EMERSON
Industrial Automation

User Guide

Commander SX

**IP66/Nema 4X
AC variable speed drive**

Part Number : 3840 en - 09.2007/c

CONTROL TECHNIQUES

www.controltechniques.com

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.

⚠ WARNING

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

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

The variable speed drive is fitted with safety devices which, in the event of a 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.
Before programming a high speed, it is important that the user checks that the installation can withstand it.

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

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

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Manual corresponding to software versions higher than or equal to 3.10

This generation of drives requires the use of SXSoft parameter-setting software version higher than or equal to V3.00, or the KEYPAD-LCD version higher than or equal to V3.10

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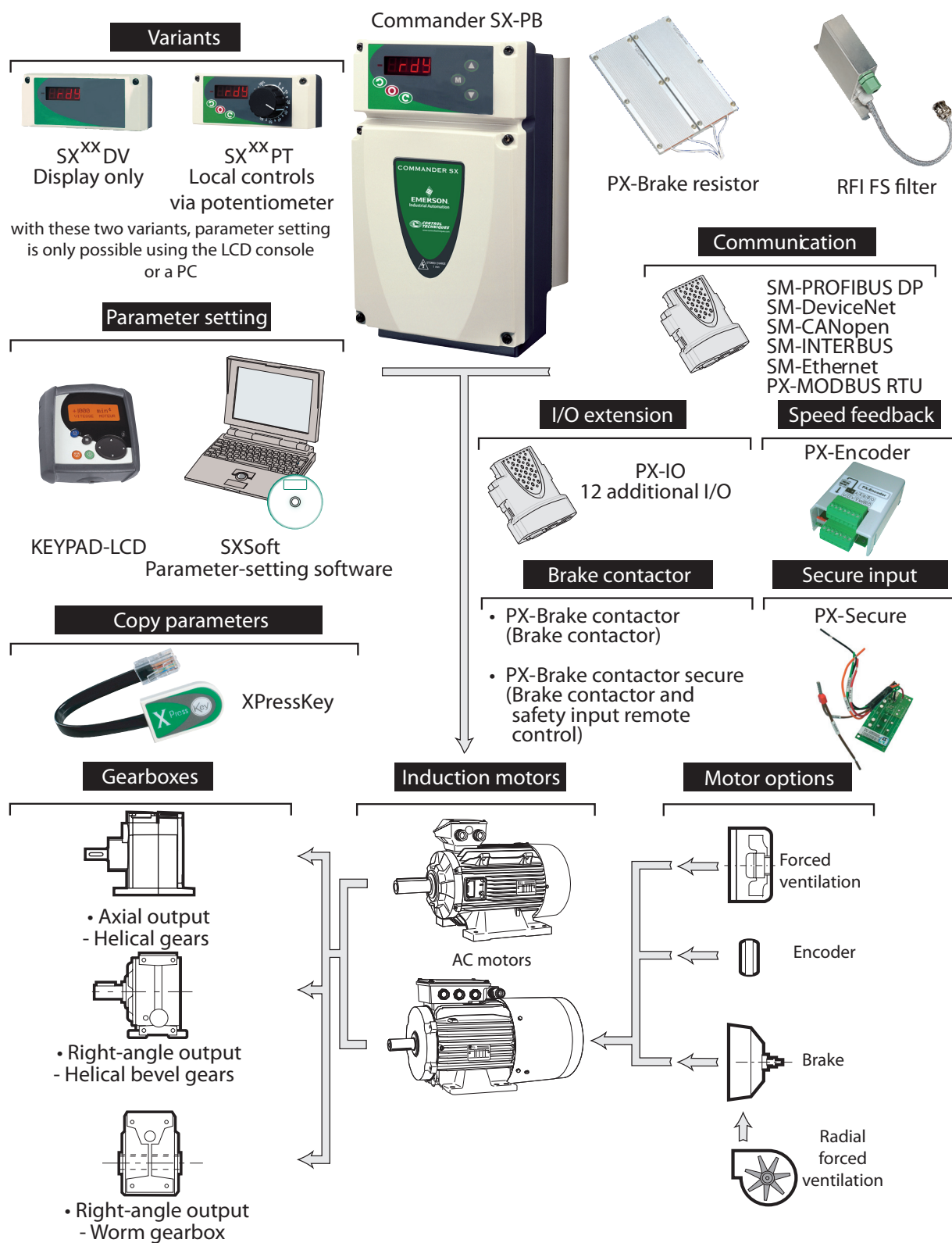
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[1] Independent approval by CETIM has been given for sizes 1 to 3.

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-PB

Variants

SX^{XX}DV
Display only

SX^{XX}PT
Local controls
via potentiometer

with these two variants, parameter setting is only possible using the LCD console or a PC

PX-Brake resistor

RFI FS filter

Communication

SM-PROFIBUS DP
SM-DeviceNet
SM-CANopen
SM-INTERBUS
SM-Ethernet
PX-MODBUS RTU

Parameter setting

KEYPAD-LCD

SXSoft
Parameter-setting software

I/O extension

PX-IO
12 additional I/O

Speed feedback

PX-Encoder

Copy parameters

XPressKey

Brake contactor

• PX-Brake contactor
  (Brake contactor)

• PX-Brake contactor secure
  (Brake contactor and safety input remote control)

Secure input

PX-Secure

Gearboxes

• Axial output
  - Helical gears

• Right-angle output
  - Helical bevel gears

• Right-angle output
  - Worm gearbox

Induction motors

AC motors

Motor options

Forced ventilation

Encoder

Brake

Radial forced ventilation

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONTENTS

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONTENTS

COMMANDER SX
IP66/Nema 4X AC variable speed drive
GENERAL INFORMATION

1 - GENERAL INFORMATION

1.1 - General

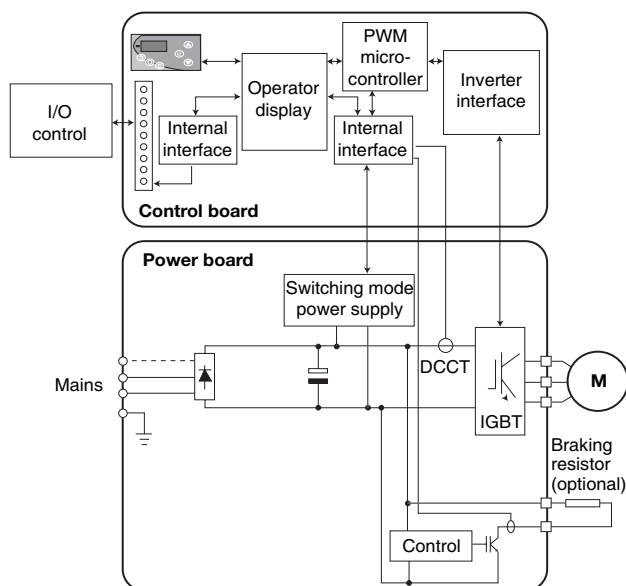The **Commander SX** is an IP66/Nema 4X electronic drive for supplying 3-phase induction motors.

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 flux (vector mode ■), the **Commander SX** controls a motor fitted with an incremental encoder or a Hall effect sensor. This makes it possible to control the torque and 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.
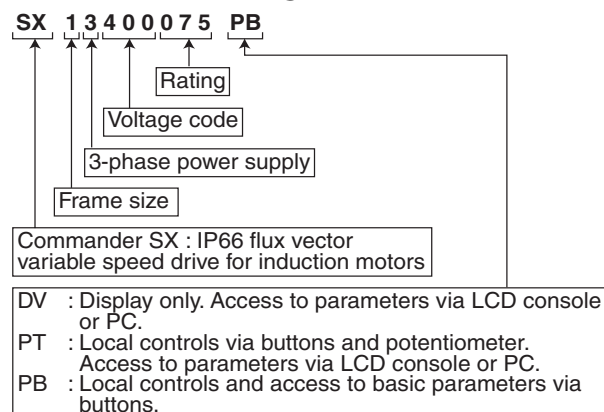
Its IP66/Nema 4X protection means that the drive can be installed close to the motor, without a cabinet.

Its flexibility enables the user to adapt the drive to his application in the majority of cases.

Diagram

1.2 - Product designation

DV	: Display only. Access to parameters via LCD console or PC.
PT	: Local controls via buttons and potentiometer. Access to parameters via LCD console or PC.
PB	: Local controls and access to basic parameters via buttons.

Nameplate

	INPUT			OUTPUT			
Ph	V	Hz	I(A)	V	Hz	I(A)	kW
3	380 - 480	50 - 60	2	0 - 480	0 - 400	2.5	0.75

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	- Use of cable glands IP66/Nema 4X or higher, correctly installed (section 3.2): 100% - Use of cable bushes: < 95% non condensing
Altitude	< 1000 m (3,000ft) without derating. The maximum authorised altitude is 4000 m (12,000ft), but above 1000 m (3,000ft), the continuous output current should be derated by 1% per additional 100 m (300ft) over 1000 m (e.g. for an altitude of 3000 m (9,000ft), derate by 20%).
Vibrations	• Non-packaged product: 0.01 g^2/Hz 1 in accordance with standard IEC 68-2 hr 34. • Sinusoidal vibration (packaged product): 2-9 Hz 3.5 ms^{-2} 9-200 Hz 10 ms^{-2} 200-500 Hz 15 ms^{-2} in accordance with 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.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
GENERAL INFORMATION

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	2% around the rated frequency (50 or 60 Hz)
Output frequency range	0 to 400 Hz (please consult us for applications requiring an output frequency > 150 Hz)
Supply voltage	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

WARNING:
In its factory setting, the drive operates with a switching frequency of 4.5 kHz at 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_{out}: Output power.

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

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

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

Commander SX		Power		Current
Size	Rating	P_{out} at 400V (kW)	P_{out} at 460V (HP)	I_{co} at 4.5 kHz (A)
1	SX13400075	0.75	1	2.5
1	SX13400110	1.1	1.5	3.2
1	SX13400150	1.5	2	4.5
2	SX23400220	2.2	3	6
2	SX23400300	3	4	8
2	SX23400400	4	5	10
3	SX33400550	5.5	7.5	13.5
3	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} depending on the switching frequency					
Size	3-phase supply			3 kHz	4.5 kHz	5.5 kHz	6 kHz	9 kHz	11 kHz
	208V - 10% to 240V +10%	380V - 10% to 480V +10%							
1	SX13200037	SX13400075	40°C	2.5	2.5	2	1.9	1.7	1.3
			50°C	2.3	2.3	1.7	1.6	1.4	1
	SX13200055	SX13400110	40°C	3.2	3.2	2.9	2.7	2.4	1.8
			50°C	2.9	2.7	2.4	2.3	2	1.5
	SX13200075	SX13400150	40°C	4.5	4.5	4	3.8	3.4	2.5
			50°C	4	3.7	3.4	3.3	2.9	2.1
2	SX23200110	SX23400220	40°C	6	6	5.4	5.3	4.6	3.5
			50°C	5.2	4.9	4.6	4.5	4	3
	SX23200150	SX23400300	40°C	8	8	7.2	6.8	6.1	4.6
			50°C	6.9	6.5	6.1	5.8	5.2	3.9
	SX23200220	SX23400400	40°C	10	10	9	8.5	7.6	5.7
			50°C	8.4	8	7.3	7.2	6.5	4.8
3	SX33200300	SX33400550	40°C	13.5	13.5	12.4	11.6	10.3	7.7
			50°C	11.6	11	10.5	9.9	8.8	6.6
	SX33200400	SX33400750	40°C	16.9	16.5	15.2	14.5	12.9	9.7
			50°C	14.4	13.7	12.8	12.3	11	8.2

COMMANDER SX
IP66/Nema 4X AC variable speed drive
GENERAL INFORMATION

1.5 - Electromagnetic compatibility (EMC)

WARNING:
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 discharges	Product casing	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	Bursts of fast transients	Control cable	Level 4 (industrially hardened)
		Power cable	Level 3 (industrial)
IEC 61000-4-5￼EN 61000-4-5	Shock waves	Power supply cables phase and earth	Level 4
		Power supply cables between phases	Level 3
		Earth signal circuits (refer to section 3.6.2)	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	-	Up to the required standard
EN 50082-2￼IEC 61000-6-2￼EN 61000-6-2	Generic immunity standards for the industrial environment	-	Up to the required standard
EN 61800-3￼IEC 61800-3￼EN 61000-3	Variable speed drive standards	Conforms to the first and second environment	

Emission						
			Conformity conditions according to the switching frequency			
				With RFI filter		
Standard	**Description**	**Application**	**Length of drive/motor cables**	**Internal (standard)**	**External (optional)**	
				Sizes 1 and 2	**Sizes 1 and 2**	**Size 3**
EN 61800-3￼IEC 61800-3	Variable speed drive standards	Second environment with unrestricted distribution (DENR)	≤4m (≤13ft)	≤ 11 kHz	≤ 11 kHz	≤ 11 kHz
			≤20m (≤65ft)	≤ 4.5 kHz	≤ 11 kHz	≤ 4.5 kHz
		Second environment with restricted distribution (DER)	≤20m(≤65ft)	≤ 11 kHz	≤ 11 kHz	≤ 4.5 kHz
		First environment with unrestricted distribution (R)	≤4m (≤13ft)	-	≤ 4.5 kHz	-
		First environment with restricted distribution (I)	≤4m (≤13ft)	≤ 4.5 kHz	≤ 11 kHz	≤ 4.5 kHz
			≤20m (≤65ft)	-	≤ 4.5 kHz	≤ 4.5 kHz
(EN 50081-1)￼EN 61000-6-3￼IEC 61000-6-3	Generic emission standards for residential, commercial and light industrial environments	AC supply	≤4m (≤13ft)	-	≤ 4.5 kHz	–
(EN 50081-2)￼EN 61000-6-4￼IEC 61000-6-4	Generic emission standards for the industrial environment	AC supply	≤4m (≤13ft)	≤ 4.5 kHz	≤ 11 kHz	≤ 4.5 kHz
			≤20m (≤653ft)	-	≤ 4.5 kHz	≤ 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.**

COMMANDER SX
IP66/Nema 4X AC variable speed drive
GENERAL INFORMATION

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 correctly in parameter **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.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
MECHANICAL INSTALLATION

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 current regulations in 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
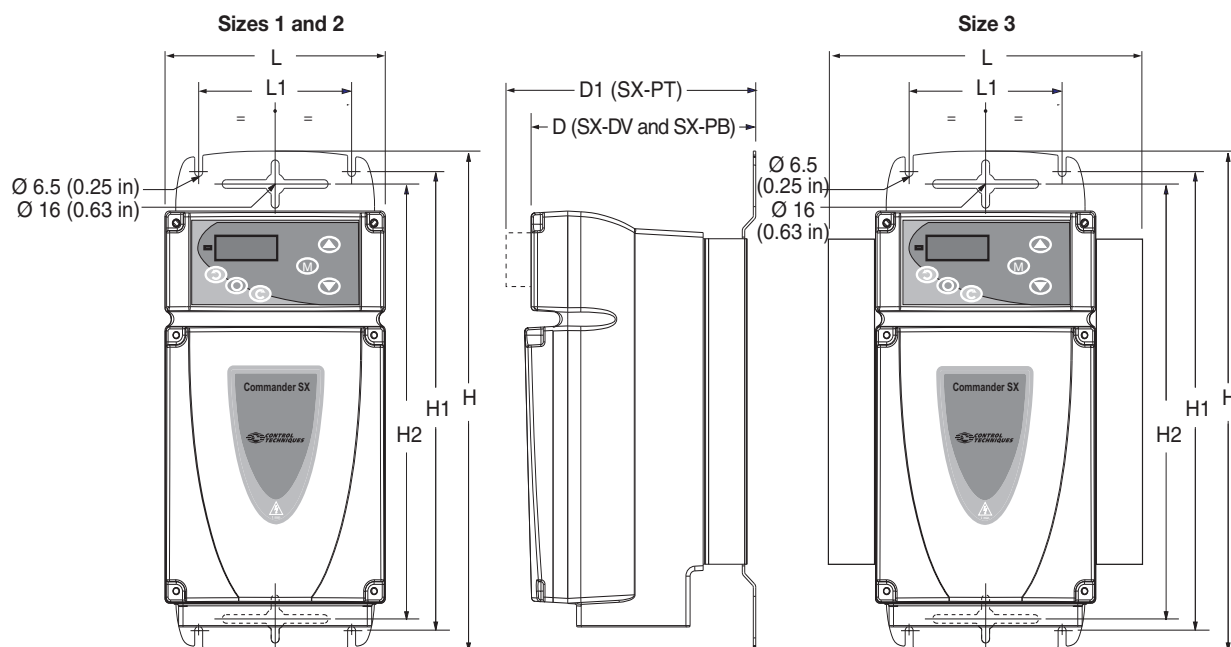
Commander SX		Dimensions mm (inches)							Screw	Weight
Size	Rating	L	L1	H	H1	H2	D	D1		(kg)
1	SX13200037 to SX13200075 SX13400075 to SX13400150	180 (7.08)	125 (4.92)	380 (14.96)	350 (13.77)	330 (12.99)	189 (7.44)	204 (8.03)	M6	4.7 (10.36)
2	SX23200110 to SX23200220 SX23400220 to SX23400400	180 (7.08)	125 (4.92)	380 (14.96)	350 (13.77)	330 (12.99)	223 (8.77)	238 (9.37)	M6	6.7 (14.77)
3	SX33200300 and SX33200400 SX33400550 and SX33400750	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°F).

• 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.

WARNING:

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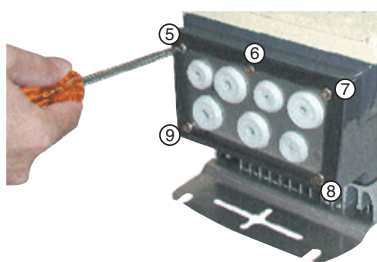
- Unscrew the 5 screws (5 to 9) on the cable gland plate using a flat or torx 25 screwdriver.
- Unscrew the grounding strip.
- Remove the cable gland plate.
- Replace the plugs fitted on the holes which should be used, with IP66/Nema 4X cable glands (or higher), as specified in the table below.

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

WARNING:

• The Commander SX is supplied with IP66/Nema 4X 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. See section 6.5

• The plugs fitted as standard on the plate can be used as cable bushes 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 IP 54/Nema 12.

UL conformity: The cable bushes are deemed to be transportation plugs and must be replaced by cable glands or UL approved cable bushes.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.3 - Terminal block locations

Control terminal blocks

10V ADI1 0V ADI2 0V ADIO3 | DIO1 24V DI2 DI3 24V DI4 | SDI1 (+24V) SDI2 | COM RL1C RL1O SDO1 SDO2
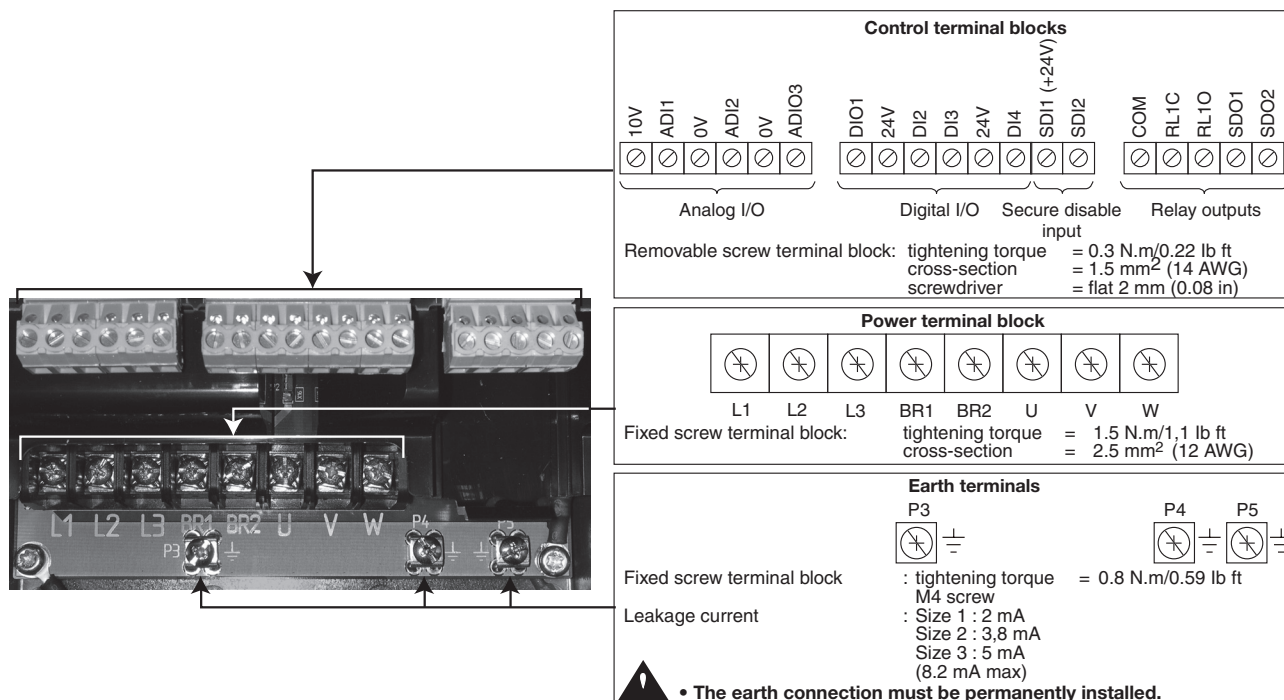
Analog I/O | Digital I/O | Secure disable input | Relay outputs

Removable screw terminal block:
tightening torque = 0.3 N.m/0.22 lb ft
cross-section = 1.5 mm^2 (14 AWG)
screwdriver = flat 2 mm (0.08 in)

Power terminal block

L1 L2 L3 BR1 BR2 U V W

Fixed screw terminal block:
tightening torque = 1.5 N.m/1,1 lb ft
cross-section = 2.5 mm^2 (12 AWG)

Earth terminals

P3 | P4 P5

Fixed screw terminal block : tightening torque = 0.8 N.m/0.59 lb ft
M4 screw

Leakage current : Size 1 : 2 mA
Size 2 : 3,8 mA
Size 3 : 5 mA
(8.2 mA max)

⚠ • **The earth connection must be permanently installed.**

3.4 - Connection of the power

3.4.1 - Secure disable input

This input, when opened, causes the drive to lock. Independent of the microprocessor, it acts on several levels of control from the output bridge. It is designed in such a way that even if one or more circuit components were to fail, the absence of torque on the motor shaft is guaranteed with a very high level of integrity.

This input is used to create a safety function using the principles of category 1 or 3 of standard EN954-1, depending on the application diagram.

The design of the "freewheel stop" function using input SDI2 has been evaluated by CETIM.

The results of this examination are recorded in report no. 732773/502/47A (declaration of conformity no. D526 0104 1602).

This built-in functionality enables the drive to act as substitute for a contactor in order to stop the motor in freewheel mode.

By using this secure disable input redundantly with another drive digital input, a diagram can be used which is capable of resisting a single fault. The drive will stop the motor in freewheel mode using two different control channels.

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

To unlock the drive and provide the secure disable function, secure disable input SDI2 must be connected to the +24V source SDI1.

This +24V source should be reserved exclusively for the secure disable input function.

