CONTROL TECHNIQUES

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User Guide

Commander SX

IP66/Nema 4X

AC Variable Speed Drive

Part Number : 3840 en - 04.2004 / b

COMMANDER SX
IP66/Nema 4X AC Variable Speed Drive

NOTE

CONTROL TECHNIQUES 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 devices which, in the event of a fault, 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.

CONTROL TECHNIQUES declines all responsibility in the event of the above recommendations not being observed.

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Manual corresponding to software version ≥ 2.10

COMMANDER SX
IP66/Nema 4X AC Variable Speed Drive

Safety Information

Warnings, Cautions and Notes

• A Warning contains information which is essential for avoiding a safety hazard.

Caution :
A Caution contains information which is necessary for avoiding a risk of damage to the product or other equipment.

Note : A Note contains information which helps to ensure correct operation of the product.

Electrical safety - general warning
The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.
Specific warnings are given at the relevant places in this User Guide.

System design and safety of personnel
The drive is intended as a component for professional incorporation into complete equipment or a system. If installed incorrectly, the drive may present a safety hazard.
The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury.
Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this User Guide carefully.
The STOP and SECURE INPUT (Option) functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.
With the sole exception of the SECURE INPUT (Option) function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.
Careful consideration must be given to the functions of the drive which might result in a hazard, either through their intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.
The SECURE INPUT (Option) function has been approved[1] as meeting the requirements of EN954-1 category 3 for the prevention of unexpected starting of the drive. It may be used in a safety-related application. **The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.**

Environmental limits
Instructions in this User Guide regarding transport, storage, installation and use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

Compliance with regulations
The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective earth (ground) connections.
This User Guide contains instruction for achieving compliance with specific EMC standards.
Within the European Union, all machinery in which this product is used must comply with the following directives:
98/37/EC: Safety of machinery.
89/336/EEC: Electromagnetic Compatibility.

Motor
Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.
Standard squirrel cage induction motors are designed for single speed operation. If it is intended to use the capability of the drive to run a motor at speeds above its designed maximum, it is strongly recommended that the manufacturer is consulted first.
Low speeds may cause the motor to overheat because the cooling fan becomes less effective. The motor should be fitted with a protection thermistor. If necessary, an electric forced vent fan should be used.
The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.
It is essential that the correct value is entered in parameter 06 motor rated current. This affects the thermal protection of the motor.

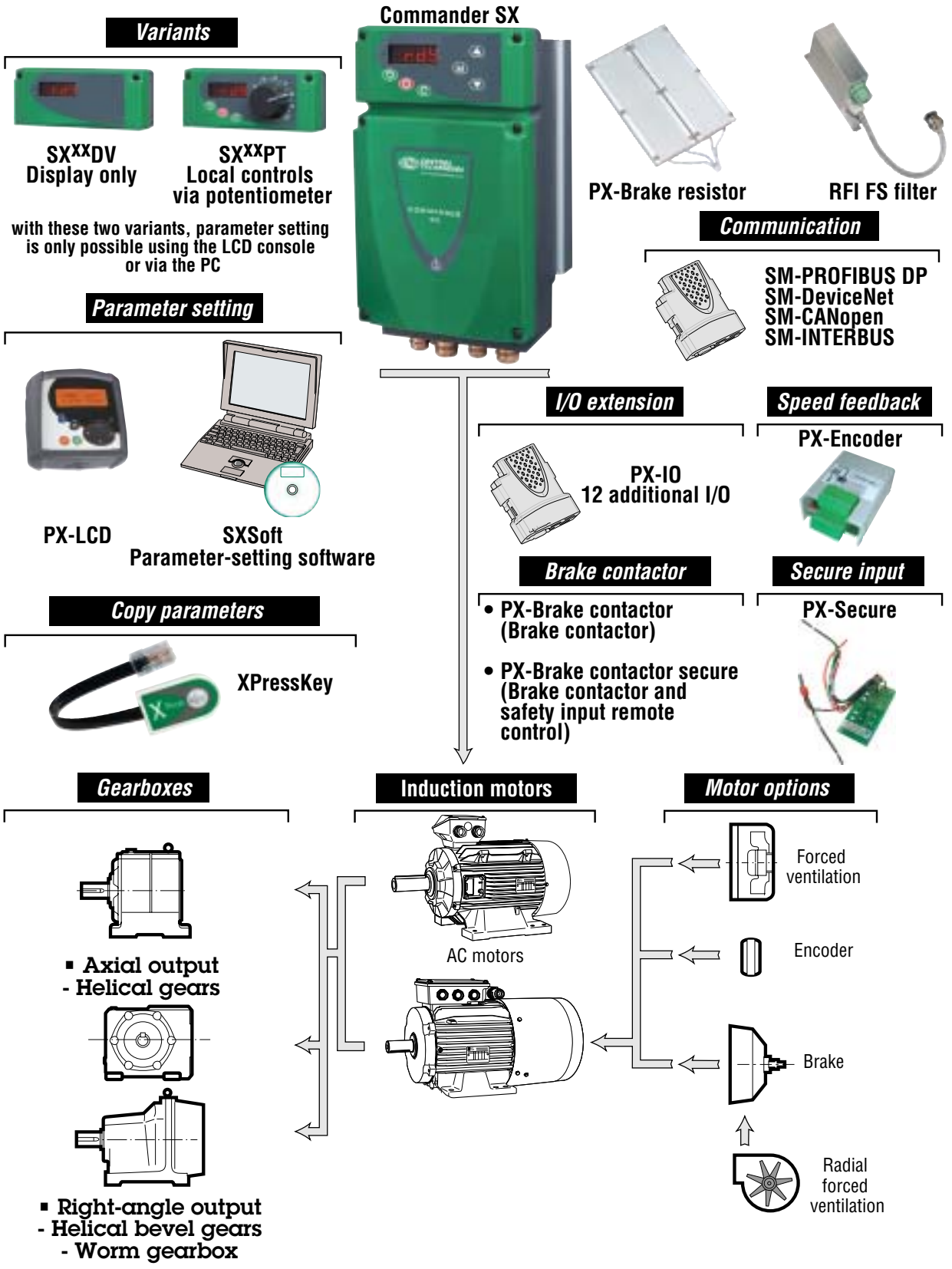
Adjusting parameters
Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

[1] Independent approval by CETIM has been given for sizes 1 to 3.

COMMANDER SX
IP66/Nema 4X AC Variable Speed Drive

FOREWORD

This manual describes the installation and commissioning of IP66/Nema 4X **Commander SX** variable speed drives. It also gives details of all its options and extensions which the user may choose to suit his requirements.



COMMANDER SX
IP66/Nema 4X AC Variable Speed Drive

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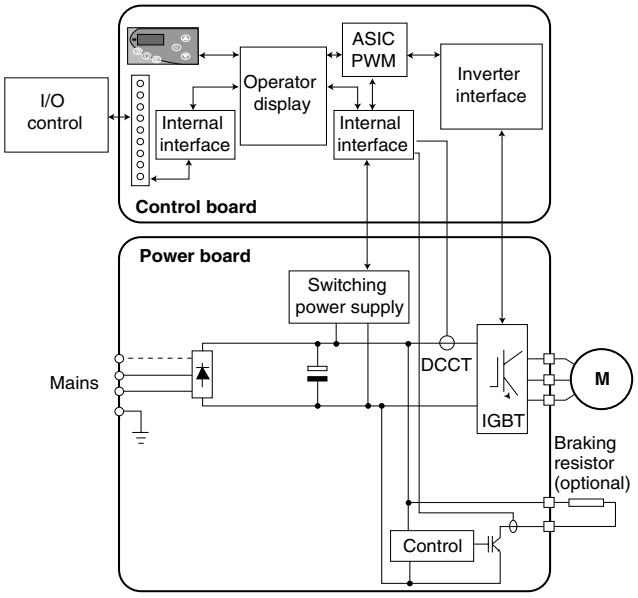
COMMANDER SX
IP66/Nema 4X AC Variable Speed Drive
GENERAL INFORMATION

1 - GENERAL INFORMATION

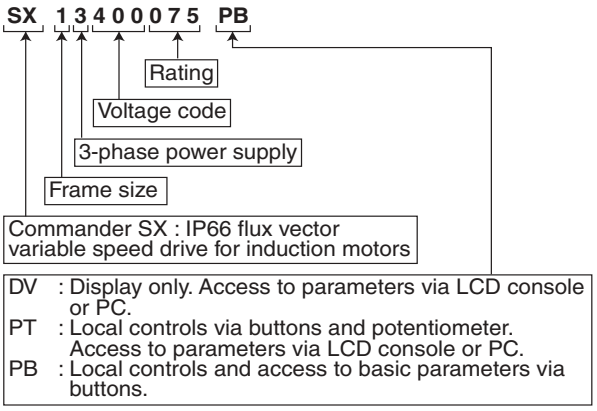
1.1 - General information

The **Commander SX** is an IP66/Nema 4X electronic drive for supplying 3-phase induction motors.
In the standard version, the **Commander SX** is an open loop ( ) flux vector drive with very high performance levels (maintaining the rated torque over a speed range from N to N/10), and is therefore suitable for the majority of applications.
With the speed feedback option (closed loop vector mode), the **Commander SX** controls a motor fitted with an incremental encoder, which makes it possible to control the torque and the speed over a wider speed range (including zero speed), with increased dynamic performance.
The performance of the **Commander SX** is compatible with use in all 4 quadrants of the torque/speed plane.
Its IP66/Nema 4X protection means that the drive can be installed close to the motor, without a cabinet.
Its flexibility enables the user to adapt the drive to his application in the majority of cases.

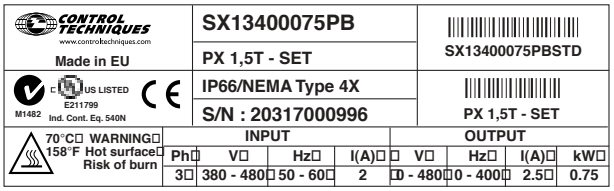
Diagram



1.2 - Product designation



Nameplate



1.3 - Environmental characteristics

• Inexperienced personnel must not have access to the drive.

Characteristics	Level
Protection	IP66/Nema 4X.
Storage and transport temperature	-40°C (-40°F) to +60°C (+140°F). Conforming to standard IEC 60068-2-1.
Operating temperature	-10°C (14°F) to 50°C (122°F). The drive characteristics are given for +40°C (104°F). Above 40°C (104°F), see the derating table in section 1.4.3.
Relative humidity	- 100 % RH with the use of IP66/Nema 4X cable gland on conduit (refer to §3.2), - < 95 % RH non condensing with the use of plug (refer to § 3.2).
Altitude	< 1000 m (3,000 ft) without derating. The maximum authorised altitude is 4000m (12,000 ft), but above 1000 m (3,000 ft), the continuous output current should be derated by 1% per additional 100 m (300 ft) over 1000 m (3,000 ft) (eg: for an altitude of 3000 m (9,000 ft), derate by 20%).
Vibration	• Exposed product: 0.01 g^2/Hz 1hr in accordance with standard IEC 68-2-34. • Sinusoidal vibration : (packed product) 2-9 Hz 3.5 ms^{-2} 9-200 Hz 10 ms^{-2} 200-500 Hz 15 ms^{-2} in accordance with standard IEC 68-2-6.
Shocks	Packaged product: 15 g, 6 ms, 500 times/direction in all 6 directions in accordance with standard IEC 60068-2-29.

1.4 - Electrical characteristics

1.4.1 - General characteristics

Characteristics	Level
Phase voltage imbalance	3%
Maximum number of power-ups per hour	< 100
Input frequency	50 or 60 Hz ± 2%
Output frequency range	0 to 400 Hz (contact CONTROL TECHNIQUES for application with output frequency above 150 Hz)
Power supply	Voltage code 200 = 208V -10% to 240V +10%
	Voltage code 400 = 380V -10% to 480V +10%
Maximum overload for 60 seconds	150% I_{co}

1.4.2 - Electrical characteristics at 40°C (104°F)

CAUTION:
In its factory setting, the drive operates with a switching frequency of 4.5 kHz for an ambient temperature of 40°C (104°F). If a higher switching frequency has been selected, the continuous output current (I_{co}) may need to be derated. See table in section 1.4.3.

I_{co} : Continuous output current.
P_{mot} : Motor power.

3-phase mains, 208V -10% to 240V +10%

Commander SX		Power		Current
Size	Rating	P_{mot} at 230V (kW)	P_{mot} at 230V (hp)	I_{co} at 4.5 kHz (A)
1	SX13200037	0.37	0.50	2.5
	SX13200055	0.55	0.75	3.2
	SX13200075	0.75	1	4.5
2	SX23200110	1.1	1.5	6
	SX23200150	1.5	2	8
	SX23200220	2.2	3	10
3	SX33200300	3	4	13.5
	SX33200400	4	5	16.5

3-phase mains, 380V -10% to 480V +10%

Commander SX		Power		Current
Size	Rating	P_{mot} at 400V (kW)	P_{mot} at 460V (hp)	I_{co} at 4.5 kHz (A)
1	SX13400075	0.75	1	2.5
	SX13400110	1.1	1.5	3.2
	SX13400150	1.5	2	4.5
2	SX23400220	2.2	3	6
	SX23400300	3	4	8
	SX23400400	4	5	10
3	SX33400550	5.5	7.5	13.5
	SX33400750	7.5	10	16.5

1.4.3 - Derating according to the temperature and switching frequency

Commander SX			Temp.	Continuous output current I_{co} with switching frequency ≥ 3 kHz					
Size	3-phase supply			3 kHz	4.5 kHz	5.5 kHz	6 kHz	9 kHz	11 kHz
	208V - 10% to 240V +10% Rating	380V - 10% to 480V +10% Rating							
1	SX13200037	SX13400075	40°C (104°F)	2.5	**2.5**	2.05	1.9	1.7	1.26
			50°C (122°F)	2.3	2.3	1.7	1.6	1.4	1
	SX13200055	SX13400110	40°C (104°F)	3.2	**3.2**	2.9	2.7	2.4	1.8
			50°C (122°F)	2.9	2.7	2.4	2.3	2	1.5
	SX13200075	SX13400150	40°C (104°F)	4.5	**4.5**	4	3.8	3.4	2.5
			50°C (122°F)	4	3.7	3.4	3.3	2.9	2.1
2	SX23200110	SX23400220	40°C (104°F)	6	**6**	5.45	5.3	4.6	3.5
			50°C (122°F)	5.2	4.9	4.6	4.5	4	3
	SX23200150	SX23400300	40°C (104°F)	8	**8**	7.2	6.8	6.1	4.6
			50°C (122°F)	6.9	6.5	6.1	5.8	5.2	3.9
	SX23200220	SX23400400	40°C (104°F)	10	**10**	9	8.5	7.6	5.7
			50°C (122°F)	8.4	8	7.3	7.2	6.5	4.8
3	SX33200300	SX33400550	40°C (104°F)	13.5	**13.5**	12.4	11.6	10.3	7.7
			50°C (122°F)	11.6	11	10.5	9.9	8.8	6.6
	SX33200400	SX33400750	40°C (104°F)	16.9	**16.5**	15.2	14.5	12.9	9.7
			50°C (122°F)	14.4	13.7	12.8	12.3	11	8.2

1.5 - 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 EN 61000-4-2	Electrostatic discharge	Module enclosure	Level 3 (industrial)
IEC 61000-4-3 EN 61000-4-3	Immunity standards for radiated radio-frequency	Product casing	Level 3 (industrial)
IEC 61000-4-4 EN 61000-4-4	Fast transient burst	Control lines	Level 4 (industrial harsh)
		Power lines	Level 3 (industrial)
IEC 61000-4-5 EN 61000-4-5	Surges	AC supply lines : line to earth	Level 4
		AC supply lines : line to line	Level 3
		Signal ports to earth	Level 2
IEC 61000-4-6 EN 61000-4-6	Generic immunity standards for conducted radio-frequency	Control and power cables	Level 3 (industrial)
EN 50082-1 IEC 61000-6-1 EN 61000-6-1	Generic immunity standards for residential, commercial and light industrial environments	-	Conforms
EN 50082-2 IEC 61000-6-2 EN 61000-6-2	Generic immunity standards for the industrial environment	-	Conforms
EN 61800-3 IEC 61800-3 EN 61000-3	Variable speed drive standards	Conforms to the first and second environment	

Emission						
Standard	**Description**	**Application**	**Conformity conditions according to the switching frequency**			
			Length of drive/ motor cables	**With RFI filter**		
				Internal (standard)	**External (Option)**	
				Sizes 1 and 2	**Sizes 1 and 2**	**Size 3**
EN 61800-3	Variable speed drive standards	Second environment with unrestricted distribution (DENR)	≤ 4 m (≤ 13 ft)	≤11 kHz	≤11 kHz	≤11 kHz
			≤ 20 m (≤ 65 ft)	≤4.5 kHz	≤11 kHz	≤4.5 kHz
		Second environment with restricted distribution (DER)	≤ 20 m (≤ 65 ft)	≤11 kHz	≤11 kHz	≤4.5 kHz
		First environment with unrestricted distribution (R)	≤ 4 m (≤ 13 ft)	-	≤4.5 kHz	-
		First environment with restricted distribution (I)	≤ 4 m (≤ 13 ft)	≤4.5 kHz	≤11 kHz	≤4.5 kHz
			≤ 20 m (≤ 65 ft)	-	≤4.5 kHz	≤4.5 kHz
EN 50081-1 EN61000-6-3	Generic emission standards for residential, commercial and light industrial environments	A.C. supply	≤ 4 m (≤ 13 ft)	-	≤4.5 kHz	≤4.5 kHz
EN 50081-2 EN 61000-6-4	Generic emission standards for the industrial environment	A.C. supply	≤ 4 m (≤ 13 ft)	≤ 4.5 kHz	≤ 11 kHz	-
			≤ 20 m (≤ 65 ft)	-	≤4.5 kHz	-

• The second environment includes industrial networks supplied with low voltage but which do not serve buildings for domestic use. Operation of a drive without an RFI filter in this type of environment may result in interference on certain electronic appliances located near the drive whose immunity level might not be compatible with industrial conditions. If it proves impossible to filter the disturbed element, add an external RFI filter.

1.6 - UL conformity

• For UL conformity, the operating temperature must not exceed 40°C (104°F).

• Motor overload protection
The drive has motor overload protection.
The overload level is 150% of the drive full-load current.
It is therefore necessary to set the current parameter correctly in parameter 0.06 to ensure that the protection is effective (the protection level can be set below 150% if required).

• Motor thermal protection
The drive has built-in motor thermal protection.

• UL and cUL file number E211799
Confirmation of UL and cUL listing approval can be found on UL website : WWW.ul.com.

2 - MECHANICAL INSTALLATION

• It is the responsibility of the owner or user to ensure that the installation, operation and maintenance of the drive and its options comply with legislation relating to the safety of equipment and personnel 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.

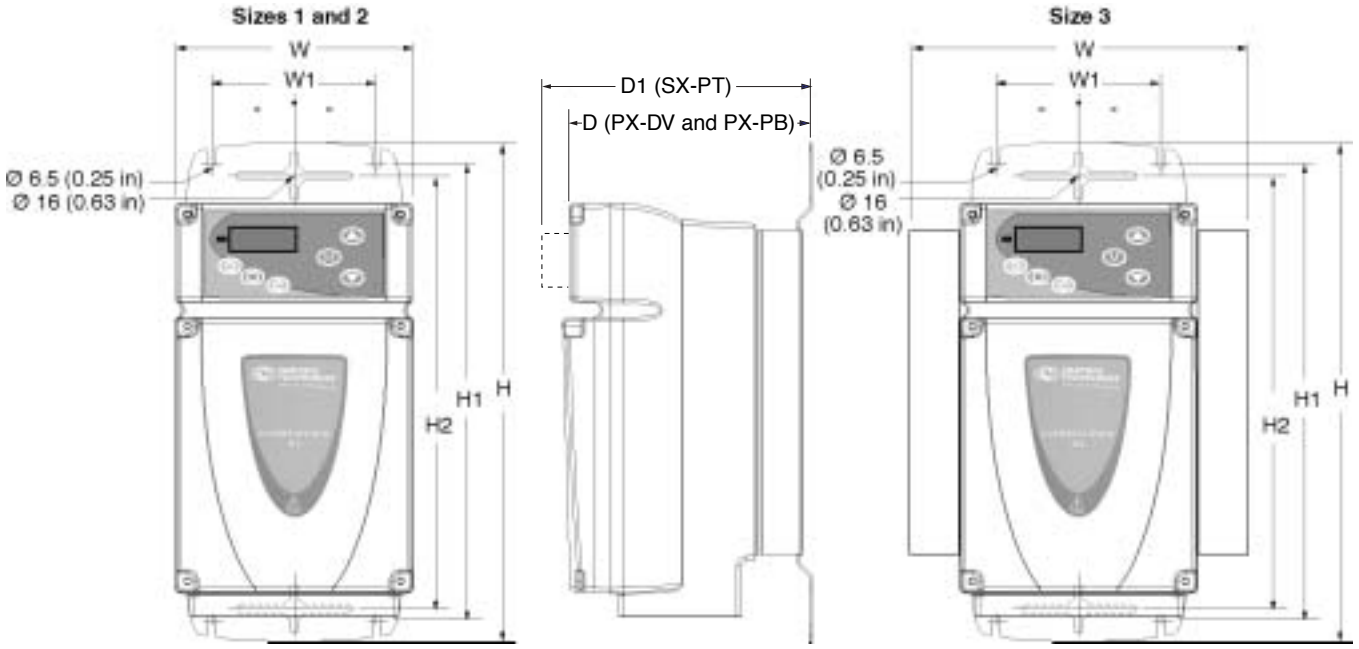
2.1 - Checks on receipt

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

2.2 - Installation recommendations

- Mount the **Commander SX** vertically, allowing a space of 100 mm (4 in) above and below to ensure that air can flow freely around the heatsink.
- Do not place the **Commander SX** above a heat source.

2.3 - Dimensions and weight



Commander SX	Dimensions mm (inches)							Screw	Weight
Size	W	W1	H	H1	H2	D	D1		kgs (lbs)
1	180 (7.08)	125 (4.92)	380 (14.96)	350 (13.77)	330 (12.99)	189 (7.44)	204 (8.03)	M6	4.7 (10.36)
2	180 (7.08)	125 (4.92)	380 (14.96)	350 (13.77)	330 (12.99)	223 (8.77)	238 (9.37)	M6	6.7 (14.77)
3	281 (11.06)	125 (4.92)	380 (14.96)	350 (13.77)	330 (12.99)	233 (8.77)	248 (9.76)	M6	8.8 (19.4)

COMMANDER SX
IP66/Nema 4X AC Variable Speed Drive
CONNECTIONS

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 in 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.

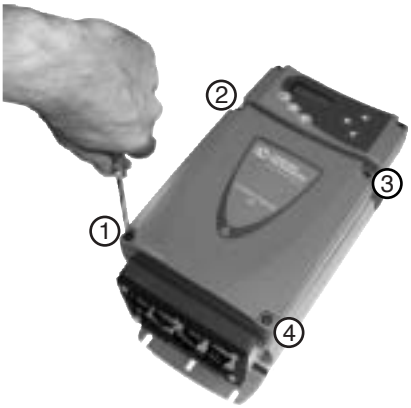
• Check that the DC bus voltage is below 40V before carrying out any work.

• 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, therefore avoid touching it (70°C/158°C).

• Take special care with a drive installed in a device connected to the mains via fast-on connectors. The drive supply terminals are connected to internal capacitors via a diode bridge, which does not provide adequate insulation in this instance. It is therefore necessary to add an automatic insulation system for the fast-on connectors when they are not connected together.

