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**SOFT STARTER WITH TORQUE CONTROL "ADX"**  
 For three-phase induction motors (squirrel cage)

ADX...BP: Standard duty, 22A to 231A with integrated bypass incorporated.

ADX...B: Severe duty, 17A to 245A with integrated bypass incorporated.

ADX...: Severe duty, 310A to 1200A predisposed for external bypass.

## USER'S MANUAL



Rev. 08 January 2005

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#### IMPORTANT

Technical descriptions and data given in this document are accurate, to the best of our knowledge, but can be subject to change without prior notice so no liabilities for errors, omissions or contingencies arising therefrom are accepted. Moreover, the starter should be set up and used by qualified personnel and, in any case, in compliance to current installation standards, to avoid damages or safety hazards.

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## INTRODUCTION

### Preliminary controls

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- Remove the starter from the carton packing and verify if there is any external damage to the starter, eventually caused during transport.
  - Check if the starter reference given on the identification label corresponds to the transport document as well as the purchase order.
- N.B.** The RS232 interface connection cable and the software disks, for PC setup, are not included in this supply but can be ordered separately; see last page of this documentation.

### User's manual revision number

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It is advisable to always use the manual included with the unit, to have knowledge and access of new functions of the ADX soft starter.  
**This manual is valid for starter software revision no. 16 or higher, displayed when voltage is applied.**

### New functions of the ADX starter respect with the previous one

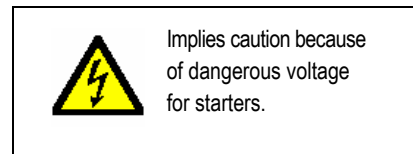
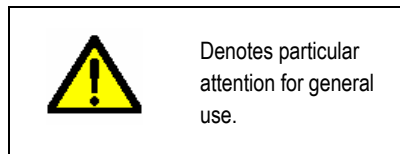
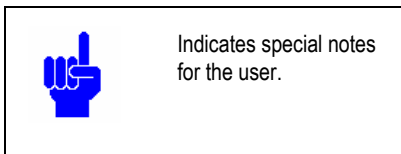
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1. Manual update for addition of the new ADX...BP series

### Symbols used in this manual

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There are notes given in this manual, which require a particular consideration and reading. These are indicated by the following symbols:



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## PRESENTATION

The ADXsoft starter has been designed according to Worst-case methodology that takes into consideration the worst operating conditions. The design includes the use of electronic components of the latest generation (multilayer circuits, SMD's, Flash microprocessor, high noise immunity devices) and advanced assembly technologies, providing the starter with both excellent reliability and an ultimate performance level.

Some of the operational characteristics of the starter are given below:

### Operating functions (Display keypad):

- LED indication* : "POWER", "RUN" and "FAULT"
- Parameter setup* (Menus): Basic, Advanced, Functions, Clock and Commands
- Readings display*: Voltage, current, power factor, motor torque, power, motor thermal status, heatsink temperature, etc.
- Message display*: Operating status, alarms and events with date and time
- Keypad controls*: Alarms reset, logged data and events, SCR testing and motor starting and stopping, if setup enabled
- Multilanguage*: Italian / English / French / Spanish

### Control functions

- Start-Stop control*: Via digital inputs, ramp analog output and control threshold
- Starting method*: Torque and current control
- Stopping method*: Free wheel, deceleration with torque control and dynamic braking
- Data acquisition and logging*: Operating hours of the motor and hours remaining before equipment service maintenance
- Malfunction diagnostics*: Time-sequential logging of the last 20 alarms and/or events, each with relative time and date, in a retentive memory
- SCR and bypass contactor control*: Fault detection and operating test at stopped motor

### Protections

- Auxiliary supply*: Voltage too low
- Power supply*: Phase failure, phase sequence and frequency out of limits
- Motor*: High temperature, locked rotor, current asymmetry, starting too long and minimum torque
- Starter*: High temperature, overcurrent, SCR and bypass contactor malfunction
- Inputs and analog output*: 24VDC short circuit static protection

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### Starters with integrated bypass ADX...BP – Standard duty

Designed for standard duty. During the acceleration phase, it can erogate starting currents up to 350% of rated starter current. With motor current ratings lower than rated starter current, it can erogate currents up to 700% of the rated motor current.

It includes a by-pass contactor which closes when the motor is running and opens at the stopping command. In cases with frequency startings and the closing time of the by-pass contacts is reduced to a few seconds it can be conveniently disabled. The disenabling can be obtained by programming "OFF" at partmeter "P23 BY-pass contactor" in the ADVANCED menu.

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### Starters with integrated bypass ADX...B – Severe duty

Designed for severe duty. During the acceleration phase, it can deliver starting currents up to 500% of rated starter current. With motor current ratings lower than rated starter current, it can erogate currents up to 720% of the rated motor current.

It includes a by-pass contactor which closes when the motor is running and opens at the stopping command. In cases with frequency startings and the closing time of the by-pass contacts is reduced to a few seconds it can be conveniently disabled. The disenabling can be obtained by programming "OFF" at partmeter "P23 BY-pass contactor" in the ADVANCED menu.

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### Starters without integrated bypass ADX – Severe duty

Designed for severe duty. This versions has the same features as the ADX...B types.

It is predisposed for the connection of an external by-pass contactor. For the command of the by-pass, the starter has a dedicated normally-open (N/O) contact. The by-pass function must be enabled by programming "ON" at parameter "P23 Bypass contactor" in the ADVANCED menu. The by-pass contactor closes when the motor is running and opens at the stopping command.



#### Recommendations

- The starter supply must be disconnected whenever any intervention on the electrical and/or mechanical part of the equipment or system is necessary.
- A disconnecting device, such as load-break switch, line contactor, etc., must always be included to cut off the power supply.
- Do not use the starter to drive supply transformers of the motor.
- Do not install the starter in ambient with explosives or inflammable gases.
- Do not install the starter near heat sources.
- Do not use insulated enclosures since provide poor heat dispersion.
- Adequate short circuit protection of the starter SCR's can be provided only by means of quick fuses; consult the technical characteristics section for a correct choice.  
The SCR's are not affected by short-circuit, overload or overvoltage when the bypass contactor is closed (i.e. during running).



#### Power factor correction

Whenever power factor correction capacitors must be installed in the circuitry, they must be connected upstream of the starter along with a suitable contactor and protection fuses.

**The capacitors must be switched on only when the starting phase is terminated and then switched off before the stopping phase begins.**

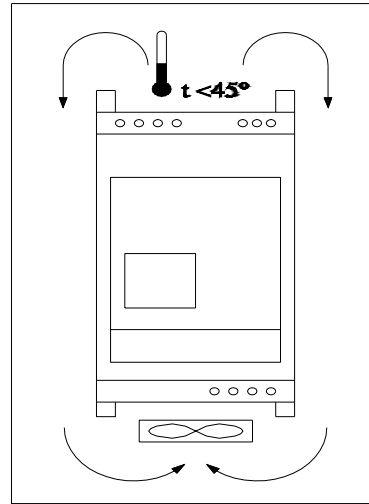
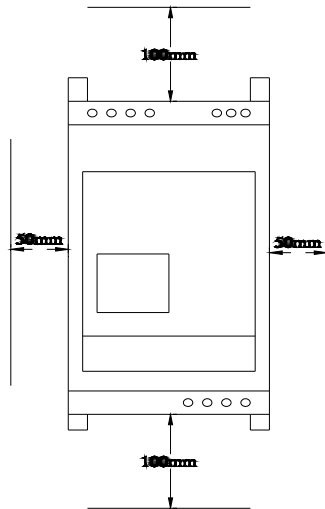
One of the relay outputs programmed for "Up to speed" (motor running) can be used for the contactor control.

## MOUNTING AND INSTALLATION

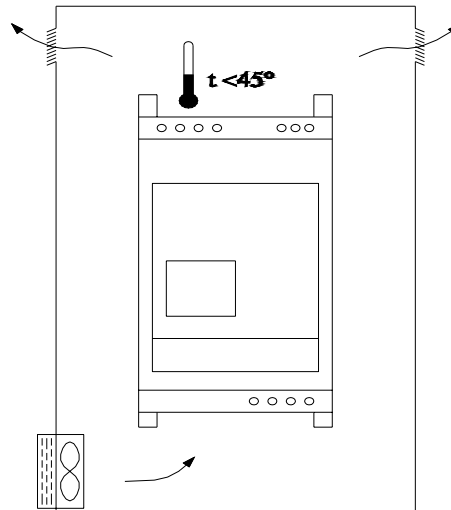
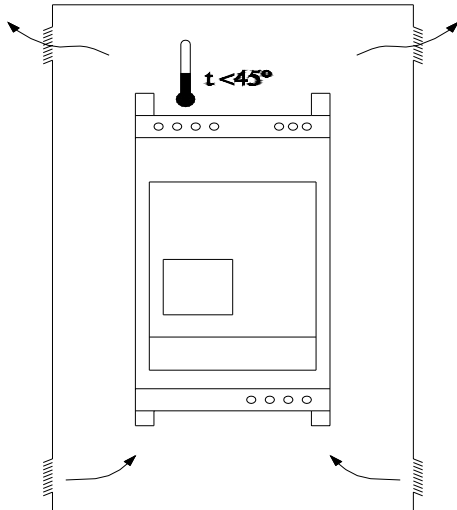
- ❑ Install the starter on a vertical plane. The vertical position is essential to obtain an appropriate cooling air circulation. A maximum  $\pm 15^\circ$  inclination is admissible.
- ❑ The starter must be installed in a clean environment, free of electrically conductive dust (dry, humid or containing particles such as carbon fibres, salt, etc.) and water.
- ❑ Leave sufficient space around the starter for adequate airflow, imperative for effective cooling (see the figure below, on the left).
- ❑ Whenever the starter is mounted in an IP54 enclosure or cabinet with poor ventilation or cooling, a fan may be required and positioned in the lower section of the enclosure (see the figure below, on the right). It avoids hot spots and the eventual tripping of the SCR protection.
- ❑ Check the thermal operating conditions of the starter by displaying the starter temperature and the thermal protection tripping thresholds on the keypad.



Plastic enclosures are not suitable since provide poor heat dispersion.



- ❑ Assure for adequate airflow inside the enclosure or cabinet, either by means of simple louvers, as shown in the figure below on the left, or ventilation fan with relative filter, as given in the figure below on the right.



- The calculation of the free external panel surface needed in relation to the power dissipation is given by the following formula:

$$S = \frac{P}{K \cdot \Delta t}$$

**whereas:**

- S = Free external panel surface (sides + front + top), given in m<sup>2</sup>
- P = Total dissipation inside the cabinet (starter and eventual other devices), given in W
- K = Heat dissipation coefficient (for example: K=5.5 is the coefficient for paint finish sheet steel)
- Δt = Difference between ti and ta temperatures, given in °C
- ti = Internal cabinet temperature, given in °C
- ta = Ambient temperature around the enclosure, given in °C

**Example:**

Calculation of surface:

- Internal heat to dissipate: 400W
- Maximum internal temperature: 55°C
- Ambient temperature: 40°C
- Δt = 55°C - 40°C = 15°C

$$S = \frac{400}{5.5 \cdot 15} = 4.85 m^2$$

- If ever the cabinet size should result too large, a forced cooling system, consisting of ventilation fans can be considered. The following formula provides a good estimate of the fan power to consider:

$$V = \frac{3100 \cdot P}{\Delta t}$$

**whereas:**

- 3100 = Multiplying coefficient applied to forced ventilation systems
- V = Volume of the required air, given in m<sup>3</sup>/h
- P = Total dissipation inside the cabinet (starter and eventual other devices), given in kW
- Δt = Difference between ti and ta temperatures, given in °C
- ti = Internal cabinet temperature, given in °C
- ta = Ambient temperature around the enclosure, given in °C

**Example:**

Calculation of the fan power required for cooling equipment with the following characteristics:

- Internal heat to dissipate: 0.4kW
- Maximum internal temperature: 55°C
- Ambient temperature: 40°C
- Δt = 55°C - 40°C = 15°C

$$V = \frac{3100 \cdot 0.4}{15} = 82.6 m^3 / h$$

**Bear in mind:**

- The air intake and outlet are to be situated as far apart as possible.
- If air filters are used, a 15-20% increase of the fan capacity is required to compensate for loss because of eventual dirt accumulation on the filter element.

- In case the starter remains without supply for long periods of time and to avoid inconveniences owing to condensation, a heating system is necessary and to be powered when the starter is switched off. The heating, anticondensation system normally contemplates 0.2-0.5W power per dm<sup>2</sup> of the enclosure. Generally, the starter maintains a sufficient internal temperature when switched on, to avoid risks of condensation.
- In case the motor starting is irregular, that is a jerky acceleration, inductances must be connected in series with the power supply of the starter. This problem takes place when more than one soft starter or AC motor drive are connected in the same circuitry. In these circumstances and in absence of mains inductances, it is good practice to avoid simultaneous acceleration and/or deceleration of various motors.

## Auxiliary power supply connection

The auxiliary power supply, 208-240VAC  $\pm$  10%, 50 or 60Hz, must be connected to terminals marked with the letters "L" and "N" only.



### CAUTION

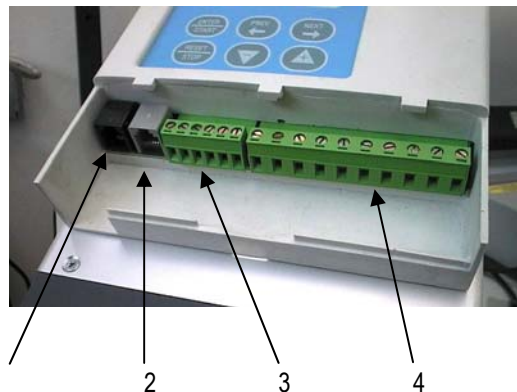
Never connect the earth wire to terminal "D".

Terminal "D" is solely used to switch the bypass contactor to exclude the power circuit during starter fault conditions. The motor can be possibly started direct-on-line by means of the line contactor in these circumstances. See the application wiring diagram on the following pages.

## I/O Connections

- ❑ Make power connections with cables having a cross section adequate to the motor current.
- ❑ To have access to the input and output connections as indicated in the figure below, push the protection cover slightly upwards and then remove it.
- ❑ The inputs of terminals 2 (START), 3 (STOP) and 4 (PROG-IN) can be directly controlled by the positive static outputs of the programmable logic controls (PLC). In this case, terminal 6 (0V) must be connected to the negative terminal of the PLC.
- ❑ The STOP input can be programmed for other functions if it is not used. See parameter P.19 STOP function assignment in the advance setup menu.
- ❑ PROG-IN is a programmable multifunction input. See the following section giving the various use capabilities.
- ❑ The K1, K2 and K3 outputs are programmable relays and each have one free normally open contact.
- ❑ The K4 output is a global alarm relay, normally energised, and implements one normally open and one normally closed contacts.
- ❑ The output relay contacts are not energised.
- ❑ The 24VDC voltage available at the terminals can be used to supply externally installed devices with current consumption  $\leq$ 10mA. In case the analog output is not required, available current is  $\leq$ 30mA.

