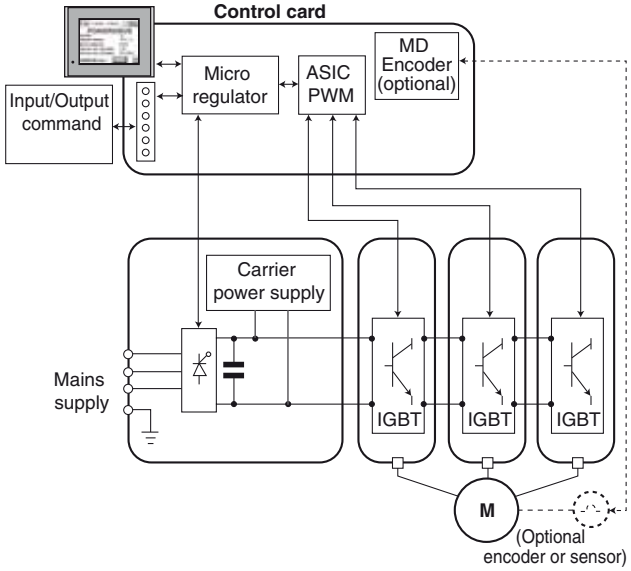
LEROY SOMER®

3902 en - 2010.05 / e

This manual is to be given to the end user



POWERDRIVE

Variable speed drive

Installation manual

POWERDRIVE
Variable speed drive

NOTE

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

CAUTION

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

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

The variable speed drive is fitted with safety devices which, in the event of a problem, control stopping and thus stop the motor. The motor itself can become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, may also cause the motor to stop. The removal of the causes of the shutdown can lead to restarting, which may be dangerous for certain machines or installations.
In such cases, it is essential that the user takes appropriate precautions against the motor restarting after an unscheduled stop.

The variable speed drive is designed to be able to supply a motor and the driven machine above its rated speed.
If the motor or the machine are not mechanically designed to withstand such speeds, the user may be exposed to serious danger resulting from their mechanical deterioration.
It is important that the user checks that the installation can withstand it before programming a high speed.

The variable speed drive which is the subject of this manual is designed to be integrated in an installation or an electrical machine, and can under no circumstances be considered to be a safety device. It is therefore the responsibility of the machine manufacturer, the designer of the installation or the user to take all necessary precautions to ensure that the system complies with current standards, and to provide any devices required to ensure the safety of equipment and personnel.

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

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This manual only describes the general features, characteristics and installation of the POWERDRIVE. For commissioning, refer to manual 3871.

POWERDRIVE
Variable speed drive

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

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

1 - General

Depending on their degree of protection, the variable speed drives may contain unprotected live parts, which may be moving or rotating, as well as hot surfaces, during operation. Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel and equipment.
For further information, consult the manual.
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/CE (Machinery Directive). It is also necessary to comply with standard EN 60204, which stipulates in particular that electrical actuators (which include variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches.
Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2004/108/CE) are met.
The variable speed drives meet the requirements of the Low Voltage Directive 2006/95/CE. 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 manual supplied with the product.
The variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts.
The variable speed drives contain parts which are sensitive to electrostatic stresses and may be easily damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!).

5 - Electrical connection

When work is performed on variable speed drives which are powered up, the national accident prevention regulations must be observed.
The electrical installation must comply with the relevant specifications (for example, conductor cross-sections, protection via fused circuit-breaker, connection of protective conductor). More detailed information is given in the manual.
Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion of cables and conductors, are given in the documentation supplied with the variable speed drives. These instructions must be followed in all cases, even if the variable speed drive carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation

Installations in which variable speed drives are to be integrated must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations, such as the law on technical equipment, accident prevention regulations, etc. Modifications to the variable speed drives using control software are permitted.
Active parts of the device and the live power connections must not be touched immediately after the variable speed drive is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to the variable speed drives must be observed.
During operation, all doors and protective covers must be kept closed.

7 - Servicing and maintenance

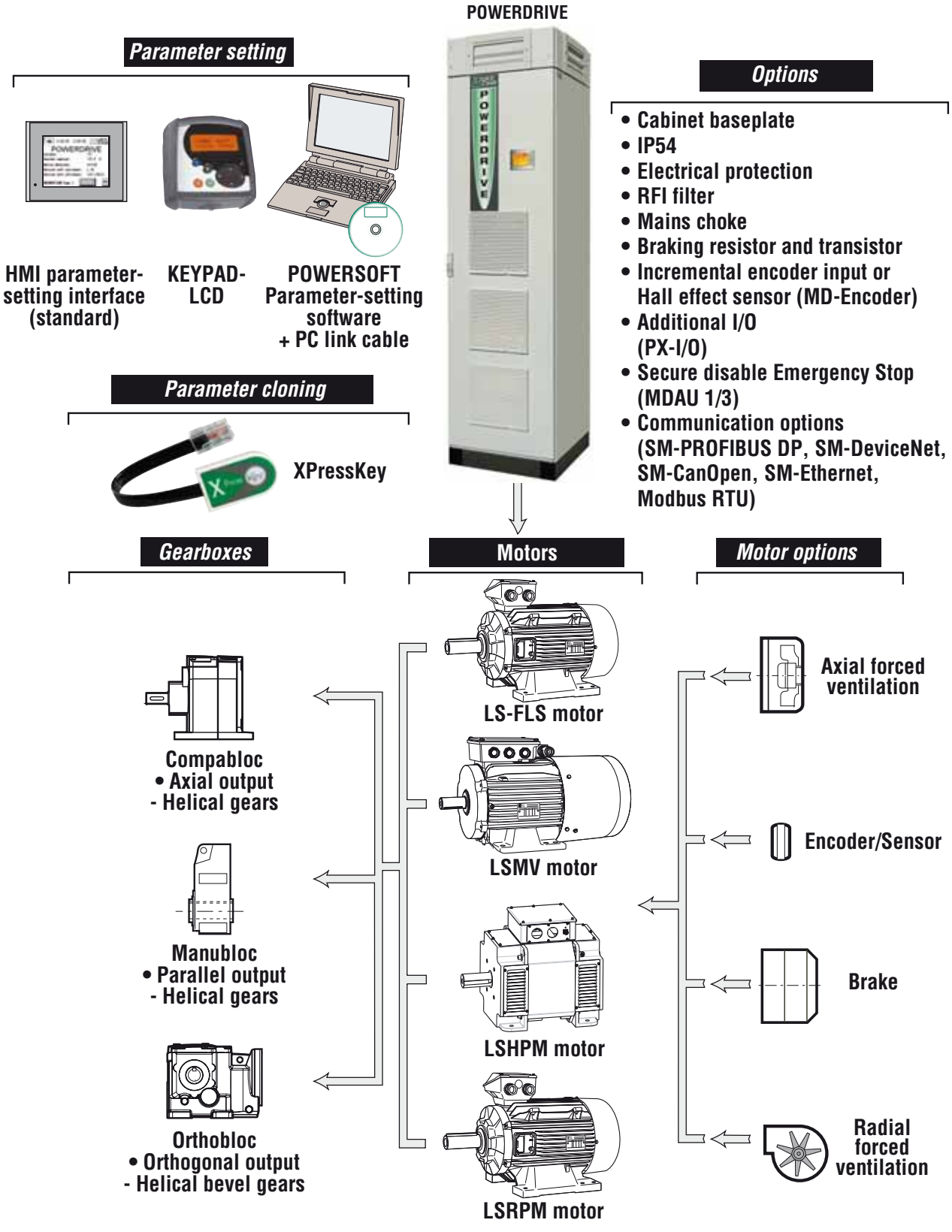
Refer to the manufacturer's documentation.

This manual is to be given to the end user.

POWERDRIVE
Variable speed drive

FOREWORD

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



POWERDRIVE
Variable speed drive

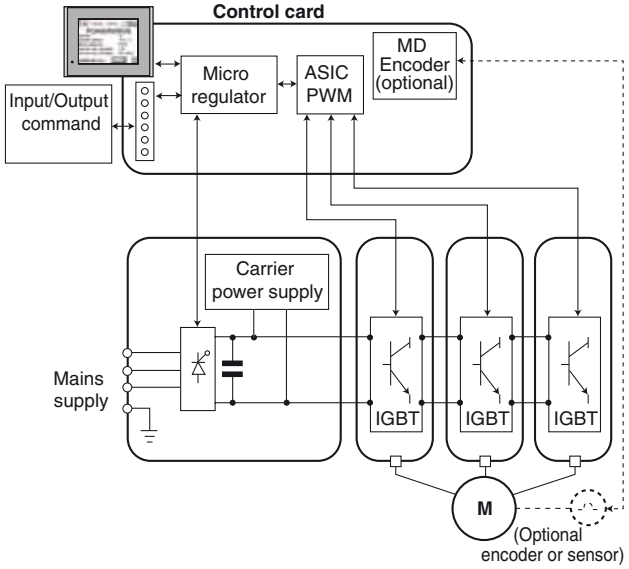
CONTENTS

1 - GENERAL INFORMATION

1.1 - General

POWERDRIVE is a modular electronic drive in an IP21 or IP54 electrical cabinet, designed for supplying power to asynchronous or synchronous 3-phase motors.
In the standard version, **POWERDRIVE** is a variable speed drive with flux vector control and without speed feedback (open loop) with very high performances levels, making it suitable for the majority of applications.
With the speed feedback (closed loop) option, **POWERDRIVE** controls motors equipped with an incremental encoder with or without commutation channels, or a Hall effect sensor. This makes it possible to control the torque and the speed over the whole speed range (including zero speed), with enhanced dynamic performance.
The performance of **POWERDRIVE** (MDS) is compatible with use in all 4 quadrants of the torque/speed plane (with built-in braking module). The regenerative **POWERDRIVE** (MDR) can be used to restore energy without a braking resistor.
With IP54 protection (optional), it can be installed directly on the machine in harsh environments.

Diagram (MDS)



1.2 - Product designation

POWERDRIVE MDS - - 180 T

- Modular variable speed drive with flux vector control
- Cabinet version
  - MDS : 6 pulses
  - MDT : 12 pulses
  - MDE : 18 pulses
  - MDW : 24 pulses
  - MDR*: Regen
- \- : Air cooling
  L*: Liquid cooling
- \- : Single output
  D : Dual output (to control 2 motors)
- Rating in kVA
  - T : 400 V to 480 V 3-phase power supply
  - TH : 525 V to 690 V 3-phase power supply

(*) See the corresponding installation manual

Nameplate

LEROY SOMER
MOTEURS LEROY-SOMER
16015 ANGOULEME FRANCE

ENTREE - INPUT			
Ph	V (V)	Hz (Hz)	I(A)
3	400/480	50/60	295

Alim auxiliaire 800 VA
400V/50Hz 480/60Hz

TYPE : **POWERDRIVE MDS - 180T**
S/N : 09999999999

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

1.3 - Environmental characteristics

Characteristics	Level
Protection	IP21 (optional IP54)
Storage and transport temperature	-25°C to +60°C 12 months maximum, after which the drive must be switched on (power and electronics) for 24 hours every 6 months
Operating temperature	• Drive: -10°C to +40°C, up to +50°C with derating (see section 1.4.4). • HMI keypad: 0°C to +50°C.
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 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 at an ambient temperature of $[40°- (3 \times 0.6°)] = 38.2°C$.
Vibrations	• In accordance with IEC 60068-2-6 • Exposed product: $2 m/s^2$ (9-200 Hz), 0.6mm (2-9 Hz) • Packaged product: $10 m/s^2$ (9-200 Hz), 3 mm (2-9 Hz)
Shocks	Packaged product: In accordance with IEC 60068-2-29
Atmospheric pressure	700 to 1060 hPa
Temperature cycle	In accordance IEC 60068-2-14 -10°C to +40°C, 5 cycles

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: 400 V -10% to 480 V +10% ("T" ratings) or 525 V -10% to 690 V +10% ("TH" ratings)	
Phase voltage imbalance	2%	
Forced ventilation and auxiliary power supply power and voltage (Px4 terminal block(s))	Single phase mains supply:	
	400 V/50 Hz (± 10%) or 460-480 V/60 Hz (± 10%)	500 V -10% to 690 V +5%
	• 60T to 150T : P = 350 VA • 180T to 270T : P = 800 VA • 340T to 470T : P = 1200 VA • 600T and 750T : P = 2400 VA • 900T and 1100T : P = 3600 VA	• 270TH to 500TH : P = 1200 VA • 600TH to 900TH : P = 2400 VA • 1200TH and 1500TH : P = 3600 VA
Input frequency	5% around the rated frequency (50 or 60 Hz)	
Maximum number of power-ups per hour (power)	20	
Output frequency range	0 to 590 Hz	

• For operation with a neutral IT point connection, follow the instructions given in section 4.4.3.

1.4.2 - Electrical characteristics at 40°C

I_{co}: Continuous output current.
P_{out}: Output power.
I_{max} (60 s): Maximum output current *.
I_{max} (2 s): Peak output current for 2 s after start-up.
Heavy duty: For high overload constant torque machines, for example: presses, grinders, extruders, conveyors, sieves, hoisting or applications where significant inertia has to be accelerated quickly.
Normal duty: For low overload constant torque or centrifugal torque machines, for example: pumps, fans, compressors.
(*) Current available for 60 seconds every 600 seconds, at maximum drive temperature.

CAUTION:
In its factory setting, the drive operates with a switching frequency of 3 kHz at an ambient temperature of 40°C.
Note: With the IP54 option, the values in the table below are valid for a switching frequency setting of 2 kHz.

3-phase mains supply, 400 V -10% to 480 V +10%

POWERDRIVE rating	Heavy duty				Normal duty			
	P_{out} (kW)	I_{co} (A)	I_{max} (60 s) (A)	I_{max} (2 s) (A)	P_{out} (kW)	I_{co} (A)	I_{max} (60 s) (A)	I_{max} (2 s) (A)
60T	45	90	120	140	55	110	120	140
75T	55	110	165	175	75	145	165	175
100T	75	145	200	220	90	175	200	220
120T	90	175	240	270	110	215	240	270
150T	110	220	308	375	132	260	308	375
180T	132	260	360	425	160	305	360	425
220T	160	305	450	460	200	380	450	460
270T	200	380	530	600	250	470	530	600
340T	250	470	660	770	315	580	660	770
400T	315	570	760	900	355	630	760	900
470T	355	680	940	1060	450	800	940	1060
600T	450	820	1140	1210	550	990	1140	1210
750T	550	990	1400	1525	675	1220	1400	1525
900T	675	1220	1725	1890	750	1430	1725	1890
1100T	750	1430	2050	2165	900	1700	2050	2165

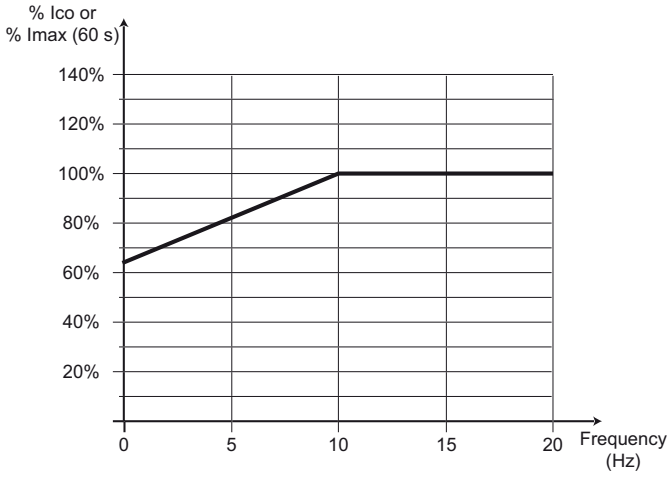
CAUTION:
In its factory setting, the drive operates with a switching frequency of 3 kHz at an ambient temperature of 40°C.
Note: With the IP54 option, the values in the table below are valid for a switching frequency setting of 2 kHz.

3-phase mains supply, 525 V -10% to 690 V +10%

POWERDRIVE rating	Heavy duty					Normal duty				
	P_{out} at 575 V (kW)	P_{out} at 690 V (kW)	I_{co} (A)	I_{max} (60 s) (A)	I_{max} (2 s) (A)	P_{out} at 575 V (kW)	P_{out} at 690 V (kW)	I_{co} (A)	I_{max} (60 s) (A)	I_{max} (2 s) (A)
270TH	160	200	225	308	350	200	250	280	308	350
340TH	200	250	280	378	432	250	315	340	378	432
400TH	250	315	340	465	520	315	400	415	465	520
500TH	315	400	415	545	600	400	450	500	545	600
600TH	400	450	500	638	684	450	550	580	638	684
750TH	450	550	580	800	880	550	700	730	800	880
900TH	550	700	730	1000	1152	700	850	900	1000	1152
1200TH	700	850	900	1230	1350	850	1100	1120	1230	1350
1500TH	850	1100	1120	1485	1690	1100	1300	1350	1485	1690

1.4.3 - Derating at low frequency

At low frequencies, IGBT modules are subject to significant temperature cycling, which may reduce their life.
Measuring the temperature of the power bridges in conjunction with thermal modelling of the IGBTs protects the Powerdrive against overheating.
The curve below therefore indicates the output current derating necessary when operating at low frequency, in continuous and transient operation.