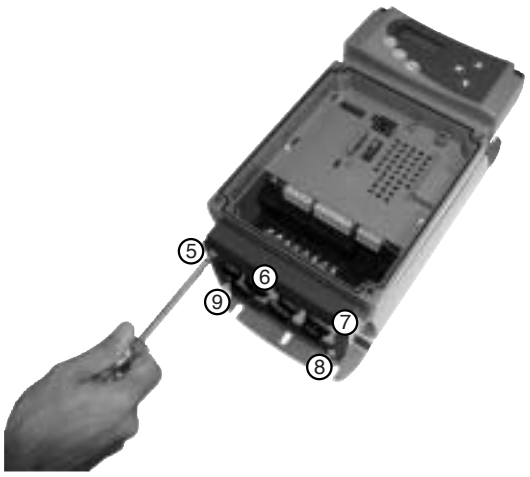
3.1 - Access to the terminal blocks

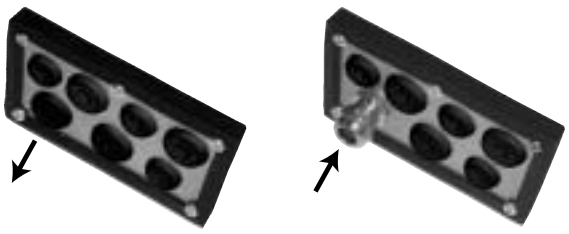


- Unscrew the 4 screws (1 to 4) on the cover using a flat or torx 25 screwdriver.
- Lift the cover.

CAUTION:
To maintain the Commander SX IP66/Nema 4X protection index, it is essential to:
- avoid damaging the seal while removing the cover
- reposition the cover correctly when reassembling and tighten each of the 4 screws to a tightening torque of 2 Nm (1.5 lb/ft).

3.2 - Cable runs



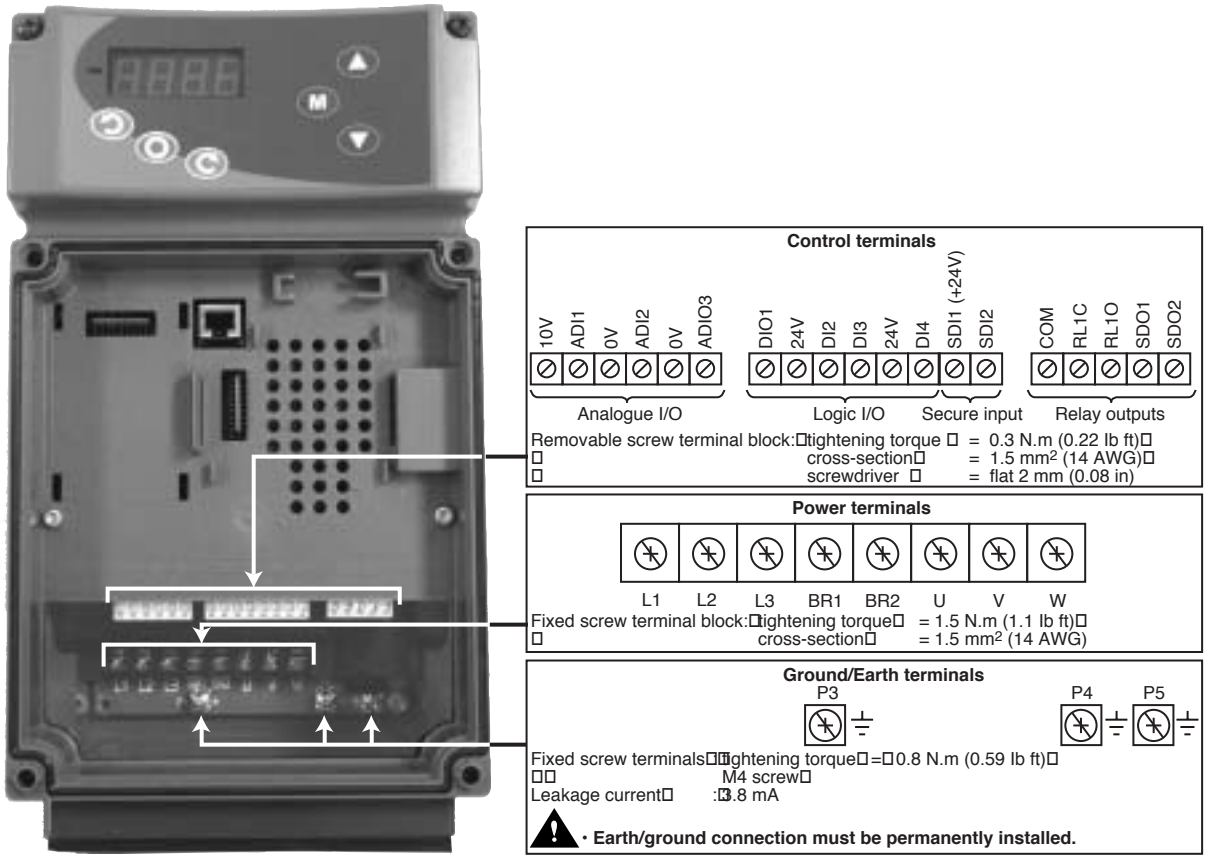


- Unscrew the 5 screws (5 to 9) on the cable gland plate using a flat or torx 25 screwdriver.
- Remove earth/ground strap.
- Remove the cable gland plate.
- Replace plugs fitted to be used with IP66/Nema 4X cable glands or conduit, as specified in the table below.

Connection	Cable glands with nut	
	Type	Dimensions
Mains supply input	Standard	M 20
Motor output	EMC	M 20
Logic I/O	Standard	M 16 or M 20
Analogue I/O	EMC	M 16 or M 20

CAUTION:
• The Commander SX is supplied with IP66/Nema 4X index protection. Only the use of IP66/Nema 4X or higher cable glands, correctly installed, ensures that this protection index is maintained. The optional PX-Cabling kit includes all the cable glands needed for connection of the standard product.
• The plugs fitted as standard on the plate can be used as cable glands if the Commander SX is installed in an enclosure which is not subject to condensation (damp enclosure and/or enclosure subject to significant temperature variations) or if the environment permits a protection index limited to IP54/Nema 12.
UL and cUL conformity : Plugs provided with the drive are suitable for transportation, to comply with UL and cUL requirement, suitable cable glands or conduits must be fitted in place of plugs.

3.3 - Terminal block locations



3.4 - Connection of the power

3.4.1 - Secure input

This input, when opened, causes the drive to disable. Independent of the microprocessor, it acts on several levels of control from the power 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 allow the use of a safety function by using the principle of category 1 or 3 listed in EN954-1 standard as per application diagram.

The principle of " free-wheel coasting " using SDI2 input has been evaluated by CETIM.

Official evaluation results are listed in report reference n°732773 / 502 / 47A (certificate of conformity n° D526 0 104 1602).

This built-in feature allow the drive to be substituted for a contactor to ensure the motor to coast-stop in free-wheel mode.

The use of this secure input together with another digital input allow the possibility to overcome a simple fault. In such configuration, the drive will make the motor stop in free-wheel mode by using two separate command channels.

For a correct set-up, connection diagrams listed in this manual must be followed and applied.

To enable the drive and to ensure the functionality of this safety principle, SDI2 input must be connected to +24V SDI1 source.

This +24V supply must be exclusively used by the secure input function.

• The secure 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 input, when open, locks the drive, meaning the dynamic braking function is no longer available. If a braking function is required before the drive safety disable is applied, a time-delayed safety relay should be installed to activate locking automatically after the end of braking.

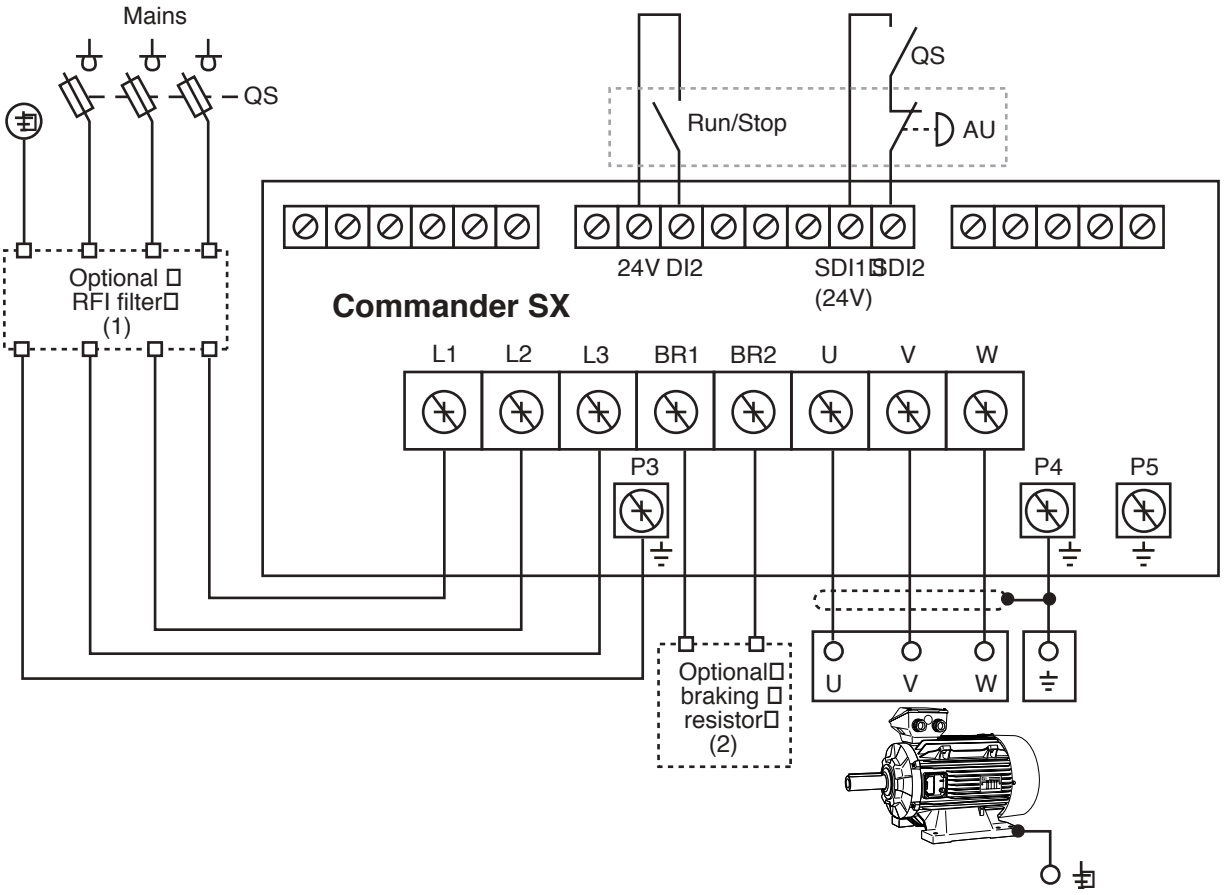
If braking needs to be a machine safety function, it should be provided by an electromechanical solution since the dynamic braking by the drive function is not considered to be a safety function.

• The secure 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).

• The secure function is not active when drive is operated by keypad control or by field bus.

3.4.2 - 3-phase AC power supply in accordance with safety standard EN954-1 - category 1

Applying secure input SDI2 to obtain a secure stop



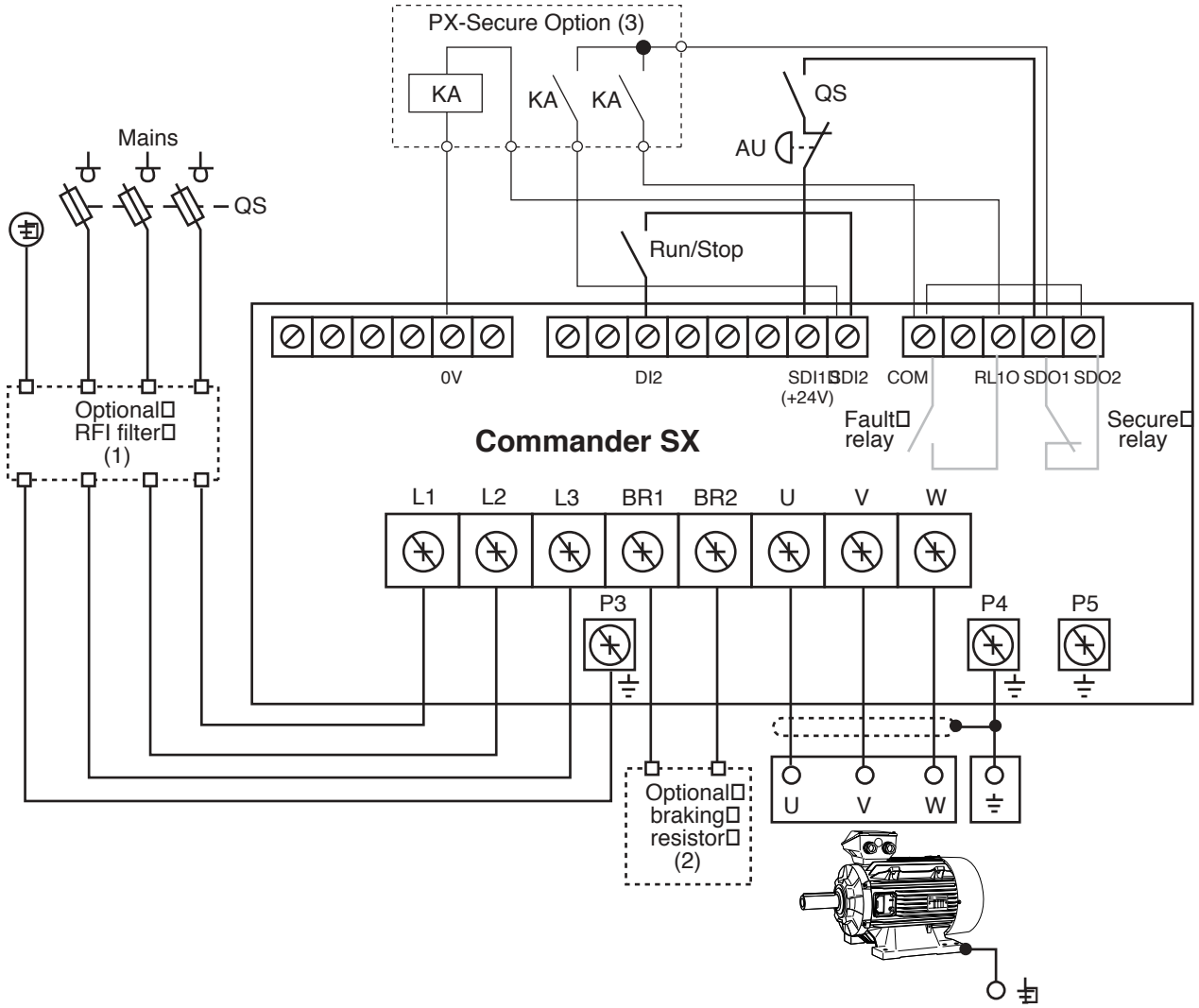
QS : Fused isolator : must be open before any maintenance intervention whether on motor - drive or any electrical components.
AU : Emergency stop button
(1) Optional RFI filter. For conformity with the generic standard EN 50081-2 for size 3 drives and in certain conditions for sizes 1 and 2, it is necessary to add an external RFI filter.
(2) Optional braking resistor. Used to dissipate the active power returned by the motor onto the drive DC bus in the case of a driving machine. See section 6.3.

The use of the secure input allows to a motor in free-wheel mode without the need for a line contactor. The drive has 2 built-in internal system secure enough to allow a stop by using only this secure input (as per category 1 of EN954-1 standard).

CAUTION :
The particular use of secure input is not compatible with keypad control. When the Run/Stop command needs to be done using keypad, then SDI2 input must be configured as a simple disable in such case, power circuit must comply with security rules.

3.4.3 - 3-phase AC power supply in accordance with safety standard EN954-1 - category 2 or 3

Applying secure input SDI2 together with digital input DI2



QS : Fused isolator : must be open before any maintenance intervention whether on motor - drive or any electrical components.
AU : Emergency stop button
KA : Relays
(1) Optional RFI filter. For conformity with the generic standard EN 50081-2 for size 3 drives and in certain conditions for sizes 1 and 2, it is necessary to add an external RFI filter. See section 6.4.
(2) Optional braking resistor. Used to dissipate the active power returned by the motor onto the drive DC bus in the case of a driving machine. See section 6.3.
(3) Category 2 or 3 optional redundancy control circuit. See section 6.1.4.

The use of the secure input allows to a motor in free-wheel mode without the need for a line contactor. The drive has 2 built-in internal system secure enough to allow a stop by using only this secure input (as per category 1 of EN954-1 standard).
The duplication of a stop command signal with a digital input an internal redundancy within the drive to ensure free-wheel coast-stop (as per category 3 of EN 954-1 standard).

CAUTION :
The particular use of secure input is not compatible with keypad control. When the Run/Stop command needs to be done using keypad, then SDI2 input must be configured as a simple disable in such case, power circuit must comply with security rules.

3.4.4 - Cables and fuses

• It is the responsibility of the user to connect and provide protection for the Commander SX 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, acknowledging faults, insulation and protection against overcurrents.

• These tables are given for information only, and must under no circumstances be used in place of the current standards.

Commander SX rating	Mains supply						Motor		
	I_{rated}	I_{max}	Fuses		Cable cross-sections (2)		I_{co} (1)	Cable cross-sections (1) (3)	
			IEC (gG)	USA	EN60204	UL508C		EN60204	UL508C
	(A)	(A)	(A)	(A)	(mm^2)	(AWG)	(A)	(mm^2)	(AWG)
SX13200037	2	3.5	6		1	18	2.5	1	22
SX13200055	3	4.5	6		1	18	3.2	1	20
SX13200075	4.2	6.3	10		1.5	14	4.2	1	18
SX23200110	5.8	8.7	12	15	1.5	14	5.8	1	16
SX23200150	7.6	11.4	20		4	12	7.6	1	14
SX23200220	9.5	14.2	20		4	12	9.5	1.5	14
SX33200300	12.9	19.4	20		4	12	13.5	2.5	14
SX33200400	16.1	24.2	25		4	10	16.1	4	10
SX13400075	2	3.5	6		1	18	2.1	1	22
SX13400110	3	4.5	6		1	16	3.2	1	20
SX13400150	4.2	6.3	8	10	1	16	4.2	1	18
SX23400220	5.8	8.7	12	15	1.5	14	5.8	1	16
SX23400300	7.6	11.4	12	15	1.5	14	7.6	1	14
SX23400400	9.5	14.2	16	15	2.5	14	9.5	1.5	14
SX33400550	12.9	19.4	20		4	12	13.5	2.5	14
SX33400750	16.1	24.2	25		4	10	16.5	4	10

Maximum length of motor cables: 20 m (65 ft).
(1) The value of the rated current and the motor cable cross-sections is given for information only. Since the motor rated current permitted by the drive varies according to the switching frequency and the temperature, see paragraph 1.4.
(2) The recommended cross-sections are given for a single-wire cable with a maximum length of 30 m (98 ft), beyond this, take the line drops due to the length into account.
(3) The recommended cross-sections are given for a single-wire cable with a maximum length of 10 m (32 ft), beyond this, take the line drops due to the length into account.

Note:
• The mains current value is a typical value which depends on the source impedance. The higher the impedance, the lower the current.
• In factory-set configuration, the switching frequency is 4.5 kHz.
• To determine the cross-section of the earth cables (in accordance with standard EN 60204), if phase cable cross-section ≤ $16mm^2$ (5 AWG), use an earth cable with the same cross-section.

CAUTION:
To reduce leakage currents, we recommend the use of cables with a capacity of 260pF/m or less. If it is necessary to use cables with a higher capacity, reduce by half the maximum motor cable length given in the above table.

3.4.5 - UL (and cUL) conformity

3.4.5.1 - Specified mains supply

The drive can be incorporated in an installation which can deliver 5000A rms maximum at a voltage of 264VAC rms maximum for 230V drives or 528VAC rms maximum for 400V drives.

3.4.5.2 - Cables

Only class 1 copper cables 60/75 °C (140/167 °F) should be used.

3.4.5.3 - Fuses

UL conformity is adhered to if the fuses used are fast-blow fuses (class CC up to 30A, and class J thereafter) and the short-circuit symmetrical current does not exceed 5 kA.
Example of fast-blow fuses:
- Limitron KTK from Bussman
- Amp - trap ATM from Gould

3.5 - Connection of the control

⚠ • The Commander SX has 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.

3.5.1 - Terminal characteristics

1	10V	+10V internal analogue source
Accuracy		± 2%
Maximum output current		20 mA
Protection		Threshold at 15V

2	ADI1	Analogue or logic input 1
Characteristics		Unipolar analog voltage (common mode) or current
Resolution		10 bits
Sampling		6 ms
Voltage input		
Full scale voltage range		10V ± 2%
Maximum voltage		33V
Input impedance		95 kΩ
Current input		
Current ranges		0 to 20 mA ± 5%
Maximum voltage		33V/0V
Maximum current		33 mA
Input impedance		500 Ω
Logic input (if connected to the +24V)		
Thresholds		0: < 5V 1: > 10V
Voltage range		0 to +24V
Maximum voltage		33V/0V
Load		95 kΩ
Input threshold		7.5V

3 5	0V	Logic circuit common 0V

4	ADI2	Analogue or logic input 2
Characteristics		Unipolar analog voltage (common mode) or current
Resolution		10 bits
Sampling		6 ms
Voltage input		
Full scale voltage range		10V ± 2%
Maximum voltage		33V
Input impedance		95 kΩ
Current input		
Current ranges		0 to 20 mA ± 5%
Maximum voltage		33V/0V
Maximum current		33 mA
Input impedance		500 Ω
Logic input (if connected to the +24V)		
Thresholds		0: < 5V 1: > 10V
Voltage range		0 to +24V
Maximum voltage		33V/0V
Load		95 kΩ
Input threshold		7.5V
PTC sensor input		
Internal voltage		5V
Default threshold		≥ 3.3kΩ
Reset default threshold		< 1.8 kΩ

6	ADIO3	Analogue or logic input or analogue output 3
Characteristics		Unipolar analog voltage (common mode) or current
Resolution		10 bits
Sampling		6 ms
Voltage input		
Full scale voltage range		10V ± 2%
Maximum voltage		33V
Input impedance		95 kΩ
Current input		
Current ranges		0 to 20 mA ± 5%
Maximum voltage		33V
Maximum current		33 mA
Input impedance		500 Ω
Logic input (if connected to the +24V)		
Thresholds		0: < 5V 1: > 10V
Voltage range		0 to +24V
Maximum voltage		33V/0V
Load		95 kΩ
Input threshold		7.5V
Voltage output		
Voltage range		0 to 10V
Load resistor		2 kΩ
Protection		Short-circuit (40 mA max)
Current output		
Current range		0 to 20 mA
Maximum voltage		10V
Maximum load resistor		1 kΩ

COMMANDER SX
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CONNECTIONS

7	DIO1	Logic input or output 1
Characteristics		Logic input or output (positive logic)
Thresholds		0: < 5V 1: > 10V
Voltage range		0 to +24V
Sampling/refreshment		2 ms
Logic input		
Maximum voltage		0 to +35V
Load		15 kΩ
Input threshold		7.5V
Logic output		
Maximum output current		50 mA
Overload current		50 mA

8 11	+24V	+24V internal source
Output current		100 mA in total
Overload current		150 mA
Accuracy		± 5%
Protection		Current limiting and setting to fault mode

9	DI2	Logic input 2
10	DI3	Logic input 3
12	DI4	Logic input 4
Characteristics		Logic input (positive logic)
Thresholds		0: < 5V 1: > 10V
Voltage range		0 to +24V
Sampling/refreshment		2 ms
Maximum voltage		0 to +35V
Load		15 kΩ
Input threshold		7.5V

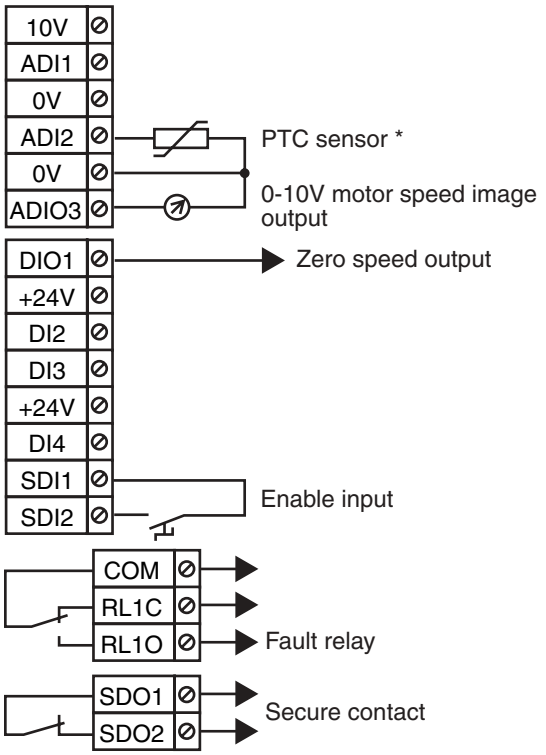
13	SDI1	+24Vdc dedicated to secure input only
14	SDI2	Secure input/enable
Characteristics		Logic input (positive logic)
Thresholds		0: < 5V 1: > 18V
Voltage range		9V to 33V
Impedance		820 Ω

15	COM	Fault relay output
16	RL1C	
17	RL1O	
Characteristics		NO_NC single-pole changeover contact 250VAC
Maximum contact current		• 2A, resistive load • 2A, inductive load

18	SDO1	Secure contact
19	SDO2	
Characteristics		250 VAC
Maximum contact current		• 2A, resistive load • 1A, inductive load

3.5.2 - Commander SX-PT control terminal connection

Out of the box, the **Commander SX-PT** is in default setting as following connection drawing. A LCD keypad or the SXSoft software is needed for access to further settings.



