Nidec

All for dreams

Installation guide

POWERDRIVE FX

4-quadrant
Variable speed drive

Part number: 4729 en - 2017.08 / c

LEROY-SOMER™

NOTE

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

CAUTION

For the user's safety, the variable speed drive must be connected to an approved earth (⏚ terminal).

If accidentally starting the installation is likely to cause a risk to personnel or the machines being driven, it is essential to comply with the power connection diagrams recommended in this manual.

The variable speed drive is fitted with safety devices which, in the event of a fault, order it to stop and, at the same time, 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.

Using the drive for hoisting: when using this application, it is essential to follow the special instructions in an application-specific manual which is available on request. It is the responsibility of the user to obtain this manual from his usual LEROY-SOMER contact.

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 FX. For commissioning, refer to manual ref.4617.

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

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

1 - General

Depending on their degree of protection, 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 or CENELEC HD 384, or DIN VDE 0100 and 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 taken place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2004/108/EC) are met.
The variable speed drives meet the requirements of the Low Voltage Directive 2006/95/EC. The harmonised standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.
The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage

All instructions concerning transportation, storage and correct handling must be observed.
The climatic conditions specified in the technical manual must be observed.

4 - Installation

The installation and cooling of equipment must comply with the specifications in the documentation supplied with the product.
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 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, 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 int 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 which incorporate variable speed drives must be fitted with additional protection and monitoring devices as specified in 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 FX** variable speed drives. It also gives details of all its options and extensions which the user may choose to suit his requirements.

POWERDRIVE FX

Parameter setting

MDX-Powerscreen parameter-setting interface

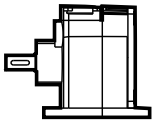
MDX-KEYPAD

MDX-SOFT parameter-setting software + PC link cable

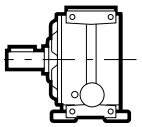
Options

- RFI filter
- Encoder or resolver input
- Additional I/O
- Datalogger
- Communication options

Gearboxes

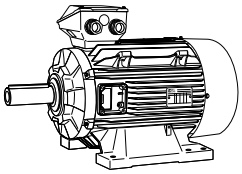


Compabloc
• Axial output
- Helical gears

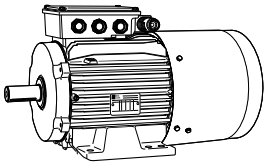


Orthobloc
• Orthogonal output
- Helical bevel gears

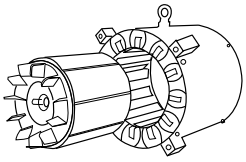
Motors



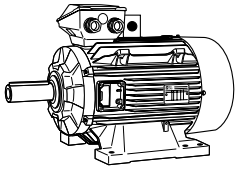
LS-FLS motor



LSMV motor

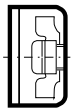


HPM motor



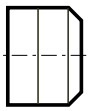
LSRPM motor

Motor options



Axial forced ventilation

Encoder/Sensor



Brake

Radial forced ventilation

CONTENTS

1 - GENERAL INFORMATION

1.1 - General

The **POWERDRIVE FX** is an electrical drive with flux vector control, designed for supplying asynchronous or synchronous 3-phase motors.

The **POWERDRIVE FX** has a rectifier with IGBT bridge controlled at the frequency of the mains supply, which has the following advantages:

- Motor energy feedback to the mains supply (operation in all 4 quadrants of the torque/speed plane without energy dissipation),

- Limiting of the level of current harmonics generated on the power supply line, at a much lower level than that of a conventional 6-pilse drive using a line reactor.

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

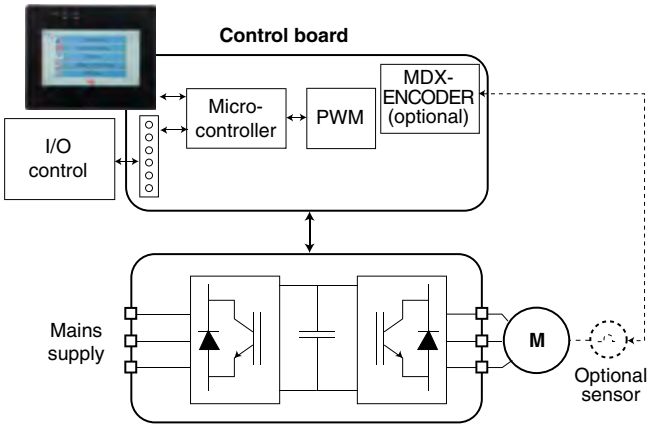
- Induction motors without speed sensor (Open loop mode select) for applications that do not need rated torque control above 1/10th of the rated speed.

- Asynchronous or synchronous permanent magnet motors with virtual speed feedback (Flux vector mode with software sensor function) for applications that require rated torque control from 1/20th of the rated speed.

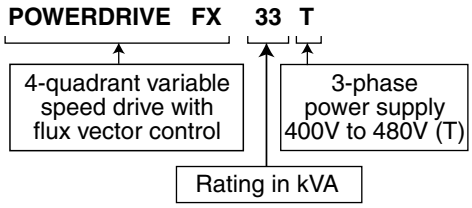
Combined with the MDX-ENCODER option, the **POWERDRIVE FX** is a drive that can also be used to control asynchronous or synchronous magnet machines for applications that require very high dynamic performances or torque control from zero speed (Closed loop vector mode with speed feedback).

• POWERDRIVE FX drives are designed for installation in a cabinet or an enclosure to ensure protection from conducting dust and condensation. Prevent access by unauthorised personnel.

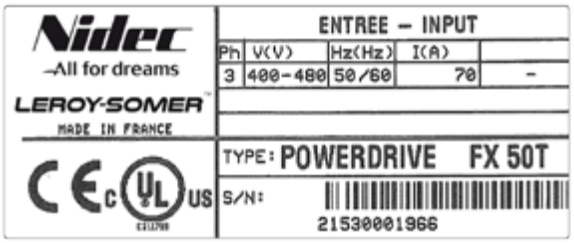
Diagram



1.2 - Product designation



Nameplate



The nameplate is located at the bottom right-hand side of the product (front view).

1.3 - Environmental characteristics

Characteristics	Level
Protection	IP20
Storage and transport temperature	-30°C to +70°C
Ambient operating temperature (outside the cabinet)	-10°C to +40°C, up to +50°C with derating (see section 1.4.3)
Classification of environmental conditions	In accordance with IEC 60721-3-3 : • Biological classification in accordance with class 3B1, • Classification as regards chemically active substances in accordance with class 3C2, • Classification as regards mechanically active substances in accordance with class 3S2
Relative humidity	• In accordance with IEC 60068-2-56 • < 90% non condensing
Altitude	• ≤ 1000 m without derating • > 1000 m: operating temperature derating of 0.6°C per 100 m, up to 4000 m maximum *E.g. for an altitude of 1300 m, the electrical characteristics must be taken into account for an ambient temperature of:* [40° - (3 x 0.6°)] = 38.2°C
Vibrations	• In accordance with IEC 60068-2-6 • Non-packaged product: 2m/s² (9-200Hz), 0.6mm (2-9Hz) • Packaged product: 10m/s² (9-200Hz), 3mm (2-9Hz)
Shocks	Packaged product: in accordance with IEC 60068-2-29
Atmospheric pressure	700 to 1060 hPa

1.4 - Electrical characteristics

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

1.4.1 - General characteristics

Characteristics	Level
Power supply voltage	3-phase mains supply: 400V -10% to 480V +6%
Phase voltage imbalance	< 3%
Input frequency	2% around te rated frequency (50 or 60 Hz)
Maximum number of power-ups per hour (power)	• 20
Output frequency range	0 to 200 Hz
Mains short-circuit capability at the point of connection	See section 4.4.3
ROHS conformance	Conforming to standard 2002-95-EC

1.4.2 - Electrical characteristics at +40°C

I_{co}: Continuous output current
P_{out}: Output power
I_{max} **(60s)**: Maximum output current*
Heavy duty: For high overload constant torque machines (presses, grinders, hoists, etc) and all applications where significant inertia has to be accelerated quickly (centrifuges, translation of travelling cranes, etc).
Normal duty: For low overload constant torque or centrifugal torque machines (fans, compressors, etc).
**: Current available for 60 seconds every 600 seconds.*

The output currents I_{co} in the table below are given for:
- A 4 kHz switching frequency,
- An ambient temperature of +40°C,
- An altitude of 1000m maximum.

POWERDRIVE FX		Heavy duty			Normal duty		
Size	Rating	P_{out} kW	I_{co} A	I_{max} (60s) A	P_{out} kW	I_{co} A	I_{max} (60s) A
2	33T	22	45	68	30	59	64
	40T	30	59	89	37	73	79
	50T	37	73	105	45	86	95
3	60T	45	92	135	55	110	119
	75T	55	110	165	75	145	157
	100T	75	145	200	90	175	189

1.4.3 - Derating according to the temperature and switching frequency

POWERDRIVE FX rating	Duty	I_{co} (A)		
		4kHz	5kHz	6kHz
33T	Heavy	**45**	43	41
	Normal	**59**	56	53
40T	Heavy	**59**	55	50
	Normal	**73**	68	62
50T	Heavy	**73**	68	63
	Normal	**86**	80	74
60T	Heavy	**92**	88	84
	Normal	**110**	106	100
75T	Heavy	**110**	100	88
	Normal	**145**	132	116
100T	Heavy	**145**	131	113
	Normal	**175**	158	137

The I_{co} output currents are given at an ambient temperature of +40°C. For a temperature above +40°C, derate the current by 1.5% for every additional degree up to a maximum temperature of +50°C.

Notes

2 - MECHANICAL INSTALLATION

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

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

• The casing of the POWERDRIVE FX is not fireproof. If necessary, use a flameproof cabinet.

