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**GB** SOFT STARTER

Instructions manual

**ADXN...**



**WARNING!**

- Read the manual carefully before installation and use.
- These devices must be installed by qualified personnel, in compliance with current plant-engineering regulations, in order to avoid damage to persons or property.
- Before any maintenance operation on the device, switch off power supply from measuring and supply inputs.
- The manufacturer assumes no responsibility for electrical safety in the event of improper use of the device.
- The products described in this document are subject to updates or modifications at any time. Data and descriptions in the catalogue therefore do not have any contractual value.
- The building's electrical system must incorporate a switch or circuit breaker. It must be installed close to the equipment and within easy reach of the operator. It must be marked as the disconnecting device of the equipment: IEC/EN/BS 61010-1 § 6.11.3.1.
- Clean the instrument with a soft cloth. Do not use abrasives, liquid detergents or solvents.

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1. DESCRIPTION

The soft starters ADXN series are the ideal solution for those who need a simple, compact and fast to configure product for the gradual control of the starting and stopping of the motors. Their versatility makes them suitable for several applications such as the control of pumps, fans, conveyor belts, compressors and they are available with rated currents from 6 to 45A.

The soft starters ADXN series are available in three versions:

- **Basic version ADXNB:** ideal solution for those who need a soft starter with basic functions and extremely simple to configure, with the only purpose to control the gradual starting and the stopping of the motor. The configuration requires the settings of only 3 parameters (starting voltage, acceleration ramp and deceleration ramp) adjusted with 3 potentiometers present on the front of the soft starter.
- **NFC version ADXNF:** version provided with NFC (Near Field Communication) connectivity for the programming via smartphone and LOVATO NFC App. The default settings make it ready to use for the control of scroll compressors, typically used in conditioning systems, refrigerators and heating pumps without need for any programming. Thanks to the NFC antenna integrated on front it is however possible to modify the parameters of the soft starter via smartphone for the control of loads different from compressors, like pumps, fans, conveyors, etc., solution which makes ADXNF extremely flexible for any kind of application. The setting of parameters in digital format guarantees accuracy and repeatability, with possibility to save the programming on the smartphone to be immediately transferred on others ADXNF of the same model. It is also possible to configure a password for the lock of the settings to protect the soft starter against tampering of the parameters by unauthorized personnel.
- **Advanced version ADXNP:** version which provides the current thermal overload protection of the motor, obtained thanks to the presence of integrated current transformers, which allow the motor thermal overload protection and the management of starting ramps with current limiting, which are automatically adapted to follow the load variations. The soft starter ADXNP can also be equipped with an optional RS485 communication module (CX04) to be integrated in a remote control and supervision system. It is provided with both potentiometers on front, for the setting of the basic parameters (starting voltage, acceleration ramp and deceleration ramp), and NFC connectivity for the programming of the advanced parameters through the LOVATO NFC App, such as the motor rated current, the tripping thermal class, password, protection thresholds and tripping delays, communication parameters, the function of the relay outputs and alarm properties. Through the built-in optical port on front it is also possible to connect the optional communication devices type USB (CX01) and Wi-Fi (CX02) for programming, data download and diagnostic from a PC or App.

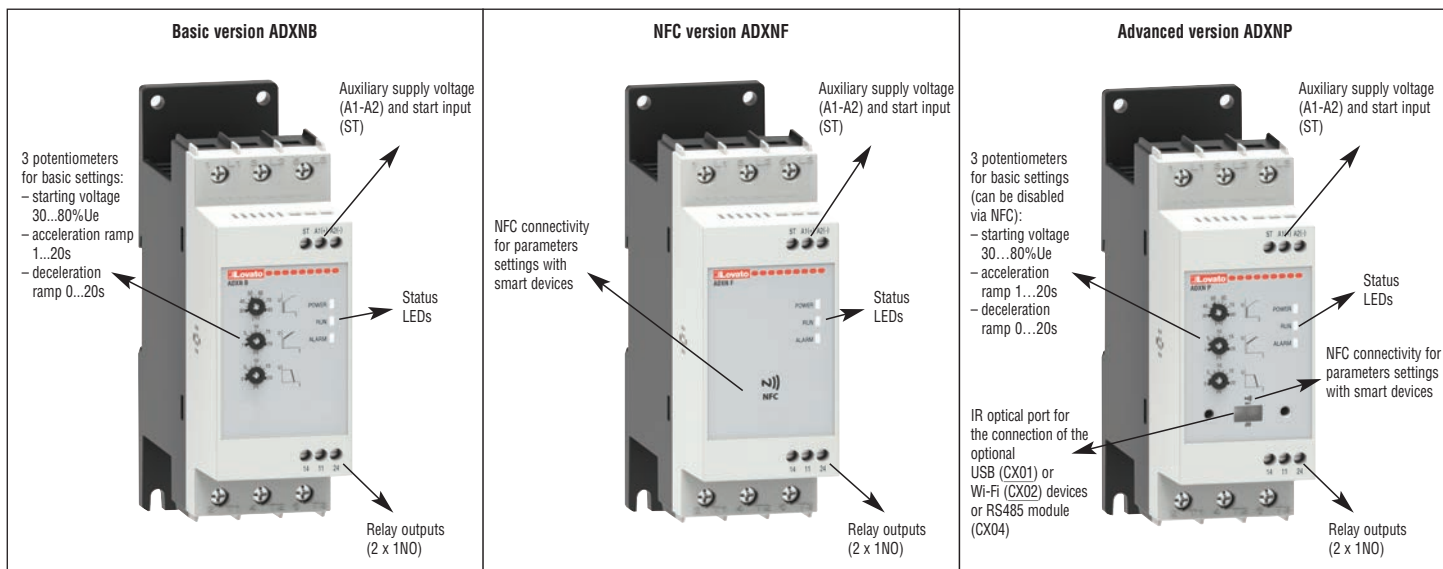
The following table shows the main differences between the functions of the three versions.