1.4.4 - Derating according to the temperature and switching frequency

POWERDRIVE rating	Temperature	I_{co} (A)									
		Heavy duty					Normal duty				
		2 kHz	3 kHz	4 kHz	5 kHz	6 kHz	2 kHz	3 kHz	4 kHz	5 kHz	6 kHz
60T	40°C	90	90	82	76	72	110	110	100	92	85
	50°C	85	75				105	90			
75T	40°C	110	110	100	94	90	145	145	132	120	112
	50°C	102	100				135	120			
100T	40°C	145	145	132	122	115	180	175	165	150	138
	50°C	135	125				165	165			
120T	40°C	175	175	160	148	138	215	215	200	180	165
	50°C	165	155				205	195			
150T	40°C	220	220	195	175	165	260	260	240	215	195
	50°C	205	205				245	230			
180T	40°C	260	260	245	230	220	305	305	305	290	265
	50°C	250	250				305	305			
220T	40°C	305	305	290	265	250	380	380	330	315	290
	50°C	290	260				355	315			
270T	40°C	380	380	350	320	305	470	470	430	390	355
	50°C	360	320				440	400			
340T	40°C	470	470	430	400	375	580	580	510	460	425
	50°C	440	400				515	475			
400T	40°C	570	570	520	480	455	650	630	600	550	500
	50°C	535	470				590	540			
470T	40°C	680	680	620	590	550	800	800	750	680	625
	50°C	640	600				770	720			
600T	40°C	820	820	760	710	670	990	990	920	830	760
	50°C	770	745				930	900			
750T	40°C	990	990	920	850	800	1220	1220	1120	1020	930
	50°C	930	900				1150	1100			
900T	40°C	1220	1220	1120	1050	950	1430	1430	1300	1210	1100
	50°C	1150	1100				1360	1310			
1100T	40°C	1430	1430	1310	1220	1100	1700	1700	1580	1430	1320
	50°C	1360	1310				1620	1550			
270TH	40°C	225	225	190	170	150	280	280	250	220	190
	50°C		200					225			
340TH	40°C	280	280	250	220	190	340	340	310	280	255
	50°C		255					310			
400TH	40°C	340	340	310	280	255	415	415	415	370	330
	50°C		310					415			
500TH	40°C	415	415	415	370	330	500	500	425	370	330
	50°C		415					450			
600TH	40°C	500	500	425	370	330	580	580	520	465	430
	50°C		450					525			
750TH	40°C	580	580	520	465	430	730	730	730	675	595
	50°C		525					730			
900TH	40°C	730	730	730	675	595	900	900	780	675	595
	50°C		730					815			
1200TH	40°C	900	900	780	675	595	1120	1120	1120	1000	880
	50°C		815					1120			
1500TH	40°C	1120	1120	1120	1000	880	1350	1350	1160	1000	880
	50°C		1120					1220			

Note: • With the IP54 option, look at the 3 kHz column for a switching frequency setting of 2 kHz.
• For intermediate switching frequencies, the currents can be determined by interpolation.

2 - MECHANICAL INSTALLATION

• It is the responsibility of the owner or user of the POWERDRIVE 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.
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 which operates when the drive is not in use and is switched off when the drive is in use. It is advisable to control the heating system automatically.

2.1 - Checks on receipt

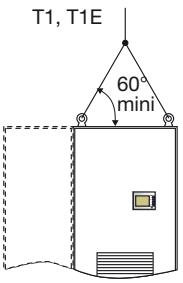
• Check that the cabinet has been transported vertically, otherwise, it may be damaged.

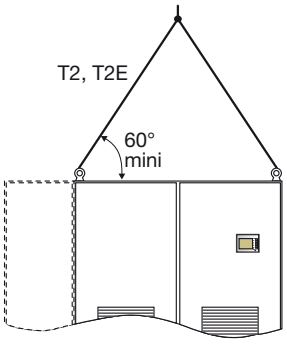
Before installing the **POWERDRIVE**, check that:
- The drive has not been damaged during transport.
- The information on the nameplate is compatible with the power supply.

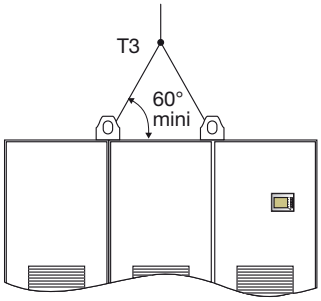
2.2 - Handling

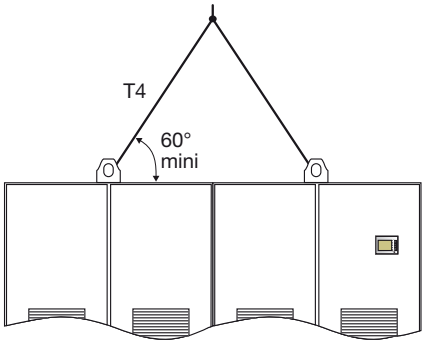
• The centre of gravity may be located in the upper half and/or off centre; make sure the cabinet is stable and does not topple over.
• Check that the handling equipment is suitable for the weight to be handled.
• The lifting accessories provided are limited solely to handling the cabinet. If subsequent handling operations are carried out, it must be ensured that these lifting accessories are in good condition.

The drive must be handled without the IP21 or IP54 cover.
IP21 **POWERDRIVE** units are supplied with the cover already fitted. Before handling the cabinet, follow the procedure set out in section 2.3. For handling, follow the instructions below, and then re-fit the cover.
IP54 **POWERDRIVE** units are supplied with the lifting rings or rails fitted. When handling the cabinet, follow the instructions below. After handling, fit the cover as described in section 2.4.





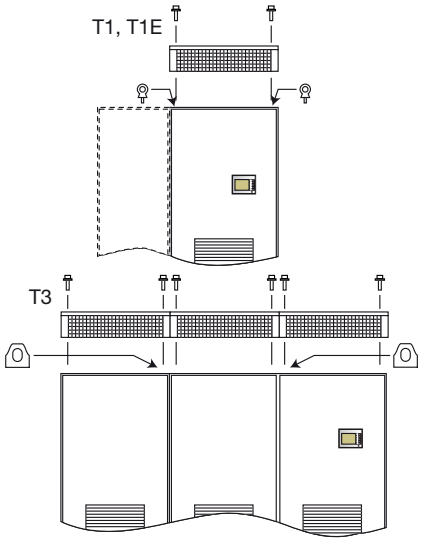


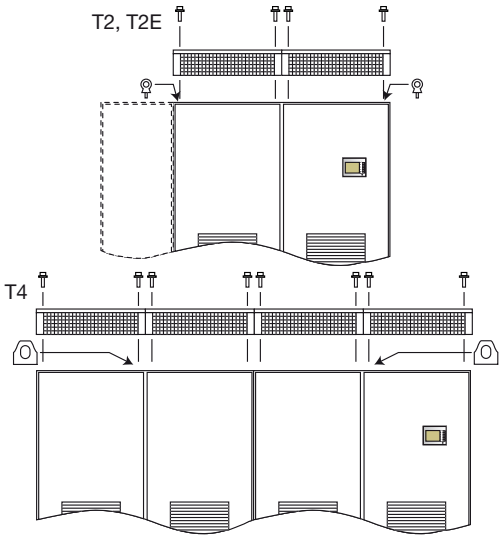


2.3 - Removing and re-fitting the IP21 cover

• Removal

1 - Remove the M12 screws.
2 - Remove the cover(s).
3 - Screw on the 4 lifting rings or 2 lifting rails using the M12 screws where indicated (Tightening torque: 20 N.m).





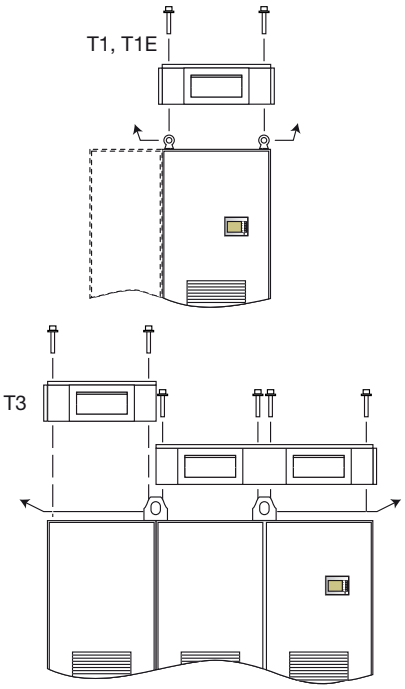
•Re-fitting

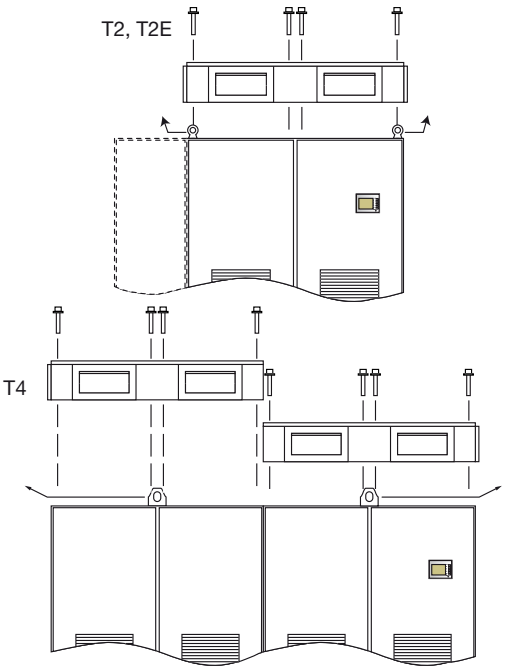
Reverse the procedure.

2.4 - Fitting and removing the IP54 cover

• Fitting

1 - Remove the 4 lifting rings or 2 lifting rails.
2 - Line up the cover casing according to the diagrams below. The side panels without louvres must be placed on opposite sides; the back of the drive has no louvres.
3 - Screw the M12 screws (included) through the cover casing.
4 - Adjust the cover casing to optimise sealing.
5 - Give the fastening screws a final tightening (tightening torque: 20 N.m).





• Removal, if necessary:

Reverse the procedure.

2.5 - Installation recommendations

• The drives must be installed away from conducting dust, corrosive gas, dripping water and any source of condensation. Prevent access by inexperienced personnel.

• After connecting the power, reposition the cable bush plates, which may be done at the back of the cabinet, to prevent the entry of foreign bodies.

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

2.6 - Dimensions and weight

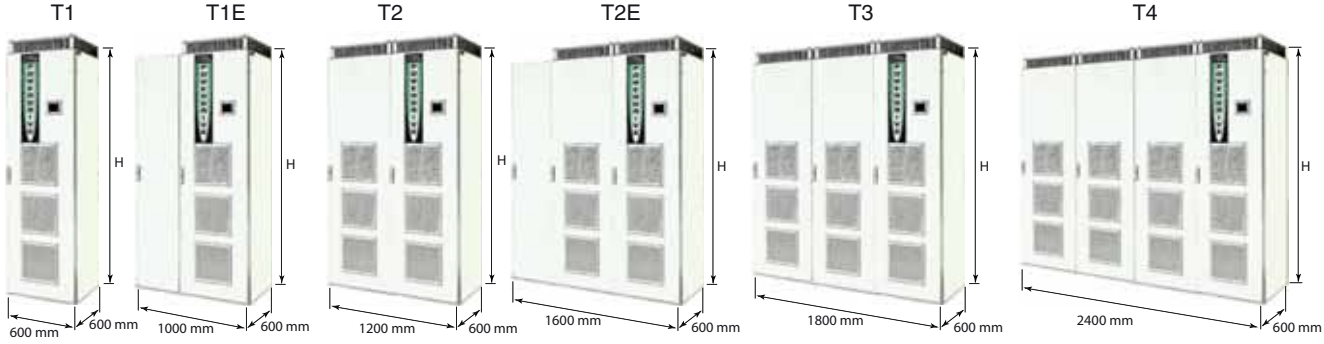
The cabinet-mounted **POWERDRIVE** solution is obtained by assembling 600x600x2000 (mm) cabinet modules and, if required, a 400x600x2000 (mm) module.
The depth is therefore constant and the width varies according to the rating and the options selected.
The MD-AU Emergency stop option (category 1 or category 2-3) can be integrated in the POWERDRIVE without altering its dimensions.
The table below gives the dimensions of the standard product.

Electrical protection (2)	RFI filter	Braking transistor	Mains choke	60T to 150T	180T to 400T	470T	600T to 900T	1100T (1)
				T1	T1	T1	T2	-
	x			T1	T1	T1E	T2E	-
	x	x		T1	T1	T1E	T2E	-
	x	x	x	T1	T1E	T1E	T2E	T4
	x		x	T1	T1E	T1E	T2E	T4
		x		T1	T1	T1	T2	-
		x	x	T1	T1E	T1E	T2E	T4
			x	T1	T1	T1	T2	T3
x	x	x	x	T1	T1E	T1E	T2E	T4
x	x			T1	T1E	T1E	T2E	-
x	x	x		T1	T1E	T1E	T2E	-
x	x		x	T1	T1E	T1E	T2E	T4
x		x		T1	T1E	T1E	T2E	-
x		x	x	T1	T1E	T1E	T2E	T4
x			x	T1	T1E	T1E	T2E	T4
x				T1	T1E	T1E	T2E	-

Electrical protection (2)	RFI filter	Braking transistor	270TH to 500TH (1)	600TH to 900TH (1)	1200TH and 1500TH (1)
			T1	T2	T3
		x	T1E	T2E	T4
	x		T1E	T2E	T4
	x	x	T1E	T2E	T4
x			T1E	T2E	T4
x		x	T1E	T2E	T4
x	x		T1E	T2E	T4
x	x	x	T1E	T2E	T4

x: Option included in the cabinet.
(1) The mains choke is integrated as standard.
(2) For electrical protection, refer to section 5.4.

• Dimensions



POWERDRIVE	H (mm)	
	Without baseplate	With 100 mm baseplate
IP21	2160	2260
With IP54 option	2260	2360

• Weights

POWERDRIVE rating	Weight (kg)		
	W/o options	With options	
	T1	T1	T1E
60T	195	max. 420	
75T	195		
100T	195		
120T	245		
150T	245		
180T	295	max. 440	max. 560
220T	295		
270T	330		
340T	355		
400T	355		
470T	355		
270TH and 340TH	355		
400TH and 500TH	400		max. 620

POWERDRIVE rating	Weight (kg)		
	W/o options	With options	
	T2	T2	T2E
600T	710	max. 860	max. 990
750T			
900T	740	max. 880	max. 1040
600TH	720		max. 780
750TH and 900TH	810		max. 1050

POWERDRIVE rating	Weight (kg)		
	W/o options	With options	
	T3	T3	T4
1100T	1350		max. 1720
1200TH and 1500TH	1250		max. 1520

2.7 - Losses, ventilation flow rate and noise levels

• Losses according to the switching frequency

Losses (kW)	POWERDRIVE														
	60T	75T	100T	120T	150T	180T	220T	270T	340T	400T	470T	600T	750T	900T	1100T
at 2 kHz	1.45	1.75	2.11	2.70	3.30	4.08	4.76	5.83	7.40	8.58	10.78	14.90	16.10	21.41	24.70
at 3 kHz	1.53	1.83	2.24	2.89	3.53	4.36	5.10	6.25	7.90	9.10	11.17	15.60	16.90	21.14	26
at 4 kHz	1.62	1.95	2.39	3.10	3.79	4.68	5.47	6.75	8.50	9.80	11.78	16.40	17.80	22.29	27.2

Losses (kW)	POWERDRIVE								
	270TH	340TH	400TH	500TH	600TH	750TH	900TH	1200TH	1500TH
at 2 kHz	5.55	9.2	8.7	10.54	15.88	16.12	20.87	26.4	31.82
at 3 kHz	5,98	9.71	9.35	11.33	16.79	17.31	22.33	28.33	34.17
at 4 kHz	6.23	9.7	9.35	11.24	16.6	19.69	22.54	32.08	34.2

Note:

• The values given above correspond to reduced overload operation and the external choke losses are included.

• Forced ventilation flow rates

Forced ventilation	POWERDRIVE														
	60T	75T	100T	120T	150T	180T	220T	270T	340T	400T	470T	600T	750T	900T	1100T
Flow rate (m^3/h)	450	450	450	450	450	900	900	900	1700	1700	1700	3400	3400	3400	5100

Forced ventilation	POWERDRIVE								
	270TH	340TH	400TH	500TH	600TH	750TH	900TH	1200TH	1500TH
Flow rate (m^3/h)	1700	1700	1700	1700	3400	3400	3400	5100	5100

• Noise

Forced ventilation	POWERDRIVE														
	60T	75T	100T	120T	150T	180T	220T	270T	340T	400T	470T	600T	750T	900T	1100T
Level (dBA)	73	73	73	76	76	76	76	76	77	77	77	80	80	80	82

Forced ventilation	POWERDRIVE								
	270TH	340TH	400TH	500TH	600TH	750TH	900TH	1200TH	1500TH
Level (dBA)	77	77	77	77	80	80	80	82	82

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.

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

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

• 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.