2.1 - Checks on receipt

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

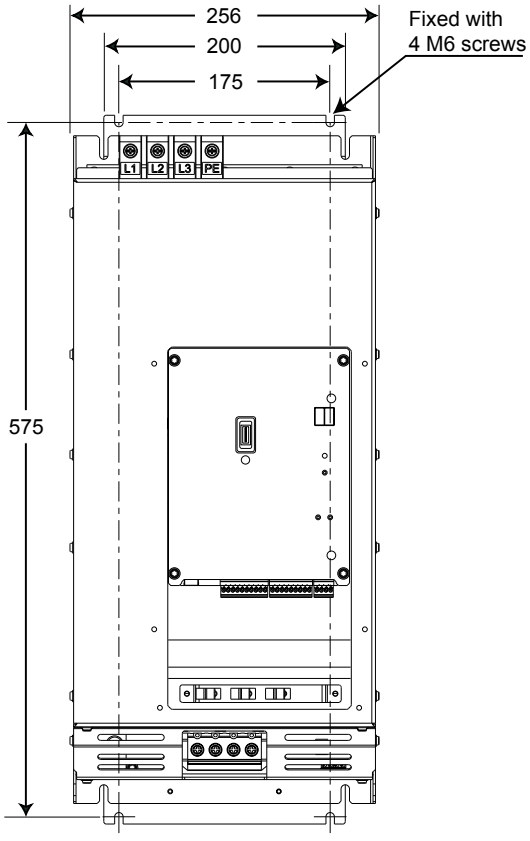
2.2 - Dimensions

CAUTION:
In the cabinet, there must be a minimum distance of 100 mm between two drives, and 200 mm above and below the drive.

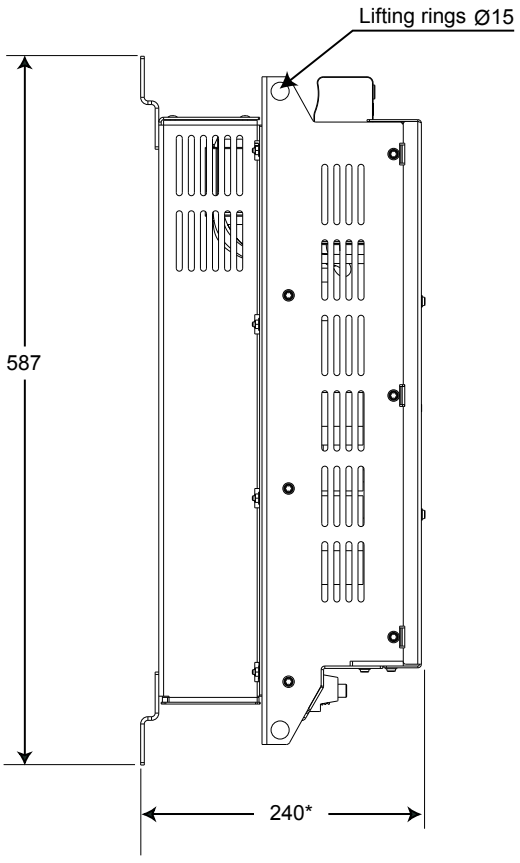
2.2.1 - Surface mounting

2.2.1.1 - Ratings 33T to 50T

Front view



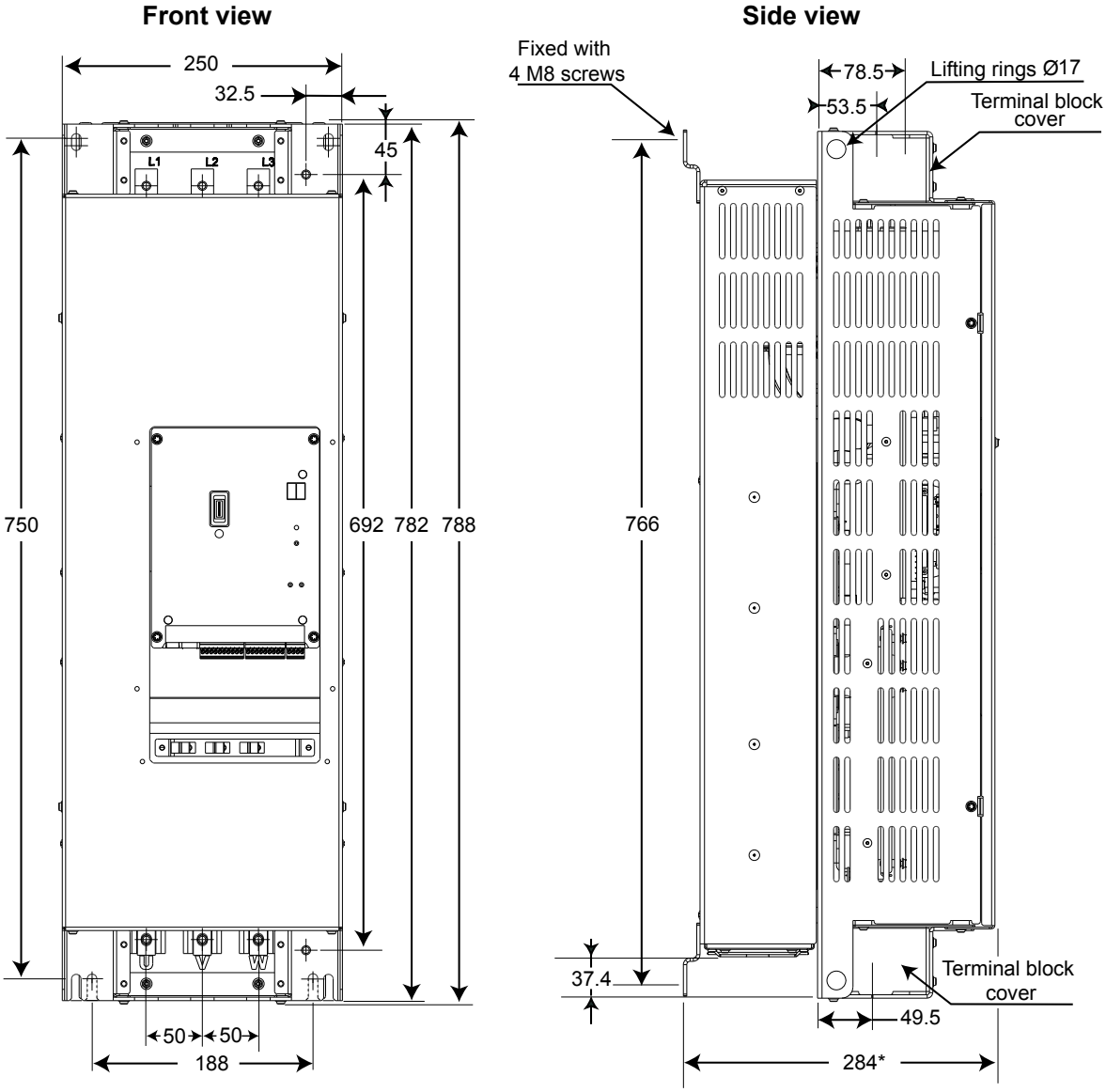
Side view



Dimensions in mm

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

2.2.1.2 - Ratings 60T to 100T



Dimensions in mm

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

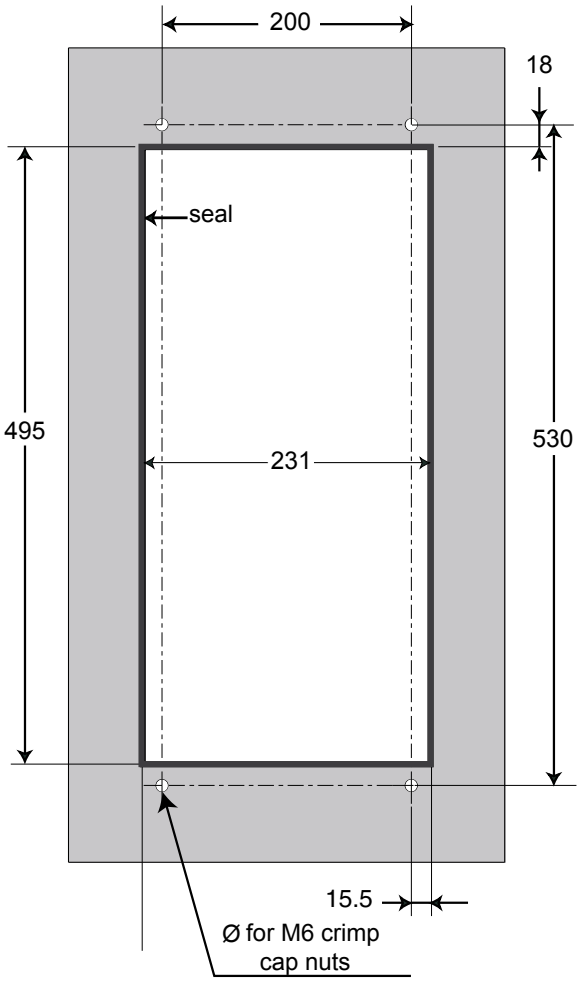
2.2.2 - Through-panel mounting

CAUTION:
To obtain IP54 protection at the back of the heatsink, an additional seal is needed (not supplied, adhesive strip of EPDM rubber or equivalent).

