

Installation Guide

**Powerdrive MD Smart
T0 MD3 Series**



33TN to 75TN

Reference: 6231 en - 2026.04 / b

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

**CAUTION**

For the safety of the user, this variable speed drive must be connected to an approved earth (terminal $\frac{1}{\text{E}}$). If accidentally starting the installation is likely to cause a risk to people or to the machines being driven, it is essential to comply with the power connection diagrams recommended in this manual.

The drive is fitted with safety devices which, in the event of a problem, control stopping and thus stop the motor. This motor itself may also become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, can also cause the motor to stop. The removal of the causes of the stoppage can lead to restarting, which could be dangerous for certain machines or installations, in particular those which must comply with Appendix 1 of Decree 92.767 of 29 July 1992 on safety.

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 capable of powering a motor and the driven machine above its rated speed. If the motor or machine is not mechanically designed to withstand such speeds, the user could be exposed to serious danger resulting from their mechanical deterioration.

Before programming a high speed, it is important that the user checks that the installation can withstand it.

The variable speed drive which is the subject of this manual is designed to be integrated in an installation or an electrical machine, and cannot under any 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 persons and property.

In the event of non-compliance with the above provisions, LEROY-SOMER disclaims any and all liability.

.....

This manual only describes the general features, characteristics, and installation of the Powerdrive MD Smart T0. For commissioning, refer to manual ref. 5641.



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

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

1 - General information

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

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

For further information, see the documentation.

All work relating to transportation, installation, commissioning, and maintenance must be performed by qualified and certified 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 who possess the relevant qualifications.

2 - Use

Variable speed drives are components designed for integration in electrical installations or 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). Observe the EN 60204 standard, which stipulates in particular that electric actuators (including variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches. Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2014/30/EC) are met.

The variable speed drives meet the requirements of the Low Voltage Directive 2014/35/EU. The harmonized standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable. The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage

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

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

4 - Installation

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

Variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearances between components during transportation and handling.

Avoid touching the electronic components and contact parts.

Variable speed drives contain parts that are sensitive to electrostatic charges and can easily be damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!).

5 - Electrical connection

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

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

The requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct laying of cables and conductors, are given in the documentation supplied with the variable speed drives. These requirements must be complied with in all cases, even when the drive bears the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation

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

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

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

7 - Servicing and maintenance

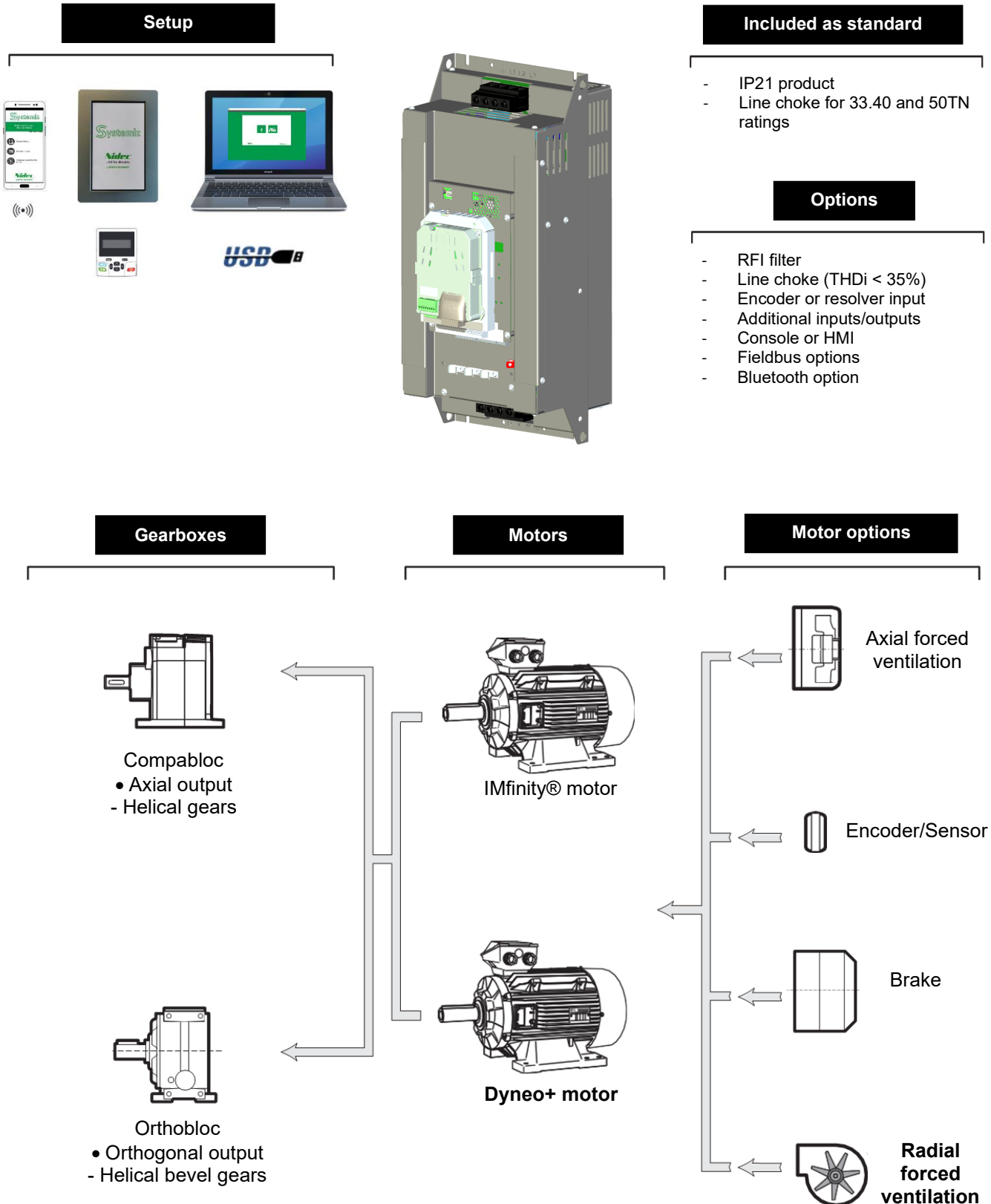
Refer to the manufacturer's documentation.

See the Maintenance chapter in this document.

This manual is to be given to the end user.

This manual describes the installation of **Powerdrive MD Smart T0** variable speed drives. It also details all its options and extensions adapted to the user's needs.

POWERDRIVE MD Smart T0



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1 - GENERAL INFORMATION

1.1 General information

The **Powerdrive MD Smart T0** is a variable speed drive with very high performance levels that can be used to control:

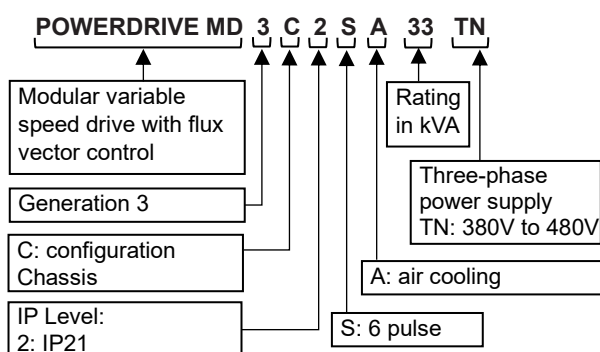
- Induction motors without a speed sensor (open loop mode) for applications that do not need rated torque control above 1/10th of the rated speed.
- Induction motors or synchronous permanent magnet motors with virtual speed feedback (flux vector mode with software sensor function) for applications that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

Combined with the MDX-ENCODER option, the **Powerdrive MD Smart T0** is a drive that can also be used to control induction or synchronous magnet machines for applications that require very high dynamic performances or torque control from zero speed (closed loop vector mode with speed feedback).

⚠ • **Powerdrive MD Smart T0 drives are intended to be installed in a cabinet or enclosure to protect them from conductive dust and condensation.**

No access allowed to unauthorised persons.