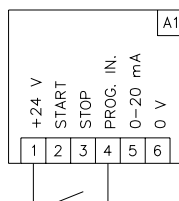
1. RS485 serial interface port for remote display keypad
2. RS232 serial interface port for general purpose (PC, etc.)
3. Control inputs and analog output
4. Relay outputs



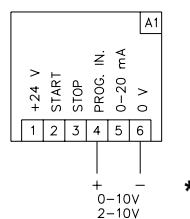
## PROG-IN multifunction input connections

The PROG-IN input can be used as a digital or analog type of input. See "P27 - PROG-IN Function Assignment" parameter along with the following ones, P28 to P36, under the Advanced Setup section

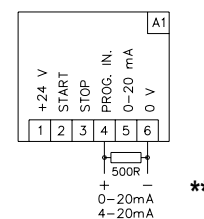
Connection as digital input



Connection as 0-10V analog input



Connection as 0-20mA or 0.4-20mA analog input



### \* CAUTION

The analog input impedance of 120 $\Omega$  (instead of 100k $\Omega$ ) has inverse polarity. Be sure of the polarity since an incorrect connection can damage the device generating the signal.

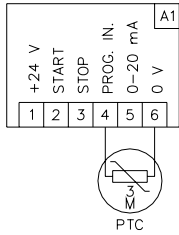


### \*\* IMPORTANT

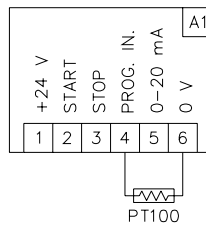
The resistor connected across terminals 4 and 6 must be a 500 $\Omega$  1% 1/2W type.

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### Connection as PTC (motor protection) analog input



### Connection as PT100 (temperature sensor) analog input



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### RS232 and RS485 serial communications interface

- The starter is equipped with two non-insulated serial communications interface ports. The connecting cables, directly plugged in to these ports, must be 3m long only.
- The RS485 interface is used for the remote keypad connection only.
- The RS232 interface is normally used for communications with personal computer (PC), modem or GSM modem.
- The PC communication can be made by normal cable, RS232/RS485 converter drive, modem or GSM modem.
- The RS232 interface combined with the RS232/RS485 drive (galvanically isolated) can communicate with the remote keypad, at considerable distances too.

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### Remote keypad

- The remote keypad operates exactly as the one integrated on the starter, except for the start and stop commands of the motor, which are permanently disabled.
- Functions have been included to transfer parameters, operating data and/or events/alarms with date and time entry, between the keypad and starter memory.
- The keypad can be connected to the RS485 port by means of the 3-meter long cable, standard supplied. For major distances, it can be connected to the RS232 port through the galvanically isolated RS232/RS485 converter drive.
- The connecting cables for the RS485 port and the galvanically isolated RS232/RS485 drive can be supplied by LOVATO; see the last page of this document.

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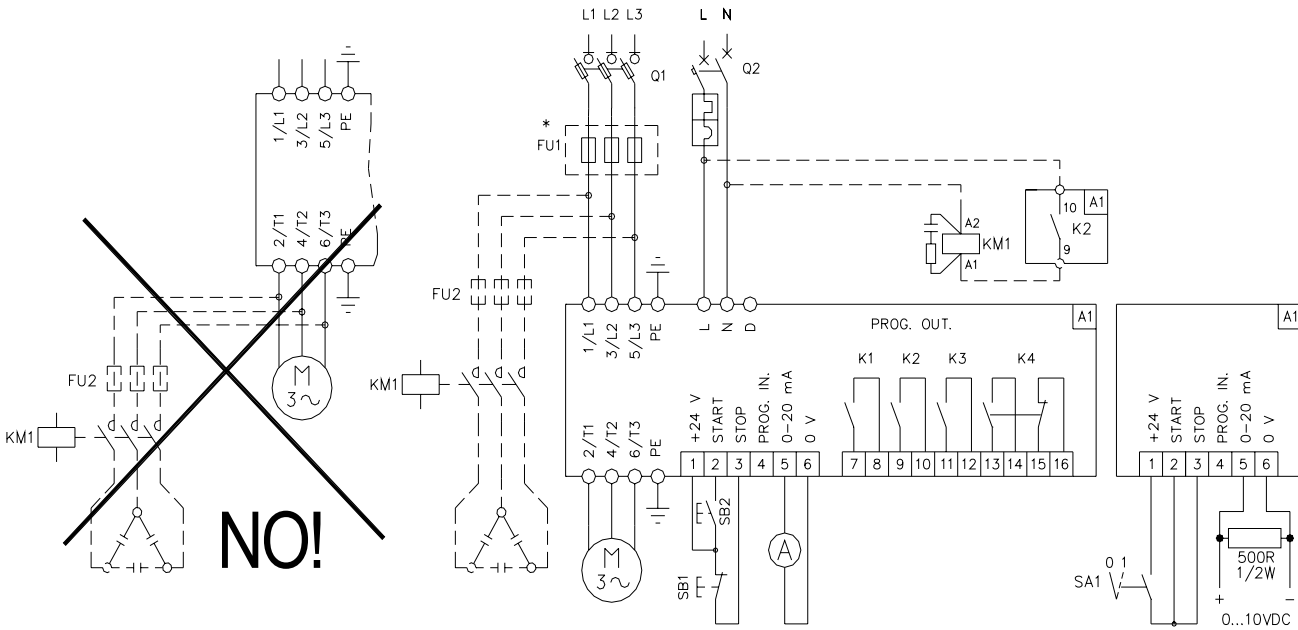
### Setup and remote control software

- The setup and remote control can be made from a personal computer, connected to the RS232 port of the starter.
  - The connection to the ADX RS232 port can be completed using one of the following methods: normal cable, RS232/RS485 converter drive, modem or GSM modem.
  - The direct communication by cable must be restricted to use during the starter setup phase only.
  - Main software characteristics:
    - Setup parameters transfer ADX ⇒ PC
    - Adjustment of each setup parameter
    - Setup parameters transfer PC ⇒ ADX
    - Virtual ADX keypad operated by mouse, with the possibility of motor starting and stopping
    - Torque and current graphs at motor starting and stopping
    - Readings display in numerical and graphical format
    - Display of data, messages and the last 20 alarm/event conditions with date and time entry
    - Modem or GSM modem setup with the possibility to enable the ADX "Auto-call" function
- N.B.** The "Auto-Call" function allows the ADX starter to autonomously communicate with a remote PC or to send a message to a mobile cellular telephone SMS (Send Message Service) or E-mail address.

## WIRING DIAGRAMS

The following diagrams illustrate typical wiring layouts and are suitable for all of the ADX starter types, unless indicated otherwise. It is advisable to use the same connecting typology for particular applications requiring a special wiring diagram or contact Lovato Customer Service (tel. ...+39 0354282422) if necessary.

### Starting with one direction of running and free-wheel or soft stopping



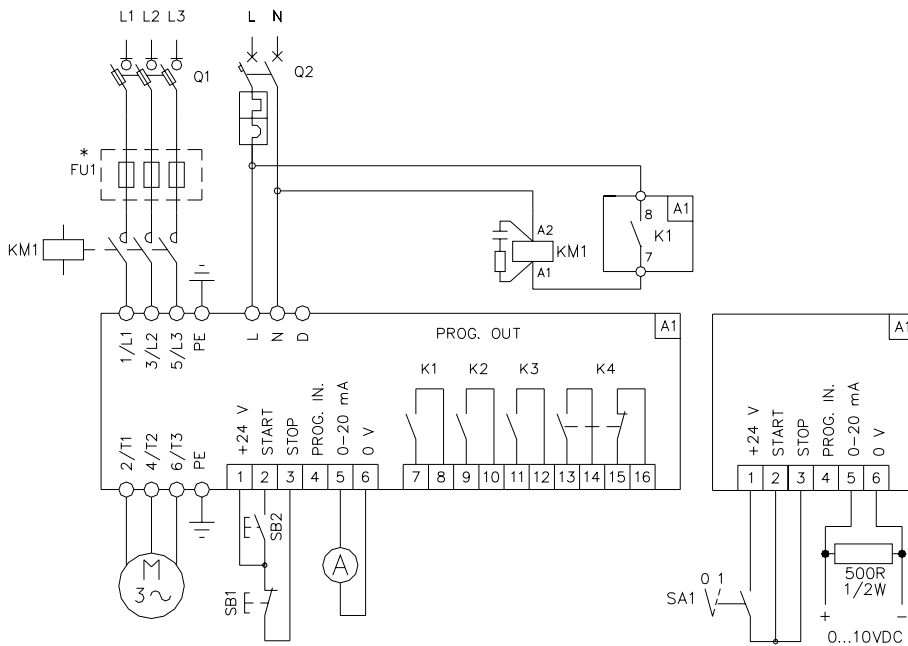
\* FU1: Include quick fuses in the case of type 2 coordination.



#### IMPORTANT

The eventual power factor correction bank must be switched on at the end of the starting phase and switched off before the stopping or deceleration phase. For the KM1 contactor control, use the K2 relay which has "Up to speed" setup default.

### Starting with one direction of running, line contactor and free-wheel or soft stopping

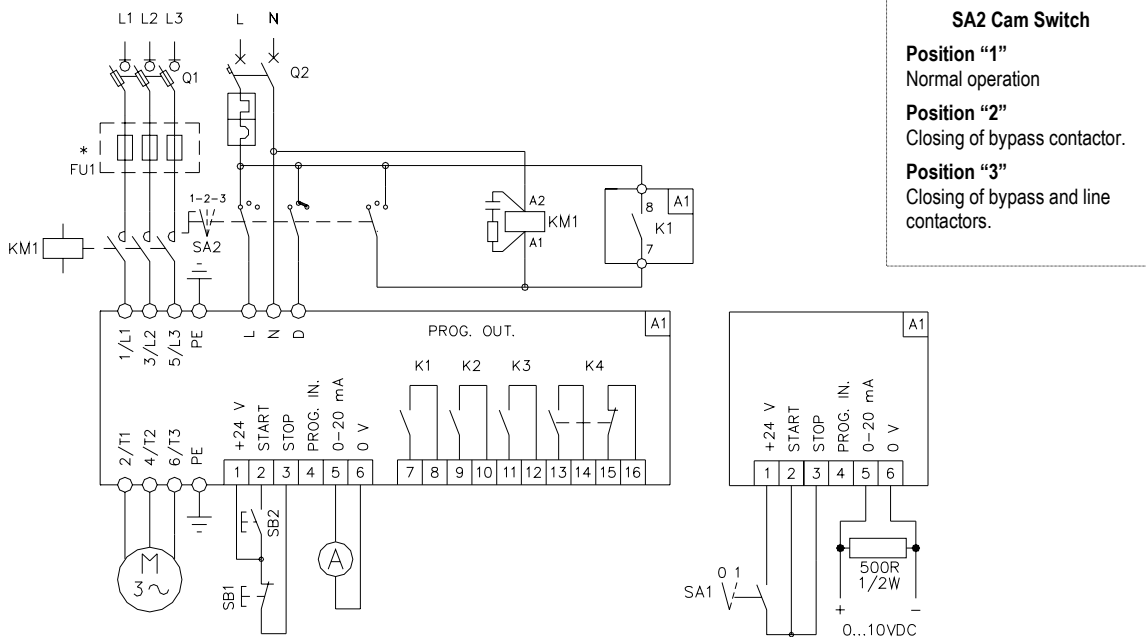


\* FU1: Include quick fuses in the case of type 2 coordination.

**N.B.** The K1 relay must have "Motor powered" function assignment which is also its setup default.



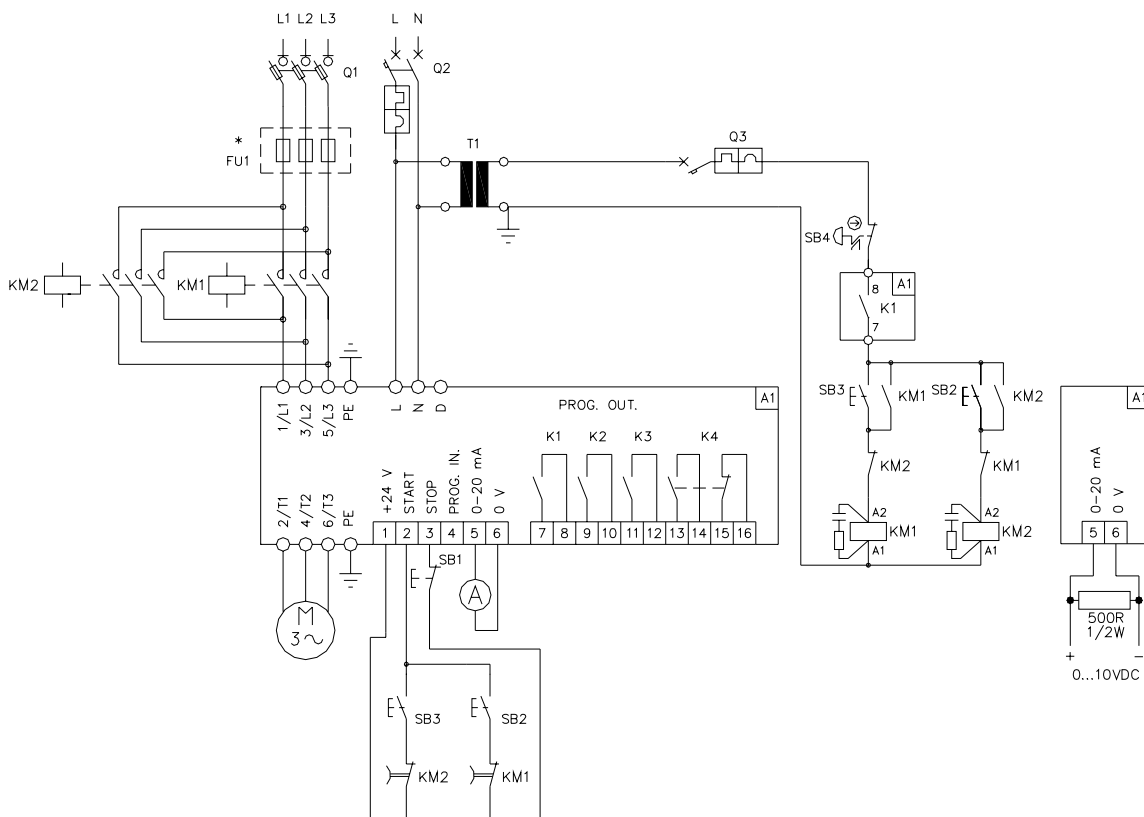
**Starting with one direction of running, line contactor, free-wheel or soft stopping and device for direct-on-line motor starting in case of starter fault**  
(for starters with integrated bypass only)



\* FU1: Include quick fuses in the case of type 2 coordination.