⚠ • **The secure disable input is a safety component which must be incorporated into the complete system dedicated to machine safety. As for any installation, the complete machine must be the subject of a risk analysis by the integrator which will determine the safety category with which the installation must comply.**
• **The secure disable input, when open, locks the drive, meaning the dynamic braking function is no longer available. If a braking function is required before the drive secure disable lock is applied, a time-delayed safety relay should be installed to activate locking automatically after the end of braking.**
If braking needs to be a machine safety function, it should be provided by an electromechanical solution since the dynamic braking by the drive function is not considered to be a safety function.
• **The secure disable input does not provide the electrical isolation function. Before any work is carried out, the power supply must be cut by an approved isolating device (isolator, switch, etc).**
• **The secure disable function is not enabled when the drive is controlled via the KEYPAD-LCD or via a fieldbus.**
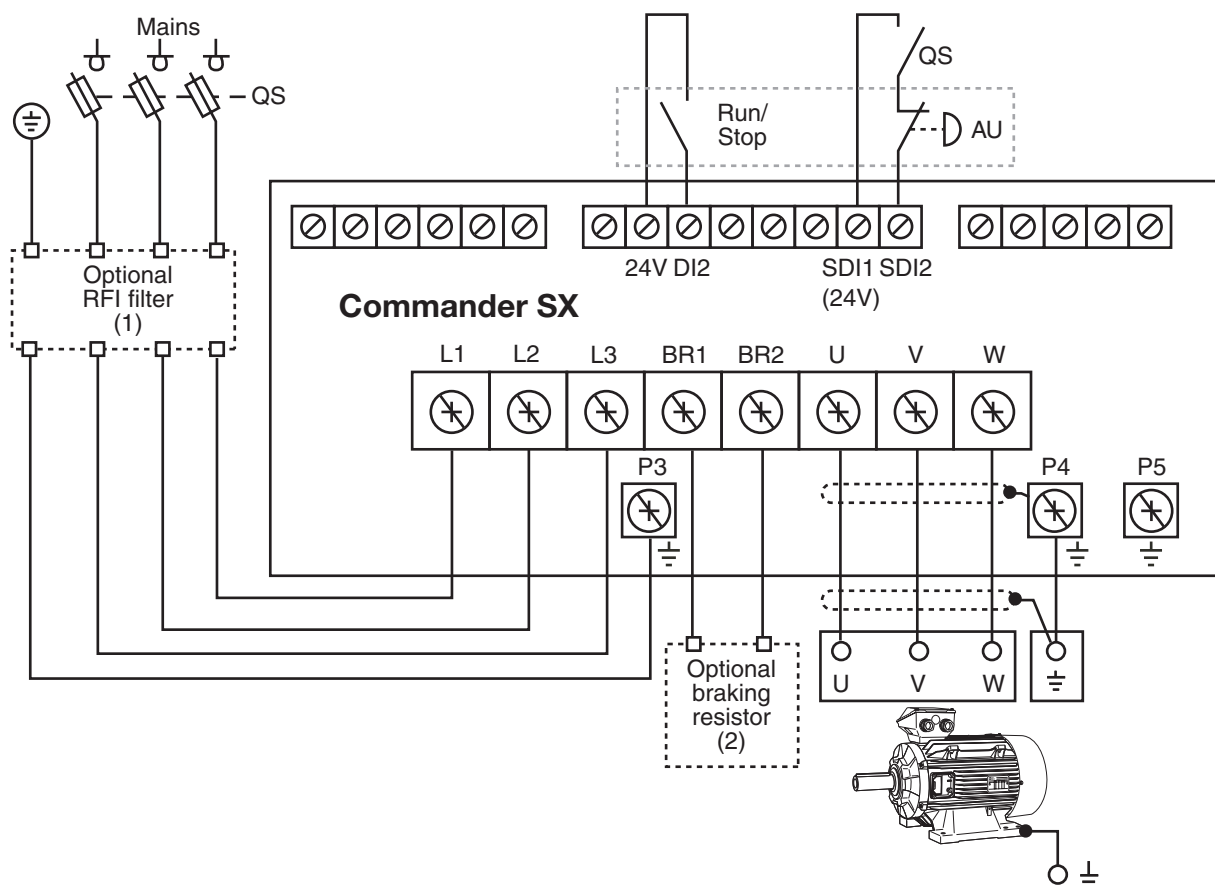
COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.4.2 - 3-phase AC power supply, in accordance with safety standard EN 954-1 - category 1

Using secure disable input SDI2 to stop safely

QS : Fused isolator: QS must be opened before any intervention on the electrical parts of the drive or motor.
AU : Emergency stop button
(1) Optional RFI filter. For conformity with the generic standard EN 61000-6-4 (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

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

WARNING:
The special way in which the secure disable input is managed is not compatible with the Run/Stop commands being controlled by the Commander SX-PT and PB keypads. When control via a KEYPAD-LCD is required, input SDI2 should be viewed as a simple unlocking input. In this case, the power diagram must comply with the usual safety regulations.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.4.3 - 3-phase AC power supply, in accordance with safety standard EN 954-1 - category 2 or 3

Using secure disable input SDI2 redundantly with digital input DI2
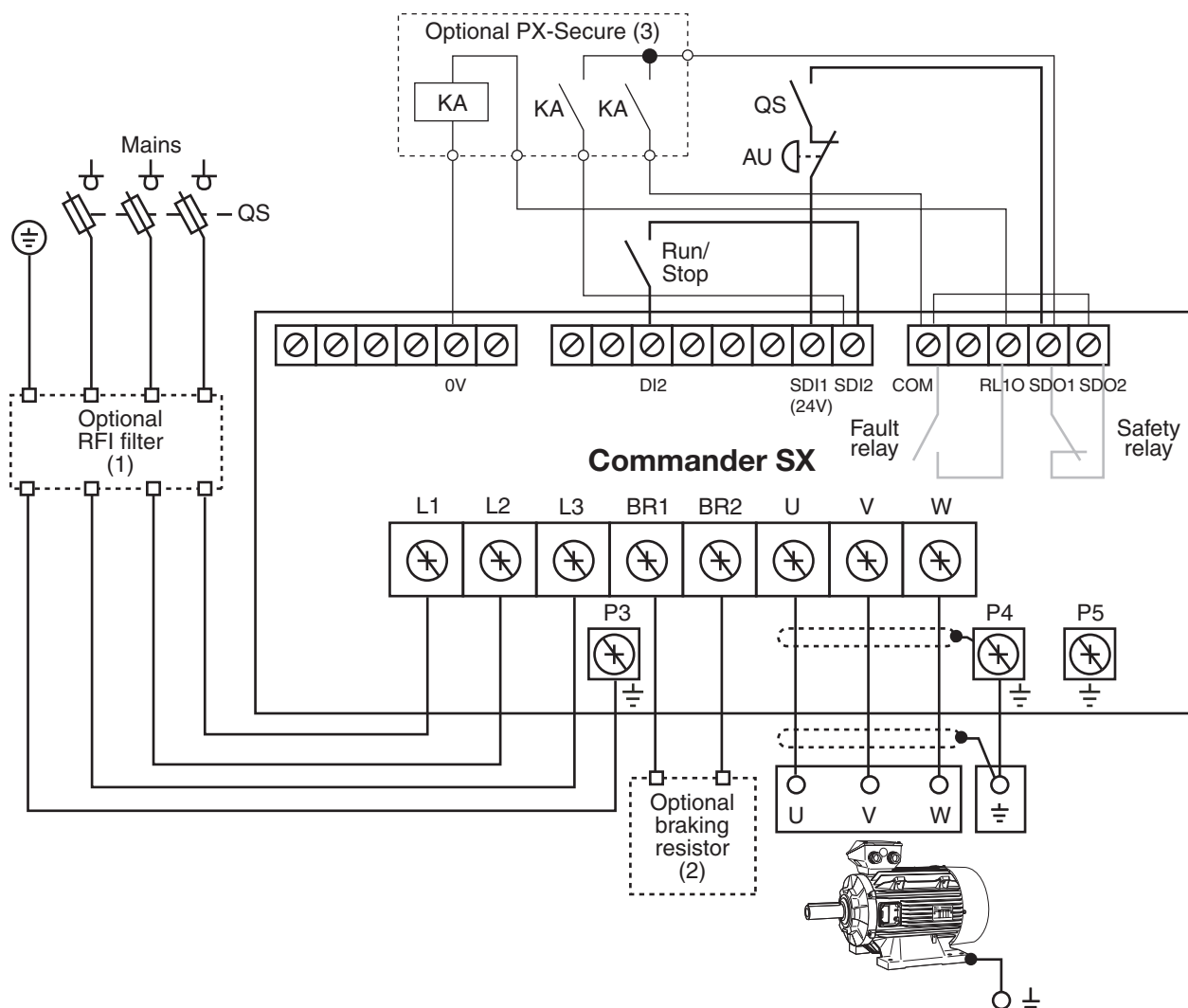
QS : Fused isolator: QS must be opened before any intervention on the electrical parts of the drive or motor.
AU : Emergency stop button
KA : Remote control relay.
(1) Optional RFI filter. For conformity with the generic standard EN 61000-6-4 (EN 50081-2) for size 3 drives and in certain conditions for 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) Optional remote control, categories 2 or 3, with secure disable input. See section 6.1.5.

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

Duplication of the stop command on a digital input enables use of the internal drive redundancy to perform a freewheel stop (application of category 3 principles in accordance with EN 954 for the part relating to the drive).

WARNING:
The special way in which the secure disable input is managed is not compatible with the Run/Stop commands being controlled by the Commander SX-PT and PB keypads. When control via a KEYPAD-LCD is required, input SDI2 should be viewed as a simple unlocking input. In this case, the power diagram must comply with the usual safety regulations.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

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	Mains supply					I_{co} (1)	Motor	
	Input I at 380V	Fuses		Cable cross-section (2)			Cable cross-section (1) (3)	
		IEC (gG)	USA	EN60204	UL508C		EN60204	UL508C
	(A)	(A)	(A)	(mm^2)	(AWG)	(A)	(mm^2)	(AWG)
SX13200037	2.5	6		1	18	2.5	1	22
SX13200055	3.5	6		1	18	3.2	1	20
SX13200075	4.5	10		1.5	14	4.5	1	18
SX23200110	5.6	12	15	1.5	14	6	1	16
SX23200150	8	16		1.5	12	8	1.5	14
SX23200220	10.5	20		1.5	12	10	1.5	14
SX33200300	13.5	20		2.5	12	13.5	2.5	14
SX33200400	16.5	20		2.5	12	16.5	2.5	12
SX13400075	2.5	6		1	18	2.5	1	22
SX13400110	3.5	6		1	18	3.2	1	20
SX13400150	4.5	10		1	14	4.5	1	18
SX23400220	5.6	12	15	1.5	14	6	1.5	16
SX23400300	8	12	15	1.5	12	8	1.5	14
SX23400400	10.5	16	15	1.5	12	10	1.5	14
SX33400550	13.5	16		2.5	12	13.5	2.5	14
SX33400750	16.5	20		2.5	12	16.5	2.5	12

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 the phase cable cross-section is ≤ 16 mm^2 (5 AWG), use an earth cable with the same cross-section.

WARNING:
To reduce leakage currents, we recommend the use of cables with a capacity of 260 pF/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 conformity

3.4.5.1 - Specified mains supply
The drive can be incorporated in an installation which can deliver 5000 rms symmetrical Amps maximum at a voltage of 480 VAC maximum, protected by a UL approved R/C (JFHR2).

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 25 A) and the short-circuit symmetrical current does not exceed 5 kA.
Example of fast-blow fuses 5 (sized as indicated above) :
- GBH from Bussman
- Amp - trap ATM from Gould

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

Notes

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

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 analog source
Accuracy		± 2%
Maximum output current		20 mA
Protection		Threshold at 15V

2	ADI1	Analog or digital input 1
Characteristics		Analog voltage (common mode) or **unipolar** 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 range		0 to 20 mA ±5%
Maximum voltage		33V/0V
Maximum current		33 mA
Input impedance		500 Ω
Digital 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	0V common

4	ADI2	Analog or digital input 2
Characteristics		Analog voltage (common mode) or **unipolar** 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 range		0 to 20 mA ±5%
Maximum voltage		33V/0V
Maximum current		33 mA
Input impedance		500 Ω
Digital 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
Motor sensor input		
Internal voltage		5V
Trip threshold		≥ 3.3 kΩ
Reset threshold		< 1.8 kΩ

6	ADIO3	Analog or digital input or analog output 3
Characteristics		Analog voltage (common mode) or **unipolar** 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 range		0 to 20 mA ±5%
Maximum voltage		33V
Maximum current		33 mA
Input impedance		500 Ω
Digital 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)
Maximum current		10 mA
Current output		
Current range		0 to 20 mA
Maximum voltage		10V
Maximum load resistor		1 kΩ

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

7	**DIO1**	Digital input or output 1

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

8	**+24V**	+24V internal source
11		

Output current	100 mA in total
Overload current	150 mA
Accuracy	± 5%
Protection	Current limiting and setting to trip mode

9	**DI2**	Digital input 2
10	**DI3**	Digital input 3
12	**DI4**	Digital input 4

Characteristics	Digital input (positive logic)
Thresholds	0: < 5V 1: > 10V
Voltage range	0 to +24V
Sampling/refreshment	2 ms
Absolute maximum voltage range	0V to +35V
Load	15 kΩ
Input threshold	7.5V

13	**SDI1**	+24V dedicated to the secure disable input
14	**SDI2**	Secure disable/drive unlocking input

Characteristics	Digital input (positive logic)
Thresholds	0: < 5V 1: > 18V
Voltage range (relay power supply)	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**	Safety contact
19	**SDO2**	

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

3.5.2 - Connection of a Commander SX-PT control terminal block

As standard, the **Commander SX-PT** cannot be used to access parameter setting.
Follow the connection diagram below for commissioning using the factory configuration.
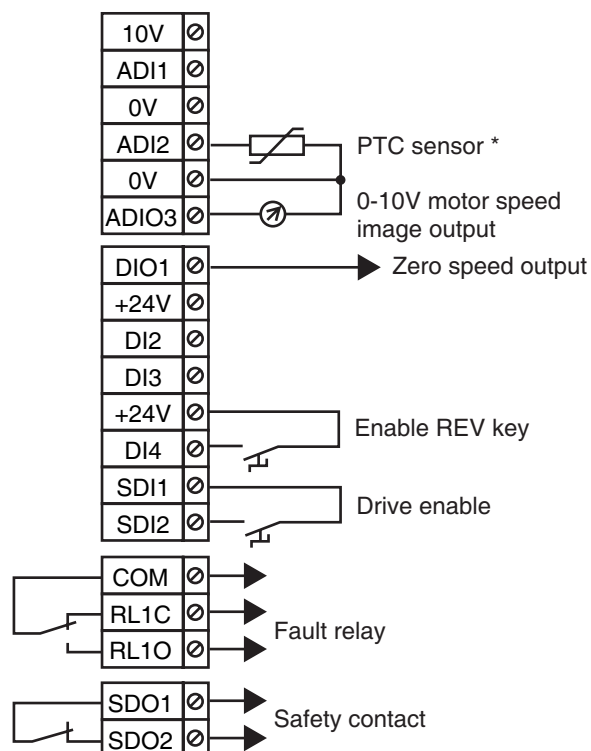
In this configuration, Run/Stop commands and the speed reference come from the KEYPAD-LCD.
* If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

WARNING:
Input SDI2 is configured as a simple unlocking input.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

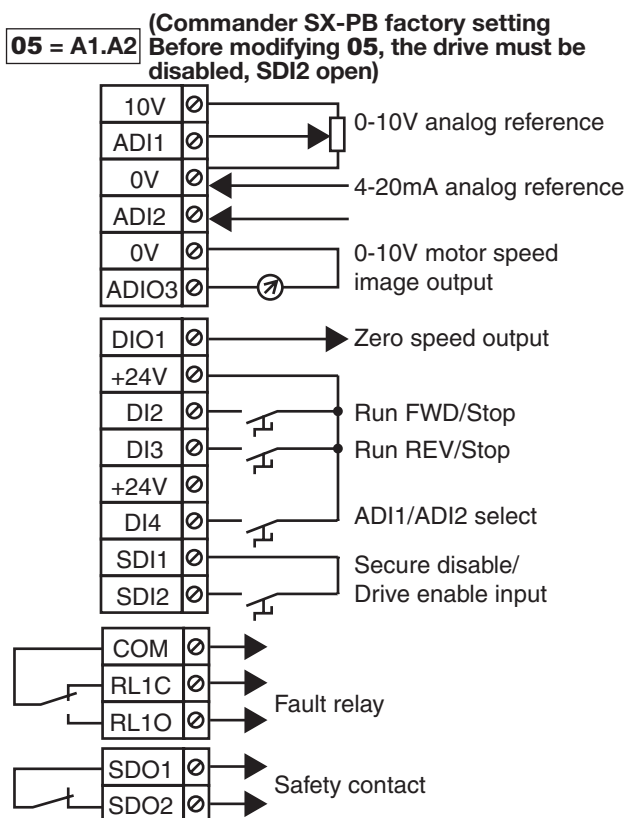## 3.5.3 - Preset configurations for the control terminal block

WARNING:
These configurations can be accessed from a Commander SX-PB or from a Commander SX-DV combined with an KEYPAD-LCD or the 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 A1.A2: voltage (0-10V) or current (4-20mA) reference

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

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

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

3.5.3.2 - Configuration A1.Pr: voltage reference (0-10V) or 3 preset references
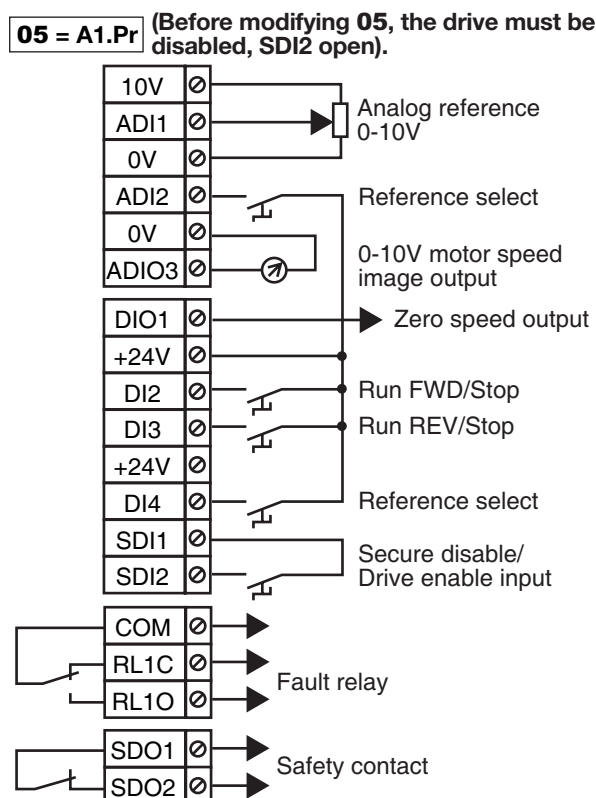
05 = A1.Pr (Before modifying **05**, the drive must be disabled, SDI2 open).

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

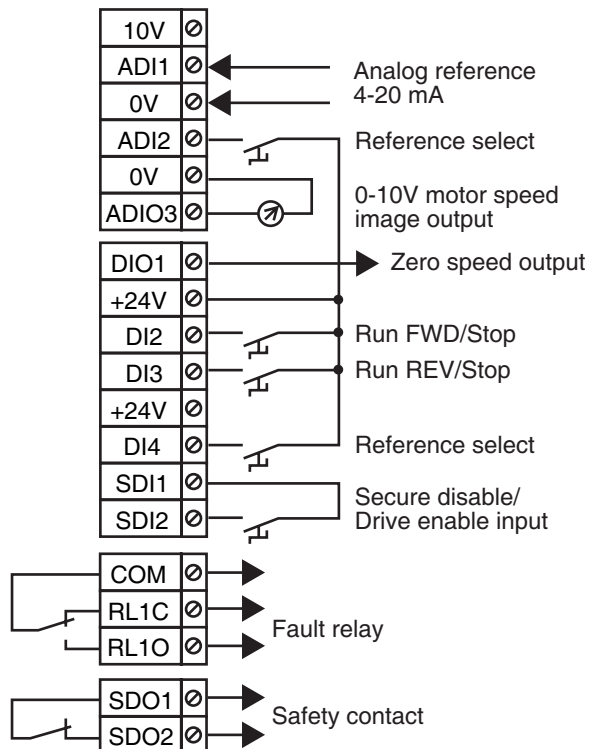**Note:** Input SDI2 must be closed before executing the run command.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.5.3.3 - Configuration A2.Pr: current reference (4-20mA) or 3 preset references

3.5.3.4 - Configuration 4Pr: 4 preset references
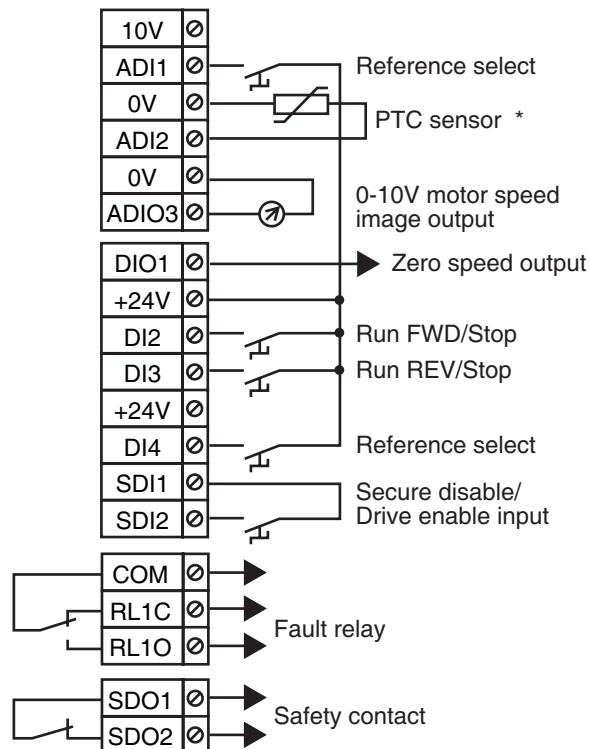
05 = A2.Pr	**(Before modifying 05, the drive must be disabled, SDI2 open).**

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

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

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

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 does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

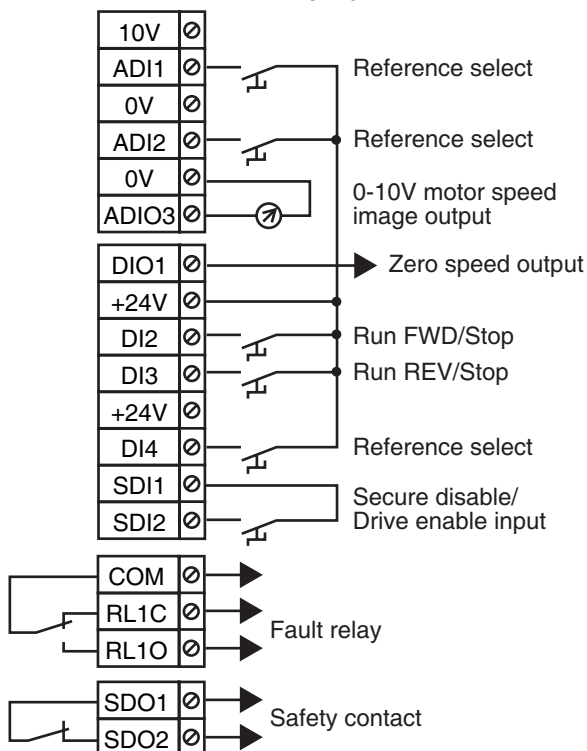**Note:** Input SDI2 must be closed before executing the run command.
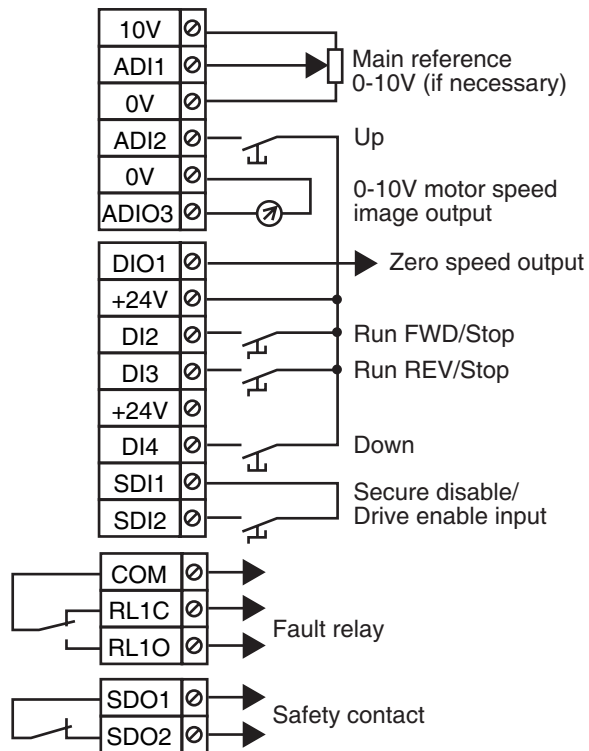
COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.5.3.5 - Configuration 8Pr: 8 preset references