1.2 Product designation



Type plate:

 Bvd Marcelin Leroy, CS10015 16915 Angoulême cedex 9, France		INPUT				
		Ph	V(kV)	Hz(Hz)	I(A)	(kW)
		0	000-000	000-000	000-000	000/000
		OUTPUT				
		Ph	V(kV)	Hz(Hz)	I(A)	(kW)
		0	000-000	000-000	000-000	000/000
for use on any supply type i.e TN-S, TN-C-S, TT and IT						
E211799		P/N: POWERDRIVE		MD3C2SA33TN		
 		Type: 123456789012345				
		S/N: 09999999999				

1.3 Environmental characteristics

1.3.1 Environmental characteristics during transportation and storage

Parameter	Standard	Value limits
Storage temperature	Class 1K5 of EN60721-3-1	-40°C to +70°C
Storage humidity	Class 1K3 of EN60721-3-1	5% to 95% RH
Temperature cycle during transportation	Class 2K4 of EN60721-3-2	5 cycles: -40°C/+30°C 95%RH
Vibrations during transportation	Class 2M2 of EN60721-3-2	3.5 mm from 2 to 9Hz 10 ms ⁻² from 9 to 200Hz
Shocks during transportation	Class 2M2 of EN60721-3-2	10g peak, 11ms pulse duration, half sine, 100 shocks in each direction
Free fall during transportation	Class 2M2 of EN60721-3-2	1m (20 to 100kg) 0.25m (>100kg)

1.3.2 Environmental conditions during operation

Parameter	Standard	Value limits
Protection		IP21
Ambient operating temperature		-10°C to +40°C without derating Up to 70°C with derating
Humidity		< 90% non-condensing
Altitude		1000 m without derating Up to 3000m with derating
Pollution level		Dry non-conductive pollution only (pollution degree 2 according to IEC60664-1)
Vibrations	Class 3M1 of EN60721-3-3	0.6 mm peak displacement from 2 to 9 Hz Peak acceleration of 2 m/s ² from 9 to 200 Hz
Atmosphere pressure		700 hPa to 1060 hPa

1.4 Standards

The **Powerdrive MD Smart T0** drives have been designed and manufactured in accordance with the following standards and directives:

1.4.1 European Standards

EN 61800-5-1 2023	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-5-2 2017	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional
EN60204-1:2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 61800-3 2018	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
EN 63000 2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
EN60529:1992/A1:2000/A2:2014	Degrees of protection provided by enclosures
EN61800-9-2: 2018	Adjustable speed electrical power drive systems (PDS) - Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Energy efficiency indicators for power drive systems and motor starters
IEC/EN 62061 2005; SIL3	STO-1 and STO-2 inputs §3.3
Self-certification	"FORCE START" or "FIRE MODE" certification

1.4.2 US and Canada Standards

UL 61800-5-1 2022 CUR E211799	Safety standard: Adjustable speed electrical power drive systems
CSA22.2 No. 274-2017	Adjustable speed drives

1.4.3 Directives

2014/35/EU	Low Voltage Directive
2014/30/EU	Electromagnetic Compatibility Directive
2011/65/EU	ROHS Directive 2
2014/53/EU	Radio Equipment Directive (RED)
2006/42/EC	Machinery Directive
Ecodesign Directive 2009/125/EC & Ecodesign implementing commission regulation (EU) 2019/1781	ERP Directive

1.5 Electrical characteristics



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

1.5.1 General characteristics

Characteristics	Level
Power supply voltage	Three-phase power supply: 400V -10% to 480V +10% ("TN" ratings)
Interphase voltage imbalance	< 2%
Input frequency	5% around the rated frequency (50 or 60 Hz)
Maximum number of power-ons per hour (power)	20
Output frequency range	0 to 590 Hz

1.5.2 Electrical characteristics at 40°C

I_{co}: Continuous output current

P_{out}: Output power.

I_{max} (60s): Maximum output current, available for 60 seconds every 600 seconds

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

400V to 480V 3-phase supply

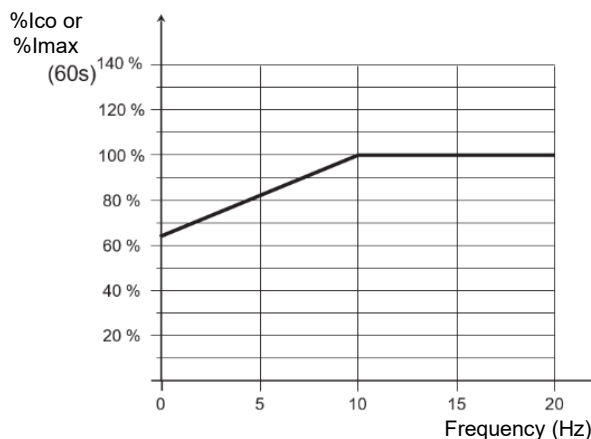
Switching frequency = 3 kHz - ambient temperature ≤ 40°C - altitude ≤ 1000m

Rating	Heavy duty		Normal duty		I _{max} (3s) (A)	I _{max} (60s) (A)
	P _{out} at 400V (kW)	I _{co} (A)	P _{out} at 400V (kW)	I _{co} (A)		
33 TN	22	45	30	58	69	63
40 TN	30	54	37	70	83	77
50 TN	37	68	45	88	104	96
60 TN	45	88	55	112	134	123
75 TN	55	110	75	140	168	154

1.5.3 Derating at low frequency

Measuring the temperature of the power bridges in conjunction with thermal modelling of the IGBTs ensures protection against overheating of the **Powerdrive MD Smart T0**.

At low frequencies, IGBT modules are subject to significant temperature cycling, which can shorten their service life. It is necessary to take into account the curve opposite which indicates the derating for the output current when operating at low frequency in continuous and transient operation.



1.5.4 Derating according to the temperature and switching frequency

Rating	Ambient temperature	Ico current Continuous output current (A)									
		Normal duty (ND)				Heavy duty (HD)				I _{max} 3s (A)	I _{max} 60s (A)
		3kHz	4kHz	6kHz	8kHz	3kHz	4kHz	6kHz	8kHz		
33TN	40°C	58	52	44	38	45	41	34	30	70	64
	50°C	52	48	40	35	41	37	31	27		
40TN	40°C	70	63	53	46	54	50	42	37	84	77
	50°C	63	58	48	42	50	45	38	33		
50TN	40°C	88	79	66	58	68	62	52	46	104	96
	50°C	79	72	60	53	62	56	47	41		
60TN	40°C	112	92	79	66	88	73	62	52	134	123
	50°C	89	84	72	60	70	66	57	47		
75TN	40°C	140	115	99	83	110	91	78	65	168	154
	50°C	111	105	90	75	87	82	71	59		

2 MECHANICAL INSTALLATION



• It is the responsibility of the owner or user of the Powerdrive MD Smart T0 to ensure that the installation, operation and maintenance of the drive and its options comply with legislation relating to the safety of people and property, and with the current regulations in the country of use.

• Powerdrive MD Smart T0 drives must be installed in an environment free of conductive dust, corrosive fumes 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 certified.

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

• The casing of the Powerdrive MD Smart T0 is not non-flammable; if necessary, use a fire cabinet.

2.1 Acceptance checks

Before installing the Powerdrive MD Smart T0, check that:

- the drive has not been damaged during transportation,
- the information on the nameplate is compatible with the power supply.

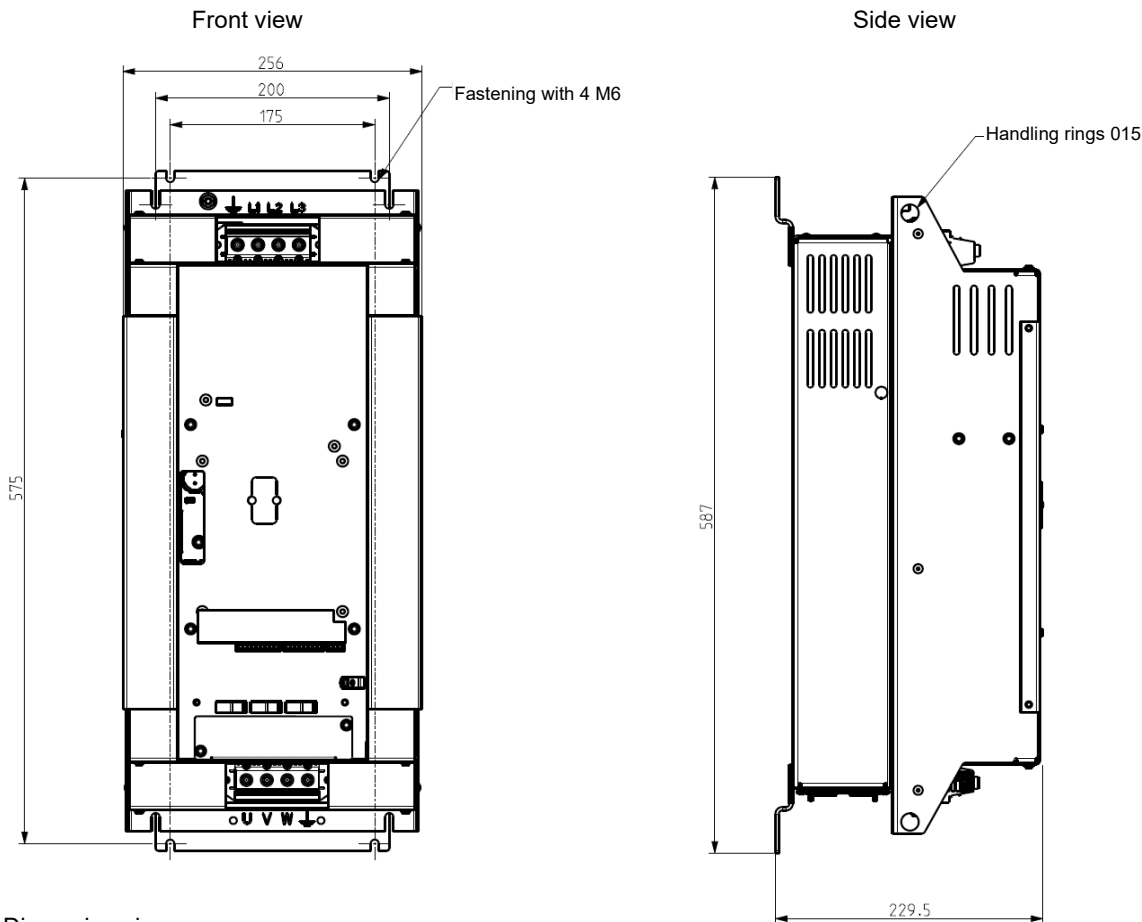
2.2 Dimensions



CAUTION:

In the cabinet, a minimum distance of 100 mm is required between 2 drives, and 200 mm above and below the drive.