In this configuration, Run/Stop commands and the speed reference come from keypad.
* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

CAUTION :
If Run/Stop commands come from keypad, SDI2 terminal must be set as enable input only.

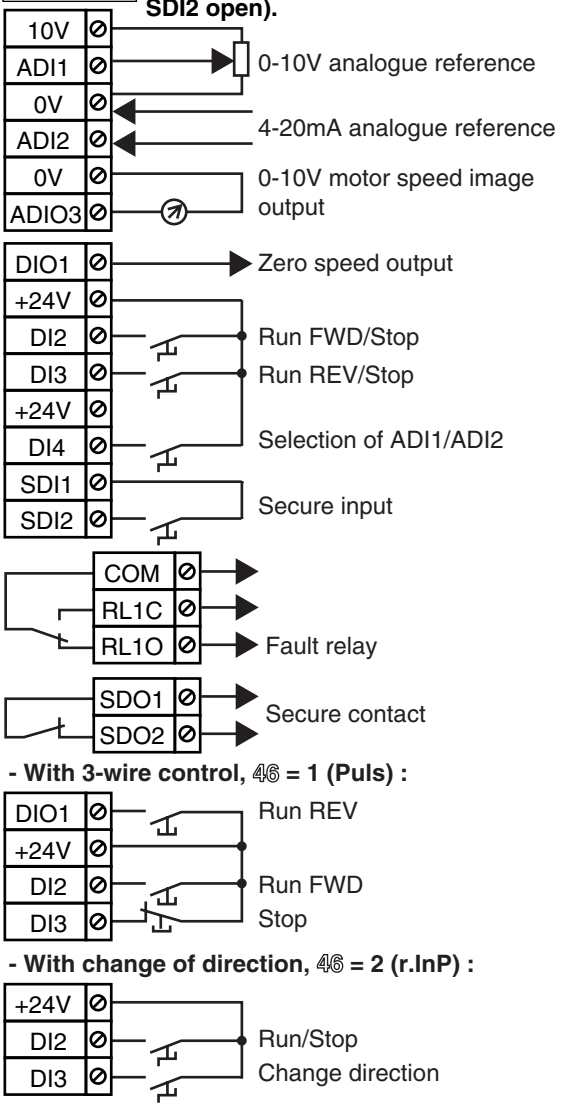
3.5.3 - Preset configurations for the control terminal block

CAUTION :
These preset configurations are available from Commander SX-PB or from Commander SX-PT associated with LCD keypad or SXSoft software.

The **Commander SX** enables the user to configure the terminal block very easily by selecting one of the different preset configurations from a single parameter (05).
These configurations have been designed to meet the needs of the most common applications.

3.5.3.1 - Preset configuration 0: selection of a voltage (0-10V) or current (4-20mA) reference via logic input

05 = A1.A2 **(Commander SX-PB factory setting. Before changing 05, drive must be disabled SDI2 open).**



- With 3-wire control, 46 = 1 (Puls) :

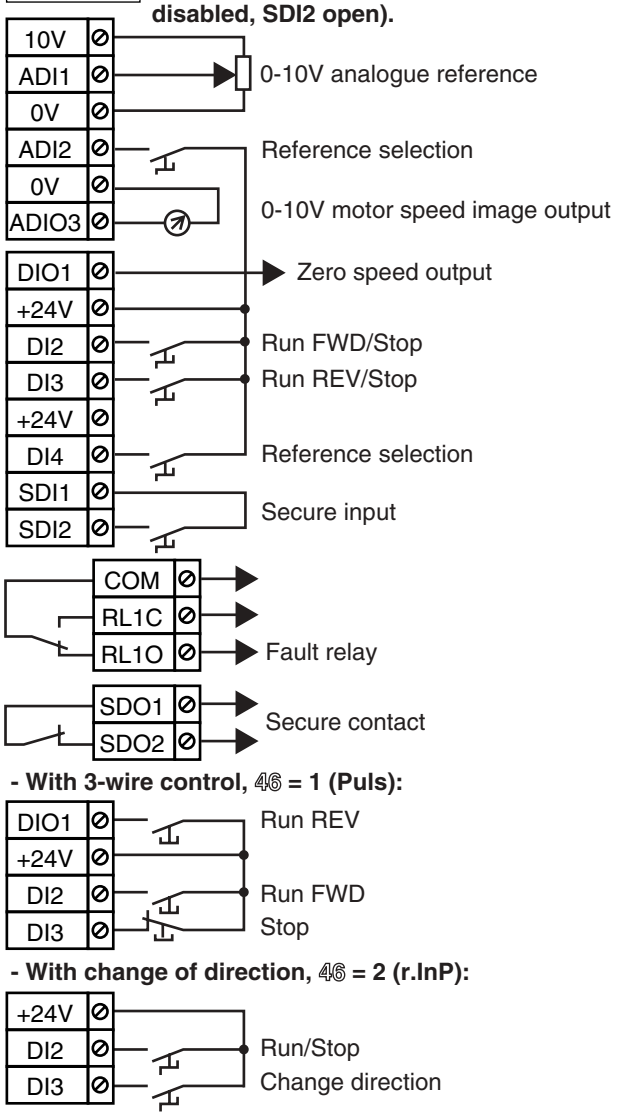
- With change of direction, 46 = 2 (r.InP) :

DI4	Selection
0	0-10V analogue reference (ADI1)
1	4-20mA analogue reference (ADI2)

Note : SDI2 input must be closed before giving Run command.

3.5.3.2 - Configuration 1: selection of a voltage (0-10V) reference or 3 preset references via 2 digital inputs

05 = A1.Pr **(Before changing 05, drive must be disabled, SDI2 open).**



- With 3-wire control, 46 = 1 (Puls):

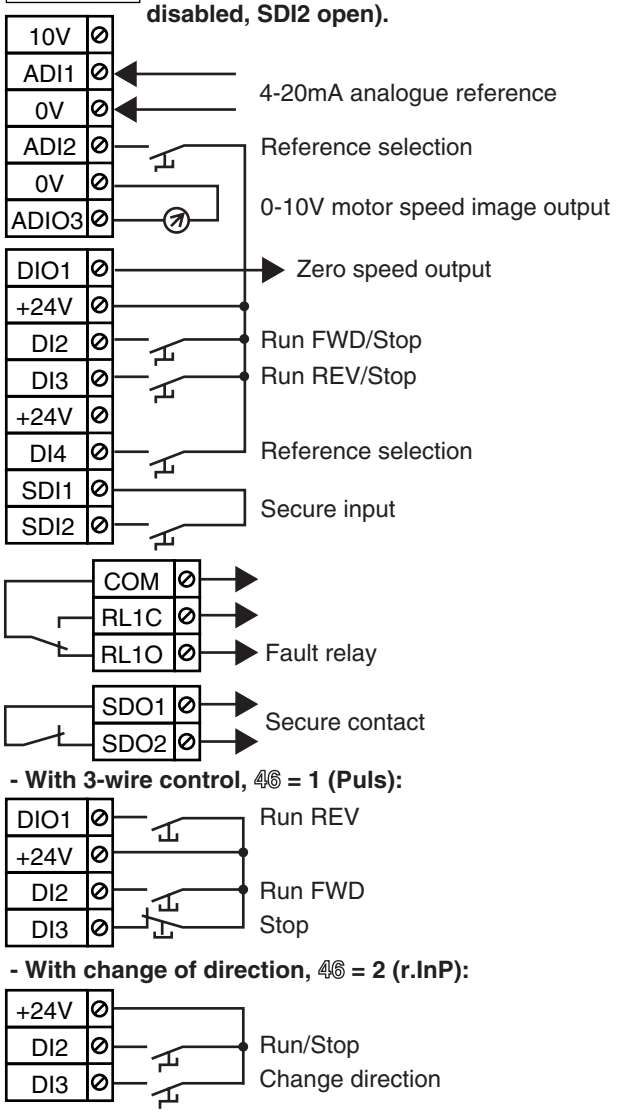
- With change of direction, 46 = 2 (r.InP):

DI4	ADI2	Selection
0	0	0-10V analogue reference (ADI1)
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

Note : SDI2 input must be closed before giving Run command.

3.5.3.3 - Configuration 2: selection of a current (4-20mA) reference or 3 preset references via 2 digital inputs

05 = A2.Pr **(Before changing 05, drive must be disabled, SDI2 open).**



- With 3-wire control, 46 = 1 (Puls):

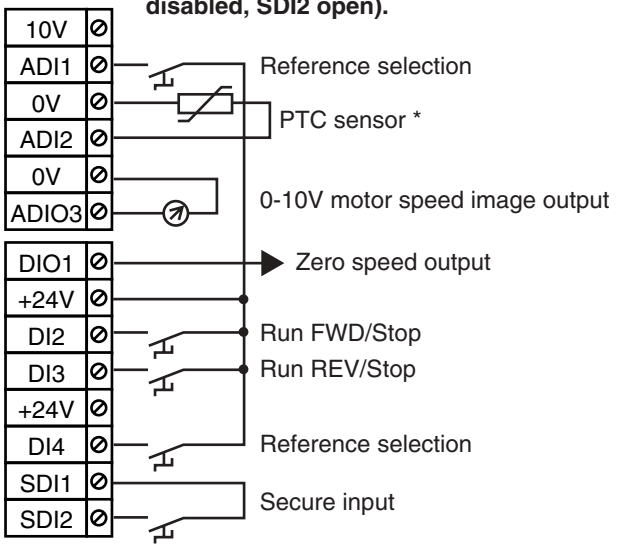
- With change of direction, 46 = 2 (r.InP):

DI4	ADI2	Selection
0	0	4-20mA analogue reference (ADI1)
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

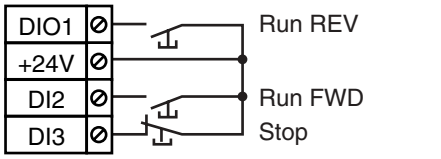
Note : SDI2 input must be closed before giving Run command.

3.5.3.4 - Configuration 3: selection of 4 preset references via 2 digital inputs

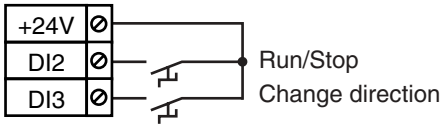
05 = 4Pr **(Before changing 05, drive must be disabled, SDI2 open).**



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



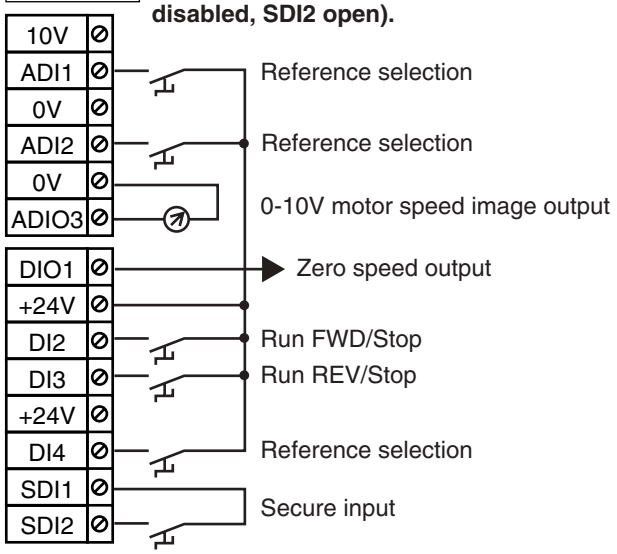
DI4	ADI1	Selection
0	0	Preset reference 1
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

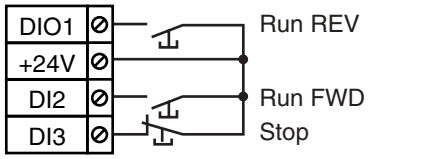
Note : SDI2 input must be closed before giving Run command.

3.5.3.5 - Configuration 4: selection of 8 preset references via 3 digital inputs

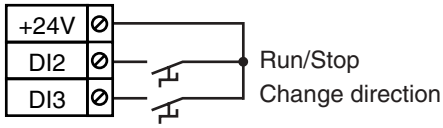
05 = 8Pr **(Before changing 05, drive must be disabled, SDI2 open).**



- With 3-wire control, 46 = 1 (Puls):



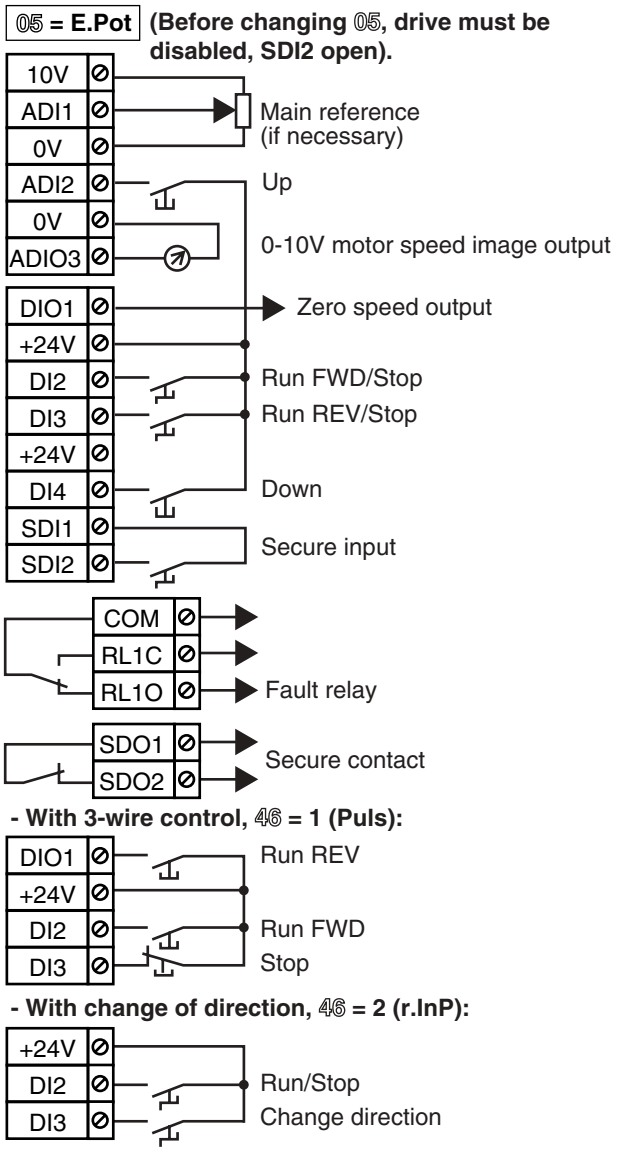
- With change of direction, 46 = 2 (r.InP):



DI4	ADI1	ADI2	Selection
0	0	0	Preset reference 1
1	0	0	Preset reference 2
0	1	0	Preset reference 3
1	1	0	Preset reference 4
0	0	1	Preset reference 5
1	0	1	Preset reference 6
0	1	1	Preset reference 7
1	1	1	Preset reference 8

Note : SDI2 input must be closed before giving Run command.

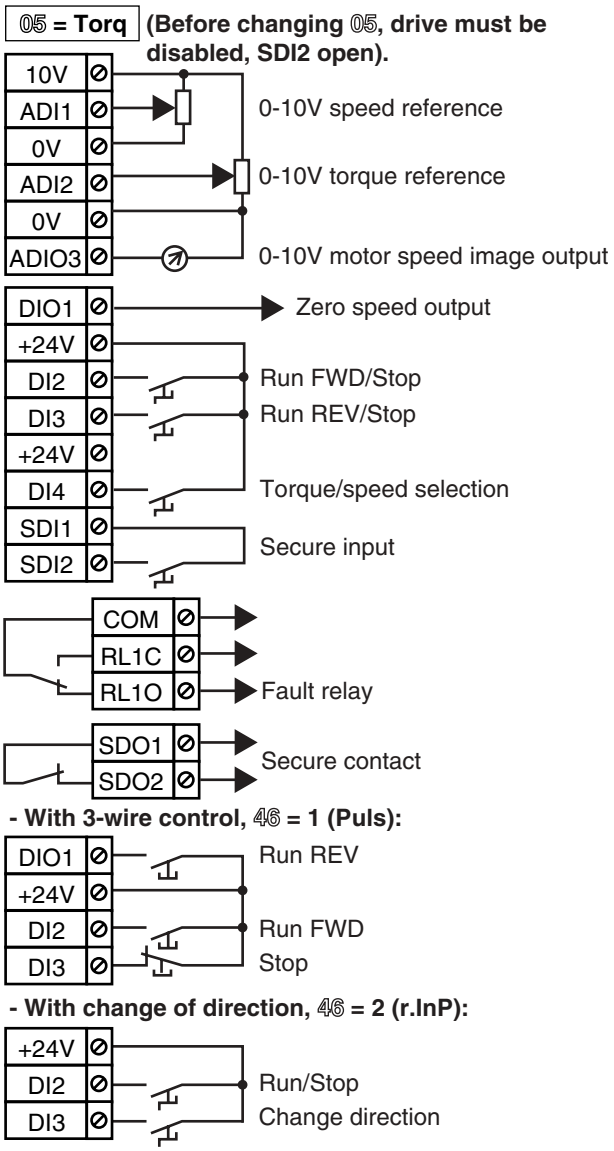
3.5.3.6 - Configuration 5: motorised potentiometer



Operation :
The speed reference comes from the main reference connected to ADI1. This reference is increased by pulses on " Up " input, and reduced by pulses on " Down " input. If there is no main reference, the speed reference comes from " Up/ Down " commands only.

Note : SDI2 input must be closed before giving Run command.

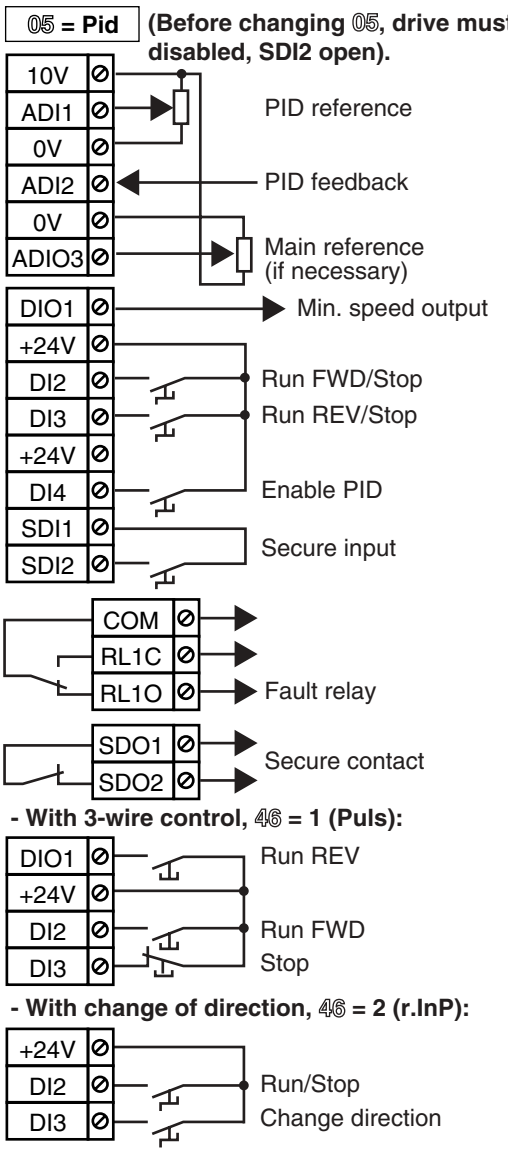
3.5.3.7 - Configuration 6: selection of speed control or torque control with speed limiting via digital input



DI4	Selection
0	Speed-reference control via ADI1
1	Torque-reference control via ADI2 and speed limiting via 02

Note : SDI2 input must be closed before giving Run command.

3.5.3.8 - Configuration 7: PID regulation

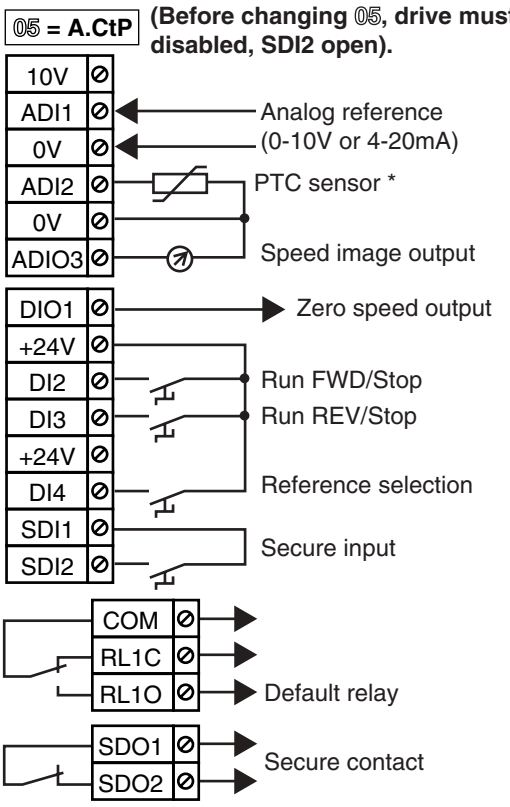


Operation :
This configuration allows a PID control loop between a "PID reference" (process set point) and a "PID feedback " measurement (pressure, temperature, flow rate, level dancer).
If the "main reference" is not connected, the PID controller output covers directly the speed range.
If the "main reference" is connected, the PID controller output acts as a partial correction of the speed reference. This is useful to improve PID stability.