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

10V	
ADI1	Reference select
0V	
ADI2	Reference select
0V	
ADIO3	0-10V motor speed image output
DIO1	Zero speed output
+24V	
DI2	Run FWD/Stop
DI3	Run REV/Stop
+24V	
DI4	Reference select
SDI1	Secure disable/ Drive enable input
SDI2	
COM	
RL1C	Fault relay
RL1O	
SDO1	Safety contact
SDO2	

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

3.5.3.6 - Configuration E.Pot: motorised potentiometer

05 = E.Pot **(Before modifying 05, the drive must be disabled, SDI2 open).**

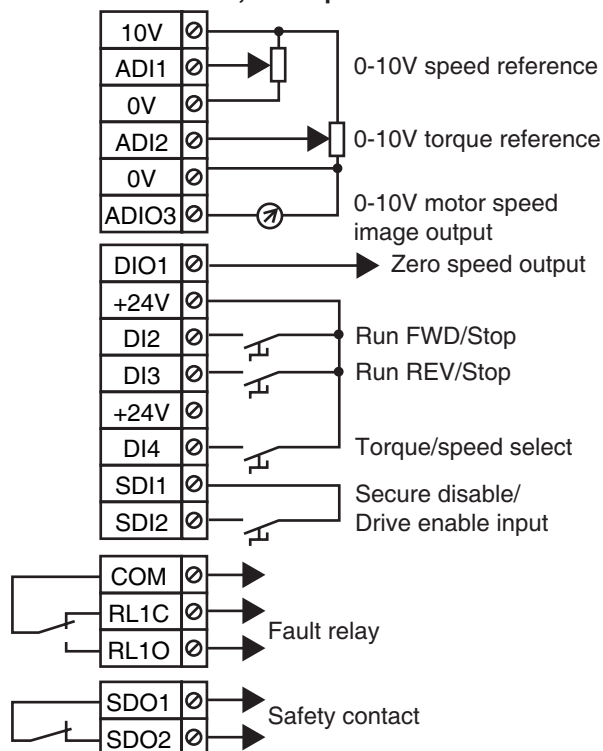| 10V | |
ADI1	Main reference 0-10V (if necessary)
0V	
ADI2	Up
0V	
ADIO3	0-10V motor speed image output
DIO1	Zero speed output
+24V	
DI2	Run FWD/Stop
DI3	Run REV/Stop
+24V	
DI4	Down
SDI1	Secure disable/ Drive enable input
SDI2	
COM	
RL1C	Fault relay
RL1O	
SDO1	Safety contact
SDO2	

Note: Input SDI2 must be closed before executing the run command.
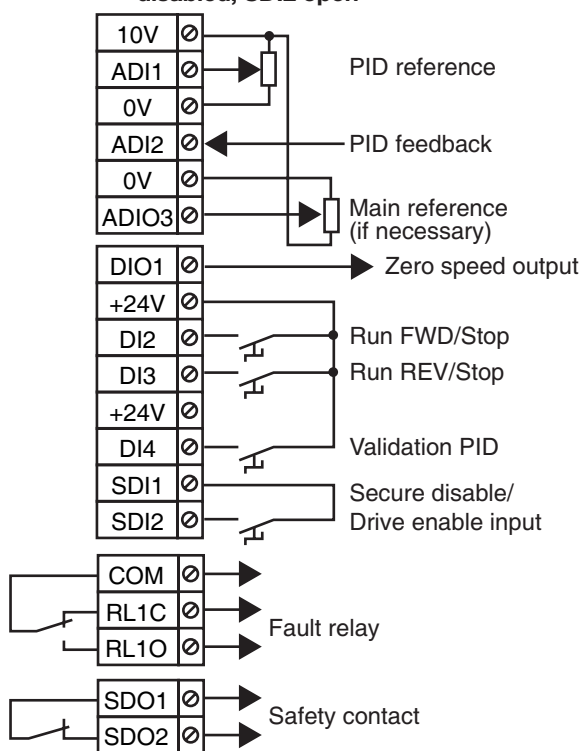
COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.5.3.7 - Configuration Torq: Speed or torque control

05 = Torq (Before modifying **05**, the drive must be disabled, SDI2 open

Terminal	Description
10V	
ADI1	0-10V speed reference
0V	
ADI2	0-10V torque reference
0V	
ADIO3	0-10V motor speed image output
DIO1	Zero speed output
+24V	
DI2	Run FWD/Stop
DI3	Run REV/Stop
+24V	
DI4	Torque/speed select
SDI1	Secure disable/ Drive enable input
SDI2	
COM	
RL1C	Fault relay
RL1O	
SDO1	Safety contact
SDO2	

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

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

3.5.3.8 - Configuration PID: PID control

05 = PID (Before modifying **05**, the drive must be disabled, SDI2 open

Terminal	Description
10V	
ADI1	PID reference
0V	
ADI2	PID feedback
0V	
ADIO3	Main reference (if necessary)
DIO1	Zero speed output
+24V	
DI2	Run FWD/Stop
DI3	Run REV/Stop
+24V	
DI4	Validation PID
SDI1	Secure disable/ Drive enable input
SDI2	
COM	
RL1C	Fault relay
RL1O	
SDO1	Safety contact
SDO2	

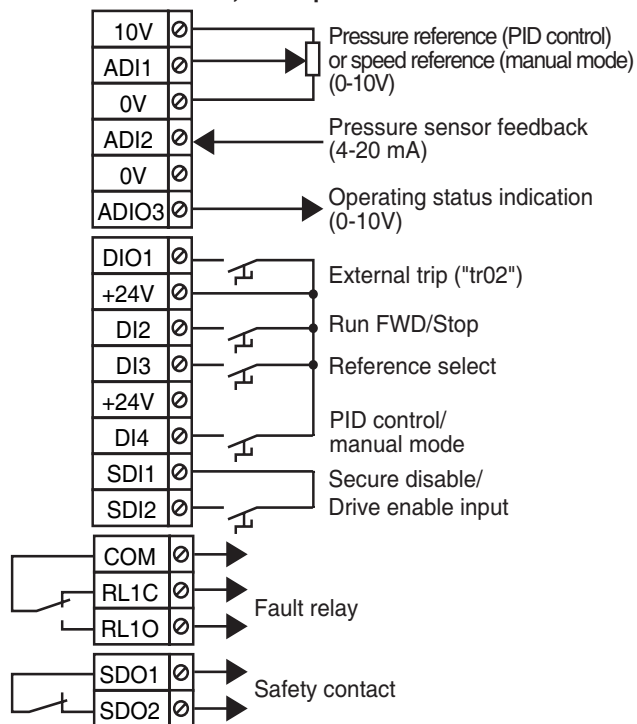**Note:** Input SDI2 must be closed before executing the run command.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.5.3.9 - Configuration PUMP: pump control

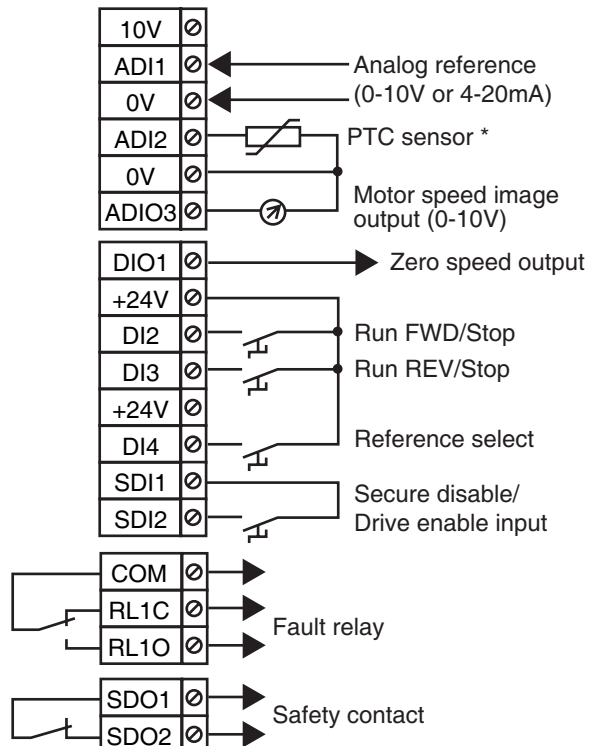05 = PUMP (Before modifying **05**, the drive must be disabled, SDI2 open

DI3	Reference selection
0	0-10V analog reference (ADI1)
1	Digital reference 0-100% defined by **18**

DI4	PID control/manual mode
0	Manual mode (speed)
1	PID control

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

3.5.3.10 - Configuration A.CtP: voltage or current input and PTC sensor management

05 = A.CtP (Before modifying **05**, the drive must be disabled, SDI2 open

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

* If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

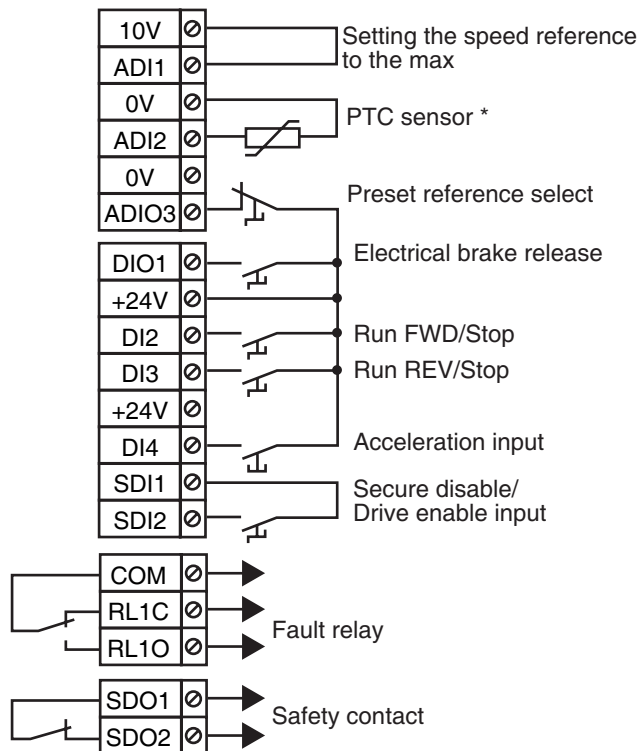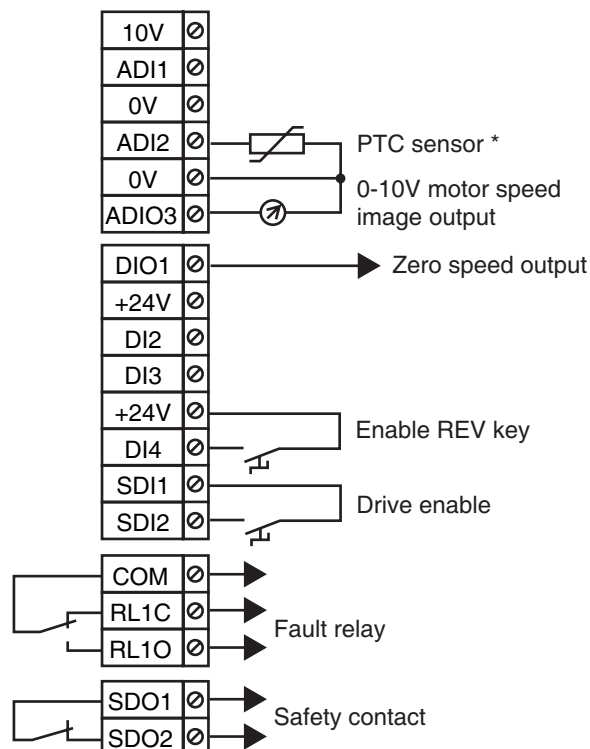**Note:** Input SDI2 must be closed before executing the run command.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

3.5.3.11 - Configuration HoiS: control of travelling crane or hoist

| 05 = HoiS | (Before modifying 05, the drive must be disabled, SDI2 open). |
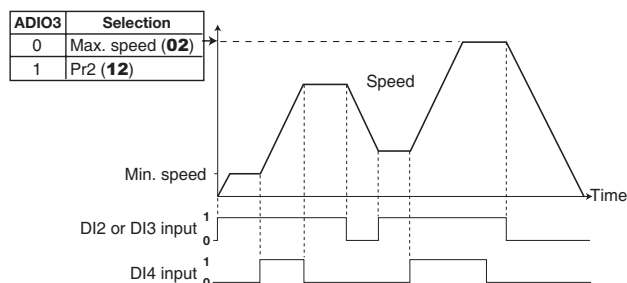
Terminal	Connection
10V	Setting the speed reference to the max
ADI1	
0V	PTC sensor *
ADI2	
0V	Preset reference select
ADIO3	
DIO1	Electrical brake release
+24V	
DI2	Run FWD/Stop
DI3	Run REV/Stop
+24V	
DI4	Acceleration input
SDI1	Secure disable/
SDI2	Drive enable input
COM	
RL1C	Fault relay
RL1O	
SDO1	Safety contact
SDO2	

ADIO3	Selection
0	Max. speed (02)
1	Pr2 (12)

Speed

Min. speed

Time

DI2 or DI3 input

DI4 input

* If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

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

3.5.3.12 - Configuration Pad: control via KEYPAD-LCD (Commander SX-PT factory setting, invalid for the Commander SX-DV)

| 05 = Pad | (Before modifying 05, the drive must be disabled, SDI2 open). |

Terminal	Connection
10V	
ADI1	
0V	
ADI2	PTC sensor *
0V	0-10V motor speed image output
ADIO3	
DIO1	Zero speed output
+24V	
DI2	
DI3	
+24V	Enable REV key
DI4	
SDI1	Drive enable
SDI2	
COM	
RL1C	Fault relay
RL1O	
SDO1	Safety contact
SDO2	

* If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

WARNING:
Input SDI2 is configured as a simple unlocking input.

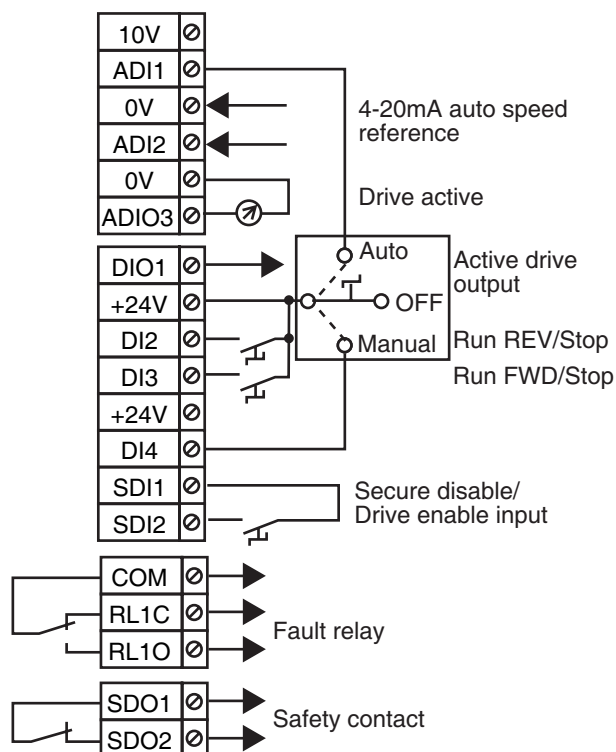**Note:** Input SDI2 must be closed before executing the run command.

**3.5.3.13 - Configuration HuAC: auto-manual mode
(invalid for the Commander SX-DV)**

05 = HuAC **(Before modifying 05, the drive must be disabled, SDI2 open).**

Terminal	Description
10V	
ADI1	
0V	4-20mA auto speed reference
ADI2	
0V	
ADIO3	Drive active
DIO1	Auto — Active drive output
+24V	OFF
DI2	Manual — Run REV/Stop
DI3	Run FWD/Stop
+24V	
DI4	
SDI1	Secure disable/ Drive enable input
SDI2	
COM	
RL1C	Fault relay
RL1O	
SDO1	Safety contact
SDO2	

OFF	No run command or reference is taken into account.
Auto	Run/Stop commands and the reference come from the terminals.
Manual	Run/Stop commands and the reference come from the **Commander SX-PB** Keypad.

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

COMMANDER SX
IP66/Nema 4X AC variable speed drive
CONNECTIONS

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 analog 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
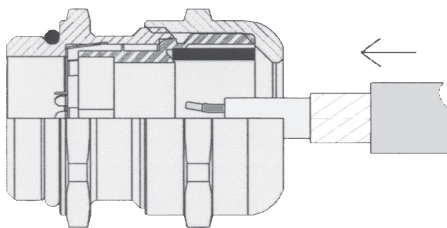
Step 3: tighten the gland
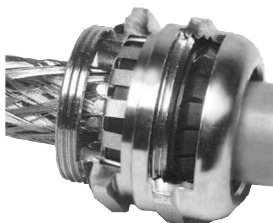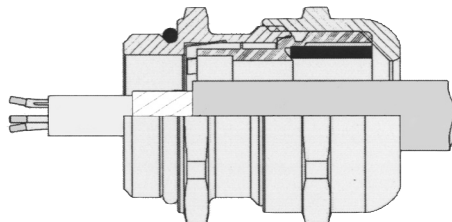
3.6.2 - Immunity to overvoltages

(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.
- Back up 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 digital and analog I/O protection by adding a zener diode or a peak limiter.

Elimination of unipolar digital and analog I/O overvoltages

Signal	to the drive
	30V Zener diode
0V	0V
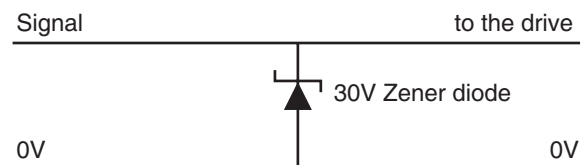
This circuit is available in a module (DIN rail mounting), e.g. from Phoenix Contact (unipolar: TT UKK5 D/24 DC).
This type of circuit is not suitable for encoder signals or for high-speed logic data networks, because the diodes may affect the signal. The majority of encoders have galvanic isolation between the motor casing and the encoder circuit, and in this case, no precautions are necessary. For data networks, follow the specific network recommendations.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
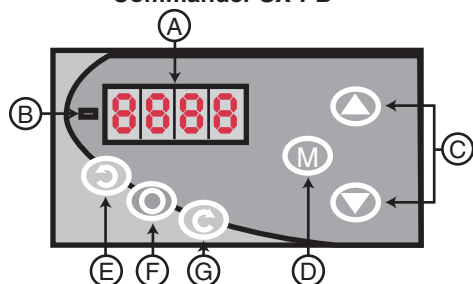### COMMISSIONING

4 - COMMISSIONING

⚠ • **The drives use an 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 terminals BR1 and BR2.**

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.

Commander SX-PB

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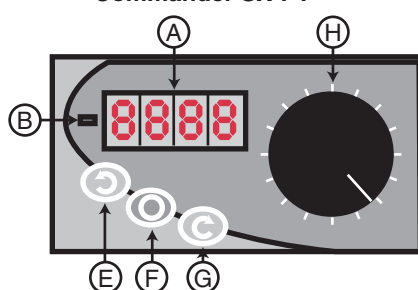
| Ref.	Function
Ⓐ	Display comprising 4 x 7-segment digits for indicating: - the drive operating status - certain operating data - the adjustment parameters (**01** to **80**) and their value (Commander SX-PB only).
Ⓑ	LED providing a sign for the data (the lit LED corresponds to the " - " sign)
Ⓒ	Keys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

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.2 - Commissioning the Commander SX-PT

• **Connection of the control terminal block (reminder)**
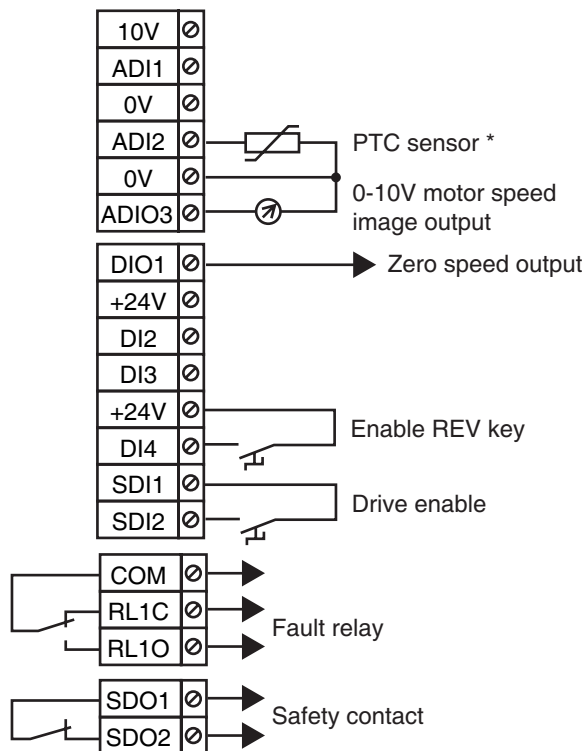
* If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

WARNING:
Input SDI2 is configured as a simple unlocking input.

⚠ • **As standard, the Commander SX-PT cannot be used to access parameter setting. Before commissioning, check that the factory settings are suitable for the application.**

• **Commander SX-PT factory settings:**
- Minimum reference clamp: 0 rpm.
- Maximum reference clamp: 1500 rpm.
- Acceleration rate: 3 seconds/1000 rpm.
- Deceleration rate: 5 seconds/1000 rpm.
- Motor rated current and rated speed:

Commander SX-PT	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 the potentiometer button to minimum (0%).
- Enable the drive with terminal SDI2. The display indicates "rdy".
- Press the Run Forward button ⓒ .
- Vary the speed with the potentiometer button to obtain the required speed.
- To stop the system, reduce the speed with the potentiometer button until the motor stops.
- Press the Stop key ◎ .
- Disable the drive with terminal SDI2.