2.2.1 Surface mounting

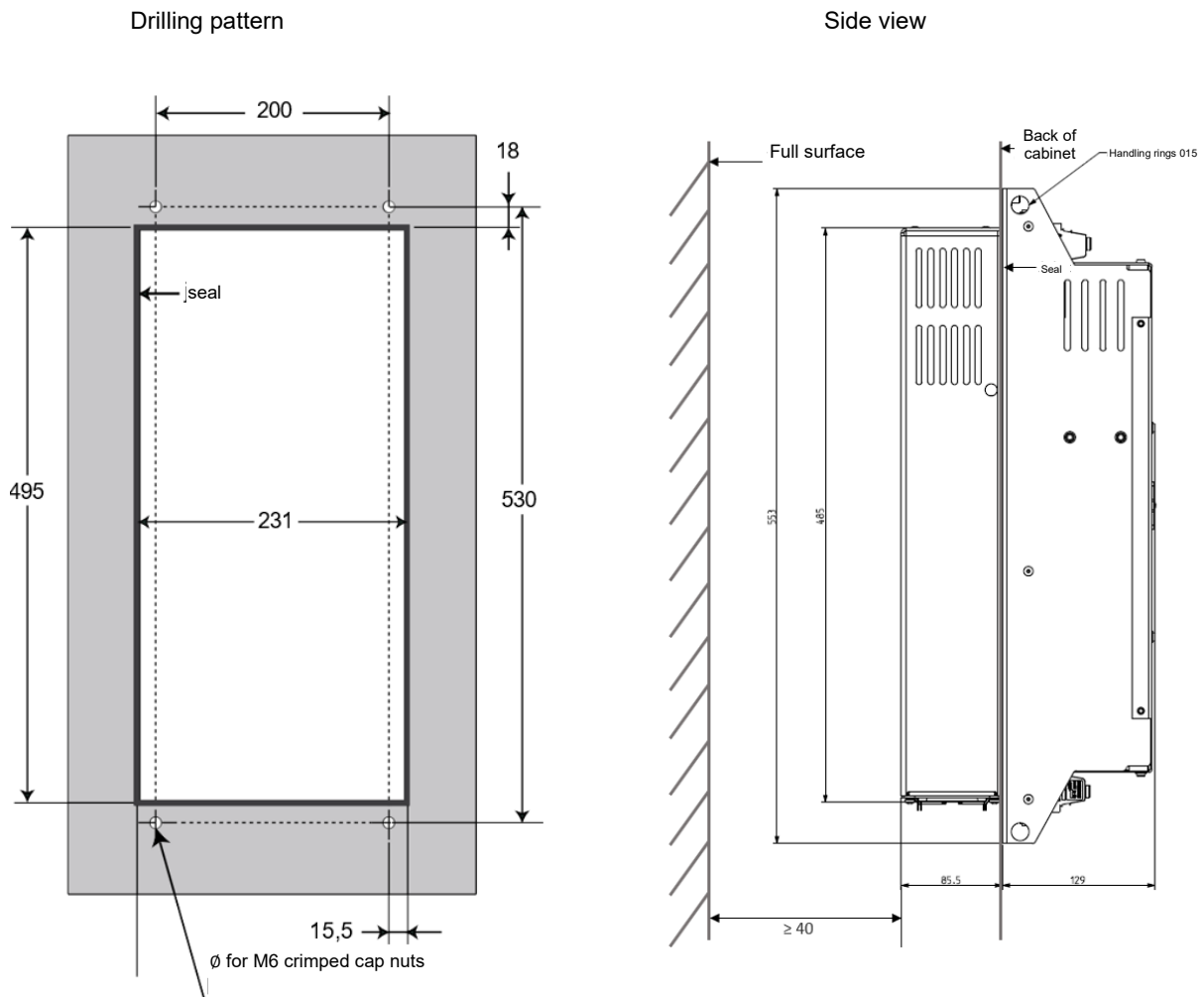


Dimensions in mm

- (*) • With MDX-I/O M2M option, add +25 mm
 • With MDX-ENCODER, MDX-RESOLVER, MDX-I/O Lite option or MDX-Fieldbus, add +30 mm
 (the 2 types of option can be combined, i.e. an additional 55 mm)

2.2.2 Flush-mounted

The **Powerdrive MD Smart T0** is delivered with the mounting brackets fitted, ready for surface mounting. For flush mounted, remove the brackets and follow the instructions described below.



Dimensions in mm

- (*) • With MDX-I/O M2M option, add +25 mm
- With MDX-ENCODER, MDX-RESOLVER, MDX-I/O Lite option or MDX-Fieldbus, add +30 mm
(the 2 types of option can be combined, i.e. an additional 55 mm)

2.3 Weights

Weights (kg)	33TN	40TN	50TN	60TN	75TN
		25			22



• It is necessary to provide the appropriate handling equipment according to the weight of the drives.

2.4 Losses, ventilation flow and noise levels

• Losses

Losses* (W)	33TN	40TN	50TN	60TN	75TN
Totals	800	980	1150	1450	1850
Wiring inside the cabinet (flush mounting)	90	100	110	140	170

(*) Maximum losses for normal duty operation at the output currents I_{∞} given in [§1.5.3](#).

• Forced ventilation flow rates

Forced ventilation	33TN	40TN	50TN	60TN	75TN
Flow rate (m ³ /h)	230			340	

• Noise

Noise	33TN	40TN	50TN	60TN	75TN
Level (dBA)	52			56	

3 CONNECTIONS



• All connection work must be carried out according to the laws in force in the country where the variable speed drive is installed. This includes earthing or bonding to ensure that no part of the drive directly accessible to the user can be at mains potential or at any other voltage which may be dangerous and cause serious injury, malfunction, or electromagnetic interference.

• Voltages on the mains, motor, or filter cables or connections can cause fatal electrical shocks. In all cases, avoid contact with these items.

• The variable speed drive must be powered via a cut-off device in order to be able to turn it off safely.

• The power supply of the drive must be protected against overloads and short circuits.

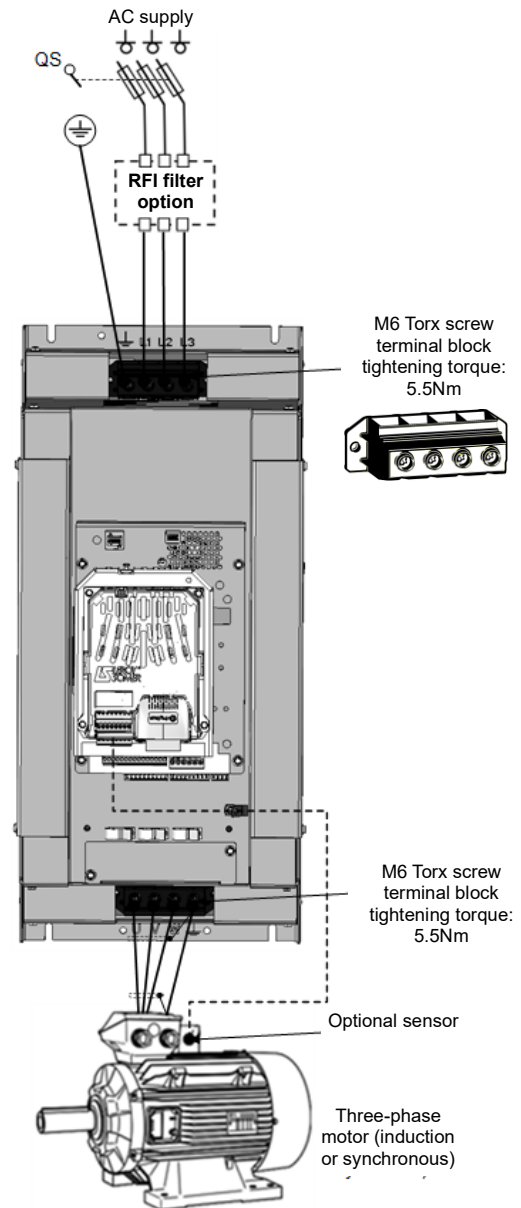
• The drive stop function does not protect against high voltages on the terminal blocks.

• Check that the voltage and current of the drive, the motor and the AC supply are compatible.

• After the drive has been operated, keep away from the heatsink as it may be very hot (70°C).

• When the drive controls a permanent magnet motor, only one motor can be connected to the output of the drive. It is recommended to install a cut-off device between the permanent magnet synchronous motor and the output of the drive. This switch is used to isolate the motor during maintenance work on the drive.