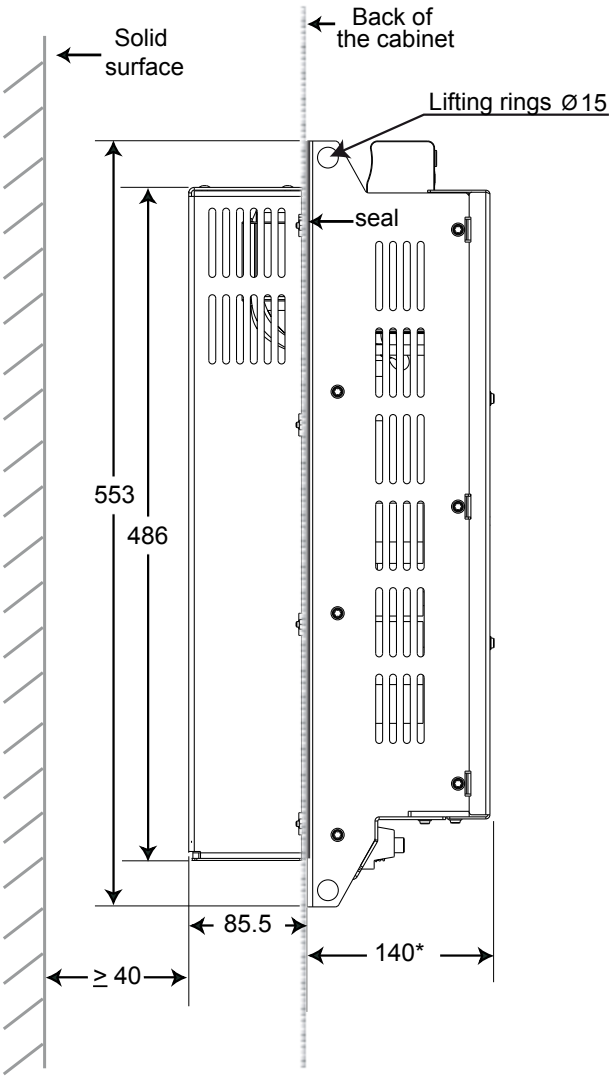
The **POWERDRIVE FX** is delivered with its fixing feed mounted, ready for surface mounting. For through-panel mounting, remove the feet, and follow the instructions below.

2.2.2.1 - Ratings 33T to 50T

Drill hole diagram



Side view

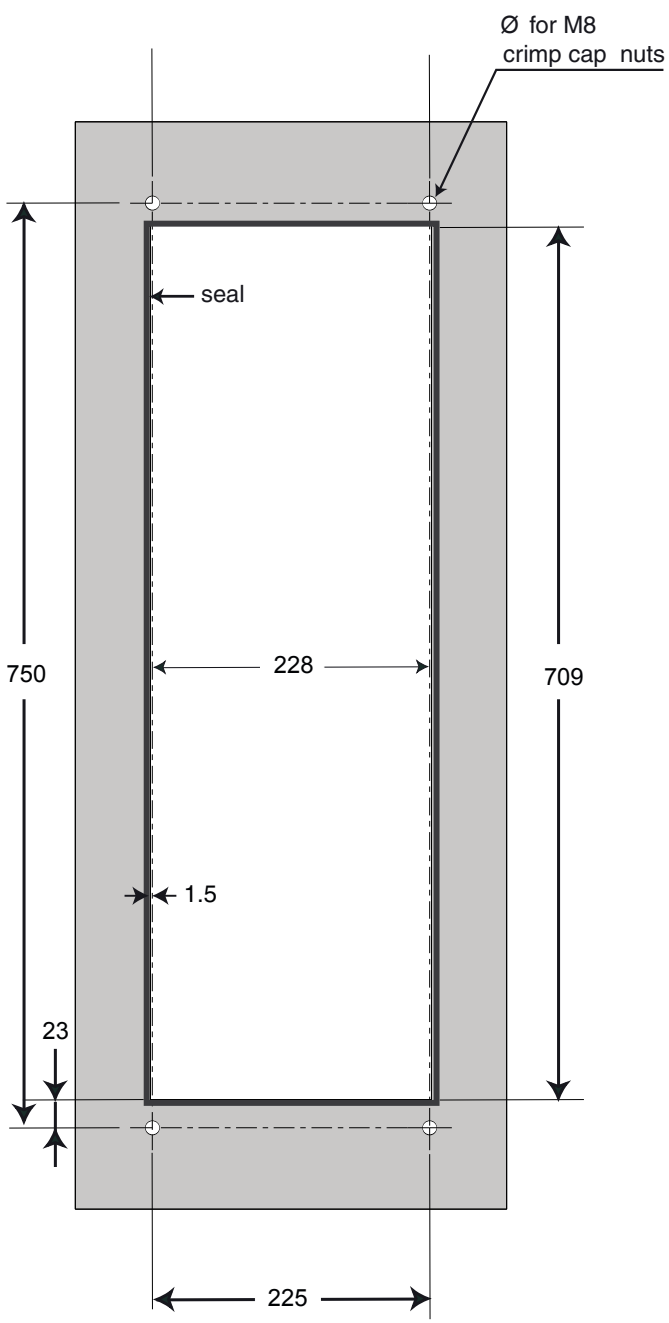


Dimensions in mm

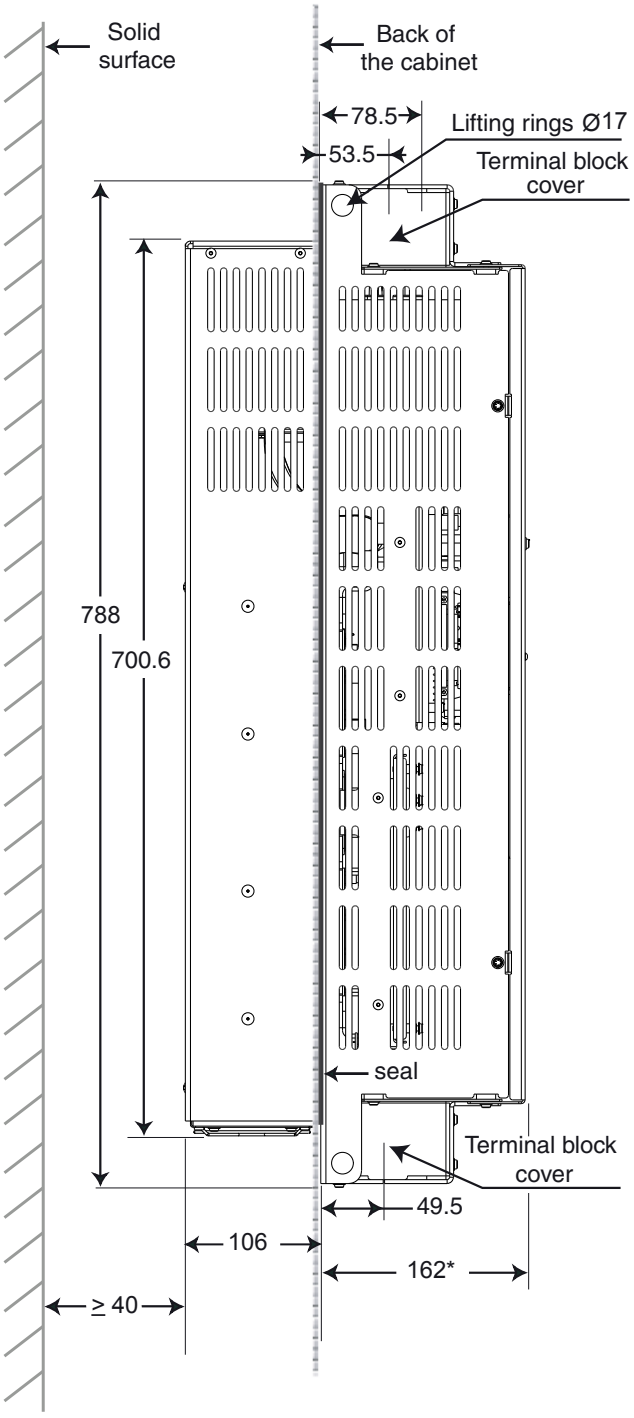
(*) • With MDX-I/O M2M option, add +25mm
• With MDX-ENCODER, MDX-RESOLVER, MDX-I/O Lite or MDX-Fieldbus option, add +30mm
(the 2 option types can be combined, add +55mm)

2.2.2.2 - Ratings 60T to 100T

Drill hole diagram



Side view



Dimensions in mm

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

2.3 - Weights

POWERDRIVE FX rating	33T	40T	50T	60T	75T	100T
Weight (kg)	20			37		

• Suitable handling equipment must be provided according to the weight of the drives.

2.4 - Losses, ventilation flow rate and noise levels

• Losses

Losses* (W)	POWERDRIVE FX					
	33T	40T	50T	60T	75T	100T
Total	800	980	1150	1450	1850	2200
Inside the cabinet (through-panel mounting)	90	100	110	140	170	200

(*) Maximum losses for normal duty operation at the I_{co} output currents given in section 1.4.3.

• Forced ventilation flow rates

Forced ventilation	POWERDRIVE FX					
	33T	40T	50T	60T	75T	100T
Flow rate (m^3/h)	230			340		

• Noise

Forced ventilation	POWERDRIVE FX					
	33T	40T	50T	60T	75T	100T
Level (dBA)	52			56		

Notes

3 - CONNECTIONS

⚠ • All connection work must be performed 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, a source of serious injury, malfunctions or electromagnetic interference.

• The voltages on the cables or connections of the mains supply, the motor or the filter may cause fatal electric shocks. Contact with these items must be avoided under all circumstances.

• The drive must be supplied via a circuit-breaking device so that it can be powered down safety.