**N.B.** The K1 relay must have "Motor powered" function assignment which is also its setup default.

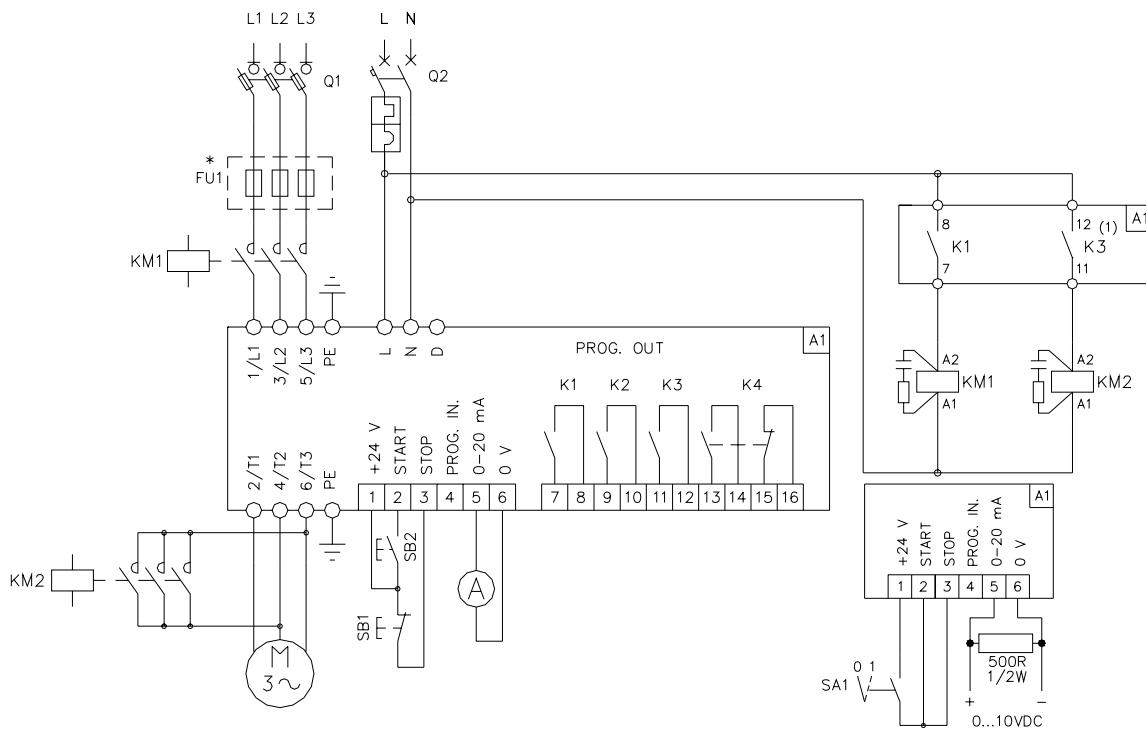
**Starting with bidirectional running, free-wheel or soft stopping and delay interval at reverse running**



\* FU1: Include quick fuses in the case of type 2 coordination.

**N.B.** The K1 relay must have "Motor powered" function assignment which is also its setup default.

### Starting with one direction of running, line contactor and braking

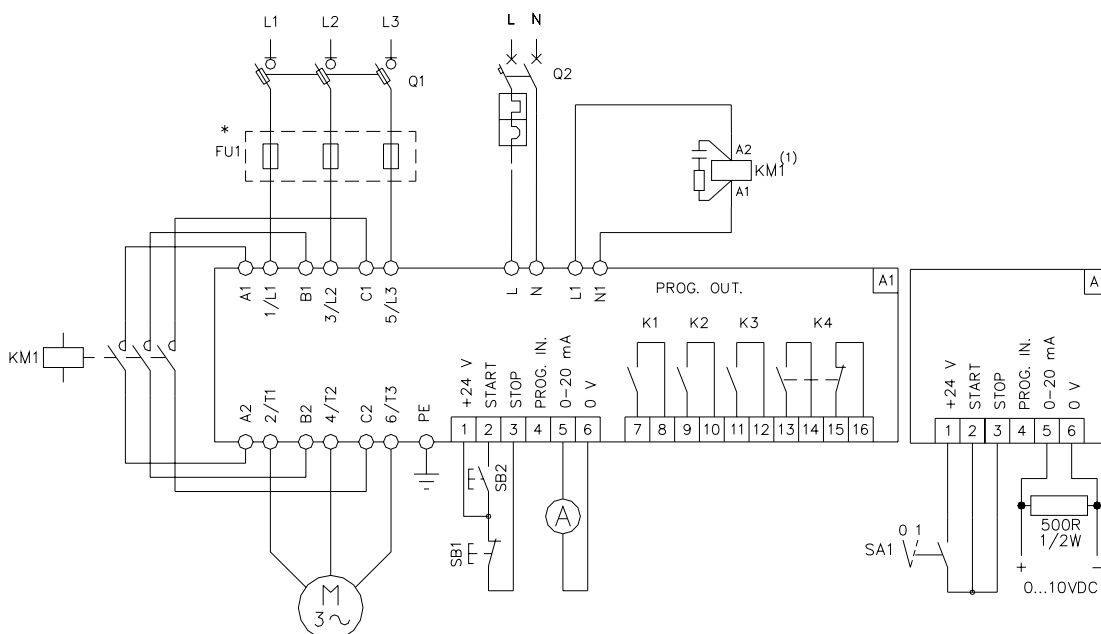


- FU1: Include quick fuses in the case of type 2 coordination.
- **N.B.** The K1 relay must have "Motor powered" function assignment which is also its setup default.



(1) **CAUTION** The "Braking" function is combined to K3 output relay, as default. An incorrect setting of the K3 relay will seriously damage the starter. Adjust the braking torque via P15 parameter and the relative time with P16 parameter.

### Starting with one direction of running and free-wheel or deceleration stopping (for starters with external bypass only)



\* FU1: Include quick fuses in the case of type 2 coordination.



(1) **CAUTION** The KM1 contactor control current should be  $\leq 1.5A$  in AC15 category.

## MOTOR STARTING AND STOPPING

The motor starting is obtained through the START and STOP inputs, available on the plug-in terminal block. The connection of both inputs to the “+24V” causes the starting while the stopping is switched off. For start and stop push button starting, contemplate the application wiring diagrams given in this document. The disconnection of the STOP input from “+24V” causes the alarms resetting.

**N.B.** The motor start/stop controls can be made through the keypad if setup enabled beforehand. It is important to use this function during the setup phase only.

## KEYPAD DISPLAY

- POWER LED** indicates the presence of the auxiliary supply voltage.
- RUN LED** denotes the motor is running. During acceleration and deceleration, this LED is flashing.
- FAULT LED** indicates alarm conditions and the relative output relay is enabled too.
- The **ENTER/START** key is used to confirm operations of the logged data or, if setup enabled, to command the motor starting.
- The **RESET/STOP** key is used to enter and exit the setup menus, to cancel operations from the data log, to reset alarms and, if setup enabled, to command the motor stopping.
- PREVIOUS** and **NEXT** keys are used to access the readings, to choose the menu and to select the parameter.
- ▼** and **▲** keys are used to modify the setup parameters and to access additional information relating to each screen.
- The **LCD display** shows the readings, operating status, alarms, data and parameters. It is automatically backlit by pushing any of the keys or in alarm conditions. It switches off after 4 minutes from the last event, which caused its switching on. Display contrast is keypad adjusted.

## Choice of language

To select the required language, proceed in the following way:

- Press the **RESET/STOP** key for 3 seconds to enter the setup menu.
- Press the **NEXT** key until the **Language** menu is displayed. Eventually use the **PREVIOUS** key to inversely scroll the menus.
- Push the **ENTER/START** key to enter this menu.
- Use the **▼** and **▲** keys to set the language required.
- Press the **RESET/STOP** key to exit the **Language** menu.
- Push the **RESET/STOP** key again to exit setup and return to the normal display.

**N.B.** For the setup data adjustment, consult the **Setup** section.

## Readings and data display

Useful information concerning the soft starter is displayed during the setup and whenever there is a motor or starter malfunction.

- Press the **PREVIOUS** or **NEXT** key to access one of the screens illustrated below.
- Press the **RESET/STOP** key for the 1° screen display.

**N.B.** The 1° screen shows the starter operating status in the second line.

1° screen (Voltage, current, torque and status)

4	1	5	V		3	7	.	4	A		9	7	%	T
	U	P			T	O			S	P	E	E	D	

3° screen (3 line voltages)

L	1	L	2			L	2	L	3			L	3	L	1
4	0	1	V			4	0	0	V			4	0	2	V

5° screen (Motor current and relative bar graph)

C	U	R	R	E	N	T							9	4	%
---	---	---	---	---	---	---	--	--	--	--	--	--	---	---	---

**NOTE:** Press the **▲** key to see the maximum current value of the last starting or the **▼** key of the deceleration or both **▲** and **▼** for the current value during the running.

7° screen (Motor thermal status)

T	H	E	R	M		S	T	A	T	E			9	7	%
---	---	---	---	---	--	---	---	---	---	---	--	--	---	---	---

**NOTE:** Press the **▲** key to see the tripping time of the motor protection. This screen is not displayed if the PTC protection is contemplated.

9° screen (Clock calendar)

D	A	T	E	:		1	7	.	0	6	.	1	9	9	8
T	I	M	E	:			1	4	:	5	2	:	1	8	

11° screen (LCD contrast adjustment)

L	C	D			C	O	N	T	R	A	S	T		A	D	J
---	---	---	--	--	---	---	---	---	---	---	---	---	--	---	---	---

2° screen (Active and apparent power, power factor)

		K	W					K	V	A				P	F		
	1	9	.	9				2	6	.	9			0	.	7	4

4° screen (3 line motor currents)

I	1		A			I	2		A			I	3		A
3	6	.	7			3	7	.	2			3	7	.	6

6° screen (Motor torque and relative bar graph)

T	O	R	Q	U	E									8	7	%
---	---	---	---	---	---	--	--	--	--	--	--	--	--	---	---	---

8° screen (Starter thermal status)

S	T	A	R	T	E	R		T	E	M	P			4	2	°
---	---	---	---	---	---	---	--	---	---	---	---	--	--	---	---	---

**NOTE:** Press the **▼** key to display warning and protection tripping thresholds. For ADX0310 to ADX1200 types, push the **▲** key to display the heatsink temperature of each phase.

10° screen (Event log)

*	*	*	E	V	E	N	T		L	O	G	*	*	*	*
			P	R	E	S	S		E	N	T	E	R		

**NOTE:** After having depressed ENTER, push the **▲** key to see the relative entry date and time, then press **▼** to see the remaining part of the event log text.

12° screen (Energy meter)

E	N	E	R	G	Y					M	E	T	E	R		
						1	9	.	4	2	k	W	h			

**NOTE:** Press the **▲** key to view the date and time of the metering start (subsequent to last resetting).

(continued on following page)

(continuation from previous page)

13° screen (Motor hour meter)

M	O	T	O	R		P	O	W	E	R	E	D			
									5	:	4	2	:	1	7

14° screen (Service expiry)

S	E	R	V	I	C	E		E	X	P	I	R	Y				
							-	9	9	9	9	:	1	2	:	4	3

15° screen (Inputs/outputs status)

I	N	P	:					S	T	O					
O	U	T	:		K	1		K	2					K	4

16° screen (Programmable input function)

P	R	O	G	-	I	N								O	F	F

## OPERATING STATUS

The relative messages of the starter operating status listed below are displayed in the second line of the 1° screen.

Table of operating status	
Message	Description
<i>No power line</i>	Power voltage supply is not available
<i>Preheating</i>	Preheating of motor windings
<i>Starter ready</i>	Starter ready for running
<i>Start delay xx</i>	Delay lapsing for start command
<i>Starting booster</i>	Boost voltage
<i>Acceleration ramp</i>	Motor acceleration
<i>Current limit</i>	Current limitation during acceleration
<i>Torque limit</i>	Torque limitation during acceleration
<i>Up to speed</i>	Motor up to speed and running
<i>Bypass closed</i>	Bypass contactor closed
<i>Current tripping threshold</i>	Preset current threshold reached
<i>Deceleration ramp</i>	Motor deceleration
<i>Braking</i>	Motor braking
<i>Prebraking</i>	Braking before the motor starting
<i>Protections inhibited!</i>	All protections are inhibited by external control
<i>Free wheel</i>	Remote control for free wheel stopping
<i>Fault</i>	Alarm condition
<i>Programmed Stop threshold</i>	Motor stopped because of programmed stop threshold at analog input

## EVENTS

The events are operating status and operations of the starter, which are logged with date and time entry. The 10° screen can display this data. Both alarms and events conditions are logged.

Table of events		
Code	Message	Description
E01	<i>Auxiliary power on</i>	Auxiliary voltage supplied of starter
E02	<i>Auxiliary power off</i>	Auxiliary supply voltage of starter removed
E03	<i>Start command</i>	Motor starting command
E04	<i>Current limit</i>	Current limitation during acceleration
E05	<i>Up to speed</i>	Motor running up to speed
E06	<i>Stop command</i>	Stop command
E07	<i>Motor stopped</i>	Motor stopped
E08	<i>BASIC setup changed</i>	BASIC setup changed
E09	<i>ADVANCED setup changed</i>	ADVANCED setup changed
E10	<i>FUNCTIONS setup changed</i>	FUNCTIONS setup changed
E11	<i>CLOCK setup changed</i>	Variation of CLOCK menu parameter
E12	<i>Setup parameters reset to default</i>	Parameter resetting command to default value
E13	<i>Motor thermal status resetting</i>	Resetting command of motor thermal status
E14	<i>Motor hour counter resetting</i>	Resetting command of motor hour counter
E15	<i>Service interval resetting</i>	Resetting command of service maintenance
E16	<i>Events log cleared</i>	Events log cleared
E17	<i>SCR test conducted</i>	SCR test conducted
E18	<i>Start with protections inhibited</i>	Start with protections inhibited
E19	<i>Incoming call from modem</i>	PC to ADX connection via modem
E20	<i>PC-modem connection</i>	ADX to PC connection via modem or GSM modem
E21	<i>SMS message transmission</i>	ADX message transmitted to cellular phone via GSM modem
E22	<i>E-mail message transmission</i>	ADX message transmitted to mailbox via GSM modem
E23	<i>Modem connection failed</i>	Communication impossible
E24	<i>Modem line closed</i>	Connection with remote number terminated
E25	<i>Modem line active</i>	Remote number reached and communication activated

## ALARMS

A message is displayed whenever there are alarm conditions, the K4 alarm relay simultaneously trips and the eventual motor stopping takes place as indicated in the table. The reading screens can be displayed by using the PREVIOUS and NEXT keys but without necessarily resetting the alarm. The display will automatically show the alarm if no key is pushed for 10 seconds. These alarm conditions along with the events are logged with date and time entry. This data can be displayed at the 10° screen.