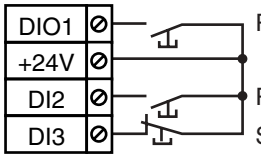
Note : SDI2 input must be closed before giving Run command.

3.5.3.9 - Configuration 8: pump regulation

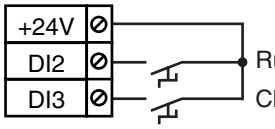
3.5.3.10 - Configuration 9 : voltage or current input and PTC sensor



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):

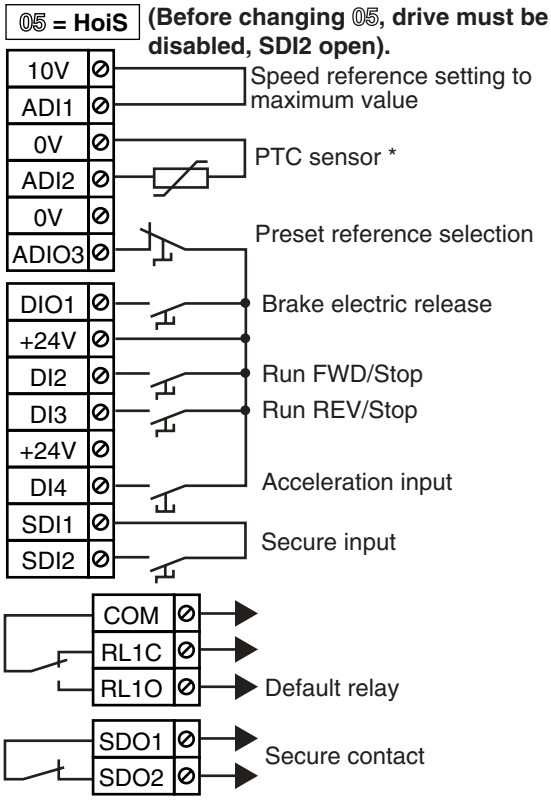


DI4	Selection
0	Analog reference 0-10V
1	Analog reference 4-20mA

* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

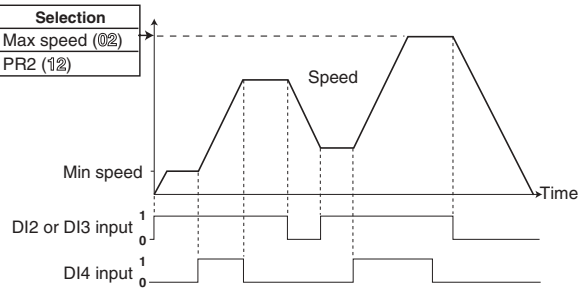
Note : SDI2 input must be closed before giving Run command.

3.5.3.11 - Configuration 10 : control of travelling crane or hoist



Operation :

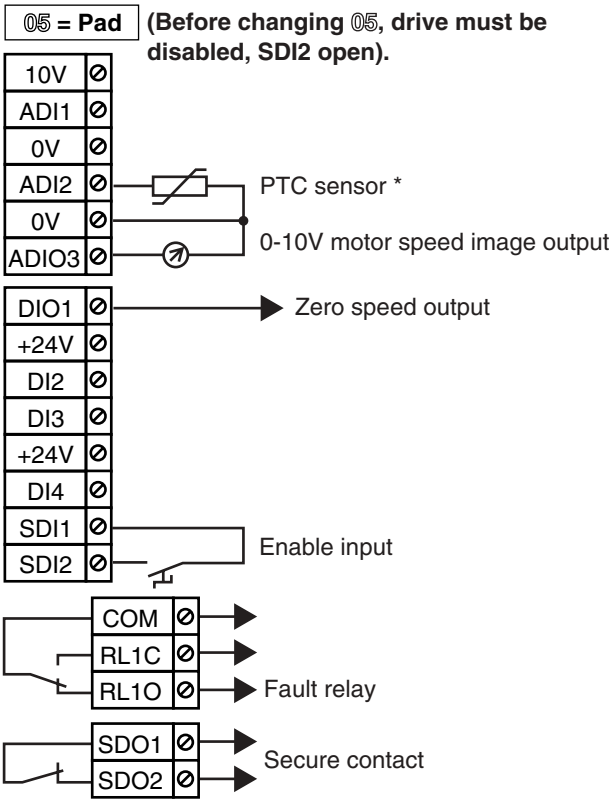
ADIO3	Selection
0	Max speed (02)
1	PR2 (12)



* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

Note : SDI2 input must be closed before giving Run command.

3.5.3.12 - Configuration 11: control via keypad (default setting for PT type Commander SX)

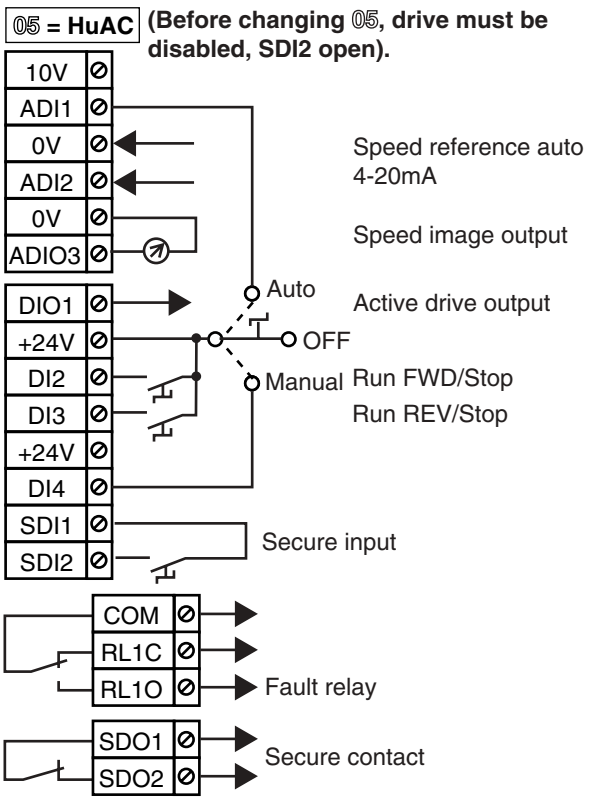


Operation :
Run/Stop commands and the speed reference come from the optional keypad on PT or PB type drives.
* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

CAUTION :
If Run/Stop commands come from keypad, SDI2 input must be set as enable input only.

Note : SDI2 input must be closed before giving Run command.

3.5.3.13 - Configuration 12 : Auto/manual mode



OFF	Neither command nor reference are used
Auto	Run/Stop commands and reference come from control terminal block
Manual	Run/Stop commands and reference come from **Commander SX-PT** or **PB** keypad

Note : SDI2 input must be closed before giving Run command.

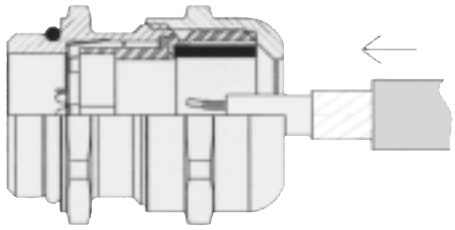
3.6 - EMC recommendations

3.6.1 - Using EMC cable glands

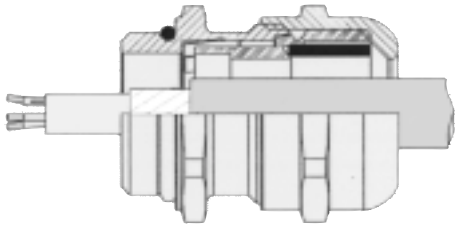
In order to comply with the **Commander SX** emission and immunity levels, both the motor output cable and the cables used to connect the analogue I/O should be shielded. The shielding should then be connected to the **Commander SX** earth.
Given that the **Commander SX** cable gland plate is made of metal, and connected to the general earth, the use of EMC cable glands simplifies connection and ensures excellent shielding quality.

Step 1: strip the cable

Step 2: insert the cable



Step 3: tighten the gland

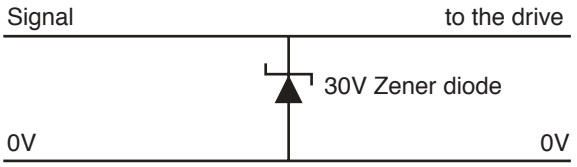


3.6.2 - Immunity to overvoltages

Immunity to overvoltages in control circuits or in long cables connected to the outside of a building.

The various drive input and output circuits conform to standard EN61000-6-2 (1kV) 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 (100 ft). To limit the risks of damage to the drive, the following precautions could be taken:
- Galvanic isolation of the I/O.
- Duplication of the cable shielding with an earth wire of 10mm^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 logic and analogue I/O protection by adding a zener diode or a peak limiter.

Elimination of unipolar logic and analog I/O overvoltages



This circuit is available in module (DIN rail mounting), eg. from Phoenix Contact (uni-directional: 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.

4 - COMMISSIONING

⚠ • The drives use algorithm which is adjusted by parameters. The performance levels obtained depend on the parameter setting. Inappropriate settings may have serious consequences for personnel and machinery.

• The drive parameters should only be set by appropriately qualified and experienced personnel.

• Before powering up the drive, check that the power connections (mains supply and motor) are correct, and that any moving parts are mechanically protected.

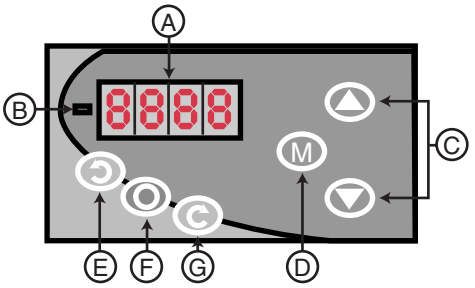
• Users of the drive should take particular care to avoid starting it accidentally.

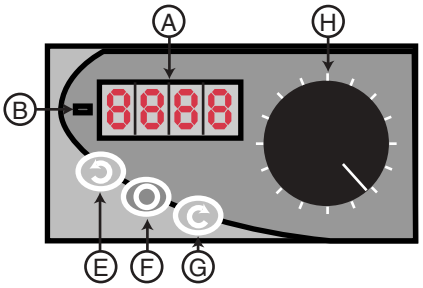
• If braking resistors are being used, check that they are connected correctly between the BR1 and BR2 terminals.

4.1 - Presentation of the Operator display

The **Commander SX-PB** operator panel consists of a display, three control buttons and three parameter-setting keys.

The **Commander SX-PT** operator panel consists of a display, three control buttons and a potentiometer button.

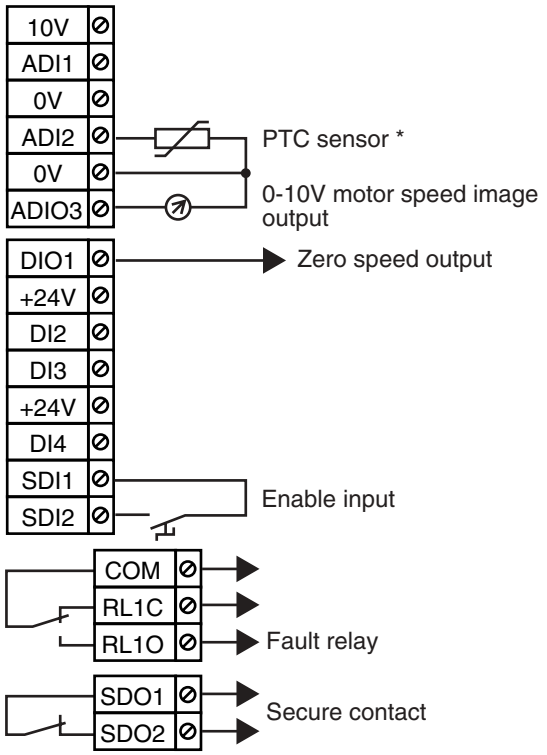




Marking	Function
Ⓐ	Display comprising 4 x 7-segment digits for indicating: - the drive operating status - certain operating data - the adjustment parameters (01 to 80) and their value (SX-PB)
Ⓑ	LED providing a sign for the data (the lit LED corresponds to the " - " sign)
Ⓒ	Keys which can be used to scroll up and down through the parameters or their value.
Ⓓ	Mode button which can be used to switch from standard mode to parameter-setting mode. In parameter-setting mode, the parameter number and value are displayed alternately on the display.
Ⓔ Ⓕ Ⓖ	In keypad mode, these buttons are used for the following commands : - Reverse - Stop, trip reset - Forward
Ⓗ	Potentiometer button which can be used to vary motor speed.

4.2 - Commander SX-PT commissioning

• Connection of the control terminal block (reminder)



* If the motor is not equipped with therminal sensor, ADI2 and 0V terminals must be strapped together.

⚠ • By default, the Commander SX-PT does not allow parameter setting. Before commissioning, check that default parameter values are suitable with the application.

• Commander SX-PT default settings :
- minimum limit : 0 rpm,
- maximum limit : 1500 rpm,
- acceleration rate : 3 seconds/1000 rpm,
- deceleration rate : 5 seconds/1000 rpm,
- motor rated current and rated speed :

Commander SX	Current (A)	Speed (rpm)
SX13200037	1.7	1400
SX13200055	2.7	1429
SX13200075	3.4	1428
SX23200110	4.2	1436
SX23200150	6.0	1437
SX23200220	8.0	1438
SX33200300	10.8	1447
SX33200400	13.8	1451
SX13400075	2.0	1400
SX13400110	2.5	1429
SX13400150	3.5	1428
SX23400220	5.1	1436
SX23400300	7.2	1437
SX23400400	9.1	1438
SX33400550	11.9	1447
SX33400750	15.2	1451

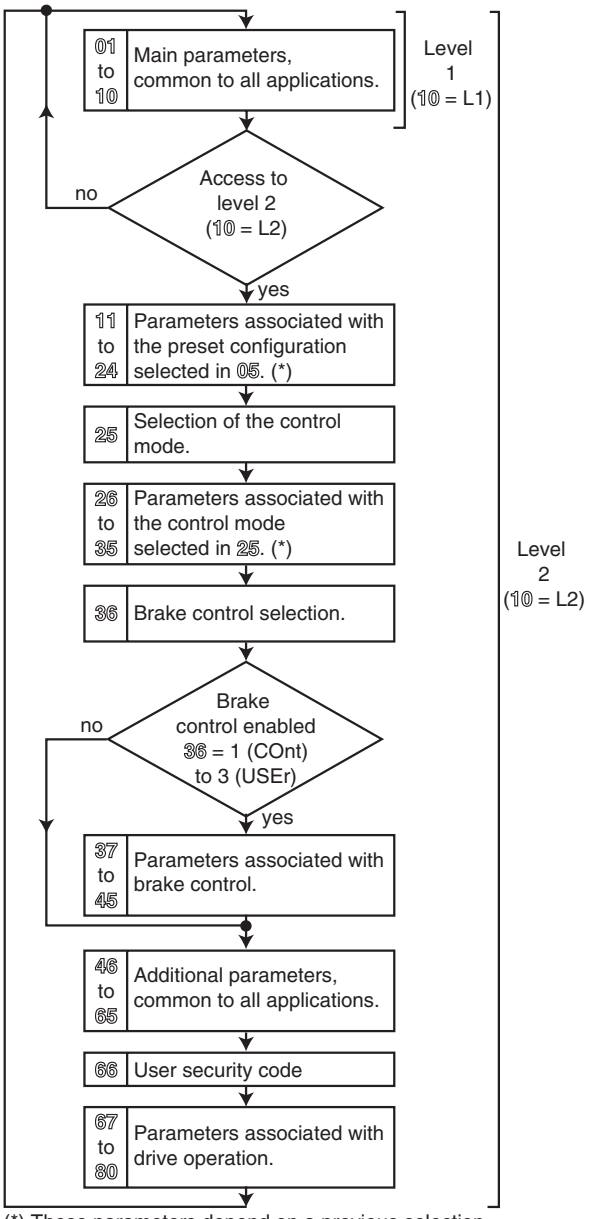
• Operation :
- Power up the drive, the display indicates " inh ".
- Turn down the potentiometer button to minimum value (0%).
- Enable the drive with SDI2 terminal. The display indicates "rdy".
- Press Run forward key ⓒ.
- Increase the speed by potentiometer button up to required speed.
- To stop the system, reduce the speed by potentiometer button until the motor stops.
- Press Stop key ⓞ.
- Disable the drive with SDI2 terminal.

Reminder : Reverse key ⓡ is not enabled. To enable the key, use PX-LCD keypad or SXSoft software.

4.3 - Commander SX-PB (or Commander SX-PT with a setting option) commissioning

4.3.1 - Parameter setting

The **Commander SX** factory configuration can be modified in order to meet the requirements of the application.
The parameter-setting keys are used to select and modify a list of parameters known as the "simplified" menu (parameters 01 to 80).
This menu consists of numerical or binary parameters (value 0 or 1) which can be accessed:
- either in read-only mode (RO): they provide information concerning the drive operation
- or in read-write mode (R-W): they can be read and/or modified in order to refine the drive settings to meet the application requirements as closely as possible.

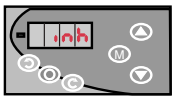
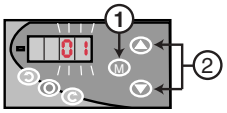
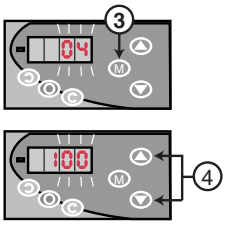
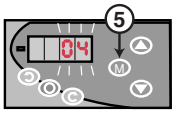
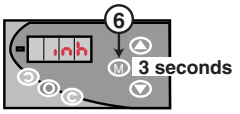


(*) These parameters depend on a previous selection. As a result, they change from one configuration to the next. The number of parameters can also vary. In this case, the Commander SX will not offer unused parameters.

4.3.2 - Selection and modification of a parameter

CAUTION:
• This procedure has been drawn up for initial commissioning.
• If the drive is already powered up, the first parameter displayed may not be 01. Simply select the parameter to be displayed or modified using the ▲ or ▼ key.

Note:
• To switch from parameter-setting mode to read mode, press the M button for 3 seconds.
• In parameter-setting mode, if there is no operator action for 4 minutes, the display stops flashing and returns automatically to the initial drive state.

Action	Comment
	Power-up Drive disabled (SDI2 input contact open). Display in "Read" mode (initial state).
	**1:** Access to parameter-setting mode. Press M key. Parameter 01 is displayed, flashing alternately with its value. **2:** The ▲ and ▼ keys are used to access the parameter to be modified. For example, select parameter 04.
	**3:** Access to parameter modification. Press M key. The parameter value flashes. **4:** Press and hold down the key, to quickly scroll through the parameter value. The final setting is made by short presses on the same key.
	**5:** Press M key. The new value 04 is stored, and the parameter flashes alternately with its value. Press the ▲ and ▼ keys to select a new parameter to be modified.
	**6:** Return to the initial drive status.

4.3.3 - Selection of the parameter access level

• Selection of level 2

Select the parameter:	Enter the value:	Action	Saving
10	**L2 (1)**	Access to parameters 01 to 80	Press the M key

• Return to level 1

Select the parameter:	Enter the value:	Action	Saving
10	**L1 (0)**	Limited access to parameters 01 to 10	Press the M key

4.3.4 - Storing

All modifications to parameters in the "simplified" menu are stored automatically.
To revert to the initial drive configuration, follow the procedure for returning to factory settings.

4.3.5 - Return to factory settings

⚠ •Before starting this procedure, check that the motor is stopped and that the safety of the system is not compromised.

• Return to European factory settings (50 Hz supply)

Select the parameter:	Enter the value:	Action	Saving
10	**L2 (1)**	Access parameter 65	-
65	**Eur (1)**	Drive factory default settings for Europe (50 Hz)	Press the M key

• Return to North America factory settings (60 Hz supply)

Select the parameter:	Enter the value:	Action	Saving
10	**L2 (1)**	Access parameter 65	-
65	**USA (2)**	Drive factory default settings for North America (60 Hz)	Press the M key

4.3.6 - Security code

In some cases, it is necessary to prevent modification of the drive parameters, while still allowing them to be read.

• Locking the settings with a security code

Select the parameter:	Enter the value:	Action	Confirmation
10	**L2 (1)**	Access parameter 66	Press the M key
66	**any number between 1 and 9999**	Choose the security code	
10	**Loc (2)**	Activate the security code	- Press the Stop key
Parameter 10 automatically returns to the value "L1": all the user menu parameters are visible but cannot be modified. The value of 66 returns automatically to 0.			

Note: Do not use 0 as a security code.

• Access to parameter setting with a security code
Select the parameter to be modified.
Press the M key, the display indicates "CodE".
Using the ▲ and ▼ arrows, enter the security code, then press M again.
- Correct code: the parameter is in parameter-setting mode, ready to be modified.
- Incorrect code: the parameter stays in read-only mode, as do all the other parameters.
To return to read-only mode, select 10 and enter the value "Loc", then press the Stop key.
The security code is active again.

• Deleting a security code
Select a parameter.
Press the M key, the display indicates "CodE".
Using the ▲ and ▼ arrows, enter the security code, then press M again.
Select 66, enter the value 0 and press M again.

• Finding a security code
Should the user forget the security code (drive locked in read-only mode), get in touch with your usual CONTROL TECHNIQUES contact.

4.3.7 - Commissioning from a preset configuration

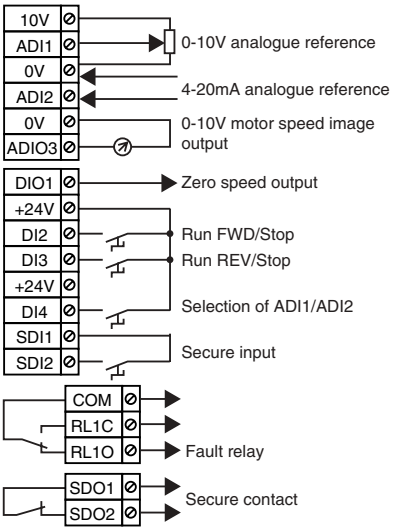
• The parameter values affect the motor protection and the safety of the system.
• Parameters concerning the motor must be set using the information given on the nameplate of the motor used.
The change from configuration to another does not modify motor parameters already set.

Selection of a preset configuration via parameter 05 results in automatic configuration of the terminal block and the creation of the list of associated parameters. It is therefore advisable to select the configuration most similar to the application by consulting the following pages and following the associated commissioning procedure.

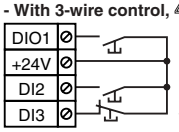
CAUTION :
Before selecting a preset configuration using 05, drive must be disabled (SDI2 open).

4.3.7.1 - Configuration 0: selection of a voltage (0-10V) or current (4-20mA) reference via digital input - 05 = A1.A2

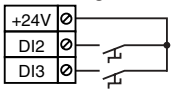
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



DI4	Selection
0	0-10V analogue reference (ADI1)
1	4-20mA analogue reference (ADI2)

Note : SDI2 input must be closed before giving Run command.