## 4.3 - Commissioning the Commander SX-PB

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.
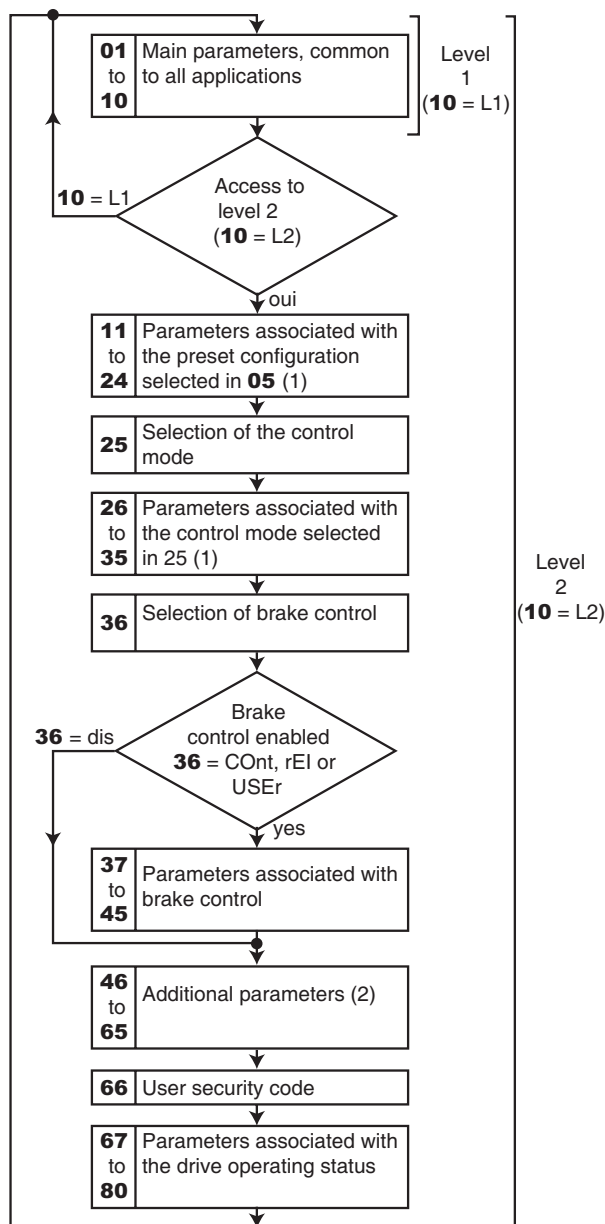
(1) These parameters depend on a previous selection.
As a result, they change from one configuration to the next.
The number of associated parameters may also vary. In this case, the **Commander SX** will not offer unused parameters.
(2) These parameter functions are common to all applications, except for the Pump configuration (**05** = PUMP).

4.3.2 - Selection and modification of a parameter

WARNING:
• 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 ▼ keys.

Switching from parameter-setting mode to read mode:
• To switch from parameter-setting mode to read mode, press the Ⓜ 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 status.

Action	Comment
	Power-up. Drive disabled (SDI2 input open). Display in "Read" mode (initial status).
	1: Access to parameter-setting mode. Press the Ⓜ 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, press ▲ to select parameter **04**.
	3: Access to parameter modification. Press the Ⓜ key. The parameter value flashes. **4:** Press and hold down the ▲ or ▼ key, to quickly scroll through the parameter value. The final setting is made by short presses on the same key.
	5: Press the Ⓜ key. The new value of **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.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.3.3 - Selection of the parameter access level

• **Selection of level 2**

Select the parameter:	Enter the value:	Action	Storing
10	**L2**	Access to parameters **01** to **80**	Press the Ⓜ key

• **Return to level 1**

Select the parameter:	Enter the value:	Action	Storing
10	**L1**	Limited access to parameters **01** to **10**	Press the Ⓜ key

4.3.4 - Storing

All modifications to parameters 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, that the drive is disabled, and that the safety of the system and personnel is not compromised.**

• **Return to European factory settings (50 Hz supply)**

Select the parameter:	Enter the value:	Action	Storing
10	**L2**	Access parameter **65**	Press the Ⓜ key
65	**Eur**	Configure the drive with European factory settings (50 Hz)	

• **Return to North American factory settings (60 Hz supply)**

Select the parameter:	Enter the value:	Action	Storing
10	**L2**	Access parameter **65**	Press the Ⓜ key
65	**USA**	Configure the drive with North American factory settings (60 Hz)	

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	Confirm
10	**L2**	Access parameter **66**	Press the Ⓜ key
66	**any number between 1 and 9999**	Choose the security code	
10	**Loc**	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 Ⓜ key, the display indicates "CodE".
Using the ⌃ and ⌄ arrows, enter the security code, then press Ⓜ 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 Ⓜ key, the display indicates "CodE".
Using the ⌃ and ⌄ arrows, enter the security code, then press Ⓜ again.
Select **66**, enter the value 0 and press Ⓜ 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.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

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 one configuration to another does not affect any 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 corresponding to the application and follow the associated commissioning procedure.
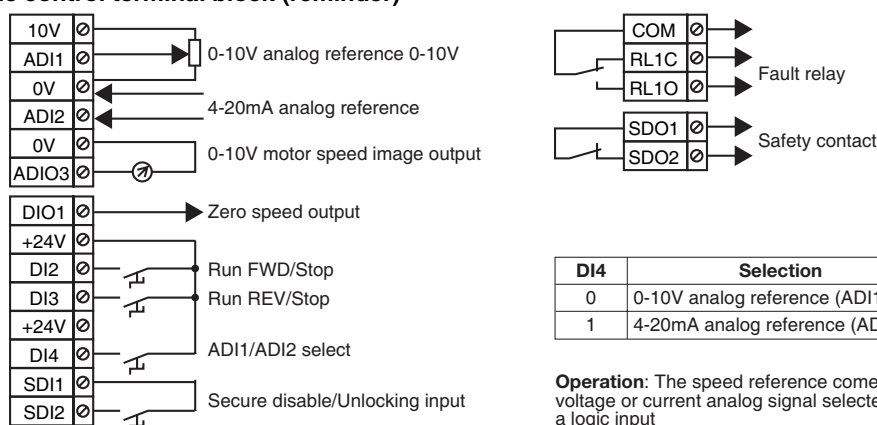**WARNING:**
Before selecting the configuration preset by 05, the drive must be disabled (terminal SDI2 open).

Key: RO = read-only parameter - R-W = read-write parameter.

4.3.7.1 - Configuration A1.A2: selection of a voltage (0-10V) or current (4-20mA) reference via digital input
• **Connection of the control terminal block (reminder)**

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

Operation: The speed reference comes from a voltage or current analog signal selected via a logic input

• **Parameters to be set**
Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "A1.A2", then set the drive parameters.   Set parameter **10** to "L2" to access parameters higher than **10** if necessary.
When parameter setting is complete, enable the drive (close terminal SDI2), select the speed reference (terminal DI4), then give a Run command (terminal DI2 or DI3).
To stop the motor, open terminal DI2 or DI3 closed previously.

• **List of corresponding parameters 01 to 24**

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	**11.46**	R-W	A1.A2	**A1.A2**, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, Pid, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I$_{co}$ (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	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)	**5.10**	R-W	0.85	0 to 1.00
10	Quick setup menu access	**11.44**	R-W	L1	L1, L2, Loc
11	ADI1 mode	**7.06**	R-W	volt (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input
12	ADI2 input mode	**7.11**	R-W	4-.20 (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input; CtP: motor sensor
13 to **24**	Not used				

• **For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.**
• **For detailed explanations of all parameters, see section 4.4 page 49.**
* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.
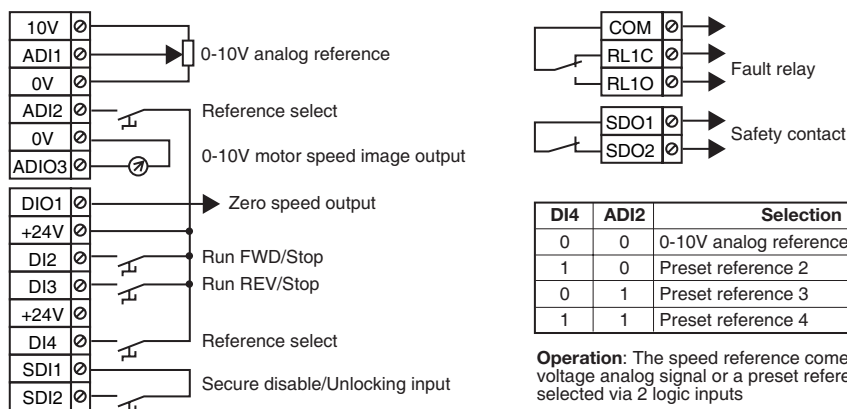
COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

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

• Connection of the control terminal block (reminder)

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

Operation: The speed reference comes from a voltage analog signal or a preset reference, selected via 2 logic inputs

• Parameters to be set

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "A1.Pr", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2), select the speed reference (terminal DI4 and ADI2), then give a Run command (close terminal DI2 or DI3).

To stop the motor, open terminal DI2 or DI3 closed previously.

• List of corresponding parameters 01 to 24

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	**11.46**	R-W	A1.Pr	A1.A2, **A1.Pr**, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, Pid, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	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)	**5.10**	R-W	0.85	0 to 1.00
10	Quick setup menu access	**11.44**	R-W	L1	L1, L2, Loc
11	ADI1 mode	**7.06**	R-W	volt (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input
12 to **14**	Preset reference 2 (Pr2) to Preset reference 4 (Pr4)	**1.22** to **1.24**	R-W	0	± Maximum reference clamp (parameter **02**) rpm
15 to **24**	Not used				

• For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.

• For detailed explanations of all parameters, see section 4.4 page 49.

* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.
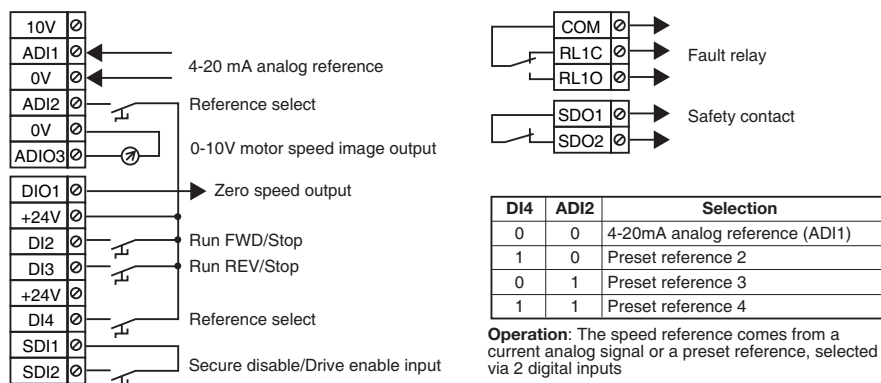
COMMANDER SX
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4.3.7.3 - Configuration A2.Pr: selection of a current reference (4-20mA) or 3 preset references via 2 digital inputs
• Connection of the control terminal block (reminder)

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

Operation: The speed reference comes from a current analog signal or a preset reference, selected via 2 digital inputs

• Parameters to be set

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "A2.Pr", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2), select the speed reference (terminal DI4 and ADI2), then give a Run command (close terminal DI2 or DI3).

To stop the motor, open terminal DI2 or DI3 closed previously.

• List of corresponding parameters 01 to 24

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	1.07	R-W	0	0 to (parameter 02) rpm
02	Maximum reference clamp	1.06	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	2.11	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	2.21	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	11.46	R-W	A2.Pr	A1.A2, A1.Pr, **A2.Pr**, 4Pr, 8Pr, E.Pot, TorQ, Pid, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	5.07	R-W	Motor rated current (A)	0 to Ico (A)
07	Motor rated speed	5.08	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	5.09	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)	5.10	R-W	0.85	0 to 1.00
10	Quick setup menu access	11.44	R-W	L1	L1, L2, Loc
11	ADI1 mode	7.06	R-W	4-.20 (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input
12 to 14	Preset reference 2 (Pr2) to Preset reference 4 (Pr4)	1.22 to 1.24	R-W	0	± Maximum reference clamp (parameter 02) rpm
15 to 24	Not used				

• For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.
• For detailed explanations of all parameters, see section 4.4 page 49.

* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.
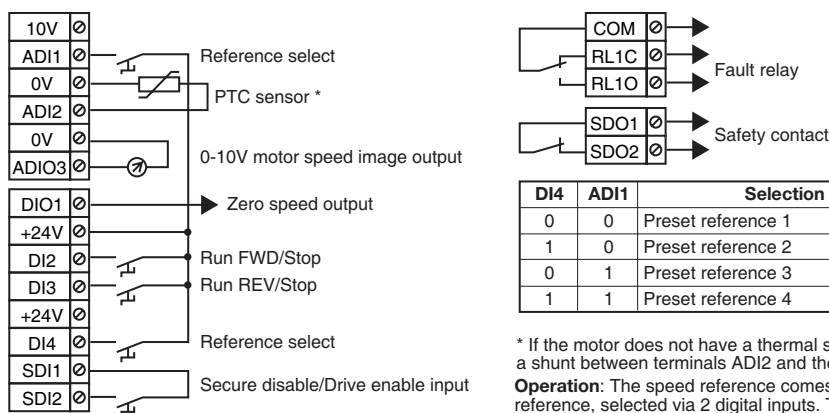
COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.3.7.4 - Configuration 4Pr: selection of 4 preset references via 2 digital inputs
• Connection of the control terminal block (reminder)

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 does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

Operation: The speed reference comes from a preset reference, selected via 2 digital inputs. The motor thermal sensor is managed by the drive

• Parameters to be set

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "4Pr", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2), select the speed reference (terminal DI4 and ADI1), then give a Run command (close terminal DI2 or DI3).

To stop the motor, open terminal DI2 or DI3 closed previously.

• List of corresponding parameters 01 to 24

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	1.07	R-W	0	0 to (parameter 02) rpm
02	Maximum reference clamp	1.06	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	2.11	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	2.21	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	11.46	R-W	4Pr	A1.A2, A1.Pr, A2.Pr, **4Pr**, 8Pr, E.Pot, TorQ, Pid, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	5.07	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	5.08	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	5.09	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)	5.10	R-W	0.85	0 to 1.00
10	Quick setup menu access	11.44	R-W	L1	L1, L2, Loc
11 to 14	Preset reference 1 (Pr1) to Preset reference 4 (Pr4)	1.21 to 1.24	R-W	0	± Maximum reference clamp (parameter 02) rpm
15 to 24	Not used				

• For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.

• For detailed explanations of all parameters, see section 4.4 page 49.

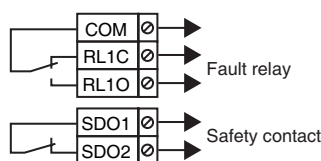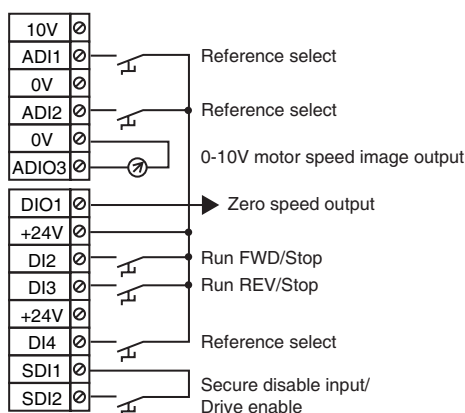# COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.3.7.5 - Configuration 8Pr: selection of 8 preset references via 3 digital inputs
• Connection of the control terminal block (reminder)

DI4	ADI1	ADI2	Sélection
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

Operation: The speed reference comes from a preset reference, selected via 3 digital inputs

• Parameters to be set

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "8Pr", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2), select the speed reference (terminal DI4, ADI1 and ADI2), then give a Run command (close terminal DI2 or DI3).

To stop the motor, open terminal DI2 or DI3 closed previously.

• List of corresponding parameters 01 to 24

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	**11.46**	R-W	8Pr	A1.A2, A1.Pr, A2.Pr, 4Pr, **8Pr**, E.Pot, TorQ, Pid, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	R-W	Voltage code 200 = 200V(Eur),230V(USA) Voltage code 400 = 400V(Eur),	0 to 480V
09	Rated power factor (cos φ)	**5.10**	R-W	0.85	0 to 1.00
10	Parameter-setting level	**11.44**	R-W	L1	L1, L2, Loc
11 to **18**	Preset reference 1 (Pr1) to Preset reference 8 (Pr8)	**1.21** to **1.28**	R-W	0	± Maximum reference clamp (parameter **02**) rpm
19 to **24**	Not used				

• For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.

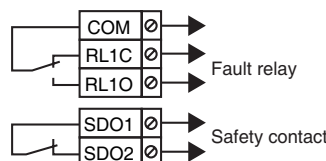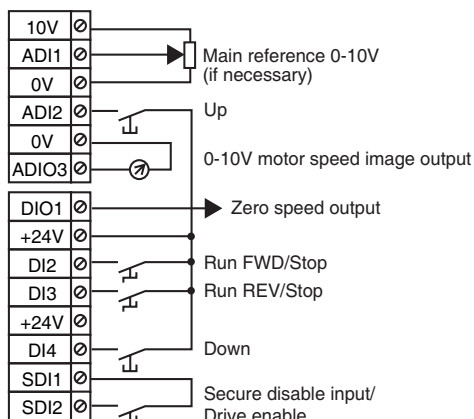**• For detailed explanations of all parameters, see section 4.4 page 49.**

4.3.7.6 - Configuration E.Pot: motorised potentiometer
• Connection of the control terminal block (reminder)

Operation: Speed reference = 0-10V
main reference + reference from the up/down inputs
(motorised potentiometer function).

• Parameters to be set

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "E.Pot", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.
When parameter setting is complete, enable the drive (close terminal SDI2), then give a Run command (close terminal DI2 or DI3). To stop the motor, open terminal DI2 or DI3 closed previously.

• List of corresponding parameters 01 to 24

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	**11.46**	R-W	E.Pot	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, **E.Pot**, TorQ, Pid, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	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)	**5.10**	R-W	0.85	0 to 1.00
10	Quick setup menu access	**11.44**	R-W	L1	L1, L2, Loc
11	ADI1 mode	**7.06**	R-W	volt (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input
12	Motorised pot reset	**9.28**	R-W	no	no, RSEt
13	Auto reset of motorised pot	**9.21**	R-W	Rst.d (*)	Rst.e: Reset on each power-up, Pre.e: On power-up, the reference is at the level of the last power-down, Rst.d: Reset on each power-up. Up/down inputs active when drive output active, Pre.d: On power-up, the reference is at the level of the last power-down. Up/down inputs active when drive output active.
14	Motorised pot bipolar select	**9.22**	R-W	Pos	Pos, biPo.
15	Motorised pot rate	**9.23**	R-W	20 s	0 to 250 s
16	Motorised pot scale factor	**9.24**	R-W	1.00	0 to 2.50
17	Motorised pot output	**9.03**	RO	-	±100.0%
18 to **24**	Not used				

• For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.
• For detailed explanations of all parameters, see section 4.4 page 49.
* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.
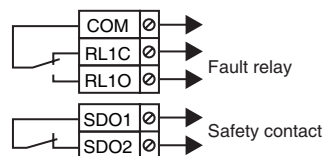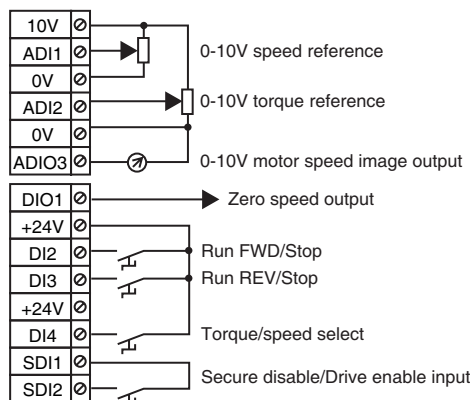
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4.3.7.7 - Configuration TorQ: selection of speed control or torque control with speed limiting via digital input
• Connection of the control terminal block (reminder)

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

Operation: The drive may be in either speed or torque control mode. The speed reference and the torque reference come from 2 voltage analog signals, selected via a digital input.

• Parameters to be set
Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "TorQ", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.
When parameter setting is complete, enable the drive (close terminal SDI2), select the speed or torque reference via DI4, then give a Run command (close terminal DI2 or DI3). To stop the motor, open terminal DI2 or DI3 closed previously.

• List of corresponding parameters **01** to **24**
WARNING:
• Do not change from speed regulation to torque regulation when there is an active run command.

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	**11.46**	R-W	TorQ	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, **TorQ**, Pid, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	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)	**5.10**	R-W	0.85	0 to 1.00
10	Quick setup menu access	**11.44**	R-W	L1	L1, L2, Loc
11	ADI1 mode	**7.06**	R-W	volt (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input
12	ADI2 input mode	**7.11**	R-W	4-.20 (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input; CtP: motor sensor
13 to **18**	Not used				
19	ADI2 scaling	**7.12**	R-W	1.00	0 to 2.50
20 to **24**	Not used				

• For additional drive parameter settings (parameters **25** to **80**), see section 4.3.8 page 46.
• For detailed explanations of all parameters, see section 4.4 page 49.
* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.
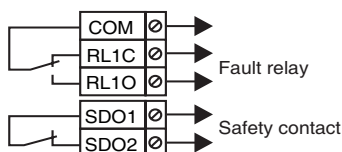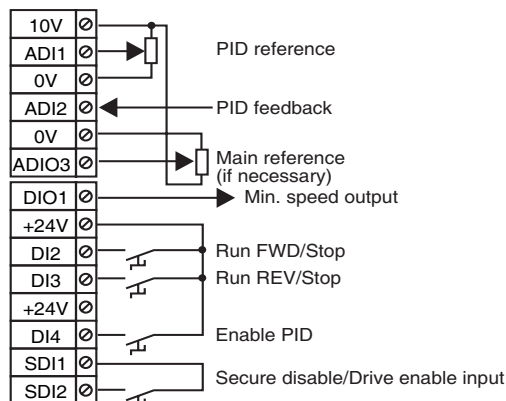
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4.3.7.8 - Configuration PID: PID control
• Connection of the control terminal block (reminder)

Operation:
This function is used to control an analog reference from the "PID reference" in relation to a "PID feedback" measurement (temperature, pressure, flow rate, level, replica master). In this case, the PID controller only covers the speed range. When the PID does not control the whole of a signal (partial correction), the " PID main reference" can be used as a main signal to improve the stability of the PID for example.

• Parameters to be set

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "Pid", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.
When parameter setting is complete, enable the drive (close terminal SDI2). Enable PID control (close DI4), then give a Run command (close terminal DI2 or DI3).
If the controller performance is not optimal, adjust the proportional **13**, integral **14** and derivative **15** gains.
To stop the motor, open terminal DI2 or DI3 closed previously.

• List of corresponding parameters 01 to 24

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	**11.46**	R-W	Pid	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, **Pid**, PUMP, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	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)	**5.10**	R-W	0.85	0 to 1.00
10	Quick setup menu access	**11.44**	R-W	L1	L1, L2, Loc
11	ADI1 mode	**7.06**	R-W	volt (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input
12	ADI2 input mode	**7.11**	R-W	4-.20 (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input; CtP: motor sensor
13	PID proportional gain	**14.10**	R-W	10.00	0 to 320.00
14	PID integral gain	**14.11**	R-W	5.00	0 to 320.00
15	PID derivative gain	**14.12**	R-W	0	0 to 2.50
16	PID upper limit	**14.13**	R-W	100.0%	0 to 100.0%
17	PID lower limit	**14.14**	R-W	- 100.0%	± 100.0%
18	PID scaling	**14.15**	R-W	1.00	0 to 2.50
19	ADI2 input scaling	**7.12**	R-W	1.00	0 to 2.50
20	ADIO3 input scaling	**7.16**	R-W	1.00	0 to 2.50
21	PID reference	**14.20**	RO	-	± 100%
22	PID feedback	**14.21**	RO	-	± 100%
23	PID main reference	**14.19**	RO	-	± 100%
24	PID output	**14.01**	RO	-	± 100%

• For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.
• For detailed explanations of all parameters, see section 4.4 page 49.
* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.
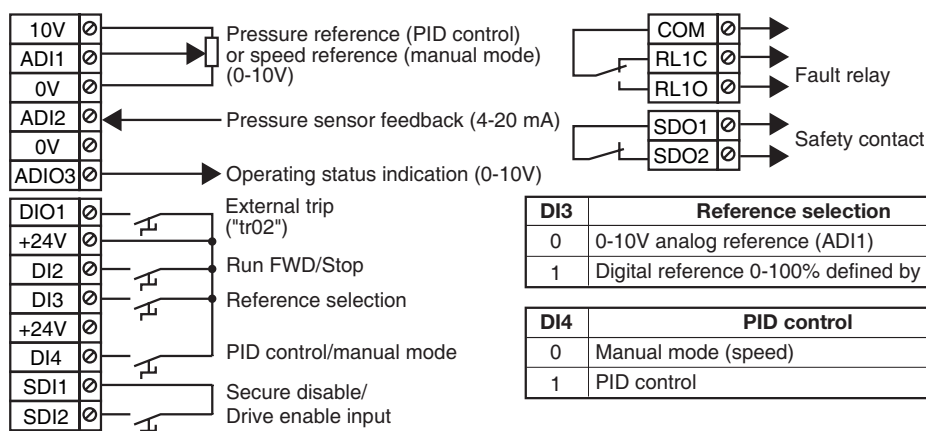
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4.3.7.9 - Configuration PUMP: pump regulation
• **Connection of the control terminal block (reminder)**

DI3	Reference selection
0	0-10V analog reference (ADI1)
1	Digital reference 0-100% defined by **18**

DI4	PID control
0	Manual mode (speed)
1	PID control

• **Operation:**

ADI1 is configured as 0-10V (**11**) and receives a reference produced by a potentiometer or an external signal.