Table of alarms						
Code	Displayed message	Retentive alarm	Alarm (1) relay	Motor stopping (2) immediate	decelerated	Automatic reset (3)
A01	<b>Power line absent</b> All three phases absent at starting command	yes	yes	-	-	yes
A02	<b>Power line phase failure</b> One of the phases failed at the starting command or during motor running	yes	yes	yes	no	yes
A03	<b>Incorrect phase sequence (4)</b> (Alarm disabled. To enable set parameter P50) Phase sequence different than preset one	yes	yes	-	-	no
A04	<b>Frequency out of limits (4)</b> Frequency of power line voltage is out of limits	yes	yes	-	-	yes
A05	<b>Auxiliary voltage failure (5)</b> Voltage too low or power loss longer than the tolerated period of time	no	yes	yes	no	-
A06	<b>Current asymmetry</b> (Alarm disabled. To enable set parameter P51) Asymmetry higher than preset value for a period of time $\geq 10$ sec	yes	yes	yes	yes	yes
A07	<b>Overcurrent tripping</b> ADX...BP - Current $>450\%I_e$ (rated starter current) for a time $\geq 200$ msec during starting. ADX... and ADX...B – Current $>550\%I_e$ (rated starter current) for a time $\geq 200$ msec during starting.	yes	yes	yes	no	no
A08	<b>Locked rotor</b> Current $>500\%I_n$ (rated motor current) for interval $\geq 200$ ms during motor running	yes	yes	yes	no	no
A09	<b>Motor load torque too low</b> (Alarm disabled. To enable set parameter P47) Motor load torque less than preset value	yes	yes	yes	yes	yes
A10	<b>Starting time too long</b> (Alarm disabled. To enable set parameter P49) Starting time longer than preset value	yes	yes	yes	yes	no
A11	<b>Bypass contactor fault (6)</b> No contact closing or opening of bypass contactor	yes	yes	yes	yes	no
A12	<b>Motor thermal warning (7)</b> Imminent motor protection tripping	no	no	no	-	-
A13	<b>Heatsink thermal warning</b> Imminent starter protection tripping	no	no	no	-	-
A14	<b>Motor thermal protection trip</b> Motor thermal protection tripping (starter integrated or via PTC sensor)	yes	yes	yes	yes	-
A15	<b>Heatsink over temperature</b> Starter thermal protection tripping	yes	yes	yes	yes	-
A16	<b>External alarm</b> (Alarm disabled. To enable set parameter P27) Alarm signal at PROG-IN programmable input	yes	yes	yes	-	-
A17	<b>24VDC output shorted</b> Incorrect I/O connections	yes	yes	yes	-	no
A18	<b>Phase L<sub>-</sub> - T<sub>-</sub> shorted (8)</b> Shorted SCR or main contacts of bypass contactor welded	yes	yes	yes	-	no
A19	<b>Temperature sensor fault (9)</b> Starter heatsink temperature sensor malfunction or faulty	yes	yes	no	no	no
A20	<b>Incorrect date/time (10)</b> Backup battery dead. Replace the battery and adjust the clock setup.	yes	no	no	no	no
A21	<b>System error CODE: __ (11)</b> Control card malfunction	yes	yes	yes	-	-
A22	<b>Line voltage too low</b> (Alarm disabled. To enable, see P58 forward) Power line voltage below preset value	yes	yes	yes	yes	yes
A23	<b>Line voltage too high</b> (Alarm disabled. To enable, see P59 forward) Power line voltage above preset value	yes	yes	yes	yes	yes
A24	<b>Motor current too low</b> Motor current $<10\%I_n$ ( $I_n$ = preset rated motor current)	yes	yes	yes	no	yes
A25	<b>Motor not connected</b> Motor connection not detected at starting	yes	yes	yes	no	-
(1)	K4 global alarm relay, normally energised, not programmable					
(2)	Decelerated stopping only if programmed.					
(3)	Automatic alarms resetting only if enabled by "P42 Automatic alarms restarting".					
(4)	The motor is not affected by alarm conditions if stopped; otherwise the above-given are valid.					
(5)	The motor restarts if alarm conditions have terminated (e.g. 2-wire control). The alarm message lasts for 10 seconds.					
(6)	The starter requires repair service.					
(7)	The "Motor thermal warning" is activated three minutes before the motor thermal protection tripping. This alarm is disabled during starting and stopping stages. This alarm is also not possible in the event of protection by means of PTC sensors.					
(8)	The starter requires repair service. Consult commands menu for SCR testing.					
(9)	The starter requires repair service but can still operate. In these circumstances, the cooling system remains permanently switched on.					
(10)	The battery is inside the starter. Before any replacement, disconnect the power and auxiliary lines. To have access to the battery, loosen the 4 fixing screws of the cover. Type of battery: CR2032 Lithium 3V <u>not rechargeable</u> .					
(11)	Contact Lovato Customer Service (tel. ...+39 0354282422).					

## Motor thermal protection

The 7° screen shows the thermal status of the motor, in both numerical and graphic format; for conventional reasons, it is indicated as 100% when the motor is steadily running at rated current. At current conditions  $> 112\%I_n$  ( $I_n$  = rated motor current), the thermal status will reach the maximum accepted value corresponding to 140% and the relative alarm tripping "A14 Motor thermal protection trip" will take place. The tripping times in relation to the overload are defined in the tables given on the following pages. When the motor is stopped, the thermal status will reduce to zero within the defined time but is always dependent on the preset thermal protection class. The motor thermal protection alarm resetting is possible when the thermal status decreases to a value equal to or lower than the value imposed by parameter "P11 Motor thermal protection reset" which default value is 120%. This can be modified on the basis of specific requirements without causing any change to the tripping times.



The thermal memory correctly operates also if the starter is not supplied.

## Motor thermal protection by means of PTC sensor

The starter has a programmable PROG-IN input for the connection of the motor protection PTC sensor. The tripping and resetting values of the protection comply to DIN 44081 standards. The protection tripping causes "A14 Motor thermal protection" alarm conditions and the subsequent motor stopping. The alarm resetting is possible only when the PTC sensor resistance returns to a value as per standards prescriptions.



The programmed PROG-IN input for the PTC connection disables the thermal protection programmed via P11 and P12 parameters.

## Starter thermal protection

The heatsink temperature and the thermal status of the starter are given in the 8° screen. When the bar graph reaches the maximum value, the alarm "A15 Starter thermal protection" trips. The resetting is automatic once the starter temperature decreases to an acceptable level. Press the ▼ key to see the warning and protection thresholds. Instead for the starter ADX0310 or bigger, press ▲ to verify the heatsink temperature of the three phases.

## Auxiliary 24VDC short circuit protection

When this alarm trips, it is imperative to immediately remove the cause. When the short circuit is removed, the 24VDC supply is automatically reset and the alarm resetting can then be made.

## SETUP

The setup can only be made at stopped motor, by means of the keypad or via personal computer. The following elements are needed for PC set-up: PC-ADX connecting cable and remote control communications software; see the order codes on the last page of this document.

For keypad set-up, the following operations are to be sequentially conducted:

- Press the **RESET/STOP** key for 3 seconds to access the setup.
- Press **PREVIOUS** or **NEXT** to select **Basic, Advanced, Functions, Commands, Choice of language** or **Clock** menus.
- Press **ENTER/START** to have access to the parameters.
- Press **PREVIOUS** or **NEXT** to select the parameter.
- Press ▼ or ▲ to change the parameter value.
- Press **RESET/STOP** to store the parameter changes, to exit the relative menu and to return to the menu choice screen.
- Press **RESET/STOP** again to exit setup and return to the main screen.



The ENTER/START key is used to confirm a certain operation in the COMMANDS menu while RESET/STOP cancels one.

## Basic menu

Code	Description	Range	Default
P00	Rated motor current $I_n$ (1)	(50...105/115% $I_e$ ) (2)	(100% $I_e$ )
P01	Starting current limit $I_{Lt}$ (3)	ADX...BP 150...700% $I_n$ (max 350% $I_e$ ) ADX..., ADX...B 150...720% $I_n$ (max 500% $I_e$ )	300%
P02	Initial acceleration torque	0...100% $T_n$	10%
P03	Accelerating ramp	1...120s	10
P04	Deceleration ramp	OFF / 1...120s	OFF
P05	Threshold at the end of deceleration	0...100% $T_n$	20
(1)	$I_n$ = Rated motor current. The maximum current adjustment of the starters is 105% $I_e$ with bypass or 115% $I_e$ without bypass.		
(2)	$I_e$ = Starter nameplate current.		
(3)	$I_{Lt}$ = Maximum starting current. The maximum programmable current is 350% $I_e$ for ADX...BP, while it is 500% $I_e$ for ADX... and ADX...B $I_{Lt}$ can be higher than the above-given limits only when $I_n < I_e$ .		

## Basic set-up second motor

- This menu can be viewed only with P27 set as "Second motor" and shows the same codes as the basic Set-up menu.
- It is used to set the characteristic data of the second motor or of the second winding in the case of double-winding motor (two speed or Dahlander).
- During programming, the display shows the alternating current parameter number at "M02" to indicate that the setting refers to the "Second motor" function.

**P00 – Rated motor current [default=50%]**

Rated motor nameplate current, to be between 50 and 105% or 115% rated starter current (depending on the brand of the motor). Rated current values lower or higher than 100% Ie respectively increase or decrease the adjustment range of "P01 Current limit".

**P01 – Current limit [default=300%]**

Maximum current that the starter can delivery durino the starting phase, expressed as % of the rated motor current. Based on the type of starter, the maximum current limits can vary as indicated below:

ADX...BP: 350%Ie

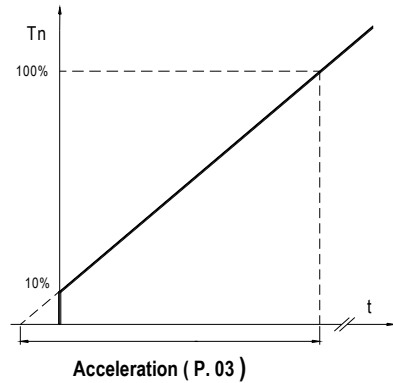
ADX... e ADX...B: 500%Ie

For rated motor currents <100%Ie the current limit I<sub>Lt</sub> can be programmed at higher values than the previously stated limits.

The maximum programmable current limit I<sub>Lt</sub> is determined by the formula  $I_{Lt} = \max \text{starting } I_e \bullet (I_e / I_n)$ , but in any case not higher than 700%I<sub>n</sub> for types ADX...BP or 720%I<sub>n</sub> for types ADX...and ADX...B.

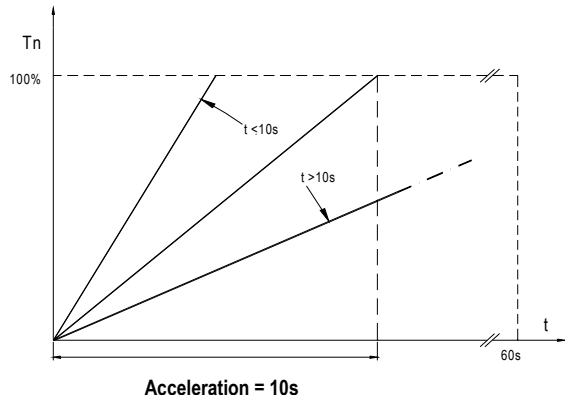
**P02 – Initial acceleration torque [default=10%]**

The starter torque supplied at the beginning of the acceleration, which gradually increases until it achieves the maximum value with the inclination, determined by "P03 Acceleration ramp".



**P03 – Acceleration ramp [default=10]**

Given in seconds, determined by the torque acceleration ramp, that is torque increase per unit of time.

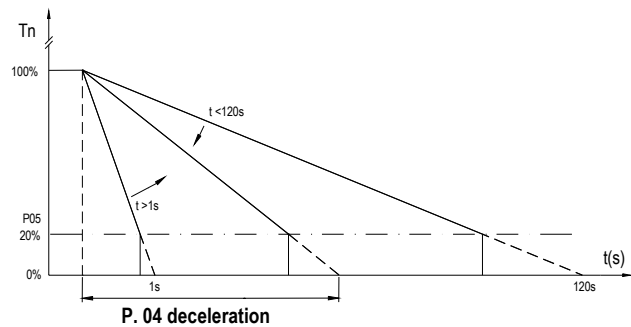


**P04 – Deceleration ramp [default=OFF]**

Given in seconds, determined by the torque deceleration ramp. The 100% torque value indicated in the graph is referred to the one detected during the motor running. The end of the deceleration ramp is established by "P05 Threshold for end of the deceleration". If adjusted to OFF, no deceleration ramp will be conducted; if "P16 Braking time" is set at OFF too, a free-wheel stopping will then take place.

**P05 – Threshold for end of deceleration [default=20%]**

It determines the torque value for the end of the deceleration. This threshold is directly related to the torque value detected during motor running. Deceleration is not considered if parameter "P04 Deceleration ramp" is regulated to OFF.





## Advanced menu

Code	Description	Range	Default
P10	Motor thermal protection enable(1)	OFF / ON	ON
P11	Starting thermal protection class	2 / 10A / 10 / 15 / 20 / 25 / 30 / 35 / 40	10
P12	Running thermal protection class	2 / 10A / 10 / 15 / 20 / 25 / 30	10
P13	Motor thermal protection resetting	0...140%	120%
P14	Starting booster voltage	OFF / 50...100%Ue	OFF
P15	Braking torque	50...100%	50%
P16	Braking time	OFF...45s	OFF
P17	Advance braking time	OFF...30s	OFF
P18	Alarm resetting command	STOP input opening / START input closing / Both	STOP input opening
P19	STOP function assignment (Programmable input)	STOP / Free-wheel stopping / External alarm / Motor preheat / Local control / Alarms inhibit / Manual resetting of motor thermal protection / Keypad lock / Second motor(8) / Second motor + t.s.r. (8)	STOP
P20	K1 relay function assignment (Programmable output)	OFF / Motor powered / Up to speed / Braking / Current limit / Service required / Cascade starting / PROG-IN thresholds / Alarm A...	Motor powered
P21	K2 relay function assignment (Programmable output)	OFF / Motor powered / Up to speed / Braking / Current limit / Service required / Cascade starting / PROG-IN thresholds / Alarm A...	Up to speed
P22	K3 relay function assignment (Programmable output)	OFF / Motor powered / Up to speed / Braking / Current limit / Service required / Cascade starting / PROG-IN thresholds / Alarm A...	Braking
P23	Bypass contactor	OFF / ON	--
P24	Analog output assignment	OFF / Current / Torque / Thermal status / Power factor / Active power	Current
P25	Analog output full scale	50...500%	100%
P26	Analog output range	0...20mA / 4...20mA	0...20mA
P27	PROG-IN function assignment (Programmable multifunction input)  See note (2) for <b>0-20mA and 4-20mA input.</b>	OFF / Free-wheel stopping / External alarm / Motor preheat / Local control / Alarms inhibit / Manual resetting of motor thermal protection / Cascade starting / Keypad lock / Second motor (8) / Second motor + t.s.r. (8) / 0-10V ramp / 2-10V ramp / 0-10V Start-Stop / 2-10V Start-Stop / PT100 Start-Stop / PTC protection	Free-wheel stopping
P28	Ramp dead zone PROG-IN (3)	OFF / 1...100%	OFF
P29	Start motor threshold PROG-IN (4)	OFF / 0.0...10V	OFF
P30	Stop motor threshold PROG-IN (4)	OFF / 0.0...10V	OFF
P31	ON relay threshold PROG-IN (5)	OFF / 0.0...10V	OFF
P32	OFF relay threshold PROG-IN (5)	OFF / 0.0...10V	OFF
P33	Start motor temperature PROG-IN (6)	OFF / -50°...+250°C	OFF
P34	Stop motor temperature PROG-IN (6)	OFF / -50°...+250°C	OFF
P35	ON relay temperature PROG-IN (7)	OFF / -50°...+250°C	OFF
P36	OFF relay temperature PROG-IN (7)	OFF / -50°...+250°C	OFF

(1) Whenever PROG-IN is programmed for " PTC protection", the protection is automatically disabled.

(2) A 500Ω 1% ½ W resistor connected in parallel to the analog output transforms the input configuration from 0-10V or 2-10V to 0-20mA or 4-20mA.

(3) This parameter is activated when the analog input is programmed as 0-10V or 2-10V ramp only.  
**N.B.** The usual starting command must be indispensably performed to complete this function.

(4) This parameter is activated when the analog input is programmed as 0-10V or 2-10V Start-Stop.  
**N.B.** The usual starting command must be indispensably performed to complete this function.

(5) This parameter is activated when the analog input is programmed as 0-10V or 2-10V Start-Stop.

(6) This parameter is activated when the analog input is programmed as PT100 Start-Stop.  
**N.B.** The usual starting command must be indispensably performed to complete this function.

(7) This parameter is activated when the analog input is programmed as PT100 Start-Stop.

(8) For information on how to use this function, contact Lovato Customer Service (tel. ...+39 0354282422)



**P10 – Motor thermal protection enable [default=ON]**

Common enabling of thermal protections programmed with parameters P11 and P12. If programmed to OFF (for example with cascade starting of more than one motor with the same starter), both protections are disabled.