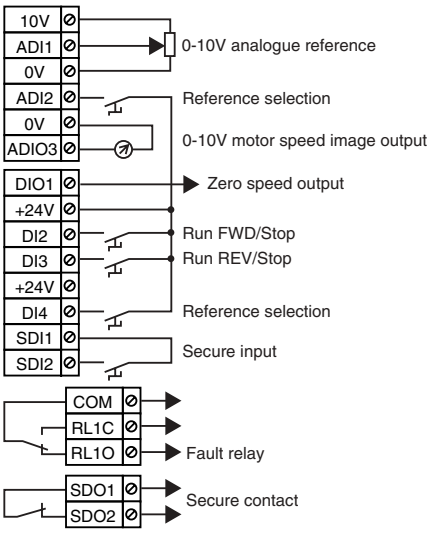
• List of parameters to be set
CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	**0 (A1.A2)**, 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	ADI1 mode	R-W	6 (uolt)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); 4 (4-.20), 5 (20-.4): current input without detection of signal 7 (d-In): logic input
12	ADI2 mode	R-W	4 (4-.20)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); **4 (4-.20)**, 5 (20-.4): current input without detection of signal 7 (d-In): logic input; 8 (PTC): motor sensor
13 to 24	Not used			

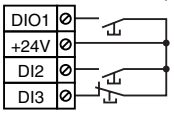
See section 4.3.8 for additional information on commissioning.

4.3.7.2 - Configuration 1: selection of a voltage (0-10V) reference or 3 references preset via 2 digital inputs - 05 = A1.Pr

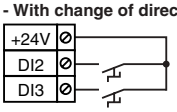
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



DI4	ADI2	Selection
0	0	0-10V analogue reference (ADI1)
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

CAUTION :

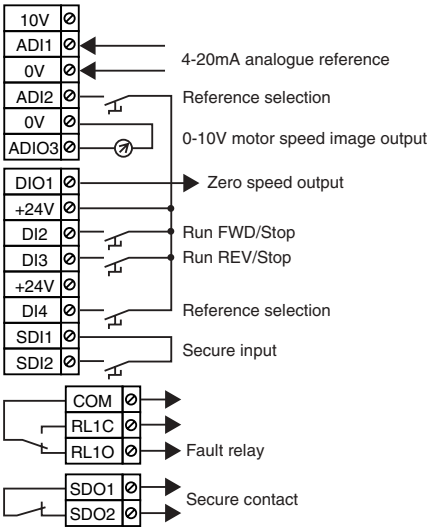
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), **1 (A1.Pr)**, 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	ADI1 mode	R-W	6 (uolt)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); 4 (4-.20), 5 (20-.4): current input without detection of signal loss (mA); **6 (uolt)**: voltage input (0 to 10V); 7 (d-In): logic input
12 to 14	Preset reference 2 (PR2) to Preset reference 4 (PR4)	R-W	0	± Maximum limit (02) rpm
15 to 24	Not used			

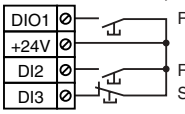
See section 4.3.8 for additional information on commissioning.

4.3.7.3 - Configuration 2: selection of a current (4-20mA) reference or 3 references preset via 2 digital inputs - 05 = A2.Pr

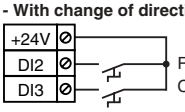
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



DI4	ADI2	Selection
0	0	4-20mA analogue reference (ADI1)
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

CAUTION :

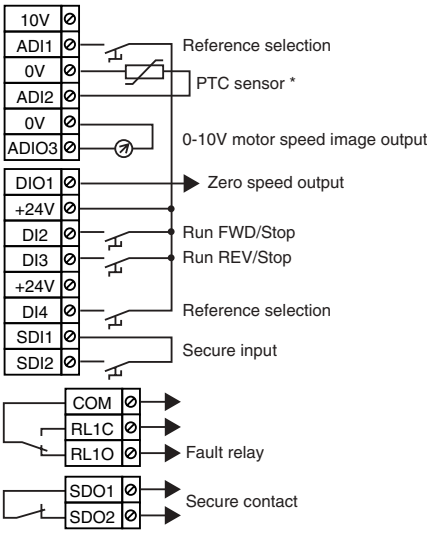
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), **2 (A2.Pr)**, 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to Ico (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	ADI1 mode	R-W	4 (4-.20)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); **4 (4-.20)**, 5 (20-.4): current input without detection of signal loss (mA); 6 (uolt): voltage input (0 to 10V); 7 (d-In): logic input
12 to 14	Preset reference 2 (PR2) to Preset reference 4 (PR4)	R-W	0	± Maximum limit (02) rpm
15 to 24	Not used			

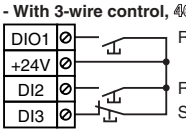
See section 4.3.8 for additional information on commissioning.

4.3.7.4 - Configuration 3: selection of 4 preset references via 2 digital inputs - 05 = 4Pr

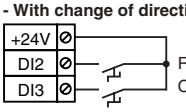
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



DI4	ADI1	Selection
0	0	Preset reference 1
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

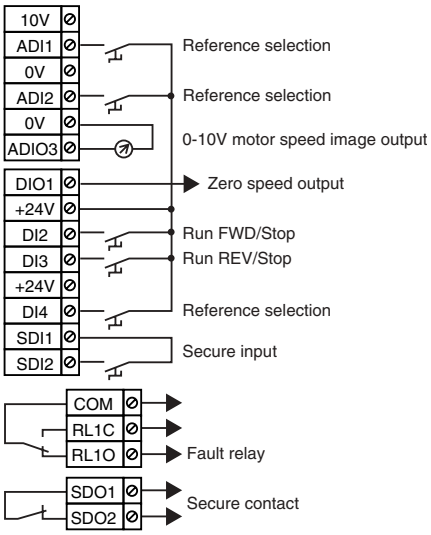
CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), **3 (4Pr)**, 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11 to 14	Preset reference 1 (PR1) to Preset reference 4 (PR4)	R-W	0	± Maximum limit (02) rpm
15 to 24	Not used			

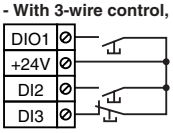
See section 4.3.8 for additional information on commissioning.

4.3.7.5 - Configuration 4: selection of 8 preset references via 3 digital inputs - 05 = 8Pr

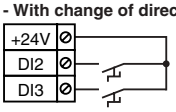
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



DI4	ADI1	ADI2	Selection
0	0	0	Preset reference 1
1	0	0	Preset reference 2
0	1	0	Preset reference 3
1	1	0	Preset reference 4
0	0	1	Preset reference 5
1	0	1	Preset reference 6
0	1	1	Preset reference 7
1	1	1	Preset reference 8

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

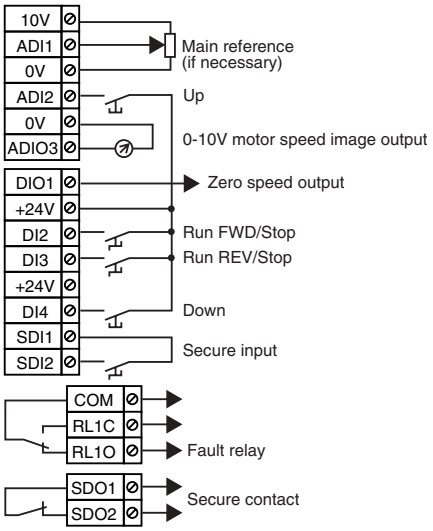
CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), **4 (8Pr)**, 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11 to 18	Preset reference 1 (PR1) to Preset reference 8 (PR8)	R-W	0	± Maximum limit (02) rpm
19 to 24	Not used			

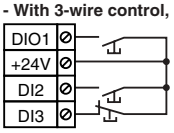
See section 4.3.8 for additional information on commissioning.

4.3.7.6 - Configuration 5 : motorised potentiometer - 05 = E.Pot

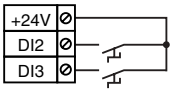
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



Operation :
The speed reference comes from the main reference connected to ADI1. This reference is increased by pulses on " Up " input, and reduced by pulses on " Down " input. If there is no main reference, the speed reference comes from " Up/Down " commands only.

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

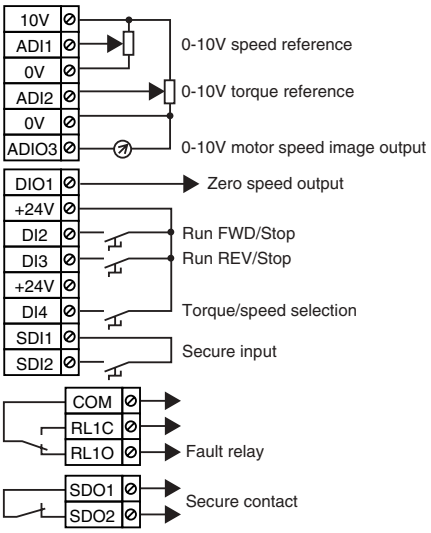
CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), **5 (E.Pot)**, 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	ADI1 mode	R-W	6 (uolt)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); 4 (4-.20), 5 (20-.4): current input without detection of signal loss (mA); **6 (uolt)**: voltage input (0 to 10V); 7 (d-In): logic input
12	Motorised pot reset	R-W	0 (no)	0 (no), 1 (Rset)
13	Motorised pot mode	R-W	2 (RSt.d)	0 (RSt.e) : reference is reset on each power up 1 (Pre.e) : on power up, reference is at the same level as before power down 2 (RSt.d) : reference is reset on each power up, Up/Down inputs active when drive output active. 3 (Pre.d) : on power up, reference is at the same level as before power down, Up/Down inputs active when drive output active
14	Motorised pot bipolar select	R-W	0 (Pos)	0 (Pos), 1 (biPo.)
15	Motorised pot rate	R-W	20 s	0 to 250 s
16	Motorised pot scale factor	R-W	1.00	0 to 2.50
17	Motorised pot output	RO	-	±100.0%
18 to 24	Not used			

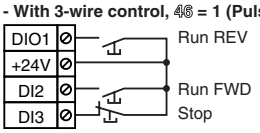
See section 4.3.8 for additional information on commissioning.

4.3.7.7 - Configuration 6 : selection of speed control or torque control via digital input - 05 = TorQ

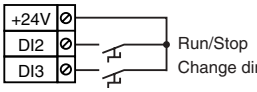
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



DI4	Selection
0	Speed-reference control via ADI1
1	Torque-reference control via ADI2 and speed limiting via 02

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

CAUTION :

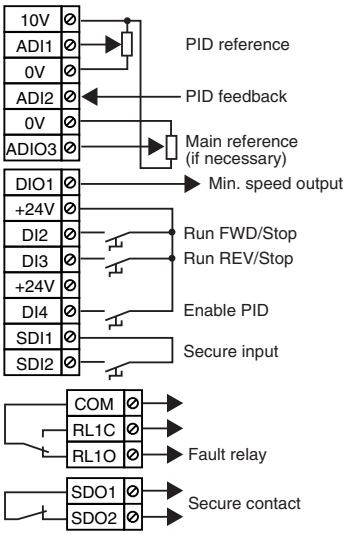
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

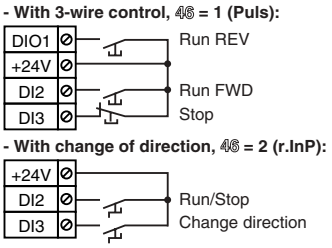
Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), **6 (TorQ)**, 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	ADI1 mode	R-W	6 (uolt)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); 4 (4-.20), 5 (20-.4): current input without detection of signal loss (mA); **6 (uolt)**: voltage input (0 to 10V); 7 (d-In): logic input
12	ADI2 mode	R-W	4 (4-.20)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); 4 (4-.20), 5 (20-.4): current input without detection of signal loss (mA); **6 (uolt)**: voltage input (0 to 10V); 7 (d-In): logic input; 8 (PTC): motor sensor
13 to 18	Not used			
19	ADI2 input scaling	R-W	1.00	0 à 2.50
20 to 24	Not used			

See section 4.3.8 for additional information on commissioning.

4.3.7.8 - Configuration 7: PID regulation - 05 = Pid

• Connection of the control terminal block (reminder)





Operation :
This configuration allows a PID control loop between a "PID reference" (process set point) and a "PID feedback" measurement (pressure, temperature, flowrate, level, dancer).
If the "main reference" is not connected, the PID controller output covers directly the speed range.
If the "main reference" is connected, the PID controller output acts as a partial correction of the speed reference. This is useful to improve PID stability.

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

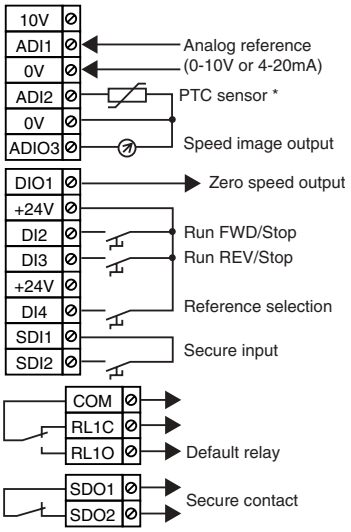
Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), **7 (Pid)**, 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	ADI1 mode	R-W	6 (uolt)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); 4 (4-.20), 5 (20-.4): current input without detection of signal loss (mA); **6 (uolt)**: voltage input (0 to 10V); 7 (d-In): logic input
12	ADI2 mode	R-W	4 (4-.20)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); **4 (4-.20)**, 5 (20-.4): current input without detection of signal loss (mA); 6 (uolt): voltage input (0 to 10V); 7 (d-In): logic input ; 8 (PTC): motor sensor
13	PID proportional gain	R-W	1.00	0 to 2.50
14	PID integral gain	R-W	0.50	0 to 2.50
15	PID derivative gain	R-W	0	0 to 2.50
16	PID upper limit	R-W	100.0%	0 to 100.0%
17	PID lower limit	R-W	- 100.0%	± 100.0%
18	PID output scaling	R-W	1.00	0 to 2.50
19	ADI2 input scaling	R-W	1.00	0 to 2.50
20	ADIO3 input scaling	R-W	1.00	0 to 2.50
21	PID reference	RO	-	± 100 %
22	PID feedback	RO	-	± 100 %
23	PID main reference	RO	-	± 100%
24	PID output	RO	-	± 100%

See section 4.3.8 for additional information on commissioning.

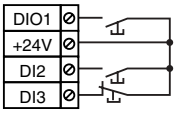
4.3.7.9 - Configuration 8: pump regulation - 05 = Pump

4.3.7.10 - Configuration 9 : voltage or current input and PTC sensor - 05 = A.CtP

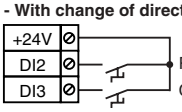
• Connection of the control terminal block (reminder)



- With 3-wire control, 46 = 1 (Puls):



- With change of direction, 46 = 2 (r.InP):



DI4	Selection
0	Analog reference 0-10V
1	Analog reference 4-20mA

* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

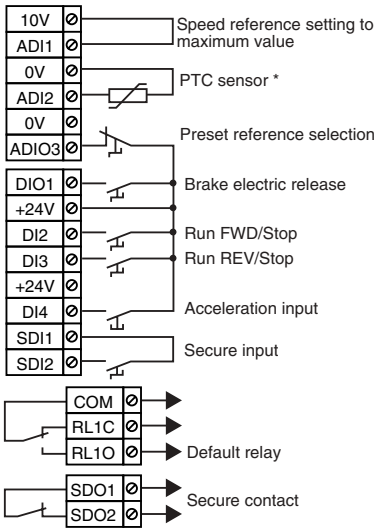
CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), **9 (A.CtP)**, 10 (HoiS), 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11 to 24	Not used			

See section 4.3.8 for additional information on commissioning.

4.3.7.11 - Configuration 10 : Control of travelling crane or hoist - 05 = HoiS

• Connection of the control terminal block (reminder)

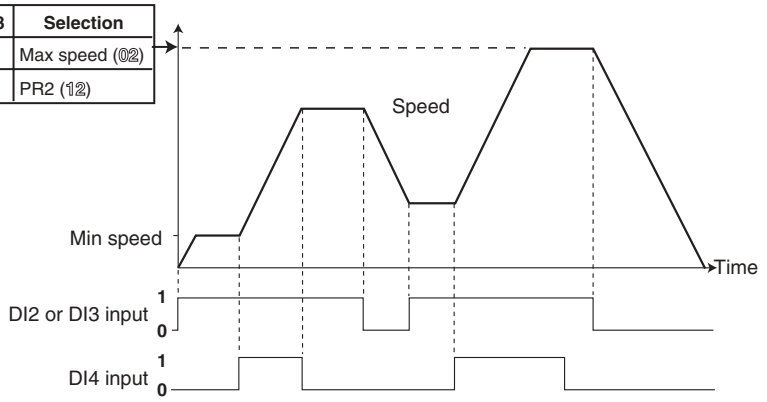


* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

Note : SDI2 input must be closed before giving Run command.

• Operation diagram :

ADIO3	Selection
0	Max speed (02)
1	PR2 (12)



• List of parameters to be set

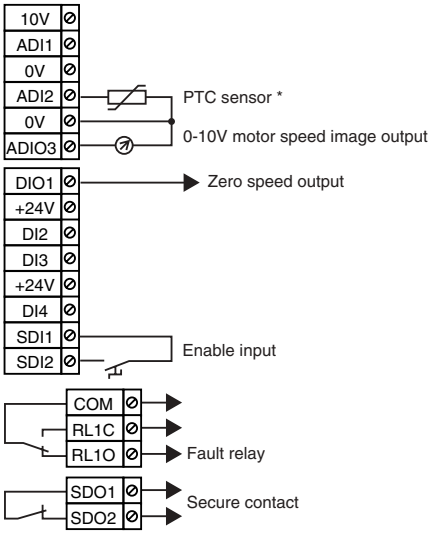
CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), **10 (HoiS)**, 11 (Pad), 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	Not used			
12	Preset reference 2 (PR2)	R-W	0	± maximum limit (02) rpm
13 to 24	Not used			

See section 4.3.8 for additional information on commissioning.

4.3.7.12 - Configuration 11: control via keypad - 05 = Pad

• Connection of the control terminal block (reminder)



Operation :
Run/Stop commands and the speed reference come from the optional keypad on PT or PB type drives.
* If the motor is not equipped with thermal sensor, ADI2 and 0V terminals must be strapped together.

CAUTION :
If Run/Stop commands come from keypad, SDI2 input must be set enable input only.

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

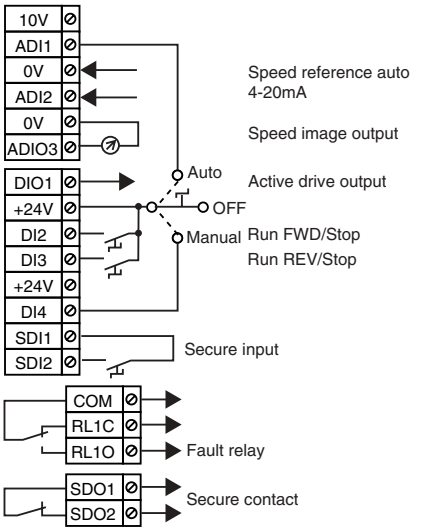
CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), **11 (Pad)**, 12 (HuAC), 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 200V (Eur), 230V Voltage code 400 400V (Eur), 460V	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	Power-up keypad control mode reference	R-W	0 (rSet)	0 (rSet): at zero; 1 (PreC): identical to the reference at the time of powering down; 2 (Pr1): identical to PR1
12	Reference on power-up (PR1)	R-W	0	± Maximum limit (02) rpm
13	Enable the local control FWD key	R-W	1 (On)	0 (OFF), 1 (On)
14	Enable the local control Stop key	R-W	1 (On)	0 (OFF), 1 (On)
15	Enable the keypad REV key	R-W	0 (OFF)	0 (OFF), 1 (On)
16 to 24	Not used			

See section 4.3.8 for additional information on commissioning.

4.3.7.13 - Configuration 12 : Auto/manual mode - 05 = HuAC

• Connection of the control terminal block (reminder)



OFF	Neither command nor reference are used
Auto	Run/Stop commands and reference come from control terminal block
Manual	Run/Stop commands and reference come from **Commander SX-PT** or **PB** keypad

Note : SDI2 input must be closed before giving Run command.

• List of parameters to be set

CAUTION :
Drive must be disabled before modifying any parameter settings. Then, enable the drive before giving Run command.

Parameter	Name	Type	Factory setting	Adjustment range
01	Minimum reference clamp	R-W	0	0 to 02 rpm
02	Maximum reference clamp	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	R-W	0 (A1.A2)	0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr), 5 (E.Pot), 6 (TorQ), 7 (Pid), 8 (PUMP), 9 (A.CtP), 10 (HoiS), 11 (Pad), **12 (HuAC)**, 13 (OPEn)
06	Motor rated current	R-W	Motor nominal current(A)	0 to I_{co} (A)
07	Motor rated speed	R-W	Motor nominal speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	R-W	Voltage code 200 : 200V (Eur), 230V (USA) Voltage code 400 : 400V (Eur), 460V (USA)	0 to 480V
09	Rated power factor (cos φ)	R-W	0.85	0 to 1.00
10	Parameter-setting level	R-W	0 (L1)	0 (L1), 1 (L2), 2 (Loc)
11	Not used			
12	ADI2 mode	R-W	4 (4-.20)	0 (0-20), 1 (20-0), 2 (4-20), 3 (20-4): current input (mA); **4 (4-.20)**, 5 (20-.4): current input without detection of signal loss (mA); 6 (uolt): voltage input (0 to 10V); 7 (d-In): logic input ; 8 (PTC): motor sensor
13 to 24	Not used			

See section 4.3.8 for additional information on commissioning.