	ADXNB (basic)	ADXNF (NFC)	ADXNP (advanced)
Controlled phases	2	2	2
Built-in bypass	●	●	●
Adjustable current limit	-	-	●
Electronic motor thermal overload protection	-	-	●
Protection against phase loss	●	●	●
Protection against phase inversion	●	●	●
Protection against locked rotor	-	-	●
Protection against thyristor overtemperature	●	●	●
Protection against low load	-	-	●
Signaling of load too high (max torque)	-	-	●
Programmable alarm properties	-	●	●
Start digital input	●	●	●
Relay outputs	● (2, fixed function)	● (2, programmable)	● (2, programmable)
Potentiometers for basic parameters	●	-	● (can be overridden via NFC)
NFC connectivity for programming	-	●	●
IR optical port for configuration and monitoring with USB (CX01) and Wi-Fi (CX02) devices	-	-	●
RS485 Modbus RTU module (CX04) for remote control and supervision	-	-	optional

2. GENERAL CHARACTERISTICS

- 2-phase controlled soft starter
- built-in bypass relay
- rated soft starter current Ie: 6...45A
- rated mains input voltage: 208...600VAC
- rated mains frequency: 50/60Hz auto-configuring
- auxiliary supply voltage Us: 24VAC/DC (ADXN...24 version), 100...240VAC (ADXN... version)
- voltage ramp starting for versions ADXNB and ADXNF
- voltage ramp starting with current limitation for advanced version ADXNP
- free wheel or controlled stop with deceleration ramp
- programming with potentiometers on front (for versions ADXNB and ADXNP for basic parameters): starting voltage, acceleration ramp and deceleration ramp
- programming with smartphone with NFC connectivity (versions ADXNF and ADXNP) and LOVATO NFC App, available for iOS and Android smart devices, freely downloadable from Google Play Store and App Store
- 1 digital input for motor start command
- 2 relay outputs with normally open contact (NO), programmable on ADXNF and ADXNP versions, with fixed function on ADXNB version
- 3 status LEDs: POWER = presence of auxiliary power supply, RUN = signaling of ramp in progress or full voltage (TOR, Top Of Ramp), ALARM = active alarm, with identification of the type of alarm in progress by the number of the flashes of the LED
- optical port on front (only for advanced version ADXNP) for the connection of the optional USB (CX01) and Wi-Fi (CX02) devices for programming, data download and diagnostic from PC with Xpress software and smartphone or tablet with LOVATO SAM1 App, freely downloadable from Google Play Store and App Store
- optional RS485 port with CX04 module (only for advanced version ADXNP), Modbus-RTU protocol, for supervision, command and monitoring
- integrated soft starter thermal protection
- integrated electronic motor thermal overload protection with programmable thermal protection class (only for advanced version ADXNP)
- operating temperature: -20...+40°C (up to 60°C with soft starter current derating)
- storage temperature: -30...+80°C
- optional fan (built-in on sizes 38 and 45A) for the increase of the number of operations per hour
- optional rigid connection for soft starter from 6 to 38 A for the direct mounting to motor protection circuit breaker type SM1R
- screw fixing or mounting on 35mm DIN rail (IEC/EN/BS 60715)
- IP20 protection degree.

## 3. FRONTAL LAYOUT



## 4. STATUS LED

**POWER LED** (green) – presence of the auxiliary power supply (terminals A1-A2).

**RUN LED** (green) – flashing: ramp in progress. Steady on: full voltage (Top Of Ramp).

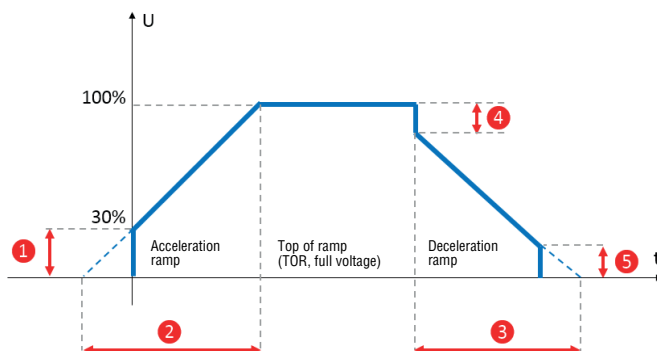
**ALARM LED** (red) – active alarm. The type of alarm in progress is identified by the number of the flashes of the LED. For more information see the chapter 10 ALARMS.

## 5. STARTING AND STOPPING RAMPS MANAGEMENT

## 5.1 PARAMETERS FOR THE MANAGEMENT OF THE STARTING AND STOPPING RAMPS

The soft starters ADXN work with voltage ramps, which consist of generate a ramp by supplying voltage from the starting value (which can be set from the 30% to the 80% of the line voltage  $U_e$ ) up to the 100% of the line voltage in the acceleration time set with progressive growth. The closure of the integrated bypass relay occurs at the reaching of the full voltage. The same behavior applies for the deceleration ramp (if enabled).

The following chart shows the trend of the output voltage of the soft starter during the motor starting and stopping, with the indication of the relative setup parameters.



Ref.	Description	Setup method (potentiometer and/or NFC)		
		ADXNB (basic)	ADXNF (NFC)	ADXNP (advanced)
❶	Starting voltage [%U]	30-80% $U_e$	P01.01	30-80% $U_e$ P01.01
❷	Acceleration ramp time [s]	1-20s	P01.02	1-20s P01.02
❸	Deceleration ramp time [s]	0-20s	P01.03	0-20s P01.03
❹	Step down voltage [%U]	Fixed 20%	P01.04	P01.04
❺	End of deceleration step [%U]	Fixed 20%	P01.05	P01.05

❶ **Starting voltage:** initial acceleration voltage step, delivered immediately after the start command, adjustable between the 30 and the 80% of the line voltage, after which the voltage will increase linearly up to the maximum value within the set acceleration ramp time ❷.

The starting voltage must be set in such a way that the motor starts running slowly immediately after the start command. If the motor doesn't start, increase the voltage step until you get the start. If the motor starts to rotate but it doesn't reach its maximum speed at the end of the acceleration ramp time, it is necessary to increase the acceleration ramp time ❷.

❷ **Acceleration ramp time:** time that defines the slope of the acceleration ramp, adjustable from 1 to 20 seconds according to the application requirements.

