V/0 V  |

#### Voltage mode

|                                |         |
|--------------------------------|---------|
| Input impedance                | > 50 kΩ |
| Absolute maximum voltage range | ± 30 V  |

#### Current mode

|                          |       |
|--------------------------|-------|
| Input impedance          | 100 Ω |
| Absolute maximum current | 30 mA |

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

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

|  |           |                           |
|--|-----------|---------------------------|
| <b>10</b>  | <b>0V</b> | Analog circuit common 0 V |
| The 0 V on the electronics is connected to the metal ground of the drive |           |                           |

**3.2.1.2 - PX2 terminal block characteristics**

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

|                               |        |  |
|-------------------------------|--------|--|
| <b>+24 VDC external input</b> |        |  |
| Rated voltage                 | 24 VDC |  |
| Minimum operating voltage     | 22 V   |  |
| Absolute maximum voltage      | 28 V   |  |
| Recommended power             | 50 W   |  |
| Recommended fuse              | 2.5 A  |  |

An external power supply connected to the +24V Ref terminal is used to maintain the control power supply in the event of mains loss.

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

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

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

**3.2.1.3 - PX3 terminal block characteristics**

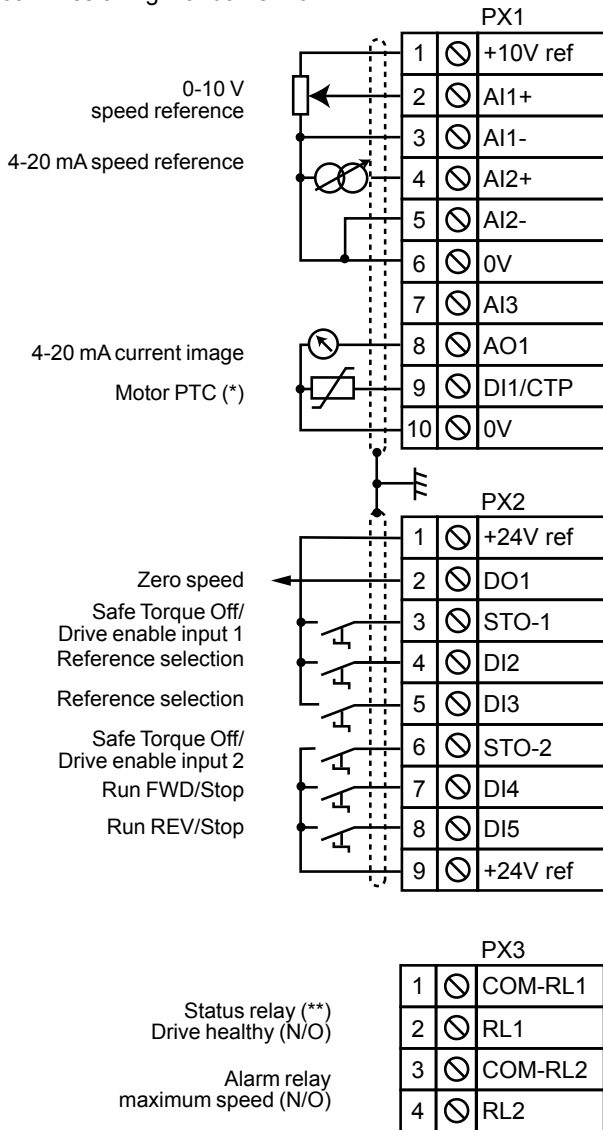
|                         |                               |                                  |
|-------------------------|-------------------------------|----------------------------------|
| <b>1</b>                | <b>COM-RL1</b>                | N/O (normally open) relay output |
| <b>2</b>     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

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

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

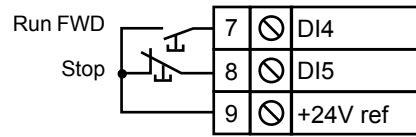
### 3.2.2 - Factory configuration of control terminal blocks

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



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

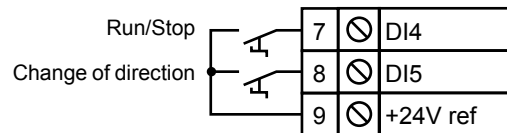
- For "3-wire" control (jog Run/Stop):



List of parameters to set:

- Ctr.06 (06.04)** = Run Latched (1)
- I/O.10 (08.25)** = **06.39** Stop (DI5 terminal)

- For Run/Stop control with change of direction:



List of parameters to set:

- Ctr.06 (06.04)** = Run Fwd/Rev (2)
- I/O.09 (08.24)** = **06.34** Run/Stop (DI4 terminal)
- I/O.10 (08.25)** = **06.33** Fwd/Reverse (DI5 terminal)

#### • Selection of the reference via digital inputs:

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

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

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

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

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

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

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

The opening of a minimum of one input locks the output bridge.

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

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

- EN 61800-5-2
- EN/ISO 13849-1: 2006; PL<sub>e</sub>
- IEC/EN 62061: 2005; SIL3

(CETIM approval no. CET0047520)

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

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

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

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

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

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

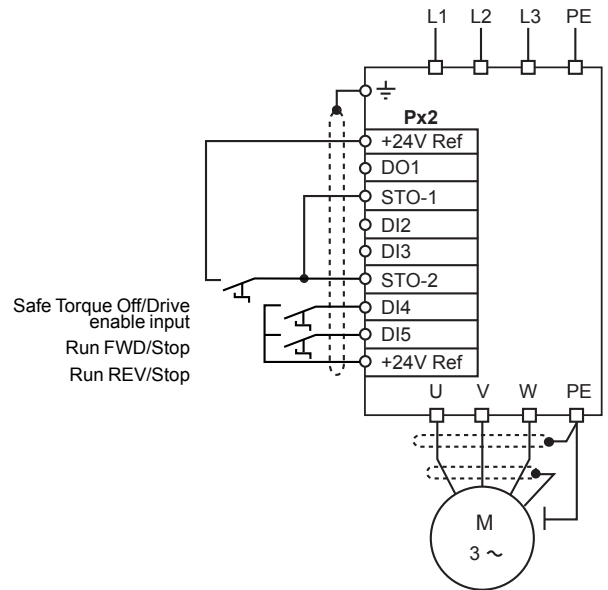
If braking needs to be a machine safety function, it must be provided by an electromechanical solution since the dynamic braking by the drive function is not considered as a secure disable function.

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

• The line switch integrated as an option in the drive does not isolate the drive input busbars. During the installation and maintenance phases, make sure that the power supply line is disrupted.