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

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

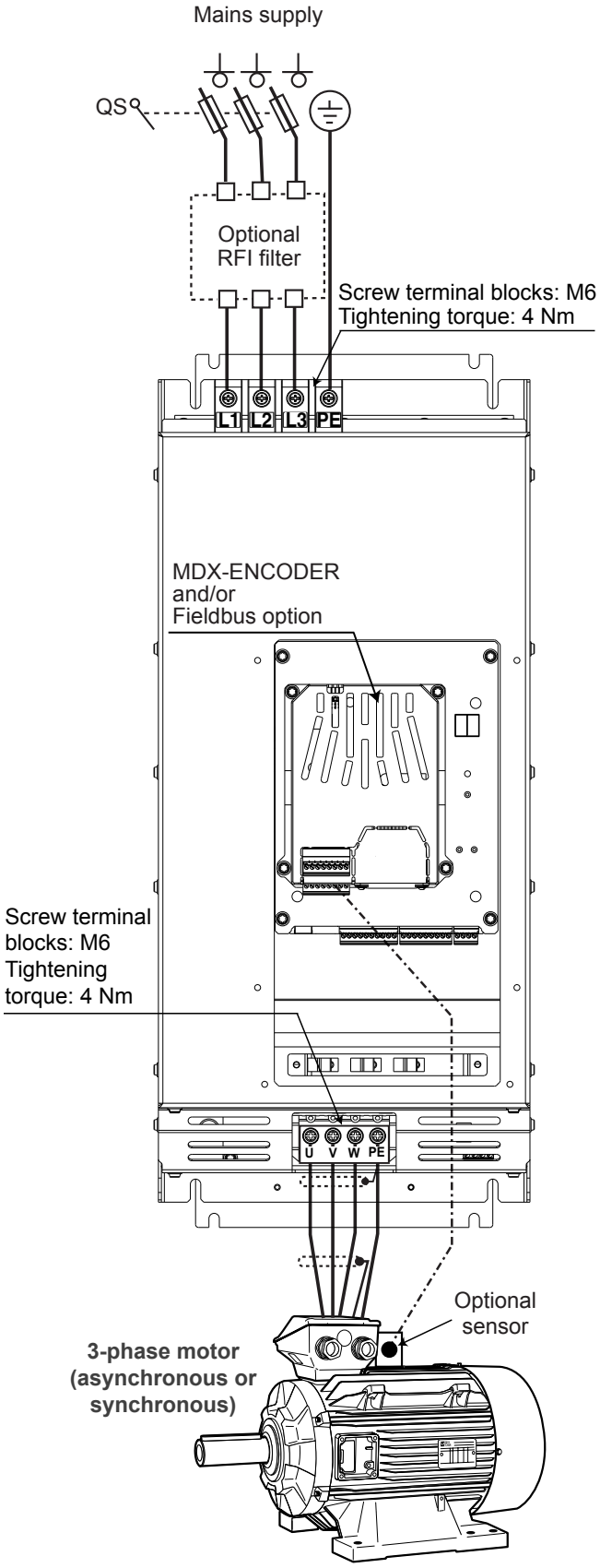
• Check that the voltage and current of the drive, the motor and the mains supply are compatible.

• After the drive has been operating, 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 drive output. It is advisable to install a circuit-breaking device between the permanent magnet synchronous motor and the drive output. This breaker isolates the motor during maintenance work on the drive.

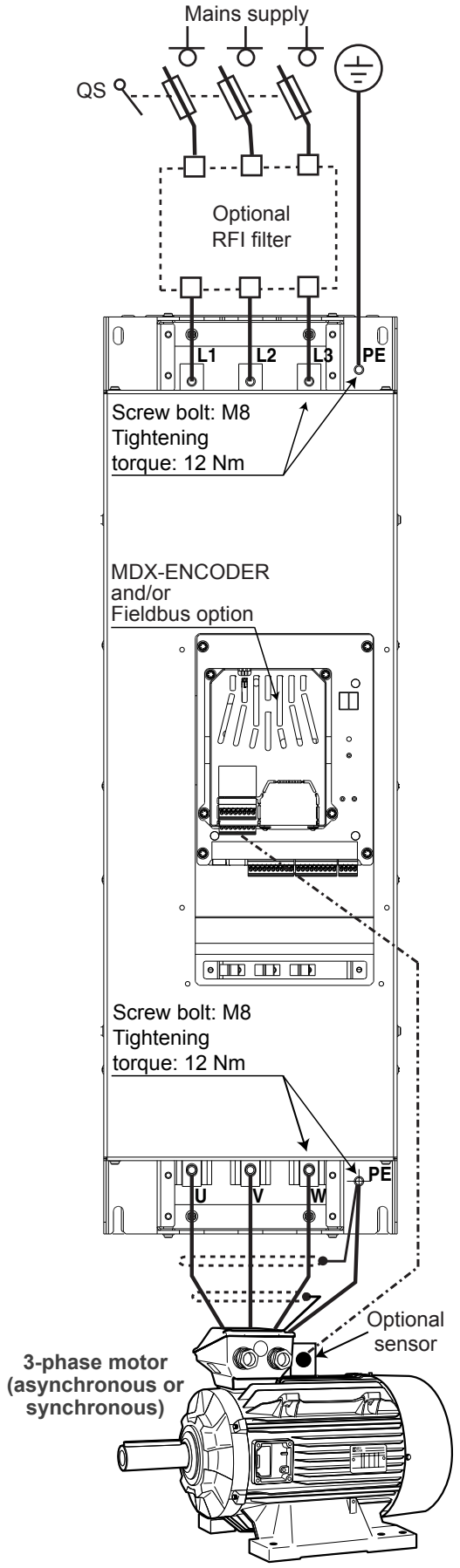
3.1 - Connection of the power

3.1.1 - Ratings 33T to 50T (size 2)



QS: Fused isolator. QS must be opened before working on any electrical parts of the drive or motor.

3.1.2 - Ratings 60T to 100T (size 3)



QS: Fused isolator. QS must be opened before working on any electrical parts of the drive or motor.

3.1.3 - Cables and fuses

• It is the responsibilityof the user to connect and provide protection for the POWERDRIVE FX in accordance with the current legislation and regulations in the country of use. This is particularly important as regards 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.

• This table is given for information only, and must under no circumstances be used in place of the current standards.

I_{co}: Continuous output current
$I_L M$: Maximum continuous line current permitted in motor mode (power drawn by the motor)
$I_L G$: Maximum continuous line current permitted in regenerative mode (power transmitted to the mains supply)

POWERDRIVE FX		Mains supply											Motor (1)	
		400V - 50Hz					460/480V - 60Hz							
Rating / duty		$I_L M$ (A)	$I_L G$ (A)	Fuses		Cable cross-sections (2) (mm^2)	$I_L M$ (A)	$I_L G$ (A)	Fuses			Cable cross-sections (2) (mm^2)	I_{co} (A)	Cable cross-sections (2) (mm^2)
				Gg type	aR type				Gg type	aR type	Class J			
33T	Heavy	42	34	50	80	3x10 + 10	37	30	50	80	60	3x10 + 10	45	3x10 + 10
	Normal	57	45	63	100	3x16 + 16	50	39	63	100	80	3x16 + 16	59	3x16 + 16
40T	Heavy	57	45	63	100	3x16 + 16	50	39	63	100	80	3x16 + 16	59	3x16 + 16
	Normal	68	55	80	125	3x25 + 15	59	48	80	125	100	3x25 + 16	73	3x25 + 16
50T	Heavy	68	55	80	125	3x25 + 16	59	48	80	125	100	3x25 + 16	73	3x25 + 16
	Normal	83	66	100	160	3x25 + 16	72	57	100	160	125	3x25 + 16	86	3x25 + 16
60T	Heavy	83	66	100	160	3x25 + 16	72	57	100	160	125	3x35 + 16	92	3x35 + 16
	Normal	100	80	125	200	3x50 + 25	87	70	125	200	150	3x35 + 16	110	3x50 + 25
75T	Heavy	100	80	125	200	3x50 + 25	87	70	125	200	150	3x35 + 16	110	3x50 + 25
	Normal	135	108	160	250	3x70 + 35	117	94	160	250	200	3x70 + 35	145	3x70 + 35
100T	Heavy	135	108	160	250	3x70 + 35	117	94	160	250	200	3x70 + 35	145	3x70 + 35
	Normal	162	130	200	350	3x95 + 50	141	113	200	350	225	3x70 + 35	175	3x95 + 50

(1) The value of the rated current and the motor cable cross-sections are given for information only. As a reminder, the motor rated current permitted by the drive varies according to the switching frequency and the temperature.
(2) The recommended cross-sections have been determined for single-conductor copper cable with a maximum length of 10 m. For longer cables, take line drops due to the length into account.

Note:
• The cable cross-sections are defined according to the following model:
E.g. for a 100T drive in normal duty, a cable cross-section of (3 x 95 + 50) is given, i.e. 1 bundle consisting of 3 phase conductors (cross-section 95) and 1 earth conductor (cross-section 50).
• The I_{co} output currents are given at an ambient temperature of 40°C. For a temperature above 40°C, derate the current by 1.5% for every additional degree up to a maximum temperature of 50°C.

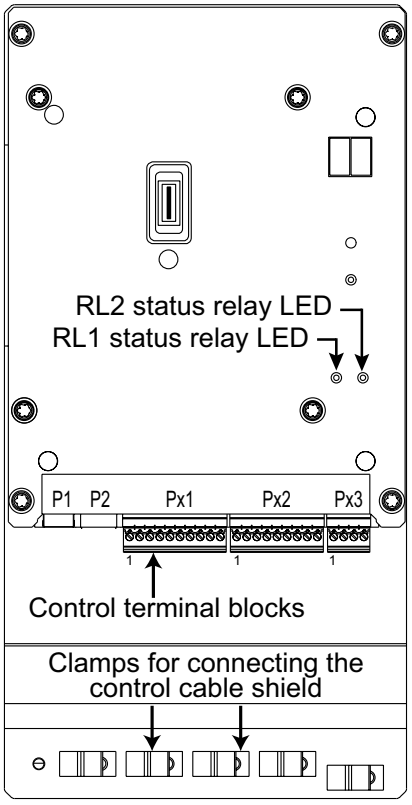
3.2 - Connection of the control

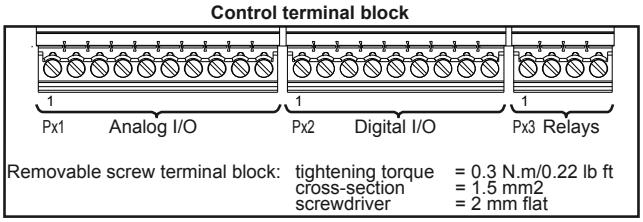
• The POWERDRIVE FX inputs have a positive logic configuration. Using a drive with a control system which has a different control logic may cause unwanted starting of the motor.

• The POWERDRIVE FX 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 circuit conforming to SELV safety requirements, additional insulation must be inserted to maintain the SELV classification (see EN 61140).