Note. The actual acceleration time taken by the soft starter to reach the full voltage is dependent also by the starting voltage set ❶: the higher the starting voltage, the shorter the effective ramp time will be, because the voltage already starts from a high value.

Specifically, the ramp time is reduced by a percentage factor equal to the starting voltage ❶: for instance, setting an acceleration ramp time ❷ of 10 seconds and a starting voltage ❶ of 30%, the actual acceleration time will be 10 seconds minus the contribution of the starting voltage (in this example equal to the 30% of the set acceleration ramp time, so 3 seconds), therefore in total about 7 seconds.

❸ **Deceleration ramp time:** time required from the stop command to gradually decrease the motor voltage from 100% to 0. The time is adjustable from 0 to 20 seconds. In case of setting of 0 seconds, the deceleration ramp is disabled and the motor stops by inertia with free wheel.

Note. The actual deceleration time may vary according to the characteristics of the load and the value of the end of deceleration step ❺ (fixed to 20% for the version ADXNB, adjustable on the versions ADXNF and ADXNP with parameter P01.05).

Specifically, the deceleration ramp time is reduced by a percentage factor equal to the end of deceleration step ❺. For instance, setting a deceleration ramp time ❸ of 10 seconds and an end of deceleration step ❺ of 20%, the actual deceleration time will be 10 seconds minus the contribution of the end of deceleration step (in this example equal to the 20% of the set deceleration ramp time, so 2 seconds), therefore in total about 8 seconds.

❹ **Step down voltage:** percentage of voltage that is instantly removed as soon as the stop command is given, immediately before the starting of the deceleration ramp. It is used for some specific applications, such as the control of some types of pumps, for which it introduces benefits during the pump stop.

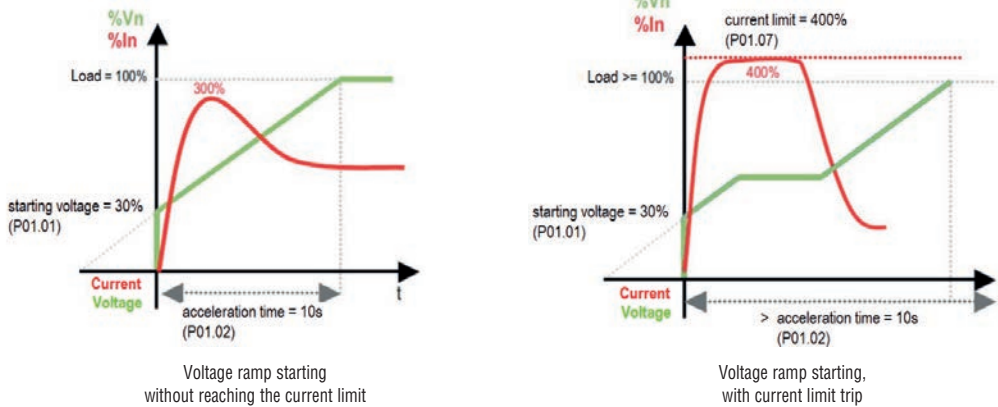
❺ **End of deceleration step:** step used for the regulation of the final voltage. At the stop command, the soft starter performs the deceleration ramp and once the voltage reaches the set value ❺ it goes to zero instantly and the motor is powered off. The purpose of this voltage step is to stop the motor when it is in a condition where there is no rotation at all, avoiding generating noise and accumulating heat without producing any useful movement.

For details about the setting range of the parameters see the chapters 8 and 9.

5.2 MANAGEMENT OF STARTING RAMPS WITH CURRENT LIMIT (ONLY FOR ADXNP)

The advanced version ADXNP integrates current transformers, which allow to limit the current during the starting phase below a programmable threshold (P01.07) and to adapt the acceleration ramp according to the load conditions.

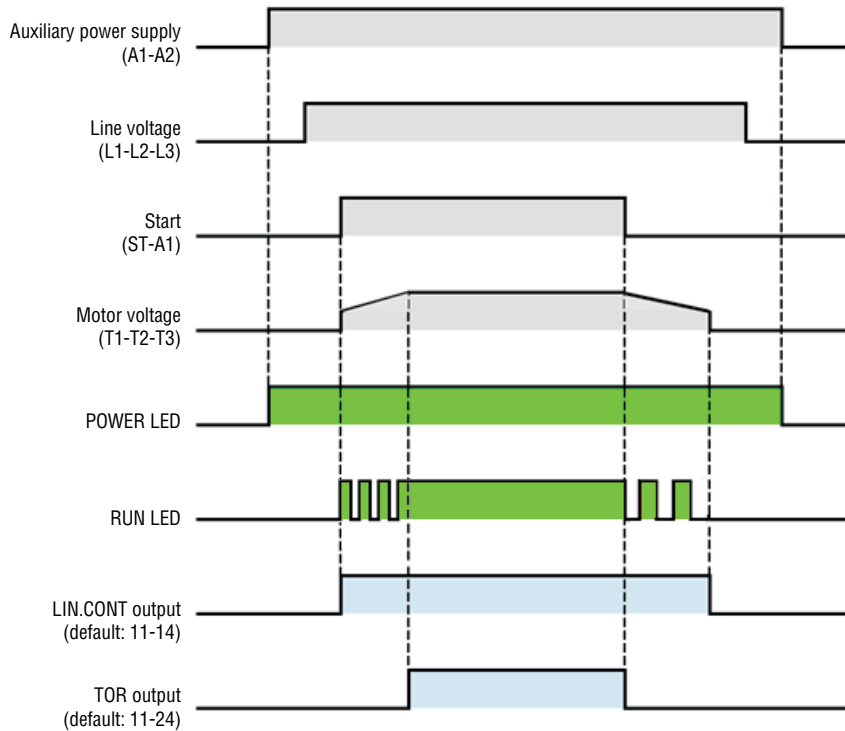
If the current delivered by the highest of the three phases reaches or exceeds the set limit, the ADXNP reduces the voltage applied to motor to remain below the maximum limit setting (P01.07). This behavior has priority over the voltage ramp, and thus momentarily flattens it. Obviously, reducing the current also reduces the motor's torque delivery: if the current limit is set too low, the torque delivery may be insufficient to overcome the resistant load and start the machine. It's about finding the right compromise when setting this parameter. If this situation occurs, it will trip the protection for starting time too long or the motor thermal overload protection.