3.1 Power supply connections



QS: Fuse switch. Need to open QS before working on the electrical parts of the drive or motor

3.1.1 Connection terminal characteristics

Marking	Functions/connections	Type of connection and tightening torque
L1, L2, L3, PE	AC power supply (on choke)	M6 Torx screw terminal block - 5.5 Nm
U, V, W, PE	Motor outputs	M6 Torx screw terminal block - 5.5 Nm
PE	Earth	M6 screw - 5.5 Nm



Do not exceed the indicated maximum tightening torque.

3.1.2 Cables and fuses



It is the responsibility of the user to connect and fit protective devices for the Powerdrive MD Smart T0 in accordance with the legislation and regulations in force in the country in which it is used. This is particularly important as regards the size of the cables, the type and rating of fuses, the earth or grounding 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 not under any circumstances be used in place of the current standards.

I_{co} : Continuous output current

I_L max: Maximum authorised continuous line current

Powerdrive MD Smart MD3 T0		AC supply								Motor (1)	
		400V - 50Hz				460/480V - 60Hz				I_{co} (A)	Cable cross-section (mm ²) (2)
		I rated (A)	I_L max (A)	Fuse gS (A)	Cable cross-section (mm ²) (2)	I rated (A)	I_L max (A)	Fuse J (A)	Cable cross-section (mm ²) (2)		
33TN	Heavy	42	47	63	3x10 + 10	37	40	70	3x10 + 10	45	3x10 + 10
	Normal	57	60	80	3x16 + 16	50	55	90	3x16 + 16	54	3x16 + 16
40TN	Heavy	57	60	80	3x16 + 16	50	55	90	3x16 + 16	54	3x16 + 16
	Normal	68	75	100	3x25 + 15	59	65	110	3x25 + 16	68	3x25 + 16
50TN	Heavy	68	75	100	3x25 + 16	59	65	110	3x25 + 16	68	3x25 + 16
	Normal	83	90	125	3x35 + 25	72	80	125	3x25 + 16	88	3x35 + 25
60TN	Heavy	83	90	125	3x35 + 25	72	80	125	3x35 + 16	88	3x35 + 25
	Normal	100	110	160	3x35 + 25	87	100	150	3x35 + 16	110	3x35 + 25
75TN	Heavy	100	110	160	3x35 + 25	87	100	150	3x35 + 16	110	3x35 + 25
	Normal	137	150	-	3x70 + 35	117	130	200	3x50 + 25	140	3x70 + 35

(1) The rated current value and the motor cable cross-sections are given as a rough guide. As a reminder, the admissible rated motor current for by the drive varies according to the switching frequency and temperature.

(2) The recommended cross-sections are for symmetrical shielded cable (shielded 3-core cables with symmetrical conductors for protective earthing (PE)) with a maximum length of 10m. For longer cables, take line drops due to the length into account.

Suitable for use on A circuit capable of delivering not more than 5kA rms Symmetrical Amperes from 33TN to 40TN and 10kA rms Symmetrical Amperes from 50TN to 75TN drive rating.

600 Vac maximum, when protected by UL fuse listed on above table column "Fuse gS (A)" and Column "Fuse J (A)" based on AC Supply Voltage.

Note:

- The cable cross-sections are defined according to the following template:
E.g.: for a 75TN drive in normal duty, the cable cross-section is noted as (3 x 70 + 35); i.e., 1 harness comprising 3 phase conductors with a cross-section of 70 + 1 earth conductor with a cross-section of 35.
- The output currents I_{sp} are given at an ambient temperature of +40°C. For a temperature above +40°C, derate the current by 1.5% per additional degree up to a maximum temperature of +50°C.
- On 400V 50Hz AC networks, gS type fuses will protect semiconductors against short-circuit and overload currents. In the case of the 75TN rating in normal duty, it is recommended to protect the drive with 2 fuses, an aR type fuse (250A) associated with a gG type device (C-curve 160A circuit breaker) to be installed at the head of the line.
- On 460V-480V 60Hz AC networks, UL Class J fuses (HSJ, ATJ,...) are ultra-fast fuses that will protect the drive against short-circuit and overload currents.

3.2 Connection of the control

⚠ • The Powerdrive MD Smart T0 inputs have a positive logic configuration. Using a drive with a control system which has a different control logic may cause unexpected starting of the motor.

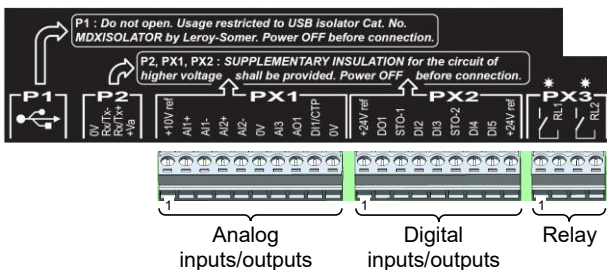
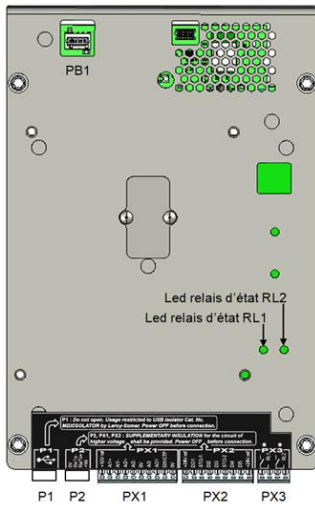
• The Powerdrive MD Smart T0 control circuit is isolated from the power circuits by single insulation. Its electronic 0V is connected to the connection terminal on the outer protective conductor (earth terminal). The installer must ensure that the external control circuits are isolated against any human contact.

• If the control terminals (PX1, PX2) need to be connected to circuits complying with SELV safety requirements, additional insulation must be inserted to maintain the SELV classification (see EN 61140).

• The output relays (PX3) are limited for OVCII (OverVoltage Category 2) use (RL1 and RL2 must have the same polarity). The voltage rating between two consecutive terminals must not exceed 150Vrms.

• For serial ports P1, P2 and PB1 see §5

3.2.1 Control terminal block location



Plug-in screw terminal block:
Tightening torque = 0.3 N.m/0.22 lb ft
Cross-section = 1.5 mm²
Flat-head screwdriver 2 mm

3.2.2 Control terminal block characteristics

3.2.2.1 PX1 terminal block characteristics

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

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

6	0V	0V common analog circuit
The 0V of the electronics is connected to the metal earth of the drive		

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

CONNECTIONS

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

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

10	0V	0V common analog circuit
The 0V of the electronics is connected to the metal earth of the drive		

3.2.2.2 PX2 terminal block characteristics

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

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

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

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

3.2.2.3 - PX3 terminal block characteristics

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

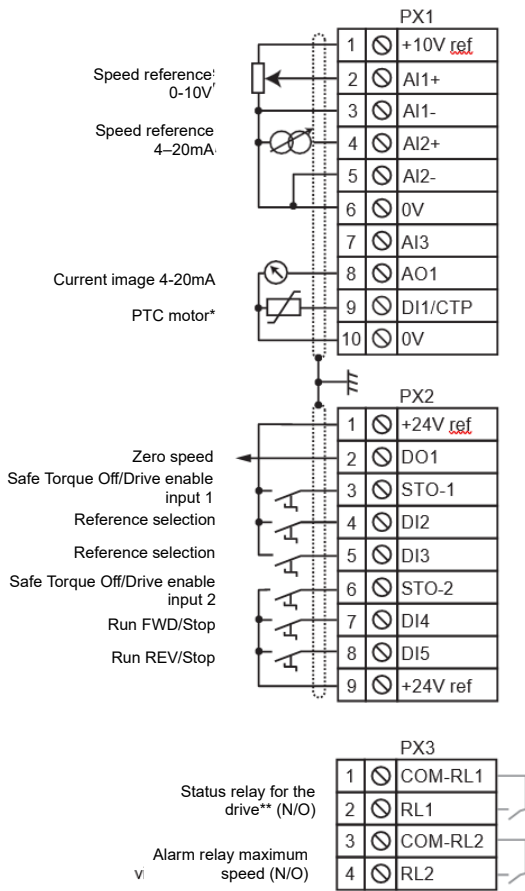


• Provide a fuse or other overcurrent protection in the relay circuit.

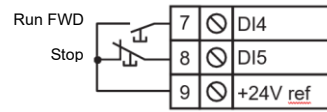
Note: When the RL1 or RL2 relay is activated, the corresponding status LED on the control board lights up.

3.2.3 Factory configuration of control terminal blocks

Note: For more details on settings, refer to the commissioning manual ref. 5641c-en



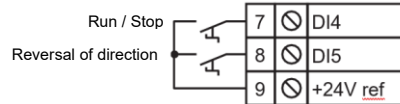
- Modification of the Run/Stop control logic
- For "3-wire" control (jog Run/Stop):



List of parameters to be set:

- #06.04 = Run Latched (1),
- #08.25 = 06.39 Stop (DI5 terminal).

- For Run/Stop control with change of direction:



List of parameters to be set:

- #06.04 = Run/Stop + change of direction (2),
- #08.24 = 06.34 Run/Stop (DI4 terminal),
- #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 (4-20mA) on analog input AI2+, AI2-
1	0	Preset reference 2 (RP2) #01.22 to be set
1	1	

Note: This configuration is 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.