ADI2 is configured as 4-20mA (**12**) and receives the analog pressure sensor (max. consumption: 60 mA).

ADIO3 indicates the drive operating status: 0V corresponds to normal operation, 10V indicates that the drive has tripped, 6 and 10V alternately indicate that the drive is in current limiting mode.

DIO1 is used to initiate a customer trip "tr02" (terminal open).

WARNING:
The PUMP configuration requires the use of the KEYPAD-LCD or the SXSoft software.

• **Parameters to be set:**

- Check that the drive has been disabled (terminal SDI2 open and terminal DIO1 closed) before setting the drive parameters. Next, select the configuration by setting parameter **05** = PUMP. Then, using the KEYPAD-LCD or SXSoft software, set **8.14** = Yes. Parameter **05** then changes to the value "Open".

- Return to menu 0, and set motor parameters **06** to **09**.

- Determining the direction of rotation: open DI4 to select manual mode. Close SDI2 and apply a speed reference to ADI1 or set parameter **18**, and select the corresponding reference type with DI3. Close DI2 for a moment. If the pump direction of rotation is incorrect, power down the drive and swap two phases at the drive output. Open SDI2.

- Set the reference pressure on ADI1 or in parameter **18**.
Example of setting: sensor 0-10 bars, regulation at 7 bars, reference on 0-10V on ADI1; the value to be set on ADI1 will be 7V.

- Scale the reading of the reference (**20**) and sensor feedback (**21**) using parameter **19**.
E.g. sensor 0-10 bars, set 10 in **19**, for a reading in mbars.

- To adjust the draining function, set the draining threshold in parameter **16** (as a percentage of the sensor pressure) and the time delay in parameter **17** (in seconds). In pressure regulation mode, if the pressure does not reach the threshold set in **16** after a period set in **17**, the drive trips due to draining "tr01". This protection is active on starting and while regulation is in progress.

- Set the maximum speed in parameter **02** by referring to the pump characteristics. For optimum regulation dynamics, set the acceleration rate to 0.1 s in parameter **03** and the deceleration rate in parameter **04** of the reference.

- Close terminal SDI2 to enable the drive, then close DI4. Read the value of parameter **20**, and adjust the pressure reference if necessary. Give a run command by closing DI2; the value of the pressure feedback is given in parameter **21**.

- In the event of rapid variation of the reference or flow rate, optimize the setting of the proportional (**13**) and integral (**14**) gains if inadequate, select the menu 2 using the KEYPAD-LCD or SXSoft, and set **2.04** to 0 (fixed ramp).

- The stop on minimum speed function is active as standard (**15** = Yes). When the speed is at minimum for a period of 25 s, the drive automatically stops the motor. To adjust this minimum speed, read the motor speed in parameter **22** when the flow rate is low or zero (close a pump pressure valve, then set the value read in **22** + 300 rpm in parameter **01**. Restarting occurs when the pressure falls below the reference pressure set by the user x 1.05 (coefficient adjustable in parameter **48**).

- If the pump is overloaded, the speed will automatically be reduced so as to avoid the drive tripping.

- To stop the motor, open DI2.

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• **List of corresponding parameters 01 to 58**

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	1.07	R-W	0	0 to (parameter 02) rpm
02	Maximum reference clamp	1.06	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	2.11	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	2.21	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	11.46	R-W	PUMP	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, Pid, **PUMP**, A.CtP, HoiS, Pad, HuAC, OPEn
06	Motor rated current	5.07	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	5.08	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	5.09	R-W	400V	0 to 480V
09	Rated power factor (cos φ)	5.10	R-W	0.85	0 to 1.00
10	Quick setup menu access	11.44	R-W	L2	L1, L2, Loc
11	ADI1 mode	7.06	R-W	volt (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input
12	ADI2 input mode	7.11	R-W	4-20 (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input; CtP: motor sensor
13	PID proportional gain	14.10	R-W	150.00	0 to 320.00
14	PID integral gain	14.11	R-W	20.00	0 to 320.00
15	Stop on Vmin enable	14.56	R-W	Yes	No - Yes
16	Draining threshold	12.04	R-W	20.0%	0 to 20.0%
17	Draining time delay	16.05	R-W	10.0s	0 to 10.0 s
18	Digital reference	14.51	R-W	0.00	0 to 100.00%
19	Customer unit coefficient	14.53	R-W	1	0 to 30
20	Customer reference value	14.54	RO	-	±32000
21	Customer feedback value	14.55	RO	-	±32000
22	Motor speed	5.04	RO	-	± 2 x 1.06 rpm
23 and 24	Not used				
25 to 45	See section 4.3.8.1 Selection of control mode and section 4.3.8.2 Selection of brake control and setting its parameters, if necessary				
46	Run time: years.days	6.22	RO		0 to 9.364
47	Run time: hours.minutes	6.23	RO		0 to 23.59
48	Automatic restart threshold	7.62	R-W	1.05	0 to 2.50
49	Trip -1 (most recent)	10.20	RO	-	0 to 50
50	Trip -2	10.21	RO	-	0 to 50
51	Trip -3	10.22	RO	-	0 to 50
52	Trip -4	10.23	RO	-	0 to 50
53	Trip -5	10.24	RO	-	0 to 50
54	Trip -6	10.25	RO	-	0 to 50
55	Trip -7	10.26	RO	-	0 to 50
56	Trip -8	10.27	RO	-	0 to 50
57	Trip -9	10.28	RO	-	0 to 50
58	Trip -10	10.29	RO	-	0 to 50

• **For additional drive parameter settings (parameters 59 to 80), see section 4.3.8 page 46.**
• **For detailed explanations of all parameters, see section 4.4 page 49.**
* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.
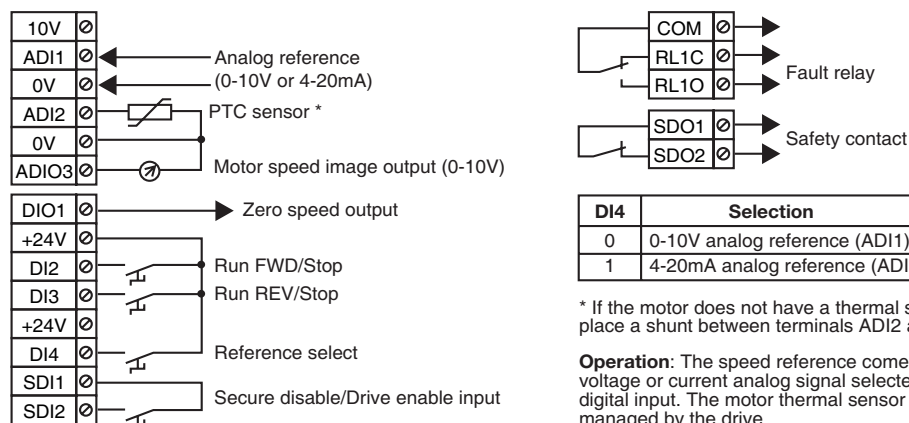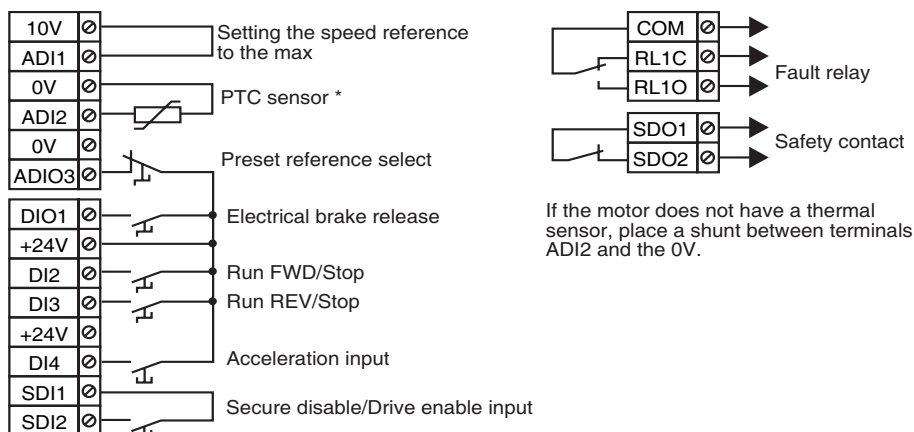
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4.3.7.10 - Configuration A.CtP: Voltage or current input and PTC sensor management
• **Connection of the control terminal block (reminder)**

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

* If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and 0V.

Operation: The speed reference comes from a voltage or current analog signal selected via a digital input. The motor thermal sensor is managed by the drive.

• **Parameters to be set**

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "A.CtP", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2). Select the reference type chosen for ADI1 (terminal DI4), then give a Run command (close terminal DI2 or DI3). To stop the motor, open terminal DI2 or DI3 closed previously.

• **List of corresponding parameters 01 to 24**

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	1.07	R-W	0	0 to (parameter 02) rpm
02	Maximum reference clamp	1.06	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	2.11	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	2.21	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	11.46	R-W	A.CtP	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, Pid, PUMP, **A.CtP**, HoiS, Pad, HuAC, OPEn
06	Motor rated current	5.07	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	5.08	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	5.09	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)	5.10	R-W	0.85	0 to 1.00
10	Quick setup menu access	11.44	R-W	L1	L1, L2, Loc
11 to 24	Not used				

• **For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.**

• **For detailed explanations of all parameters, see section 4.4 page 49.**

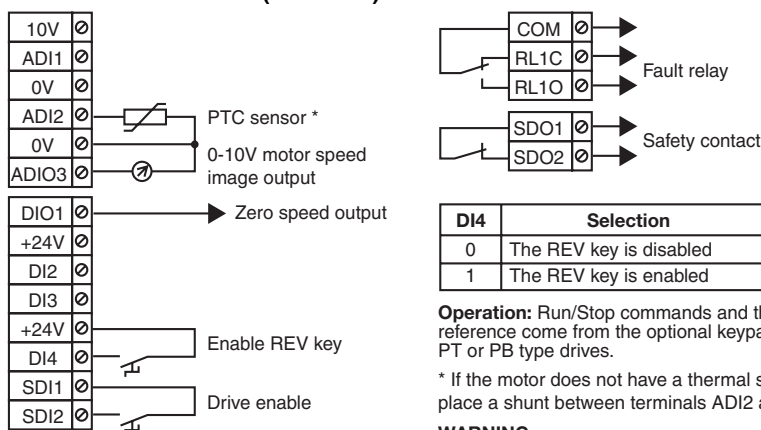## 4.3.7.11 - Configuration HoiS: Control of travelling crane or hoist
• Connection of the control terminal block (reminder)
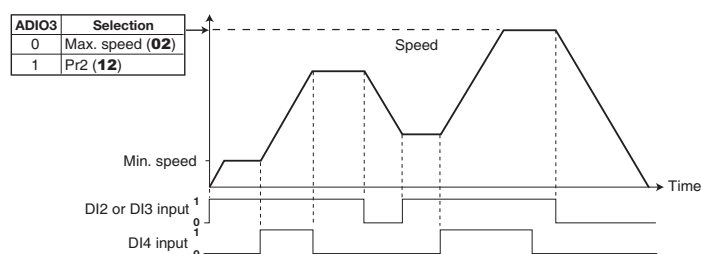
If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

• Operating diagram

ADIO3	Selection
0	Max. speed (**02**)
1	Pr2 (**12**)

• Parameters to be set
Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "HoiS", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2). Select the maximum speed value (terminal ADIO3), then give a Run command (close terminal DI2 or DI3). To stop the motor, open terminal DI2 or DI3 closed previously.

WARNING:

If the load is driving with a braking resistor, set 55 to Fst.

• List of corresponding parameters 01 to 24

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm **WARNING: In the case of a driving load, set parameter 55 = Fst and an external braking resistor will often be needed.**
05	Preset configuration select	**11.46**	R-W	HoiS	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, Pid, PUMP, A.CtP, **HoiS**, Pad, HuAC, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	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)	**5.10**	R-W	0.85	0 to 1.00
10	Quick setup menu access	**11.44**	R-W	L1	L1, L2, Loc
11	Not used				
12	Preset reference 2 (Pr2)	**1.22**	R-W	0	± Maximum reference clamp (parameter **02**) rpm
13 to **24**	Not used				

• For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.
• For detailed explanations of all parameters, see section 4.4 page 49.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.3.7.12 - Configuration Pad: control via keypad
• **Connection of the control terminal block (reminder)**

DI4	Selection
0	The REV key is disabled
1	The REV key is enabled

Operation: Run/Stop commands and the speed reference come from the optional keypad on PT or PB type drives.

* If the motor does not have a thermal sensor, place a shunt between terminals ADI2 and the 0V.

WARNING:
Input SDI2 is configured as a simple unlocking input.

• **Parameters to be set**

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "Pad", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2), then give a Run command (press the Run key). Increase the speed by using the keypad arrows. To stop the motor, press the Stop button.

• **List of corresponding parameters 01 to 24**

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	1.07	R-W	0	0 to (parameter 02) rpm
02	Maximum reference clamp	1.06	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	2.11	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	2.21	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	11.46	R-W	Pad	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, Pid, PUMP, A.CtP, HoiS, **Pad**, HuAC, OPEn
06	Motor rated current	5.07	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	5.08	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	5.09	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)	5.10	R-W	0.85	0 to 1.00
10	Quick setup menu access	11.44	R-W	L1	L1, L2, Loc
11	Power-up KEYPAD-LCD control mode reference	1.51	R-W	rSEt	rSEt: at zero; Prec: identical to the reference at the time of powering down; Pr1: identical to Pr1
12	Reference on power-up (Pr1)	1.21	R-W	0	± Maximum reference clamp (parameter 02) rpm
13	Enable KEYPAD-LCD FWD key	6.11	R-W	On (*)	OFF, On
14	Enable KEYPAD-LCD Stop key	6.12	R-W	On (*)	OFF, On
15 to 24	Not used				

• **For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.**
• **For detailed explanations of all parameters, see section 4.4 page 49.**

* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.3.7.13 - Configuration HuAC: Auto/manual mode
• **Connection of the control terminal block (reminder)**
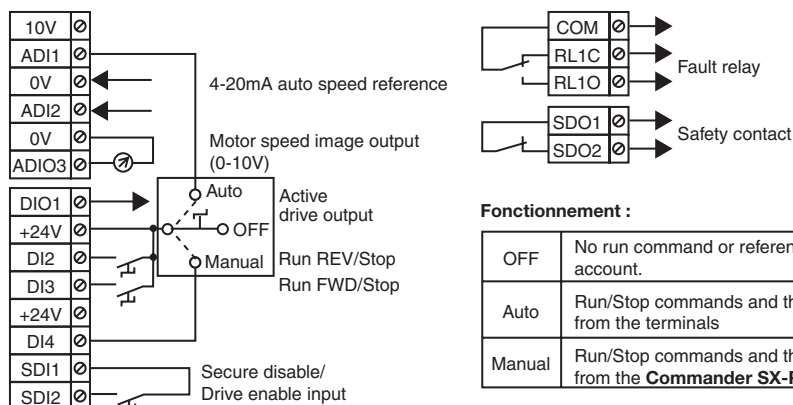
Fonctionnement :

OFF	No run command or reference is taken into account.
Auto	Run/Stop commands and the reference come from the terminals
Manual	Run/Stop commands and the reference come from the **Commander SX-PB** keypad

• **Parameters to be set**

Check that the drive has been disabled (terminal SDI2 open). Set parameter **05** to "HuAC", then set the drive parameters. Set parameter **10** to "L2" to access parameters higher than **10** if necessary.

When parameter setting is complete, enable the drive (close terminal SDI2), then select the control mode (terminals or keypad) with the auto/manual switch. Give a Run command (press the Run key or close terminal DI2 or DI3). Increase the speed by using the keypad arrows for a "PB" drive version or via the potentiometer for a "PT" drive version. To stop the motor, press the Stop key or open terminal DI2 or DI3 closed previously.

• **List of corresponding parameters 01 to 24**

Parameter	Name	Address	Type	Configuration setting	Adjustment range
01	Minimum reference clamp	**1.07**	R-W	0	0 to (parameter **02**) rpm
02	Maximum reference clamp	**1.06**	R-W	1500 rpm (Eur) 1800 rpm (USA)	0 to 32000 rpm
03	Acceleration rate	**2.11**	R-W	3.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
04	Deceleration rate	**2.21**	R-W	5.0 s/1000 rpm	0.1 to 600.0 s/1000 rpm
05	Preset configuration select	**11.46**	R-W	HuAC	A1.A2, A1.Pr, A2.Pr, 4Pr, 8Pr, E.Pot, TorQ, Pid, PUMP, A.CtP, HoiS, Pad, **HuAC**, OPEn
06	Motor rated current	**5.07**	R-W	Motor rated current (A)	0 to I_{co} (A)
07	Motor rated speed	**5.08**	R-W	Motor rated speed (rpm)	0 to 9999 rpm
08	Motor rated voltage	**5.09**	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)	**5.10**	R-W	0.85	0 to 1.00
10	Quick setup menu access	**11.44**	R-W	L1	L1, L2, Loc
11	Not used				
12	ADI2 input mode	**7.11**	R-W	4-.20 (*)	0-20, 20-0, 4-20, 20-4: current input (mA); 4-.20, 20-.4: current input without detection of signal loss (mA); volt: voltage input (0 to 10V); d-In: digital input; CtP: motor sensor
13 to **24**	Not used				

• **For additional drive parameter settings (parameters 25 to 80), see section 4.3.8 page 46.**

• **For detailed explanations of all parameters, see section 4.4 page 49.**

* Any change in the value of this parameter causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.3.8 - Commissioning (continued)

Key: RO = read-only parameter; R-W = read-write parameter.
    ▣ = Open loop flux vector control; ▣ = Closed loop flux vector control.

4.3.8.1 - Selection of the control mode

Parameter	Name	Address	Type	Factory setting	Adjustment range
25	Operating mode	11.31	R-W	oP.LP	oP.LP: open loop mode select cL.LP: closed loop mode select SruO: servo motor control

• If 25 = oP.LP: Open loop

Parameter	Name	Address	Type	Factory setting	Adjustment range
26	Open loop mode select ▣	5.14	R-W	r-FSt	r.run: stator resistance measurement and voltage offset at each run command; r.no: no measurement UtoF: U/F mode; r.FSt: equivalent to r.no mode; r.On: equivalent to r.run after the first start; SqrE: square law characteristic.
27 and **28**	Not used				
• If 26 = UtoF					
29	Boost	5.15	R-W	0	0 to 25.0% of (**08**)
30	Dynamic V to F	5.13	R-W	Lin	Lin: fixed U/F ratio dyn: dynamic U/F ratio (varies with the load)
31 to **35**	Not used				
• If 26 = r.run, r.no, r.FSt, r.On or SqrE					
29 and **30**	Not used				
31	Current loop proportional gain	4.13	R-W	20	0 to 999
32	Current loop integral gain	4.14	R-W	40	0 to 250
33 to **35**	Not used				

• If 25 = cL.LP: closed loop or SruO: servo

Parameter	Name	Address	Type	Factory setting	Adjustment range
26	Sensor type	3.38	R-W	• If **25** = oP.LP or cL.LP: Incr. • If **25** = SruO: CoMM	Incr.: quadrature incremental encoder Fd: F/D incremental encoder Fr: FWD/REV incremental encoder CoMM: incremental encoder with commutation channels haLL: hall effect sensor tyP1 to tyP4 : sensorless mode 1 to 4.
27	Encoder lines per revolution	3.34	R-W	1024 lines	0 to 32000 lines
28	Drive encoder filter ▣	3.42	R-W	3.0	0 to 10.0
29	Speed loop proportional gain Kp1 ▣	3.10	R-W	200	0 to 32000
30	Speed loop integral gain Ki1 ▣	3.11	R-W	100	0 to 32000
31	Current loop proportional gain	4.13	R-W	20	0 to 999
32	Current loop integral gain	4.14	R-W	40	0 to 250
33	Ramp bypass ▣	2.02	R-W	raMP	raMP or no
34 and **35**	Not used				

4.3.8.2 - Selection of brake control and setting its parameters

Parameter	Name	Address	Type	Factory setting	Adjustment range
36	Brake controller enable	12.41	R-W	dis (*)	dis: brake control disabled; COnt: brake control enabled on Px-Brake Contactor; rEI: brake control enabled on the relay; USEr: brake control enabled and any assignment.

• For help with commissioning, see section 4.5 page 61.
• For detailed explanations of all parameters, see section 4.4 page 49.
* Setting parameter **36** to rEI will cause parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected preset configuration.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

• **If 36 = COnt, rEI, USEr:**

Parameter	Name	Address	Type	Factory setting	Adjustment range
37	Upper current threshold	12.42	R-W	10%	0 to 200%
38	Lower current threshold	12.43	R-W	10%	0 to 200%
39	Brake release frequency	12.44	R-W	1.0 Hz	0 to 20.0 Hz
40	Brake apply frequency ▣	12.45	R-W	2.0 Hz	0 to 20.0 Hz
	Brake apply speed ▣			5 rpm	0 to 100 rpm
41	Magnetisation time delay ▣	12.46	R-W	0.10 s ▣	0 to 25.00 s
	Pre-brake release delay ▣			0.30 s ▣	
42	Post-brake release delay	12.47	R-W	0.10 s	0 to 25.00 s
43	Brake apply delay ▣	12.48	R-W	0	0 to 25.00 s
44 and 45	Not used				

• **For detailed explanations of all parameters, see section 4.4 page 49.**

4.3.8.3 - Additional parameter settings

Parameter	Name	Address	Type	Factory setting	Adjustment range
46 #	Start/stop logic select	6.04	R-W	Lchd (*)	Lchd: FWD/Stop (DI2) and REV/Stop (DI3) latched; Puls: FWD (DI2), Stop (DI3) and REV (DIO1) jog operation; r.InP: Run/Stop (DI2) and direction of rotation (DI3) latched.
47 #	SDI select	8.10	R-W	Secu (*)	Enab: locking input only (SDI); SEcu: locking and secure disable (SDI) input (disabled, if 05 = Pad).
48 #	ADIO3 mode	7.15	R-W	0 - 10 o (*)	0.20i, 20.0i, 4.20i, 20.4i: current input (mA); 4.20i., 20.4i.: current input without detection of signal loss (mA); 0.10i: 0 to 10V voltage input; d-In: digital input; 0.20o, 4.20o: current output (mA); 0.10o: 0 to 10V voltage output.
49 #	ADIO3 feature	7.33	R-W	SPd (*)	SPd: motor speed; Ld: motor load; A: motor current; Puur: motor power; Adv: any assignment.
50 #	DIO1 feature	8.41	R-W	n = 0 (*)	n = 0: zero speed output; At.SP: reference reached output; Lo.SP: Minimum speed output; At.Ld: 100% load reached output; act: drive output active; alar: drive general alarm output; I.Lt: current limiting output; JoG: jogging input; rESE: reset input; Adv: any assignment.
51 #	Jog reference	1.05	R-W	45 rpm	0 to 16000 rpm
52 #	Bipolar reference enable	1.10	R-W	PoS	PoS: negative references equal zero nEg: change direction of rotation via reference polarity
53 #	Skip (critical speed)	1.29	R-W	0	0 to 02 rpm
54 #	Skip reference band	1.30	R-W	15 rpm	0 to 300 rpm
55 #	Deceleration ramp mode select	2.04	R-W	Std	Fst: deceleration ramp imposed; Std: automatic extension StdH: automatic extension with U_n + 20% FstH: deceleration imposed with U_n + 20%
56 #	Ramp type	2.06	R-W	Lin	Lin: linear ramp; S-rP: S ramp enabled

For the PUMP configuration, this parameter has a different function. See section 4.3.7.9.
• **For detailed explanations of all parameters, see section 4.4 page 49.**
* Any change in this parameter will cause parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected preset configuration.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

Parameter	Name	Address	Type	Factory setting	Adjustment range
57 #	Stop mode	6.01	R-W	rAMP	FrEE: freewheel stop; rAMP: stop on ramp; rP.dC: stop on ramp with DC injection; dC-o: stop by braking (DC injection) until zero speed; dC-t: stop by braking (DC injection) with an imposed time.
58 #	Mains loss mode	6.03	R-W	diS	diS: continues to operate on a mains supply break if there is enough DC bus voltage; StOP: controlled deceleration on a mains supply break until the motor stops; rd.th: controlled deceleration on a mains supply break, then acceleration on return of the mains supply.
59	Catch a spinning motor	6.09	R-W	no	no: disabled; On.2d: in both directions; On.Fd: clockwise; On.rS: Counter-clockwise
60	Switching frequency	5.18	R-W	4.5 kHz	3 kHz, 4.5 kHz, 5.5 kHz, 6 kHz, 9 kHz, 11 kHz.
61	Motor rated frequency	5.06	R-W	50.0 Hz (Eur) 60.0 Hz (USA)	0 to 400.0 Hz
62	Number of motor poles	5.11	R-W	Auto	Auto, 2 poles, 4 poles, 6 poles, 8 poles.
63	Autotune	5.12	R-W	no	no: no autotune; StoP: measurement of motor characteristics when stopped; rot: measurement of motor characteristics with rotation ⚠ • Motor uncoupled. • Must not present a risk to safety.
64	Parameter cloning	11.42	R-W	no	no: no action; rEAd: transfer XPressKey to drive; 2 (Prog): transfer from drive to XPressKey; Auto: automatic transfer of parameter modifications into XPressKey.
65	Factory settings	11.43	R-W	no	no, Eur, USA

For the PUMP configuration, this parameter has a different function. See section 4.3.7.9.