4.3.8 - Selection of the control mode

Parameter	Name	Type	Factory setting	Adjustment range
25	User drive mode	R-W	0 (oP.LP)	0 (oP.LP) or 1 (oP.LP) : open loop mode control 2 (cL.LP) : closed loop flux vector mode control 3 (SruO) : servo motor control

• If 25 = 0 (oP.LP) or 1 (oP.LP) : open loop

Parameter	Name	Type	Factory setting	Adjustment range
26	Voltage mode select	R-W	3 (r-FSt)	0 (r.run) : stator resistance and voltage offset measurement at each run command; 1 (r.no) : no measurement; 2 (UtoF) : V/F mode; 3 (r.FSt) : stator resistance and voltage offset measurement the first time the drive is enabled; 4 (r.On) : stator resistance and voltage offset measurement the first time the drive is enabled following drive power up; 5 (SqrE) : square low characteristic.
27 and 28	Not used			
• If 26 = 2 (UtoF)				
29	Boost	R-W	5.0 % of 08	0 to 25.0 % of 08
30	Dynamic V to F	R-W	0 (Lin)	0 (Lin) : fixed V/F ratio 1 (dyn) : dynamic V/F ratio (varies with the load)
31 to 35	Not used			
• If 26 = 0 (r.run), 1 (r.no), 3 (r.FSt), 4 (r.On) or 5 (SqrE)				
29 and 30	Not used			
31	Current controller Kp proportional gain	R-W	20	0 to 250
32	Current controller Ki integral gain	R-W	40	0 to 250
33 to 35	Not used			

• If 25 = 2 (cL.LP) : closed loop or 3 (SruO) : servo

Parameter	Name	Type	Factory setting	Adjustment range
26	Drive encoder type	R-W	• If 25 = 0 to 2 : 0 (Incr.) • If 25 = 3 : 3 (CoMM)	0 (Incr.): quadrature incremental encoder; 1 (Fd): F/D incremental encoder; 2 (Fr) : FWD/REV incremental encoder; 3 (CoMM) : incremental encoder with commutation channels; 4 (haLL) : hall effect sensor; 5 (tyP1) to 8 (tyP4) : sensorless mode 1 to 4.
27	Drive encoder lines/rev	R-W	1024 lines/rev	0 to 32000 lines/rev
28	Encoder feedback filter	R-W	0	0 to 16.0 ms
29	Speed controller proportional gain Kp1	R-W	200	0 to 32000
30	Speed controller integral gain Ki1	R-W	100	0 to 32000
31	Current controller proportional gain	R-W	20	0 to 250
32	Current controller integral gain	R-W	40	0 to 250
33	Ramp by-pass	R-W	0 (raMP)	0 (raMP) or 1 (no)
34 and 35	Not used			

4.3.9 - Selection of brake control and setting its parameters

Parameter	Name	Type	Factory setting	Adjustment range
36	Brake control enable	R-W	0 (dis)	0 (dis): disabled 1 (COnt): enabled on Px-brake contactor 2 (rEl): enabled on the relay 3 (USEr): enabled with any assignment

• 36 = 1 (COnt), 2 (rEl), 3 (USEr):

Parameter	Name	Type	Factory setting	Adjustment range
37	Upper current threshold	R-W	30%	0 to 200%
38	Lower current threshold	R-W	10%	0 to 200%
39	Brake release frequency	R-W	1.0 Hz	0 to 20.0 Hz
40	Brake apply frequency	R-W	2.0 Hz	0 to 20.0 Hz
	Brake apply speed		5 rpm	0 to 100 rpm
41	Pre-brake release delay	R-W	0.30 s	0 to 25.00 s
	Brake apply speed delay			
42	Post-brake release time	R-W	1.00 s	0 to 25.00 s
43	Brake apply delay	R-W	0	0 to 25.00 s
44	Enable position controller during brake release	R-W	0 (OFF)	0 (OFF): held ramp when drive output is not active until the post brake release delay 42 has expired 1 (On): position controller enable while the ramp is held
45	Not used			

4.3.10 - Additional parameter settings

Parameter	Name	Type	Factory setting	Adjustment range
46	Start/Stop logic select	R-W	0 (Lchd)	0 (Lchd): FWD/Stop (DI2) and REV/Stop (DI3) latched 1 (Puls): FWD (DI2), Stop (DI3) and REV (DIO1) jog operation 2 (r.InP): Run/Stop (DI2) and direction of rotation (DI3) latched
47	Drive enable mode select	R-W	1 (Secu)	0 (Enab): locking input only (SDI) 1 (Secu): secure input (SDI), not enabled if 05 = 11 (Pad)
48	ADIO3 mode	R-W	10 (0 - 10 o)	0 (0-20): 0 to 20mA current input; 1 (20-0): 20 to 0mA current input; 2 (4-20): 4 to 20mA current input; 3 (20-4): 20 to 4mA current input; 4 (4-.20): 4 to 20mA current input without detection of signal loss; 5 (20-.4): 20 to 4mA current input without detection of signal loss; 6 (uolt): 0 to 10V voltage input; 7 (d-In): logic input; 8 (0-20o): 0 to 20mA current output; 9 (4-20o): 4 to 20mA current output; 10 (0-10o): 0 to 10V voltage output
49	ADIO3 control	R-W	0 (SPd)	0 (SPd): motor speed; 1 (Ld): motor load 2 (A): motor current; 3 (Puur): motor power; 4 (Adv): any assignment
50	DIO1 control	R-W	0 (n = 0)	0 (n = 0): zero speed output; 1 (At.SP): reference reached output 2 (Lo.SP): Minimum speed output; 3 (At.Ld): Rated load reached output; 4 (act): drive output active; 5 (alar): drive general alarm output 6 (I.Lt): current limiting output; 7 (JoG): jogging input 8 (rESE): reset input; 9 (Adv): any assignment
51	Jog reference	R-W	45 rpm	0 to 16000 rpm
52	Bipolar reference enable	R-W	0 (PoS)	0 (PoS): negative references equal zero 1 (nEg): change direction of rotation via reference polarity
53	Skip reference (critical speed)	R-W	0	0 to 32000 rpm
54	Skip reference band	R-W	15 rpm	0 to 300 rpm
55	Ramp mode select	R-W	1 (Std)	0 (Fst): deceleration ramp imposed; 1 (Std): automatic extension 2 (StdH): automatic extension with U_n + 20% 3 (FstH): deceleration imposed with U_n + 20%

Additional parameter settings (suite)

Parameter	Name	Type	Factory setting	Adjustment range
56	S ramp enable	R-W	0 (Lin)	0 (Lin): linear ramp; 1 (S-rP): S ramp enabled
57	Stop mode	R-W	1 (rAMP)	0 (FrEE): freewheel stop; 1 (rAMP): stop on ramp; 2 (rP.dC): stop on ramp with DC injection; 3 (dC-o): stop by braking (DC injection) until zero speed; 4 (dC-t): stop by braking (DC injection) with an imposed time
58	Main loss mode	R-W	0 (diS)	0 (diS): continues to operate on mains supply breaks while there is sufficient voltage on DC bus; 1 (StOP): deceleration on a ramp on a mains supply break until the motor stops; 2 (rd.th): deceleration on a ramp on a mains supply break, then acceleration on returning to normal conditions
59	Catch a spinning motor	R-W	0 (no)	0 (no): flying restart disabled; 1 (On.2d): flying restart of a motor in both directions 2 (On.Fd): flying restart of a motor in clockwise direction 3 (On.rS): flying restart of a motor in anti-clockwise direction
60	Switching frequency	R-W	1 (4.5 kHz)	0: 3 kHz; 1: 4.5 kHz; 2: 5.5 kHz; 3: 6 kHz; 4: 9 kHz; 5: 11 kHz
61	Motor rated frequency	R-W	50.0 Hz (Eur) 60.0 Hz (USA)	0 to 400.0 Hz
62	Number of motor poles	R-W	0 (Auto)	0 (Auto); 1 (2 poles); 2 (4 poles); 3 (6 poles); 4 (8 poles)
63	Autotune	R-W	0 (no)	0 (no): No autocalibration; 1 (StoP): Measurement of motor characteristics when stopped; 2 (rot): Measurement of motor characteristics with rotation ⚠ **• Motor uncoupled.** **• Must not present a risk to safety.**
64	Parameter cloning	R-W	0 (no)	0 (no): No action; 1 (rEAd): Transfer from XPressKey to drive; 2 (Prog): Transfer from drive to XPressKey; 3 (Auto): Automatic transfer of parameter modifications into XPressKey.
65	Load default	R-W	0 (no)	0 (no) ; 1 (Eur) ; 2 (USA)

4.3.11 - Security code

Parameter	Name	Type	Factory setting	Adjustment range
66	User security code	R-W	0	0 to 9999

4.3.12 - Parameters associated with the drive operating status

Parameter	Name	Type	Factory setting	Adjustment range
67	Unit displayed at power-up	R-W	0 (Spd)	0 (Spd) : speed display 1 (Load) : load display 2 (SP.Ld) : intermittent display of speed or load/current
68	Selection of load display	R-W	0 (Ld)	0 (Ld): load level 1 (A): total motor current
69	Unit for displaying the speed	R-W	1 (SP)	0 (Fr): output frequency (Hz) 1 (SP): motor speed (rpm) 2 (Cd): customer unit = 79 x 70
70	Customer unit	R-W	1.00	0 to 9.999
71	Last trip	RO	-	0 to 50
72	Penultimate trip	RO	-	0 to 50
73	ADI1 level	RO	-	0 to 100.0%
74	ADI2 level	RO	-	0 to 100.0%
75	ADIO3 input	RO	-	0 to 100.0%
76	Pre-offset reference	RO	-	± 02 rpm
77	Pre-ramp reference	RO	-	± 02 or 01 to 02 rpm
78	Current magnitude	RO	-	0 to drive Imax.
79	Motor rpm	RO	-	± 2 x 02 rpm
80	DC bus voltage	RO	-	0 to 420 V (voltage code : 200) 0 to 860 V (voltage code : 400)

4.3.13 - Detailed explanation of the parameters

4.3.13.1 - Main parameters (01 to 10)

01 : Minimum reference clamp

In unipolar mode, this parameter defines the minimum speed.

CAUTION:

• This parameter is inactive during jog operation.

• If the value of 02 is lower than that of 01, the value of 01 is automatically changed to the new value of 02.

02 : Maximum reference clamp

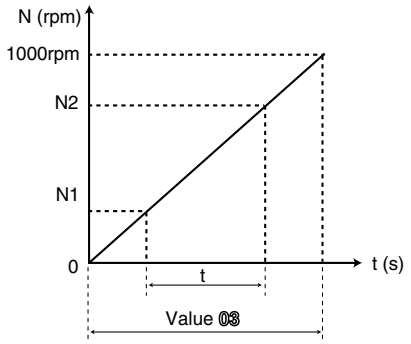
• Before setting a high maximum reference clamp, check that the motor and the driven machine can withstand it.

This parameter defines the maximum speed in both directions of rotation.

03 : Acceleration rate

Sets the time for acceleration from 0 to 1000 rpm.

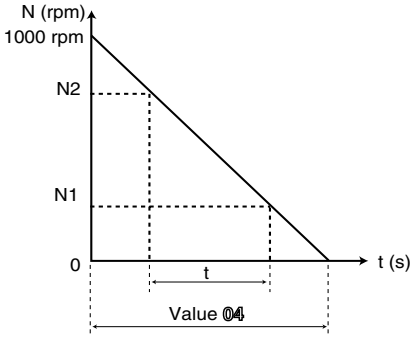
$$03 = \frac{t\ (s) \times 1000\ rpm}{(N2-N1)\ rpm}$$



04 : Deceleration rate

Sets the time for deceleration from 1000 rpm to 0.

$$04 = \frac{t\ (s) \times 1000\ rpm}{(N2-N1)\ rpm}$$



05 : Preset configuration select

0 (A1.A2) : A 0-10V voltage reference input and a 4-20mA current reference input selectable via digital input.
1 (A1.Pr) : A 0-10V voltage reference input and 3 preset references selectable via 2 digital inputs.
2 (A2.Pr) : A 4-20mA current reference input and 3 preset references, selectable via 2 digital inputs.
3 (4Pr) : 4 preset references selectable via 2 digital inputs.
4 (8Pr) : 8 preset references selectable via 3 digital inputs.
5 (E.Pot) : Motorised potentiometer (Up, Down).
6 (TorQ) : Speed control or torque control via digital input.
7 (Pid) : PID regulation.
8 (PUMP) : Pump regulation.
9 (A.CtP) : A voltage or current reference and PTC input.
10 (HoiS) : Control of a travelling crane or hoist.
11 (Pad) : Local control via the keypad.
12 (HuAC): Auto/manual mode.
13 (OPEn): No configuration, parameter-setting mode is open.

06 : Motor rated current

This is the value of the motor rated current indicated on the nameplate. The overload is calculated from this value.

07 : Motor rated speed

This is the rated load speed of the motor indicated on the nameplate.

08 : Motor rated voltage

This is the rated voltage indicated on the motor nameplate.

09 : Rated power factor (Cos φ)

The power factor is measured automatically during an autotune phase in level 2 (see 63 in 4.3.13.5) and set in this parameter.
If it is not possible to carry out the autocalibration with rotation procedure, enter the Cos φ value indicated on the motor nameplate.

10 : Parameter-setting level

0 (L1): Level 1 access. Only parameters 01 to 10 can be accessed via the keypad.
1 (L2): Level 2 access. Parameters 01 to 80 can be accessed via the keypad.
2 (Loc): Used to store or reactivate a security code.

4.3.13.2 - Parameters associated with preset configurations (11 to 24)

11 :

• Configurations 0 (A1.A2), 1 (A1.Pr), 2 (A2.Pr), 5 (E.Pot), 6 (TorQ) and 7 (Pid): ADI1 mode
Used to define the type of signal on the ADI1 input.

11	LED display	Description
0	0-20	0-20mA current signal, 0mA corresponds to the minimum reference
1	20-0	20-0mA current signal, 20mA corresponds to the minimum reference
2	4-20	4-20mA current signal with detection of signal loss. 4mA corresponds to the minimum reference
3	20-4	20-4mA current signal with detection of signal loss. 20mA corresponds to the minimum reference
4	4-.20	4-20mA current signal without detection of signal loss. 4mA corresponds to the minimum reference
5	20-.4	20-4mA current signal without detection of signal loss. 20mA corresponds to the minimum reference
6	**uoIt**	**0-10V voltage signal**
7	d-In	The input is configured as a digital input

• Configuration 3 (4Pr) and 4 (8Pr): Preset reference 1
Used to define preset reference PR1.

• Configuration 11 (Pad): Power-up keypad control mode reference
0 (rSet) : On power-up, the keypad reference is reset to zero.
1 (Prec) : On power-up, the keypad reference retains the value it had before power-down.
2 (Pr1) : On power-up, the keypad reference retains the preset reference 1 value (12).

12 :

• Configurations 0 (A1.A2), 6 (TorQ), 7 (Pid) and 12 (HuAC) : ADI2 mode
Used to define the type of signal on the ADI2 input.

12	LED display	Description
0	0-20	0-20mA current signal, 0mA corresponds to the minimum reference
1	20-0	20-0mA current signal, 20mA corresponds to the minimum reference
2	4-20	4-20mA current signal with detection of signal loss. 4mA corresponds to the minimum reference
3	20-4	20-4mA current signal with detection of signal loss. 20mA corresponds to the minimum reference
4	**4-.20**	**4-20mA current signal without detection of signal loss. 4mA corresponds to the minimum reference**
5	20-.4	20-4mA current signal without detection of signal loss. 20mA corresponds to the minimum reference
6	uoIt	0-10V voltage signal
7	d-In	The input is configured as a digital input
8	CtP	The input is configured to manage the motor PTC sensors

• Configurations 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr), 4 (8Pr) and 10 (HoiS) : Preset reference 2
Used to define preset reference PR2.

• Configuration 5 (E.Pot): Motorised pot reset
When this parameter is at 1 (RSEt), the motorised reference is reset to zero.

• Configuration 11 (Pad): Reference on power-up PR1
Used to define the reference on power-up when 11 is set to 2 (Pr1).

13 :

• Configurations 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr) and 4 (8Pr): Preset reference 3
Used to define preset reference PR3.

• Configuration 5 (E.Pot): Motorised pot mode
0 (Rst.e): The reference is reset to 0 on each power-up. The up/down and reset inputs are active at all times.
1 (Pre.e): On power-up, the reference is at the same level as before power-down. The up/down and reset inputs are active at all times.
2 (Rst.d): The reference is reset to 0 on each power-up. The up/down inputs are only active when the drive output is active. The reset input is active at all times.
3 (Pre.d): On power-up, the reference is at the same level as before power-down. The up/down inputs are only active when the drive output is active. The reset input is active at all times.

• Configuration 7 (Pid): PID proportional gain
This is the proportional gain applied to the PID error.
After modifying this parameter, open terminal DI4 (enable PID), then close it again so that modification of the gain is taken into account.

• Configuration 11 (Pad): Enable the local control FWD key
0 (OFF): local control FWD key disabled.
1 (On): local control FWD key enabled.

14 :

• Configurations 1 (A1.Pr), 2 (A2.Pr), 3 (4Pr) and 4 (8Pr): Preset reference 4
Used to define preset reference PR4.

• Configuration 5 (E.Pot): Motorised pot bipolar select
0 (Pos): The Up/Down pot reference is limited to positive values (0 to 100.0%).
1 (biPo.): The Up/Down pot reference can change from -100% to +100%.

• Configuration 7 (Pid): PID integral gain
This is the gain applied to the PID error before integration.
After modifying this parameter, open terminal DI4 (enable PID), then close it again so that modification of the gain is taken into account.

• Configuration 11 (Pad): Enable the local control Stop key
0 (OFF): local control Stop key disabled.
1 (On): local control Stop key enabled.
If the Stop key is enabled, it is taken into account even if control is via the terminal block.
If a stop is ordered via the local console while a run command is present on the terminal block, the run command must be opened to authorise restarting.

15 :

• Configuration 4 (8Pr): Preset reference 5
Used to define preset reference PR5.

• Configuration 5 (E.Pot): Motorised pot rate
This parameter defines the time it takes for the Up/Down pot reference to change from 0 to 100.0%.
It will take twice as long to change from -100.0% to +100.0%.
Defines the potentiometer sensitivity.

• Configuration 7 (Pid): PID derivative gain
This is the gain applied to the PID error before derivation.
After modifying this parameter, open terminal DI4 (PID enabled), then close it again so that modification of the gain is taken into account.

• Configuration 11 (Pad): Enable the keypad REV key
0 (OFF): Local control REV key disabled.
1 (On): Enables the local control REV key.

16 :

• Configuration 4 (8Pr): Preset reference 6
Used to define preset reference PR6.

• Configuration 5 (E.Pot): Motorised pot scale factor
The maximum value of the Up/Down pot reference automatically takes the maximum value of the parameter 02. This parameter can be used to correct the Up/Down reference if main reference is used.
For a maximum Up/Down reference value egual to 1000rpm.

$$\Rightarrow 16 = \frac{1000}{02}$$

• Configuration 7 (Pid): PID upper limit
Used to limit the maximum value of the PID output.

17 :

• Configuration 4 (8Pr): Preset reference 7
Used to define preset reference PR7.

• Configuration 5 (E.Pot): Motorised pot output
Indicates the level of the reference before scaling (expressed as a percentage).

• Configuration 7 (Pid): PID lower limit
Used to limit the maximum negative value or the minimum positive value of the PID output.

18 :

• Configuration 4 (8Pr): Preset reference 8
Used to define preset reference PR8.

• Configuration 7 (Pid): PID output scaling
Used to scale the PID output before it is added to the main reference.
The sum of both references is automatically scaled according to the adjustment range of the parameter to which it is addressed.

19 :

• Configuration 7 (Pid): ADI2 input scaling
Used if necessary to scale analog input ADI2. However, this rarely proves necessary since the maximum input level (100%) automatically corresponds to the max. value of the destination parameter.
Not used when the input is used as a digital input.

20 :

• Configuration 7 (Pid): ADIO3 input scaling
Used if necessary to scale the analog input. However, this rarely proves necessary since the maximum value of the analog input automatically corresponds to the maximum value of the parameter which has been assigned.

21 :

• Configuration 7 (Pid): PID reference
Indicates the PID reference value.

22 :

• Configuration 7 (Pid): PID feedback
Indicates the PID feedback value.

23 :

• Configuration 7 (Pid): PID main reference
Indicates the main reference value.

24 :

• Configuration 7 (Pid): PID output
Indicates the level of the PID regulator output before scaling.

4.3.13.3 - Parameters associated with the control mode (25 to 35)

25 **: User drive mode**

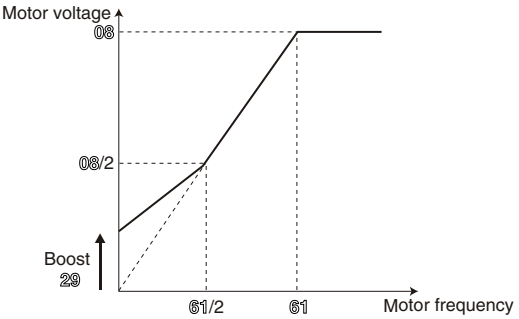
0 (oP.LP): The drive is controlled in open loop mode. The open loop control mode is defined by parameter 26.
1 (oP.LP): The drive is controlled in open loop mode. The open loop control mode is defined by parameter 26.
2 (cL.LP): The drive controls an induction motor in closed loop flux vector control mode. The encoder type and control mode are defined by parameter 26.
3 (SruO): The drive controls a servo motor. The encoder type and control mode are defined by parameter 26.
This parameter is used to select the control mode.
Returning to factory settings does not change the operating mode.
The choice of operating mode can only be made when the drive is stopped.
Note : Changing from open loop mode (25 = 0 or 1) to closed loop mode (25 = 2 or 3) or conversely, parameters 40 "Brake apply frequency or speed" and 41 "Pre-brake release delay/ brake apply speed delay" are set to their default value.

26 :

• If 25 = 0 (OP.LP), 1 (OP.LP) : voltage mode select
Determines the open loop control mode. Modes 0, 1, 3 or 4 are used in flux vector control mode. The difference between these modes is the method used to identify the motor parameters, particularly the stator resistance. As these parameters vary with the temperature and are essential to obtain optimum performance, the machine cycle should be taken into account when selecting the most appropriate mode. Modes 2 and 5 correspond to a U/F ratio control mode. This ratio is linear in mode 2 and square in mode 5.
0 (r.run): The stator resistance and voltage offset are measured each time the drive receives a run command.
These measurements are only valid if the machine is stopped, and totally defluxed. The measurement is not taken when the run command is given less than 2 seconds after the previous stop. This is the most effective flux vector control mode. However, the operating cycle should be compatible with the 2 seconds required between a stop command and a new run command.

1 (r.no): The stator resistance and voltage offset are not measured.
This mode is of course the least effective. It should only be used when mode 0 (r.run) is incompatible with the operating cycle.

2 (UtoF): Voltage-frequency ratio with fixed boost adjustable via parameters 29 and 08.

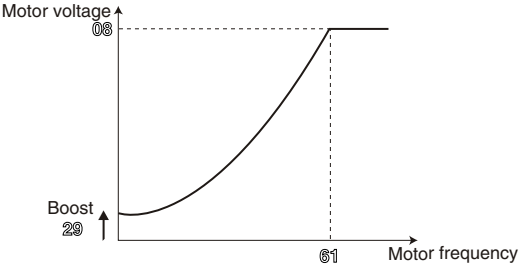


CAUTION:
Use this mode to control several motors.

3 (r.FSt): The stator resistance and voltage offset are measured the first time the drive is enabled.

4 (r.On): The stator resistance and voltage offset are measured the first time the drive is enabled following each power-up.

5 (SqrE): Square law characteristic.



• In mode 4 (r.On), a voltage is briefly applied to the motor. For safety, no electrical circuit must be accessible once the drive has been powered up.

• If 25 = 2 (cL.LP) or 3 (SruO) : Drive encoder type
0 (Incr.) : Quadrature incremental encoder.
1 (Fd): Incremental encoder with Frequency/Direction output.
2 (Fr): Incremental encoder with FWD/REV outputs.
3 (CoMM): Incremental encoder with commutation channels.
4 (haLL): Hall effect sensor
5 (tyP1) to 8 (tyP4): Sensorless mode 1 to 4.

27 :

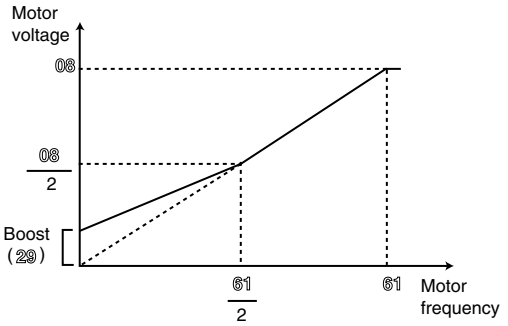
• If 25 = 4 (cL.LP): Drive encoder lines per revolution
Used to configure the number of lines per encoder revolution. Converts the encoder input into a speed.

28 :

• If 25 = 2 (cL.LP) or 3 (SruO) : Drive encoder filter (▣)
This parameter introduces a sliding window filter to the encoder speed feedback. It is particularly usefull to reduce current demand when the load has high inertia and significant gain is required on the speed controller. If the filter is not enabled in such conditions, it is possible for the speed controller output to change constantly from one current limit to another, and lock the integral term of speed controller.
The filter is disabled when 28 = 0.

29 :

• If 25 = 0 (oP.LP) or 1 (oP.LP) and 26 = 2 (UtoF) : Boost
For operation in V/F mode (26 at 2), parameter 29 is used to overflux the motor at low speed so that it delivers more torque on starting. It is a percentage of the rated motor voltage (08).



• If 25 = 2 (cL.LP) or 3 (SruO): Speed controller proportional gain (▣)
Adjusts the stability of the motor speed in the event of sudden variations in the reference.
Increase the proportional gain until vibration occurs in the motor, then reduce the value by 20 to 30%, checking that the motor remains stable in the event of sudden variations in speed, both at no load and on load.