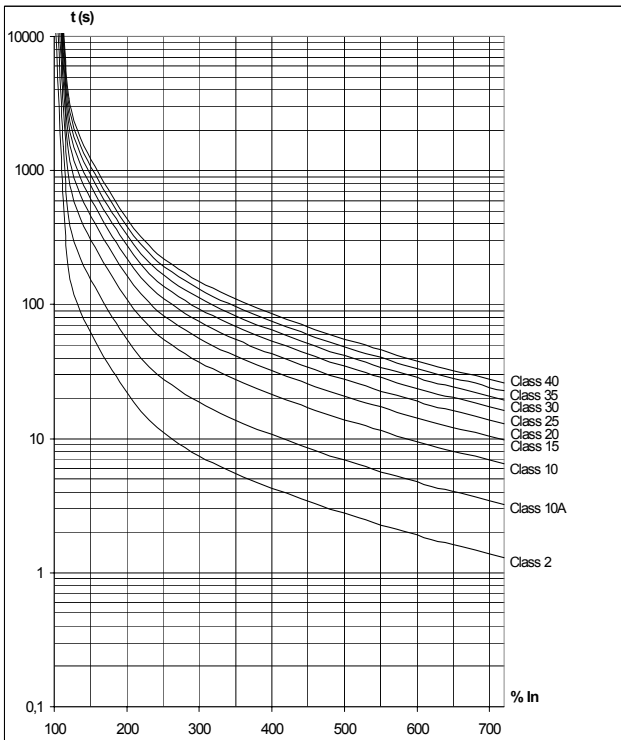
The thermal protections are also disabled when the multifunction input is programmed for PTC protection.

**P11 – Thermal protection class during starting [default=10] and P12 – Thermal protection class during running [default=10]**

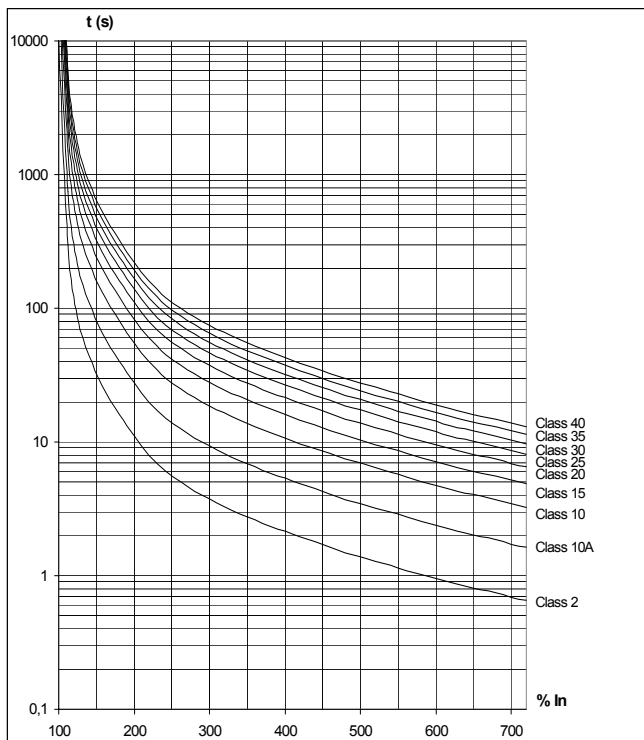
The thermal protection class of the motor is selected according to the type of application. As a standard, Class 10 is normally used while class 20, 30, etc., is considered for heavy motor duty conditions. A higher protection class during the starting phase can be considered with respect to the running one for a improved protection for heavy motor duty.



The protection class programmed for the running phase is used during the deceleration ramp too.



Tripping curves at cold state



Tripping curves at hot state

**P13 – Motor thermal protection resetting [default=120%]**

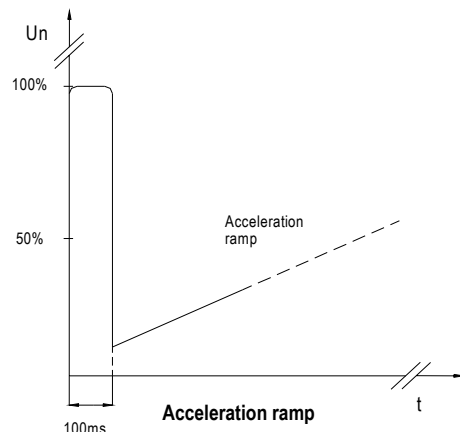
It establishes the level of the thermal status below which the motor thermal protection can be reset.

**P14 - Starting booster voltage [default=OFF]**

The booster is required to impose a high torque to the motor at the initial starting interval. The booster duration is fixed at 5 cycles corresponding to 100ms at 50Hz and 83ms at 60Hz. The booster is used when the initial acceleration torque is insufficient to overcome the static friction.



The boost must be used only when strictly indispensable. The voltage is supplied to the motor without current limit during the boost stage. It is therefore imperative to be absolutely sure when this parameter is going to be used; always begin at the low value adjustment and then gradually increase it.



**P15 – Braking torque [default=50%]**

The direct current of the dynamic braking applied to the motor windings during the prebraking or actual braking phase.



Refer to the application wiring diagram for the braking given in this document.

**P16 – Braking time [default=OFF]**

It fixes the length of time for braking from when the STOP command is given or from the end of the deceleration, if enabled.



The exact stopping time of the equipment can not be adjusted and it exclusively depends on equipment inertia and the braking current.

**P17 – Prebraking time [default=OFF]**

It determines the length of time for the prebraking once the START command is given but before the acceleration ramp. It is used to stop the motor if it is rotating in the inverse direction to the starting one.



The exact stopping time of the equipment can not be adjusted but it exclusively depends on equipment inertia and the braking current.

**P18 – Alarms reset command [default=STOP input opening]**

It defines the origin of the alarms resetting.

**P19 – STOP function assignment [default=STOP]**

If the STOP input is used for one of the functions given below, the START input simultaneously performs both functions of START and STOP of the starter.

<b>STOP</b>	STOP function of the motor
<b>Free-wheel stopping</b>	Disables the stopping with deceleration and/or braking
<b>External alarm</b>	Generates the alarm and stops the motor as programmed
<b>Motor preheating</b>	Delivers a small preheating unidirectional current to the motor windings, at modulated intervals every 10 seconds. In this way, the motor thermal state is maintained between 0 and 10%.
<b>Local control</b>	Disables the PC remote control (commands, setup, display, etc.).
<b>Alarms inhibition (1)</b>	Inhibits all alarms, indistinctly, which prevent motor starting and disable the torque control. In this case, the starting time corresponds exactly to the preset time "P03 Acceleration ramp".
<b>Motor thermal protection manual resetting (2)</b>	At the contact closing, the thermal status of the motor is forced to 100% if this value is higher. If the protection trips, it also accomplishes the resetting: In this way, the alarm resetting can be possibly made via the STOP command.
<b>Keypad lock</b>	Precludes access to the setup menu.
<b>Second motor</b>	This function makes it possible to start two motors with different characteristic data or a single motor with double winding (two speed or Dahlander)
<b>Second motor + t.s.r.</b>	As for Second Motor function but with the difference that, when passing from one configuration to another, the thermal status used for temperature protection is reset (returning to cold status, i.e. 0%).



**CAUTION**

- (1) The use of the Alarms Inhibition function revokes warranty conditions of the starter. Use it only when strictly indispensable.
- (2) The use of the Motor Thermal Protection Manual Resetting function modifies the motor thermal protection tripping and can cause dangerous motor overheating.

**P20, P21 and P22 – K1-K2-K3 output function assignment [K1 default=Motor powered]-[K2 default=Up to speed]-[K3 default=Braking]**

One of the following functions can be assigned to each of these outputs:

<b>OFF</b>	No function
<b>Motor powered</b>	The relay energises at the start command and de-energises at the end of the motor stopping
<b>Up to speed</b>	The relay energises when the motor is at full voltage and de-energises at the beginning of the motor stopping stage
<b>Braking contactor</b>	The relay energises either for the period set at the STOP command if "P16 Braking time" is enabled or at the end of the deceleration ramp if "P4 Deceleration ramp" is enabled. Otherwise, it energises for the preset time after the "P17 Prebraking time" and then the motor starting begins.
<b>Current threshold</b>	The output relay is energised if "P52 Current threshold" parameter is enabled and only when the current passes the value set for the time longer than fixed by parameter "P53 Current threshold tripping delay". It de-energises when the current falls below a value equal to 10% of the set limit. <b>N.B.</b> The function is not enabled during motor acceleration and/or deceleration ramps.
<b>Service required</b>	If parameter "P54 Service expiry" is enabled, the relay is energised when the service counter reaches zero. It de-energises with the command "C02 Service counter resetting".
<b>Multiple starting</b>	Cascade starting and stopping of multiple motors. Enabled by the K3 relay only. Contact Lovato Customer Service (tel. ..+39 0354282422), for detailed information concerning the use of this function.
<b>PROG-IN thresholds</b>	The relay is energised or de-energised on the basis of the ON-OFF function assigned to the thresholds variables of the 0-100V or PT100 analog input.
<b>Alarm A....</b>	The relay energises when the specific alarm generates. Press the ▼ or ▲ key to select the alarm.

### P23 – Bypass contactor

This parameter is adjusted to ON as default in starters with integrated bypass. In case of frequent startings, the bypass can be disabled but an upgraded starter must be considered.

In starters without bypass, it is set at OFF as default. It must be however adjusted to ON whenever the external bypass contactor is installed.

### P24 – Analog output assignment [default=Current]

An analog output signal is provided, proportional to one of the digital measurements available: current, torque, thermal status, power factor and active power.

### P25 – Analog output full scale [default=100%]

It defines the full scale value of the selected measurement.

### P26 – Output analog configuration [default=0...20]

The type of analog output is established either as 0-20mA or 4-20mA. When the 0-10V output is required, configure it as 0-20mA output and connect a 500Ω 1% ½ W resistor across the terminals:

### P27 - PROG-IN function assignment [default=Free-wheel stopping]

One of the following functions can be assigned to this input:

<b>OFF</b>	No function
<b>Free-wheel stopping</b>	Disables the stopping with deceleration and/or braking
<b>External alarm</b>	Generates the alarm and stops the motor as programmed
<b>Motor preheating</b>	Delivers a small preheating unidirectional current to the motor windings at modulated intervals every 10 seconds. In this way, the motor thermal state is maintained between 0 and 10%.
<b>Local control</b>	Inhibits all remote control functions (commands, setup, display, etc.)
<b>Alarms inhibition (1)</b>	Inhibits all alarms, indistinctly, which prevent motor starting and disable the torque control. In this case, the starting time corresponds exactly to the preset time "P03 Acceleration ramp".
<b>Motor thermal protection manual resetting (2)</b>	At the contact closing, the thermal status of the motor is forced to 100% if this value is higher. If the protection trips, it also accomplishes the resetting: In this way, the alarm resetting can be possibly made via the STOP command.
<b>Multiple starting</b>	Cascade starting and stopping of multiple motors. Contact Lovato Customer Service (tel. ...+39 0354282422), for detailed information concerning the use of this function.
<b>Keypad lock</b>	Precludes access to the setup menu.
<b>Second motor</b>	This function makes it possible to start two motors with different characteristic data or a single motor with double winding (two speed or Dahlander)
<b>Second motor + t.s.r.</b>	As for Second Motor function but with the difference that, when passing from one configuration to another, the thermal status used for temperature protection is reset (returning to cold status, i.e. 0%).
<b>0-10V ramp</b>	0-10V analog input assignment (or 0-20mA with 500Ω 1% ½ W resistor on analog input) for the acceleration and deceleration ramps. Analog signal connection across terminals 4 and 6.
<b>2-10V ramp</b>	2-10V analog input assignment (or 4-20mA with 500Ω 1% ½ W resistor on analog input) for the acceleration and deceleration ramps. Analog signal connection across terminals 4 and 6.
<b>0-10V Start-Stop</b>	0-10V analog input assignment (or 0-20mA with 500Ω 1% ½ W resistor on analog input) for motor Start-Stop commands and/or output relay energising/de-energising. Analog signal connection across terminals 4 and 6.
<b>2-10V Start-Stop</b>	2-10V analog input assignment (or 4-20mA with 500Ω 1% ½ W resistor on analog input) for motor Start-Stop commands and/or output relay energising/de-energising. Analog signal connection across terminals 4 and 6.
<b>PT100 Start-Stop</b>	Analog input assignment for PT100 temperature sensor, for motor Start/Stop commands and/or output relay energising/de-energising. PT100 connection across terminals 4 and 6.
<b>PTC protection</b>	Analog input assignment for PTC temperature sensor. PTC connection across terminals 4 and 6. <b>N.B.</b> This setting disables the thermal protection fixed by parameters P11 and P12.



#### CAUTION

- (1) The use of the Alarms Inhibition function revokes warranty conditions of the starter. Use it only when strictly indispensable.
- (2) The use of the Motor Thermal Protection Manual Resetting function modifies the motor thermal protection tripping and can cause dangerous motor overheating.

### P28 – Ramp dead zone PROG-IN [default=OFF]

This function is enabled when the analog input is regulated to 0-10V or 2-10V ramp. It defines the inaccessible initial ramp range where the motor is stopped. A 20% adjustment must be intended as the ramp will operate when input voltage is  $\geq 2V$  or  $\geq 3.6V$  depending on the respective 0-10V or 2-10V input assignment.



Motor operation is always subordinated to normal Start-Stop commands.

### **P29 – Start motor PROG-IN threshold [default=OFF] and P30 – Stop motor PROG-IN threshold [default=OFF]**

These functions are enabled when the analog input is adjusted to 0-10V or 2-10V Start-Stop. The Start and Stop thresholds define an input signal range within which the motor will operate. The two thresholds can intersect each other and in this way, the motor can be started at the maximum threshold and stopped at the minimum one or else started at the minimum threshold and stopped at the maximum one.



Motor operation is always subordinated to normal Start-Stop commands.

### **P31 – ON relay PROG-IN threshold [default=OFF] and P32 – OFF relay PROG-IN threshold [default=OFF]**

These functions are enabled when the analog input is adjusted to 0-10V or 2-10V Start-Stop. The ON and OFF thresholds define an input signal range within which the relay will energise. The two thresholds can intersect each other and in this way, the relay can be energised at the maximum threshold and de-energised at the minimum one or else energised at the minimum threshold and de-energised at the maximum one.



Motor operation is always subordinated to normal Start-Stop commands.

### **P33 – Start motor temperature PROG-IN [default=OFF] and P34 – Stop motor temperature PROG-IN [default=OFF]**

These functions are enabled when the analog input is adjusted to PT100 Start-Stop. The Start and Stop thresholds define a temperature range within which the motor will operate. The two thresholds can intersect each other and in this way, the motor can be started at the maximum threshold and stopped at the minimum one or else started at the minimum threshold and stopped at the maximum one.

### **P35 – ON relay temperature PROG-IN [default=OFF] and P36 – OFF relay temperature PROG-IN [default=OFF]**

These functions are enabled when the analog input is adjusted to PT100 Start-Stop. The ON and OFF thresholds define a temperature range within which the relay will energise. The two thresholds can intersect each other and in this way, the relay can be energised at the maximum threshold and de-energised at the minimum one or else energised at the minimum threshold and de-energised at the maximum one.