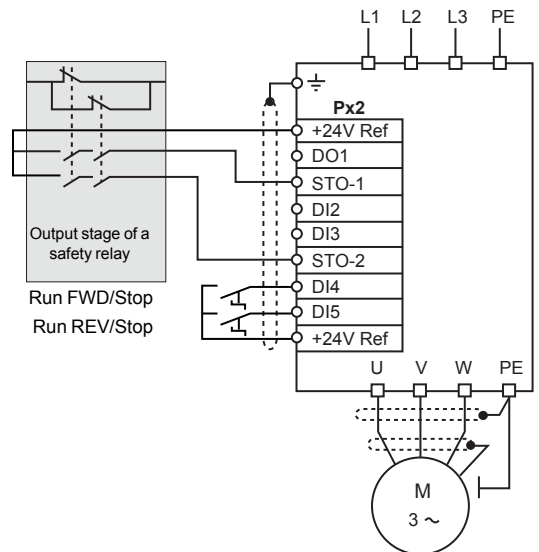
#### 3.3.1 - Single channel locking (SIL1 - PL<sub>b</sub>)

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



#### 3.3.2 - Double channel locking (SIL3 - PL<sub>e</sub>).

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



## 4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE

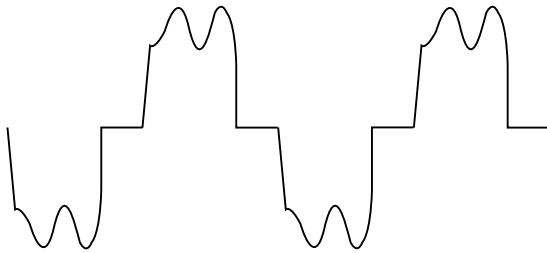
The power structure of frequency inverters leads to the occurrence of two types of phenomenon :

- Low-frequency harmonics fed back to the mains supply
- Emission of radio-frequency signals (RFI)

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

### 4.1 - Low-frequency harmonics

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



3-phase rectifier line current consumption.

This current carries harmonics with number  $6n \pm 1$ .

**Their amplitudes depend on the impedance of the mains supply upstream the rectifier bridge, and on the structure of the DC bus downstream the rectifier bridge.**

The more inductive the mains supply and the DC bus, the more these harmonics are reduced.

They only affect the quality of the mains supply for loads on frequency inverters of several hundred kVA, if these loads represent more than a quarter of the total load on a site.

In the above conditions:

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

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

## 4.2 - Radio-frequency interference: Immunity

### 4.2.1 - General

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

### 4.2.2 - Standards

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

### 4.2.3 - Recommendations

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

## 4.3 - Radio-frequency interference: Emission

### 4.3.1 - General

In order to limit motor losses and obtain a low level of motor noise, frequency inverters use high-speed switches (transistors, semi-conductors) which switch high voltages (> 550 V) at high frequencies (several kHz).

As a result, they generate radio-frequency (R.F.) signals which may disturb operation of other equipments or distort measurements taken by sensors:

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

These phenomena are of direct interest to the user.

The frequency range concerned (radio frequency) does not affect the energy distribution company.

### 4.3.2 - Standards

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

## 4.4 - Mains supply

### 4.4.1 - General

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

The **Powerdrive MD2MS** is designed to operate with mains supplies typical of industrial sites throughout the world. However, for each installation, it is important to know the characteristics of the mains supply in order to carry out corrective measures in the event of abnormal conditions.

### 4.4.2 - Mains transient overvoltages

There are numerous sources of overvoltages on an electrical installation:

- Connection/disconnection of banks of power factor correction capacitors
- High-power thyristor-controlled equipment (oven, DC drive, etc)
- Results of lightning

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

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

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

- The threshold between steps is low enough to avoid causing overvoltage on the line
- The capacitors are not permanently connected

#### 4.4.2.2 - Presence of commutation notches on the line

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

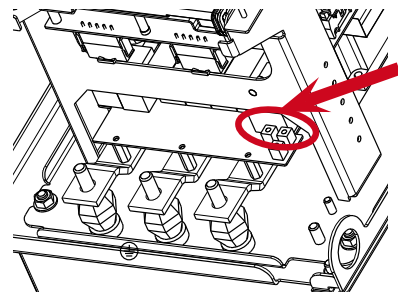
### 4.4.3 - Unbalanced power supply

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

Additional mains chokes can be installed upstream of a **Powerdrive MD2MS** supplied by an unbalanced mains in order to reduce the current imbalance factor (see characteristics in section "Line reactors").

#### Neutral IT point connection

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



Powerdrive MD2MS 60100T to 270T

### 4.4.4 - Ground connections

The equipotential earth bonding of some industrial sites is not always observed. This lack of equipotentiality leads to leakage currents which flow via the earth cables (green/yellow), the machine chassis, the pipework, etc, and also via the electrical equipment. In some extreme cases, these currents can trip the drive.

It is essential that the earth network is designed and implemented by the installation supervisor so that its impedance is as low as possible, so as to distribute the fault currents and high-frequency currents without them passing through electronic equipment.

Metal grounds must be mechanically connected to each other with the largest possible electrical contact area. Under no circumstances can the earth connections designed to protect people, by linking metal grounds to earth via a cable, serve as a substitute for the ground connections (see IEC 61000-5-2).

The immunity and radio-frequency emission level are directly linked to the quality of the ground connections.

## 4.5 - Basic precautions for installation

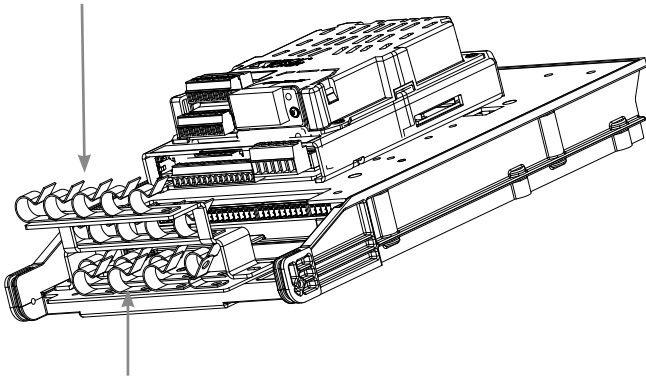
These should be taken into account when wiring the **Powerdrive MD2MS** and the external components. In each paragraph, they are listed in decreasing order of effect on correct operation of the installation.

### 4.5.1 - Wiring inside the cabinet product

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

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

Grounding bracket of the options



Grounding bracket

All cables entering or exiting the **Powerdrive MD2MS IP54** must pass through a gland. For shielded cables, use metal cable glands providing the shield continuity.

The bottom plate of the **Powerdrive MD2MS** comes undrilled.

### 4.5.2 - Wiring outside the cabinet product

#### 4.5.2.1 - Control wiring

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

#### 4.5.2.2 - Power wiring

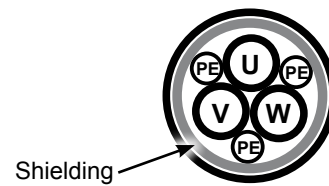
- **Connect the motor earth terminal directly to that of the drive.**



**Never use shielded single-core cables**

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

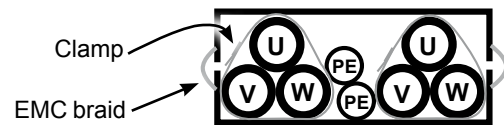
The shield must be connected at both ends: drive end and motor end (connected round the whole circumference).