30 :

• If 25 = 0 (oP.LP) or 1 (oP.LP) : Dynamic V to F
0 (Lin): The V/F ratio is fixed and set by the base frequency (61).
1 (dyn): Dynamic V/F ratio.
Generates a voltage/frequency characteristic which varies with the load. It is for use in quadratic torque applications (pumps/fans/compressors). It can be used in constant torque applications with low dynamics to reduce motor noise.

• If 25 = 2 (cL.LP) ou 3 (SruO) : Speed controller integral gain (▣)
Adjusts the stability of the motor speed on load impact.
Increase the integral gain so that the same speed is obtained on load and at no load in the event of load impact.

31 : Current controller Kp proportional gain

32 : Current controller Ki integral gain
• If 25 = 0 (oP.LP) or 1 (oP.LP) and 26 ≠ 2 (UtoF) or if 25 = 2 (cL.LP) or 3 (SruO) :
Due to a certain number of internal drive factors, oscillations may occur in the following cases:
- Frequency regulation with current limiting around the rated frequency and on load impacts.
- Torque regulation on machines with a low load and around the rated speed.
- On a mains supply break or on a controlled deceleration ramp when DC bus regulation is requested.
To reduce these oscillations, we recommend that you first:
- increase the proportional gain 31,
- then reduce the integral gain 32.

33 :

• If 25 = 2 (cL.LP) or 3 (SruO) : Ramp by-pass (▣)
0 (raMP): Active ramps.
1 (no): Ramps short-circuited.

34 and 35 : Not used

4.3.13.4 - Parameters associated with brake control (36 to 45)

36 : Brake controller enable
Used to enable brake control and to select to which digital output it will be assigned.
0 (dis): brake control is not enabled.
1 (COnt): brake control is enabled and routed to the integrated brake contactor option.
2 (rEl): brake control is enabled and routed to the relay. In this case, the "drive ready" indication is rerouted to digital output DIO1.
3 (USEr): brake control is enabled. The output is not assigned automatically : it is up to the user to select the destination. Refer to the advanced manual.

37 :

• If 36 ≠ 0 (dis) : Upper current threshold
Used to set the current threshold at which the brake will be controlled. This current level should ensure sufficient torque at the time the brake is released.

38 :

• If 36 ≠ 0 (dis) : Lower current threshold
Used to set the current threshold below which brake control will be disabled. It should be set so as to detect loss of the motor power supply is detected.

39 :

• If 36 ≠ 0 (dis) : Brake release frequency
Used to set the frequency threshold at which the brake will be controlled. This frequency level should ensure sufficient torque is provided to drive the load in the right direction at the time the brake is released. This threshold is usually set at a value slightly above the frequency corresponding to the motor slip at full load.
Example:
- 1500 rpm = 50 Hz
- rated on-load speed = 1470 rpm
- slip = 1500 - 1470 = 30 rpm
- slip frequency = 30/1500 x 50 = 1 Hz

40 :
• If 36 ≠ 0 (dis) : Brake apply frequency ( ) or speed ( )
Used to adjust the frequency or speed threshold at which brake control will be disabled. This threshold enables the brake to be applied before zero speed so as to avoid load veering while the brake is being engaged.
If the frequency or speed drops below this threshold when no stop request has been made (change of direction of rotation), brake control will remain activated. This exception can be used to avoid the brake being engaged as the speed passes though zero.

41 :
• If 36 ≠ 0 (dis) : Pre-brake release delay ( )
Brake apply speed delay ( )
( ) : This time delay is triggered when all the conditions for brake release have been met. It enables enough time to establish an adequate level of flux in the motor and to ensure that the slip compensation function has become fully active. When this time delay has elapsed, brake control is enabled. During the whole pre-brake delay period, the ramp applied to the reference is held constant.

( ) : This time delay is used to delay the brake apply command in relation to the passage below the minimum speed threshold (40). It is useful for avoiding repeated oscillation of the brake when being used around zero speed.

42 :
• If 36 ≠ 0 (dis) : Post brake release delay
This time delay is triggered when brake control is enabled. It is used to allow time for the brake to release before unlocking the ramp.

43 :
• If 36 ≠ 0 (dis) : Brake apply delay
This time delay is used to maintain the torque at standstill while the brake is applied. When this time delay has elapsed, the drive output is disabled.

44 :
• If 36 ≠ 0 (dis) : Enable position controller during brake release ( )
0 (OFF): The ramp is held when the drive output is not active, until the post-brake release delay (42) has expired. This enables the speed reference to remain at 0 until the brake is released.
1 (On): Position controller enabled while the ramp is held. This function avoids the load moving during the brake release phase.
Function not available in version V2.10.

45 : **Not used**

4.3.13.5 - Parameters common to all applications (46 to 65)

46 : **Management of logic commands**
Used to choose one of 3 Run/Stop command and Direction of rotation management modes.
0 (Lchd) : DI2 terminal used as FWD/Stop
DI3 terminal used as REV/Stop
Commands given by latched contacts.
1 (Puls) : DI2 terminal used as FWD
DI3 terminal used as Stop
DIO1 terminal used as REV
Commands given by non latched contacts.
To switch from FWD to REV command or vice versa, an intermediate stop command is necessary.
2 (r.InP) : DI2 terminal used as Run/Stop
DI3 terminal used to select the direction of rotation.
Commands given by latched contacts.
These three configurations result in automatic assignment of the logic inputs.
Note : Modifications to 46 must be made with the drive disabled.

47 : **Drive enable mode select**
0 (Enab): the SDI input is used as a simple disable input.
1 (Secu): the SDI input is used as a secure input. In order to conform to safety standard EN 954-1 category 3, the drive must be wired in accordance with the recommended diagram (section 3.4).
Note : Changes in 47 must be carried-out while drive is disabled.

• The factory default setting of 47 is 0 (Enab) for configuration 11 Pad (05 = 11). Also if the drive is controlled by field bus or LCD key-pad.

48 : **ADIO3 mode**
Used to define whether ADIO3 is used as an input or output and the type of signal used.

48	LED display	Description
0	0-20	0-20mA current input, 0mA corresponds to the minimum reference
1	20-0	20-0mA current input, 20mA corresponds to the minimum reference
2	4-20	4-20mA current input with detection of signal loss. 4mA corresponds to the minimum reference
3	20-4	20-4mA current input with detection of signal loss. 20mA corresponds to the minimum reference
4	4-.20	4-20mA current input without detection of signal loss. 4mA corresponds to the minimum reference
5	20-.4	20-4mA current input without detection of signal loss. 20mA corresponds to the minimum reference
6	uolt	0-10V voltage input
7	d-In	The input is configured as a logic input
8	0 -20 o	0-20mA current output, where 20mA corresponds to the maximum value of the assigned parameter
9	4 -20 o	4-20mA current output, where 20mA corresponds to the maximum value of the assigned parameter
10	**0 -10 o**	**0-10V voltage output, where 10V corresponds to the maximum value of the assigned parameter**

49 : ADIO3 control

This parameter is used to assign the ADIO3 function quickly in cases where it is being used as an output.

49	LED display	ADIO3 function
0	**SPd**	**Motor rpm**
1	Ld	Motor load
2	A	Motor current
3	Puur	Motor power
4	Adv	Any assignment

If ADIO3 is used as an input, 49 in forced to 4 (Adv).
When 49 = 4 (Adv), assignment is at the user's discretion. Refer to the advanced manual.

50 : DIO1 control

This parameter is used to assign the DIO1 function quickly.

50	LED display	DIO1 function
0	**n = 0**	**Zero speed output**
1	At.SP	Reference reached output
2	Lo.SP	Minimum speed output
3	At.Ld	Rated load reached output
4	act	Drive output active
5	alar	Drive general alarm output
6	I.Lt	Current limit output
7	JoG	Jogging input
8	rESE	Reset input
9	Adv	Any assignment

51 : Jog operation reference

Operating frequency when the jog operation input has been selected.

52 : Bipolar reference enable

0 (PoS): all negative references are treated as zero.
1 (nEg): used to change the direction of rotation by the reference polarity. May come from preset references.

53 : Skip reference

A skip is available to avoid a machine running at a critical speed. When the parameter is at 0, the function is disabled.

54 : Skip reference band

Defines the skip band around the avoided speed. The total skip will therefore equal the threshold set ± skip band. When the reference is within the window determined in this way, the drive will restore the speed corresponding to the lower value in the window.

55 : Ramp mode select

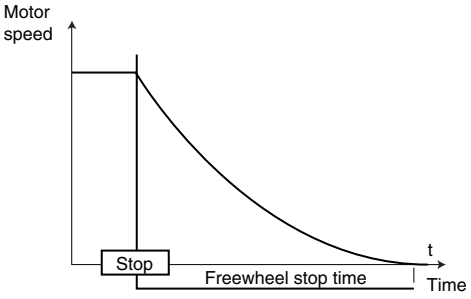
0 (Fst): deceleration ramp imposed. If the deceleration ramp which has been set is too fast in relation to the inertia of the load, the DC bus voltage exceeds its maximum value and the drive switches to overvoltage fault "OU".
CAUTION:
Select mode 55 = 0 (FSt) when a braking resistor is being used.
1 (Std): Standard deceleration ramp with automatic extension of the ramp time in order to avoid causing a DC bus overvoltage fault on the drive.
2 (StdH): The drive allows the motor voltage to be increased up to 1.2 times the rated voltage set in 08 (motor rated voltage), to avoid reaching the maximum DC bus voltage threshold. However, if this is not adequate, the standard deceleration ramp time is extended, to avoid causing a DC bus overvoltage trip on the drive.
For the same quantity of energy, mode 2 (StdH) enables faster deceleration than mode 1 (Std).
3 (FstH): same as mode 2 (StdH), but the ramp is imposed. If the configured ramp is too fast, the drive goes into OU trip mode.
CAUTION:
In mode 2 (StdH) and 3 (FstH), the motor must be able to tolerate additional losses relating to the increase in voltage at its terminals.

56 : S ramp enable

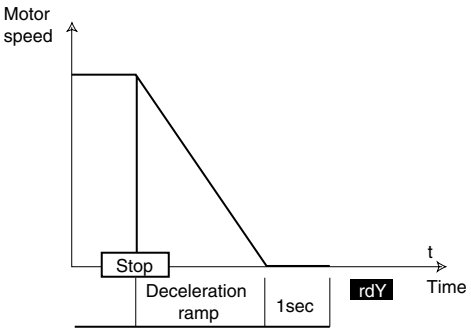
0 (Lin): the ramp is linear.
1 (S-rP): a curved part at the start and end of the ramp avoids load swinging.
CAUTION:
The S ramp is disabled during controlled decelerations, 55 = 1 (Std) or 2 (StdH).

57 : Stop mode

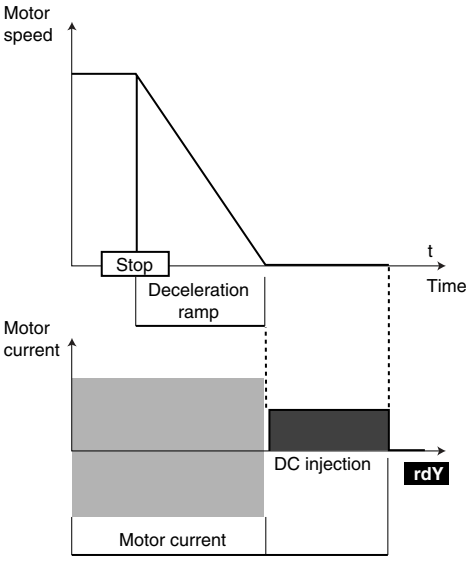
0 (FrEE): freewheel stop.
The power bridge is disabled as soon as the stop command is given.
The drive cannot receive another run command for 2s, the time required for motor demagnetisation.
The display indicates rdY, 2 seconds after the stop command.
The machine stopping time depends on its inertia.



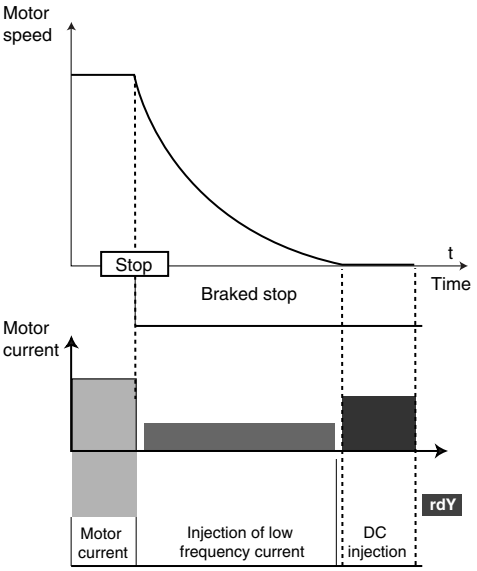
1 (rAMP): stop on deceleration ramp.
The drive decelerates the motor according to the deceleration mode chosen in parameter 55.
One second after the stop, the display indicates rdY.



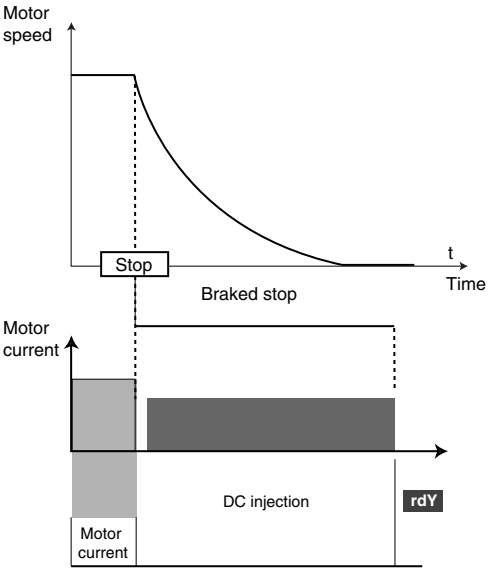
2 (rP.dC): stop on deceleration ramp with DC injection for an imposed period of time.
The drive decelerates the motor according to the deceleration mode chosen in parameter 55.
When zero frequency is reached, the drive injects DC current for 1 second.
The drive then displays rdY.



3 (dC-O) : stop by DC injection braking, and elimination at zero speed.
The drive decelerates the motor by setting a low frequency current resulting in almost zero speed, which the drive detects automatically.
The drive then injects DC current for 1 second. The drive then displays rdY. No run command can be taken into account until rdY is displayed.



4 (dC-t) : stop on DC injection with an imposed period of time.
The drive decelerates the motor by imposing DC current for one second, then the drive displays rdY. No run command can be taken into account until rdY is displayed.



58 : Mains loss mode

0 (diS): The drive does not take account of mains supply breaks and continues to operate while there is sufficient voltage on the DC bus.

1 (StOP): In the event of a mains supply break, the drive will decelerate on a ramp, automatically calculated by the drive, so that the motor sends back the energy to the drive DC bus and therefore continues to power its control electronics. On returning to normal conditions, deceleration continues until the motor stops, but according to the deceleration mode configured in 55.

2 (rd.th): In the event of a mains supply break, the drive will decelerate on a ramp, automatically calculated by the drive, so that the motor sends back the energy to the drive DC bus and therefore continues to power its control electronics. On returning to normal conditions, the motor reaccelerates up to the reference speed.

59 : Catch a spinning motor

If this parameter is enabled by 59 = 1 (On.2d), 2 (On.Fd) or 3 (On.rS), when there is a run command or after a mains supply break, the drive executes a procedure to calculate the motor frequency and direction of rotation. It will automatically recalibrate the output frequency to the measured value and reaccelerate the motor up to the reference frequency.

59	Functions
0 (no)	**Function disabled**
1 (On.2d)	Enable to catch a spinning motor which is rotating clockwise or anti-clockwise
2 (On.Fd)	Enable to catch a spinning motor which is rotating clockwise only
3 (On.rS)	Enable to catch a spinning motor which is rotating anti-clockwise only

• If the load is stationary at the time of the run command or when the mains supply returns, this operation may cause the machine to rotate in both directions before the motor accelerates.

• Before enabling this function, check that there is no danger to equipment and personnel.

60 : Maximum switching frequency

Sets the PWM switching frequency.

3 kHz	0
4.5 kHz	**1**
5.5 kHz	2
6 kHz	3
9 kHz	4
11 kHz	5

CAUTION:
A high switching frequency reduces the magnetic noise, but it increases the motor temperature rise and the level of radio-frequency interference emission, and reduces the starting torque.
If the temperature becomes too high, the drive can reduce the switching frequency selected by the user.

61 : Motor rated frequency

This is the point at which motor operation changes from constant torque to constant power.
In standard operation, it is the frequency indicated on the motor nameplate.

62 : Number of motor poles

When this parameter is at 0 (Auto), the drive automatically calculates the number of poles according to the rated speed (07) and the rated frequency (61). However, the value can be entered directly in accordance with the table below:

Motor rated speed rpm	Display	62
3000	2 P	1
1500	4 P	2
1000	6 P	3
750	8 P	4

63 : Autotune

• The measurement taken when 63 = 2 (rot) should be taken with the motor uncoupled since the variable speed drive drives the motor at 2/3 of its rated speed.
Check that this operation does not present any safety risk, and ensure that the motor is stopped before the autocalibration procedure.

• After modifying the motor parameters, repeat autotuning.

0 (no): no autotune

1 (StoP): measurement of motor characteristics when stopped.
The stator resistance and voltage offset are measured.
Procedure:
- Check that the motor parameters have been set and that motor is standstill.
- Enable the drive.
- Give a run command. The display indicates "Auto" and "tunE" alternately. Wait for the display to stabilise at "0.0".
- Disable the drive and remove run command.

The motor is then ready to operate normally.
Parameter 63 returns to 0 as soon as autotuning is complete.
CAUTION:
This autotune is performed automatically even though 63 = 0, in the following cases:
- initial drive commissioning
- return to factory settings, after the drive has been enabled and a run command given

2 (rot): measurement of motor characteristics with rotation.
The stator resistance and the voltage offset are stored, and the magnetising current and the leakage inductance are used to calculate the power factor 09. This mode is used to obtain optimum performance.
Procedure:
- Check that the motor parameters have been set and that motor is standstill.
- Enable the drive.
- Give a run command. The motor accelerates up to 2/3 of the rated speed, then performs a freewheel stop. During autotuning, the display indicates "Auto" and "tunE" alternately. Wait for the display to stabilise at "0.0".
- Disable the drive and remove run command.

The motor is then ready to operate normally.
Parameter 63 returns to 0 as soon as autotuning has been completed.

64 **: Parameter cloning**

Disable the drive before parameter cloning or transfering with the XPressKey (SDI2 terminal open).
0 (no): No action.
1 (rEad): When this parameter is stored at 1 (rEad) and the drive output is not active, the display alternates between "rEad" and "hEY ?". Pressing the "key" button causes the parameters contained in the copy key to be stored in the drive. When the transfer is complete, the parameter reverts to 0. The rEad function can also be activated via the pushbutton located on the copy key. The first press on the button corresponds to parameter 64 changing to 1 and the second press confirms it. Without exception, if confirmation is not received within 10 seconds of the first press, the action is cancelled.
2 (Prog): When this parameter is stored at 2 (Prog) and the drive output is not active, the display alternates between "Prog" and "hEY ?". Pressing the "key" button causes the parameters contained in the drive to be stored in the copy key. When the transfer is complete, the parameter reverts to 0. If confirmation is not received within 10 seconds of the first press, the action is cancelled.
3 (Auto): Any modification of a parameter is automatically saved to the copy key. The action is confirmed at the time of storing (M key). No data is written to the copy key on a return to factory settings.
CAUTION:
The copy key contains parameters relating to the drive rating. If the parameters are copied into a drive with a different rating, the parameters relating to the drive and the motor characteristics will not be copied and the message "C.rtg" will flash on the display to alert the user on the need to enter motor parameters.

65 **: Load defaults**

CAUTION :
Disable the drive before modifying 65.
0 (no): no procedure for return to factory settings has been set.
1 (Eur) : allows the drive to be configured for 50Hz mains supply as factory default setting.
2 (USA) : allows the drive to be configured for 60Hz mains supply as factory default setting.

4.3.14 - Security code

66 **: User security code**

If this parameter is other than 0 and 10 is set to 2 (Loc), no parameter modification can take place.
To modify a parameter, the user must enter the code equivalent to the value of 66 (see procedure described in section 4.3.6).

4.3.15 - Parameters linked to the drive operating status (67 to 80)

67 **: Unit displayed on power-up**

0: On power-up, the speed is displayed.
The unit depends on the setting of 69 (frequency in Hz, speed in rpm or a unit defined by the user).
1: On power-up, the load is displayed.
The unit displayed depends on the setting of 68 (motor load as a % or output current in A).
2: Displays the speed and the load alternately, or the current.

68 **: Selection of load display**

This parameter is used to obtain an indication of the load or the total current on the display.

68	LED display	Functions
0	**Ld**	**Display of the drive load level.**
1	A	Display of the total motor current.

69 **: Unit for displaying the speed**

69	Drive display	Function
0	Fr	Output frequency expressed in Hz.
1	**SP**	**Motor speed expressed in rpm.**
2	Cd	Customer unit defined using a coefficient determined in parameter 70 as follows : Cd = 79 motor speed in rpm x parameter 70

70 **: Customer unit**

This is a multiplication coefficient applied to the motor speed for expressing the speed in a unit defined by the user (see 69).
Example: to obtain a reading in m/min for an application where the product is moving 200 mm for each motor revolution ==> 70 = 0.2.

71 **and** 72 **:Store the last 2 trips**

Contains the last 2 drive trips.
71: indicates the most recent fault.

73 **and** 74 **:ADI1 and ADI2 levels**

Used to read the value of the analog input or the state of the corresponding digital input.

75 **: ADIO3 input or output**

Used to read the corresponding analog input or output.

76 **: Pre-offset reference**

Indicates the value of the selected reference before offset.

77 **: Pre-ramp reference**

Indicates the reference after the skip but before the acceleration or deceleration ramp.

78 **: Current magnitude**

Reading of the rms current in each drive output phase.
This is the result of the vectorial sum of the magnetising current and the active current.

79 **: Motor rpm**

Indicates the calculated motor speed.

80 **: DC bus voltage**

Indicates the DC bus voltage measurement.

5 - FAULTS - DIAGNOSTICS

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

The **Commander SX** display gives a certain amount of information which simplifies the diagnostic process.
This information is broken down into 2 categories:
- Information concerning operation
- Fault tripping

5.1 - Information concerning operation

This information tells the user the drive status when stopped or running.

-8888	Comment
Auto/tunE	• Auto and tunE are displayed alternately • Autocalibration phase in progress
dEC	Deceleration in progress after a stop command
inh	• The drive is disabled, and cannot start the motor • Freewheel stop
rdY	• The drive is enabled, and is waiting for a command • The motor is ready to run
StoP	The drive is holding the motor torque at zero speed (▣)
triP	• The drive is faulty • Alternating display of triP and the fault code (for the code meaning, please refer to section 5.2)
Alar./USrx	Alar. and USrx are displayed alternately, where x is user fault number (1 to 4) Alarms enabled by 10.54 to 10.57 (refer to advanced user guide)
Err/Crtg	Err and Crtg are displayed alternately. If the user confirms by pressing once on the XPressKey key, the parameters are transfered into the drive except motor parameters (06, 07, 08, 31 and 32)

5.2 - Fault tripping

If the drive goes into fault mode, the drive output bridge is inactive, and the drive no longer controls the motor.
The display indicates "triP" and the fault code alternately.
All the trips indicated by the display unit are listed in the following table in alphabetical order.