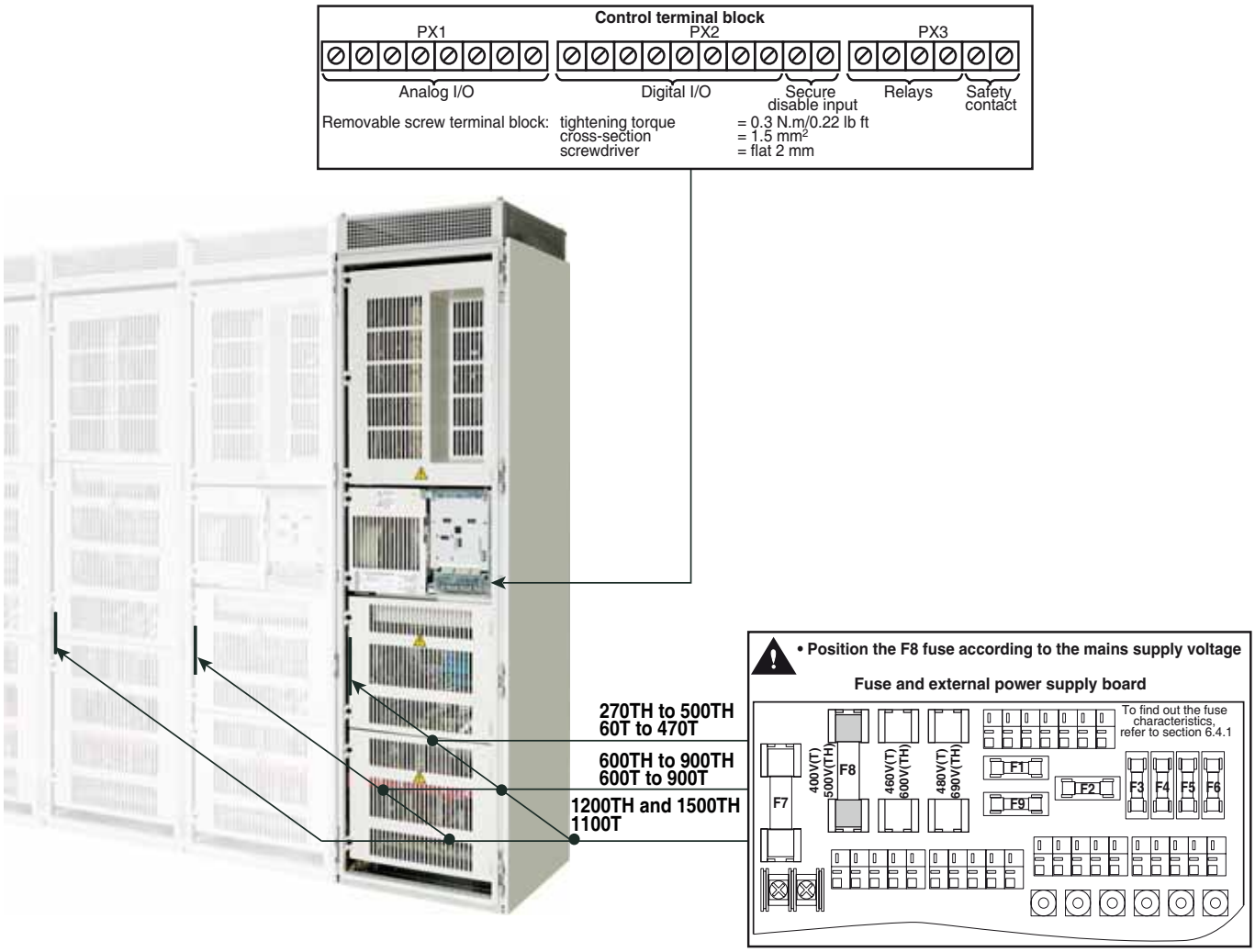
• Ensure that the DC bus voltage is below 40 V before carrying out any work (the control card power-on indicator LED must be off, see section 5.5.1).

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

• After the drive has been operating, the heatsink may be very hot; avoid touching it (70°C).

3.1 - Location of terminal blocks

3.1.1 - Location of control terminal block, external power supply and fuse boards

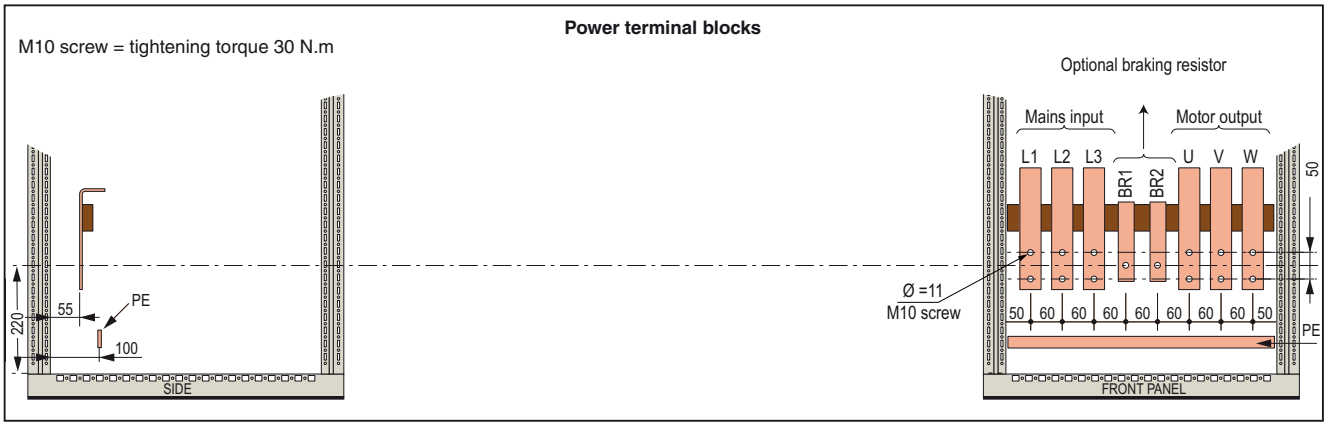


3.1.2 - Location of power terminal blocks

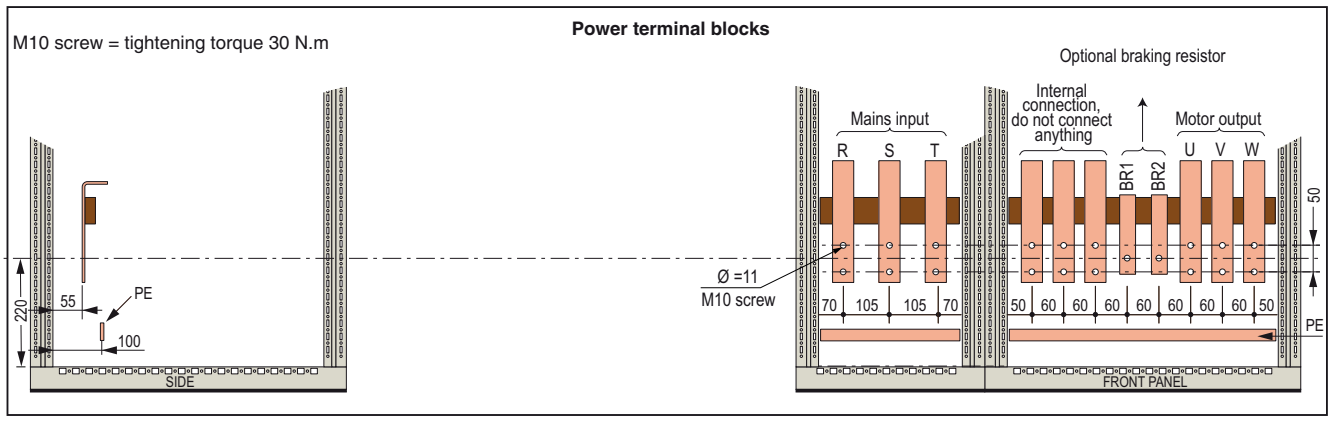
The table below shows the power terminal block configuration according to drive rating and dimensions.

POWERDRIVE rating	Dimensions								
	Drive without options			Drive with options					
	T1	T2	T3	T1	T1E	T2	T2E	T3	T4
60T to 150T	§ 3.1.2.1			§ 3.1.2.1					
180T to 270T	§ 3.1.2.1			§ 3.1.2.1	§ 3.1.2.2				
340T to 470T 270TH to 500TH	§ 3.1.2.3			§ 3.1.2.3	§ 3.1.2.4				
600T to 900T 600TH to 900TH		§ 3.1.2.5				§ 3.1.2.5	§ 3.1.2.6		
1100T 1200TH and 1500TH			§ 3.1.2.7					§ 3.1.2.7	§ 3.1.2.8

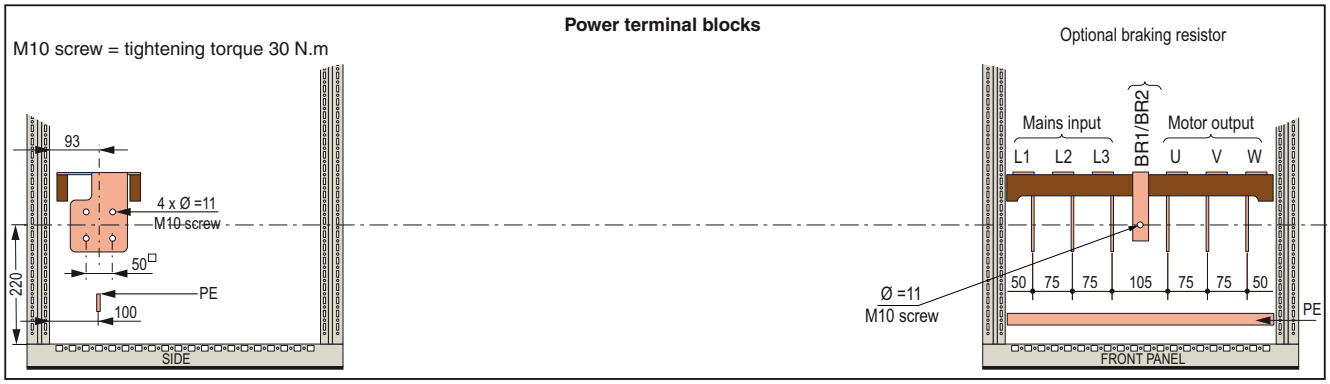
3.1.2.1 - 60T to 270T power terminal blocks, dimension T1



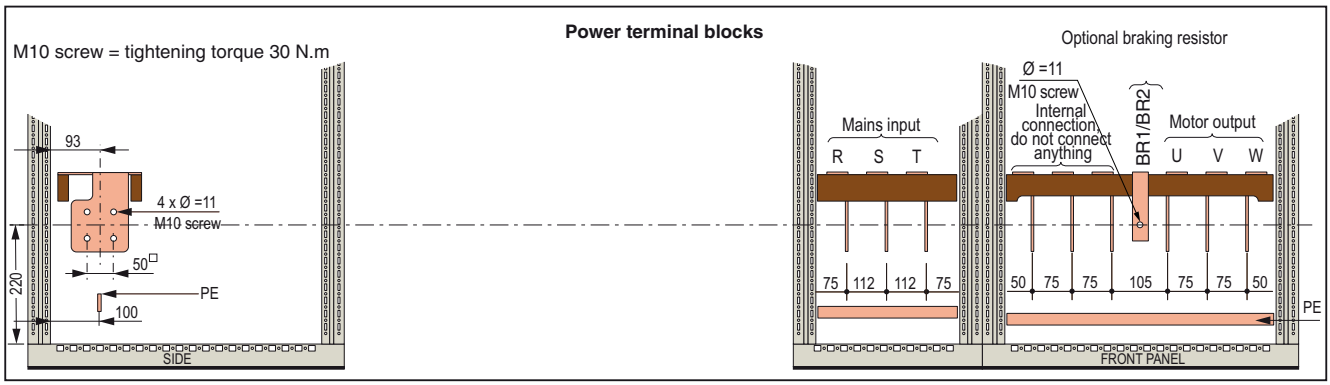
3.1.2.2 - 180T to 270T power terminal blocks, dimension T1E



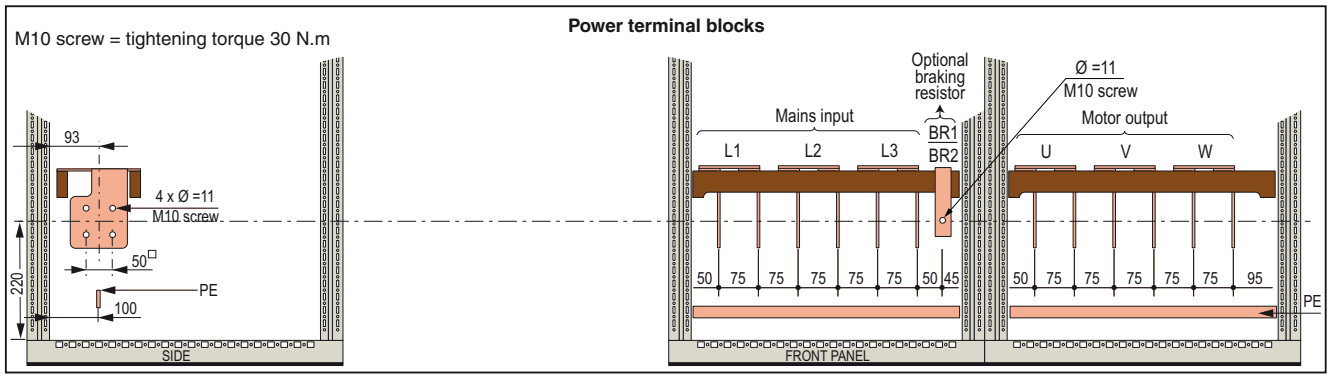
3.1.2.3 - 340T to 470T and 270TH to 500TH power terminal blocks, dimension T1



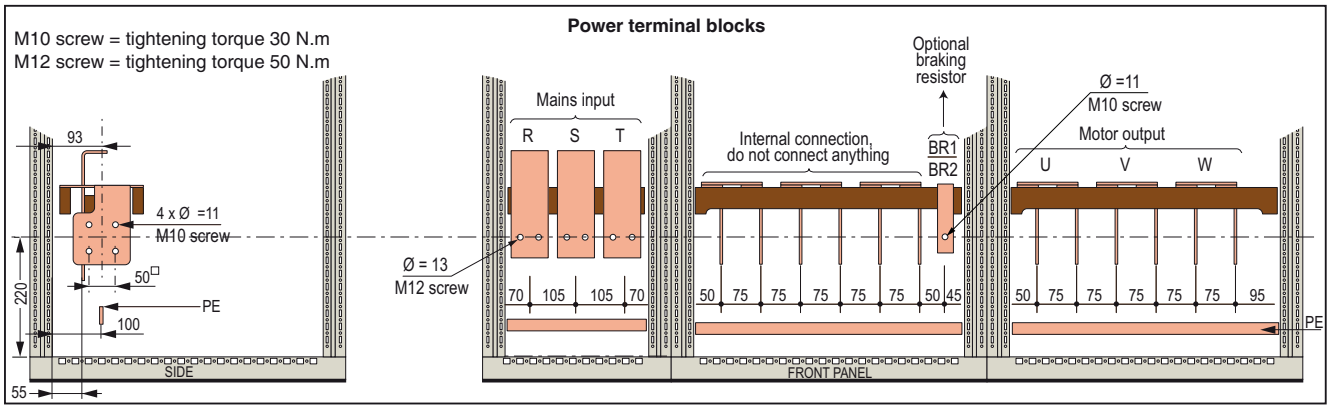
3.1.2.4 - 340T to 470T and 270TH to 500TH power terminal blocks, dimension T1E



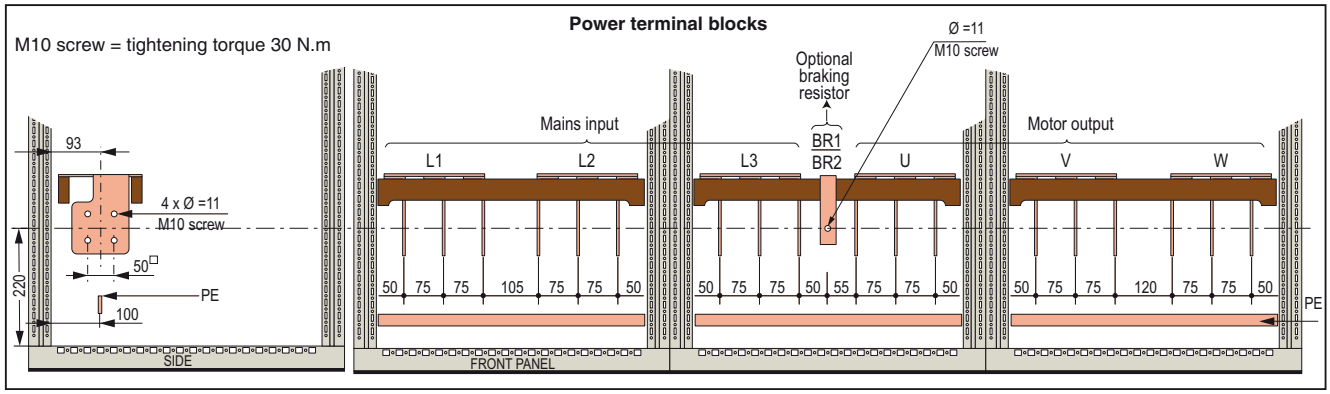
3.1.2.5 - 600T to 900T and 600TH to 900TH power terminal blocks, dimension T2



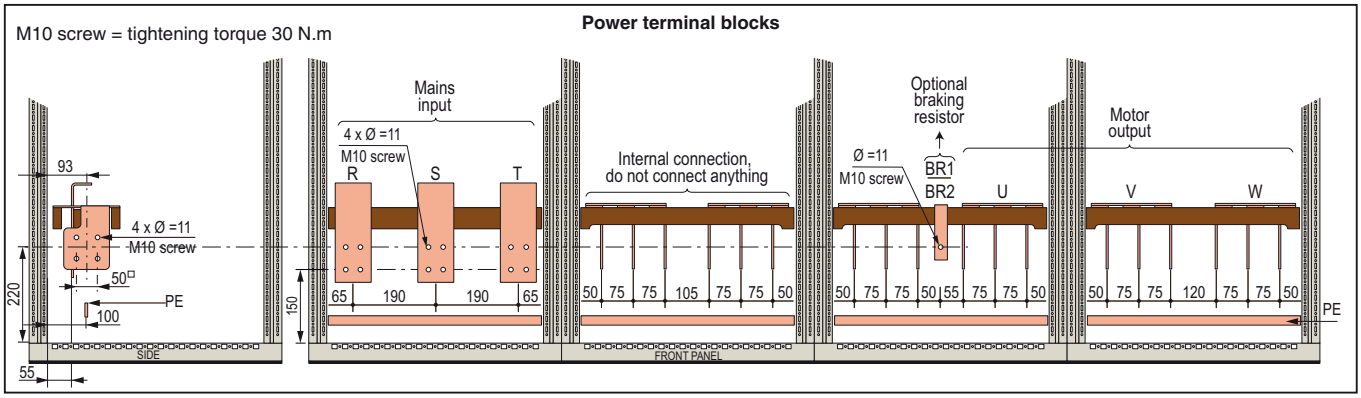
3.1.2.6 - 600T to 900T and 600TH to 900TH power terminal blocks, dimension T2E



3.1.2.7 - 1100T, 1200TH and 1500TH power terminal blocks, dimension T3



3.1.2.8 - 1100T, 1200TH and 1500TH power terminal blocks, dimension T4



3.2 - Connection of the power

3.2.1 - "Secure disable" input

This input, when open, causes the drive to lock. Independent of the microprocessor, it acts on several levels of control from the output bridge. It is designed in such a way that even if one or more circuit components were to fail, the absence of torque on the motor shaft is guaranteed with a very high level of integrity.
This input is used to create a safety function using the principles of category 1 or 3 of standard EN 954-1, depending on the application diagram.
The design of the "freewheel stop" function using input SDI2 has been approved by CETIM (report no. 781422/5D2/472). This built-in function enables the drive to act as substitute for a contactor in order to stop the motor in freewheel mode.
By using this "Secure disable" input redundantly with another drive logic input, a diagram can be used which is capable of resisting a single failure. The drive will stop the motor in freewheel mode using two different control channels.
For correct use, the power (and control) connection diagrams described in the following sections must be adhered to.
To unlock the drive and provide the "Secure disable" function, "Secure disable" input SDI2 must be connected to the +24 V source SDI1.
This +24 V source must be reserved exclusively for the "Secure disable" input function.