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

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

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



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



## 4.6 - Electromagnetic compatibility (EMC)

**CAUTION:**

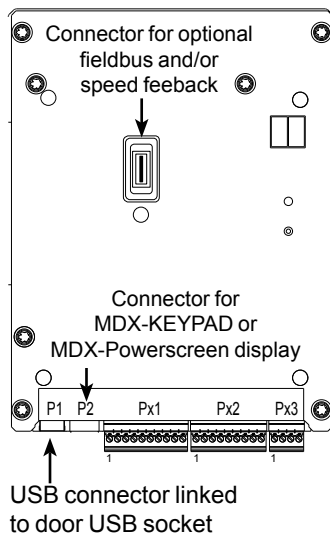
Conformity of the drive is only assured when the mechanical and electrical installation instructions described in this manual are adhered to.

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

| Emission   |                                |          |   |   |
|------------|--------------------------------|----------|---|---|
| Standard   | Description                    | Category | Conformity conditions   |   |
|            |                                |          | Standard  | With optional RFI filter  |
| EN 61800-3 | Variable speed drive standards | C1       | -   | -   |
|            |                                | C2       | -   | Conforming<br>- Cable length < 10 m<br>- Switching frequency < 4 kHz  |
|            |                                | C3       | Conforming<br>- Cable length < 100 m<br>- Switching frequency < 4 kHz | Conforming<br>- Cable length < 100 m<br>- Switching frequency < 6 kHz |

## 5 - PARAMETER-SETTING INTERFACE AND OPTIONS

Location of the drive connectors / ports



### ◦ P1 connector

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

### ◦ 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         |

## 5.1 - Drive setting interfaces

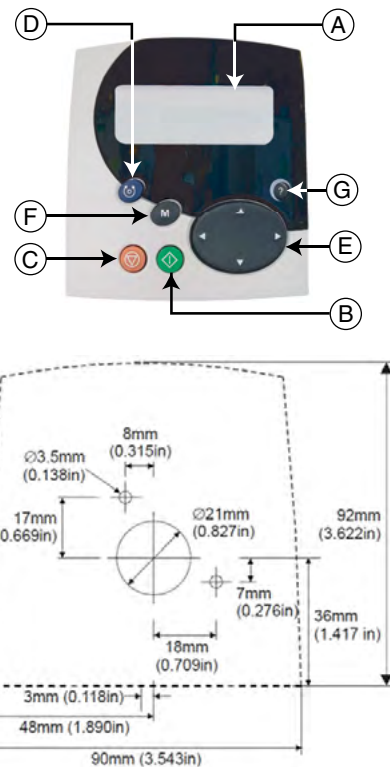
### 5.1.1 - MDX-KEYPAD

#### 5.1.1.1 - General

This keypad, which is remote from the drive, makes it easy to set up the **POWERDRIVE MD2MS** and provides access to all parameters. Its LCD display, consisting of one line of 12 characters and 2 lines of 16 characters, offers text which can be displayed in 5 languages (English, French, German, Italian and Spanish).

The MDX-KEYPAD has 2 main functions:

- A read mode for **POWERDRIVE MD2MS** supervision and diagnostics
- Access to all the **POWERDRIVE MD2MS** parameters in order to optimise settings or even configure particular applications. As soon as it is switched on, the MDX-KEYPAD is set to read mode. The buttons are used to scroll through the all parameters required for supervision and diagnostics:
  - Motor current,
  - Motor frequency,
  - Motor voltage,
  - Analog I/O levels,
  - Digital I/O states,
  - Logic function states,
  - Timer.



| Pos. | Function  |
|------|---|
| (A)  | 3-line backlist LCD display indicating:<br>- The drive operating status and its lain data,<br>- The main adjustment parameters via a “ <b>Quick parameter setting</b> ” menu,<br>- All the drive parameters via 21 “ <b>Advanced parameter setting</b> ” menus (access via a code). |
| (B)  | Green button for run command if control via the keypad is enable.<br>See “ <b>Parameter setting via the keypad</b> ”.   |
| (C)  | Red button for drive reset or to give a stop command if control via the keypad is enabled.<br>See parameters <b>Ctr.05 (6.43)</b> and <b>06.12</b> .  |
| (D)  | Blue button for change of direction of rotation if control via the keypad is enabled.<br>See parameter <b>Ctr.05 (6.43)</b> .   |
| (E)  | Navigation button () for moving through the various menus and changing the contents of parameters.  |
| (F)  | button for storing settings and changing mode (display, read, set parameters).  |
| (G)  | “?” button not used.  |

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

#### 5.1.1.2 - Installation

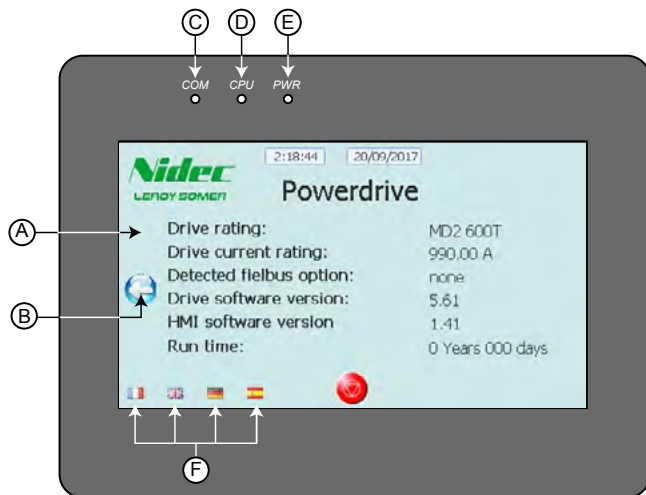
The MDX-KEYPAD does not require any special installation. Simply connect it via its 1.5 metre cable (supplied with the keypad), as shown in section 5.1.1.

### 5.1.2 - MDX-Powerscreen

**• General**

The POWERSCREEN interface is a touch screen which can be used to access various menus to setup and supervise the drive. It is installed as standard on the **POWERDRIVE MD2MS**.

After the loading phase following the power-up of the drive, the parameter-setting interface displays the screen below in french. Select language using the "F" buttons below



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

**• Architecture**

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

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

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

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

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

### 5.1.3 - MDX-SOFT

The MDX-SOFT enables parameter setting or supervision of the **Powerdrive MD2MS** 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

This software can be downloaded from the web at the following address: <http://www.leroy-somer.com/>

**Powerdrive MD2MS** can be set via the USB connector, even if the drive is not powered.

Attention. In this case, options modules will not be powered and settings will not be saved. To make an option module setting / backup , it is necessary to provide an auxiliary power supply.