## **Functions menu**

<b>Code</b>	<b>Description</b>	<b>Range</b>	<b>Default</b>
P40	Keypad motor control	OFF / ON	OFF
P41	START command delay	OFF / 1...20s	OFF
P42	Automatic alarms resetting	OFF / 1...6	OFF
P43	Automatic alarms resetting time delay	1...30min	1
P44	Torque control	ON / OFF	ON
P45	Maximum torque limit	OFF / 10...200% T <sub>n</sub>	OFF
P46	Torque control compensation	50...150%	100
P47	Minimum torque threshold	OFF / 20...100% T <sub>n</sub>	OFF
P48	Minimum torque tripping delay	1...20s	10
P49	Maximum starting time	OFF / 10...1000s	OFF
P50	Phase sequence	OFF / L1-L2-L3 / L3-L2-L1	OFF
P51	Current asymmetry	OFF / 1...25%	OFF
P52	Current threshold	OFF / 50...300% I <sub>n</sub>	OFF
P53	Current threshold tripping delay	1...60s	10
P54	Service expiry	OFF / 0...50,000h	OFF
P55	RS232 serial communications Baud-rate	4800 / 9600 / 19200	9600
P56	RS232 serial communications address	1...255	1
P57	Modem communication	OFF / ON	OFF
P58	Minimum voltage threshold	OFF / 170...760	OFF
P59	Minimum voltage tripping delay	0...240s	5
P60	Maximum voltage threshold	170...760 / OFF	OFF
P61	Maximum voltage tripping delay	0...240s	5
P62	Serial communication protocol	Lovato / Modbus <sup>®</sup> RTU	Lovato
P63	Serial communication parity	None/ Even / Odd	None

### **P40 – Keypad motor control [default=OFF]**

The START and STOP commands are keypad enabled. The keypad control operates only if the STOP input is connected to +24V. The motor starting is obtained by pushing the START key for two seconds.

**P41 – START command delay [default=OFF]**

The motor starting command is delayed.



It is important to use this function with a 2-wire start control.

**P42 – Automatic alarms resetting [default=OFF]**

This function is used in all unmanned applications with a 2-wire motor start control. In circumstances caused by A01, A02, A04, A06, A9, A22, A23 or A24 alarm conditions and after the "P43" Automatic alarms resetting time delay " has lapsed, the automatic alarms resetting will take place and the motor will be started as a result. During alarm conditions, the display alternately shows the alarm instated and the time remaining before the automatic resetting takes place.

**P43 – Automatic alarms resetting time delay [default=1]**

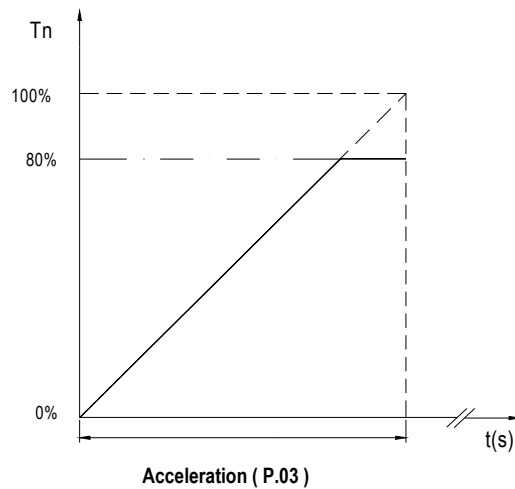
This parameter defines the time delay between any alarm which has caused the motor to stop and the subsequent automatic alarms resetting.

**P44 – Torque control [default=ON]**

Torque control is disabled with cascade starting or when more than one motor rating is different than the starter power. Whenever the torque control is disabled, the starting is conducted in voltage ramp for which the initial acceleration and end of deceleration voltages are determined respectively by parameter "P02 Initial acceleration torque" and parameter "P05 Threshold for end of deceleration".

**P45 – Maximum torque limit [default=OFF]**

This parameter limits the maximum torque value during acceleration. It is used whenever the mass inertia is exceptionally large which could cause difficulties to the transmission system, such as belt slipping or possible breaking of mechanical parts.

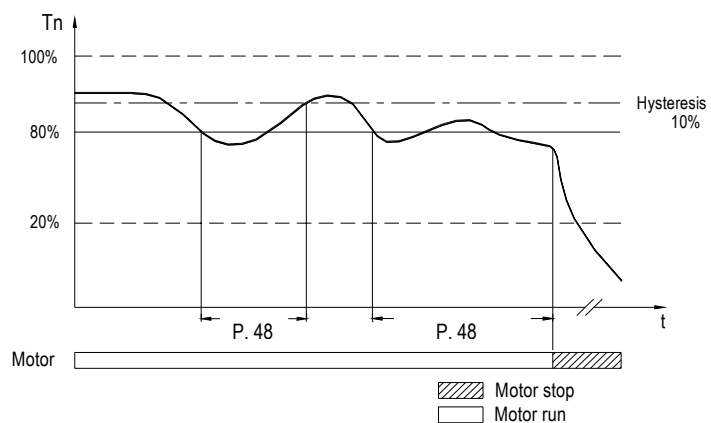


**P46 – Torque control compensation [default=100%]**

Motors of the same power rating can deliver different torque values than the presumed because of different manufacturing standards. Under these circumstances, it is useful to adjust this parameter to obtain optimum supply. Values higher than 100% are set when the acceleration results unsteady during the initial phase and abrupt at the final stage. Contrarily, values lower than 100% are set when the acceleration is abrupt during the initial phase and unsteady at the final stage.

**P47 – Minimum torque threshold [default=OFF]**

It is normally used as protection against dry pump running and to detect the breaking of driving belts. If the torque value is lower than the preset value, after the "P48 Minimum torque tripping delay", the alarm "A09 Motor load too low" is generated. The tripping delay is revoked if the torque increases to a value +10% of the preset one.



**P48 – Minimum torque tripping delay [default=10s]**

The tripping is delayed when the torque is lower than parameter "P47 Minimum torque threshold". The tripping delay is revoked when the torque increases to +10% of the preset value.

**P49 – Maximum starting time [default=OFF]**

A control is made so the motor starting time is not longer than the preset value; in other words, to verify if any mechanical part has not undergone any change, because of wear or malfunction, that could possibly prevent the correct starting of the equipment. A interval longer than the preset value will cause alarm "A10 Starting time too long" to trip.

**P50 –Phase sequence [default=OFF]**


The phase sequence of the power supply is checked, that is if the direction of the motor rotation is correct. The L1-L2-L3 setting corresponds to forward rotation while L3-L2-L1 to reverse. A sequence other than the preset one will cause alarm "A03 Incorrect phase sequence" to trip.

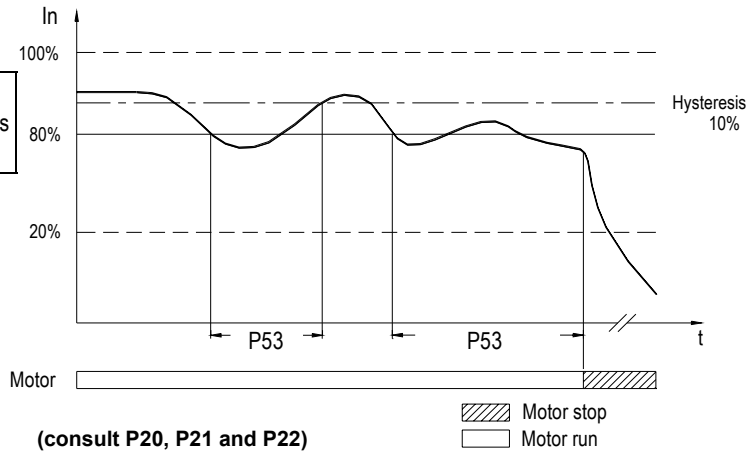
**P51 – Current asymmetry [default=OFF]**

It controls current asymmetry. An asymmetry higher than the preset value for a period (fixed) longer than 10 seconds causes alarm "A06 Current asymmetry" to trip.

**P52 – Current threshold [default=OFF]**

The output relay is energised if the current is higher than the preset value for a period longer than parameter "P53 Current threshold tripping delay". The relay de-energises when the current value decreases to -10% of the preset value.

 This function is enabled when the motor is running. The relay is regulated by parameters P20, P21 or P22.




**P53 – Current threshold tripping delay [default=10s]**

This parameter delays the tripping when the current is higher than "P52-Current threshold". The delay is reset when the current decreases to -10% of the preset value.

**P54 – Service expiry [default=OFF]**

The output relay is energised when the service counter reaches zero. It is de-energised with the command "C02 Service counter resetting" which also simultaneously resets the counter.

 The relay must be adjusted through parameters P20, P21 or P22.

**P55 – RS232 serial communications Baud-rate [default=9600]**

Choice of the transmission speed.

**P56 – RS232 serial communications address [default=1]**

Choice of the starter serial communications address. The personal computer must send the address corresponding to the preset one to communicate with the starter. In case of remote control where the communications are made through a RS232/RS485 converter drive, galvanically isolated, up to 31 starters can be connected to the same RS485 line. Using special signal repeaters, a total of maximum 255 devices can be connected on the same bus. To avoid communication conflict, each starter must have its own address so only one starter answers the call with the PC request.

**P57 – Modem communication [default=OFF]**

Enables communications via modem or GSM modem.

**P58 – Minimum voltage threshold [default=OFF]**

Alarm "A22 Line voltage too low" is originated if a voltage value of the power line is detected below the preset value for more than the time preset by "P59 Minimum voltage tripping delay".

**P59 – Minimum voltage tripping delay [default=5]**

Delays the tripping when the voltage is lower than "P58 Minimum voltage threshold". The delay is reset when the voltage of the power line is equal to or higher than the preset value.

**P60 – Maximum voltage threshold [default=OFF]**

Alarm "A23 Line voltage too high" is originated if a voltage value of the power line is detected above the preset value for more than the time preset by "P61 Maximum voltage tripping delay".

**P61 – Maximum voltage tripping delay [default=5]**

Delays the tripping when the voltage is higher than "P60 Maximum voltage threshold". The delay is reset when the voltage of the power line is equal to or lower than the preset value.

**P62 – Serial communication protocol [default=Lovato]**

Selects the communication protocol used on the RS232 port. It is possible to choose between the Lovato proprietary ASCII protocol and the Modbus RTU protocol. To use the Lovato Remote control PC software and / or modem communications it is necessary to set Lovato protocol.

**P63 – Serial communication parity [default=None]**

Enables parity check on the RS232 port. To use Lovato protocol and Adx Remote control PC software it is necessary to set this parameter to None.

## Commands menu

Code	Description	Effect of the command
C00	Motor thermal status resetting (1)	Resetting of motor thermal status and relative protection
C01	Motor hour meter resetting	Meter resetting
C02	Service counter resetting	Counter resetting (count-down type)
C03	Events log resetting	Resetting of all events and logging
C04	BASIC setup default restore	Restore to default parameter values
C05	ADVANCED setup default restore	Restore to default parameter values
C06	FUNCTIONS setup default restore	Restore to default parameter values
C07	ALL setups default restore	Restore to default parameter values of all setups
C08	Test with smaller motor (2)	Permits the verification of the power circuit by starting a motor having a current rating lower than the foreseen one
C09	SCR test (3)	Control for eventual shorted SCR (on L1-T1/L2-T2/L3-T3 phases)
C10	kWh meter resetting	Resetting of motor energy consumption meter



### CAUTION

- (1) This control modifies the motor thermal protection tripping and can eventually cause dangerous motor overheating conditions.
- (2) The starting is forced in voltage ramp during the test with a low power motor. This command is automatically disabled when the starter power is removed.
- (3) Before conducting the test, make sure the bypass contactor does not have welded contacts. The test can be conducted with the motor connected and no consent to motor starting.

## Clock menu

Code	Description	Range	Default (1)
-	Year	1990...2089	2000
-	Month	1...12	1
-	Day	1...28/29/30/31	1
-	Hours	0...23	00
-	Minutes	0...59	00
-	Seconds	0...59	00
(1)	When an incorrect date is detected, the clock will automatically reset to default values.		



## TECHNICAL CHARACTERISTICS

<b>Auxiliary and power supply</b>	
Motor supply voltage Ue ADX 0022BP... ADX 0231BP, ADX 0017B... ADX 0245B ADX 0310 ... ADX 1200	208...500VAC ±10% 208...415VAC ±10% (440...690VAC on request)
Rated motor current Ie ADX 0022BP... ADX 0231BP, ADX 0017B... ADX 0245B ADX 0310 ... ADX 1200	50...105% Ie 50...115% Ie
Auxiliary supply Us	208...240VAC ± 10%
Control card auxiliary supply protection fuse	Plug-in 250mA T (slow blow) <b>N.B.</b> Protection to internal bypass and ventilation system are excluded.
Auxiliary power loss ride through	≤25ms (at 208VAC)
Mains frequency	50 or 60Hz ±5% self configurable
<b>Digital inputs</b>	
Rated voltage of inputs	24VDC ± 10%
Input current	11mA at 24VDC
Input voltage of logic status "0" and "1"	< 5V logic status "0" and > 12V logic status "1"
Maximum input voltage	28VDC
Input delay	50ms
<b>Analog input 0...10V</b> (0...20mA or 4...20mA with 500Ω 1% ½W resistor connected in parallel to input)	
Input signal range	0 - 10V
Measurement input impedance	>100 kΩ
Repeat accuracy	±2%
<b>Analog input PT100</b>	
Type of sensor	2-wire compliant to DIN 43760
Measurement range	-50° to +250°C
Accuracy	±5°C max (Value of the accuracy related to connecting cables must be added to this rate value)
<b>Analog input PTC</b>	
Type of sensor	Compliant to DIN 44081
Total resistance	≤ 1.5 kΩ at 25°C
Tripping resistance	≅ 2.9 kΩ
Resetting resistance	≅ 1.6 kΩ
<b>Output relay contacts</b>	
Rated thermal current Ith	5A – 250VAC (AC1)
Maximum switchable voltage	250VAC
Maximum capacity	AC15 2A - 250VAC / DC13 0.5A - 50VDC
Insulation category/Rated voltage	C/250 (VDE0110)
Switchable capacity	1500VA maximum / 100mA at 24VDC minimum
<b>Bypass contactor command (for starters without integrated bypass only)</b>	
Control voltage	208 ... 240VAC ± 10% (based on auxiliary supply)
Maximum capacity	1.5A - 250VAC (AC15) / 5A - 250VAC (AC1)
<b>Analog output</b> (associated with current, torque, thermal status or power factor readings)	
Output current	0-20mA or 4-20mA (0-10V with 500Ω 1% ½W resistor on the output configured as 0...20mA)
Load impedance	0...850Ω max
Full scale	50...500% of range selected
Linearity	±2%
Repeat accuracy	±1%
<b>Communication lines</b>	
RS232 serial interface (for set-up and service maintenance)	Baud-rate 4800, 9600 and 19200bps selectable (connecting cables maximum 3 meters long)
RS485 serial interface (for remote keypad)	Baud-rate 9600bps fixed (connecting cable maximum 3 meters long)
Starter remote control	By galvanically isolated RS232/RS485 converter drive, modem or GSM modem connected to RS232 port
<b>Operating limits</b>	
Operating temperature	-10° to +45°C (Maximum temperature 55°C, between 45° and 55°C derate the starter current 1.5% per °C)
Storage temperature	-30° to +70°C
Climatic sequence Z/ABDM Method 1: Dry hot, dry humid, cold and dry humid	-30° to +70°C temperature, 95% humidity without condensation or dripping
Altitude	1000m without derating (Over 1000m, derate the starter current 0.5% per 100m)
Operating position	On vertical plane with a maximum ±15° inclination <b>N.B.</b> Inclinations up to ±45° are admissible but only momentarily
<b>Miscellaneous</b>	
Degree of protection ADX0022BP...ADX0126BP.  ADX 0017B...ADX0125B. ADX 0150BP...ADX 0231BP. ADX 0142B...ADX 0245B. ADX 0310...ADX 1200.	IP20 IP20 IP00 IP00 IP00 IP00
Pollution degree 0022BP...ADX0231BP.  ADX 0017B...ADX0245B. ADX 0310...ADX 1200.	3 3 3