Note. The current limit also depends on the starting voltage set and the load conditions at the start-up. For example, by setting a very low current limit (e.g. under the 300%) and an high starting voltage, the inrush current might increase above the limit set on the parameter P01.07 (due to the fact that the ramp starts from a high voltage value and at the same time the load requires an high torque), condition necessary to overcome the resistant torque of the load, allowing the motor to start and preventing it from stalling.

6. FUNCTIONAL DIAGRAM

Here below it is represented the functional diagram of the soft starters ADXN.



## 7. PROTECTIONS

All the soft starters ADXN integrate the protection against overtemperature, measured by an integrated temperature sensor.

The versions provided with NFC connectivity (ADXNF and ADXNP) provides additional functions dedicated to the protection of the motor and the soft starter itself, some of which are programmable.

The following table summarizes the protections available in the different versions and their associated parameters and alarms.

For information about the configuration of the protection thresholds and tripping delays of the soft starters type ADXNF and ADXNP please refer to the menu M03 PROTECTIONS.

PROTECTION	MOTOR (MOT) / SOFT STARTER (STA)	PARAMETERS	ALARM	ADXNB	ADXNF	ADXNP
Line voltage not present	MOT	-	A01	●	●	●
Phase loss	MOT	-	A02	●	●	●
Wrong phase sequence	MOT	P03.01	A03	● (*)	●	●
Frequency out of limits	MOT	-	A04	●	●	●
Voltage out of limits	MOT	P03.02-P03.03-P03.04-P03.05	A05	-	●	●
Soft starter thermal protection (overtemperature)	STA	-	A06	●	●	●
Temperature sensor fault	STA	-	A07	●	●	●
Bypass relay fault	STA	-	A08	●	●	●
System error	STA	-	A09	●	●	●
Motor current thermal overload protection	MOT	P03.09-P03.10-P03.11-P03.12	A10	-	-	●
Overcurrent	MOT-STA	-	A11	-	-	●
Locked rotor	MOT-STA	-	A12	-	-	●
Load too low	MOT	P03.13-P03.14	A13	-	-	●
Current asymmetry	MOT	P03.18-P03.19	A14	-	-	●
Starting time too long	MOT	P03.17	A15	-	-	●
Phase shorted	STA	-	A16	-	-	●

For information about the meaning and causes of the alarms see the chapter 10 ALARMS.

(\*) To enable the phase sequence control (disabled as default) on the basic version ADXNB see the chapter 7.1.

### 7.1 ENABLING THE PHASE SEQUENCE CONTROL (ADXNB)

To enable phase sequence control on basic soft starters type ADXNB follow the procedure below.

- **Enabling of the phase sequence control:** as soon as the soft starter is powered up, when the LEDs have stopped flashing, turn quickly the central potentiometer (acceleration ramp) to the maximum value of its scale (20), then turn it to the minimum value (1) and then again to the maximum value (20) and then to minimum value (1).

After this operation, the activation of the phase sequence control is signaled by a short flash of the green LED RUN (~1 second). Now set the desired acceleration ramp time with the dedicated potentiometer 'acceleration ramp'.

- **Disabling of the phase sequence control:** repeat the same procedure followed for the activation of the phase sequence control: as soon as the soft starter is powered up, when the LEDs have stopped flashing, turn quickly the central potentiometer (acceleration ramp) to the maximum value of its scale (20), then turn it to the minimum value (1) and then again to the maximum value (20) and then to minimum value (1). After this operation, the de-activation of the phase sequence control is signaled by a short flash of the red LED ALARM (~1 second). Now set the desired acceleration ramp time with the dedicated potentiometer 'acceleration ramp'.

### 7.2 MOTOR THERMAL OVERLOAD PROTECTION

The advanced soft starter type ADXNP is provided with electronic current thermal overload protection of the motor, programmable with the menu M03 PROTECTIONS.

- The electronic thermal overload protection (if enabled with parameter P03.09=ON) trips when the motor thermal status overcomes the limit of the set thermal overload class, with consequent trip of the alarm A10 Motor thermal overload protection.

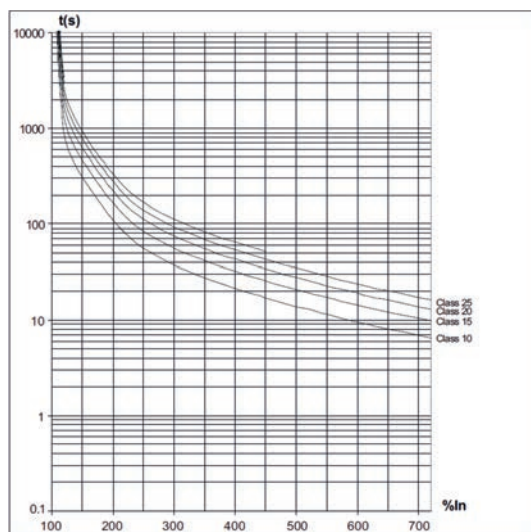
- The tripping delays may vary according to the overload current and are defined in the charts illustrated below.

- The curves for the various charts refer to the thermal protection class selected with parameters P03.10 (starting thermal protection class) and P03.11 (running thermal protection class), configurable between the class 10, 15, 20 and 25.

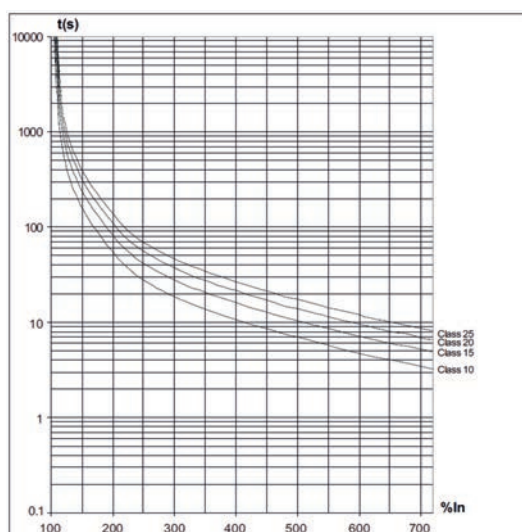
- The cold trip curves indicate the trip delay starting from thermal status 0%, while the hot trip curves start from thermal status 100% (motor running stably at rated current and voltage).