### 5.1.4 - Special settings

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

**• Clogged filter alarm**

**Powerdrive MD2MS** has an "overtemperature" alarm (# 10.18) which warns the user when the internal temperature of the product reaches 60°C or when a power module overheats.

To set a different alarm treshold, you can use the following settings:

Using comparator 3:

- #12.63 = 7.55 (source = control board temperature)
- #12.64 = 60 (threshold = 60 ° C)
- #12.65 = 2°C (hysteresis)
- #12.65 = 0

To display information on the HMI of the drive:

- #12.67 = 10.54 (User Alarm 1)
- To adress information to a digital output (eg. DO1)
- # 8.26 = 12.61 (DO1 assigned to comparator 3)

Reminder: **Powerdrive MD2MS** filters are washable and must be kept clean. See § 7 - Maintenance

## 5.2 - Add-on options

The control board of the **Powerdrive MD2MS'** motor inverter is designed to be plugged with various optional modules. Several options can be combined:

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

### 5.2.1 - Fieldbus modules

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



**MDX option:** option to be fitted to the control board



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

Association table :

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

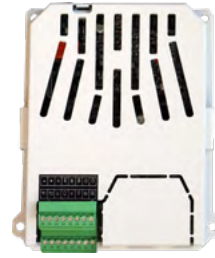
Fieldbus modules can be used to communicate with the corresponding networks respective. They can be integrated in and are supplied by the drive.

The following fieldbus are available on **Powerdrive MD2MS** :

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

For more details, consult the specific documentations.

### 5.2.2 - Speed feedback options



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

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

For more details, consult the specific documentations.

### 5.2.3 - Additionnal I/O options

Two options are available to increase the **Powerdrive MD2MS** number of inputs and outputs :



**MDX-I/O LITE**



**MDX-I/O M2M**

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

For more details, consult the specific documentations.

### 5.3 - Electrical protections

In the factory, a switching device can be integrated as an option to the **Powerdrive MD2MS**.

**⚠ 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 and electrically 'lock-out'.**

#### 5.3.1 - Line switch

The **Powerdrive MD2MS** can be installed with a three pole line switch. This option allows isolating the motor 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

#### Characteristics at 40 ° C in category AC21

| Rating       | Reference        |
|--------------|------------------|
| 60T à 100T   | <b>MD2MDCT11</b> |
| 120T et 150T | <b>MD2MDCT12</b> |
| 180T et 220T | <b>MD2MDCT21</b> |
| 270T         | <b>MD2MDCT21</b> |

#### 5.3.2 - Emergency stop

**MD2MAU** option consists in an emergency stop push button mounted on the front door and wired on the STO inputs. A terminal located at the right of the control board (see below) allows to connect an external emergency stop push button, inserted in the security chain.

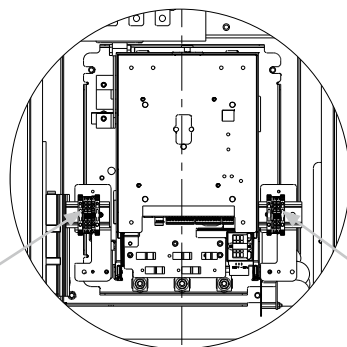
### 5.4 - Heater kit

To prevent condensation in the **Powerdrive MD2MS** a self-limited temperature heater is available as an option.

The connection is made on a dedicated terminal located on a rail at the top right of the product (see §3.1.3)

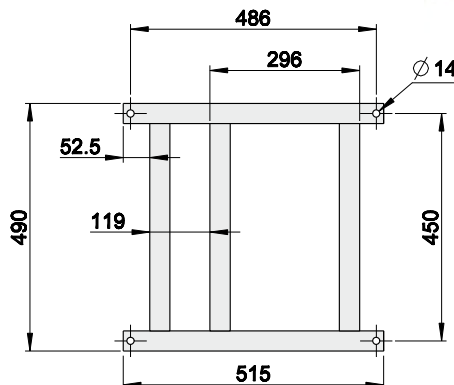
The installer must provide ~230V single phase protection (fuse rating indicated below) and ensure its control (the module must be turned off when the drive is in operation).

| Rating      | Reference       | Pn (W) | Max current (A) | Time delay fuse (A) |
|-------------|-----------------|--------|-----------------|---------------------|
| 60T à 150T  | <b>MD2HEAT1</b> | 75     | 4               | 4                   |
| 180T à 270T | <b>MD2HEAT2</b> | 150    | 9               | 6,3                 |



MD2HEAT terminals

MD2MAU terminals



### 5.5 - RFI filters

The use of RFI filters contributes to a reduction in the emission levels of radio-frequency signals. They allow the compliance of the **Powerdrive MD2MS** components with the variable speed standard EN61800-3.

Depending on the drive and the application, install the RFI filter recommended in the table below between the mains and the drive input.

| Rating      | Reference        | Leak current (mA) |
|-------------|------------------|-------------------|
| 60T to 100T | <b>MD2MFLT11</b> | 13.8              |
| 120T & 150T | <b>MD2MFLT12</b> | 13.8              |
| 180T & 220T | <b>MD2MFLT21</b> | 13.8              |
| 270T        | <b>MD2MFLT22</b> | 13.8              |

#### CAUTION:

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

### 5.6 - MD2MBASE support

The MD2MBASE is a 400mm high base allowing the **Powerdrive MD2MS** to stand alone. This support made of brushed stainless steel can withstand the most demanding environments.

Fixing the support on the ground :  
4 screw bolt Ø 14 mm


Fixing the drive :  
by bolting thread provided in the 4 corners of the product

Overall dimensions :  
515 mm x 490 mm x 400 mm



## 6 - TRIPS - DIAGNOSTICS

### 6.1 - Safety notice

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

### 6.2 - Alarms

Alarms may appear during drive operation.

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

The HMI displays a page «active trips» where «ALARM» appears at the top of the screen. All alarms shown on the console or the configuration interface are listed in the following table.

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

| Code | No.          | Meaning  |
|------|--------------|--|
| A.L. | 1<br>to<br>4 | User alarm 1 ( <b>10.54</b> )<br>to<br>User alarm 4 ( <b>10.54</b> ) |
|      | 6            | Motor overload ( <b>10.17</b> )                                      |
|      | 7            | Drive overtemperature ( <b>10.18</b> )                               |
|      | 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.

After consulting the table, follow the procedure below:

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

The HMI displays an active trip page, where "TRIP" appears at the top of the screen.

All the trips indicated on the keypad or parameter-setting interface are listed in the table below.