4.3.8.4 - Security code

Parameter	Name	Address	Type	Factory setting	Adjustment range
66	User security code	11.30	R-W	0	0 to 9999

When using a security code, follow the procedure in section 4.3.6.

4.3.8.5 - Parameters associated with the drive operating status

Parameter	Name	Address	Type	Factory setting	Adjustment range
67	Unit displayed on power-up	11.22	R-W	Spd	Spd: speed display; Load: load display SP.Ld: intermittent display of speed or load/current; USER, SP.US and Ld.US: functions only accessible with the advanced menus. (See manual ref. 3854).
68	Selection of load display	4.21	R-W	Ld	Ld: load level A: total motor current
69	Unit for displaying the speed	5.34	R-W	SP	Fr: output frequency (Hz) SP: motor speed (rpm) Cd: customer unit = **79** x **70**
70	Parameter scaling	11.21	R-W	1.00	0 to 9.999
71	Last trip	10.20	RO	-	0 to 54
72	Penultimate trip	10.21	RO	-	0 to 54
73	ADI1 input level	7.01	RO	-	0 to 100.0%
74	ADI2 input level	7.02	RO	-	0 to 100.0%
75	ADIO3 input or output level	7.03	RO	-	0 to 100.0%
76	Pre-offset reference	1.60	RO	-	± **02** rpm
77	Pre-ramp reference	1.03	RO	-	± **02** or (**01** to **02**)
78	Current magnitude	4.01	RO	-	0 to drive Imax (A)
79	Motor speed	5.04	RO	-	± 2 x **02** rpm
80	DC bus voltage	5.05	RO	-	0 to 420 V (voltage code 200) 0 to 860 V (voltage code 400)

• For detailed explanations of all parameters, see section 4.4 page 49.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.4 - Detailed explanation of the parameters

Key: RO = read-only parameter
R-W = read-write parameter
■ = open loop flux vector control
■ = closed loop flux vector control

01 :Minimum reference clamp

In unipolar mode, this parameter defines the minimum speed.
WARNING:
• **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 machine can withstand it.**
This parameter defines the maximum speed in both directions of rotation.

03 : Acceleration rate

Sets the time to accelerate from 0 to 1000 rpm.

$$03 = \frac{t\ (s)\ x\ 1000\ rpm}{(N2-N1)\ rpm}$$
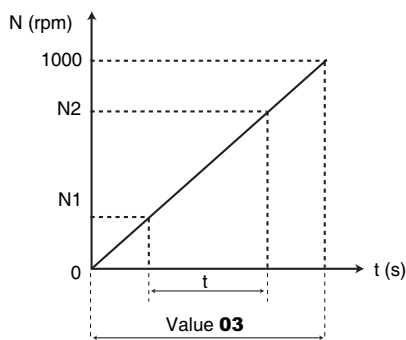
04 : Deceleration rate

Sets the time to decelerate from 1000 rpm to 0.

$$04 = \frac{t\ (s)\ x\ 1000\ rpm}{(N2-N1)\ rpm}$$
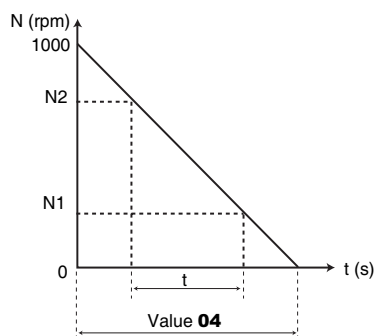
05 : Selection of preset configuration

A1.A2 : One 0-10V voltage reference input and one 4-20mA current reference input selectable via digital input.
A1.Pr : One voltage reference input and 3 preset references selectable via 2 digital inputs.
A2.Pr : One 4-20mA current reference input and 3 preset references, selectable via 2 digital inputs.
4Pr : 4 preset references selectable via 2 digital inputs.
8Pr : 8 preset references selectable via 3 digital inputs.
E.Pot : Motorised potentiometer (up, down).
TorQ : selection of speed control or torque control via digital input (with speed limiting).
Pid : PID control.
PUMP : Pump regulation.
A.CtP : One voltage or current reference input and one PTC sensor input.
HoiS : Control of travelling crane.
Pad : Local control via the keypad.
HuAC : Auto/manual mode.
OPEn : Parameter-setting mode is open.

Note: Modification of certain parameters in menu 0 automatically causes **05** to change to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected preset configuration.

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 on-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 a level 2 autotune phase (see **63**) and set in this parameter.
If it is not possible to carry out autotuning with rotation, enter the Cos φ value indicated on the motor nameplate.

10 : Quick setup menu access

L1: Level 1 access. Only parameters **01** to **10** can be accessed via the KEYPAD-LCD.
L2: Level 2 access. Parameters **01** to **80** can be accessed via the KEYPAD-LCD.
Loc: Used to store or reactivate a security code (see procedure in section 4.3.7).

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

11 :

• Configurations A1.A2, A1.Pr, A2.Pr, E.Pot, TorQ, Pid and PUMP: ADI1 mode
Used to define the type of signal on the ADI1 input.
Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.
Possible settings:

11	Description
0-20	0-20 mA current signal, 0 mA corresponds to the minimum reference
20-0	20-0 mA current signal, 20 mA corresponds the minimum reference
4-20	4-20 mA current signal with detection of signal loss. 4 mA corresponds to the minimum reference
20-4	20-4 mA current signal with detection of signal loss. 20 mA corresponds to the minimum reference
4-.20	4-20 mA current signal without detection of signal loss. 4 mA corresponds to the minimum reference
20-.4	20-4 mA current signal without detection of signal loss. 20 mA corresponds to the minimum reference
volt	**0-10V voltage signal**
d-In	The input is configured as a digital input

• Configuration 4Pr and 8Pr: Preset reference 1
Used to define preset reference Pr1.

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

12 :

• Configurations A1.A2, TorQ, Pid, PUMP and HuAC: ADI2 mode
Used to define the type of signal on the ADI2 input.
Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.
Possible settings:

12	Description
0-20	0-20 mA current signal, 0 mA corresponds to the minimum reference
20-0	20-0 mA current signal, 20 mA corresponds the minimum reference
4-20	4-20 mA current signal with detection of signal loss. 4 mA corresponds to the minimum reference
20-4	20-4 mA current signal with detection of signal loss. 20 mA corresponds to the minimum reference
4-.20	**4-20 mA current signal without detection signal loss. 4 mA corresponds to the minimum reference**
20-.4	20-4 mA current signal without detection of signal loss. 20 mA corresponds to the minimum reference
volt	0-10V voltage signal
d-In	The input is configured as a digital input
CtP	The input is configured to manage the motor PTC sensors

• Configurations A1.Pr, A2.Pr, 4Pr, 8Pr and HoiS: Preset reference 2
Used to define preset reference Pr2.

• Configuration E.Pot: Motorised pot reset

When this parameter is at RSEt, the up/down command reference is reset to zero.

• Configuration Pad: Power-up keypad reference Preset 1
Used to define the reference on power-up when **11** is set to Pr1.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

13 :

• **Configurations A1.Pr, A2.Pr, 4Pr and 8Pr: Preset reference 3**
Used to define preset reference Pr3.

• **Configuration of E.Pot: Motorised pot reset mode**
Used to select the type of automatic reset.
Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.
Possible settings:
Rst.e: The reference is reset to 0 on each power-up. The up/down and reset inputs are active at all times.
Pre.e: On power-up, the reference is at the level it was on power-down. The up/down and reset inputs are active at all times.
Rst.d: The reference is reset to 0 on each power-up. The up/down inputs are active only when the drive output is active. The reset input is active at all times.
Pre.d: On power-up, the reference is at the level it was on power-down. The up/down inputs are active only when the drive output is active. The reset input is active at all times.

• **Configuration Pid and PUMP: PID proportional gain**
This is the proportional gain applied to the PID error.
Note: The gain values configured for a version V2.20 drive must not be kept for a version V3.10 drive (modified adjustment range).

• **Configuration Pad: Enable keypad FWD key**
Used to enable or disable the keypad forward key.
Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.
Possible settings:
OFF: keypad FWD key disabled.
On: keypad FWD key enabled.

14 :

• **Configurations A1.Pr, A2.Pr, 4Pr and 8Pr: Preset reference 4**
Used to define preset reference Pr4.

• **Configuration E.Pot: Motorised pot bipolar select**
Pos: The up/down command reference is limited to positive values (0 to 100.0%).
biPo. : The up/down command reference can change from -100% to +100%.

• **Configuration Pid and PUMP: PID integral gain**
This is the gain applied to the PID error before integration.
Note: The gain values configured for a version V2.20 drive must not be kept for a version V3.10 drive (modified adjustment range).

• **Configuration Pad: Enable keypad Stop key**
Used to enable the keypad stop key.
Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.
Possible settings:
OFF: keypad Stop key disabled.
On: keypad Stop key enabled.

15 :

• **Configuration 8Pr: Preset reference 5**
Used to define preset reference Pr5.

• **Configuration 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 sensitivity of the command.

• **Configuration Pid: PID derivative gain**
This is the gain applied to the PID error before derivation.

• **Configuration PUMP: Stop on Vmin enable**
This parameter is used to enable the run/stop on minimum speed function. During operation, if **15** = Yes, and the flow rate is at minimum (min. speed) for a period of 25 seconds, the drive automatically disables PID control and stops the motor. Restarting occurs when the pressure falls below the pressure set by the user (reference pressure x **48**).

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

16 :

• **Configuration 8Pr: Preset reference 6**
Used to define preset reference Pr6.

• **Configuration E.Pot: Motorised pot scale factor**

The maximum value of the up/down pot reference automatically takes the maximum value **02**.
This parameter is used to correct the action of the up/down pot reference, in cases where the main PID reference is used.
For a maximum up/down pot reference, at 1000 rpm:

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

• **Configuration Pid: PID upper limit**
Used to limit the maximum value of the PID output.

• **Configuration PUMP: Draining threshold**
This parameter is used to set the threshold (as a percentage of the sensor pressure) of the drive draining trip "tr01", when the back pressure is not reached.

17 :
• **Configuration 8Pr: Preset reference 7**
Used to define preset reference Pr7.

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

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

• **Configuration PUMP: Draining time delay**
Used to set the period before the drive draining trip "tr01", when the back pressure is not reached.

18 :
• **Configuration 8Pr: Preset reference 8**
Used to define preset reference Pr8.

• **Configuration 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.

• **Configuration PUMP: Digital reference**
If the regulation reference is digital (terminal DI3 closed), **18** is used to define the value of this reference (as a percentage of the pressure, see example in section 4.3.7.9).

19 :
• **Configuration TorQ and 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.

• **Configuration PUMP: Customer unit coefficient**
This parameter is a multiplication coefficient allowing the PID reference and PID feedback to be displayed as a customer value (**20** and **21**).

20 :
• **Configuration 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.

20 :

• **Configuration PUMP: Customer reference value**
This parameter indicates the value of the PID reference in customer units (scaled using **19**).

21 :

• **Configuration Pid: PID reference**
Indicates the value of the PID reference.

• **Configuration PUMP: Customer feedback value**
This parameter indicates the value of the sensor feedback in customer units (scaled using **19**).

22 :

• **Configuration Pid: PID feedback**
Indicates the PID feedback value.

• **Configuration PUMP: Motor speed**
This parameter indicates the motor speed of rotation.

23 :

• **Configuration Pid: PID main reference**
Indicates the value of the PID main reference.

24 :

• **Configuration Pid: PID output**
Indicates the level of the PID controller output before scaling.

25 : Operating mode
This parameter is used to select the control mode.
A return to factory settings procedure does not modify the operating mode.
The operating mode can only be selected when the drive is stopped.
oP.LP: The drive is controlled in open loop mode. Open loop control mode is defined by parameter 26.
cL.LP: The drive controls an induction motor in closed loop flux vector control mode. The encoder type or control mode are defined by parameter **26**.
SruO: The drive controls a servo motor. The encoder type or control mode are defined by parameter **26**.
Note: The change from open loop mode (**25** = oP.LP) to closed loop mode (**25** = cL.LP or SruO), or vice-versa, initiates a return to factory settings of parameters **40** (brake apply frequency or brake apply speed) and **41** (magnetisation delay/pre-brake release delay).

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

26 :

• If 25 = oP.LP: Open loop mode select (■)

Determines the open loop control mode. Modes r.run, r.no, r.FSt or r.On are used in flux vector control. The difference between these modes is the method used to identify the motor parameters, particularly the stator resistance. As these parameters vary with temperature and are essential for obtaining optimum performance, the machine cycle must be taken into account for selecting the most appropriate mode. Modes UtoF and SqrE correspond to a U/F ratio control mode. This ratio is linear in UtoF mode and square in SqrE mode.

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 must be compatible with the 2 seconds required between a stop command and a new run command.

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 r.run mode is incompatible with the operating cycle.

UtoF: Voltage-frequency ratio with fixed boost adjustable via parameters **29** and **08**.
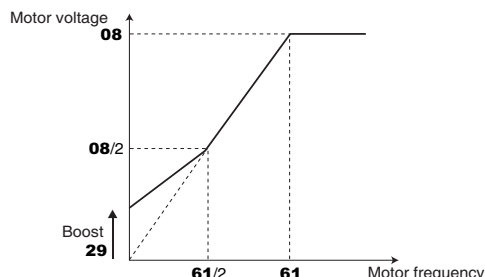
WARNING:
Use this mode to control several motors.

r.FSt: Operation equivalent to r.no mode.
r.On: Operation equivalent to r.run mode after the first start.

⚠ **• In r.On mode, a voltage is briefly applied to the motor. For safety reasons, no electrical circuit should be accessible once the drive is powered up.**

SqrE: Square voltage/frequency law.

• If 25 = cL.LP or Sruo: Sensor type
Incr.: Quadrature incremental encoder
Fd: Incremental encoder with Frequency/Direction output
Fr: Incremental encoder with FWD/REV outputs
CoMM: Incremental encoder with commutation channels
haLL: Hall effect sensor
tyP1 to tyP4: Sensorless mode 1 to mode 4 (specific modes, requiring the use of advanced menus, see manual ref. 3854).

27 :

• If 25 = cL.LP or Srvo: Encoder lines per revolution
Used to configure the number of lines per encoder revolution. Converts the encoder input into a speed.

28 :

• If 25 = cL.LP or Srvo: Drive encoder filter (■)
This parameter is used to insert a filter in the encoder speed feedback, such that:
time constant = 2^{28} ms.

This is particularly useful for attenuating the current demand when the load has high inertia and high gain is necessary on the speed loop. If the filter is not enabled under these conditions, it is possible for the speed loop output to change continuously from one current limit to another, disabling the integral function of the speed loop.

The filter is inactive if **28** = 0.

29 :

• If 25 = oP.LP and 26 = UtoF: Boost
For operation in V/F mode, 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 motor rated voltage (**08**).

• If 25 = cL.LP or Srvo: Speed loop proportional gain Kp1 (■)
Adjusts the stability of the motor speed in the event of sudden variations in the reference.

Increase the proportional gain until vibrations occur 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 = oP.LP and 26 = UtoF: Dynamic V to F
Lin: The V/F ratio is fixed and set by the base frequency (61).
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 = cL.LP or Srvo: Speed loop integral gain Ki1 (■)
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.
WARNING:
Do not configure a zero value in this parameter (may cause difficulties when the motor stops).

31 : **Current loop proportional gain**

32 : **Current loop integral gain**

• If 25 = oP.LP and 26 ≠ UtoF or if 25 = cL.LP or Srvo:
Due to a certain number of internal drive factors, oscillations may occur in the following cases:
- Frequency control with current limiting around the rated frequency and on load impacts.
- Torque control on machines with a low load and around the rated speed.
- On a mains supply break or on a controlled deceleration ramp when control via the DC bus 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 = cL.LP or Srvo: Ramp bypass (■)
raMP: Active ramps.
no: Ramps short-circuited.

34 and **35** : **Not used**

36 : **Brake controller enable**
Used to enable brake control and to select to which digital output it will be assigned.
dis: Brake control is not enabled.
COnt: Brake control is enabled and routed to the PX-Brake Contactor (or PX-Brake Contactor Secure) option.
rEI: Brake control is enabled and directed towards the relay. In this case, the function initially assigned to the drive relay (fault relay) is rerouted to digital output DIO1.
USEr: Brake control is enabled. The output is not assigned automatically; it is up to the user to make the selection. See the extended functions manual ref. 3854.
WARNING:
• The secure disable function overrides brake control: if 47 = SEcu then 36 = rEI, brake control is indeed enabled but the relay keeps its fault relay function and 36 switches automatically to USEr.
Consequently, disable the safety function by 47 = Enab before setting 36 = rEI.
Note: Setting **36** to rEI will cause parameter **05** to change to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected preset configuration.

37 :
• If 36 ≠ dis: Upper current threshold
Used to set the current threshold at which the brake will be controlled. This current level should provide sufficient torque at the time the brake is released.

38 :
• If 36 ≠ dis: Lower current threshold
Used to set the current threshold below which brake control will be disabled (brake applied). It should be set so that loss of the motor power supply is detected.

39 :
• If 36 ≠ 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 when 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 ≠ dis:Brake apply frequency(■) or speed (■) threshold
Used to set 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 applied.
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 applied as the motor passes through zero speed.

41 :
• If 36 ≠ dis: Magnetisation delay (■)
Pre-brake release delay (■)
■: This time delay is triggered when all the conditions for brake release have been met. It allows enough time to establish an adequate level of reactive current in the motor and to ensure that the slip compensation function is fully activated. When this time delay has elapsed, brake control is enabled. For the full duration of this time delay, 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 it is being applied around zero speed.

42 :
• If 36 ≠ 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 ≠ 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 deactivated.

44 and **45** :**Not used**

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

46 :

• All configurations except PUMP configuration: Start/stop logic select

Used to choose one of 3 Run/Stop command and Direction of rotation management modes.

Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.

Possible settings:

Lchd : DI2 terminal used as FWD/Stop
DI3 terminal used as REV/Stop
Commands given via latched contacts.

Puls : DI2 terminal used as FWD
DI3 terminal used as Stop
DIO1 terminal used as REV
Commands given via pulsed contacts.

To change from FWD to REV or vice versa, go via a stop command.

r.InP : DI2 terminal used as Run/Stop
DI3 terminal used to select the direction of rotation.
Commands given via latched contacts.

These three configurations result in automatic assignment of the digital inputs.

Note: Modifications to **46** must be made with the drive disabled.

• With "3-wire" control (jog Run/Stop)
46 = Puls :

DIO1	⊘	Run reverse
+24V	⊘	
DI2	⊘	Run forward
DI3	⊘	Stop
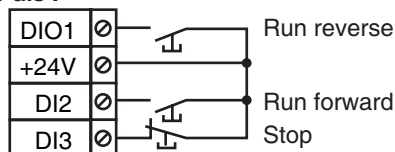
• With reverse direction, 46 = r.InP:

+24V	⊘	
DI2	⊘	Run/Stop
DI3	⊘	Reverse
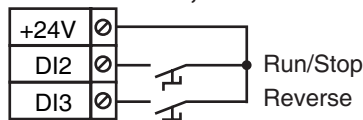
46 :

• Configuration PUMP: Run time: years.days

This parameter records the number of years and days of operation since the drive was first commissioned.

47 :

• All configurations except configuration PUMP: SDI select

Used to define the SDI input type. Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.

Possible settings:

Enab: The SDI input is used as a simple unlocking input.

SEcu: The SDI input is used as a secure disable input. In order to conform to safety standard EN 954-1 category 3, the drive must be wired in accordance with the recommended diagram in the manual (section 3.4).

Note: Modifications to **47** must be made with the drive disabled.

WARNING:
The factory setting of 47 is Enab for the Pad configuration. The same applies if the drive is controlled by a fieldbus or a KEYPAD-LCD.

47 :

• Configuration PUMP: Run time: hours.minutes

This parameter records the number of hours and minutes of operation since the drive was first commissioned. After 23.59, **47** returns to 0 and **46** is incremented by one day.

48 :

• All configurations except configuration PUMP: ADIO3 mode

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

Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.

Possible settings:

48	Description
0.20i	0-20 mA current input, 0 mA corresponds to the minimum reference
20.0i	20-0 mA current input, 20 mA corresponds to the minimum reference
4.20i	4-20 mA current input with detection of signal loss. 4 mA corresponds to the minimum reference
20.4i	20-4 mA current input with detection of signal loss. 20 mA corresponds to the minimum reference
4.20i.	4-20 mA current input without detection of signal loss. 4 mA corresponds to the minimum reference
20.4i.	20-4 mA current input without detection of signal loss. 20 mA corresponds to the minimum reference
0.10i	0-10V voltage input
d-In	The input is configured as a digital input
0.20o	0-20 mA current output, where 20 mA corresponds to the maximum value of the
4.20o	4-20 mA current output, where 20 mA corresponds to the maximum value of the
0.10o	**0-10V voltage output, where 10V corresponds to the maximum value of the assigned parameter**

• Configuration PUMP: Automatic restart threshold

After a stop on minimum speed, the motor restarts when the pressure falls below the pressure set by the user, i.e. reference pressure x **48**.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

49 :

• **All configurations except configuration PUMP: ADIO3 feature**

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

Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.