(*) By default, the motor thermistor is disabled. If the motor thermistor needs to be connected to DI1/PTC, set #05.70 = Drive terminal (1)

(**) Relay RL1 opens if one of the STO inputs 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 each other. 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 the standards:

- EN 61800-5-2
- EN/ISO 13849-1: 2006; PL e
- 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 free-wheel mode.

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

If the data sent by the 2 inputs 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 with any installation, the complete machine must be subject to a risk analysis. The integrator shall determine the safety category with which the installation must comply.

- 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.

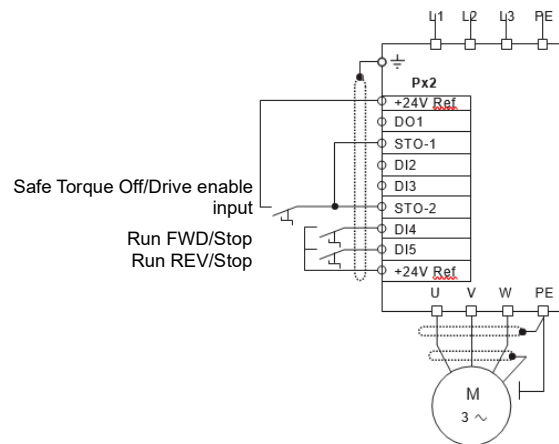
If braking needs to be a machine safety function, it must be provided by an electromechanical solution, since the dynamic braking by the drive function is not considered a safe disable function.

- 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 via an approved isolating device (isolator, switch, etc).

- The line switch integrated as an option in the drive does not isolate the drive input busbars. It must be associated with a cut-off device located on the control panel. In all cases, the interior of the drive may only be accessed after first disconnecting the distribution network power supply.

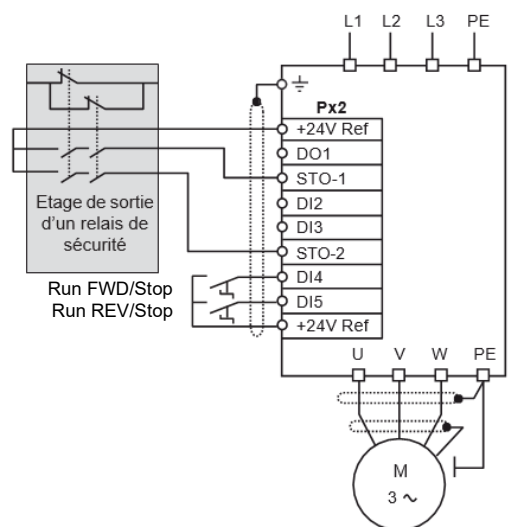
3.3.1 Single channel locking (SIL1 - PLb)

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



3.3.2 Double channel locking (SIL1 - PLb)

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



4 GENERAL EMC - HARMONICS - MAINS INTERFERENCE

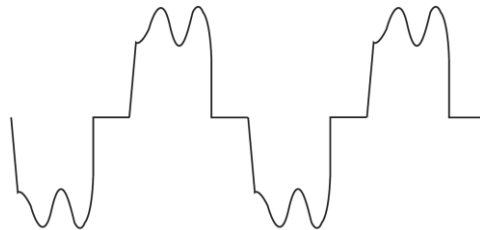
The power structure of frequency inverters leads to the occurrence of two types of phenomena:

- 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 of the rectifier bridge, and on the structure of the DC bus downstream of 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.

Under 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 information

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 information

Frequency inverters use high-speed switches (transistors, semi-conductors) which switch high voltages (> 550 V) at high frequencies (several kHz). This results in better efficiency and a low motor noise level.

As a result, they generate radio-frequency (RF) signals which may interfere with the operation of other devices 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 RF 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 power distribution company.

4.3.2 Standards

Standard EN 61800-3 defines the maximum emission levels to comply with according to the type of environment in which the drive is installed. In some cases, it may be necessary to add an external RFI filter (see [§5.3](#))

4.4 AC supply

4.4.1 General information

Each industrial power supply has its own intrinsic characteristics (short-circuit capability, voltage value and fluctuation, phase imbalance, etc.) and powers devices, 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 devices, especially variable speed drives.

The **Powerdrive MD Smart T0** is designed to operate with mains supplies typical of industrial sites around 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.).
- Power supply from overhead line

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

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

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

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

4.4.2.2 - Presence of commutation notches on the line

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

4.4.3 Mains short-circuit power

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.

The installation of additional chokes upstream of a **Powerdrive MD Smart T0** powered by an unbalanced network reduces the rate of current imbalance (see characteristics [§5.4](#)).

4.4.4 Ground connections

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

It is essential that the earth network is designed and implemented by the installation supervisor so that its impedance is as low as possible, in order 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.

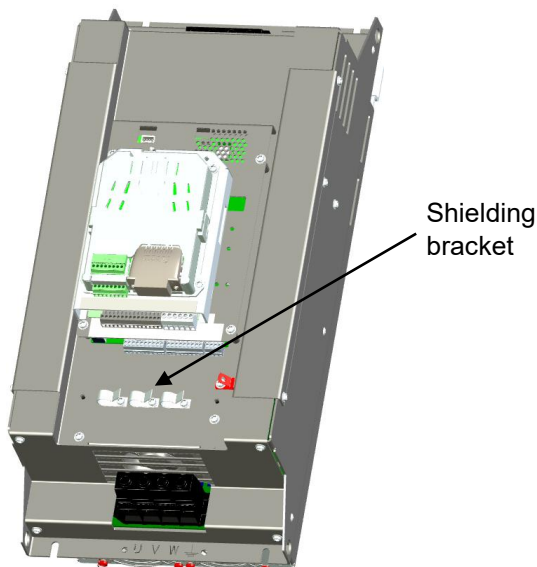
4.5 Basic wiring precautions for installation in a cabinet

These precautions must be taken into account when wiring the **Powerdrive MD Smart T0** drive in a cabinet and wiring the external components. In each paragraph, they are listed in decreasing order of effect on correct operation of the installation.



4.5.1 Wiring inside the cabinet

- Separate as far as possible control cables and power cables.
- For control cables, use shielded twisted cables and connect the shield to the drive grounding bracket.



4.5.2 Wiring inside the cabinet

4.5.2.1 - Control wiring

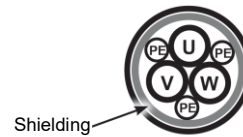
If the control cable needs to run outside the cabinet, use shielded twisted cables and connect the shield to the drive grounding bracket.

4.5.2.2 - Power wiring

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

Never use shielded single-core cables.

The recommended motor cable type is a shielded 3-core cable with symmetrical conductors for protective earthing .



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 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 AC power cables should not be routed side by side in the same channel to reduce proximity couplings.
- Refer to the EMC recommendations in §4.6 in order to comply with the maximum permitted lengths.

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/EN 61000-4-2	Electrostatic discharges	Product casing	6 kV "contact discharge" 8 kV "air discharge"
IEC/EN 61000-4-3	Immunity standards for radiated radio-frequency	Product casing	10V/m 80% AM (1 kHz) 80 to 1000 MHz»
IEC/EN 61000-4-4	Bursts of fast transients	Control cable	2 kV/5 kHz
		Power cable	4 kV/5 kHz
IEC/EN 61000-4-5	Shock waves	Power cables	2 kV between phase 4 kV between phase & earth
IEC/EN 61000-4-6	Generic immunity standards for conducted radio-frequency	Control cable and power cable	20V - 80% AM (1 kHz) 0.15 to 80 MHz
EN 50082-2	Generic immunity standards for industrial environments	-	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			

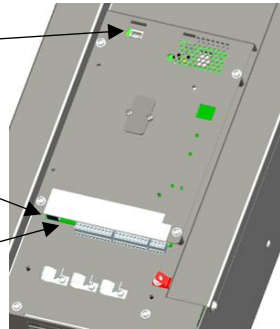
Emission				
Standard	Description	Category	Conformity conditions	
			Standard	With optional RFI filter
EN 61800-3	Variable speed drive standards	C1	-	-
		C2	-	Conforming - Cable length < 10 m - Switching frequency < 4 kHz
		C3	Conforming - Cable length < 100m - Switching frequency < 4 kHz	Conforming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

5 SETUP INTERFACES AND OPTIONS

PB1: 4p connector, RS485 for the setup interface if Bluetooth option present

P1: USB connector for PC communication

P2: 4p connector, RS485 for the setup interface



◦ **P1 connectors:**

USB port for PC communication using SYSTMIZ software. It must be used via the MDXISOLATOR connection option (§5.2.5).



◦ **P2 , PB1 connectors:**

Standard 4pt connector for the RS485/RS422 link allowing the connection of a setup interface (MD3KEYPAD,...). You will need to connect to PB1 if there is the Bluetooth option.