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

| No. | Parameter-setting interface name | Reason for trip     | Solution   |
|-----|----------------------------------|---------------------|--|
| 1   | DC UnderVolt                     | DC bus undervoltage | <ul style="list-style-type: none"> <li>• Check the input fuses.</li> <li>• Check the quality of the power supply (voltage dips).</li> </ul>  |
| 2   | DC over volt                     | DC bus overvoltage  | <ul style="list-style-type: none"> <li>• Check that the mains voltage is within the permitted tolerance.</li> <li>• Check the quality of the power supply (commutation notches or transient overvoltages).</li> <li>• Check the motor insulation.</li> <li>• Check that the deceleration mode (<b>02.04</b>) is compatible with the application.</li> <li>• If an MD2-TF option is used, check its size, its wiring and the state of the thermal relay.</li> </ul> |


| No. | Parameter-setting interface name | Reason for trip   | Solution  |
|-----|----------------------------------|---|---|
| 3   | Over current                     | Overcurrent at drive output   | <ul style="list-style-type: none"> <li>• Check the motor insulation.</li> <li>• Check the motor cables (connections and insulation).</li> <li>• Check the quality of the mains supply.</li> <li>• Run power diagnostics.</li> </ul>   |
|     |                                  | <b>This trip cannot be reset for a period of 10 seconds.</b>  |   |
| 4   | Not used                         |   |   |
| 5   | I IMBALANCED                     | Motor current imbalance: vectorial sum of the 3 motor currents is not zero                          | <ul style="list-style-type: none"> <li>• Check the motor insulation.</li> <li>• Check the cable insulation.</li> </ul>  |
| 6   | Out Ph. loss of a motor phase    | Loss of a motor phase   | Check the motor cable and resistance values between motor phases.   |
| 7   | Overspeed                        | The speed is greater than $(1.3 \times \mathbf{01.06})$ or $(\mathbf{01.06} + 1000 \text{ rpm})$    | <ul style="list-style-type: none"> <li>• Check the drive settings.</li> <li>• When the flying restart function is not being used, check that <b>06.09</b> is at "Disabled".</li> </ul>  |
| 8   | Drive overload lxt               | The drive overload level exceeds the conditions defined in section 1.4.2 of the installation manual | <ul style="list-style-type: none"> <li>• Check the drive is suitable for the motor current cycle.</li> <li>• Check the ambient temperature.</li> </ul>  |
| 9   | IGBT U                           | Internal protection of phase U IGBTs  | <ul style="list-style-type: none"> <li>• Check the motor and cable insulation.</li> <li>• Run power diagnostics.</li> </ul>   |
| 10  | Th rectifier                     | Rectifier heatsink temperature too high Not used  | <ul style="list-style-type: none"> <li>• Clean the cabinet dust filters.</li> <li>• Check the drive external and internal fans are working correctly.</li> <li>• Check that the product air inlet temperature is not outside the limits.</li> </ul>   |
| 11  | Encoder rot                      | The measured position does not vary (only if a feedback speed option is present)                    | <ul style="list-style-type: none"> <li>• Check the encoder wiring.</li> <li>• Check that the motor shaft turns.</li> </ul>  |
| 13  | UVW invert                       | The encoder U, V, W signals are reversed (only if a feedback speed option is present)               | Check the conformity of the encoder wiring.   |
| 14  | TUNE U Encod                     | During the autotune phase, one of the encoder U, V or W commutation channels is not present         | <ul style="list-style-type: none"> <li>• Check the encoder wiring.</li> <li>• Check the encoder connections.</li> <li>• Change the encoder.</li> </ul>  |
| 15  | TUNE V Encod                     |   |   |
| 16  | TUNE W Encod                     |   |   |
| 18  | AUTOTUNE                         | A stop command has been given during the autotune phase.  | Repeat the autotune procedure (see <b>05.12</b> )   |
| 19  | Not used                         |   |   |
| 21  | IGBT U overheating               | Overheating of phase U IGBTs  | <ul style="list-style-type: none"> <li>• Clean the cabinet dust filters.</li> <li>• Check the drive ventilation units are working correctly.</li> <li>• Check that the product air inlet temperature is not outside the limits.</li> <li>• If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency are complied with.</li> <li>• Check that the switching frequency <b>05.18</b> is compatible with the motor current level.</li> </ul> |

| No. | Parameter-setting interface name | Reason for trip  | Solution   |
|-----|----------------------------------|--|--|
| 24  | Motor PTC                        | Opening of the PTC input of the PX1 terminal block or T1 and T2 inputs of the MDX-ENCODER option | <ul style="list-style-type: none"> <li>• Check the ambient temperature around the motor.</li> <li>• Check that the motor current is less than the stated current.</li> <li>• Check the thermal sensor wiring.</li> </ul> |
| 26  | Overload + 24V                   | Overload on the +24 V power supply or digital outputs  | Check the I/O wiring.  |
| 28  | AI2 loss                         | Loss of the current reference on analog input AI2  | Check the input wiring and source.   |
| 29  | AI3 loss                         | Loss of the current reference on analog input AI3  |  |
| 30  | COM loss                         | Loss of communication on the P2 connector serial link  | <ul style="list-style-type: none"> <li>• Check the cable connections.</li> <li>• Check that parameter <b>11.63</b> is compatible with the timing of requests from the master.</li> </ul>                                 |
| 31  | EEPROM                           | Number of write cycles to EEPROM exceeded (>1,000,000)   | <ul style="list-style-type: none"> <li>• Change the control board.</li> <li>• Check the recurrence of write cycles from the drive controller.</li> </ul>   |
| 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                                   | <ul style="list-style-type: none"> <li>• Check the fieldbus connections.</li> <li>• Check that parameter <b>15.07</b> is compatible with the timing of requests from the master.</li> </ul>                              |
| 35  | STO inputs                       | Simultaneous opening of both STO (Safe Torque Off) inputs during operation                       | Check the remote control link.   |
| 37  | Encoder break                    | One of the encoder feedback data items is missing  | <ul style="list-style-type: none"> <li>• Check the encoder wiring.</li> <li>• Check the encoder connections.</li> </ul>  |
| 38  | Breakdown                        | Breakdown of synchronous motor in sensorless closed loop mode                                    | Check the menu <b>5</b> parameters are compatible with the values on the motor nameplate   |
| 39  | Not used                         |  |  |
| 41  | User 1                           | User trip 1 triggered by <b>10.61</b> .  | • See <b>10.61</b> .   |
| 42  | User 2                           | User trip 2 triggered by <b>10.63</b> .  | • See <b>10.63</b> .   |
| 43  | User 3                           | User trip 3 triggered by <b>10.65</b> .  | • See <b>10.65</b> .   |
| 44  | User 4                           | User trip 4 triggered by <b>10.67</b> .  | • See <b>10.67</b> .   |
| 45  | User 5                           | User trip 5 triggered by the serial link <b>10.38</b> = 45                                       | • See <b>10.38</b> .   |
| 46  | User 6                           | User trip 6 triggered by the serial link <b>10.38</b> = 46                                       |  |
| 47  | User 7                           | User trip 7 triggered by the serial link <b>10.38</b> = 47                                       |  |
| 48  | User 8                           | User trip 8 triggered by the serial link <b>10.38</b> = 48                                       |  |
| 49  | User 9                           | User trip 9 triggered by the serial link <b>10.38</b> = 49                                       |  |
| 50  | User 10                          | User trip 10 triggered by the serial link <b>10.38</b> = 50                                      |  |