3.2.1 - Location of control terminal blocks





3.2.2 - Characteristics of control terminal blocks

3.2.2.1 - Characteristics of the PX1 terminal block

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

2	**AI1+**	Differential analog input 1 (+)
3	**AI1-**	Differential analog input 1 (-)
Factory setting		0-10 V 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		± 24V / 0 V
Input impedence		> 100 kΩ
Resolution		11 bits + sign
Sampling period		2 ms
Input filter bandwidth		~ 200 Hz

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

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

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

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

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

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

3.2.2.2 - Characteristics of the PX2 terminal block

1 9	+24V ref	+24 VDC user output or +24 VDC external input
+24 VDC user output		
Output current		100 mA
Accuracy		± 5%
Protection		Current limitig and setting to trip mode
+24 VDC external input		
Rated voltage		24 VDC
Minimum operating voltage		22 V
Absolute maximum voltage		28 V
Recommended power		50 W
Recommended fuse		2.5 A
An external power supply connected to the +24 V Ref terminal is used to maintain the control power supply in the event of mains loss		

2	DO1	Digital output
Factory setting		Zero speed
Characteristics		Open collector
Absolute maximum voltage		+ 30 V / 0 V
Overload current		200 mA

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

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

3.2.2.3 - Characteristics of the PX3 terminal block

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

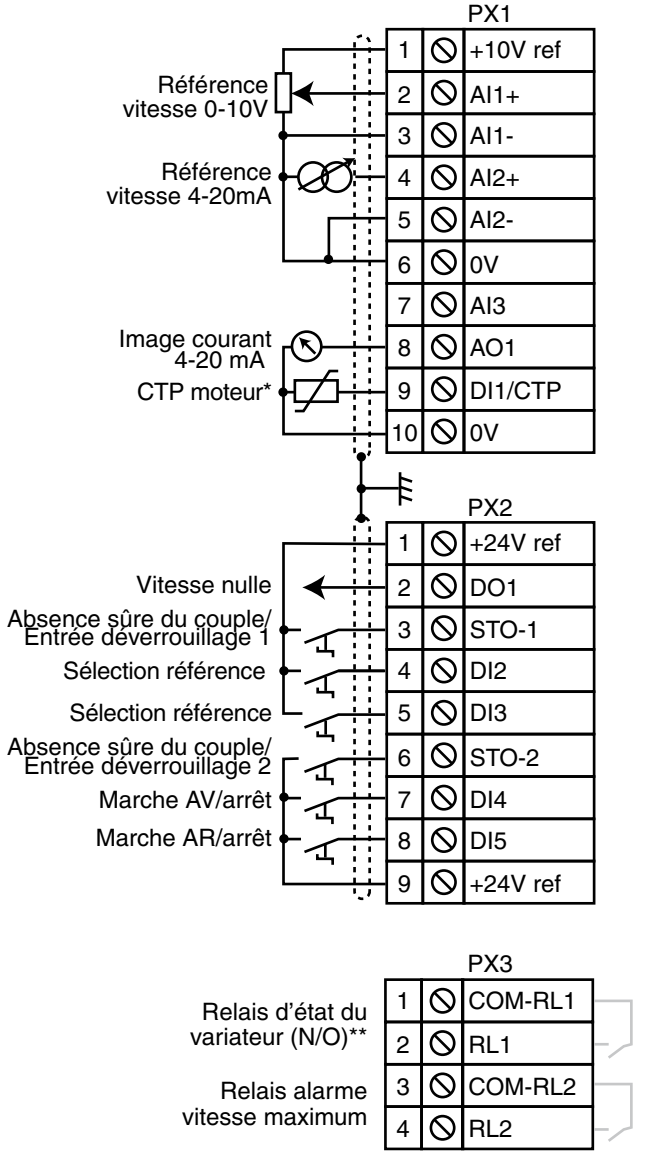
3 4	COM-RL2 RL2	N/O (normally open) relay output
Factory setting		Vmax alarm
Voltage		250 VAC
Maximum contact current		• 2 A - 250 VAC, resistive load • 1 A - 250 VAC, inductive load • 2 A - 30 VDC, resistive load

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

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

3.2.3 - Factory configuration of control terminal blocks

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

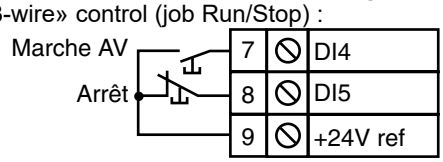


Note:
This configuration has been obtained from a drive with factory settings (default parameter settings).
The STO-1 and STO-2 inputs must be closed before giving a run command.

(*) By default, the motor sensor detection is disabled. If the motor thermal sensor needs to be connected to DI1/CTP, set **Mtr.06 (05.70)** = Drive terminal (1).
(**) RL1 relay opens when at least one of the STO is open.

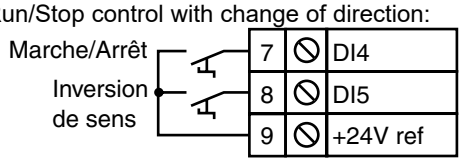
• Modification of the Run/Stop control logic

- For «3-wire» control (job Run/Stop) :



List of parameters to set:
Ctr.06 (06.04) = Run latched (1),
I/O.10 (08.25) = **06.39** Stop sequencing bit (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 sequencing bit (DI4 terminal)
I/O.10 (08.25) = **06.33** FWD/Reverse sequencing bit (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 (RP2)
1	1	**Spd.05 (01.22)** to be set

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 that it cannot transmit any torque to the motor.
They are independent of one another. They drive a simple hardware not connected to the microcontroller, which acts on two different stages of the IGBT output bridge control.
To enable the drive, the STO-1 and STO-2 inputs must be connected to the +24V source.
Opening one of the inputs locks the output bridge.

These 2 inputs can be used in conjunction to create a (Safe Torque Off) function with a 2 separate channel logic.
In this configuration, the «Safe Torque Off» function is guaranteed with a very high level of integrity in conformity with standards:
- EN 61800-5-2
- EN/ISO 13849-1: 2006; PLe
- CEI/EN 62061: 2005; SIL3
(CETIM approval no. CET0047520)

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

The STO-1 and STO-2 inputs are compatible with self-tested logic outputs in controllers such asPLCs, for which the test pulse lasts for 3 ms maximum.
If the data sent by the 2 inputs is not identical, this generates a drive trip. The RL1 relay opens and the drive indicates a «t.r./35» trip on the drive 2-digit display or «STO inputs» with a parameter-setting interface.

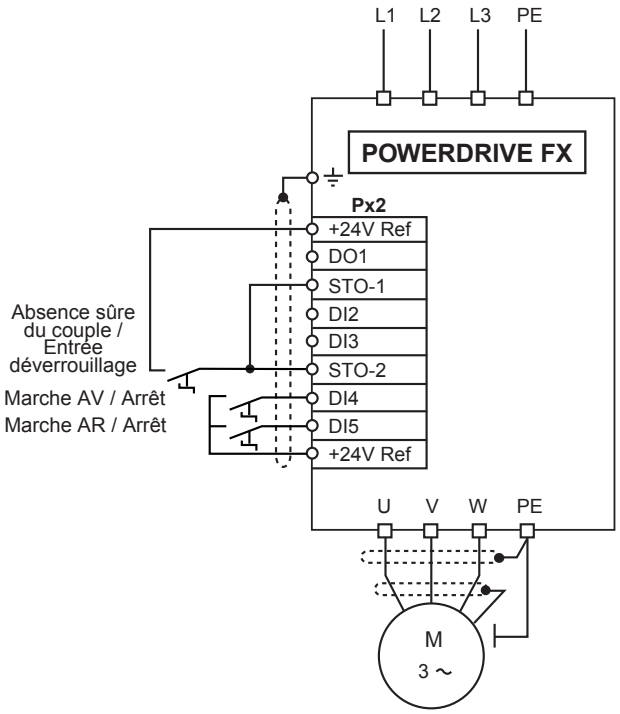
For correct use, the power and control connection diagrams described in the following paragraphs must be implemented.

⚠ • 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 integrator must carry out a risk analysis of the whole machine, which will determine the safety category with which the installation must comply.

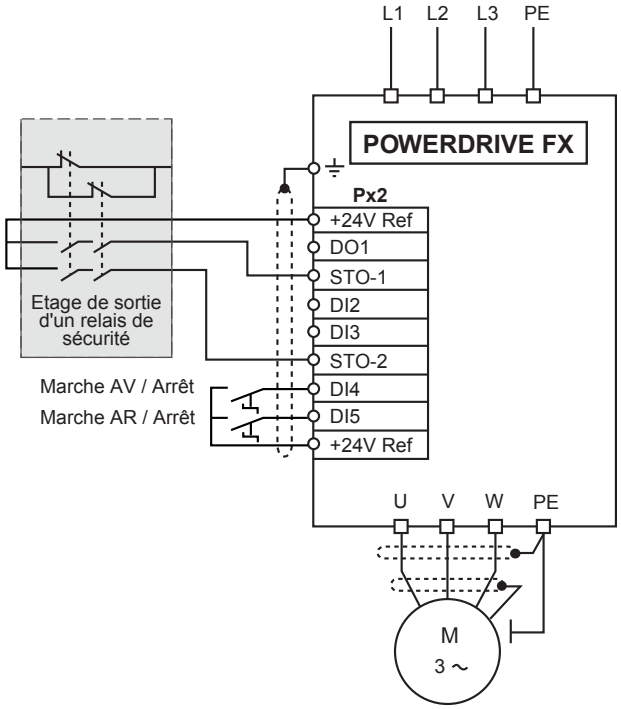
• The STO-1 and STO-2 inputs, when open, lock the drive, so that the dynamic braking function is no longer available. If a braking function is required before the drive secure disable lock is applied, a time-delayed safety relay must be installed to activate locking automatically after the end of braking.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

• The STO-1/STO-2 inputs do not provide the electrical isolation function. Before any work is carried out, the power supply must be cut by an approved isolating device (isolator, switch, etc).

3.3.1 - 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 - 3-phase AC power supply, in accordance with safety standard IEC/EN 62061: 2005 and EN/ISO 13849-1: 2006 - Double channel locking with feedback (SIL3 - PLe)

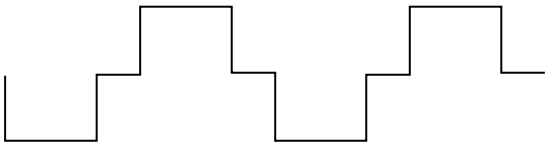


4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE

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.