• The "Secure disable" input is a safety component which must be incorporated into the complete system dedicated to machine safety. As for any installation, the complete machine must be the subject of a risk analysis by the integrator which will determine the safety category with which the installation must comply.

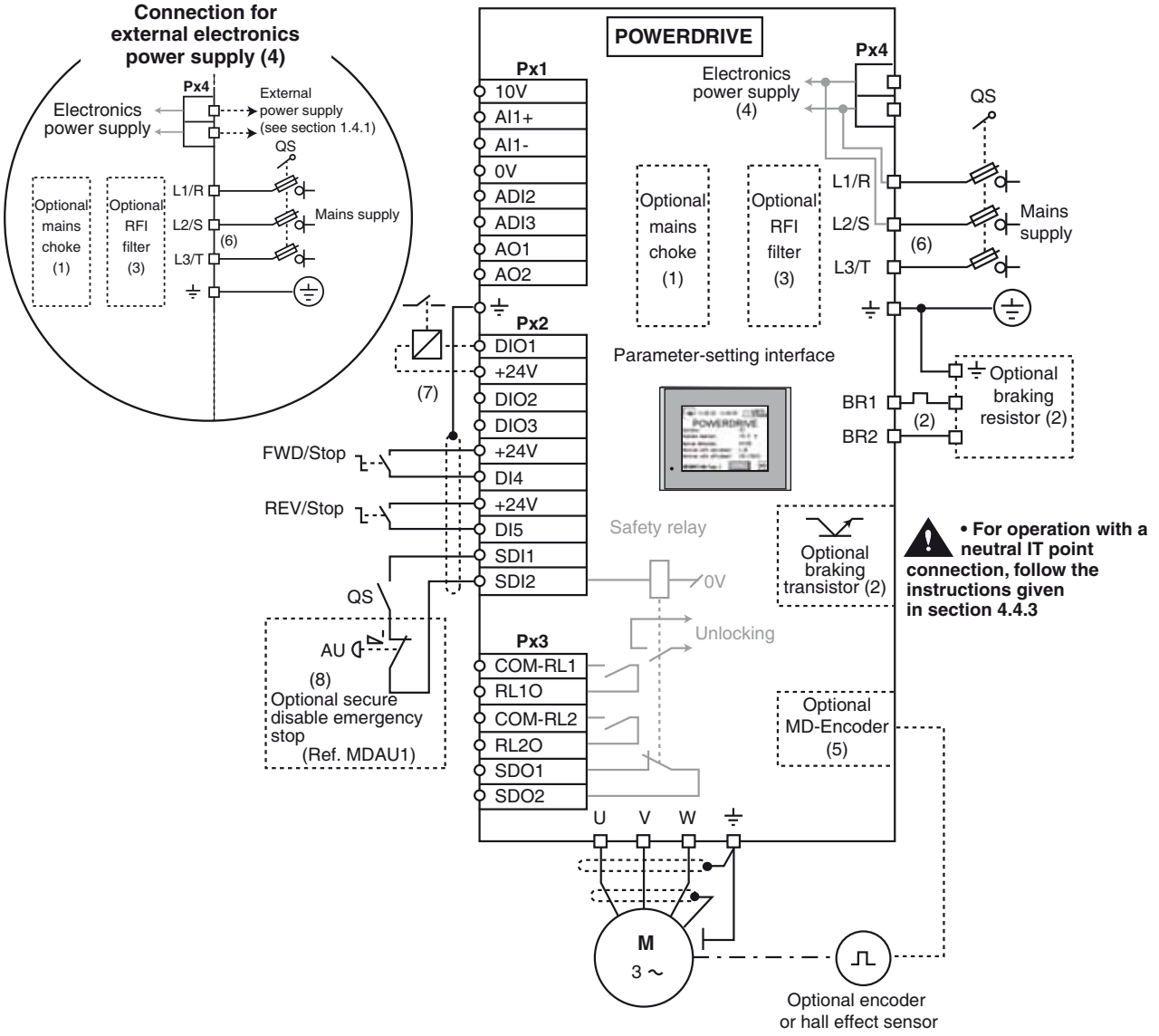
• The "Secure disable" input, when open, locks the drive, so that the dynamic braking function is no longer available. If a braking function is required before the drive "Secure disable" lock is applied, a time-delayed safety relay should be installed to activate locking automatically after the end of braking.
If braking needs to be a machine safety function, it should be provided by an electromechanical solution since the drive dynamic braking function is not considered to be a "Secure disable" function.

• The "Secure disable" input does 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).

• When the drive is controlled via the console or a fieldbus, the "Secure disable" input SDI is automatically configured as an unlocking input.
The "Secure disable" function according to standard EN 954-1 is therefore no longer enabled in categories 2 and 3. However, compliance with standard EN 954-1 is still ensured for category 1.

3.2.2 - 3-phase AC mains supply, in accordance with safety standard EN 954-1 - CATEGORY 1

Using the "Secure disable" input SDI2 to stop safely



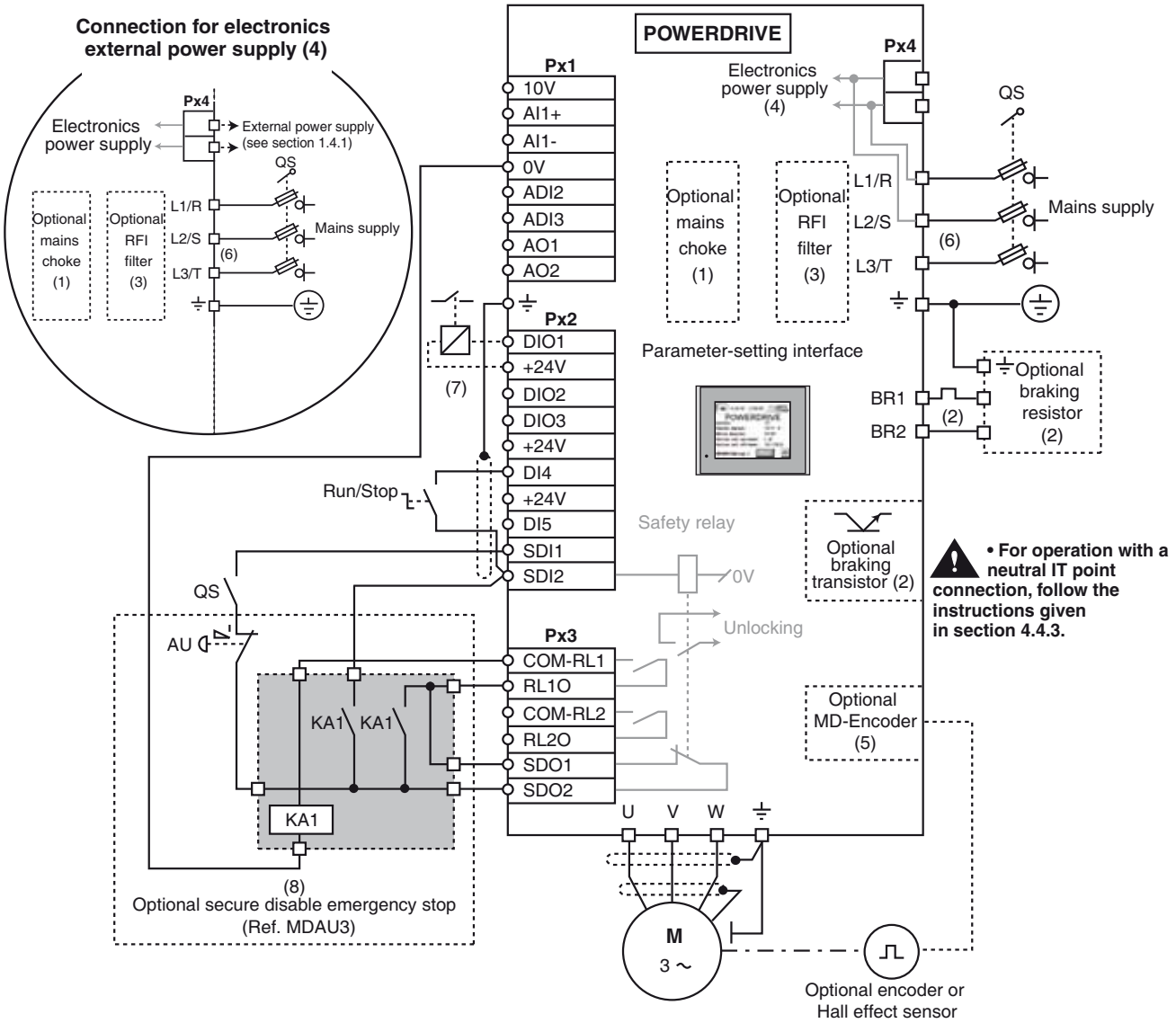
QS : Fused isolator: QS must be opened before any intervention on the electrical parts of the drive or motor.
AU : Emergency stop button.
(1) Optional mains choke (see section 5.2).
(2) Optional braking transistor and resistor (see section 5.3). Provide a thermal relay to protect the resistor, that will stop and switch off the drive.
(3) Optional RFI filter. For compliance with the drive standard EN 61800-3, see sections 4.6 and 5.1.
(4) The electronics power supply is connected internally as standard. If an external power supply is being used, disconnect the internal wiring and connect the external power supply to the Px4 terminal block (several Px4 terminal blocks for 600T to 1100T ratings and TH ratings. See section 3.1.1).
(5) Optional MD-Encoder. Used to manage the encoder feedback or a Hall effect sensor (see section 5.5.5).
(6) The drive mains supply is connected on L1, L2, L3 or R, S, T depending on the options present (see section 3.1.2).
(7) If DIO1 is being used for relay control, the state of the relay is opposite to the output state (in its factory setting, the output is active and the relay is therefore inactive).
(8) The MDAU1 option includes an "Emergency stop" wired in the "Secure disable" input circuit (see section 5.4).

Using the safety input means the motor can be stopped in freewheel mode without using a line contactor. The drive's internal principles are sufficiently reliable to perform a stop using the "Secure disable" input directly (category 1 of EN 954-1).

CAUTION:
Whatever the configuration of the SDI input (00.24 = 08.10 = UNLOCKING or SECURE DISABLE) and the origin of commands, compliance with standard EN 954-1 Category 1 is always maintained.

3.2.3 - 3-phase AC power supply, in accordance with safety standard EN 954-1 - CATEGORY 2 or 3

Using the "Secure disable" input SDI2 redundantly with digital input DI4



QS : Fused isolator: QS must be opened before any intervention on the electrical parts of the drive or motor.
AU : Emergency stop button.
KA1: Remote control safety relay.
(1) Optional mains choke (see section 5.2).
(2) Optional braking transistor and resistor (see section 5.3). Provide a thermal relay to protect the resistor, that will stop and switch off the drive.
(3) Optional RFI filter. For compliance with the drive standard EN 61800-3, see sections 4.6 and 5.1.
(4) The electronics power supply is connected internally as standard. If an external power supply is being used, disconnect the internal wiring and connect the external power supply to the Px4 terminal block (several Px4 terminal blocks for 600T to 1100T ratings and TH ratings. See section 3.1.1).
(5) Optional MD-Encoder. Used to manage the encoder feedback or a Hall effect sensor (see section 5.5.5).
(6) The drive mains supply is connected on L1, L2, L3 or R, S, T depending on the options present (see section 3.1.2).
(7) If DIO1 is being used for relay control, the state of the relay is opposite to the output state (in its factory setting, the output is active and the relay is therefore inactive).
(8) The MDAU3 option is a category 2 or 3 remote control which includes a safety relay and an "Emergency stop" already integrated and wired-up (see section 5.4).

Using the safety input means the motor can be stopped in freewheel mode without using a line contactor. The drive's internal principles are sufficiently reliable to perform a stop using the "Secure disable" input directly (category 2 or 3 of EN 954-1).

Duplicating the stop command on a logic input enables internal redundancy to be implemented in the drive so as to ensure freewheel stopping (application of category 3 principles according to EN 954 for the part relating to the drive).

CAUTION:

The special way in which the "Secure disable" input is managed is not compatible with the Run/Stop commands being controlled by the POWERDRIVE parameter-setting interface or a fieldbus. When control via a console or fieldbus is required, the SDI2 input should be viewed as a simple unlocking input. In this case, the power circuit diagram must comply with the usual safety regulations.

3.2.4 - Cables and fuses

• It is the responsibility of the user to connect and provide protection for the POWERDRIVE in accordance with 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, trip acknowledgments, insulation and protection against overcurrents.

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

POWERDRIVE		Mains power supply									Motor (1)	
		400 V - 50 Hz				460/480 V - 60 Hz						
Rating/Duty		Current (A)	Fuses		Cable cross-section (mm^2) (2)	Current (A)	Fuses			Cable cross-section (mm^2) (2)	Ico (A)	Cable cross-section (mm^2) (2)
			Gg type	aR type			Gg type	aR type	Class J (UL)			
60T	Heavy	85	100	200	3x35 + 16	76	100	150	125	3x35 + 16	90	3x35 + 16
	Normal	105	125	200	3x50 + 25	95	125	200	150	3x35 + 16	110	3x50 + 25
75T	Heavy	105	125	200	3x50 + 25	95	125	200	150	3x35 + 16	110	3x50 + 25
	Normal	140	160	250	3x70 + 35	125	160	250	200	3x70 + 35	145	3x70 + 35
100T	Heavy	140	160	250	3x70 + 35	125	160	250	200	3x70 + 30	145	3x70 + 35
	Normal	170	200	350	3x95 + 50	150	200	350	225	3x70 + 35	175	3x95 + 50
120T	Heavy	170	200	350	3x95 + 50	150	200	350	225	3x70 + 35	175	3x95 + 50
	Normal	198	250	400	3x120 + 70	175	200	350	250	3x95 + 50	215	3x120 + 70
150T	Heavy	205	250	400	3x120 + 70	175	200	350	250	3x95 + 50	220	3x120 + 70
	Normal	245	315	500	3x150 + 70	215	250	450	300	3x120 + 70	260	3x150 + 70
180T	Heavy	245	315	500	3x150 + 70	215	250	450	300	3x120 + 70	260	3x150 + 70
	Normal	295	315	630	3x240 + 120	255	315	500	400	3x185 + 90	305	3x240 + 120
220T	Heavy	290	315	630	3x240 + 120	255	315	500	400	3x185 + 90	305	3x240 + 120
	Normal	370	400	800	2x(3x95 + 50)	320	400	630	500	3x240 + 120	380	2x(3x95 + 50)
270T	Heavy	375	400	800	2x(3x95 + 50)	325	400	630	500	3x240 + 120	380	2x(3x95 + 50)
	Normal	460	500	1000	2x(3x150 + 95)	405	500	800	600	2x(3x120 + 70)	470	2x(3x150 + 95)
340T	Heavy	465	500	1000	2x(3x150 + 95)	410	500	800	600	2x(3x120 + 70)	470	2x(3x150 + 95)
	Normal	580	630	1250	2x(3x185 + 95)	495	630	800	--	2x(3x150 + 95)	580	2x(3x185 + 95)
400T	Heavy	585	630	1250	2x(3x185 + 95)	500	630	1000	--	2x(3x150 + 95)	570	2x(3x185 + 95)
	Normal	650	800	1250	2x(3x240 + 120)	560	630	1000	--	2x(3x185 + 95)	630	2x(3x240 + 120)
470T	Heavy	655	800	1250	2x(3x240 + 120)	560	630	1000	--	2x(3x185 + 95)	680	2x(3x240 + 120)
	Normal	815	1000	1400	3x(3x185 + 95)	700	800	1250	--	2x(3x240 + 120)	800	3x(3x185 + 95)
600T	Heavy	825	1000	1400	3x(3x185 + 95)	710	800	1250	--	2x(3x240 + 120)	820	3x(3x185 + 95)
	Normal	998	1250	1600	4x(3x150 + 95)	856	1000	1400	--	3x(3x185 + 95)	990	4x(3x150 + 95)
750T	Heavy	1010	1250	1600	4x(3x150 + 95)	865	1000	1400	--	4x(3x150 + 95)	990	4x(3x150 + 95)
	Normal	1225	1600	1800	3x(3x240 + 120)	1050	1250	1600	--	4x(3x150 + 95)	1220	3x(3x240 + 120)
900T	Heavy	1250	1600	1800	3x(3x240 + 120)	1060	1250	1600	--	3x(3x240 + 120)	1220	3x(3x240 + 120)
	Normal	1360	1800	2000	4x(3x240 + 120)	1170	1600	1800	--	3x(3x240 + 120)	1430	4x(3x240 + 120)
1100T	Heavy	1380	1800	2000	4x(3x240 + 120)	1180	1600	1800	--	4x(3x240 + 120)	1430	4x(3x240 + 120)
	Normal	1635	2000	2200	4x(3x240 + 120)	1400	1800	2000	--	4x(3x240 + 120)	1700	4x(3x240 + 120)