| No. | Parameter-setting interface name | Reason for trip   | Solution  |
|-----|----------------------------------|---|---|
| 51  | <b>DO2 MDX-I/O over Id</b>       | The DO2 output load current (MDX-I/O option) is >200 mA   | Check that DO2 is not short-circuited.  |
| 52  | <b>DO3 MDX-I/O over Id</b>       | The DO3 output load current (MDX-I/O option) is >200 mA   | Check that DO3 is not short-circuited.  |
| 53  | <b>MDX-I/O link</b>              | Communication problem between the drive and the MDX-I/O option  | Check the MDX-I/O option mounting.  |
| 54  | Not used                         |   |   |
| 55  | <b>Unstable DC bus</b>           | The drive DC bus oscillates significantly   | <ul style="list-style-type: none"> <li>• Check the balancing of the mains phases.</li> <li>• Check that all 3 mains phases are present.</li> </ul>  |
| 56  | <b>IGBT V</b>                    | Internal protection of phase V IGBTs  | <ul style="list-style-type: none"> <li>• Check the motor and cable insulation.</li> <li>• Run power diagnostics.</li> </ul>   |
| 57  | <b>IGBT W</b>                    | Internal protection of phase W IGBTs  |   |
| 58  | <b>IGBT V overheating</b>        | Overheating of phase V IGBTs  | <ul style="list-style-type: none"> <li>• Clean the cabinet dust filters.</li> <li>• Check the drive ventilation units are working correctly.</li> <li>• Check that the product air inlet temperature is not outside the limits.</li> <li>• If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency have been complied with.</li> <li>• Check that the switching frequency <b>05.18</b> is compatible with the motor current level.</li> </ul> |
| 59  | <b>IGBT W overheating</b>        | Overheating of phase W IGBTs  |   |
| 60  | <b>Diagnostic</b>                | Problem detected during the control and interface boards test, the power test or during the self-test | <ul style="list-style-type: none"> <li>• Check that the STO1 and STO2 inputs are closed.</li> <li>• See diagnostic error table.</li> </ul>  |
| 63  | <b>STO input inconsistency</b>   | The STO1 and STO2 inputs have had a different state for more than 100 ms                              | Check the remote control link for the STO1 and STO2 inputs.   |
| 65  | <b>10V over Id</b>               | Overload on the +10 V power supply  | Check the I/O wiring  |
| 66  | <b>DO1 over Id</b>               | The DO1 output load current is >200 mA  | Check that DO1 is not short-circuited.  |
| 67  | Not used                         |   |   |
| 68  | <b>Motor overcurrent</b>         | The current has exceeded the limit programmed in <b>05.55</b> . The load is too high for the setting. | Check that <b>05.55</b> is consistent with the application.   |
| 69  | <b>24 V MDX-I/O over Id</b>      | The 24 V load current is too high   | Check the MDX-I/O option I/O wiring.  |
| 70  | <b>4 mA loss on MDX-IO AI4</b>   | Loss of the current reference on analog input AI4 of the MDX-I/O option                               | Check the input wiring and source of the MDX-I/O option.  |
| 71  | <b>4 mA loss on MDX-IO AI5</b>   | Loss of the current reference on analog input AI5 of the MDX-I/O option                               |   |
| 101 | <b>AC mains loss</b>             | Loss of AC supply   | <ul style="list-style-type: none"> <li>• Check the input fuses</li> <li>• Check the quality of the power supply (voltage dips)</li> </ul>   |
| 102 | Not used                         |   |   |

## 7 - MAINTENANCE

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

There are very few maintenance and repair operations to be performed by the user on **Powerdrive MD2MS** drives. Regular servicing operations are described below.

### • Servicing

Printed circuits and drive components do not normally require any maintenance. Contact your vendor or the nearest approved repair company in the event of a problem.

#### CAUTION:

**Do not dismantle the printed circuits while the drive is still under warranty, as this immediately makes the warranty null and void.**

Do not touch the integrated circuits or the microprocessor with your fingers (ESD risk).

From time to time, with the drive powered down, check that the power connections are correctly tightened. The door filters must be checked and changed regularly depending on their state.

### • Preventive maintenance

| Device                                   | Action          | Frequency |
|--|-----------------|-----------|
| Door filters (10µm)                      | Clean (1)       | 3 months  |
|  | Replace         | 2 years   |
| Power connections                        | Check tightness | 1 year    |
| Internal ventilation and in cabinet roof | Replace         | 5 years   |
| Surge suppressor board                   | Replace         | 5 years   |

(1) Door filters are washable.

## 7.1 - Storage

The **Powerdrive MD2MS** incorporates aluminium electrolytic capacitors.

If the drive has been stored for more than 12 months, it must therefore be switched on for 5 hrs at the rated operating voltage, and this operation must be repeated every 6 months. If the drive has been stored for more than 36 months, the capacitors must be reformed.

This consists of gradually applying a DC voltage to the banks of capacitors, until voltage values close to the rated voltages are achieved, while ensuring that the dissipated power does not exceed the maximum values authorised by the manufacturer.

An instruction sheet is available - please contact your local technical support.

## 7.2 - Replacing products

#### CAUTION:

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

### 7.3 - List of spare parts

#### 7.3.1 - First emergency kit

| Ratings    | LS Code      |
|------------|--------------|
| MD2MS 60T  | KITSPMD260T  |
| MD2MS 75T  | KITSPMD275T  |
| MD2MS 100T | KITSPMD2100T |
| MD2MS 120T | KITSPMD2120T |
| MD2MS 150T | KITSPMD2150T |
| MD2MS 180T | KITSPMD2180T |
| MD2MS 220T | KITSPMD2220T |
| MD2MS 270T | KITSPMD2270T |

Each kit is composed of the following parts :