Possible settings:

49	ADIO3 function
SPd	Motor speed
Ld	Motor load
A	Motor current
Puur	Output power
Adv	Any assignment

If ADIO3 is used as an input, **49** in forced to Adv.
When **49** = Adv, assignment is at the user's discretion. Refer to the "extended functions" manual ref. 3854.

49 :

• **Configuration PUMP: Trip -1 (most recent)**
Used to find out the last drive trip.

50 :

• **All configurations except configuration PUMP: DIO1 feature**

This parameter is used to assign the DIO1 function quickly.

Any setting other than the preset configuration causes parameter **05** to switch to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected configuration.

Possible settings:

50	DIO1 function
n = 0	**Zero speed output**
At.SP	At speed output
Lo.SP	Minimum speed output
At.Ld	At rated load output
act	Drive output active
alar	Drive general alarm output
I.Lt	Current limit output
JoG	Jogging input
rESE	Reset input
Adv	Any assignment

50 :

• **Configuration PUMP: Trip -2**
Reads trip -2.

51 :

• **All configurations except configuration PUMP: Jog reference**
Operating speed when the jog input has been selected (see **50**).

51 :

• **Configuration PUMP: Trip -3**
Reads trip -3.

52 :

• **All configurations except configuration PUMP: Bipolar reference select**
PoS: All negative references are treated as zero.
nEg: Used to change the direction of rotation by the reference polarity. May come from preset references.
Note: The analog inputs are unipolar.

52 :

• **Configuration PUMP: Trip -4**
Reads trip -4.

53 :

• **All configurations except configuration PUMP: Skip (critical speed)**
A skip is available to avoid a machine running at a critical speed. When the parameter is at 0, the function is deactivated.

53 :

• **Configuration PUMP: Trip -5**
Reads trip -5.

54 :

• **All configurations except configuration PUMP: Skip reference band**
Defines the skip reference band around the avoided speed. The total skip will therefore equal the threshold set ± skip reference band. When the reference is within the window determined in this way, the drive will prevent operation in this zone.

54 :

• **Configuration PUMP: Trip -6**
Reads trip -6.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

55 :

**• All configurations except configuration PUMP: Deceleration ramp mode select**

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 trip "OU".

WARNING:

Select mode 55 = FSt when a braking resistor is used or in the case of a driving load (especially in the case of preset configuration HoiS).

Std: Standard deceleration ramp with automatic extension of the ramp time in order to avoid causing a DC bus overvoltage trip on the drive.

StdH: The drive allows the motor voltage to be increased to as much as 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 sufficient, the standard deceleration ramp time is extended, to avoid causing a DC bus overvoltage trip on the drive.

For the same amount of energy, mode StdH enables faster deceleration than mode Std.

FstH: Same as mode StdH, but the ramp is imposed. If the configured ramp is too fast, the drive goes into OU trip state.

WARNING:

In modes StdH and FstH, the motor must be able to tolerate the additional losses related to the increase in voltage at its terminals.

55 :

• Configuration PUMP: Trip -7
Reads trip -7.

56 :

• All configurations except configuration PUMP: Ramp type

Lin: The ramp is linear.

S-rP: A curved part at the start and end of the ramp avoids load swinging (S ramp).

WARNING:

The S ramp is deactivated during controlled decelerations, 55 = Std or StdH.

56 :

• Configuration PUMP: Trip -8
Reads trip -8.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

57 :

• All configurations except configuration PUMP: Stop mode

FrEE: freewheel stop.

The power bridge is deactivated as soon as the stop command is given.

The drive cannot receive another run command for 2 s, the time required for motor demagnetisation.

The display indicates rdY, 2 seconds after the stop command.

The machine stopping time depends on its inertia.
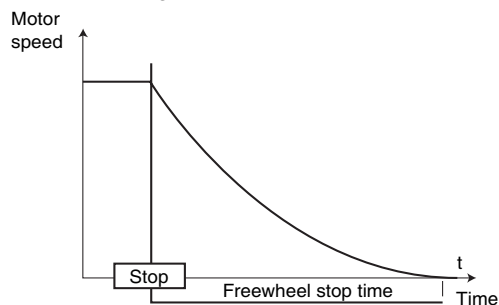
rAMP: Stop on deceleration ramp.
The drive decelerates the motor according to the deceleration mode chosen in parameter 55.
One second after the stop, the display indicates rdY.
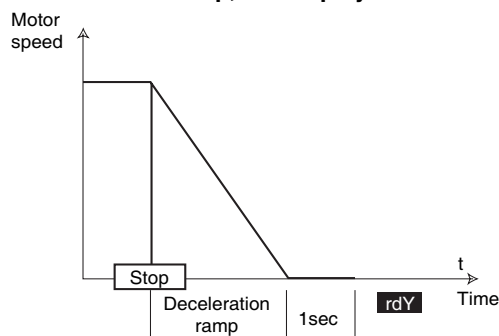
rP.dC: Stop on deceleration ramp with DC injection for an imposed period of time.

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.
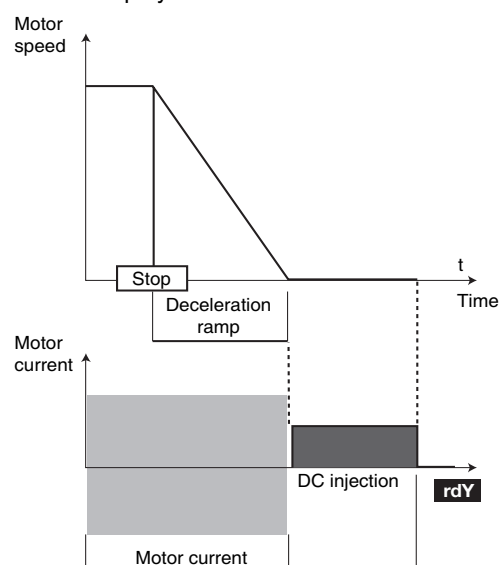
dC-O (□): Stop by DC injection braking, and elimination at zero speed.

The drive decelerates the motor by setting a low frequency current until it reaches 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.
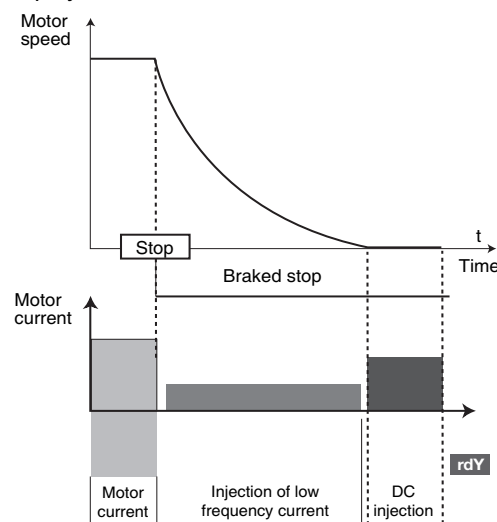
dC-t (□): Stop on DC injection with an imposed period of time.

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.
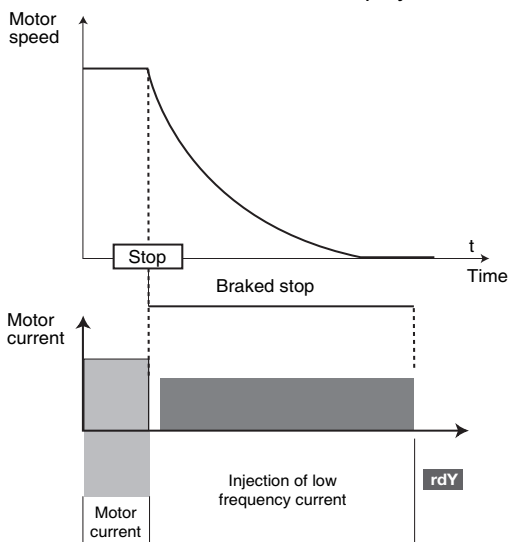
57 :

• Configuration PUMP: Trip -9
Reads trip -9.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

58 :

• **All configurations except configuration PUMP: Mains loss mode**
diS: The drive does not take account of mains supply breaks and continues to operate while there is sufficient voltage on the DC bus.
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 feeds back energy to the drive's DC bus and therefore continues to power its control electronics. Upon return to normal conditions, deceleration continues until the motor stops, but according to the deceleration mode configured in **55**.
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 feeds back energy to the drive's DC bus and therefore continues to power its control electronics. Upon return to normal conditions, the motor re-accelerates up to the reference speed.

58 :

• **Configuration PUMP: Trip -10**
Reads trip -10.

59 : Catch a spinning motor

If this parameter is enabled by **59** = On.2d, On.Fd or 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 re-accelerate the motor up to the reference frequency.

59	Functions
no	Disable catch a spinning motor function
On.2d	Enable catching of a spinning motor rotating clockwise or counter-clockwise
On.Fd	Enable catching of a spinning motor which is rotating clockwise only
On.rS	Enable catching of a spinning motor which is rotating counter-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 : Switching frequency

Sets the PWM switching frequency.

60	Frequency
3 hH	3 kHz
4.5 hH	**4.5 kHz**
5.5 hH	5.5 kHz
6 hH	6 kHz
9 hH	9 kHz
11 hH	11 kHz

WARNING:
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 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	62
3000	2 P
1500	4 P
1000	6 P
750	8 P

63 : Autotune

⚠ • **The measurement taken when 63 = 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 risk to safety, and ensure that the motor is stopped before the autotune procedure.
• **If brake control is enabled, the autotune procedure may cause the brake to be released. If there is any danger, disable brake control before initiating autotuning (36 = dis).**
• **After modifying the motor parameters, repeat autotuning.**

no: No autotune

StoP: Measurement of motor characteristics when stopped. The stator resistance and voltage offset are stored.
Procedure:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- 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 the run command.
The motor is then ready to operate normally.
Parameter **63** returns to "no" as soon as autotuning is complete.
WARNING:
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

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:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- Give a run command. The motor accelerates up to 2/3 of 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 the run command.
The motor is then ready to operate normally.
Parameter **63** returns to no as soon as autotuning is complete.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

64 : Parameter cloning

Disable the drive (terminal SDI2 open).
Connect XPressKey to the drive's serial link.
no: No action.
rEad: When this parameter is stored at rEad, the display alternates between "rEad" and "hEY?" Confirm the transfer of parameters into the drive by pressing the KeY button. 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 rEad, and the second press confirms this. Press the button on the key within 10 seconds after selecting rEad in **64**.
Prog: When this parameter is stored at Prog, the display alternates between "Prog" and "hEY?" Confirm the transfer of parameters into XPressKey by pressing the Key button on the XPressKey. When the transfer is complete, the parameter reverts to 0. Press the button on the key within 10 seconds after selecting Prog in **64**.
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.
WARNING:
• 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 drive will go into alarm mode "C.rtg".
If the user confirms the transfer by pressing the Key button on the XPressKey, the parameters are transferred into the drive, apart from the "motor" parameters (06, 07, 08, 31 and 32).
• Do not transfer parameters with the XPressKey between two drives with different voltage/frequency ("voltage code 400" drive to a "voltage code 200" or vice versa, and "voltage code 200 -50Hz" drive to "voltage code 200 -60Hz" and vice versa for example).

65 : Factory settings

WARNING:
Disable the drive before changing 65.
no: Return to factory settings is not performed.
Eur: Configures the drive to factory settings for 50 Hz mains supply.
USA: Configures the drive to factory settings for 60 Hz mains supply.
Note: After a return to factory settings, the drive automatically performs autotuning of the motor at standstill (see **63**).

66 : User security code

If this parameter is other than 0 and **10** is set to 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).

67 : Unit displayed on power-up

Spd: 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).

Load: 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).

SP.Ld: Alternately displays the speed and load, or the current.

USER, **SP.US** and **Ld.US:** Functions only accessible with the advanced menus. See manual ref. 3854.

68 : Selection of load display

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

68	Functions
Ld	**Display of the drive load level.**
A	Display of the total motor current.

69 : Unit for displaying the speed

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

70 : Parameter scaling

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** : Storing of the last 2 trips

Contains the last 2 drive trips.
71: Indicates the most recent trip.

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

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

75 : ADIO3 input or output level

Used to read the corresponding analog input or output.

76 : Pre-offset reference

Indicates the reference value without a run command.

77 : Pre-ramp reference

Indicates the reference after the speed skip (**53** and **54**) 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 speed

Indicates the calculated motor speed.

80 : DC bus voltage

Indicates the DC bus voltage measurement.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
COMMISSIONING

4.5 - Commissioning for brake control

4.5.1 - Introduction

To control an electromechanical brake from an AC single-phase source, use the optional PX-Brake Contactor (or PX-Brake Contactor Secure if the secure disable input function is also used for the application).
In the case of an application with driving load, use the optional PX-Brake Resistor or an RF external resistor.
Connect the brake and the optional PX-Brake Contactor as indicated on the installation sheet ref. 3809 (or ref. 3811 for the optional PX-Brake Contactor Secure). Then if necessary, connect the braking resistor to the power terminals BR1 and BR2, as indicated in section 6.3.2.

WARNING:
When using an external braking resistor, the drive internal braking resistor must be disconnected. To do this, follow the instructions described in section 6.3.3.

4.5.2 - Parameter settings to be made

WARNING:
Parameter setting must be carried out with the drive disabled (terminal SDI2 open). Then, enable the drive before giving the run command.

Parameter	Name	Setting	OBSERVATIONS
25	Operating mode	cL.LP ▪) or oP.LP ▪)	Enables operation in closed loop flux vector mode or Enables operation in open loop mode.
26	Sensor type ▪)	depending on the sensor	Set **26** and **27** at minimum depending on the characteristics of the sensor used (for more precise parameter setting of the speed feedback, set **28** to **33** as well, see section 4.3.8.1).
27	Encoder lines per revolution ▪)		
36	Brake controller enable	**Cont**	Enables brake control. Brake control controls the solid state relay for the optional PX-Brake Contactor (or PX-Brake Contactor Secure)
37	Upper current threshold	**10%**	After enabling the run command via DI2 or DI3, when the motor current is greater than 10%, brake contactor closing is permitted (release). **Note:** If load veering occurs when the brake is released, increase the value of this parameter.
38	Lower current threshold	**10%**	This setting is a safety mechanism in the event of loss of motor current during operation (e.g. motor power supply cable cut, winding fault). If the current is less than 10%, the brake contactor is opened (applied).
39	Brake release frequency	**1.0 Hz**	After enabling the run command via DI2 or DI3, when the frequency is greater than 1 Hz, brake contactor closing is permitted (release). **Note:** If load veering occurs when the brake is released, increase the value of this parameter.
40	Brake apply frequency ▪)	**2.0Hz** ▪)	If a stop command is given by opening DI2 or DI3, when the speed is less than 2.0 Hz ▪) or 5 rpm▪) , the brake contactor is opened (applied). The drive remains active for 1 s after the brake contactor opens. **Note:** When the deceleration ramp is short, if load veering occurs, increase the value of this parameter.
	Brake apply speed ▪)	**5 rpm** ▪)	
41	Magnetisation delay ▪)	**0. 10s**	After enabling the run command via DI2 or DI3, automatic installation of the magnetising current for 0.10 seconds.
	Pre-brake release delay ▪)	**0.30 s**	
42	Post-brake release delay	**0. 10s**	After enabling the run command via DI2 or DI3, the acceleration ramp is "frozen" for 0.1 s, even though the brake is released. Reduce this time to 0 s, if you wish the motor to turn immediately after the brake is released.
43	Brake apply delay ▪)	**1.00 s**	If a stop command is given by opening DI2 or DI3, with the brake applied, the torque is held for the whole period set by this parameter
55	Deceleration ramp mode select	**FSt**	This parameter must always be set to "FSt" during hoisting or if an external braking resistor is used. The deceleration ramp is in proportion to the time set in **04**

For a detailed explanation of these parameters, see section 4.4 page 49.

5 - TRIPS - 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 on the display
- Drive tripping with display of a code

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 • Autotuning 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 has tripped • Alternate display of triP and the trip code (to find out what the code means, see section 5.2)
Alar./USrx	• Alar. and USrx are displayed alternately, where x is the user trip number (1 to 4). Alarms enabled by **10.54** to **10.57** (see the extended functions manual ref. 3854).
Err/C.rtg	• The drive rating does not correspond to that of the XPressKey • The drive alternately displays "Err" and "Crtg". If the user confirms the transfer by pressing the Key button on the XPressKey, the parameters are transferred into the drive, apart from the "motor" parameters (**4.13**, **4.14**, **5.07** (**06**), **5.08** (**07**), **5.09** (**08**), **10.31**, **21.07**, **21.08** and **21.09**)
no	Parameter transfer via XPressKey is not possible. Disable the drive and repeat the procedure
Copy/ohl.l.	The copy by XPressKey has successfully been completed

5.2 - Trips

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

Trip code	No.	Reason for trip	Solution
cL1	27	Loss of the current reference on analog input ADI1	• Check that the reference is > 3mA • If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854).
cL2	28	Loss of the current reference on analog input ADI2	
cL3	29	Loss of the current reference on analog input ADIO3	
EEF	31	• EEPROM trip • Transfer of a set of parameters from a software version > V2.00 to a drive version V2.00 (via XPressKey)	• Perform a return to factory settings (see **65**) • If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854). • Switch off and then on again. Transfer of the XPressKey has still taken place.
EnC1	36	Loss of channel U	• Check the speed feedback • Replace the encoder
EnC2	37	Loss of channel V	• Check the encoder voltage and connections
EnC3	38	Loss of channel W	• Check the encoder voltage and connections
Fbus	34	• Disconnection of the fieldbus during operation • Error detected by the optional bus	• If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854). • Check the connection of the optional bus to the drive. • Read the error code in parameter **15.50** and refer to the manual for the corresponding optional bus for explanations.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
TRIPS - DIAGNOSTICS

Trip code	No.	Reason for trip	Solution
It.AC	20	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** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854).
It.br	19	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 built-in transistor
Oht1	21	IGBT overheating (sensor)	• Reduce the motor load, the cycle, the switching frequency and the acceleration and deceleration ramps • If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854). • If using an external braking resistor, disconnect the internal resistor (see procedure in section 6.3).
Oht2	22	Internal resistor overheating (sensor)	• Disconnect the internal resistor, if you have connected an external resistor • Reduce the switching frequency • Reduce the cycle and the motor load • If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854).
OI.AC	3	Overcurrent at drive output	• Check the motor insulation and connection • Increase the acceleration and deceleration ramps • Check the wiring, the coupling and the signals (interference) of the speed feedback • Check that the motor cables are not too long • Reduce the speed loop gains **29** (**3.10**), **30** (**3.11**) and **3.12** ■▶ and ⟳ • If it has not already been done, perform autotuning **63** = 2 ⟳ • Reduce the current loop gains **31** (**4.13**) and **32** (**4.14**) ■▶ and ⟳
Olbr	4	IGBT braking overcurrent	• Check the resistor insulation • Correct the short-circuit at the resistor output • Set a higher resistor ohmic value
Old1	26	Overload on +24V source or digital output	• Check the total current consumption • If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854).
OSP	7	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	2	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 (**55**)
Ph.AC	6	Loss of a motor phase with brake enabled	• Lower the parameter **37**
rS	33	Trip during measurement of stator resistance	• Adapt the drive power to that of the motor • Check the connection of the motor cables
SCL	30	Serial link trip	• Check that the serial link cable is not damaged, or wrongly connected. • If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854). • Check that **11.63** = 0.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
TRIPS - DIAGNOSTICS

Trip code	No.	Reason for trip	Solution
Secd	**35**	Secure disable input trip	• Give a stop command before enabling the drive
th	**24**	Motor sensor trip	• Check the motor load • Reduce the overload level • Check the motor cooling and the ambient temperature • Check the wiring of terminal ADI2 on the control terminal block • If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854).
tr01	**41**	User trip 1 via digital input	
tr02	**42**	User trip 2 via digital input	
tr03	**43**	User trip 3 via digital input	• If **10.37** = Ctld, the drive decelerates the motor before tripping (see manual ref. 3854).
tr04	**44**	User trip 4 via digital input	
tr05 to tr100	**45 to 100**	User 5 trip to User 100 trip via serial link	
UU	**1**	DC bus undervoltage	Check the mains supply

COMMANDER SX
IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS

6 - OPERATING EXTENSIONS

6.1 - Add-on options

⚠ **• It is imperative that these options (apart from XPressKey and KEYPAD-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.

WARNING:

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.

WARNING:

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 N.m.**

Speed feedback module
XPressKey

Communication module
or I/O extension

Brake contactor
PX-Brake Contactor or
PX-Brake Contactor Secure

Note: For the installation instructions, see the manuals for the corresponding options.

6.1.2 - XPressKey

6.1.2.1 - General

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.
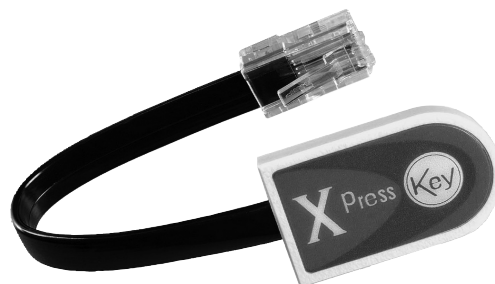
6.1.2.2 - Saving parameters in XPressKey

• Connect XPressKey to the **Commander SX**'s serial link.

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

WARNING:

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 the parameters of a drive with the same rating using XPressKey

• Connect XPressKey to the serial link.

• 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.

WARNING:

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 rating is different and the user wishes to transfer the XPressKey to the drive, the drive goes into alarm mode "C.rtg". If the user confirms the transfer by pressing the Key button on the XPressKey, the parameters are transferred into the drive, apart from the "motor" parameters (**06**, **07**, **08**, **31** and **32**).

WARNING:

Do not transfer the XPressKey parameters between two drives with different voltage/frequency ("voltage code 400" drive to a "voltage code 200" or vice versa, and "voltage code 200 -50Hz" drive to "voltage code200 - 60Hz" and vice versa for example).

COMMANDER SX
IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS

6.1.3 - PX-Encoder

The PX-Encoder option can be used to manage the motor speed feedback. PX-Encoder manages incremental encoders with or without commutation channels and Hall effect sensors.

6.1.3.1 - Terminal block installation and locations
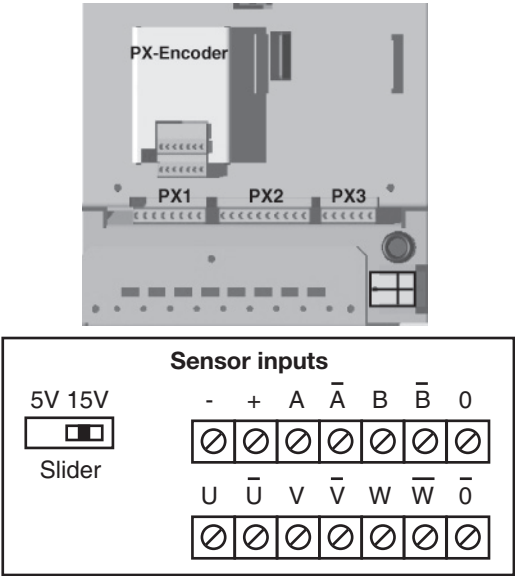
6.1.3.2 - Connection of an incremental encoder

-	0V for the encoder power supply
+	Encoder power supply depending on the position of the selector switch (slider) 5V or 15V
A	
A	Connection of encoder channels
B	
B	
0	Do not connect. 0 marker not managed
U	
U	
V	
V	Connection of commutation channels (Servo)
W	
W	
0	Do not connect. 0 marker not managed

WARNING:
Check the position of the power supply selector switch carefully.