If this serial port needs to be connected to circuits complying with SELV safety requirements, an additional 4kV insulation barrier must be inserted to maintain the SELV classification (EN61140)

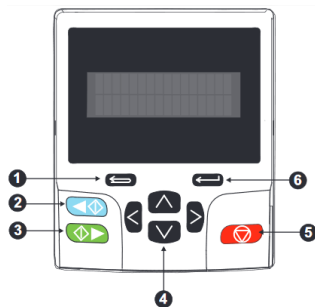
5.1 Drive setup

5.1.1 Connection to the drive

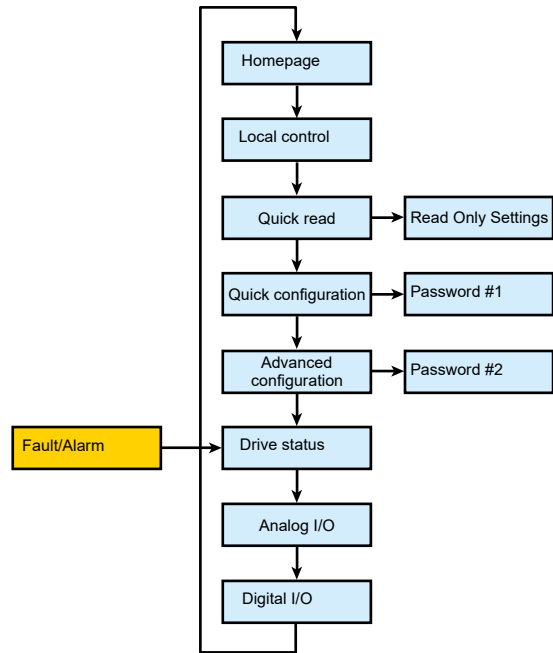
The MD3KEYPAD display enables user-friendly setup of the **Powerdrive MD Smart T0** and access to all parameters.

• **Presentation**

1. Back
2. Not used
3. Start (if controlled by console)
4. Navigation keys
5. Stop/Reset
6. Enter button



• **Architecture**



• **Homepage**

After the loading phase following power-up of the drive, the setup interface displays the following screen:

- Ready state	
- Locked state	
- In operation	

• **Local control**

Gives direct access to the motor control via the display (Start/Stop, direction of rotation, speed reference). This screen can be configured by the user via the Setup/Console setup menu. The console control is disabled in the factory setting.

- Only displayed if "Console control"

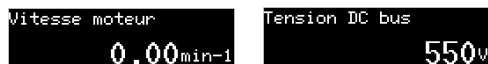
- If reference by console

- If other reference (AI, RP)

• **Read menu**

Allows the status of the drive and its main measurement points to be displayed, both at standstill and during operation.

- Quick access to some read-only parameters



• **Write menu**

- Quick access to some parameters in read-write mode
- Protection by password



• **Drive status pages**

- Drive status (fault or alarm)



- Analog I/O status

AI1	0%	AO1	0%
AI2	0%		
AI3	0%		

- Digital I/O status

DI1	DI2	DI3	DI4	DI5
DO1				ST0
RL1	RL2			

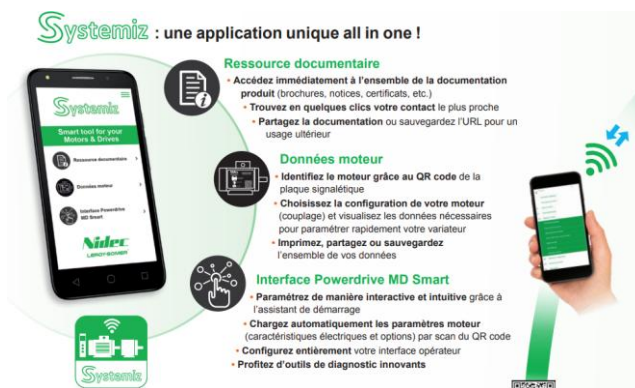
5.1.2 SYSTEMIZ

The new generation of drives is equipped with a secure wireless connection.



They are connected and smarter thanks to the Systemiz app, developed jointly, to offer a multitude of services and enhance the user experience. The overall interactivity provides greater responsiveness, remote or on-site self-diagnostic capability, and easier integration into your systems.

For further information please go to:
acim.nidec.com



POWERDRIVE MD3 & SYSTEMIZ
REF. 5688

For further information, refer to the commissioning manual ref. 5641. 5641.

This software can be downloaded from the Internet at <https://acim.nidec.com/motors/leroy-somer/products/ac-drives/powerdrive-mdsmart>.

The **Powerdrive MD Smart T0** can be set up via its USB connector, even if the drive is not powered. Caution: in this case, the optional boards will not be powered and their parameters will not be saved. To carry out setup/back-up of the parameters of the optional boards, the control block at least needs to be powered.

5.1.3 Special settings

Refer to the commissioning manual (ref. 4617) for further information on the setup of the Powerdrive MD Smart T0.

• **Overheating alarm**

The **Powerdrive MD Smart T0** has a "Drive overheating" alarm (#10.18) that warns the user when the internal temperature of the product reaches 60°C or when a power module overheats.

To set a different alarm threshold, 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 send the information on an output (e.g. DO1):

- # 8.26 = 12.61 (DO1 assigned to comparator 3)

5.2 Add-on options

The control board of the **Powerdrive MD Smart T0** is designed to receive various optional modules. Several options can be combined:

- Fieldbus option (see §5.2.1)
- Speed feedback option (see §5.2.2)
- Additional I/O option (see §5.2.3)
- Bluetooth option (see §5.2.4)
- USB isolator option (see §5.2.5)

5.2.1 Fieldbus options

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



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

MDX: option be fitted to the drive control board (white in colour)

Association table:

Main option	Field bus	
	MDX version	CM version
None	✓	-
MDX ENCODER	-	✓
MDX RESOLVER	-	✓
MDX-I/O Lite	-	✓
MDX I/O M2M	✓	-
MDX-ENCODER + MDX I/O M2M	-	✓
MDX RESOLVER + MDX I/O M2M	-	✓

Fieldbus options enable communication with the respective corresponding networks. They can be integrated in and are powered by the drive

The following fieldbuses are available on the **Powerdrive MD Smart T0**:

- **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

Further information can be found in the instructions for use of the respective modules.

5.2.2 Speed feedback option



Two options are available to manage the motor speed feedback:

- **MDX-ENCODER:** The MDX-ENCODER option can be used to manage incremental encoders with or without commutation channels (up to 500kHz).
- **MDX-RESOLVER:** The MDX-RESOLVER option can be used to manage 2- to 8-pole resolvers.

Further information can be found in the instructions for use of the respective modules.

5.2.3 Additional I/O options

Two options to increase the number of inputs/outputs for the **Powerdrive MD Smart T0**



MDX-I/O Lite



MDX-I/O M2M

Functions	MDX-I/O Lite	MDX-I/O M2M
Analog input (V, mA)	-	1
Differential analog input (V, mA)	1	1
Analog outputs (21, 22)	2	1
Motor thermistor KTY84-130 or PT100	1	1
Digital inputs	2	4
Digital outputs	1	2
Assignable relay	1	2
Drive forced fan's management	✓	✓
Real-time clock	-	✓
Ethernet connection: -WEB pages: configuration and status of the drive -2 programmable emails -Configuration backup & restoration	-	✓
Datalogger	-	✓

Further information can be found in the instructions for use of the respective modules.

5.2.4 Bluetooth option

The Bluetooth option consists of an electronic board that is located next to the control board.



QR code for Bluetooth pairing

Pairing between the mobile and the drive is done by QR code displayed on the label (see above).

Further information can be found in the instructions for use of the respective modules.

5.2.5 USB isolator option (MDXISOLATOR)



The MDXISOLATOR option must be connected between a host PC and any MD3 series drive to provide additional galvanic isolation in accordance with EN61800.

No software driver is required for installation. The MDXISOLATOR option consists of the USB isolator unit and a USB 2.0 type A/B cable, with a length of 1.8m.



- 4kV DC isolator
- Full (12 Mbps) USB 1.0 speed
- Operating temperature: -40°C to +70°C
- IP30 plastic housing
- Dimensions: 70 x 37 x 25 mm
- Weight: 20g
- Connection 1: USB B, upstream (PC)
- Connection 2: USB A, downstream (MD3)
- Cable included: USB 2.0 Type A/B - 1.8m

5.2.6 HMI option (KITIHMSUI)

The HMI that is proposed for MD Smart drives in the MD3 series is an HMI with a 7" resistive display, high-brightness LCD, and LED backlighting. The kit consists of an HMI, its 2m-long RS485 connection cable, and 4 fastening brackets.



Screen:

- 7.0" with LED backlighting
- Analog resistive touchscreen
- 500 nits brightness
- 800 x 480 resolution
- LED lifetime: 50,000 hrs
- Response time: 40 ms
- IP64, NEMA 4, aluminium frame

Power supply:

- - 9-36 VDC - 40W

Dimensions:

- - 195.60 x 139.60 x 51.70 mm

Operating temperature:

- -10°C ~ 50°C

5.3 RFI filters

5.3.1 General

The use of RFI filters helps to reduce the emission level of radio-frequency signals. They offer improved conformity of the drive with the EN 61800-3 standard on conducted and radiated radio-frequency emissions (see §4.6).