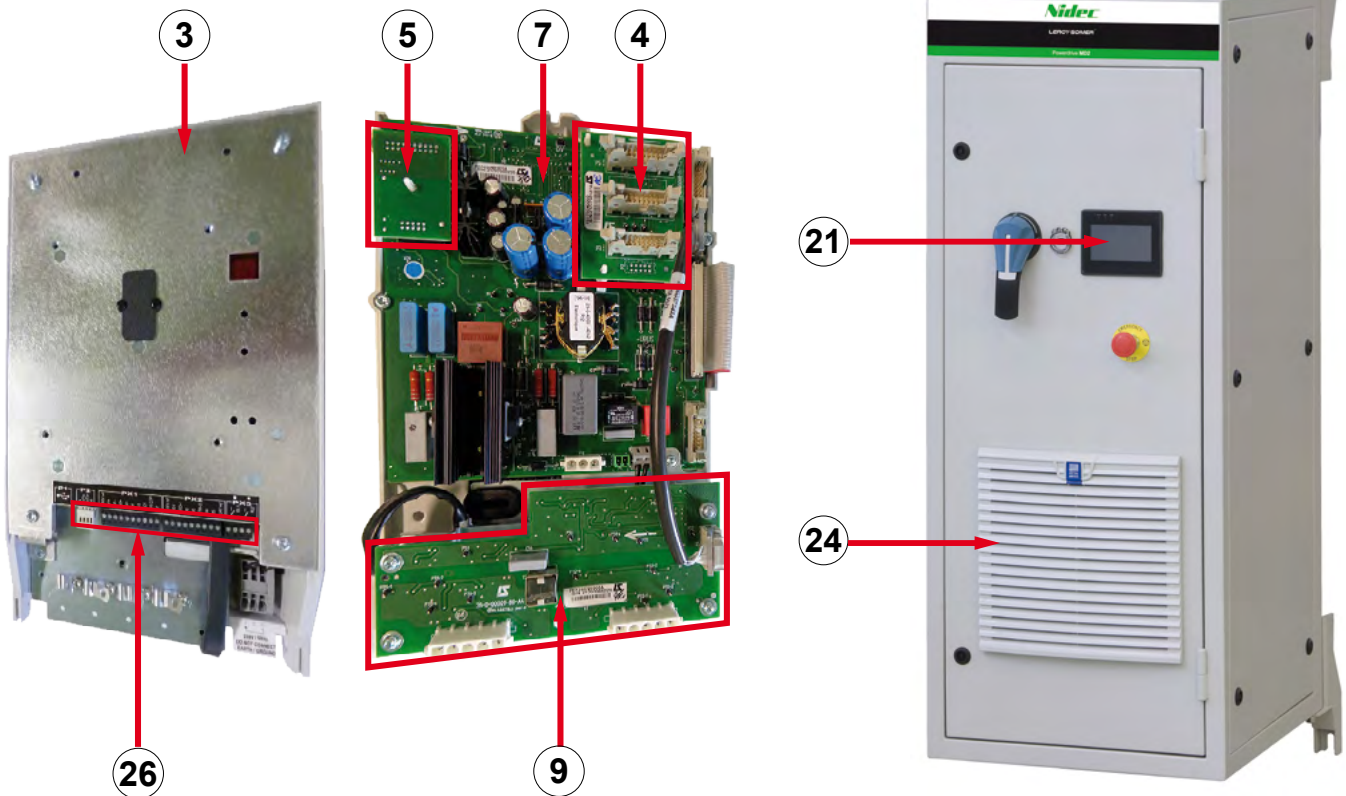
| Key | Description          | Qty |
|-----|----------------------|-----|
| 1   | Rectifier module     | 1   |
| 2   | Inverter module      | 1   |
| 3   | Control board        | 1   |
| 6   | DC bus sensing board | 1   |
| 7   | Interface board      | 1   |
| 8   | EMC Board            | 1   |
| 20  | high speed fuses kit | 1   |
| 25  | control fuses kit    | 1   |
| 30  | Cooling fan          | 1   |

#### 7.3.2 - Electronic PCB

| Key | Description                             | LS code      |
|-----|---|--------------|
| 3   | Control board                           | PEF400NB000A |
| 4   | Distribution board Ratings 60T to 150T  | PEF190NE000A |
|     | Distribution board ratings 180T to 270T | PEF720NG000  |
| 5   | Rating identification Board             | Consult. LS  |
| 7   | Interface board                         | PEF400NE001A |
| 9   | Voltage sensing Board                   | PEF280NH000A |
| 26  | Control board terminal blocs            | KITCTRLTERM  |

#### 7.3.3 - Front panel mounted parts

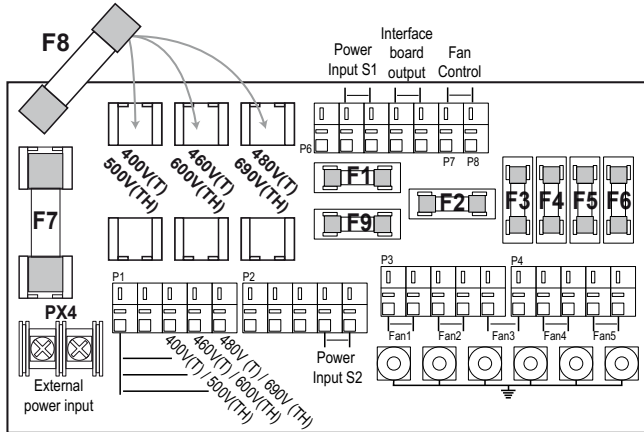
| Key | Description                | LS code         |
|-----|----------------------------|-----------------|
| 21  | HMI : MDX POWERSCREEN      | RDKITIHMMD0SPR2 |
| 24  | Enclosure Outlet filter    | VEN323FV000     |
|     | Set of 5 filter cartridges | 40018862        |



### 7.3.4 - Remote control fuses

- Fuse board (Key 10)**

Board reference: PEF28ANE000A.



- Protection fuses for the forced ventilation units :**

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

F3 to F6 are not used on ratings 60T to 150T.  
F4 to F6 are not used on ratings 180T à 270T.

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

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

Note: F9 is not used on the **Powerdrive MD2MS**

- Protection fuses for the transformer primary :**

| Fuse | Size    | Type   | Value   |
|------|---------|--------|---------|
| F7   | 10 x 38 | aM/ATQ | 4A/500V |
| F8   |         |        |         |

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

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

| Fus.    | Size   | Type | Value     |
|---------|--------|------|-----------|
| F1 / F2 | 6 x 32 | FA   | 2A / 660V |

- Fuse kit (Key 25)**

All **Powerdrive MD2MS** control fuses can be order in the kit : **EDA016LF006**. It included the following parts :

- 3 fus. 5X20 1,25A
- 3 fus. AM 10X38 4A
- 3 fus. AM 10X38 6A
- 3 fus. T6X32 2A

### 7.3.5 - Power input high speed fuses (Key 20):

These fuses are located on the input choke. Each phase is equipped with a fuse.

| Rating | Size | Value       | 3 fuses kit |
|--------|------|-------------|-------------|
| 60T    | T30  | 200A / 660V | EDA200LF001 |
| 75T    | T31  | 250A / 660V | EDA250LF000 |
| 100T   | T31  | 315A / 660V | EDA315FU001 |
| 120T   | T31  | 350A / 660V | EDA350LF000 |
| 150T   | T31  | 450A / 660V | EDA450LF000 |
| 180T   | T31  | 500A / 660V | EDA500LF001 |
| 220T   | T33  | 630A / 690V | EDA630LF000 |
| 270T   | T33  | 800A / 690V | EDA800LF000 |