- With the motor stopped, the motor thermal status will tend to zero in a set time which depends on the configured thermal protection class.

- The motor thermal overload protection alarm can be reset when the motor thermal status falls to or below the value of P03.12 (motor thermal overload protection reset), which has a default value of 120%. This value can be modified for specific needs, without changing the trip delay in any way.



Cold trip curves



Hot trip curves

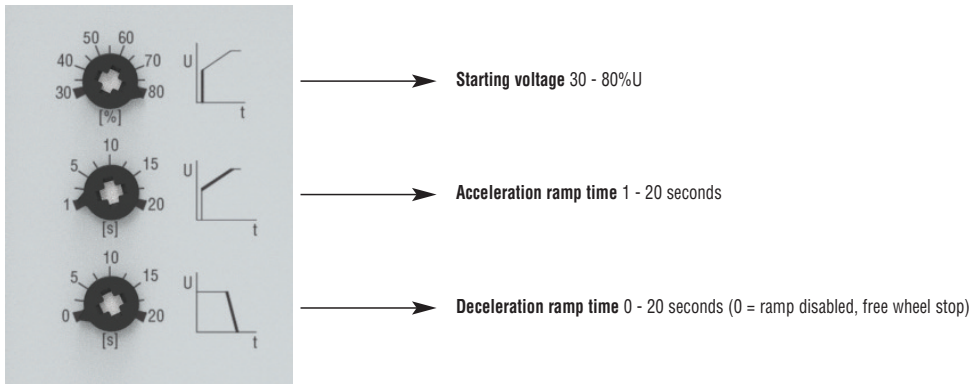
### 7.3 SOFT STARTER THERMAL PROTECTION

The soft starter thermal protection is realized by monitoring the temperature of the internal thyristors with a built-in analog sensor. At the reaching of the maximum temperature there is the trip of the alarm A06 Soft starter thermal protection. The alarm resets automatically when the soft starter returns to an acceptable temperature.

## 8 PARAMETERS SETUP

## 8.1 SETTING OF PARAMETERS WITH POTENTIOMETERS (ADXNB, ADXNP)

The soft starters type ADXNB (basic version) and ADXNP (advanced version) have on the front three potentiometers for the setting of the basic parameters:



Note. If preferable, on the advanced version ADXNP the three potentiometers can be individually disabled via NFC, to avoid the tampering of the settings. In this case, the setting of these three parameters is done via NFC connectivity.

For information regarding the meaning of the parameters see the chapter 5.1.

## 8.2 SETTING OF PARAMETERS WITH NFC (ADXNF, ADXNP)

The soft starters type ADXNF (NFC version) and ADXNP (advanced version) are provided with NFC (Near Field Communication) connectivity for the setup of parameters via smartphone or tablet with LOVATO NFC App. This innovative technology allows the configuration of the soft starter in a simple and intuitive way, does not require any connection cable and it is able to operate with the device powered off. The LOVATO NFC App is available for Android and iOS smart devices and it is freely downloadable from Google Play Store and App Store.

Simply placing the smart device against the ADXN front panel, it is possible to read or write the parameters.

Conditions for the operation:

- The smart device must be provided with NFC connectivity, which must be activated, and the smart device must be unlocked (no password active)
- If on the ADXN it is set a password (see menu M02 PASSWORD), it must be known, otherwise the access will not be possible (the App requires to type the password)
- Turn off the power of the ADXN during the setup via NFC

Steps to follow for the configuration:

- 1) Enable the NFC connectivity on the smart device from the settings menu of Android/iOS. Note: the graphical interface may be different according to the various models of smart devices.
- 2) Download the LOVATO NFC App from Google Play Store (for Android devices) or App Store (for iOS devices).

QR code for the download of the LOVATO NFC App:



- 3) Open the App and install the drivers by pressing the button DOWNLOAD DRIVERS and wait until the end of the download. Note. This operation is necessary only at the first installation or to update the drivers in case of new version available.

Download drivers

- 4) For the iOS devices, open the LOVATO NFC App and press on the button with the NFC logo.



NFC

For the Android smart devices go directly to the next step.

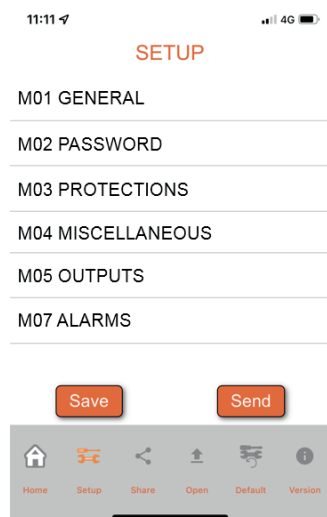
- 5) Place the smart device on the front of the ADXN in correspondence of the NFC logo as shown in the picture below. Note. The position might be different according to the location of the NFC antenna on the smart device (typically located at the center or on the top of the smartphone). Holding the smartphone in this position for few seconds will be heard a beep.



- 6) At the device recognition, the Home Page of the LOVATO NFC App shows the information about the detected device.



- 7) Press the button to access to the ADXN parameters menu.



For details about the configuration of the parameters and functionalities please refer to the chapter 9 PARAMETERS TABLE.

- 8) Once made the desired settings, press the button and place again the smart device against the front panel of the ADXN. The parameters will be transferred and activated after an automatic reboot of the soft starter.