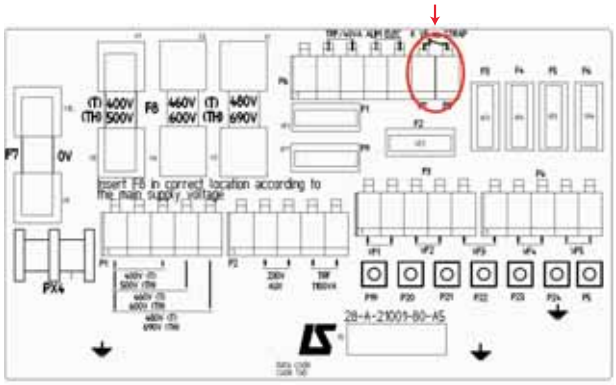
POWERDRIVE		Mains power supply								Motor (1)	
		525 V				690 V					
Rating/Duty		Current (A)	Fuses		Cable cross-section (mm^2) (2)	Current (A)	Fuses		Cable cross-section (mm^2) (2)	I_{co} (A)	Cable cross-section (mm^2) (2)
			Gg type	aR type (IEC & UL)			Gg type	aR type (IEC & UL)			
270TH	Heavy	205	250	450	3x120 + 70	215	250	450	3x120 + 70	225	3x120 + 70
	Normal	250	315	500	3x120 + 70	265	315	500	3x120 + 70	280	3x150 + 70
340TH	Heavy	250	315	500	3x120 + 70	265	315	500	3x120 + 70	280	3x150 + 70
	Normal	305	400	630	3x150 + 70	320	400	630	3x150 + 70	340	3x240 +120
400TH	Heavy	305	400	630	3x150 + 70	320	400	630	3x150 + 70	340	3x240 +120
	Normal	370	400	800	3x240 +120	390	400	800	3x240 +120	415	2x(3x120+70)
500TH	Heavy	370	400	800	3x240 +120	390	400	800	3x240 +120	415	2x(3x120+70)
	Normal	445	500	900	3x240 +120	470	500	900	3x240 +120	500	2x(3x150+95)
600TH	Heavy	445	500	900	3x240 +120	470	500	900	3x240 +120	500	2x(3x150+95)
	Normal	520	630	1100	2x(3x150+95)	545	630	1100	2x(3x150+95)	580	2x(3x185+95)
750TH	Heavy	520	630	1100	2x(3x150+95)	545	630	1100	2x(3x150+95)	580	2x(3x185+95)
	Normal	650	800	1400	2x(3x240 + 120)	685	800	1400	2x(3x240 + 120)	730	2x(3x240+120)
900TH	Heavy	650	800	1400	2x(3x240 + 120)	685	800	1400	2x(3x240 + 120)	730	2x(3x240 + 120)
	Normal	805	1000	1600	3x(3x185 + 95)	845	1000	1600	3x(3x185 + 95)	900	3x(3x185 + 95)
1200TH	Heavy	805	1000	1600	3x(3x185 + 95)	845	1000	1600	3x(3x185 + 95)	900	3x(3x185 + 95)
	Normal	1000	1250	1600	3x(3x185 + 95)	1050	1250	1600	3x(3x185 + 95)	1120	3x(3x240 + 120)
1500TH	Heavy	1000	1250	1600	3x(3x185 + 95)	1050	1250	1600	3x(3x185 + 95)	1120	3x(3x240 + 120)
	Normal	1205	1600	1800	3x(3x240 + 120)	1265	1600	1800	3x(3x240 + 120)	1350	4x(3x240 + 120)

(1) The value of the rated current and the motor cable cross-sections are given for information only. 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-wire copper cable with a maximum length of 10 m. For longer cables, take line drops due to the length into account.

Note:
• **I_{co}:** Continuous output current
• The mains current value is a typical value which depends on the source impedance. The higher the impedance, the lower the current.
• The cable cross-sections are defined according to the following model:
E.g.: For a 1100T unit, the cable cross-section is 4x(3x240 + 120), i.e., 4 cables each comprising 3 phase conductors (cross-section 240) + 1 earth conductor (cross-section 120).

3.2.5 - Disconnection of forced ventilation units

For the MDS 180T to 1100T and MDS 270TH to 1500TH drives, the fuse card described in section 3.1.1. enables the user to switch off the power supply to the drive forced ventilation units momentarily, if preheating resistors are used in the cabinet for example.
To disconnect the fans, remove the jumper connecting terminals P7 and P8 and connect a normally closed contact (230 V/7 A on resistive load). A closed contact allows the ventilation units to operate, an open contact cuts off their power supply.



3.3 - Connection of the control

• The POWERDRIVE 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 control circuits in the drive are isolated from the power circuits by single insulation (IEC 664-1). The installer must ensure that the external control circuits are isolated against any human contact.

• If the control circuits need to be connected to circuits conforming to SELV safety requirements, additional insulation must be inserted to maintain the SELV classification.

3.3.1 - Characteristics of the control terminal blocks

3.3.1.1 - Characteristics of the analog I/O terminal blocks (PX1)

1	10V	+10 V internal analog source
Accuracy		± 2%
Maximum output current		20 mA

2	AI1+	Differential analog input 1 (+)
3	AI1-	Differential analog input 1 (-)
Factory setting		± 10 V analog input
Characteristics		Bi-directional voltage (differential mode and common mode) or uni-directional current (common mode only, connect terminal 3 to the 0 V)
Resolution		13 bits + sign
Sampling		2 ms
Voltage input		
Full scale voltage range		±10 V ±2%
Maximum voltage		27 V
Input impedance		95 kΩ
Current input		
Current ranges		0 to 20 mA ±5%
Maximum voltage		27 V/0 V
Maximum current		50 mA
Input impedance		100 Ω

4	0V	Logic circuit common 0 V
The 0 V on the electronics is connected to the metal ground of the drive.		

5	ADI2	Analog or digital input 2
Factory setting		4-20 mA analog input
Characteristics		Bi-directional voltage (common mode) or uni-directional current
Resolution		9 bits + sign
Sampling		2 ms
Voltage input		
Full scale voltage range		±10 V ±2%
Maximum voltage		27 V
Input impedance		95 kΩ
Current input		
Current ranges		0 to 20 mA ±5%
Maximum voltage		27 V/0 V
Maximum current		50 mA
Input impedance		100 Ω
Digital input (if connected to the +24 V)		
Thresholds		0: < 5 V 1: > 10 V
Voltage range		0 to +24 V
Maximum voltage		27 V/0 V
Load		50 kΩ
Input threshold		7.5 V

6	ADI3	Analog or digital input or motor sensor (PTC)
Factory setting		0-10 V analog input
Characteristics		Analog voltage (common mode)
Resolution		10 bits
Sampling		2 ms
Voltage input		
Full scale voltage range		10 V ±2%
Maximum voltage		27 V
Input impedance		50 kΩ
Digital input (if connected to the +24 V)		
Thresholds		0: < 5 V 1: > 10 V
Voltage range		0 to +24 V
Maximum voltage		27 V/0 V
Load		95 kΩ
Input threshold		7.5 V
Motor sensor input		
Internal voltage		5 V
Fault trip threshold		≥ 3.3 kΩ
Drive reset threshold		< 1.8 kΩ

7	AO1	Analog output 1
8	AO2	Analog output 2
Factory setting		Analog output 1 4-20 mA Analog output 2 ±10 V
Characteristics		Bi-directional analog voltage (common mode) or uni-directional current
Resolution		AO1: 15 bits + sign AO2: 11 bits + sign
Sampling		2 ms
Voltage output		
Voltage range		±10 V
Load resistance		2 kΩ minimum
Protection		Short-circuit (40 mA max)
Current output		
Current ranges		0 to 20 mA
Maximum voltage		+10 V
Load resistance		500 Ω maximum

3.3.1.2 - Characteristics of the digital I/O terminal blocks (PX2)

1	DIO1	Digital input or output 1
3	DIO2	Digital input or output 2
4	DIO3	Digital input or output 3

Factory setting	Digital output DIO1 Digital input DIO2 Digital input DIO3
Characteristics	Digital inputs (positive or negative logic) Digital outputs (positive logic)
Thresholds	Inactive (0) < 4V = output linked to 0 V Active (1) > 13.5 V = output not linked
Voltage range	0 to +24 V
Sampling/refreshment	2 ms
Digital input	
Absolute maximum voltage range	0 V to +35 V
Load	15 kΩ
Digital output (open collector type)	
Overload current	50 mA

2 5 7	+24V	+24 V internal source

Output current	100 mA in total
Accuracy	0 to -15%
Protection	Current limit and drive set to trip state

6	DI4	Digital input 4
8	DI5	Digital input 5

Characteristics	Digital input (positive or negative logic)
Thresholds	0: < 4 V 1: > 13.5 V
Voltage range	0 to +24 V
Sampling/refreshment	2 ms
Absolute maximum voltage range	0 V to +35 V
Load	15 kΩ
Input threshold	7.5 V

9	SDI1	+24 V dedicated to secure disable input
10	SDI2	Secure disable/drive unlocking input

Factory setting	Secure disable input
Characteristics	Digital input (positive logic)
Thresholds	0: < 5 V 1: > 18 V
Voltage range	9 V to 33 V
Impedance	820 Ω

3.3.1.3 - Characteristics of the relay output terminal blocks (PX3)

1 2	COM-RL1 RL1O	N/O relay output

Characteristics	250 V AC output relay
Maximum contact current	• 2 A, resistive load • 1 A, inductive load

3 4	COM-RL2 RL2O	N/O relay output

Characteristics	250 V AC output relay
Maximum contact current	• 2 A, resistive load • 1 A, inductive load

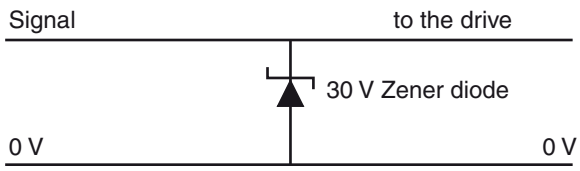
5 6	SDO1 SDO2	Safety contact

Characteristics	250 V AC
Maximum contact current	• 2 A, resistive load • 1 A, inductive load

3.3.2 - Control circuit protection devices

(Immunity to overvoltages in control circuits or long cables connected to the outside of a building).
The various drive input and output circuits comply with standard EN61000-6-2 (1 kV) relating to overvoltages. There are some exceptions, where the installation may be exposed to overvoltage peaks which exceed the levels determined by the standard. This may be the case in the event of lightning strikes or earth faults associated with long cable lengths (>30 m). To limit the risks of damage to the drive, the following precautions can be taken:
- Galvanic isolation of the I/O.
- Back up the cable shielding with an earth wire of 10 mm^2 minimum. The cable shielding and the earth wire must be linked at both ends and connected to earth with the shortest possible connection. This stratagem enables high currents to pass into the earth wire, rather than into the shielding.
- Reinforcement of the digital and analog I/O protection by adding a Zener diode or a peak limiter.

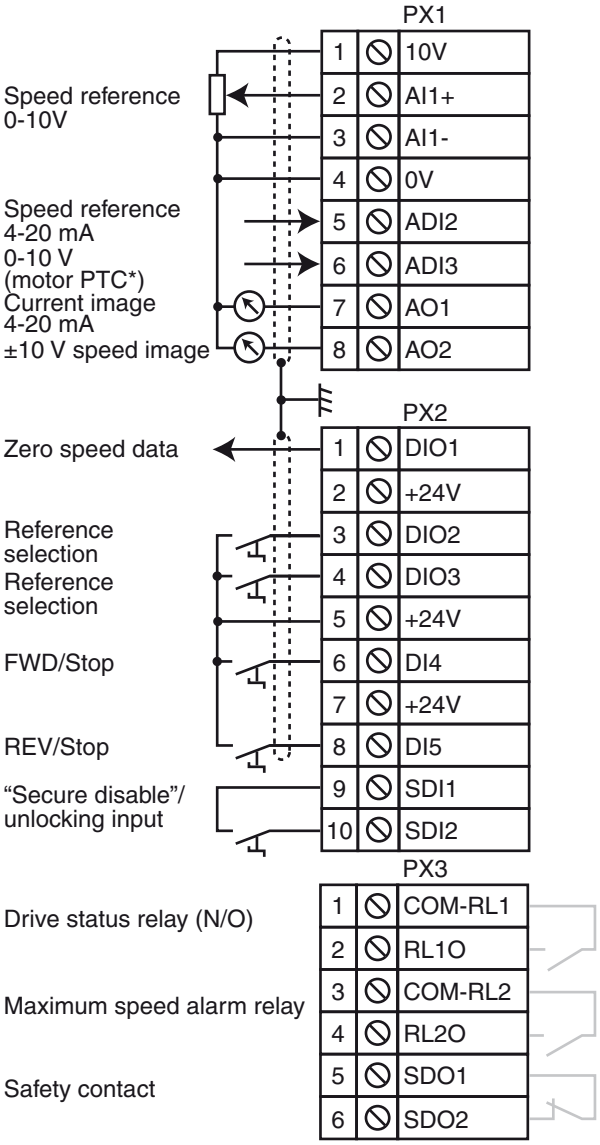
Elimination of unipolar digital and analog I/O overvoltages



This circuit is available in a module (DIN rail mounting), e.g. from Phoenix Contact (unipolar: TT UKK5 D/24 DC).
This type of circuit is not suitable for encoder signals or for high-speed logic data networks, because the diodes may affect the signal. The majority of encoders have galvanic isolation between the motor casing and the encoder circuit, and in this case, no precautions are necessary. For data networks, follow the specific network recommendations.

3.3.3 - Factory configuration of the control terminal blocks (see commissioning manual 3871)

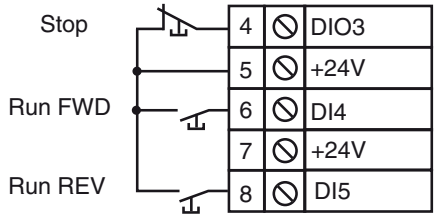
Note: For details of the parameters, refer to the commissioning manual, ref. 3871.



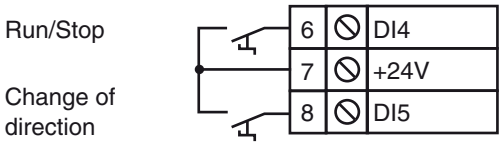
Note: Input SDI2 must be closed before executing the run command.

This configuration is obtained by returning to the "factory settings" (**00.45** = 50 Hz HIGH (1) or 50 Hz LOW (3)). This modification can only be made when the drive is disabled (SDI2 open).

- For "3-wire" control (jog Run/Stop):
00.22 = Jog R/S (1)
This mode is not operational from the user menu (if necessary, refer to parameter 06.04 in menu 6, commissioning manual ref. 3871).

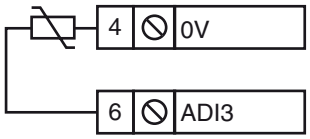


- In reverse direction: **00.22** = R/S + Reverse (2)



• List of parameters to adjust based on the factory configuration:
00.28 = (*)
00.35 = **06.34**
00.36 = **06.33**
00.47 = preset reference 2 value in rpm

(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise, keep the factory value of **00.28** (0-10 V).



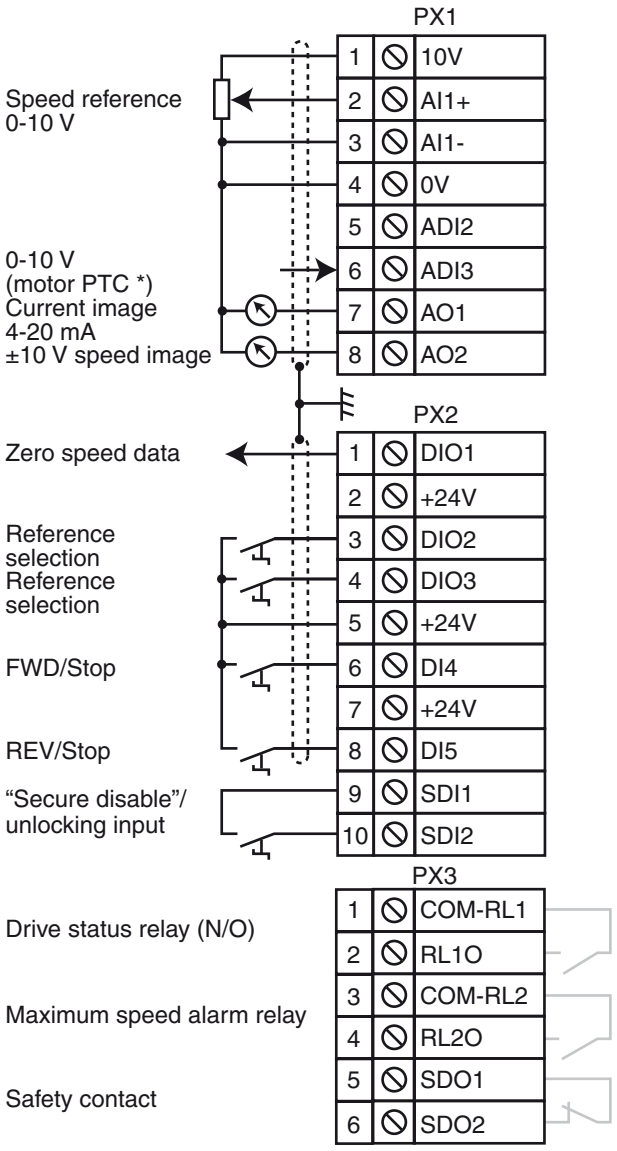
• Selection of the reference via digital inputs

DIO2	DIO3	Selection
0	0	Voltage analog reference (0-10 V)
0	1	Current analog reference (4-20 mA)
1	0	Preset reference 2
1	1	

3.3.4 - Quick configuration of the control terminal block according to the reference

Note: For details of the parameters, refer to the commissioning manual, ref. 3871.