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

Rating	RFI filter		
	Reference	Sales code	Leakage current (mA)
33TN	3F480-063.290CT	4200-4800	11.2
40TN - 50TN	3F480-113.290CT	4200-1132	11.7
60TN - 75TN	3F480-180.260	40120064	42



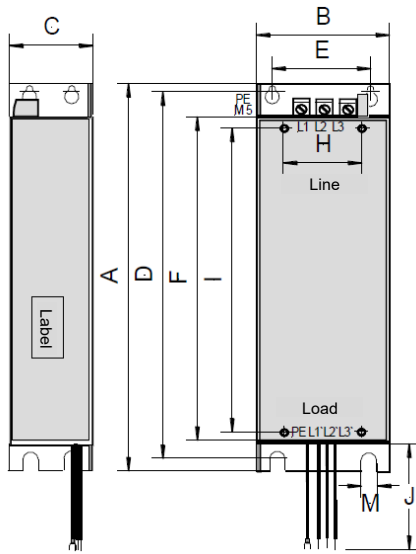
CAUTION:

The specific design of these filters is not compatible for installations with an IT neutral system. For more information, please consult LEROY-SOMER.

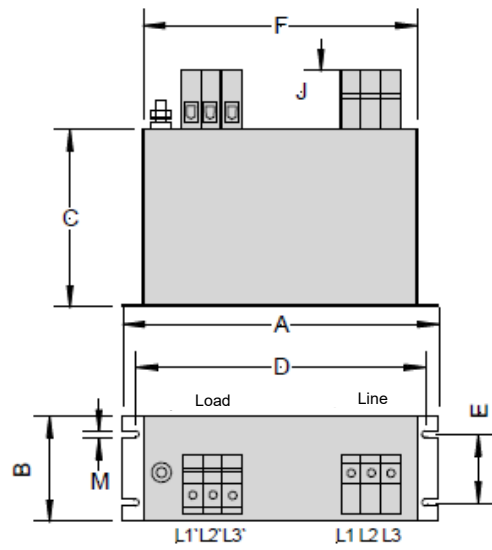
5.3.2 Dimensions and Weights

Type	Dimensions (mm)														Weight (kg)
	A	B	C	D	E	F	G	H	I	J	M	K	L	PE	
3F480-063.290CT	434	210	60	420	180	392	439	196	378	300	M6	-	-	M6	6.1
3F480-113.290CT	270	90	150	255	55	240	-	-	-	55	M6	-	-	M10	6.0
3F480-180.260	310	200	120	180	180	160	410	45	86	55	M8	30	91	M10	10.8

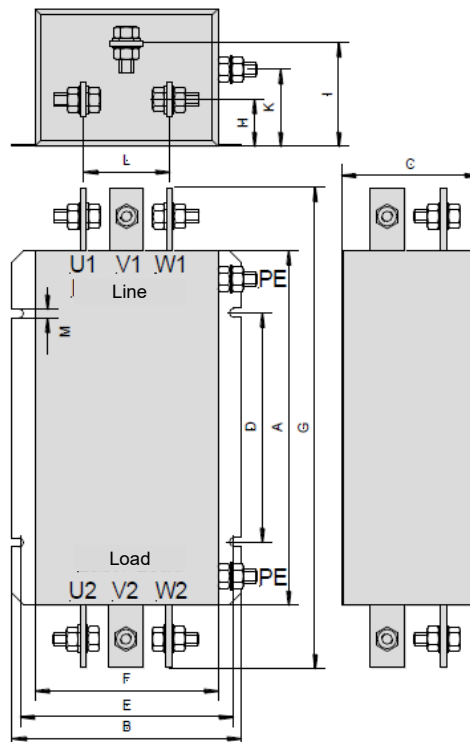
3F480-063.290CT



3F480-113.290CT



3F480-180.260



5.4 Network choke

The **Powerdrive MD Smart T0** must be operated with an AC line choke.

The 33, 40 and 50TN ratings have a choke built into the drive.

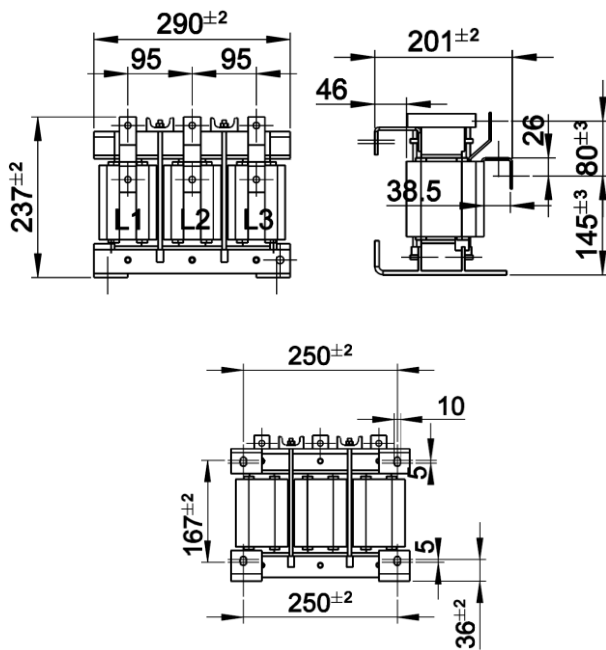
For the higher ratings – 60 and 75TN–, an external network choke must be associated with them, see characteristics below.

This choke will also reduce the harmonic level of the mains current: THDI < 35%, I_{sc} 10kA

Rating	Choke				
	Reference/LS code	In (A)	Inductance (mH)	Losses (W)	THDI
33TN, 40TN 50TN	*	80	0.08	-	< 45% (I _{sc} ≤ 5kA)
60T 75T	135 ST 0.26 / SEL135NT001	135	0.26	150	< 35% (I _{sc} ≤ 10kA)

*: internal drive choke

• Dimensions and Weight



Choke	Dimension (mm)			Fastening (mm)			Weight (kg)
	H	W	D	L1	P1	F	
135 ST 0.26 / SEL135NT001	237	290	201	250	146	Ø10	30

6 TRIPS - DIAGNOSTICS

6.1 Safety notice

⚠ Users must not attempt to repair the drive themselves, nor perform diagnostics other than those listed in this section. If the drive malfunctions, it must be returned to LEROY-SOMER through your usual contact.

6.2 Alarms

Alarms may appear during drive operation.

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

The HMI displays an active trip page, where “ALARM” appears at the top of the screen. All the trips indicated on the console or setup interface are listed in the table below.

6.3 Tripping on a safetrip

7-segment display code	No.	Meaning
AL	1 to 4	User Alarm 1 #10.54 to User Alarm 4 #10.57
	6	Motor overload #10.17
	7	Drive overheating #10.18
	8	Microcontroller over-occupancy
	9	Rectifier
	10	Emergency operation (see menu 20)

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 console or setup interface are listed in the table below.

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

TRIPS - DIAGNOSTICS

No.	Setup interface name	Reason for trip	Solution
1	DC UnderVolt	DC bus undervoltage	<ul style="list-style-type: none"> • Check the input fuses. • Check the quality of the power supply (voltage dips).
2	DC OverVolt	DC bus overvoltage	<ul style="list-style-type: none"> • Check that the mains voltage is within the permitted tolerance. • Check the quality of the power supply (commutation notches or transient overvoltages). • Check the motor insulation. • Check that the deceleration mode (02.04) is compatible with the application. • If an MD2-TF option is used, check its dimensions, its wiring and the state of the thermal relay.
3	Over current	Over current	<ul style="list-style-type: none"> • Check the motor insulation. • Check the motor cables (connections and insulation). • Check the quality of the mains supply. • Run power diagnostics.
		This trip cannot be reset for a period of 10 seconds.	
4	Not used		
5	Current imbalance	Motor current imbalance: vector sum of the 3 motor currents is not zero	<ul style="list-style-type: none"> • Check the motor insulation. • Check the cable insulation.
6	Out Ph. loss of a motor phase	Loss of a motor phase	<ul style="list-style-type: none"> • Check the motor cable and resistance values between motor phases.
7	Overspeed	The speed is greater than (1.3 x 01.06) or than (01.06 + 1000 min-1)	<ul style="list-style-type: none"> • Check the drive settings. • When the flying restart function is not being used, check that 06.09 is at "Disabled".
8	Drive overload lxt	The drive overload level exceeds the conditions defined in §1.5.2 of the installation guide.	<ul style="list-style-type: none"> • Check that the drive is suitable for the motor current cycle. • Check the ambient temperature.
9	IGBT U	Internal protection of phase U IGBTs	<ul style="list-style-type: none"> • Check the motor and cable insulation. • Run power diagnostics.
10	Th rectifier	Rectifier heatsink temperature too high.	<ul style="list-style-type: none"> • Clean the cabinet dust filters. • Check that the drive external and internal fans are working correctly. • Check that the product air inlet temperature is not outside the limits.
11	Encoder rotation	The measured position does not vary (only if a speed feedback option is present)	<ul style="list-style-type: none"> • Check the encoder wiring. • Check that the motor shaft turns.
12	Not used		
13	UVW invert	The encoder U, V, W signals are inverted (only if a feedback speed option is present)	<ul style="list-style-type: none"> • Check the conformity of the encoder wiring.
14	Tune U Encod	During the autotune phase, one of the encoder U, V or W commutation channels is not present	<ul style="list-style-type: none"> • Check the encoder wiring. • Check the encoder connections. • Change the encoder.
15	Tune V Encod		
16	Tune W Encod		
17	Not used		