### 8.3 SETTING OF PARAMETERS WITH IR OPTICAL PORT (ADXNP)

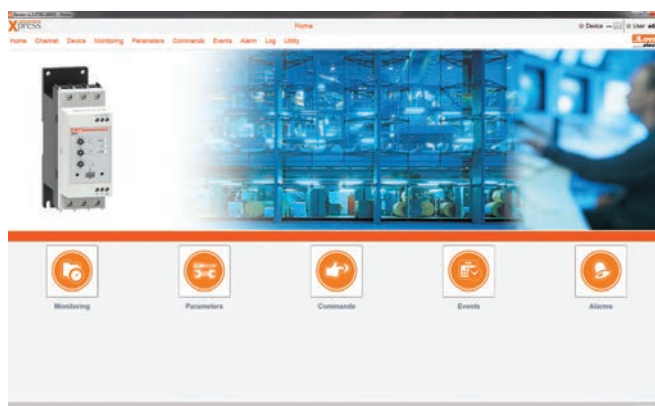
Alternatively to the programming with potentiometers or NFC connectivity, the advanced soft starters type ADXNP integrates a IR optical port for the connection of the USB (CX01) or Wi-Fi (CX02) devices, with which the soft starter can be programmed from a PC with Xpress software or via the LOVATO SAM1 App.

Simply approach a CX01/CX02 device to the front port of the ADXNP and insert the plugs in the specific holds to obtain the mutual recognition of the devices as indicated by the green LINK LED on the connection device CX01/CX02.

Note. The IR optical port can be used also for the connection of the optional RS485 communication module CX04. For more information see the chapter 12 OPTIONAL RS485 COMMUNICATION (FOR ADXNP ONLY).



– Both devices CX01 and CX02 can be used for the connection of the ADXNP soft starter to the Xpress remote control and configuration software, freely downloadable from the website [www.LovatoElectric.com](http://www.LovatoElectric.com)



With the Xpress software is possible to:

- read and modify the parameters of the soft starter, with the possibility to save a copy on the PC or to import the parameter file saved on the PC and download it in the soft starter ADXNP
- monitor the electric measures of the soft starter in pre-configured graphic widgets
- view live charts to monitor the trends of the electric measures in real time.

– With the Wi-Fi device CX02 it is also possible to connect the soft starter ADXNP to the LOVATO SAM1 App, freely downloadable from Google Play Store and App Store, where you can set the parameters and monitor the electric measures of the soft starter from a smartphone or tablet

Note. CX02 used on ADXNP soft starter can be used only for a Wi-Fi connection for parameters setup and measures monitoring, it doesn't allow the saving of a copy of the parameters inside its internal memory and the clone function.

QR code per the download of the LOVATO SAM1 App:



### 8.4 SUGGESTED SETTINGS FOR TYPICAL APPLICATIONS

In the following table are listed the suggested settings of the basic parameters (starting voltage, acceleration ramp and deceleration ramp) of some typical applications.

Note. The values shown are purely indicative, it is recommended to test the soft starter on the field with the specific application and carry out the set-up with the motor connected, first adjusting the starting voltage followed by the acceleration ramp time and finally by the deceleration ramp time, if required.

Type of application	Starting voltage	Acceleration ramp time	Deceleration ramp time
	[%U]	[s]	[s]
Pump	40	10	10
Hydraulic pump	40	2	0
Piston compressor	40	3	0
Screw compressor	50	10	0
Scroll compressor	40	1	0
Low inertia fan	40	10	0
Higher inertia fan	40	15-20	0
Centrifugal fan	40	5	0
Conveyor belt	50	5-10	5
Agitator	40	20	0

## 9 PARAMETERS TABLE

## 9.1 PARAMETERS MENU

The parameters of the soft starters type ADXNF and ADXNP, provided with NFC connectivity, are divided in the following menu, which can be read with the LOVATO NFC App or Xpress software (only for ADXNP, which integrates the optical port on front).

Note. Some menu/parameters may vary between the versions ADXNF and ADXNP. Refer to the respective parameter tables described in the following chapters.

CODE	MENU	DESCRIPTION	ADXNF	ADXNP
M01	GENERAL	Basic parameters for the starting and stopping of the motor	●	●
M02	PASSWORD	Setting of a password for the protection of the parameters	●	●
M03	PROTECTIONS	Configuration of the protection thresholds for the motor and the soft starter	●	●
M04	MISCELLANEOUS	Additional functions	●	●
M05	OUTPUTS	Setting of the function of the relay outputs	●	●
M06	COMMUNICATION	Setting of the communication parameters (optional RS485 module CX04)	-	●
M07	ALARMS	Configuration of the alarm properties	●	●

## 9.2 ADXNF (NFC VERSION) PARAMETERS TABLE

M01 – GENERAL		UoM	Default	Range
P01.01	Starting voltage	%	40	30...80
P01.02	Acceleration ramp time	s	1.0	1.0...20.0
P01.03	Deceleration ramp time	s	0.0	0.0...20.0
P01.04	Step down voltage	%	20	0...50
P01.05	End of deceleration step	%	20	0...80

**P01.01** – Initial acceleration voltage step, delivered immediately after the start command. It must be set in such a way that the motor starts running slowly immediately after the start command.

**P01.02** – Time taken by the soft starter to reach the full voltage. It defines the slope of the acceleration ramp.

**P01.03** – Time required from the stop command to gradually decrease the motor voltage from 100% to 0 (in correspondence of the end of deceleration step). In case of setting of 0 seconds, the motor stops by inertia with free wheel.

**P01.04** – Percentage of voltage that is instantly removed as soon as the stop command is given, immediately before the starting of the deceleration ramp.

**P01.05** – Step used for the regulation of the final voltage. At the stop command, the soft starter performs the deceleration ramp (if enabled) and once the voltage reaches the set value P01.05 it goes to zero instantly and the motor is powered off.

Note. For more details about the settings of the above parameters see the chapter 5. STARTING AND STOPPING RAMPS MANAGEMENT.