Courant de ligne consommé par un redresseur triphasé

This current carries harmonics with number 6n ± 1.
The **POWERDRIVE FX** THDI level is less than 32%: significantly less than the maximum level defined by standard IEC 61000-3-12 (< 45%).

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 polluted 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

Frequency inverters use high-speed switches (transistors, semi-conductors) which switch high voltages (around 550 V) and currents at high frequencies (several kHz). This provides better efficiency and a low level of motor noise.
As a result, they generate radio-frequency (R.F.) signals which may disturb operation of other equipment 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 that of the motor via the metal structures which support the motor;
- 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 supply company.

4.3.2 - Standards

The maximum emission level is set by the standards for variable speed drives (EN 61800-3).

4.3.3 - Recommendations

• Experience shows that the levels set by the standards do not necessarily need to be observed to eliminate interference phenomena.
• Following the basic precautions described in section 4.5 generally results in the correct operation of the installation.

4.4 - Mains supply power

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 equipment, especially variable speed drives.
The **POWERDRIVE FX** is designed to operate with mains supplies typical of industrial sites throughout the world. However, fo 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),
• Overhead power supply.

4.4.2.1 - Connection/disconnection of a bank of cosφ 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 1.6 x mains Vrms. If this is the case, it is essential to take corrective measures to guarantee the mains quality.

4.4.2.3 - Overhead power supply

An overhead power supply is not allowed for the **POWERDRIVE FX**.

4.4.3 - Mains short-circuit power

As with all variable speed drives, the mains short-circuit power to which the **POWERDRIVE FX** is connected has an effect on its behaviour. Notably, when the mains short-circuit power is low, voltage oscillations may appear due to resonances between the inductive impedance of the mains and the filtering capacity of the **POWERDRIVE FX**. To avoid the **POWERDRIVE FX** tripping because of these oscillations, make sure that the ratio $R_{sc} = I_{sc}/(n \times I_L M)$ is higher than 50.
Where:
I_{sc}: Mains short-circuit current at the point of connection
n: Number of **POWERDRIVE FX** drives connected on the same power supply line
$I_L M$: **POWERDRIVE FX** rated input current
As a matter of course, check that:
• The sum of the power of all **POWERDRIVE FX** drives connected to the same transformer does not exceed 35% of the total transformer rated power.
• The sum of the power of the **POWERDRIVE FX** drives installed on a generator does not exceed 20% of its rated power.

4.4.4 - Ground connections

The earth equipotential of some industrial sites is not always observed. This lack of equipotential 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 are to be taken into account when wiring the cabinet and any external components. In each paragraph, they are listed in decreasing order of effect on correct operation of the installation.

4.5.1 - Wiring inside the cabinet

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

4.5.2 - Wiring outside the cabinet

- Connect the motor earth terminal directly to that of the drive.
It is recommended that a shielded symmetrical cable is used: three phase conductors and coaxial or symmetrical PE conductor and shielding.
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 (completely connected).
- 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 fixed securely at the bottom of 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.

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	Level 3 (industrial)
IEC/EN 61000-4-3	Immunity standards for radiated radio-frequency	Product casing	Level 3 (industrial)
IEC/EN 61000-4-4	Bursts of fast transients	Control cable	Level 4 (industrially hardened)
		Power cable	Level 3 (industrial)
IEC/EN 61000-4-5	Shock waves	Power cables	Level 4
IEC/EN 61000-4-6	Generic immunity standards for conducted radio-frequency	Control and power cables	Level 3 (industrial)
EN 50082-2	Generic immunity standards for the industrial environment	-	Conforming
IEC/EN 61000-6-2			
IEC/EN 61800-3	Variable speed drive standards	Conforms to categories C1, C2 and C3	
EN 61000-3			

Emission				
Standard	**Categories**	**Size 2***	**Size 3***	**Size 2 or 3 with external filter***
EN 61800-3	C1	-	-	To be defined
	C2	Cable length < 10 m Frequency < 5 kHz	Cable length < 10 m Frequency < 5 kHz	Cable length < 100 m Frequency < 5 kHz
	C3	Cable length < 100 m Frequency < 8 kHz	Cable length < 100 m Frequency < 5 kHz	Frequency < 16 kHz

* With shielded cables

• In accordance with IEC 61800-3, in a residential environment, this device may cause radio-electrical interference. In this case, the user may be asked to take appropriate action.

Low-order harmonics		
Standard	**Size 2**	**Size 3**
THD according to EN 61000-3-12 (1)	Conforming to $I_{SC}/I_LM > 200$ (2)	Non applicable

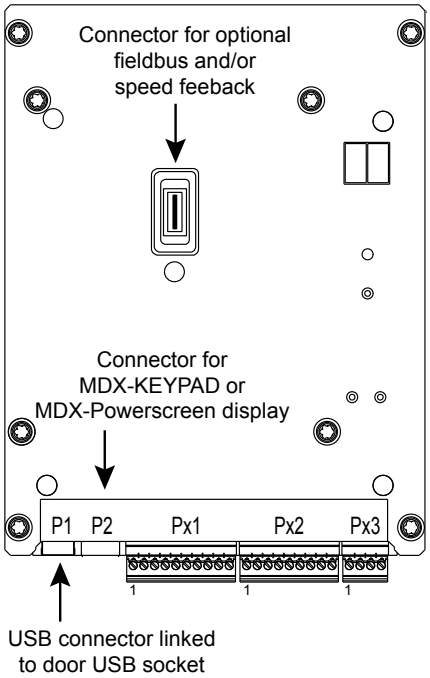
(1) Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16A and ≤ 75A per phase.
(2) I_{SC}: Mains short-circuit current at the interface between the user's power supply and the public mains supply.
I_LM: see table in section 3.1.3.

It is the responsibility of the equipment user and/or the installer to ensure, if necessary by consulting the distribution system manager, that the equipment is only connected to one power supply so that the short-circuit capability is higher than that stated in the table.

5 - OPTIONS

5.1 - Operator interfaces

5.1.1 - Connection to the drive



5.1.1.1 - P1 connector

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

• In conformity with standard EN60950, the USB link can only be used via a device that provides isolation of 4kV (MDX-USB isolator option).

5.1.1.2 - P2 terminal block

This is a standard RS485/RS422 terminal block which is used to connect a parameter-setting interface or to communicate via Modbus RTU.

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

5.1.2 - MDX-KEYPAD

5.1.2.1 - General

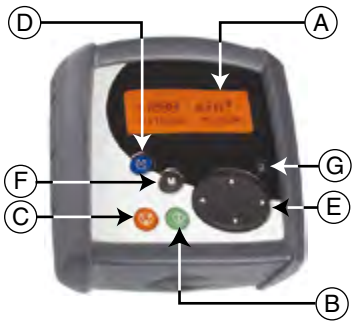
This keypad, which is remote from the drive, makes it easy to set up the **POWERDRIVE FX** and provides access to all parameters. Its LCD display, consisting of one line of 12 characters and 2 lines of 16 characters, offers text which can be displayed in 5 languages (English, French, German, Italian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

The MDX-KEYPAD has 2 main functions:

- A read mode for **POWERDRIVE FX** supervision and diagnostics
- Access to all the **POWERDRIVE FX** parameters in order to optimise settings or even configure particular applications.

As soon as it is swithched 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: - The drive operating status and its lain data, - The main adjustment parameters via a "**Quick parameter setting**" menu, - All the drive parameters via 21 "**Advanced parameter setting**" menus (access via a code).
B	Green button for run command if control via the keypad is enable. See "**Parameter setting via the keypad**".
C	Red button for drive reset or to give a stop command if control via the keypad is enabled. See parameters **Ctr.05 (6.43)** and **06.12**.
D	Blue button for change of direction of rotation if control via the keypad is enabled. See parameter **Ctr.05 (6.43)**.
F	Navigation button (, , ,) for moving through the various menus and changing the contents of parameters.
F	M 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.

5.1.2.2 - 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.

5.1.3 - MDX-Powerscreen

5.1.3.1 - General

The interface is a touch screen which can be used to access various menus. It is supplied with its own connection cable (2 metres).

After the loading phase following powering-up of the drive, the parameter-setting interface displays the screen below.

Ref.	Function
A	4.3” touch screen
B	Touch-sensitive button for access to the main menu
C	"PWR" LED, indicates the state of the interface power supply
D	Touch-sensitive buttons for language selection (can take a few minutes to load)

5.1.3.2 - 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 during operation, as well as its main measurement points.
- **Setting**: Used for reading and/or modification of all the drive parameters, as well as to set the date and time on the display.
- **Control via keypad**: Gives dirtect 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 drive's last 10 trips.

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

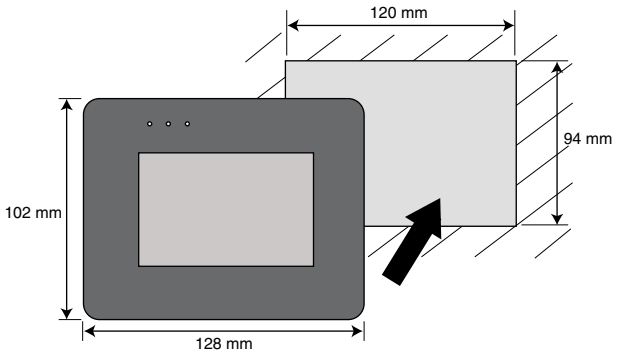
At any time and regardless of the screen displayed, the button can be used to return to previous pages, as far as the interface main page.

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

5.1.3.3 - Installation

The interface is through-panel-mounted in the front of a cabinet (IP65/NEMA 4 pounting).