6.1.3.3 - Connection of a Hall effect sensor

-	0V for the sensor power supply
+	Sensor power supply according to position of selector to be positioned on 15V
U	• Sensor signal 1
V	• Sensor signal 2
W	• Sensor signal 3

WARNING:
Check the switch position carefully: 15V for the Hall effect sensor power supply.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS

6.1.4 - PX-Brake Contactor
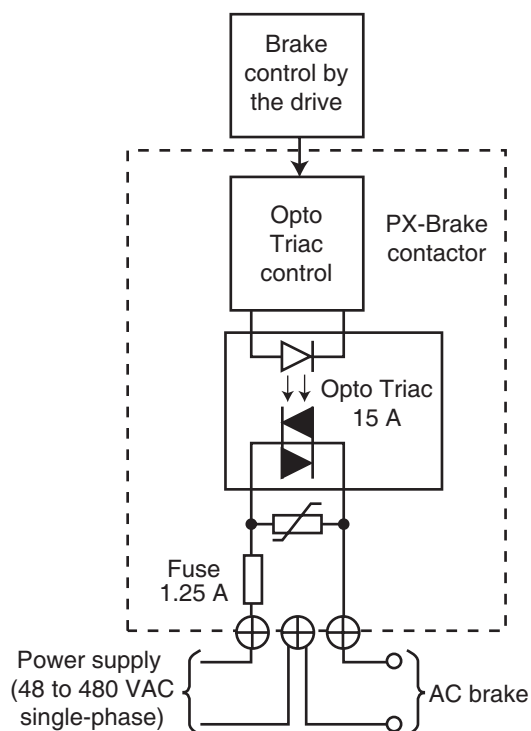
Digital output
connection
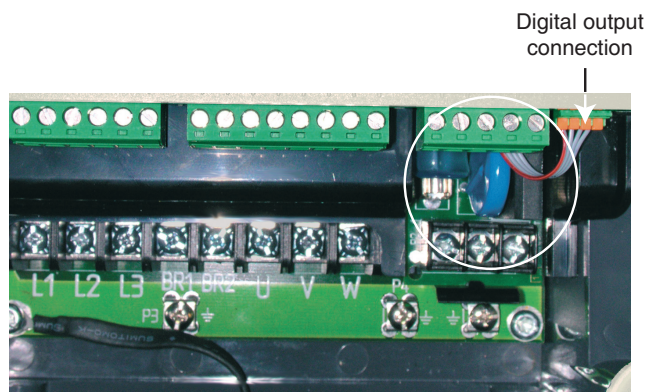
6.1.4.1 - General

The PX-Brake Contactor option is used to control an electromechanical brake directly from an AC single-phase source.
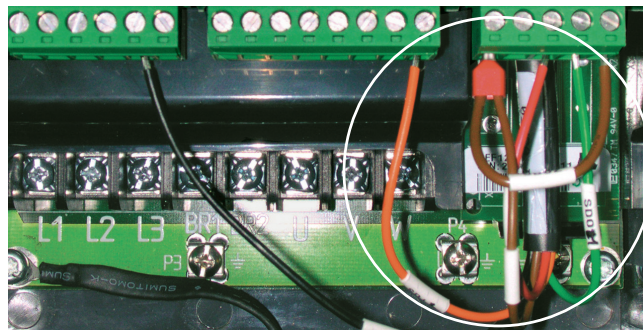
It is connected to a dedicated digital output, managed by brake control (parameters **36** to **43**).

Note: The option is protected by a fuse (rated FA 660 V, 1.25 A) labelled "F1" on the card.

6.1.4.2 - Connection

6.1.5 - PX-Secure

6.1.5.1 - General

The PX-Secure option allows terminal SDI2 to be used as a secure disable input in accordance with safety standard EN 954-1 category 2 or 3 (line contactor not required).

6.1.5.2 - Connection
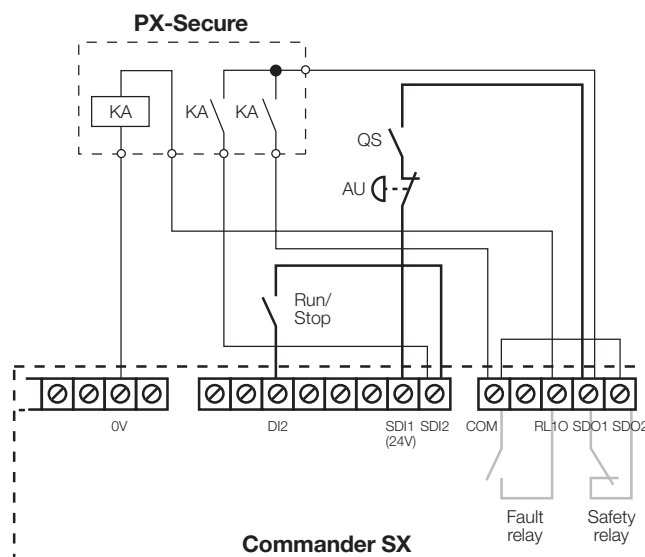
PX-Secure

6.1.6 - PX-Brake Contactor Secure
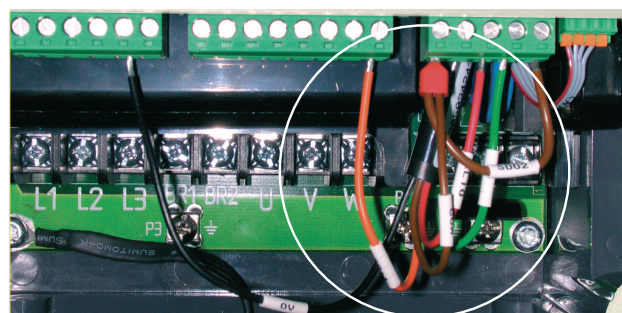
The PX-Brake Contactor Secure option includes the brake control PX-Brake Contactor option and the PX-Secure option for the secure disable input function on the same card.
For information on these options, refer to sections 6.1.4 and 6.1.5.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS
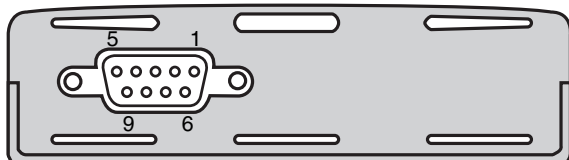
6.1.7 - SM-PROFIBUS DP module

• General
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 high as 12 Mbps.
The **Commander SX** powers the module internally.

• 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-N	Negative data line (A)

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

Note: The SXSoft parameter-setting software or the KEYPAD-LCD must be used to set the PROFIBUS-DP module parameters.

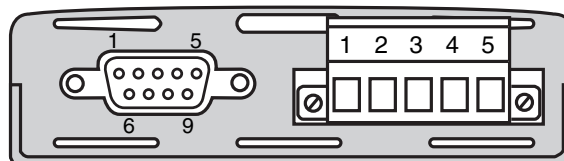## 6.1.8 - SM-DeviceNet module

• General
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 high as 500 Kbps.
The module should be powered by the DeviceNet power supply.

• Connection

5-terminal term. blk	9-pin SUB-D	Functions	Description
1	6	0V	0V for the external power
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

Note: The SXSoft parameter-setting software or the KEYPAD-LCD must be used to set the DeviceNet module parameters.

WARNING:
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.

COMMANDER SX
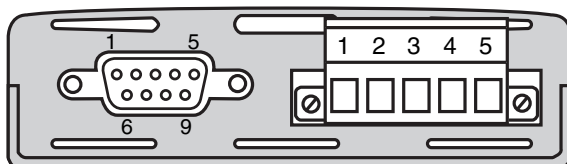## IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS

6.1.9 - SM-CANopen module

• General

The SM-CANopen module is used to communicate with a CANopen network. It integrates a 16-bit microprocessor and its transmission speed can be as high as 1 Mbps.
The **Commander SX** powers the module internally.

• Connection

5-terminal term. blk	9-pin SUB-D	Functions	Description
1	6	0V	0V for the external power
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

Note: The SXSoft parameter-setting software or the KEYPAD-LCD must be used to set the CANopen module parameters.
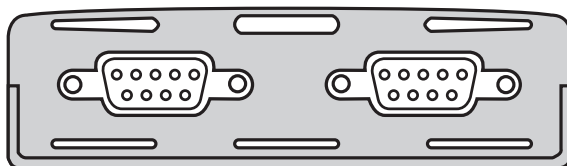
6.1.10 - SM-INTERBUS module

• General

The SM-INTERBUS module is used to communicate with an INTERBUS network. It integrates a 16-bit microprocessor, and its transmission speed can be as high as 500 Kbps.
The **Commander SX** powers the module internally.

• Connection

BUS IN   BUS OUT

Terminals	Functions	Description
IN1	DO1	Positive data IN line
IN6	/DO1	Negative data IN line
IN2	DI1	Positive data OUT line
IN7	/DI1	Negative data OUT line
IN3	0V ISO IN	Isolated 0V for IN Bus
IN shielding	Shielding	IN Bus cable shielding
OUT1	DO2	Positive data IN line
OUT6	/DO2	Negative data IN line
OUT2	DI2	Positive data OUT line
OUT7	/DI2	Negative data OUT line
OUT3	0V ISO OUT	Isolated 0V for OUT Bus
OUT5	+5V ISO OUT	Isolated +5V for OUT Bus
OUT9	RBST	Enable OUT Bus
OUT shielding	Shielding	IN Bus cable shielding
Earth	Earth	

Note: The SXSoft parameter-setting software or the KEYPAD-LCD must be used to set the INTERBUS module parameters.
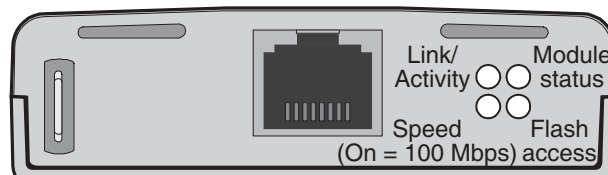
6.1.11 - SM-Ethernet module

• General

The SM-Ethernet module is used to communicate with an Ethernet network.
The **Commander SX** powers the module internally (current consumption 280 mA).
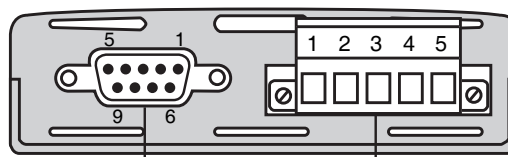
• Connection

RJ45	Internal crossover disabled (#mm.43 = 0)	Internal crossover enabled (#mm.43 = 1)
1	Transmission +Ve	Reception +Ve
2	Transmission -Ve	Reception -Ve
3	Reception +Ve	Transmission +Ve
4	-	-
5	-	-
6	Reception -Ve	Transmission -Ve
7	-	-
8	-	-

Note: The SXSoft parameter-setting software or the KEYPAD-LCD must be used to set the Ethernet module parameters.

6.1.12 - Modbus RTU module

As standard, the **Commander SX** incorporates a non-isolated 2-wire RS485 serial link port accessible via the RJ45 connector. When the user wishes to keep the KEYPAD-LCD permanently connected, it is necessary to add the Modbus RTU option with an isolated serial link port, either 2 or 4-wire.

9-pin SUB-D		5-terminal term. blk	
Pin	Description	Terminal	Description
1	0V "com"	1	0V "com"
2	TX\	2	RX\
3	RX\	3	RX
4	not connected	4	TX\
5	not connected	5	TX
6	TX		
7	RX		
8	not connected		
9	not connected		
Shielding: 0V "com"			

Note: The SXSoft parameter-setting software or the KEYPAD-LCD must be used to set the Modbus RTU module parameters.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS

6.2 - Parameter-setting options

6.2.1 - KEYPAD-LCD console

6.2.1.1 - General
This KEYPAD-LCD 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).
This KEYPAD-LCD 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 KEYPAD-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
- analog I/O levels
- digital I/O states
- logic function states
- timer
- most recent trips

6.2.1.3 - Interactive parameter-setting wizard
The parameters are set in successive steps. The parameters offered at each step by the KEYPAD-LCD 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 KEYPAD-LCD.

6.2.2 - SXSoft

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

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

6.3 - Braking resistors

6.3.1 - General

Three types of resistor can be used with the **Commander SX**:
• The internal braking resistor in drive sizes 1 and 2
• The optional PX-Brake Resistor braking resistors (IP66/Nema 4X and fixed to the back of the drive)
• The optional RF braking resistors (IP20 or IP55)

Braking occurs when the drive slows the motor or when the drive resists an increase in the motor speed, due to the mechanical environment (driving load for example).
During braking, the energy is returned to the drive which cannot absorb equivalent energy to its own losses. When the energy to be dissipated is higher, the DC bus voltage increases. In factory-set configuration, the drive automatically increases the deceleration time in order to avoid causing a DC bus overvoltage fault. If the drive needs to decelerate quickly or retain a load, an optional braking resistor must be connected.

⚠ **• Special care must be taken when carrying out any work near the resistor, as there is high voltage present and heat is given off.**
• The surface temperature of the PX-Brake Resistor can reach 120°C (248°F). The spacers supplied with the option 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 fixed. Ensure that the materials forming the support can withstand heat radiation.
• The RF braking resistor must be installed in such a way that it does not damage neighbouring components by its heat dissipation (resistor temperature higher than 70°C (158°F)). This braking resistor must be wired in series with a thermal relay calibrated to the rms current of the resistor to prevent the risk of fire which may result from a braking resistor malfunction or a short-circuit.
• If an optional braking resistor is connected, parameter 55 must be set to Fst.

6.3.2 - Connection
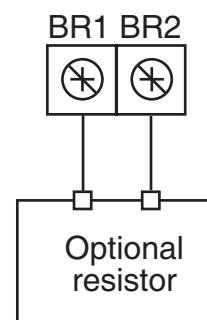
COMMANDER SX
IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS

6.3.3 - Electrical characteristics

• **Minimum resistance compatible with the drive**

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

• **Internal braking resistor**

Ohmic value (Ω)	Average power for 60 s (W)	Peak power at nominal resistance for 5 s (W)	Factory setting 10.30 (s)	Factory setting 10.31 (min)	Drive rating
1000	10	150	3.0	1.0	SX13200037 to SX13200075 SX13400075 to SX13400150
			4.0	1.0	SX23200110 to SX23200220 SX23400220 to SX23400400

Note: Size 3 drives do not contain this internal resistor.

When using an optional braking resistor, the internal resistor must be disconnected. This can easily be done by removing a jumper, whose location is indicated below (for size 1 and 2 drives only).
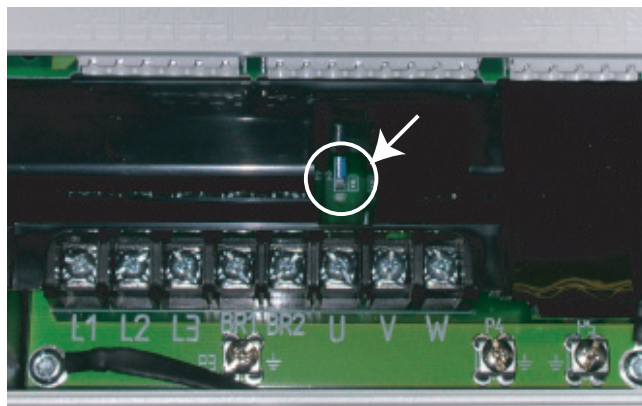
• **IP66 braking resistors, optional PX-Brake resistor**

PX-Brake Resistor reference	Ohmic value (Ω)	Thermal power (W)	Peak power at nominal resistance for 5 s (W)	Associated drive		
				SX13200037 to SX13200075 SX13400075 to SX13400150	SX23200110 to SX23200220 SX23400220 to SX23400400	SX33200300 and SX33200400 SX33400550 and SX33400750
300-200	200	300	3000	X	X	
600-200 (1)	200	600	6000	X	X	
300-50	50	300	3000			X
600-50 (2)	50	600	6000			X

(1) : Connect both 400Ω resistors in parallel
(2) : Connect both 100Ω resistors in parallel

• **IP20 or IP55 braking resistors, optional RF**

RF reference	Ohmic value (Ω)	Thermal power (W)	rms current* (A)	Thermal power (W)	Peak power (W)	Associated drive SX33200300 and SX33200400 SX33400550 and SX33400750
SIR-1100-50	50	1100	3.8	1100	10368	X
MD-2000-75	75	2000	5.7	2000	6912	X

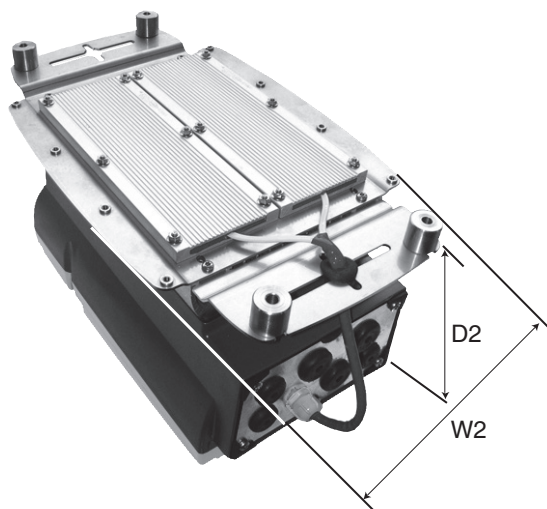* : Setting current of the thermal relay in series in the resistor.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
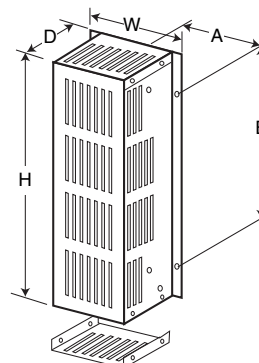### OPERATING EXTENSIONS

6.3.4 - Mechanical characteristics

• PX-Brake Resistors

Weight: 2.5 kg max/Protection: IP66/Nema 4X

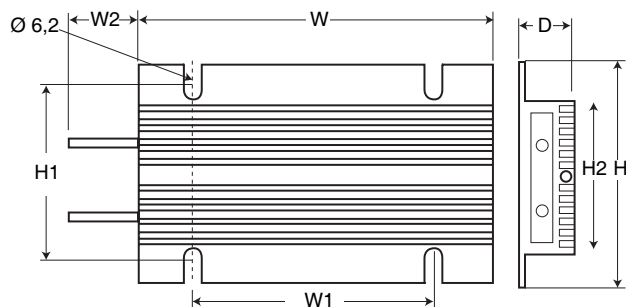| Commander SX (SX-DV and SX-PB) + PX-Brake Resistor		Dimensions (mm)	
Size	Rating	W2	D2
1	SX13200037 to SX13200075 SX13400075 to SX13400150	220	209
2	SX23200110 to SX23200220 SX23400220 to SX23400400	220	243
3	SX33200300 and SX33200400 SX33400550 to SX33400750	281	253

• RF-SIR-1100-50 resistors

Weight: 1.3 kg/Protection: IP55

Type	Dimensions (mm)						
	W	W1	W2	H	H1	H2	D
RF-SIR-1100-50	320	240	300	95	82 ±2	71	30

•RF-MD-2000-75 resistors

Weight: 5kg/Protection: IP20

Type	Dimensions (mm)			Fixings (mm) Ø 11	
	W	D	H	A	B
RF-MD-2000-75	182	140	450	160	310

COMMANDER SX
IP66/Nema 4X AC variable speed drive
### OPERATING EXTENSIONS

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 6376-17-07).
WARNING:
• Use one RFI filter for each drive.
• The drive leakage current with the filter connected is 9.6 mA maximum (leakage current for the filter only : 1.4 mA).
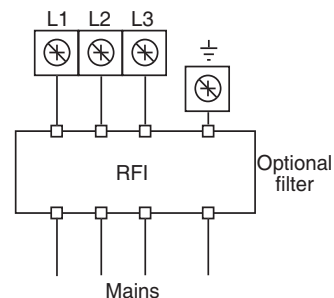
6.4.1 - Dimensions
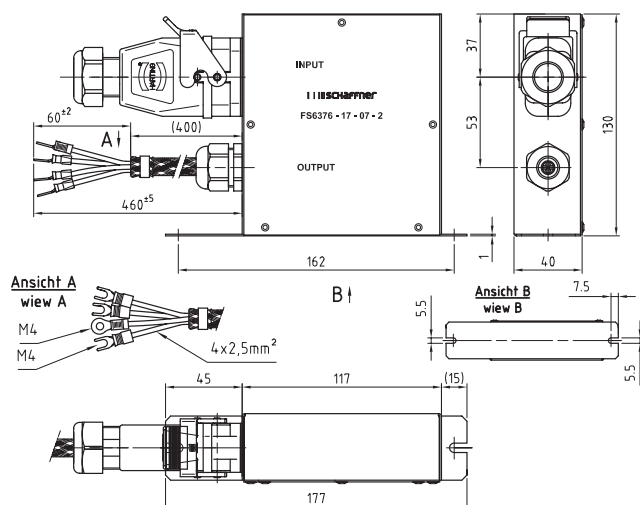
6.4.2 - Installation

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

6.4.3 - Connection

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

To connect the filter to the power supply, follow the instructions below:
- Pass the mains cable through the cable gland and its plug.
- Then pass the mains cable into the black sub-base.
- Crimp or weld phases L1, L2, L3 and the earth with care.
- Insert the cables in the grey sub-base (L1 in 1, L2 in 2, L3 in 3 and the earth in 4).
- Screw the grey sub-base to the black sub-base with the 2 plastic screws.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
OPERATING EXTENSIONS

6.5 - PX-Cabling kit

The PX-Cabling Kit option consists of the elements below:
- 2 x M20 EMC cable glands (metal)
- 1 x M20 cable gland (Polyamide)
- 2 x M16 EMC cable glands (metal)
- 1 x M16 cable gland (Polyamide)
- Nuts

This kit ensures that the drive dust and damp proof protection (IP66/Nema 4X) and the shielding quality are both maintained. See section 3.2 and 3.6.1.

Possible cable gland location :

Cable ref.	Cable gland type	Cable Ø (mm)		Assignment
		min	max	
A	M20 standard	7.5	13	Mains power supply input: L1 L2 L3
B	M20 EMC	6	13	Motor output: U V W
C	-	-	-	Brake control if necessary *
D	M16 EMC	4.5	10	Analog I/O or encoder
E	M20 EMC	6	13	Analog I/O
F	M16 EMC	4.5	10	Digital I/O or Modbus link
G	M16 standard	3	8	Digital I/O or brake control

* The kit includes 6 cable glands. If required by the number of cables, hole "C" can if necessary be used with a plastic cable gland (standard M16).

6.6 - PX-Disconnect

The PX-Disconnect option is an IP66/Nema 4X 3-pole padlockable 16A switch, with NO-NC auxiliary contacts. PX-Disconnect is supplied fitted on a plate ready to be fixed on the side of the drive.

COMMANDER SX
IP66/Nema 4X AC variable speed drive
MAINTENANCE

7 - MAINTENANCE

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

• **When a drive trip causes it to switch off, fatal residual voltages remain at the output terminals and in the drive.**

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

• **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.

WARNING:
Do not dismantle the printed circuits while the drive is still under warranty, as this would then immediately become null and void.

Do not touch the integrated circuits or the microprocessor either with your fingers or with materials which are charged or live. Earth yourself, as well as the workbench or the soldering iron, when performing any work on the circuits.
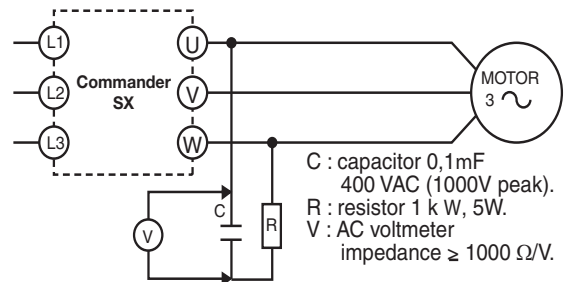
From time to time, check that the power connections are correctly tightened.

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.

C : capacitor 0,1mF
     400 VAC (1000V peak).
R : resistor 1 k W, 5W.
V : AC voltmeter
     impedance ≥ 1000 Ω/V.

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

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