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Power supply connections	Type of terminal	Conductor section (min/max)		Tightening torque		Screw
ADX 0022BP...ADX 0048BP, ADX 0017B...ADX 0045B.	Fixed	6 / 16mm <sup>2</sup>	10 / 6 AWG	3 Nm	26 lbin	-
ADX 0058BP...ADX 0126BP, ADX 0060B...ADX 0125B.	Fixed	16 / 50mm <sup>2</sup>	6 / 0 AWG	5 Nm	43 lbin	-
ADX 0150BP...ADX 0231BP, ADX 0142B...ADX 0245B.	Copper busbar	5x20mm		18Nm	156lbin	M 8
ADX 0196BP...ADX 0231BP, ADX 0190B...ADX 0245B.	Copper busbar	5x25mm		35Nm	300lbin	M 10
ADX 0310...ADX 0365.	Copper busbar	40x5mm		35Nm	300LBin	M 10
ADX 0470...ADX 0640.	Copper busbar	40x10mm		55Nm	470LBin	M 12
ADX 0820.	Copper busbar	2-30x10mm		35Nm	300LBin	M 10
ADX 1200.	Copper busbar	2-40x10mm		35Nm	300LBin	M 10
Auxiliary supply connections	Type of terminal	Conductor section (min/max)		Tightening torque		
ADX0022BP...ADX0126BP, ADX0017B...ADX0125B.	Fixed	1.5 / 6mm <sup>2</sup>	16 / 10 AWG	2 Nm	18 lbin	
ADX 0150BP...ADX 0231BP, ADX 0142B...ADX 0245B.	Plug in	0.5 / 2.5mm <sup>2</sup>	24 / 2 AWG	0.8 Nm	7 lbin	
Control input and output and bypass connections	Type of terminal	Conductor section (min/max)		Tightening torque		
ADX 0310...ADX 1200	Plug in	0.5 / 2.5mm <sup>2</sup>	24 / 2 AWG	0.8 Nm	7 lbin	
Control inputs and outputs connection	Type of terminal	Conductor section (min/max)		Tightening torque		
	Plug in	0.5 / 2.5mm <sup>2</sup>	24 / 12 AWG	0.8 Nm	7 lbin	
Version ADX0022BP...ADX0126BP, ADX0017B...ADX0125B	Base structure of extruded aluminium. Sidings and cover of anodised aluminium. Upper and lower closings and control unit holder top of Cycolac S157 thermoplastic					
ADX 0150BP...ADX 0231BP, ADX 0142B...ADX 0245B.	Base structure of extruded aluminium. Sidings and cover of epoxy finish sheet steel.					
ADX 0310...ADX 1200.	Base structure, sidings and cover of epoxy finished sheet steel. <b>N.B.</b> Control unit holder top of Cycolac S157 thermoplastic. material					

Reference standards

EC marking	Compliant with directives 73/23/CEE for low voltage and 89/336/EEC for electromagnetic compatibility and subsequent revisions
EN 60947-4-2 Standards	Conducted emission immunity (CISPR 11), irradiated emission immunity (CISPR 11), electrostatic discharge immunity (EN 61000-4-2), conducted immunity (EN 61000-4-6), irradiated immunity (EN 61000-4-3), fast transient/burst immunity (EN 61000-4-4) and surge immunity (EN 61000-4-5).
Others	Shock test (IEC 60068-2-27), vibration test (IEC 60068-2-6), climatic sequence Z/ABDM (IEC 60068-2-61), relative humidity (IEC 60068-2-3) and ambient pollution (IEC 60664).

Specific technical characteristics for ADX...BP starters with integrated by-pass (data referred to 45°C ambient temperature [ta])

Starter order code	Starter current I <sub>e</sub> A	Auxiliary supply voltage			Power dissipation		Cooling system	Maximum cable section mm <sup>2</sup>	Terminals mm
		Dissipation W (1)	Consumption VA (1)	In-rush VA (2)	start/dec (3) W/A	By-pass (4) W (ta 45°)			
51.ADX0022BP	22	11	26	93	3,6	6,5	Natural	6	None
51.ADX0034BP	34	13	28	107	3,6	12	Natural	10	None
51.ADX0048BP	48	13	28	259	3,3	21	Natural	16	None
51.ADX0058BP	58	39 (15)	60 (35)	291	3,75	17	Forced	25	None
51.ADX0068BP	68	39 (15)	60 (35)	291	3,75	22	Forced	25	None
51.ADX0082BP	82	39 (15)	60 (35)	291	3,3	28	Forced	25	None
51.ADX0092BP	92	39 (15)	60 (35)	291	3,3	35	Forced	35	None
51.ADX0114BP	114	39 (15)	60 (35)	273	3,15	43	Forced	35	None
51.ADX0126BP	126	39 (15)	60 (35)	273	3,15	53	Forced	50	None
51.ADX0150BP	150	59 (21)	106 (53)	532	3,6	48	Forced	None	20x5
51.ADX0196BP	196	56,5 (18,5)	80 (27)	380	3,6	55	Forced	None	25x5
51.ADX0231BP	231	56,5 (18,5)	80 (27)	380	3,6	82	Forced	None	25x5

- (1) The indicated data are maximum values (with fan on, if any) and refer to 240VAC voltage value. The value between brackets is the consumption with fan switched off.  
 (2) In-rush power at by-pass contactor closing.  
 (3) Starter power dissipation during starting and deceleration if preset.  
 (4) Starter power dissipation when motor running with bypass closed and starter rated current.

Specific technical characteristics for ADX...B starters with integrated by-pass (data referred to 45°C ambient temperature [ta])

Starter order code	Starter current I <sub>e</sub> A	Auxiliary supply voltage			Power dissipation		Cooling system	Maximum cable section mm <sup>2</sup>	Terminals mm
		Dissipation W (1)	Consumption VA (1)	In-rush VA (2)	start/dec (3) W/A	By-pass (4) W (ta 45°)			
51.ADX0017B	17	11	26	93	3,6	6,3	Natural	6	None
51.ADX0030B	30	11	26	93	3,6	11	Natural	10	None
51.ADX0045B	45	13	28	259	3,3	19	Natural	16	None
51.ADX0060B	60	39 (15)	60 (35)	291	3,75	18	Forced	25	None
51.ADX0075B	75	39 (15)	60 (35)	291	3,3	24	Forced	25	None
51.ADX0085B	85	39 (15)	60 (35)	291	3,3	31	Forced	35	None
51.ADX0110B	110	39 (15)	60 (35)	273	3,15	40	Forced	35	None
51.ADX0125B	125	39 (15)	60 (35)	273	3,15	52	Forced	50	None
51.ADX0142B	142	59 (21)	106 (53)	532	3,6	43	Forced	None	20x5
51.ADX0190B	190	56,5 (18,5)	80 (27)	380	3,6	51	Forced	None	25x5
51.ADX0245B	245	56,5 (18,5)	80 (27)	380	3,6	89	Forced	None	25x5

- (1) The indicated data are maximum values (with fan on, if any) and refer to 240VAC voltage value. The value between brackets is the consumption with fan switched off.  
 (2) In-rush power at by-pass contactor closing.  
 (3) Starter power dissipation during starting and deceleration if preset.  
 (4) Starter power dissipation when motor running with bypass closed and starter rated current.

Specific technical characteristics for ADX... starters predisposed for external by-pass connection

(data referred to 45°C ambient temperature [ta])

Starter order code	Starter current I <sub>e</sub> [A]	Auxiliary supply voltage Consumption [VA] (1)	Dissipation [W] (1)	Power dissipation Start/dec (2) [W/A]	Cooling system	Maximum cable section [mm <sup>2</sup> ]	Terminals [mm]
51 ADX0310	310	107 (15)	75 (8.4)	3.6	Forced	None	40x5
51 ADX0365	365	107 (15)	75 (8.4)	3.6	Forced	None	40x5
51 ADX0470	470	120 (15)	94 (8.4)	3.6	Forced	None	40x10
51 ADX0568	568	120 (15)	94 (8.4)	3.6	Forced	None	40x10
51 ADX0640	640	120 (15)	94 (8.4)	3.6	Forced	None	40x10
51 ADX0820	820	180 (15)	142 (8.4)	3.6	Forced	None	2 pcs 30x10

51 ADX1200	1200	180 (15)	142 (8.4)	3.6	Forced	None	2 pcs40x10
(1)	The indicated data are maximum values (with fan on, if any) and refer to 240Vac voltage value. The value between brackets is the consumption with fan switched off.						
(2)	Starter power dissipation during starting and deceleration if preset.						

### Recommended additional components

#### ADX.....BP starters with integrated by-pass

Starter order code	Starter current Ie A	Line contactor (3-pole type)	Bypass contactor (3-pole type)	Braking contactor	Q1 fuse AM A	FU1 fuses(1)				
						415V		660V		
						Brush	Bussman	Brush	Bussman	
51.ADX0022BP	22	BF25	-	BF12	25	63FE	FWH-60B	63FE	FWP-60B	FWJ-60A
51.ADX0034BP	34	BF40	-	BF25	40	100FE	FWH-100B	100FE	FWP-100B	FWJ-100A
51.ADX0048BP	48	BF50	-	BF40	63	140FEE	FWH-150B	140FEE	FWP-150A	-
51.ADX0058BP	58	BF65	-	BF50	80	160FEE	FWH-150B	160FEE	FWP-150A	FWJ150A
51.ADX0068BP	68	BF80	-	BF50	80	180FM	FWH-175B	180FM	FWP-175A	FWJ-175A
51.ADX0082BP	82	BF95	-	BF80	100	200FM	FWH-200B	200FM	FWP-200A	FWJ-200A
51.ADX0092BP	92	B115	-	BF95	125	280FM	FWH-275A	280FM	FWP-250A	FWJ-250A
51.ADX0114BP	114	B115	-	B115	160	280FM	FWH-275A	280FM	FWP-300A	FWJ-300A
51.ADX0126BP	126	B145	-	B115	160	315FM	FWH-325A	315FM	FWP-350A	FWJ-350A
51.ADX0150BP	150	B145	-	B115	200	500FMM	FWH-500A	500FMM	FWP-500A	FWJ-500A
51.ADX0196BP	196	B180	-	B115	250	500FMM	FWH-500A	500FMM	FWP-500A	FWJ-500A
51ADX0231BP	231	B250	-	B145	250	550FMM	FWH-600A	550FMM	FWP-600A	FWJ-600A
(1)	Quick fuse type for SCR protection									

#### ADX.....B starters with integrated by-pass

Starter order code	Starter current Ie A	Line contactor (3-pole type)	Bypass contactor (3-pole type)	Braking contactor	Q1 fuse AM A	FU1 fuses(1)				
						415V		660V		
						Brush	Bussman	Brush	Bussman	
51.ADX0017B	17	BF20	-	BF9	20	45FE	FWH-45B	45FE	FWP-50B	FWJ-50A
51.ADX0030B	30	BF32	-	BF20	32	90FE	FWH-90B	90FE	FWP-90B	FWJ-90A
51.ADX0045B	45	BF50	-	BF40	50	120FEE	FWH-125B	120FEE	FWP-125A	FWJ-125A
51.ADX0060B	60	BF65	-	BF50	80	160FEE	FWH150B	160FEE	FWP-150A	FWJ150A
51.ADX0075B	75	BF80	-	BF50	80	180FM	FWH-175B	180FM	FWP-175A	FWJ-175A
51.ADX0085B	85	BF95	-	BF80	100	200FM	FWH-200B	200FM	FWP-200A	FWJ-200A
51.ADX0110B	110	B115	-	B115	125	250FM	FWH-250A	250FM	FWP-250A	FWJ-250A
51.ADX0125B	125	B145	-	B115	160	280FM	FWH-275A	280FM	FWP-300A	FWJ-275A
51.ADX0142B	142	B145	-	B115	160	315FM	FWH-325A	315FM	FWP-350A	FWJ-325A
51.ADX0190B	190	B180	-	B115	200	500FMM	FWH-500A	500FMM	FWP-500A	FWJ-500A
51.ADX0245B	245	B250	-	B145	315	550FMM	FWH-600A	550FMM	FWP-600A	FWJ-600A
(1)	Quick fuse type for SCR protection									

#### ADX... starters predisposed for external by-pass

Starter order code	Starter current Ie A	Line contactor	Bypass contactor	Braking contactor	Q1 fuse AM A	FU1 fuses(1)				
						415V		660V		
						Brush	Bussman	Brush	Bussman	
51.ADX0310	310	B310	B250	B180	355	630FMM	FWH-700A	630FMM	FWP-700A	FWJ-700A
51.ADX0365	365	B400	B310	B250	400	800F4M	FWH-800A	800F4M	FWP-800A	FWJ-800A
51.ADX0470	470	B500	B400	B310	500	900F4M	FWH-1000A	900F4M	FWP-1000A	FWJ-1000A
51.ADX0568	568	B630	B500	B400	630	1100F4M	FWH-1200A	1100F4M	-	FWJ-1200A
51.ADX0640	640	B630	B500	B400	800	1250F4M	FWH-1200A	1250F4M	-	FWJ-1200A
51.ADX0820	820	(2)	B6301000	B630	(2)	-	FWH-1400A	-	-	FWJ-1400A
51.ADX1200	1200	(2)	B1250	B630/B1000	(2)	-	FWH-1600A	-	-	FWJ-1600A
(1)	Quick fuse type for SCR protection									
(2)	Contact Lovato Customer Service (tel. ...+39 0354282422).									

## STARTER CHOICE

The following table is an indication for the starter choice in relation to the motor power and the supply voltage. It is highly recommended to select the starter in relation to the nameplate rated motor current and the type of duty.

The data given in this table is referred to 4-pole motors, standard duty and ambient temperature no higher than 45°C.