Plan de découpe



5.1.4 - MDX-SOFT

The MDX-SOFT enables parameter setting or supervision of the **POWERDRIVE FX** from a PC. Numerous functions are available:
- Fast commissioning
- LEROY-SOMER motor database
- File saving
- Online help
- Comparison of 2 files or one file with the factory settings
- Printing of a complete file or differences compared to the factory settings
- Supervision,
- Diagnostics

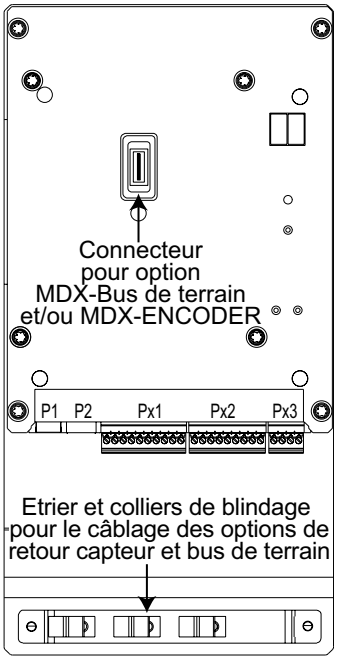
To connect the PC to the POWERDRIVE FX, use an "MDX-USB Isolator" isolated USB cable.

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

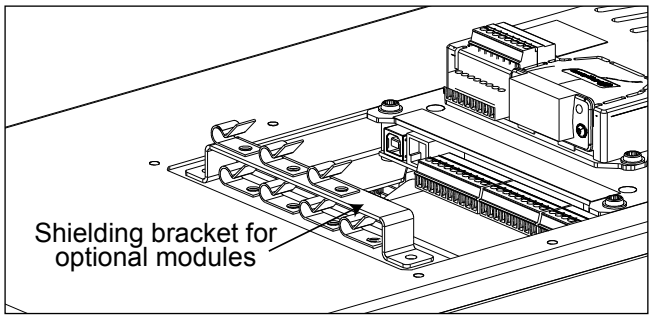
Powerdrive FX can be set via the USB connector, even if the drive is not powered.
Attention. In this case, options modules will not be powered and settings will not be saved. To make an option module setting / backup , it is necessary to provide an auxiliary power supply.

5.2 - Add-on options

5.2.1 - Connector and shielding bracket



• To connect the optional modules to the drive control board connector, remove the back plastic protective cover.
• The bracket for connecting the option shielding is supplied with each option. To attach it, screw the bracket in the location indicated below, placing it over the control cable shielding clamps (the shielding clamp furthest to the right should be removed).



5.2.2 - Fieldbus, speed feedback and I/O options

The control board is designed to be plugged with various optional modules. Several options can be combined:
• Fieldbus options (see section 5.2.3)
• Speed feedback options (see section 5.2.4)
• I/O options (see section 5.2.5).

5.2.3 - Fieldbus options

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

MDX : option to be fitted to the control board (white color)

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

Association table:

Main option	Fieldbus	
	MDX version	CM version
None	X	
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 FX :

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

For more details, consult the specific documentations.

5.2.4 - Speed feedback options

Two options are available to manage the motor speed feedback:

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

For more details, consult the specific documentations.

5.2.5 - Additional I/O options

Two options are available to increase the number of inputs / outputs of the **Powerdrive FX** :

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 (V, mA)	2	1
Motor thermistor KTY84-130 or PT100	1	1
Digital inputs	2	4
Digital outputs	1	2
Assignable relay	1	2
Drive forced fan's management	✓	✓
Real time clock	-	✓
Ethernet connection: • WEB pages: drive configuration and status • 2 programmable emails • Configuration backup & restoration	-	✓
Datalogger	-	✓

For more details, consult the specific documentations.

5.3 - RFI filters

5.3.1 - General

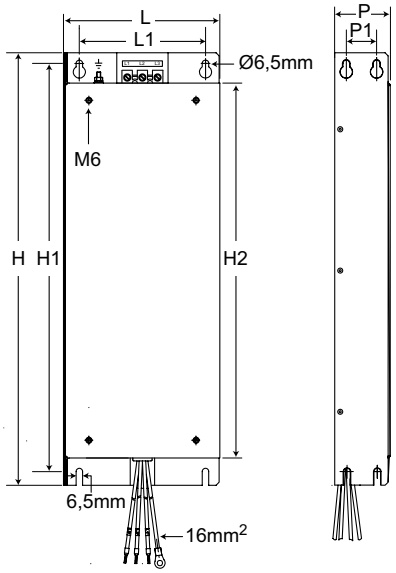
The use of RFI filters contributes to a reduction in the emission levels of radio-frequency signals. They are used to improve conformity of the drive with standard EN 61800-3 on conducted and radiated radio-frequency emissions (see section 4.6).
Depending on the drive used, install the RFI filter (recommended in the table below) between the mains and the drive input.

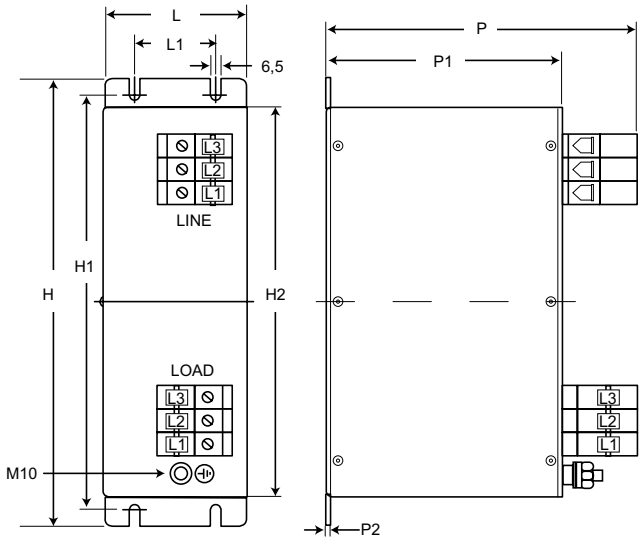
POWERDRIVE FX rating	RFI filter			
	Reference	I_{nom} at 40°C (A)	Leakage current (mA)	Losses (W)
33T	FS 6008-62-07	62	66	23
40T and 50T	FS 6008-101-35	101	73	25
60T to 100T	FN 3359-180-28	197	<6	34

CAUTION:
The specific design of these filters makes it possible to use them in the context of installations with a neutral IT point connection. The installer must however check that the insulation control systems dedicated to these installations are suitable for monitoring electrical equipment that may incorporate electronic variable speed drives.

5.3.2 - Weight and dimensions

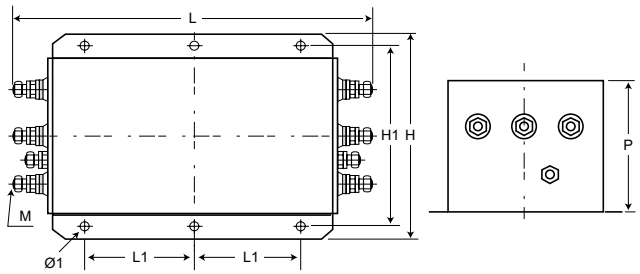
• FS 6008-62-07 and FS 6008-101-35





Type	Dimensions (mm)								Weight (kg)
	L	L1	H	H1	H2	P	P1	P2	
FS 6008-62-07	250	210	414	396	361	60	30	-	3.5
FS 6008-101-35	100	65	300	275	260	225	170	1.5	4

• FS 3359-180-28

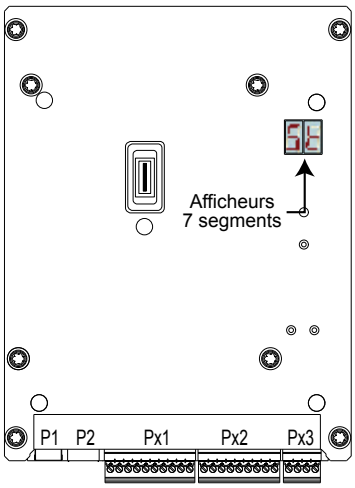


Type	Dimensions (mm)							Masse (kg)
	L	L1	H	H1	P	Ø1	M	
FN 3359-180-28	360	120	210	185	120	12	M10	6.5

6 - TRIPS - DIAGNOSTICS

• The user should never attempt either to repair the drive himself, or to perform any other diagnostics than those listed in this section. If the drive malfunctions, it should be returned to LEROY-SOMER via your usual contact.

In cases where the **POWERDRIVE FX** is not connected to an operator interface, it is still possible to find out the drive status (including trips and alarms) thanks to two 7-segment displays located on the drive control board.



6.1 - Drive status

When the drive is not in the trip or alarm state, the displays provide information about the drive status when stopped or running.
The LEDs display alternately a 2-letter code and a number that can be used to find out the drive status using the table below (this number corresponds to the value of parameter **10.98**).

IH : "Inhibit"
OP : "Operating"
St : "Stop"
Lt : "Limit"
rd : "Ready"
CH : "Check"
tr : "Trip" (see section 6.3)

Code	No.	Meaning
IH	0	Drive disabled
	30	Drive disabled with run command present, but STO-1 and STO-2 not connected or **06.15**. Drive output set to "Inhibit". **• Depending on the control logic selected in 06.04 (Ctr.06), the motor can start as soon as the drive is enabled.**
OP	1	Drive enabled, motor (on load)
	2	Drive enabled, generator (driving load)
	27	Catch a spinning motor
	28	Delay before start
	29	Delay before flying restart
	31	Supply voltage < minimum voltage
St	3	Stop on ramp, clockwise, motor
	4	Stop on ramp, clockwise, generator
	5	Stop on ramp, anti-clockwise, motor
	6	Stop on ramp, anti-clockwise, generator
	7	Stop with low-frequency current injection, clockwise, motor
	8	Stop with low-frequency current injection, clockwise, generator
	9	Stop with low-frequency current injection, anti-clockwise, motor
	10	Stop with low-frequency current injection, anti-clockwise, generator
	15	DC injection, clockwise, motor
	16	DC injection, clockwise, generator
	17	DC injection, anti-clockwise, motor
	18	DC injection, anti-clockwise, generator
Lt	19	Current limit, clockwise, motor
	20	Current limit, clockwise, generator
	21	Current limit, anti-clockwise, motor
	22	Current limit, clockwise, generator
	23	BUS voltage limit, clockwise, motor
	24	BUS voltage limit, clockwise, generator
	25	BUS voltage limit, anti-clockwise, motor
	26	BUS voltage limit, anti-clockwise, generator
rd	32	Drive healthy
CH	33	Autotune
	35	Test of boards (control/interface)

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 switch to fault mode if no corrective action is taken.