M02 – PASSWORD		UoM	Default	Range
P02.01	Enable password		OFF	OFF-ON
P02.02	Advanced level password		2000	0000...9999

**P02.01** – If set to OFF, the password management is deactivated and the access to the settings menu is free.

**P02.02** – With P02.01 active (ON), value to be specified to allow the access to the parameters.

M03 – PROTECTIONS		UoM	Default	Range
P03.01	Phase sequence control		OFF	OFF / L1-L2-L3 / L3-L2-L1
P03.02	Minimum voltage threshold	V	OFF	OFF / 170...760
P03.03	Minimum voltage trip delay	s	5	0...600
P03.04	Maximum voltage threshold	V	OFF	170...760 / OFF
P03.05	Maximum voltage trip delay	s	5	0...600
P03.06	Alarm reset mode		STOP	STOP / START
P03.07	Number of automatic alarm reset attempts		OFF	OFF / 1...6
P03.08	Automatic alarm reset interval	min	1	1...30

**P03.01** – If different from OFF, it enables the control of the power phase sequence, i.e. the direction of rotation of the motor. Setting L1-L2-L3 corresponds to forwards rotation, L3-L2-L1 to reverse. If the soft starter detects a phase sequence different than the set one, it generates the alarm A03 Wrong phase sequence.

**P03.02** – **P03.03** – A voltage lower than P03.02 for a time longer than the time set on P03.03 generates the alarm A05 Line voltage out of limits.

**P03.04** – **P03.05** – A voltage higher than P03.04 for a time longer than the time set on P03.05 generates the alarm A05 Line voltage out of limits.

**P03.06** – Defines the source of the alarms reset command. STOP = the alarms are reset when the ST input opens. START = the alarms are reset when the ST input closes.

**P03.07** – This function is used in unsupervised applications with 2-wire motor starting command. If the motor is stopped by an alarm with the property 'automatic reset' enabled, after a time defined in P03.08 the alarm resets and hence the motor starts again. If after the reset the motor does not restart, several motor reset and restarting attempts are made as set in P03.07.

**P03.08** – Delay between successive automatic reset attempts.

M04 – MISCELLANEOUS		UoM	Default	Range
P04.01	ST input closing delay	s	0.0	0.0...600.0
P04.02	ST input opening delay	s	0.0	0.0...600.0
P04.03	Start delay after auxiliary power off	s	0	0...900

**P04.01** – Delay on the closing of the start input contact (ST).

**P04.02** – Delay on the opening of the start input contact (ST).

**P04.03** – It defines a delay of the start following a power down of the auxiliary voltage: when the auxiliary voltage comes back, if the start input contact (ST) is already closed, the soft starter doesn't restart the motor immediately but only after the time specified in the parameter P04.03.

M05 – OUTPUTS (OUTn, n=1...2)		UoM	Default	Range
P05.n.01	Output function		n=1 Lin. Cont n= 2 TOR	OFF Line contactor TOR (Top Of Ramp) Global alarm Alarm Axx
P05.n.02	Channel nr (x)		1	1...99
P05.n.03	Normal status		NOR	NOR / REV

Note. This menu is divided in 2 sections, referred to digital outputs OUT1 (terminals 11-14) and OUT2 (terminals 11-24).

**P05.n.01** – Select the function of the output (see Programmable outputs function table).

**P05.n.02** – Index possibly associated to the function programmed under the previous parameter. Example: if the function of the output is set to the Alarm Axx function and this output must be energised when alarm A07 occurs, then P05.n.02 must be set to value 7.

**P05.n.03** – This parameter sets the output status when the associated function is not active: NOR (normal) = de-energised output, REV (reverse) = energised output.

M07 – ALARMS (An, n=1...9)		UoM	Default	Range
P07.n	Alarm An (see Alarms table)			

**P07.n** – Configuration of the properties of the alarm number n, where n=1,...9. For details see the chapter 10 ALARMS.  
Example – P07.03 allows to configure the properties of the alarm A03 Wrong phase sequence.

### 9.3 ADXNP PARAMETERS TABLE (ADVANCED VERSION)

M01 – GENERAL		UoM	Default	Range
P01.01	Starting voltage	%	POT	POT / 30...80
P01.02	Acceleration ramp time	s	POT	POT / 1.0...20.0
P01.03	Deceleration ramp time	s	POT	POT / 0.0...20.0
P01.04	Step down voltage	%	20	0...50
P01.05	End of deceleration step	%	20	0...80
P01.06	Rated motor current In	A	e.g. 45 (100%Ie)	e.g. 22,5...45 (50...100%Ie)
P01.07	Starting current limit	%In	300	200...500

**P01.01** – Initial acceleration voltage step, delivered immediately after the start command. It must be set in such a way that the motor starts running slowly immediately after the start command. If set to POT, the value is set via the dedicated potentiometer on the front.

**P01.02** – Time taken by the soft starter to reach the full voltage. It defines the slope of the acceleration ramp. If set to POT, the value is set via the dedicated potentiometer on the front.

**P01.03** – Time required from the stop command to gradually decrease the motor voltage from 100% to 0 (in correspondence of the end of deceleration step). If set to POT, the value is set via the dedicated potentiometer on the front. In case of setting of 0 seconds, the motor stops by inertia with free wheel.

**P01.04** – Percentage of voltage that is instantly removed as soon as the stop command is given, immediately before the starting of the deceleration ramp.

**P01.05** – Step used for the regulation of the final voltage. At the stop command, the soft starter performs the deceleration ramp (if enabled) and once the voltage reaches the set value it goes to zero instantly and the motor is powered off.

**P01.06** – Rated current of the motor (see the motor nameplate). The setting range depends on the size of the ADXNP soft starter, but for all the ADXNP models it can be adjusted between the 50% and the 100% of the soft starter rated current Ie. For instance, for a soft starter with rated current Ie=45 A, the rated motor current In can be set between 22.5 A and 45 A.

**P01.07** – Maximum current limit delivery during starting, expressed as percentage of the rated motor current In. Given that the currents of the three phases are not balanced during the starting, this limit considers the highest of the three phases, i.e. L2 (phase directly connected to the motor).

Note. For more details about the settings of the above parameters see the chapter 5. STARTING AND STOPPING RAMPS MANAGEMENT.