**N.B.** For use at higher temperatures up to a maximum of 55°C, derate the starter current by 1.5% per °C.

Selection table for ADX...BP starters (4-pole motor, standard duty, 45°C ambient temperature [ta])												
Starter order code	Starter current I <sub>e</sub>		Rated voltages according to IEC classification					Rated voltages according to UL classification				
	A	A max	220/240V KW	380/415V KW	440/460V KW	480/500V KW	660/690V KW	200/208V HP	220/240V HP	380/415V HP	440/480V HP	550/600V HP
51.ADX0022BP	22	105% I <sub>e</sub>	5,5	11	11	15	--	5	7,5	10	15	--
51.ADX0034BP	34		7,5	15	18,5	22	--	10	10	20	25	--
51.ADX0048BP	48		11	22	22	30	--	15	15	25	30	--
51.ADX0058BP	58		15	30	30	37	--	20	20	30	40	--
51.ADX0068BP	68		18,5	37	37	45	--	20	25	40	50	--
51.ADX0082BP	82		22	45	45	55	--	25	30	50	60	--
51.ADX0092BP	92		22	45	55	55	--	30	30	50	75	--
51.ADX0114BP	114		30	55	55	75	--	40	40	60	75	--
51.ADX0126BP	126		37	55	75	90	--	40	50	75	100	-
51.ADX0150BP	150		45	75	90	90	--	50	60	75	125	-
51.ADX0196BP	196		55	110	110	132	--	60	75	100	150	-
51.ADX0231BP	231		75	132	132	160	--	75	75	125	200	-

**Nota** I<sub>e</sub> = Starter rated current

Selection table for ADX... and ADX...B starters (4-pole motor, heavy duty, 45°C ambient temperature [ta])													
Starter order code	Starter current I <sub>e</sub>		Rated voltages according to IEC classification					Rated voltages according to UL classification					
	A	A max	220/240V KW	380/415V KW	440/460V KW	480/500V KW	660/690V KW	200/208V HP	220/240V HP	380/415V HP	440/480V HP	550/600V HP	
51.ADX0017B	17	105% I <sub>e</sub>	4	7,5	9	9	--	3	5	7,5	10	--	
51.ADX0030B	30		7,5	15	15	18,5	--	7,5	10	15	20	--	
51.ADX0045B	45		11	22	22	30	--	10	15	25	30	--	
51.ADX0060B	60		15	30	30	37	--	15	20	30	40	--	
51.ADX0075B	75		18,5	37	37	45	--	20	25	40	50	--	
51.ADX0085B	85		22	45	45	55	--	25	30	50	60	--	
51.ADX0110B	110		30	55	55	75	--	30	40	60	75	--	
51.ADX0125B	125		37	55	75	75	--	40	40	60	100	--	
51.ADX0142B	142		37	75	75	90	--	40	50	75	100	-	
51.ADX0190B	190		55	90	110	132	--	60	60	100	150	-	
51.ADX0245B	245		75	132	132	160	--	75	75	150	200	-	
51.ADX0310	310		115% I <sub>e</sub>	90	160	160	200	280	100	100	150	250	300
51.ADX0365	365			110	200	220	250	335	125	150	200	300	350
51.ADX0470	470	132		250	250	315	440	150	150	250	350	400	
51.ADX0568	568	160		315	355	400	500	200	200	350	400	500	
51.ADX0640	640	200		355	400	440	600	200	250	400	500	600	
51.ADX0820	820	250		440	500	600	800	250	300	500	600	700	
51.ADX1200	1200	355		630	710	800	1000	400	450	750	900	1050	

**N.B.** I<sub>e</sub> = Starter rated current

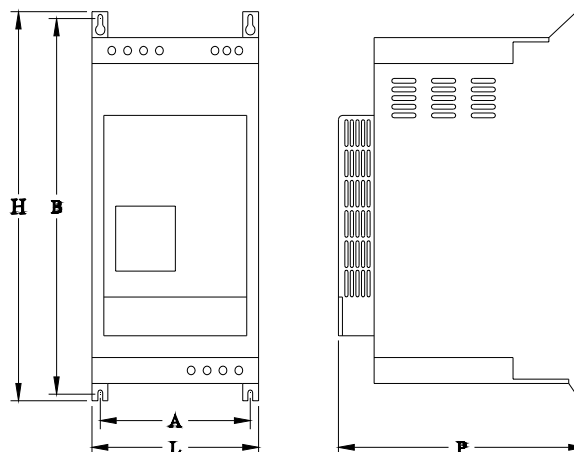
ADX...BP - Maximum number of startings/hour S4 cycle (50% duty cycle at 45°C ambient temperature[ta])						
Starter order code	Enabled BYPASS (integrated or external)			Disabled BYPASS		
	Starting current			Starting current		
	250%le	300%le	350%le	250%le	300%le	350%le
	Starting current			Starting current		
30s	15s	10s	30s	15s	10s	
51.ADX0022BP	33	43	49	NA	NA	NA
51.ADX0034BP	39	40	47	NA	NA	NA
51.ADX0048BP	21	34	32	NA	NA	NA
51.ADX0058BP	42	46	51	NA	NA	NA
51.ADX0068BP	36	41	43	NA	NA	NA
51.ADX0082BP	44	47	49	NA	NA	NA
51.ADX0092BP	37	39	39	NA	NA	NA
51.ADX0114BP	42	46	49	NA	NA	NA
51.ADX0126BP	40	44	47	NA	NA	NA
51.ADX0150BP	27	32	36	NA	NA	NA
51.ADX0196BP	40	48	48	NA	NA	NA
51.ADX0231BP	22	32	34	NA	NA	NA
<b>Attenzione!!</b>	le = Rated starter current N.A = Not available.					

ADX...B - Maximum number of startings/hour S4 cycle (50% duty cycle at 45°C ambient temperature[ta])												
Starter order code	Enabled BYPASS (integrated or external)						Disabled BYPASS					
	Starting current						Starting current					
	250%le	300%le	350%le	400%le	450%le	500%le	250%le	300%le	350%le	400%le	450%le	500%le
	Starting time						Starting time					
60s	30s	20s	10s	5s	5s	60s	30s	20s	10s	5s	5s	
51.ADX0017B	28	45	60	90	110	60	NA	NA	NA	NA	NA	NA
51.ADX0030B	28	40	35	40	110	35	NA	NA	NA	NA	NA	NA
51.ADX0045B	12	20	18	30	32	8	NA	NA	NA	NA	NA	NA
51.ADX0060B	28	50	72	90	120	100	NA	NA	NA	NA	NA	NA
51.ADX0075B	28	50	72	90	120	100	NA	NA	NA	NA	NA	NA
51.ADX0085B	28	45	45	72	100	50	NA	NA	NA	NA	NA	NA
51.ADX0110B	28	45	45	80	100	80	NA	NA	NA	NA	NA	NA
51.ADX0125B	28	45	40	60	70	45	NA	NA	NA	NA	NA	NA
51.ADX0142B	18	25	20	25	30	26	NA	NA	NA	NA	NA	NA
51.ADX0190B	22	35	30	37	46	38	NA	NA	NA	NA	NA	NA
51.ADX0245B	17	28	25	30	35	30	NA	NA	NA	NA	NA	NA
<b>Note</b>	le = Starter rated current. N.A = Not available.											

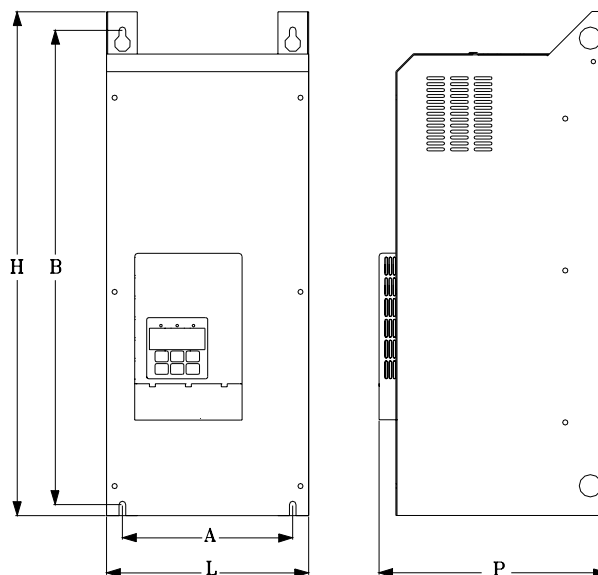
ADX... Maximum number of startings/hour S4 cycle (50% duty cycle at 45°C ambient temperature[ta])												
Starter order code	Without BYPASS						With external BYPASS					
	Starting current						Starting current					
	250%le	300%le	350%le	400%le	450%le	500%le	250%le	300%le	350%le	400%le	450%le	500%le
	Starting time						Starting time					
60s	30s	20s	10s	5s	5s	60s	30s	20s	10s	5s	5s	
51.ADX0310	10	14	18	22	34	NA	NA	NA	NA	NA	NA	NA
51.ADX0365	6	9	12	14	21	NA	NA	NA	NA	NA	NA	NA
51.ADX0470	6	7	11	13	20	NA	NA	NA	NA	NA	NA	NA
51.ADX0568	6	7	10	12	18	NA	NA	NA	NA	NA	NA	NA
51.ADX0640	4	5	7	9	14	NA	NA	NA	NA	NA	NA	NA
51.ADX0820	4	5	7	9	13	NA	NA	NA	NA	NA	NA	NA
51.ADX1200	3	4	6	8	10	NA	NA	NA	NA	NA	NA	NA
<b>Note</b>	le = Starter rated current. N.A = Not available.											

## Overall dimensions and weights

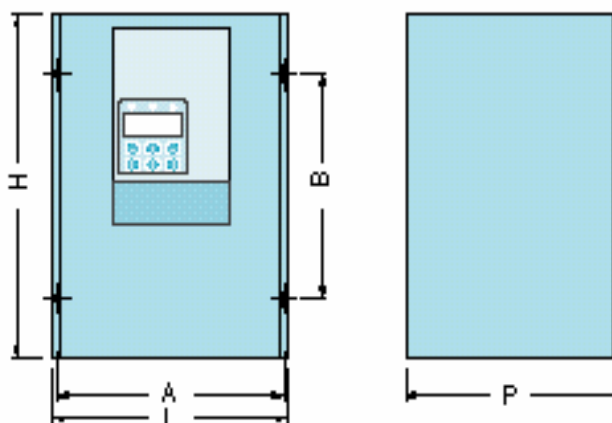
Starter order code	Dimensions [mm]			Fixing [mm]		Wt [kg]
	L	H	P	A	B	
51.ADX0022BP	157	372	223	131	357	8
51.ADX0034BP	157	372	223	131	357	8.3
51.ADX0048BP	157	372	223	131	357	8.3
51.ADX0058BP	157	534	250	132	517	14.9
51.ADX0068BP	157	534	250	132	517	14.9
51.ADX0082BP	157	534	250	132	517	14.9
51.ADX0092BP	157	534	250	132	517	14.9
51.ADX0114BP	157	584	250	132	567	15.7
51.ADX0126BP	157	584	250	132	567	15.7
51.ADX0017B	157	372	223	131	357	7.9
51.ADX0030B	157	372	223	131	357	8
51.ADX0045B	157	372	223	131	357	8.3
51.ADX0060B	157	534	250	132	517	14.9
51.ADX0075B	157	534	250	132	517	14.9
51.ADX0085B	157	534	250	132	517	14.9
51.ADX0110B	157	584	250	132	567	15.7
51.ADX0125B	157	584	250	132	567	15.7



Starter order code	Dimensions [mm]			Fixing [mm]		Wt [kg]
	L	H	P	A	B	
51.ADX0150BP	273	600	285	230	560	28
51.ADX0196BP	273	680	310	230	640	36
51.ADX0231BP	273	680	310	230	640	36
51.ADX0142B	273	600	285	230	560	28
51.ADX0190B	273	680	310	230	640	36
51.ADX0245B	273	680	310	230	640	36



Starter order code	Dimensions [mm]			Fixing [mm]		Wt [kg]
	L	H	P	A	B	
51 ADX0310	640	600	380	620	400	50
51 ADX0365	640	600	380	620	400	50
51 ADX0470	790	650	430	770	450	90
51 ADX0568	790	650	430	770	450	90
51 ADX0640	790	650	430	770	450	110
51 ADX0820	910	950	442	830	920	170
51 ADX1200	910	950	442	830	920	185



## ORDER CODES

Soft starters	
Order code	Description
51.ADX0022BP	Starter with by-pass for standard duty 11...22A - 208...500VAC
51.ADX0034BP	Starter with by-pass for standard duty 17...34A - 208...500VAC
51.ADX0048BP	Starter with by-pass for standard duty 24...48A - 208...500VAC
51.ADX0058BP	Starter with by-pass for standard duty 29...58A - 208...500VAC
51.ADX0068BP	Starter with by-pass for standard duty 34...68A - 208...500VAC
51.ADX0082BP	Starter with by-pass for standard duty 41...82A - 208...500VAC
51.ADX0092BP	Starter with by-pass for standard duty 46...92A - 208...500VAC
51.ADX0114BP	Starter with by-pass for standard duty 57...114A - 208...500VAC
51.ADX0126BP	Starter with by-pass for standard duty 63...126A - 208...500VAC
51.ADX0150BP	Starter with by-pass for standard duty 75...150A - 208...500VAC
51.ADX0196BP	Starter with by-pass for standard duty 98...196A - 208...500VAC
51.ADX0231BP	Starter with by-pass for standard duty 115...231A - 208...500VAC
51.ADX0017B	Starter with by-pass for severe duty 8.5...17A - 208...500VAC
51.ADX0030B	Starter with by-pass for severe duty 15...30A - 208...500VAC
51.ADX0045B	Starter with by-pass for severe duty 22.5...45A - 208...500VAC
51.ADX0060B	Starter with by-pass for severe duty 30...60A - 208...500VAC
51.ADX0075B	Starter with by-pass for severe duty 37.5...75A - 208...500VAC
51.ADX0085B	Starter with by-pass for severe duty 42.5...85A - 208...500VAC
51.ADX0110B	Starter with by-pass for severe duty 55...110A - 208...500VAC
51.ADX0125B	Starter with by-pass for severe duty 62.5...125A - 208...500VAC
51.ADX0142B	Starter with by-pass for severe duty 71.5...142A - 208...500VAC
51.ADX0190B	Starter with by-pass for severe duty 95...190A - 208...500VAC
51.ADX0245B	Starter with by-pass for severe duty 122.5...245A - 208...500VAC
51.ADX0310	Starter predisposed for external by-pass for severe duty 155...310A - 208...415VAC (1)
51.ADX0365	Starter predisposed for external by-pass for severe duty 182.5...365A - 208...415VAC (1)
51.ADX0470	Starter predisposed for external by-pass for severe duty 235...470A - 208...415VAC (1)
51.ADX0568	Starter predisposed for external by-pass for severe duty 284...568A - 208...415VAC (1)
51.ADX0640	Starter predisposed for external by-pass for severe duty 320...640A - 208...415VAC (1)
51.ADX0820	Starter predisposed for external by-pass for severe duty 410...820A - 208...415VAC (1)
51.ADX1200	Starter predisposed for external by-pass for severe duty 600...1200A - 208...415VAC (1)
(1)	Higher voltages on request.

Remote control		
Order code	Description	Wt [kg]
51ADXS	PC-ADX remote control software on CD-Rom, complete with connecting cables: 51C2, 51C5, 51C7 and 51C3 for communications via RS232, Analog modem or GSM modem	0.550
51C2	PC ↔ ADX connecting cable, 1.8 meters long	0.090
51C5	ADX ↔ Analog modem (1) connection cable, 1.8 meters long	0.111
***	PC ↔ Analog modem (1) connection cable	--
51C7	ADX ↔ GSM modem (1) connection cable, 1.8 meters long	0.101
51C3	PC ↔ GSM modem (1) connection cable, 1.8 meters long	0.210
4PX1	RS232/RS485 opto-isolated converter drive 220...240VAC supply (predisposed for 110...120VAC supply) (2)	0.600
51C4	PC- ↔ RS232/RS485 converter drive connection cable, 1.8 meters long	0.147
51C6	ADX ↔ RS232/RS485 converter drive connection cable, 1.8 meters long	0.102
51ADXTAST	Remote keypad 96x96mm 2 line 16 character, backlit LCD, 208...240VAC supply and 3 meter long connection cable	0.350
51C8	ADX ↔ remote keypad connection cable, 3 meters long	0.081
(1)	For the choice of a modem, consult our website „ www.lovatoelectric.com/bibli2_gb.htm“ Remote control for LOVATO devices“	
(2)	RS232/RS485 opto-isolated converter drive, 38,400 Baud-rate max, automatic or manual TRANSMIT line supervision, 220...240VAC ±10% supply (possible 110...120VAC on request).	
***	Use the connecting cable supplied with the modem.	