Fault code	PX-LCD code	Reason for fault	Solution
cL1	**ADI1 loss**	Loss of the current reference on analog input ADI1	• Check that current is > 3 mA • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
cL2	**ADI2 loss**	Loss of the current reference on analog input ADI2	
cL3	**ADIO3 loss**	Loss of the current reference on analog input ADIO3	
EEF	**EEPROM fail.**	Drive rating does not match with XPressKey	• Return to default factory settings (see 65). • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
enC2	**Encoder rot**	The measured position does not vary (the encoder is incorrectly connected or not supplied with power or the shaft is not turning)	• Check encoder connections • Check the motor rotation is normal
EnC1	**U sign. loss**	Loss of channel U	• Check the speed feedback • Replace the encoder
EnC2	**V sign. loss**	Loss of channel V	• Check the encoder voltage and connections
EnC3	**W sign. loss**	Loss of channel W	• Check the encoder voltage and connections
Fbus	**Fieldbus loss**	Disconnection of the fieldbus	• If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping

Fault code		Reason for fault	Solution
It.AC	**Motor I^2t**	Motor overload I x t	• Read the battery value in 4.19 • Check that the motor is not overloaded • Adjust the rated speed (▣) • Check that the motor rated current is correctly set (06) • Speed feedback: check the coupling, and check that the signal is not disturbed • Check the number of motor poles in 62 • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
It.br	**Brak. resist.**	Braking resistor overload I x t	• Read the battery value in 10.39 • Increase the resistor ohmic value • Check that 10.30 and 10.31 are set correctly (braking cycle too long) • Check the resistor wiring • Check the integrated transistor
Oht1	**Dv over heat**	IGBT overheating (sensor)	• Reduce the motor load, the cycle, the switching frequency and the acceleration and deceleration ramps • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
Oht2	**BR over heat**	Internal resistor overheating (sensor)	• Reduce the switching frequency • Reduce the cycle and the motor load • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
OI.AC	**Over current**	Overcurrent at drive output	• Check motor insulation and connection • Increase acceleration and deceleration rates • Check feedback devices • Check motor cable lenght • Reduce the speed controller gains 29 (3.10), 30 (3.11) and 3.12 ▣ and ⬬ • If not already set, perform an autotune 63 = 2 ⬬ • Reduce current controller gains 31 (4.13) and 32 (4.14) ▣ and ⬬
OIbr	**Brak.IGBT**	IGBT braking overcurrent	• Check the resistor insulation • Correct the short-circuit at the resistor output • Set a higher resistor ohmic value
OId1	**24V over Id**	Overload on +24V source or logic output	• Check the total current consumption • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
OSP	**Over speed**	Overspeed	• The speed is higher than 1.2 times the value of 02 • Check that the load is not driving • Check that the overspeed threshold has been set correctly • Adjust the speed loop gains • Set a longer deceleration time
OU	**DC over volt**	DC bus overvoltage	• Provide a braking resistor (optional) If a resistor is already connected, reduce its value (within permitted limits) • Check that the mains supply is not disturbed • Check the motor insulation • Set a longer deceleration time in 04 • Check the deceleration mode
ph	**In Ph. loss**	Phase loss	• Check the mains supply (3 phases present and balanced) • Check the level of supply voltage (at full load) **Note:** The loss of one phase can only be detected if the active current is between 50% and 100% of the rated value. The drive attempts to stop the motor before fault tripping occurs.
Ph.AC	**Out Ph. loss**	Motor phase loss	• Check the connection of phases U, V and W in both the motor and the drive
rot	**A/B reversed**	The a, b, a\, b\ signals are the wrong way round	• Reverse 2 motor phases or 2 encoder channels
rS	**Stator res.**	Stator resistance measurement fault	• Adapt the drive power to that of the motor • Check the connection of the motor cables.

Fault code	PX-LCD code	Reason for fault	Solution
SCL	**COM loss**	Serial link fault	• Replace the keypad or the cable • Check the connectors between the keypad and the drive • Check that the cable is not damaged • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
Secd	**Sec.disable**	Secure input fault	• Give a stop command before enabling the drive
Th	**Motor PTC**	Motor sensor trip	• Check the motor load • Reduce the level of overload • Check the motor cooling and the ambient temperature • Check the wiring of the ADI2 terminal on the control terminal block • If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
tr01	**User 1**	User fault 1 via logic input	
tr02	**User 2**	User fault 2 via logic input	
tr03	**User 3**	User fault 3 via logic input	
tr04	**User 4**	User fault 4 via logic input	
tr05	**User 5**	User fault 5 via serial link	• If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
tr06	**User 6**	User fault 6 via serial link	
tr07	**User 7**	User fault 7 via serial link	
tr08	**User 8**	User fault 8 via serial link	
tr09	**User 9**	User fault 9 via serial link	
tr10	**User 10**	User fault 10 via serial link	• If 10.37 = 1 (Ctld), the drive decelerates the motor without tripping
tun3	**UVW revers.**	The u, v, w switching signals are the wrong way round	• Check encoder and motor connections
tun4	**U sign.miss.**	Some signals are present, but U is missing	• Check encoder connections
tun5	**V sign.miss.**	Some signals are present, but V is missing	• Check encoder connections
tun6	**W sign.miss.**	Some signals are present, but W is missing	• Check encoder connections
tun7		The number of pairs of poles set is incorrect (the revolutions measured mechanically with a, b and electrically with u, v, w are inconsistent, given the number of pairs of poles entered)	• Check encoder lines per revolution • Verify 5.11 (62) " number of motor poles " setting
tunE	**Autotun. fail**	Autocalibration error	• Drive set to fault mode during the autocalibration phase • The Stop key has been pressed • The SDI2 contact has been opened during the autocalibration phase
UU	**Under volt.**	DC bus undervoltage	Check the mains supply

6 - OPERATING EXTENSIONS

6.1 - Add-on options

• It is imperative that these options (except XPressKey and PX-LCD) are installed or removed with the drive powered down.

These options can be integrated in the product, without the need for special tools and without affecting the overall dimensions.

CAUTION:

If a number of add-on options are being used, all combinations are possible except for the association of two communication interfaces or of one communication interface and one I/O extension module (only one slot available).

6.1.1 - Access to slots

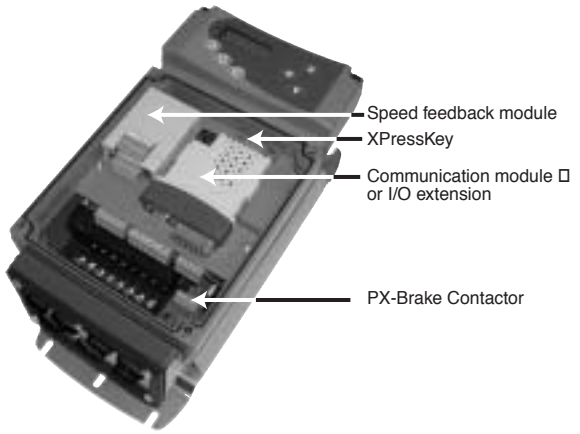
- Unscrew the 4 screws (1 to 4) on the cover using a flat or torx 25 screwdriver.
- Lift the cover.

CAUTION:

To maintain the Commander SX IP66/Nema 4X protection, it is essential to:

- Avoid damaging the seal while removing the cover.

- Reposition the cover correctly when reassembling and tighten each of the 4 screws to a tightening torque of 2 Nm (1.5 lb/ft).



6.1.2 - XPressKey

6.1.2.1 - General information

The XPressKey option is used to save a copy of all the **Commander SX** parameters so that they can be duplicated very simply in another drive.

6.1.2.2 - Saving parameters in XPressKey

• Connect XPressKey to the **Commander SX** serial port.

• With the drive disabled "Inh", set 64 to "Prog", then, press the M button. The display alternates between "Prog" and "hEY?". Confirm the transfer of parameters into XPressKey by pressing on key button of the XPressKey.

CAUTION :

If confirmation is not received within 10 seconds, the procedure is cancelled.

• When the display reverts to "COPY OK" then "Inh", the transfer is complete and XPressKey can be disconnected and replaced in its slot.

6.1.2.3 - Setting drive parameters with XPressKey

• Connect XPressKey to the serial port.

• With the drive disabled "Inh", press the "Key" button for a first time. The display alternates between "rEad" and "hEY?". Confirm the transfer of parameters into the drive by pressing the "Key" button a second time.

CAUTION:

If confirmation is not received within 10 seconds, the procedure is cancelled.

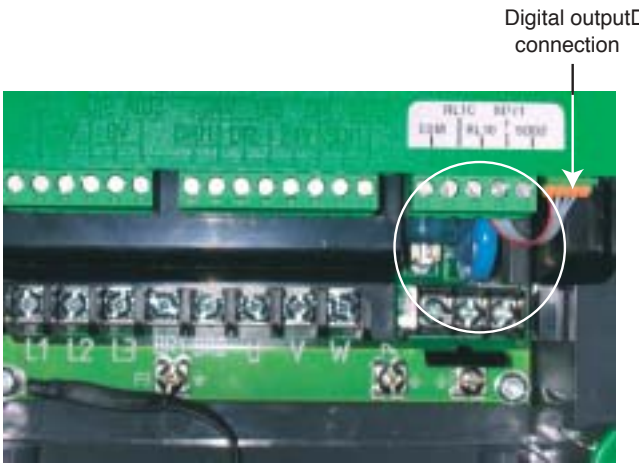
• When the display reverts to "COPY OK" then "Inh", the transfer is complete and XPressKey can be disconnected and replaced in its slot.

If the drive power rating is different and the operator wants to transfer from XPressKey to the drive then the drive will trip on alarm " C.rtg ". If the user confirms by pressing once on the XPressKey key, the parameters are transfered into the drive, except motor parameters (06, 07, 08, 31 and 32).

CAUTION :

Do not transfer XPressKey parameters between two drives with different voltage/frequency (400V type drive into 200V type one or vice versa, and 200V 50Hz type drive into 200V 60Hz type one or vice versa).

6.1.3 - PX-Brake Contactor

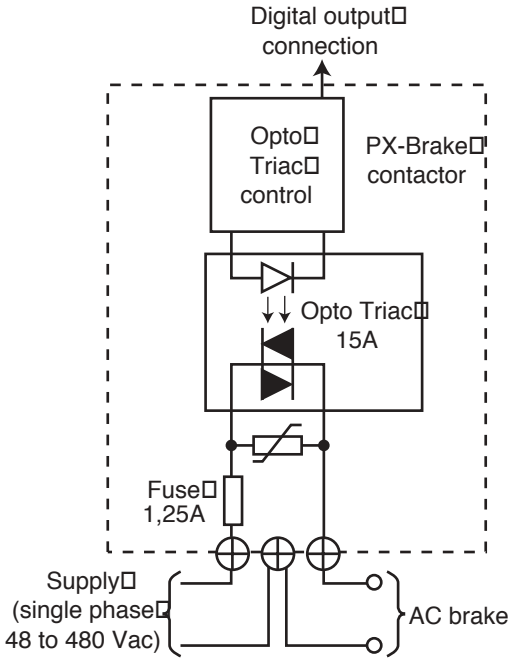


6.1.3.1 - General

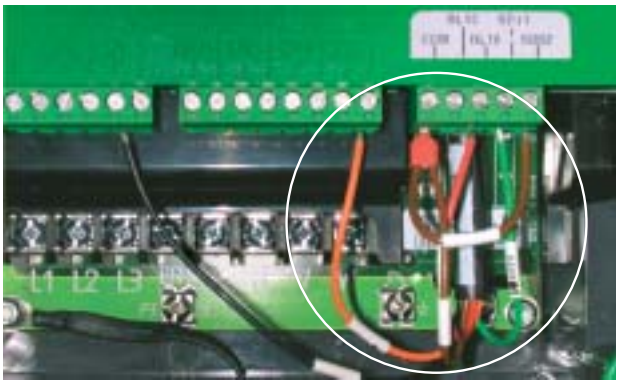
The optional PX-Brake Contactor allows the direct control of an electro-mechanical brake from a single phase AC supply. This option is connected to a dedicated digital output, controlled from the brake command (parameter ㊱ to ㊸).

Note : This option is protected by a fuse (type : FA 660V, 1.25A) marked " F1 " on PCB.

6.1.3.2 - Connections



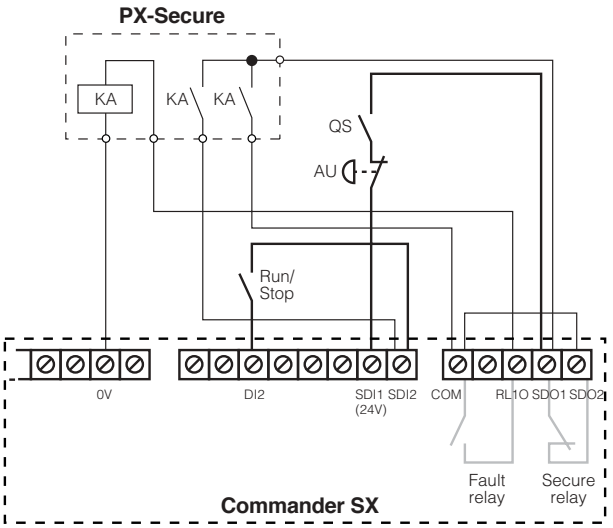
6.1.4 - PX-Secure



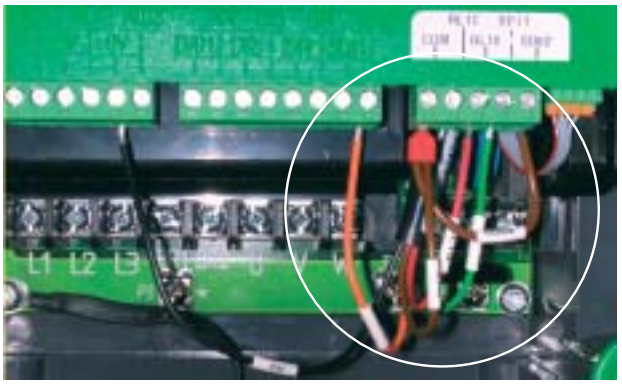
6.1.4.1 - General

Optional PX-Secure allows the use of terminal SDI2 as secure input as per safety standard EN954-1 category 2 or 3 (removal of line contactor).

6.1.4.2 - Connections



6.1.5 - PX-Brake Contactor Secure



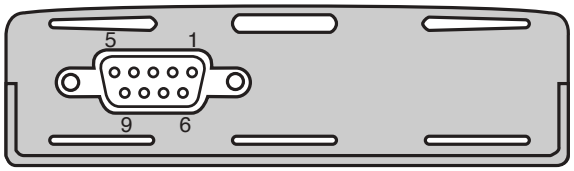
Optional PX-Brake Contactor Secure combines on one single board two options, the PX-Secure and the PX-Brake contactor, for more detailed information, refer to § 6.1.3 and 6.1.4.

6.1.6 - SM-PROFIBUS DP

6.1.6.1 - General information

The SM-PROFIBUS DP module is used to communicate with a Profibus-DP network.
It integrates a 16-bit microprocessor, and its transmission speed can be as much as 12 Mbps.
The **Commander SX** powers the module internally.

6.1.6.2 - Connection



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

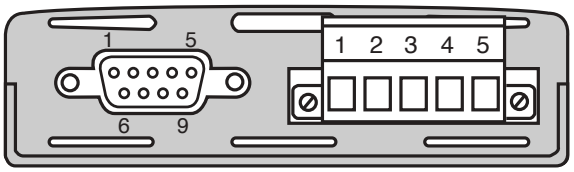
We strongly recommend the use of Profibus certified connectors.
These connectors take 2 Profibus cables and have a terminal block with 4 screws, one for each data connection. They also have a shielding connection holder, which ensures continuity of the shielding for good immunity to interference on the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

6.1.7 - SM-DeviceNet

6.1.7.1 - General information

The SM-DeviceNet module is used to communicate with a DeviceNet network.
It integrates a 16-bit microprocessor, and its transmission speed can be as much as 500 Kbps.
The module should be powered by the DeviceNet power supply. Because of the drive backup power supply, the electronics for the drive and its modules is maintained, which allows the DeviceNet network to continue to communicate with the drive, despite the loss of the mains supply.

6.1.7.2 - Connection



5-terminal term. blk	9-pin SUB-D	Functions	Description
1	6	0V	0V for the external power supply
2	2	CAN-L	Negative data line
3	3.5	Shielding	Connection for the cable shielding
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, because SUB-D connectors are not recognised for DeviceNet conformity.

6.2 - Parameter-setting options

6.2.1 - PX-LCD console

6.2.1.1 - General information

This console makes it much easier to set the **Commander SX** parameters and access all parameters. Its LCD display, consisting of one line of 12 characters and 2 lines of 16 characters, offers text which can be displayed in 5 languages (English, French, German, Italian and Spanish).
The PX-LCD console has 3 main functions:
- A read mode for **Commander SX** supervision and diagnostics.
- An interactive parameter-setting wizard which makes it very simple to configure the **Commander SX**.
- Access to all the **Commander SX** parameters in order to optimise settings or configure special applications.

6.2.1.2 - Read mode

- From the time it is switched on, the PX-LCD display is positioned in read mode. By pressing the ▲ or ▼ keys, the user can scroll through all the parameters required for supervision and diagnostics:
- motor current
- motor frequency
- motor voltage
- analogue I/O levels
- logic I/O states
- logic function states
- timer
- last faults

6.2.1.3 - Interactive parameter-setting wizard

The parameters are set in successive steps. The parameters offered at each step by the PX-LCD console depend on parameters set in the previous steps. The user will therefore only be offered those parameters required by the application.

6.2.1.4 - Access to all parameters

All the parameters, organised by menus, can be accessed via the PX-LCD console.

6.2.2 - SXSoft

The SXSoft enables very user-friendly parameter setting or supervision of the **Commander SX** from a computer and offers numerous functions:
- quick commissioning,
- LEROY-SOMER motor database
- file saving
- online help
- comparison of 2 files or one file with the factory setting
- printing of a complete file or differences compared to the factory setting
- supervision
- diagnostics
- representation of parameters in table or graphic form.

To connect the computer to **Commander SX**, use the CT Comms Cable.

6.3 - PX-Brake resistor

⚠ • Special care must be taken when carrying out any work near the resistor, as there is high voltage present and heat is given off.

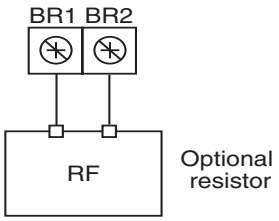
• If a braking resistor is connected, parameter 55 must be set to 0 (Fst).

6.3.1 - Installation

⚠ • The surface temperature of the resistors can reach 120°C (248°F). The spacers supplied with the optional PX-Brake resistor are used to ensure that there is a distance of 10 mm (0.4 in) between the resistor and the support on which the drive is fitted. Ensure that the materials forming the support can withstand heat radiation.

The braking resistors are supplied on a metal plate ready to be fitted using 4 screws at the back of the drive.
To ensure that the heat losses from the resistors are dissipated correctly, the drive must be fitted with spacers (supplied with the resistors).

6.3.2 - Connection



6.3.3 - Electrical characteristics

• Minimum compatible resistance

Commander SX	Minimum ohmic value (Ω)
Sizes 1 and 2	150
Size 3	50

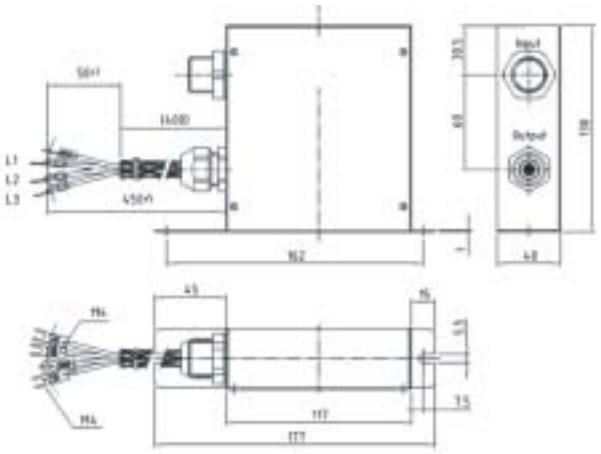
• Built-in braking resistors

PX-Brake	Ohmic value (Ω)	Power (W)
Resistor 300-200	1 x resistor of 200 Ω	300
Resistor 600-200	2 x resistors of 400 Ω connected in parrallel	600
Resistor 300-50	1 x resistor of 50 Ω	300
Resistor 600-50	2 x resistors of 100 Ω connected in parrallel	600

6.4 - RFI filter

Size 1 and 2 drives conform to the drive standard EN 61800-3 since they have an RFI filter integrated internally.
For conformity of size 3 drives and in certain conditions for sizes 1 and 2 (see section 1.5), an external RFI filter must be added (FS 6376-16-07).
CAUTION:
Use one RFI filter for each drive.

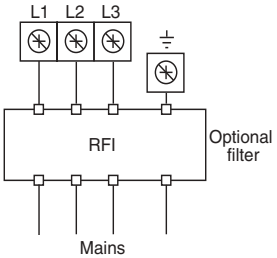
6.4.1 - Dimensions



6.4.2 - Installation

For sizes 1 and 2, the filter should be mounted on the left as close as possible to the drive.
For size 3, it could be mounted on the heatsink.

6.4.3 - Connection



The customer connects the filter to the mains supply, without any special tools, on an IP66/Nema 4X dust and damp proof insulation displacement connector.

6.5 - PX-Cabling kit

Optional PX-Cabling kit includes the following components :
- 2 x PE M20 EMC,
- 1 x PE M20 Polyamide,
- 2 x PE M16 EMC,
- 1 x PE M16 Polyamide,
- nuts.

This optional kit allows to meet the IP66/Nema 4X wash-down duty specifications. Refer to § 3.2 and 3.6.1.

6.6 - PX-Disconnect

Optional PX-Disconnect is a lockable-IP66/Nema 4X tri-polar switch rated at 16A, with auxiliary contact NO-NF.
PX-Disconnect is supplied fitted on a back plate ready to be mounted on the side of the drive.

7 - MAINTENANCE

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

• When a fault 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 disable the drive power supply and wait 1 minute to ensure that the capacitors have discharged.

• Check that the DC bus voltage is below 40 V before carrying out any work.

• 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 disabled.

• All protective covers must remain in place during tests.

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

7.1 - 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 printed circuits while the drive is still under warranty, as this would then render warranty 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.

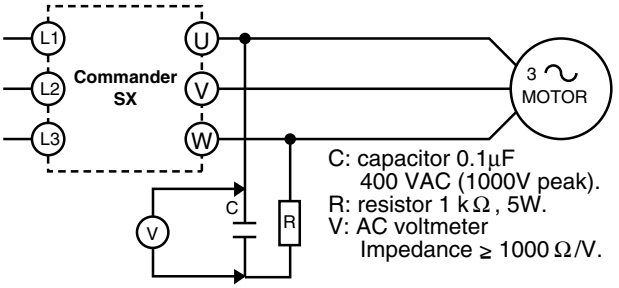
From time to time, check that the power connections are correctly tightened.

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

7.2 - Voltage, current and power measurements

7.2.1 - Measuring the voltage at the drive output

The harmonics generated by the drive mean that it is not possible to take a correct measurement of the voltage at the motor input using a conventional type of voltmeter.
However it is possible to obtain an approximate value of the rms voltage of the fundamental wave (that which affects the torque) using a conventional voltmeter connected as shown in the diagram below.



7.2.2 - Measuring the motor current

The current drawn by the motor and the drive input current can be measured approximately using a conventional moving coil ammeter.

7.2.3 - Measuring the drive input and output power

The drive input and output power can be measured using an electrodynamic instrument.

7.3 - Spare parts list

Please consult CONTROL TECHNIQUES.

7.4 - Exchanging products

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