### 7.3.6 - Power modules

- Rectifier module (Key 1)**

| Rating      | Qty | LS Code |
|-------------|-----|---------|
| 60T - 75T   | 1   | MPRB    |
| 100T - 120T | 1   | MPRC    |
| 150T        | 1   | RDMPRD  |
| 180 T- 220T | 1   | MPRE    |
| 270T        | 1   | RDMPRF  |

- Inverter module (Key 2)**

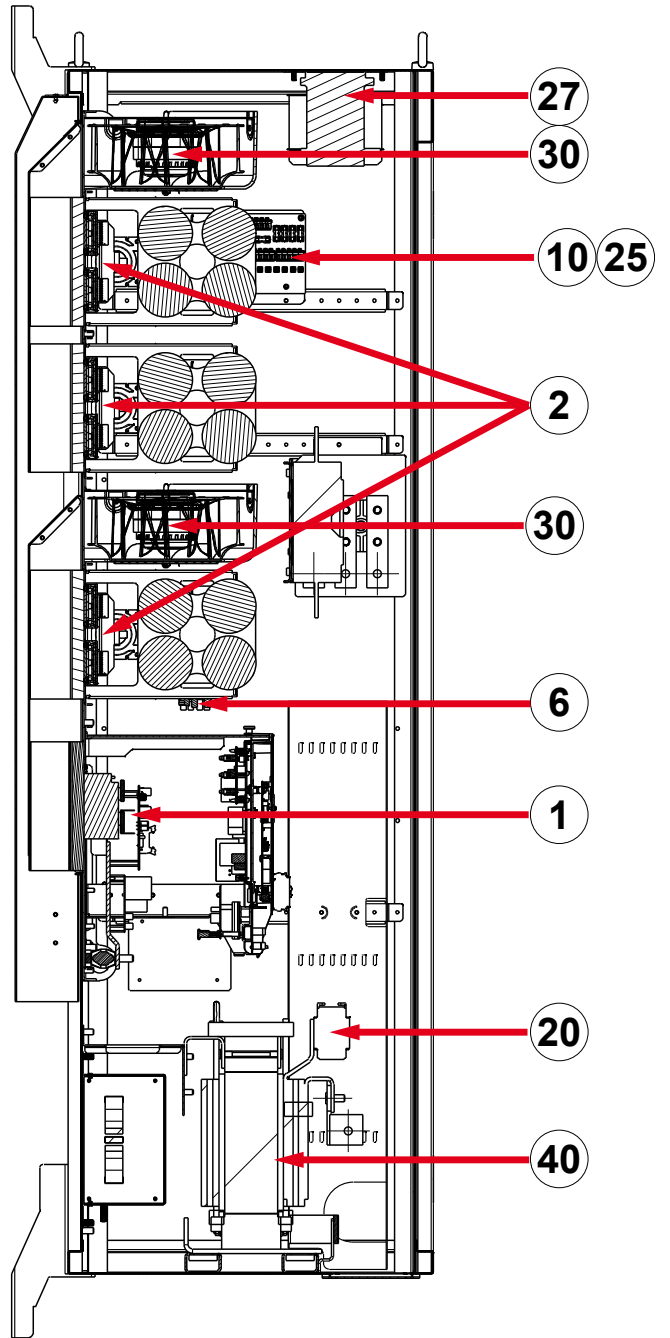
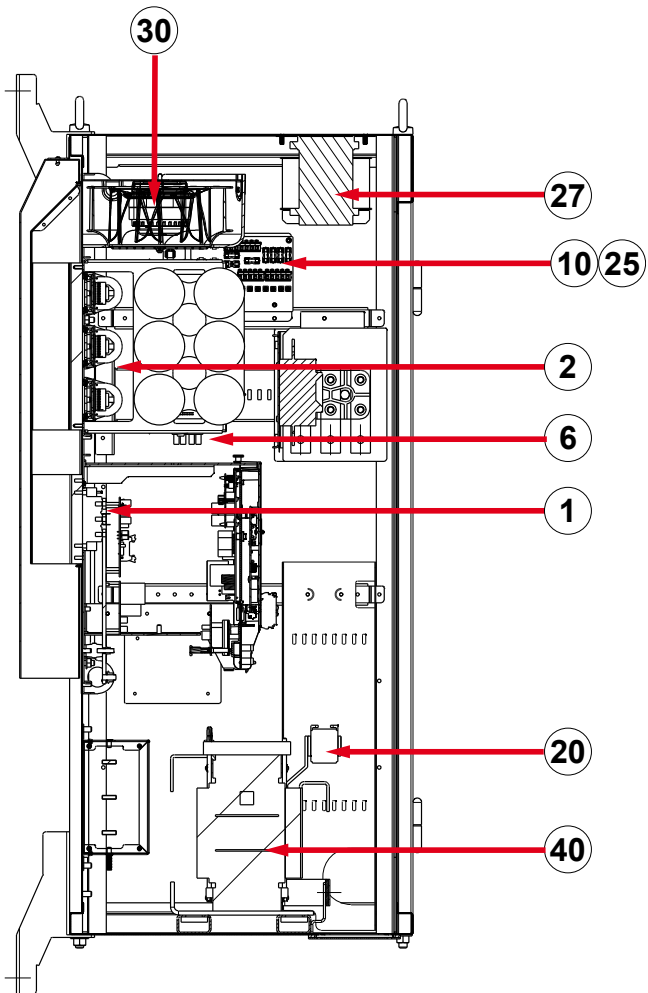
| Rating | Qty | LS Code |
|--------|-----|---------|
| 60T    | 1   | RDMPOA  |
| 75T    | 1   | MPOC    |
| 100T   | 1   | RDMPOD  |
| 120T   | 1   | MPOE    |
| 150T   | 1   | RDMPOF  |
| 180T   | 3   | MPOG    |
| 220T   | 3   | MPOH    |
| 270T   | 3   | RDMPOI  |

### 7.3.7 - Other parts

| Key | Description              | Qty | LS code                         |
|-----|--------------------------|-----|---------------------------------|
| 6   | DC bus sensing board     | 1   | PEF720NH000                     |
| 8   | EMC Board                | 1   | PEF180NA000A<br>or PEF180NA002A |
| 30  | Cooling fan 60T to 150T  | 1   | BLOCVF3MDVIR                    |
|     | Cooling fan 180T to 270T | 2   |                                 |
| 27  | Transformer              | 1   | TRF750MA003                     |
| 40  | Line choke               | 1   | Consult LS                      |

MD2MS ratings 60T to 150T

MD2MS ratings 180T to 270T







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

Limited company with capital of 38,679,664 €  
RCS Angoulême 338 567 258

[www.leroy-somer.com](http://www.leroy-somer.com)