3.3.4.1 - Connection and parameter setting for selecting a reference (0-10 V) or 3 preset references



Note: Input SDI2 must be closed before executing the run command.

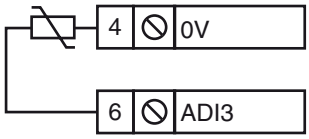
- Parameters must be set with the drive disabled (SDI2 open).
- Parameter **00.22** is used to modify the run command type ("3-wire" or reverse command: refer to section 3.3.3).

• List of parameters to adjust based on the factory configuration

- Set:

00.05 = Ana input 1 (1)
00.28 = (*)
00.34 = **01.46** (DIO3 is configured as a digital input which can be used to select the reference)
00.47 = preset reference 2 value in rpm
00.48 = preset reference 3 value in rpm
00.49 = preset reference 4 value in rpm

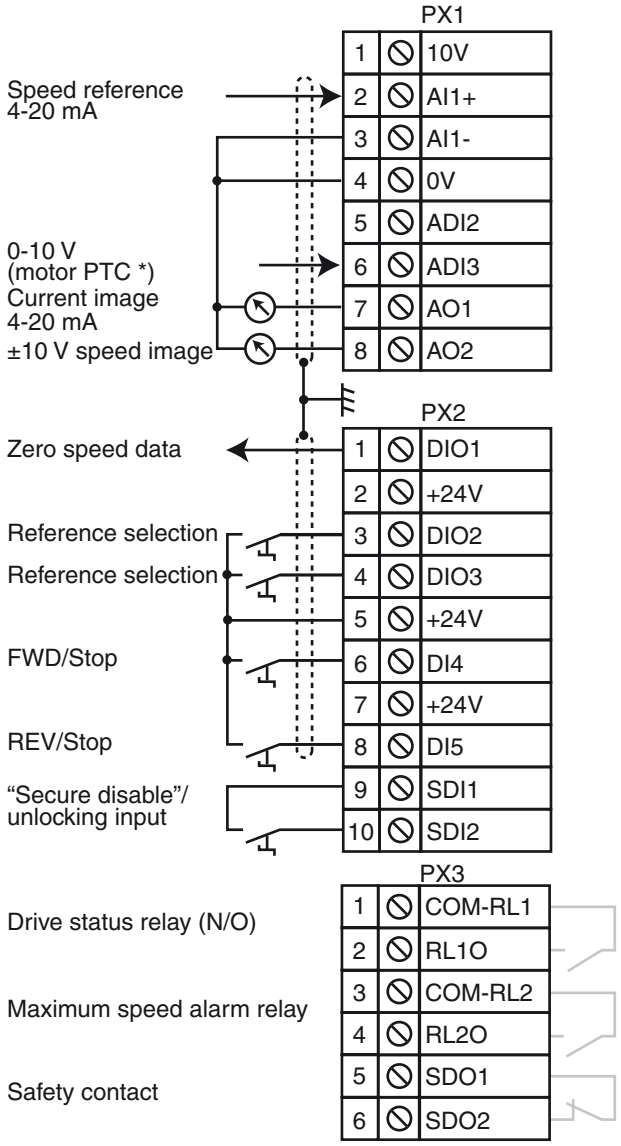
(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise keep the factory value of **00.28** (0-10 V).



• Selection of the reference via digital inputs

DIO2	DIO3	Selection
0	0	0-10 V analog reference
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

3.3.4.2 - Connection and parameter setting for selecting a reference (4-20 mA) or 3 preset references



Note: Input SDI2 must be closed before executing the run command.

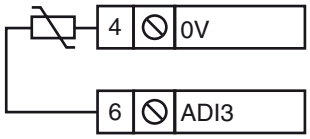
- Parameters must be set with the drive disabled (SDI2 open).
- Parameter **00.22** is used to modify the run command type ("3-wire" or reverse command: refer to section 3.3.3).

• List of parameters to adjust based on the factory configuration

- Set:

00.05 = Ana input 2 (2)
00.25 = 4-20 mA no trip (4) (AI1 is configured as an analog current input, 4-20 mA range without detection of signal loss).
00.28 = (*)
00.34 = **01.46** (DIO3 is configured as a digital input which can be used to select the reference).
00.47 = preset reference 2 value in rpm
00.48 = preset reference 3 value in rpm
00.49 = preset reference 4 value in rpm

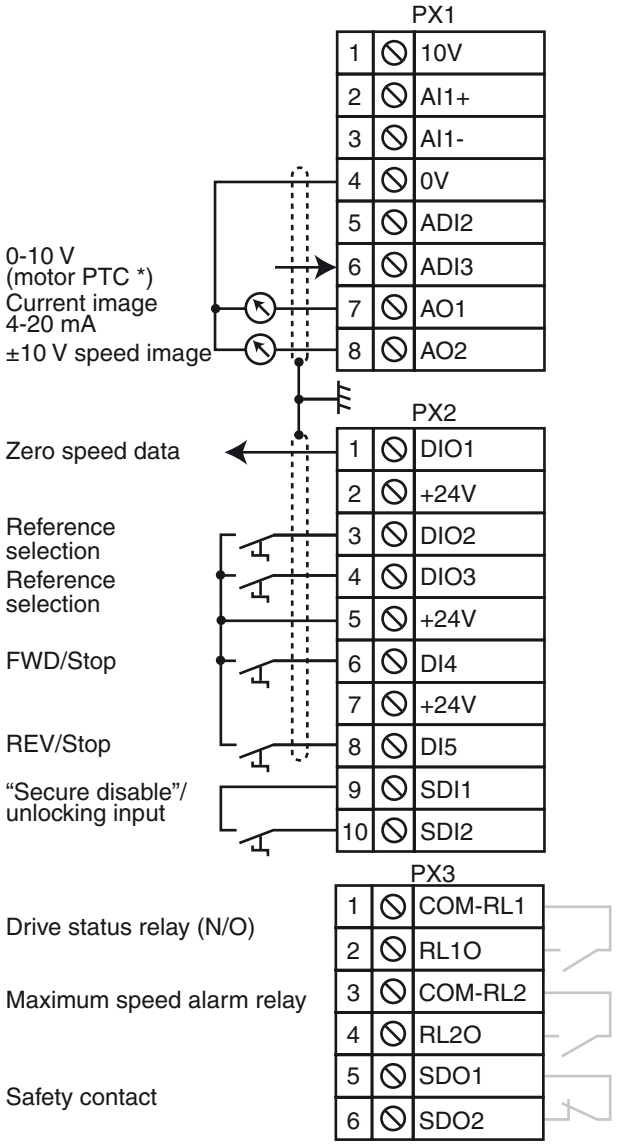
(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise keep the factory value of **00.28** (0-10 V).



• Selection of the reference via digital inputs

DIO2	DIO3	Selection
0	0	4-20 mA analog reference
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

3.3.4.3 - Connection and parameter setting for selecting 4 preset references



Note: Input SDI2 must be closed before executing the run command.

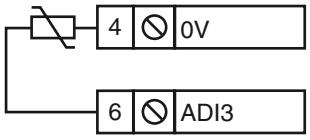
- Parameters must be set with the drive disabled (SDI2 open).
- Parameter **00.22** is used to modify the run command type ("3-wire" or reverse command: refer to section 3.3.3).

• List of parameters to adjust based on the factory configuration

- Set:

00.05 = preset ref. (4)
00.28 = (*)
00.34 = **01.46** (DIO3 is configured as a digital input which can be used to select the reference).
00.46 = preset reference 1 value in rpm
00.47 = preset reference 2 value in rpm
00.48 = preset reference 3 value in rpm
00.49 = preset reference 4 value in rpm

(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise keep the factory value of **00.28** (0-10 V).



• Selection of the reference via digital inputs

DIO2	DIO3	Selection
0	0	Preset reference 1
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE

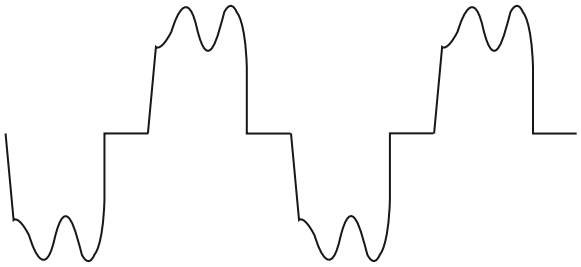
The power structure of frequency inverters leads to the occurrence of two types of phenomena:
- Low frequency harmonics fed back to the mains power supply
- Emission of radio-frequency signals (RFI)

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

4.1 - Low-frequency harmonics

4.1.1 - General

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



I mains supply line used by a 3-phase rectifier.

This current carries harmonics with number 6n ± 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 are only significant for loads on frequency inverters with several hundred kVA and if these loads represent more than a quarter of the total load on a site.
They have virtually no effect on the electrical energy consumption level. The temperature rises associated with these harmonics 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.

4.1.2 - Standards

These current harmonics introduce voltage harmonics on the mains supply. **The amplitude of the voltage harmonics depends on the impedance of the mains supply.**
The energy supply company (EDF in France), which is affected by these phenomena in the case of **high power installations**, has its own **recommendations** for the level of each voltage harmonic:
- 0.6% for even numbers
- 1% for odd numbers
- 1.6% for the total factor

This applies to the connection point of the energy supply company and not at harmonic generator level.

4.1.3 - Reduction of the level of harmonics fed back to the mains supply

The low power ratio between the drive and the mains supply on which it is installed results in a level of voltage harmonics that is generally acceptable.
However, in the rare situations where the characteristics of the mains and the total load on the drives prevent compliance with the levels of harmonics recommended by the energy distribution company, LEROY-SOMER will offer every assistance to the installer with calculating a mains choke or an appropriate filter.

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 has been 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

Frequency inverters use high-speed switches (transistors, semi-conductors) which switch high voltages 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 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 has shown that the levels set by the standards do not necessarily need to be observed to eliminate interference phenomena.
• Following the basic precautions in section 4.5 generally results in the correct operation of the installation.

4.4 - Influence of the mains power supply

The mains power supply may be subject to interference (voltage drops, voltage imbalances, fluctuation, overvoltages, etc.) which can have an actual negative impact on the performance and reliability of all electronic power equipment, including drives.
LEROY-SOMER drives are designed to operate with a mains power supply typical of industrial sites throughout the world. However, for each installation, it is important to know the characteristics of the mains power supply in order to carry out corrective measures in the event of abnormal conditions.

4.4.1 - Transient overvoltages

There are numerous reasons for overvoltages on an electrical installation:
- Connection/disconnection of a bank of capacitors which increases the cos φ.
- Short-circuit in a high-power device when an isolator is opened and/or fuses are damaged.
- Devices (ovens, DC or AC drives, etc.) with high-power thyristors (>1 MW).
- High-power motors during start-up.
- Overhead power supply.
- Etc.
The **POWERDRIVE** incorporates high-power overvoltage limiters, which protect the drive and enable reliable operation on industrial sites.
If transient overvoltages are a regular occurrence, we recommend the use of a mains choke.

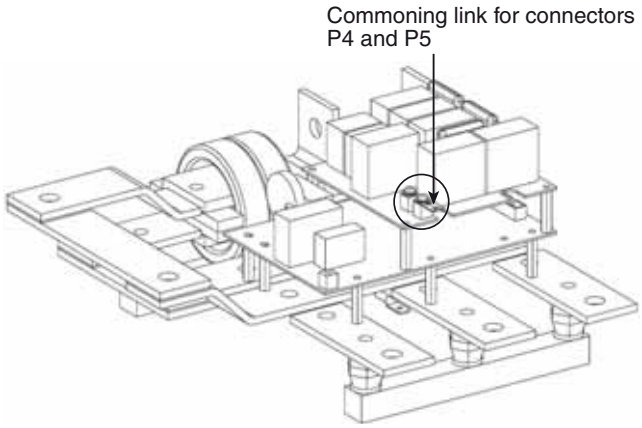
4.4.2 - Unbalanced power supply

As is seen 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.

Mains chokes can be installed upstream of a **POWERDRIVE** supplied by an unbalanced mains supply in order to reduce the current imbalance factor (the chokes are mounted in series for the 1100T rating and all TH ratings).

4.4.3 - Impedance of the mains supply

The **POWERDRIVE** is designed to operate in industrial electrical networks that have a transformer suitable for a short-circuit power between 20 and 100 times the rated power of the drive (1% < line impedance <5%). This point is to be verified during operation on a generator or transformer.
Example: For a drive with a rated input current of 100 A and a transformer with a short-circuit current capacity of 5000 A, the line impedance will be 2% (100 A/5000 A).
However, if the **POWERDRIVE** is installed near to the MV/LV power supply transformer or if a bank of capacitors which increases the cos φ is used, the impedance experienced by the **POWERDRIVE** is very low. In this case, we recommend that you use a mains choke upstream of the drive.
For installations with both neutral IT point connection and a ratio lower than twenty between the short-circuit current at the drive connection point and its rated current, it is advisable to open the commoning link for the connectors marked P4 and P5 on the PEF 720 NI 000 card.



(See location of this card in section 6.4.5).

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 extreme cases, these currents may cause drive malfunctions (spurious trips).
It is essential that the recommendations in section 4.5 are observed in order to minimise the impact of these currents.

4.5 - Basic precautions for installation

These are to be taken into account when wiring the cabinet and the external components. In each section, 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.
The recommended cable type is a shielded symmetrical cable (comprising three phase conductors and a coaxial or symmetrical PE conductor and shielding).
A PE protective conductor must be used if the conductivity of the cable shielding is 50% lower than that of the phase conductor.
- The shielding must be connected at both ends: drive end and motor end (360°).
- 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 must 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 (probe, sensors, etc.) from metal structures which may be shared by the motor support.

4.5.3 - Importance of ground wiring

The immunity and radio-frequency emission level are directly linked to the quality of the ground connections. Metal grounds must be mechanically connected to each other with the largest possible electrical contact area. Under no circumstances can the earth connections, which are designed to protect people by linking metal grounds to earth via a cable, serve as a substitute for the ground connections.

4.6 - Electromagnetic compatibility (EMC)

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

Immunity			
Standard	**Description**	**Application**	**Conformity**
IEC 61000-4-2	Electrostatic discharges	Product casing	Level 3 (industrial)
IEC 61000-4-3	Immunity standards for radiated	Product casing	Level 3 (industrial)
IEC 61000-4-4	Bursts of fast transients	Control cable	Level 4 (industrially hardened)
		Power cable	Level 3 (industrial)
IEC 61000-4-5	Shock waves	Power cables	Level 4
IEC 61000-4-6	Generic immunity standards for conducted radio-frequency	Control and power cables	Level 3 (industrial)
EN 50082-2 IEC 61000-6-2	Generic immunity standards for the industrial environment	-	Up to the required standard
IEC 61800-3 EN 61000-3	Variable speed drive standards	Conforms to categories C2 and C3	

Emission				
Standard	**Description**	**Category**	**Conformity conditions**	
			Without RFI filter	**With RFI filter**
EN 61800-3	Variable speed drive standards	C1	-	-
		C2	-	Up to the required standard - Cable length < 20 m - Switching frequency < 4 kHz
		C3	Up to the required standard - Cable length < 100 m - Switching frequency < 4 kHz	Up to the required standard - Cable length < 100 m - Switching frequency < 6 kHz

• 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.

5 - OPTIONS

5.1 - RFI filters

5.1.1 - General

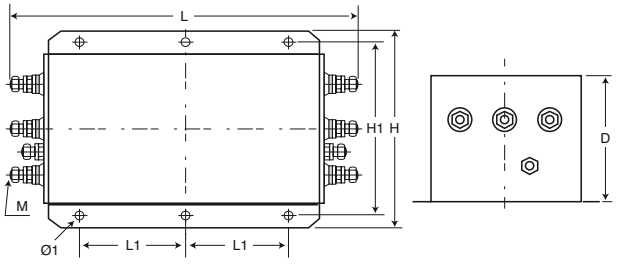
The use of RFI filters contributes to a reduction in the emission levels of radio-frequency signals. They ensure that **POWERDRIVE** components conform to variable speed drive standard EN 61800-3.
Depending on the drive used, install the RFI filter recommended in the table below between the mains and the drive input.