TRIPS - DIAGNOSTICS

No.	Setup interface name	Reason for trip	Solution
18	Autotune	A stop command has been given during the autotune phase	Repeat the autotune procedure (see 05.12).
19	Brak. resist.	Parameter 10.39 "Braking energy overload accumulator" has reached 100%	<ul style="list-style-type: none"> • Check the settings of 10.30 and 10.31. • Check that the resistor is compatible with the application requirements.
20	Not used		
21	Overheating IGBT U	Overheating of the phase U IGBTs.	<ul style="list-style-type: none"> • Clean the cabinet dust filters. • Check that the drive ventilation units are working correctly. • Check that the product air inlet temperature is not outside the limits. • If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency are complied with. • Check that the switching frequency 05.18 is compatible with the motor current level.
22	Not used		
23	Not used		
24	Motor PTC sensor	Opening of the PTC input of the PX1 terminal block or T1 and T2 inputs of the MDX-ENCODER option	<ul style="list-style-type: none"> • Check the ambient temperature around the motor. • Check that the motor current is lower than the stated current. • Check the thermal sensor wiring.
25	Not used		
26	Overload + 24V	Overload on the +24V power supply or digital outputs	<ul style="list-style-type: none"> • Check the I/O wiring.
27	Not used		
28	AI2 loss	Loss of the current reference on analog input AI2	<ul style="list-style-type: none"> • Check the AI2 input wiring and source.
29	AI3 loss	Loss of the current reference on analog input AI3	<ul style="list-style-type: none"> • Check the AI3 input wiring and source.
30	COM loss	Loss of communication on the P2 connector serial link	<ul style="list-style-type: none"> • Check the cable connections. • Check that parameter 11.63 is compatible with the timing of requests from the master.
31	EEPROM	Number of write cycles to EEPROM exceeded (>1,000,000)	<ul style="list-style-type: none"> • Change the control board. • Check the recurrence of write cycles from the drive controller.
32	Not used		
33	Stator resistance	Trip during measurement of the stator resistance	<ul style="list-style-type: none"> • Check the motor wiring.
34	Fieldbus loss	Disconnection of the fieldbus during operation or timing error	<ul style="list-style-type: none"> • Check the fieldbus connections. • Check that parameter 15.07 is compatible with the timing of requests from the master.
35	STO inputs	Simultaneous opening of both STO (Safe Torque Off) inputs during operation	<ul style="list-style-type: none"> • Check the remote control link.
36	Not used		
37	Encoder break	One of the encoder feedback data items is missing	<ul style="list-style-type: none"> • Check the encoder wiring. • Check the encoder connections.
38	Breakdown	Breakdown of synchronous motor in sensorless closed loop mode	<ul style="list-style-type: none"> • Check that the menu 5 parameters are compatible with the values on the motor nameplate.
39	Not used		

TRIPS - DIAGNOSTICS

No.	Setup interface name	Reason for trip	Solution
40	Encoder board	The control board cannot communicate with the encoder board	<ul style="list-style-type: none"> Replace the encoder board.
41	User 1	User trip 1 triggered by 10.61	<ul style="list-style-type: none"> See 10.61
42	User 2	User trip 2 triggered by 10.63	<ul style="list-style-type: none"> See 10.63
43	User 3	User trip 3 triggered by 10.65	<ul style="list-style-type: none"> See 10.65
44	User 4	User trip 4 triggered by 10.67	<ul style="list-style-type: none"> See 10.67
45	User 5	User trip 5 triggered by the serial link 10.38 = 45	<ul style="list-style-type: none"> See 10.38
46	User 6	User trip 6 triggered by the serial link 10.38 = 46	
47	User 7	User trip 7 triggered by the serial link 10.38 = 47	
48	User 8	User trip 8 triggered by the serial link 10.38 = 48	
49	User 9	User trip 9 triggered by the serial link 10.38 = 49	
50	User 10	User trip 10 triggered by the serial link 10.38 = 50	
51	DO2 MDX-I/O over Id	The DO2 output load current (MDX-I/O option) is >200 mA	<ul style="list-style-type: none"> Check that DO2 is not short-circuited.
52	DO3 MDX-I/O over Id	The DO3 output load current (MDX-I/O option) is >200 mA	<ul style="list-style-type: none"> Check that DO3 is not short-circuited.
53	MDX- I/O link	Communication problem between the drive and the MDX-I/O option	<ul style="list-style-type: none"> Check the MDX-I/O option mounting.
54	Not used		
55	Unstable DC bus	The drive DC bus oscillates significantly	<ul style="list-style-type: none"> Check the balancing of the mains phases. Check that all 3 mains phases are present.
56	IGBT V	Internal protection of phase V IGBTs	<ul style="list-style-type: none"> Check the motor and cable insulation.
57	IGBT W	Internal protection of phase W IGBTs	<ul style="list-style-type: none"> Check the motor and cable insulation.
58	IGBT V overheating	Overheating of phase V IGBTs	<ul style="list-style-type: none"> Clean the cabinet dust filters. Check that the drive ventilation units are working correctly. Check that the product air inlet temperature is not outside the limits.
59	IGBT W overheating	Overheating of phase W IGBTs	<ul style="list-style-type: none"> If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency are complied with. Check that the switching frequency 05.18 is compatible with the motor current level.

TRIPS - DIAGNOSTICS

No.	Setup interface name	Reason for trip	Solution
60	Diagnostic	Problem detected during the control and interface boards test, the power test or during the self-test	<ul style="list-style-type: none"> • Check that the STO1 and STO2 inputs are closed. • See diagnostic error table.
61 62	Not used		
63	STO input inconsistency	The STO1 and STO2 inputs have had a different state for more than 100 ms	<ul style="list-style-type: none"> • Check the remote control link for the STO1 and STO2 inputs.
64	Not used		
65	10V over Id	Overload on the +10 V power supply	<ul style="list-style-type: none"> • Check the I/O wiring.
66	DO1 over Id	The DO1 output load current is >200 mA	<ul style="list-style-type: none"> • Check that DO1 is not short-circuited.
67	Internal ventilation	Internal ventilation no longer works	<ul style="list-style-type: none"> • Contact your usual Nidec Leroy-Somer contact.
68	Motor overcurrent	The current has exceeded the limit programmed in 05.55. The load is too high for the setting.	<ul style="list-style-type: none"> • Check that 05.55 is consistent with the application.
69	24V over Id on MDX-I/O	The 24 V load current is too high	<ul style="list-style-type: none"> • Check the MDX-I/O option I/O wiring.
70	4 mA loss on MDX-IO AI4	Loss of current reference on analog input AI4 of the MDX-I/O option	<ul style="list-style-type: none"> • Check the MDX-I/O option I/O wiring.
71	4 mA loss on MDX-IO AI5	Loss of current reference on analog input AI5 of the MDX-I/O option	
72	Not used		
73	Rectifier com lost	Loss of communication between control board and rectifier	<ul style="list-style-type: none"> • Check the connection between the control board and the rectifier.
74	24V ELV	The voltage of the electronic power supply is too low.	<ul style="list-style-type: none"> • Restore the power supply of the electronics to its rated voltage of 24VDC.
75 81	Not used		
82	Firmware	Firmware/hardware Incompatibility	<ul style="list-style-type: none"> • Contact your usual Nidec Leroy-Somer contact.
83 101	Not used		
102	Rectifier	Loss of AC supply	<ul style="list-style-type: none"> • Check the input fuses. • Check the quality of the power supply (voltage dips).

7 MAINTENANCE



• All work relating to installation, commissioning and maintenance must be carried out

by qualified and certified personnel.

- When a trip detected by the drive causes the motor to stop, potentially 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 present dangerous voltage. Check that these circuits are powered down before working on the control cables.
- Ensure that the DC bus voltage is below 40V before carrying out any work (the control board power-on indicator LED must be OFF).
- After the drive has been operated, keep away from the heatsink as it may be very hot (70°C).
- After working on the motor, check that the phase order is correct when re-connecting the motor cables.
- Before performing high voltage tests or voltage withstand tests on the motor, switch off the drive and disconnect the motor.

There are very few maintenance and repair operations to be performed by the user on the **Powerdrive MD Smart T0** drives. The routine servicing operations are described below.

• Servicing

The drive's circuit boards and components normally require no maintenance. Contact your vendor or the nearest approved repair company in the event of a problem.

CAUTION:

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

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

From time to time, with the drive powered down, check that the power connections are correctly tightened.

• Preventive maintenance

Device	Action	Frequency
Power connections	Check tightness	1 year
Surge suppressor board	Replace	5 years

7.1 Storage

The **Powerdrive MD Smart T0** 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 in 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 upon request from your usual LEROY-SOMER contact.

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

Consult LEROY-SOMER

NOTES

Nidec

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