The LEDs display alternately "A.L." and a number that can be used to identify the alarm by means of the table below (this number corresponds to the value of parameter **10.97**).

Code	No.	Meaning
A.L.	1 to 4	User alarm 1 (**10.54**) to User alarm 4 (**10.57**)
	6	Motor overload (**10.17**)
	7	Drive overheating (**10.18**)
	8	Microcontroller overoccupancy
	9	Rectifier
	10	Emergency operation (see menu 20)

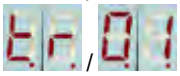
6.3 - Trips

If the drive trips, the output bridge is inactive and the drive no longer controls the motor.

The LEDs display alternately "t.r." and a number that can be used to identify the trip by means of the table below (this number corresponds to the value of parameter **10.99**). For trips numbered higher than 100, only the last 2 digits are displayed with a point displayed on both LEDs to indicate the hundred.

Example :

 : indicates trip no. 1

 : indicates trip no. 101

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

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

No.	Reason for trip	Possible cause and corrective actions
1	DC bus undervoltage	• Check the quality of the power supply (voltage dips) • Check the input fuses
2	DC bus overvoltage	• Check that the mains voltage is within the permitted tolerance • Check the quality of the power supply (commutation notches or transient overvoltages)
3	Overcurrent at drive output	• Check the motor insulation • Check the motor cables (connections and insulation) • Check the quality of the mains supply
5	Motor current imbalance: vectorial sum of the 3 motor currents not zero	• Check the motor insulation • Check the cable insulation
6	Loss of a motor phase	Check the motor cable and resistance values between motor phases
7	The speed is higher than (1.3 x **01.06**) or (**01.06** + 1000 min^{-1})	Check the drive settings
8	The drive overload level exceeds the conditions defined in section 1.4.2	• Check the drive is suitable for the load • Check the ambient temperature
9	Internal protection of phase U IGBTs	Check the motor and cable insulation
10	Overheating of the rectifier bridge IGBTs	• Clean the cabinet dust filters • Check the drive ventilation units are working correctly • Check that the product air inlet temperature is not outside the limits
11	The measured position does not vary (only if the MDX-ENCODER option is present)	• Check the encoder wiring • Check that the motor shaft turns
13	The encoder u, v, w commutation signals are not connected correctly (only if the MDX-ENCODER option is present)	Check the conformity of the encoder wiring

No.	Reason for trip	Possible cause and corrective actions
14 15 16	During the autotune phase, one of the encoder U, V or W commutation channels is not present	• Check the encoder wiring • Check the encoder connections • Change the encoder
18	A stop command has been given during the autotune phase	Repeat the autotune procedure (see **05.12**)
20	Motor thermal overload	• Make sure that the motor duty cycle does not exceed its thermal capacity • Check the setting of **04.15** "Thermal time constant" with respect to the application
21	Overheating of the phase U IGBTs	• Clean the cabinet dust filters • Check the drive ventilation units are working correctly • Check that the product air inlet temperature is not outside the limits • If the trip appears at frequencies lower than 10 Hz, check that the limit conditions given in section 1.4.3 have been complied with
24	Opening of the DI1/CTP input of the PX1 drive terminal block or T1/T2 inputs of the MDX-ENCODER option	• Check the ambient temperature around the motor • Check that the motor current is less than the stated current • Check the thermal sensor wiring
26	Overload on the +24V or digital output power supply	Check the I/O wiring
28	Loss of the current reference on analog input AI2	Check the input wiring ans source
29	Loss of the current reference on analog input AI3	
30	Loss of communication on the P2 connector serial link	• Check the cable connections • Check the parameter **11.63** is compatible with the timing of requests from the master
31	Number of write cycles to EEPROM exceeded (> 1,000,000)	• Change the control board • Check the recurrence of write cycles from the drive controller
33	Problem during measurement of the stator resistance	Check the motor wiring
34	Disconnection of the fieldbus during operation or timing error	• Check the fieldbus connections • Check that parameter **15.07** is compatible with the timing of requests from the master
35	Simultaneous opening of both STO (Safe Torque Off) inputs during operation	Check the remote control link
37	Encoder break	• Check the encoder wiring • Check the encoder connections
38	Breakdown of synchronous motor in sensorless closed loop mode	Check the menu 5 parameters are compatible with the values on the motor nameplate
39	The rectifier connot synchronise with the mains supply	Check the quality of the power supply (commutation notches)
40	Loss of exchanges between the control board and the MDX-ENCODER module	Check that the MDX-ENCODER module is properly attached
41	User trip 1 triggered by **10.61**	-
42	User trip 2 triggered by **10.63**	
43	User trip 3 triggered by **10.65**	
44	User trip 4 triggered by **10.67**	
45	User trip 5 triggered by the serial link **10.38** = 45	
46	User trip 6 triggered by the serial link **10.38** = 46	
47	User trip 7 triggered by the serial link **10.38** = 47	
48	User trip 8 triggered by the serial link **10.38** = 48	

No.	Reason for trip	Possible cause and corrective actions
49	User trip 9 triggered by the serial link **10.38** = 49	-
50	User trip 10 triggered by the serial link **10.38** = 50	
51	The DO2 output load current (MDX-I/O option) is > 200 mA	Check that DO2 is not short-circuited
52	The DO3 output load current (MDX-I/O option) is > 200 mA	Check that DO3 is not short-circuited
53	Communication problem between the drive and the MDX-I/O option	Check the MDX-I/O option mounting
54	Communication problem between the drives	-
56	Internal protection of phase V IGBTs	Check the motor and cable insulation
57	Internal protection of phase W IGBTs	
58	Overheating of phase V IGBTs	• Clean the cabinet dust filters • Check the drive ventilation units are working correctly • Check that the product air inlet temperature is not outside the limits • If the trip appears at frequencies lower than 10 Hz, check that the limit conditions given in section1.4.3 have been complied with
59	Overheating of phase W IGBTs	
60	A problem is detected during the control board and interface test	Refer to parameters **17.05**, **17.08** and **17.09** in the diagnostics menu in commissioning manual ref. 4617
63	The STO-1 and STO-2 inputs have had a different state for more than 100 ms.	Check the remote control link for the STO-1 and STO-2 inputs
65	Overload on the +10 V power supply	Check the I/O wiring
66	The DO1 output load current is > 200 mA	Check that DO1 is not short-circuited
67	The internal ventilation is not working (50T and 100T only)	Get in touch with your usual LEROY-SOMER contact
68	The current has exceeded the limit programmed in **05.55**. The load is too high for the setting	-
69	The 24V load current is too high	Check the MDX-I/O option I/O wiring
70	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	Loss of the current reference on analog input AI5 of the MDX-I/O option	Check the input wiring and source of the MDX-I/O option
101	Mains loss	• Check the input fuses • Check the quality of the power supply (voltage dips)
102	Loss of rectifier synchronisation with the mains	Check the quality of the power supply (commutation notches)

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 it to switch off, fatal residual voltages remain at the output terminals and in the drive.

• Before carrying out any work, disconnect and lock the drive power supply.

• Switch off the drive and external control circuits before working on the control cables (the external control circuits can still retain a considerable amount of voltage).

• 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.

• After working on the motor, check that the phase order is correct when re-connecting the motor cables.

• When the drive controls a permanent magnet motor, only one motor can be connected to the drive output. It is advisable to install a safety switch between the permanent magnet synchronous motor and the drive output. This breaker isolates the motor during maintenance work on the drive.

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

7.1 - Servicing

Printed circuits and the 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 would then immediately become null and void.

Do not touch the integrated circuits or the microprocessor either with your fingers or with materials which are charged or live. Earth yourself, as well as the workbench or the soldering iron, when performing any work on the circuits.

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 regulary depending on their state.

7.2 - Storage

If the drive has been stored for more than 3 years, it is essential to switch on the drive for 24 hours, and repeat this operation every 6 months.

7.3 - Exchanging products

CAUTION:

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

8 - UL LISTING INFORMATION

The **POWERDRIVE FX** file number is E211799. Confirmation of UL listing can be found on the UL website: www.ul.com

8.1 - Common UL information

Conformity
The drive conforms to UL listing requirements only when the following are observed:
• The drive is installed in a type 1 enclosure, or better, as defined by UL50
• The surrounding air temperature does not exceed 40°C (104°F) when the drive is operating
• The terminal tightening torques specified in section 3.1 *"Connection of the power"* are respected
• If the drive control stage is supplied by an axternal power supply (+24V), the external power supply must be a UL Class 2 power supply

Motor overload protection and Over speed protection
The drive does not incorporate solid state overload protection for the motor load. The drive provides overspeed protection.
However, it does not provide the level of protection afforded by an independent high integrity overspeed protection device.

Options
The MDX options are not UL-listed.

8.2 - AC supply specification

The drive is suitable for use in a circuit capable of delivering not more than 18,000rms symmetrical Amperes.

8.3 - Maximum continuous current

The drive models are listed as having the maximum continuous output currents (ISu) and maximum input currents (ILu) below

Size	Rating	ISu (A)	ILu (A)
2	33T	59	57
	40T	73	68
	50T	86	70
3	60T	110	100
	75T	145	115
	100T	165	145

8.4 - Fusing and cabling

The drive conforms to UL listing requirements only when the following is observed:
- The UL-listed class J fact acting fuses (Bussman Limitron KTK-R series, Ferraz Shawmut ATMR series or equivalent) indicated in the section 3.1.3 are used in the AC supply.
- UL listed closed-loop connectors sized according to the field wiring are used for power connections.

NOTES

NOTES

Nidec

All for dreams

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