POWERDRIVE Rating	Reference	I_{rated} at 40°C (A)	Leakage current at 500Vac/ 50Hz (mA)	Losses (W)
60T to 100T	FN3359HV-180	197	<6	34
120T and 150T	FN3359HV-250	250	<6	49
270TH	FN3359HV-320	350	<6	19
180T and 220T 340TH	FN3359HV-400	438	<6	29
270T to 400T 400TH to 600TH	FN3359HV-600	657	<6	44
470T and 600T 750TH and 900TH	FN3359HV-1000	1095	<6	60
750T 1200TH and 1500TH	FN3359HV-1600	1600	<6	131
900T and 1100T	FN3359HV-2500	2500	<6	300

CAUTION:
The specific design of these filters means they can be used in installations with neutral IT point connection. The installer should, however, ensure that insulation supervision systems dedicated to these installations are suitable for monitoring electrical equipment that may contain electronic variable speed drives.

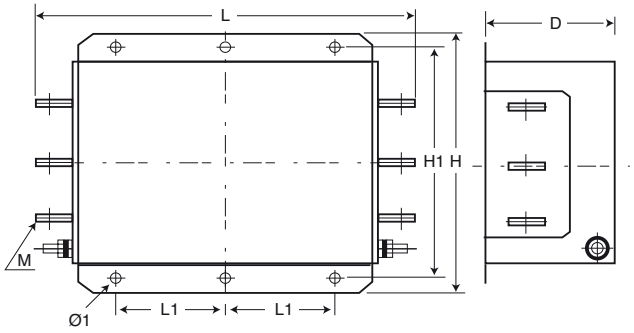
5.1.2 - Weight and dimensions

• FN 3359 HV-180 and FN 3359 HV-250



Type	Dimensions (mm)							Weight (kg)
	L	L1	H	H1	D	Ø1	M	
FN 3359 HV-180	360	120	210	185	120	12	M10	6.5
FN 3359 HV-250	360	120	230	205	125	12	M10	7

• FN 3359 HV-320 to FN 3359 HV-2500



Type	Dimensions (mm)							Weight (kg)
	L	L1	H	H1	D	Ø1	M	
FN 3359 HV-320	386	120	260	235	115	12	M12	10,5
FN 3359 HV-400	386	120	260	235	115	12	M12	10.5
FN 3359 HV-600	386	120	260	235	135	12	M12	11
FN 3359 HV-1000	456	145	280	255	170	12	M12	18
FN 3359 HV-1600	586	170	300	275	160	12	M12	27
FN 3359 HV-2500	796	250	370	330	200	14	M16	55

5.2 - Mains choke

5.2.1 - General

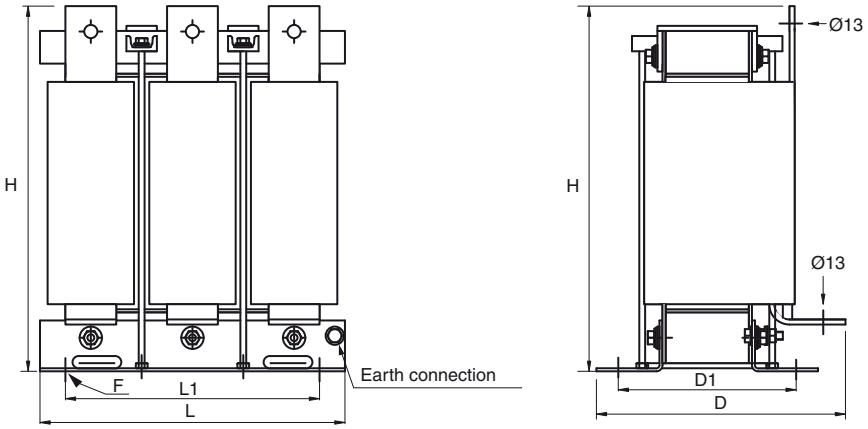
Mains chokes can be used to reduce the risk of damage to drives following a phase imbalance or significant interference on the mains supply.

POWERDRIVE rating	Choke				
	Reference	I_{rated} (A)	Inductance (mH)	Losses (W)	Weight (kg)
60T	105 ST 0.23/RWK 212 75 KL	105	0.23	170	15
75T	150 ST 0.155	150	0.155	190	15
100T	185 ST 0.13	185	0.13	200	20
120T	220 ST 0.11	220	0.11	230	22.5
150T	245 ST 0.095	245	0.095	245	25
180T	292 ST 0.08	292	0.08	280	30
220T	360 ST 0.065	360	0.065	310	35
270T	460 ST 0.05	460	0.05	350	55
340T	580 ST 0.04	580	0.04	490	55
400T	640 ST 0.035	640	0.035	515	55
470T	800 ST 0.023	800	0.023	700	70
600T	2x580 ST 0.04	1000	0.020	980	110
750T and 900T	2x640 ST 0.035	1230	0.0175	1030	110

For the 1100T and all TH ratings, the chokes are mounted in series.

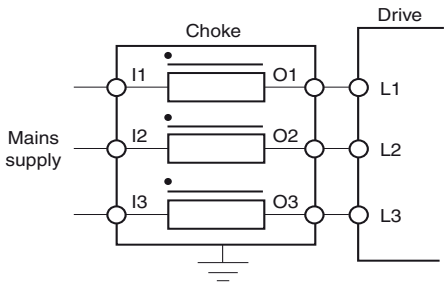
5.2.2 - Weight and dimensions

• 105 ST 0.23 to 800 ST 0.023 chokes (IP00 protection)



Chokes	Dimensions (mm)			Fixings (mm)			Connection to (mm)	Weight Kg
	H	L	D	L1	D1	F		
105 ST 0,23/RWK 212 75 KL	285	260	210	100	125	Ø11x22	section 30x5	15
150 ST 0,155	285	260	210	100	125	Ø11x22	section 30x5	15
185 ST 0.13	285	260	220	100	150	Ø11x22	section 30x5	20
220 ST 0.11	285	260	225	100	150	Ø11x22	section 30x5	22.5
245 ST 0.095	285	260	240	100	175	Ø11x22	section 30x5	25
292 ST 0.08	265	260	260	100	200	Ø11x22	section 30x5	30
360 ST 0.065	265	260	270	100	200	Ø11x22	section 30x5	35
460 ST 0.05	440	300	250	250	150	Ø11x22	section 50x5	55
580 ST 0.04	440	300	250	250	175	Ø11x22	section 50x5	55
640 ST 0.035	440	300	250	250	175	Ø11x22	section 50x5	55
800 ST 0.023	440	300	250	250	175	Ø11x22	section 50x5	70

5.2.3 - Connection



5.3 - Braking transistors and resistors

5.3.1 - Braking transistors

The transistors are mounted internally in the **POWERDRIVE**. They consist of an IGBT transistor and a control circuit.

	POWERDRIVE ratings		
	60T to 150T	**180T to 1100T**	**270TH to 1500TH**
Braking transistor reference	MD TF 200	MD TF 400	MD THF 330
Peak current (A)	200	400	330
Permanent current (A)	70	250	110
Minimum value of the associated resistor (Ω)	3.5	1.8	3.5

5.3.2 - Braking resistors

Use of the braking resistor is optional.
It is used to dissipate the active power returned by the motor to the drive DC bus if a driving machine is being used.

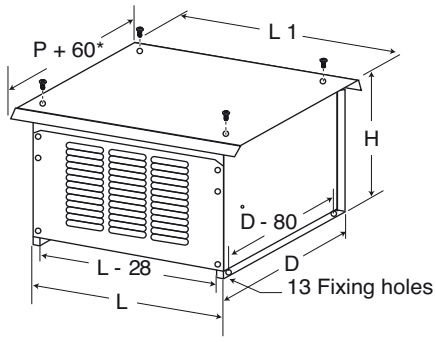
⚠ • The braking resistor must be installed so that it does not damage neighbouring components with its heat dissipation.
• Particular care should be taken when working near the resistor, due to the presence of high voltage and heat release (resistor temperature above 70°C).
• The braking resistor must be wired in series with a thermal relay calibrated to the resistor rms current to avoid risks of fire which could be caused by malfunction of the braking transistor or a short-circuit. When the relay trips, the drive must stop and switch off.
• A braking resistor must be mounted outside the cabinet, as close as possible. Ensure that it is built into a ventilated metal case, to avoid any direct contact with the resistor.

• Electrical characteristics

RF resistor type	Ohmic value (Ω)	Thermal power (kW)	Peak power (kW)	rms current (A)*
RF-MD-27500-10	10	27.5	51.8	52
RF-MD-37500-5	5	37.5	103.7	87
RF-MD-55000-5	5	55	103.7	105
RF-MD-75000-4	3.5	75	148.1	146
RF-MD-110000-3	2.35	110	220.6	216

* Setting current for the thermal relay wired in series in the resistor.

• Dimensions



IP13 protection
* becomes P + 80 from RF-MD-37500-5 upwards

Type	Dimensions (mm)				Weight (kg)
	L	L1	D	H	
RF-MD-27500-10	860	890	480	690	66
RF-MD-37500-5	960	1140	380	1150	77
RF-MD-55000-5	960	1140	540	1150	105
RF-MD-75000-4	1080	1260	680	1150	145
RF-MD-110000-3	960	1140	740	1520	200

5.4 - Electrical protection

• The various add-on options for electrical protection are:
- Isolator
- Fused isolator
- Circuit-breaker
- Contactor
- Emergency stop category 1-3
- Thermal relay

For the selection and dimensions of electrical protection devices, ask your usual LEROY-SOMER contact.

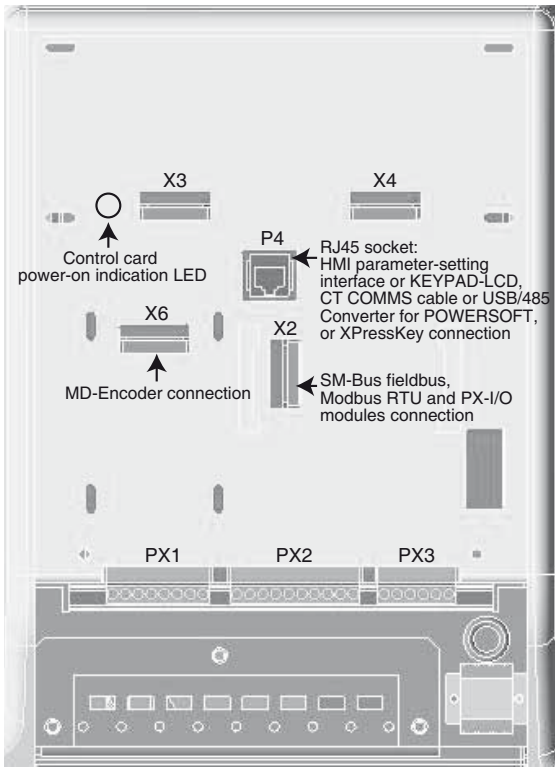
• Emergency stop, category 1-3: MD-AU 1/3

The category 1 MD-AU 1 protection device includes an emergency stop wired in the secure disable input circuit and mounted on the front panel (IP21 or IP54 version).
The MD-AU 3 protection device is a category 2 or 3 remote control with a secure disable input. This option consists of 1 safety relay and an emergency stop already wired-up and mounted on the front panel (IP21 or IP54 version).

5.5 - Add-on options

5.5.1 - Location of options

Do not connect an Ethernet network to the control card RJ45 connector, as this could damage the drive. An SM-Ethernet module is needed for this type of application.



5.5.2 - POWERSOFT

This software can be downloaded from the Internet at the following address:
http://www.leroy-somer.com, "Downloads" tab
With POWERSOFT, setting parameters and supervising the **POWERDRIVE** from a PC is very user-friendly. Numerous functions are available:
- Quick commissioning
- LEROY-SOMER motor database
- File backup
- 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
- Representation of parameters in table or graphic form

To connect the PC to the POWERDRIVE, use the CT Comms Cable (PC RS232 port) or USB/485 Converter (PC USB Port).

5.5.3 - KEYPAD-LCD

5.5.3.1 - General

With this console, setting up the **POWERDRIVE** is easy and all parameters are accessible. 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 KEYPAD-LCD has 2 main functions:
- A read mode for **POWERDRIVE** supervision and diagnostics.
- Access to all the **POWERDRIVE** parameters in order to optimise settings or even configure particular applications.

5.5.3.2 - Read mode

Immediately on power-up, KEYPAD-LCD is set to read mode. Pressing the keys scrolls through all the parameters required for supervision and diagnostics:
- motor current
- motor frequency
- motor voltage
- analog I/O levels
- digital I/O states
- logic function states
- timer
- most recent trips

5.5.4 - XPressKey

5.5.4.1 - General

The XPressKey option can be used to save a copy of all the **POWERDRIVE** parameters so that they can be duplicated very simply on another drive. **Disable the drive before saving or setting the drive parameters.**

5.5.4.2 - Saving parameters to XPressKey

- Using the parameter-setting interface, check that the drive has been disabled (terminal SDI2 open). Set **00.44** = Drive to key.

- Now replace the parameter-setting interface cable connector in the RJ45 socket with that of the XPressKey.
- Pressing the key button causes the parameters contained in the drive to be stored in the copy key. The green LED on the key remains lit throughout the transfer and goes out to indicate that the operation has been completed successfully.
- Once the parameter-setting interface has been reconnected, the parameter **00.44** returns to "no".
Note: If the transfer cannot take place, the XPressKey LED flashes quickly.

CAUTION:
Press the key button within 10 seconds maximum after selecting "Drive to key" in 00.44, otherwise the action is cancelled.

5.5.4.3 - Setting the parameters of a drive with the same rating using XPressKey

The "Key to drive" function is activated using the pushbutton located on the copy key once the key has been connected to the RJ45 socket. The first press on the button corresponds to parameter **00.44** changing to "Key to drive". The XPressKey LED flashes slowly. The second press confirms the transfer. The green LED on the key remains lit throughout the transfer and goes out to indicate completion of transfer.
Note: If the transfer cannot take place, the XPressKey LED flashes quickly.

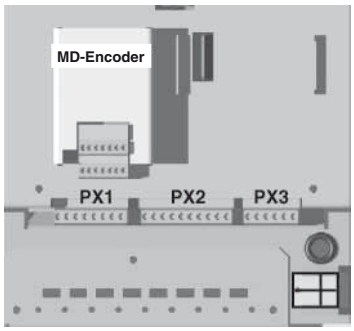
CAUTION:
• Press the key button the second time within 10 seconds maximum, otherwise the action is cancelled.
• If the ratings of the source and destination drives are different:
- destination drive software <V3.00: the transfer is not permitted
- destination drive software ≥V3.00: the transfer takes place, apart from menus 5 and 21

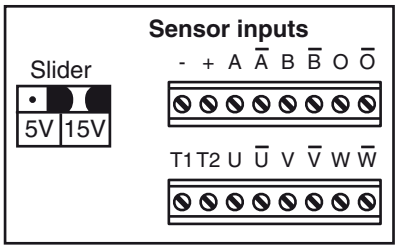
5.5.5 - MD-Encoder

The MD-Encoder option can be used to manage the motor speed feedback, i.e. incremental encoders with or without commutation channels and Hall effect sensors.
Connect the cable shielding to the drive's earth plane using a metal clamp, stripping the cable all round.

⚠ • Before installing or removing the MD-Encoder option, it is essential for the drive to be switched off and a check carried out to ensure the DC bus voltage is below 40 V (the control card power-on indicator LED must be off).

5.5.5.1 - Installation and location of terminal blocks



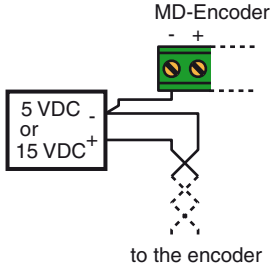


Note:
• Terminals 0 and 0\ are unused.
• The MD-Encoder module can manage the motor PTC thermal probe via terminals T1 and T2. In this case, some parameters need to be set. Refer to menu 7 in the commissioning manual, ref. 3871.

CAUTION:
For software versions < 3.00, the user should connect the motor PTC probe to the drive control terminal block between ADI3 and 0V, then set 00.28 to PTC.

5.5.5.2 - External power supply

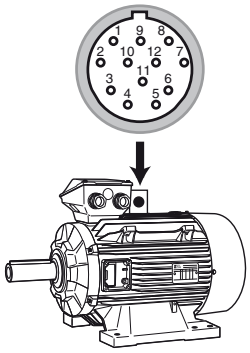
The MD-Encoder option supplies the encoder directly according to the slider position (+5 V or +15 V). However, some applications require special wiring with an external power supply. In this case, follow the connection diagram below.



5.5.5.3 - Connection of an incremental encoder (asynchronous motors)

-	Encoder power supply 0 V
+	Encoder power supply according to position of the selector switch (slider) 5 V or 15 V
A	Encoder channel connection
A\	
B	
B\	
0	Not used
0\	

• LEROY-SOMER motor connector wiring

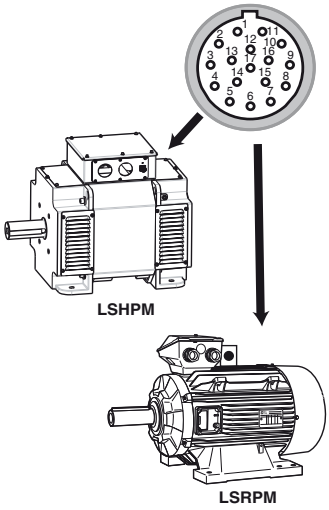


12-pin connector encoder side (male plug)		MD-Encoder terminal block
Ref.	Description	Description
1	0V	-
2	+5 V or +15 V	+
3	A	A
4	B	B
5	O	x
6	A\	A\
7	B\	B\
8	O\	x
9	-	x
10	-	x
11	Shielding	⏚
12	-	x

5.5.5.4 - Connection of an incremental encoder with commutation channels (synchronous motors)

-	0 V for the encoder power supply
+	Encoder power supply according to the position of the selector switch (slider), 5 V or 15 V
A	Encoder channel connection
A\	
B	
B\	
O	Not used
O\	
U	• Channel U connection
U\	• Channel U\ connection
V	• Channel V connection
V\	• Channel V\ connection
W	• Channel W connection
W\	• Channel W\ connection

• LEROY-SOMER motor connector wiring



17-pin connector encoder side (male plug)		MD-Encoder terminal block
Ref.	Description	Description
1	x	x
2	x	x
3	x	x
4	U	U
5	U\	U\
6	V	V
7	V\	V\
8	W	W
9	W\	W\
10	A	A
11	O	x
12	O\	x
13	A\	A\
14	B	B
15	B\	B\
16	+5 V or +15 V	+
17	0 V	-
	Shielding (*)	⏚

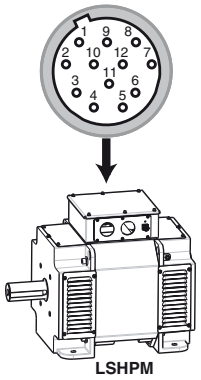
Use one shielded cable per pair.
The thermal probe is connected in the motor terminal box.
(*) to be connected to connector housing.

5.5.5.5 - Connection of a Hall effect sensor (synchronous motors)

-	0 V sensor power supply
+	Sensor power supply according to position of selector switch to be positioned at 15 V
T1	Connection of motor thermal probe (see LSRPM)
T2	
U	• Connection of sensor channel U
U\	• Connection of sensor channel U\
V	• Connection of sensor channel V
V\	• Connection of sensor channel V\
W	• Connection of sensor channel W
W\	• Connection of sensor channel W\

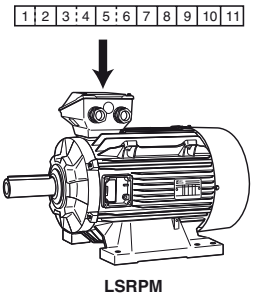
CAUTION:
Check the slider position carefully: 15V for Hall effect sensor power supply.

• LEROY-SOMER motor connector wiring



12-pin connector Hall effect sensor side (male plug)		MD-Encoder terminal block
Ref.	Description	Description
1	U	U
2	U\	U\
3	V	V
4	V\	V\
5	W	W
6	W\	W\
7	x	x
8	x	x
9	+15V	+
10	0V	-
11	x	x
12	x	x
	Shielding (*)	⏚

Use one shielded cable per pair.
The motor thermal probe is connected in the terminal box.
(*) to be connected to connector housing.



11-pin terminal block Hall effect sensor side		MD-Encoder terminal block
Ref.	Description	Description
1	U	U
2	W\	W\
3	V	V
4	U\	U\
5	W	W
6	V\	V\
7	0V	-
8	+15V	+
9	Shielding *	⏚
10	Motor thermal probe	T1
11		T2

Use one shielded cable per pair.
(*) cable shielding to be connected to terminal 9 of terminal block.

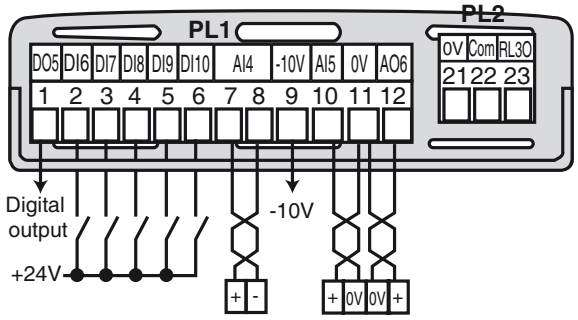
5.5.6 - PX-I/O

• General
The PX-I/O module is used to increase the number of drive inputs and outputs. This option is fully configurable.

Additional functions:
- 2 analog inputs (including a differential analog input)
- 1 analog output
- 5 digital inputs
- 1 assignable relay
- 1 internal clock
- year, month, day, hours, minutes, seconds backup mode

Terminal blocks PL1 (terminals 1 to 12) and PL2 (terminals 21 to 23) are removable.

• Connection



Note: The +24 V voltage source can come from the 24 V internal power supply on **POWERDRIVE** terminal 2, 5 or 7.

• Terminal block PL1

1	Digital output (DO5)
2	Digital input (DI6)
3	Digital input (DI7)
4	Digital input (DI8)
5	Digital input (DI9)
6	Digital input (DI10)

Control logic	Positive, conforming to standard IEC 61131, except for D05. The relay connected to the output must be connected to 0 V.
Isolation	Not isolated from the control electronics
Input	
Voltage range	0 to 24 V
Absolute maximum voltage	0 to 35 V
Sampling/refreshing	5 ms
Impedance	15 kΩ at no load/6 kΩ on load
Thresholds	0: < 5 V 1: > 10 V
Output	
Maximum output current	15 mA
Overload current	50 mA

7	Differential analog input + (AI4+)
8	Differential analog input - (AI4-)
Characteristics	Voltage bipolar differential inputs (common mode operation: connect terminals 8 and 11)
Resolution	12 bits
Sampling	5 ms
Full-scale voltage range	± 10 V ± 2%
Maximum common mode voltage	20 V ± 1%
Absolute maximum voltage	33 V
Input impedance	57 kΩ, ± 1%
9	-10 V internal analog supply
Voltage tolerance	± 1%
Maximum output current	5 mA
Protection	Threshold at -15 V
10	Analog input (AI5)
Characteristics	Bipolar analog voltage
Resolution	10 bits
Sampling	5 ms
Full-scale rated voltage	± 10 V
Absolute maximum voltage	33 V
Input impedance	20 kΩ
11	Logic circuit common 0 V
12	Analog output (AO6)
Characteristics	0 to 10 V analog voltage or 4-20 mA current
Sampling	5 ms
Resolution	13 bits
Voltage output	
Voltage range	0 to 10 V
Load resistance	2 kΩ
Protection	Short-circuit (40 mA max)
Current output	
Current range	4 to 20 mA
Maximum voltage	10 V
Load resistance	500Ω

• Terminal block PL2

21	Logic circuit common 0 V
22	Common
23	RL3O
Contact voltage	250 V AC
Maximum contact current	2 A, resistive load 1 A, inductive load

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

5.5.7 - Fieldbus modules

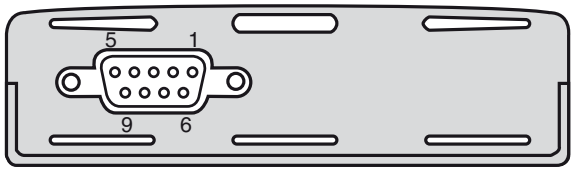
• Before installing or removing a Fieldbus option, it is essential for the drive to be switched off and a check carried out to ensure the DC bus voltage is below 40 V (the control card power-on indicator LED must be off).

5.5.7.1 - SM-Profibus DP module

• General

The SM-PROFIBUS DP module is used to communicate with a PROFIBUS-DP network.
It incorporates a 16-bit microprocessor, and its baud rate can be as much as 12 Mbps.
The **POWERDRIVE** supplies the module internally.

• Connection



SUB-D pins	Functions	Description
1	Shielding	Cable shielding connection
3	RxD/TxD-P	Positive data line (B)
4	CNTR-P	RTS line
5	0V ISO	Isolated 0V, only used for termination resistors
6	+5V ISO	Isolated 5V power supply, only used for termination resistors
8	RxD/TxD-N	Negative data line (A)

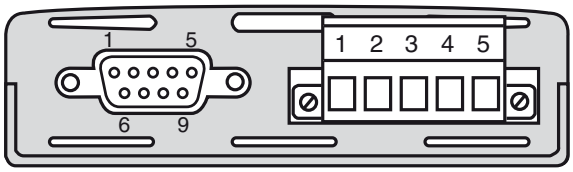
We strongly recommend the use of Profibus certified connectors.
These connectors take 2 Profibus cables and have a terminal block with 4 screws, one for each data connection. They also have a shielding connection holder, which ensures continuity of the shielding for good immunity to interference on the Profibus network.

5.5.7.2 - SM-DeviceNet module

• General

The SM-DeviceNet module is used to communicate with a DeviceNet network.
It incorporates a 16-bit microprocessor, and its baud rate can be as much as 500 Kbps.
The module must be supplied by the DeviceNet power supply.

• Connection



5-terminal block	9-pin SUB-D	Functions	Description
1	6	0V	External power supply 0 V
2	2	CAN-L	Negative data line
3	3.5	Shielding	Cable shielding connection
4	7	CAN-H	Positive data line
5	9	+24V	External power supply

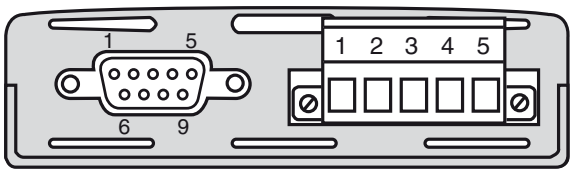
CAUTION:
We recommend using the screw terminal block rather than the SUB-D connector for connection to the DeviceNet network, as SUB-D connectors are not recognised for DeviceNet conformity.

5.5.7.3 - SM-CANopen module

• General

The SM-CANopen module is used to communicate with a CANopen network. It incorporates a 16-bit microprocessor, and its baud rate can be as much as 1 Mbps.
The **POWERDRIVE** supplies the module internally.

• Connection



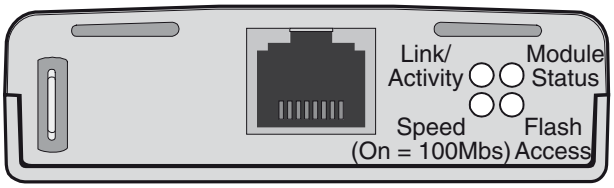
5-terminal block	9-pin SUB-D	Functions	Description
1	6	0V	External power supply 0 V
2	2	CAN-L	Negative data line
3	3.5	Shielding	Cable shielding connection
4	7	CAN-H	Positive data line
5	9	+24V	External power supply

5.5.7.4 - SM-Ethernet module

• General

The SM-Ethernet module is used to communicate with an Ethernet network using MODBUS TCP only.
The **POWERDRIVE** supplies the module internally (current consumption 280 mA).

• Connection

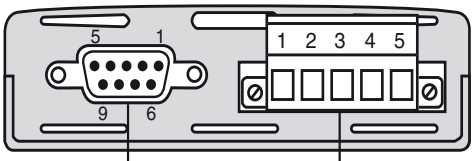


RJ45	Disable internal crossover (# mm.43 = 0)	Enable internal crossover (# mm.43 = 1)
1	Transmission +Ve	Reception +Ve
2	Transmission -Ve	Reception -Ve
3	Reception +Ve	Transmission +Ve
4	-	-
5	-	-
6	Reception -Ve	Transmission -Ve
7	-	-
8	-	-

5.5.8 - Modbus RTU module

• Before installing or removing a Modbus RTU option, it is essential for the drive to be switched off and a check carried out to ensure the DC bus voltage is below 40V (the control card power-on indicator LED must be off).

The **POWERDRIVE** incorporates as standard a non-isolated 2-wire RS485 serial link port accessible with the RJ45 connector. When the user wishes to keep the parameter-setting interface permanently connected, it is necessary to add the Modbus RTU option with an isolated 2 or 4-wire serial link port.



Female 9-pin Sub D	
Pin	Description
1	0V
2	TX\
3	RX\
4	not connected
5	not connected
6	TX
7	RX
8	not connected
9	not connected
Shielding: 0 V	

5-pin screw terminal block	
Terminal	Description
1	0V
2	RX\
3	RX
4	TX\
5	TX

6 - 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 and wait at least 10 minutes to ensure that the capacitors have discharged.

• Ensure that the DC bus voltage is below 40 V before carrying out any work (the control card power-on indicator LED must be off, see section 5.5.1).

• During maintenance operations performed with the drive switched on, the operator must stand on an insulated surface which is not connected to earth.

• During work on a motor or its power supply cables, check that the power supply of the corresponding drive is disconnected and locked.

• All protective covers must remain in place during tests.

• After connecting the power, reposition the cable bush plates, which may be done at the back of the cabinet, to prevent the entry of foreign bodies.

There are very few maintenance and repair operations on **POWERDRIVE** drives to be performed by the user. Regular servicing operations and simple methods for checking that the drive is operating correctly are described below.

6.1 - Care

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 regularly according to their condition.

6.2 - Storage

If the drive has been stored for more than 12 months, it is essential to switch it on for 24 hours (power and control), and repeat this operation every 6 months.

6.3 - Exchanging products

CAUTION:

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

6.4 - Spare parts list

6.4.1 - Internal fuses (AP6)

The location of these fuses is indicated in section 3.1.

Fuse name	Drive rating	Fuse type	Size	Value	Number	LS code
F1	60T to 1100T 270TH to 1500TH	SA	5 x 20	1.25 A/250 V	1	PEL001FA004
F2		SA	5 x 20	1.25 A/250 V	1	PEL001FA004
F3		SA	5 x 20	1.25 A/250 V	1	PEL001FA004
F4		SA	5 x 20	1.25 A/250 V	1	PEL001FA004
F5		SA	5 x 20	1.25 A/250 V	1	PEL001FA004
F6		SA	5 x 20	1.25 A/250 V	1	PEL001FA004
F7	60T to 1100T	aM/ATQ	10 x 38	4 A/500 V	1	PEL004FA000
	270TH to 1500TH	aM	10 x 38	4 A/690 V	1	PEL004FU003
F8	60T to 1100T	aM/ATQ	10 x 38	4 A/500 V	1	PEL004FA000
	270TH to 1500TH	aM	10 x 38	4 A/690 V	1	PEL004FU003

6.4.2 - Motor output bar fuses

Drive rating	Fuse type	Size	Value	Number	LS code
60T to 1100T	FA	6.3x32	2 A/660 V	3	PEL002FU004
270TH to 1500TH	U_R	10x38	4 A/690 V	3	PEL004FU003

6.4.3 - DC bus voltage pick-up fuses (AP5)

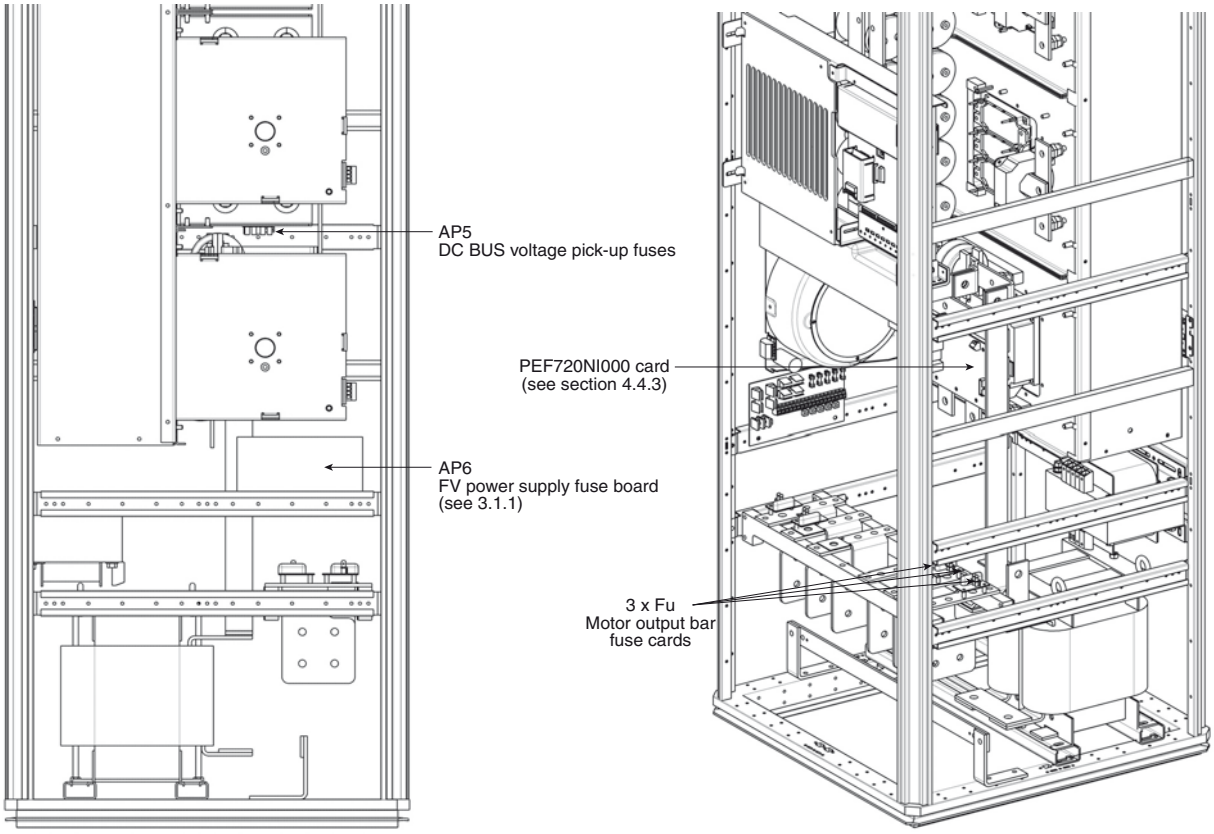
Drive rating	Fuse type	Size	Value	Number	LS code
60T to 1100T and 270TH to 1500TH	FA	6.3x32	2 A/660 V	2	PEL002FU004

6.4.4 - Auxiliary power supply protection fuses

Drive rating	Fuse type *	Size	Value	Number	LS code
60T to 150T	FA	6.3x32	3.15 A/500 V	1	PEL003FU001
	Time-delayed	5x20	1.25 A/250 V	1	PEL001FA004

* These two fuses are found on the drive's in-built card, under the control card.

6.4.5 - Identification of the fuses



Notes

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