M02 – PASSWORD		UoM	Default	Range
P02.01	Enable password		OFF	OFF-ON
P02.02	Advanced level password		2000	0000...9999

**P02.01** – If set to OFF, the password management is deactivated and the access to the settings menu is free.

**P02.02** – With P02.01 active (ON), value to be specified to allow the access to the parameters.

M03 – PROTECTIONS		UoM	Default	Range
P03.01	Phase sequence control		OFF	OFF / L1-L2-L3 / L3-L2-L1
P03.02	Minimum voltage threshold	V	OFF	OFF / 170...760
P03.03	Minimum voltage trip delay	s	5	0...600
P03.04	Maximum voltage threshold	V	OFF	170...760 / OFF
P03.05	Maximum voltage trip delay	s	5	0...600
P03.06	Alarm reset mode		STOP	STOP / START
P03.07	Number of automatic alarm reset attempts		OFF	OFF / 1...6
P03.08	Automatic alarm reset interval	min	1	1...30
P03.09	Motor thermal overload protection enable		ON	OFF-ON
P03.10	Starting motor thermal overload protection class		10	10-15-20-25
P03.11	Running motor thermal overload protection class		10	10-15-20-25
P03.12	Motor thermal overload protection reset	%	120	0...140
P03.13	Minimum torque threshold (load too low)	%Tn	OFF	OFF / 20...100
P03.14	Minimum torque trip delay	s	10	1...20
P03.15	Maximum torque threshold	%Tn	OFF	OFF / 50...200
P03.16	Maximum torque trip delay	s	3	1...20
P03.17	Maximum starting time	s	OFF	OFF / 10...100
P03.18	Current asymmetry threshold	%	OFF	OFF / 1...25
P03.19	Current asymmetry trip delay	s	5	0...600

**P03.01** – If different from OFF, it enables the control of the power phase sequence, i.e. the direction of rotation of the motor. Setting L1-L2-L3 corresponds to forwards rotation, L3-L2-L1 to reverse. If the soft starter detects a phase sequence different than the set one, it generates the alarm A03 Wrong phase sequence.

**P03.02** – **P03.03** – A voltage lower than P03.02 for a time longer than the time set on P03.03 generates the alarm A05 Line voltage out of limits.

**P03.04** – **P03.05** – A voltage higher than P03.04 for a time longer than the time set on P03.05 generates the alarm A05 Line voltage out of limits.

**P03.06** – Defines the source of the alarms reset command. STOP = the alarms are reset when the ST input opens. START = the alarms are reset when the ST input closes.

**P03.07** – This function is used in unsupervised applications with 2-wire motor starting command. If the motor is stopped by an alarm with the property 'automatic reset' enabled, after a time defined in P03.08 the alarm resets and hence the motor starts again. If after the reset the motor does not restart, several motor reset and restarting attempts are made as set in P03.07.

**P03.08** – Delay between successive automatic reset attempts.

**P03.09** – Enabling of the motor electronic thermal overload protections set with parameters P03.10 and P03.11. If this parameter is set to OFF (for example, in presence of an external thermal overload relay) both protections will be disabled.

**P03.10** – **P03.11** – Define the motor electronic thermal overload protection class, for the starting and run phases respectively. The thermal protection class is set in relation to the type of use of the motor. Class 10 is suitable to normal use, classes 15, 20 etc. for heavier duty use. If the motor has a heavy duty application, for a more effective protection you can set the starting protection class P03.10 higher than the run protection class P03.11.

**P03.12** – Determines the value of the motor thermal status beneath which the motor thermal overload protection alarm is reset.

**P03.13** – Normally used as protection against pumps dry running or to detect failure of transmission chains or belts. When the torque is lower than this setting, after the delay set in P03.14 the alarm A13 Load too low is generated. The trip delay is reset if the torque returns to a value of 10% higher than the setting.

**P03.14** – A13 Load too low alarm trip delay.

**P03.15** – If the torque detected by the soft starter overcomes the threshold set in P03.15, after the delay time P03.16 it is activated the relay output programmed with the function 'Max torque'. Note. This function doesn't cause the stop of the motor.

**P03.16** – Trip delay for the maximum torque signaling.

**P03.17** – Checks that the motor starting process does not exceed the set time, that is, that the current limitation remains active for a time too long, a symptom of a mechanical problem. A starting time longer than this setting cause the alarm A15 Starting time too long.

**P03.18** – **P03.19** – Controls the current asymmetry during full voltage running. Asymmetry greater than the setting P03.18 for a time longer than P03.19 generates the alarm A14 Current asymmetry.

M04 – MISCELLANEOUS		UoM	Default	Range
<b>P04.01</b>	ST input closing delay	s	0.0	0.0...600.0
<b>P04.02</b>	ST input opening delay	s	0.0	0.0...600.0
<b>P04.03</b>	Start delay after auxiliary power off	s	0	0...900
<b>P04.04</b>	Enable start/stop commands via Modbus		OFF	OFF-ON

**P04.01** – Delay on the closing of the start input contact (ST).

**P04.02** – Delay on the opening of the start input contact (ST).

**P04.03** – It defines a delay of the start following a power down of the auxiliary voltage: when the auxiliary voltage comes back, if the start input contact (ST) is already closed, the soft starter doesn't restart the motor immediately but only after the time specified in the parameter P04.03.

**P04.04** – Enables for the sending of motor start and stop commands via Modbus. If the soft starter ADXNP is equipped with the optional CX04 RS485 module, by setting P04.04=ON it is possible to send to the soft starter the commands for the start and stop of the motor via Modbus RTU. Once set this parameter to ON, to allows the function of the commands it is necessary that the ST input must be maintained always closed, which has a function of safety enable. In this way, in case of interruption of the communication with the Modbus RTU master, it is possible at any time to stop the motor by opening the ST input. For information about the Modbus addresses to be used for the commands see the chapter 12.1 MODBUS ADDRESS TABLE.

M05 – OUTPUTS (OUTn, n=1...2)		UoM	Default	Range
<b>P05.n.01</b>	Output function		n=1 Lin. Cont  n=2 TOR	OFF Line contactor TOR (Top Of Ramp) Global alarm Alarm Axx Max torque
<b>P05.n.02</b>	Channel nr (x)		1	1...99
<b>P05.n.03</b>	Normal status		NOR	NOR / REV

**Note.** This menu is divided in 2 sections, referred to digital outputs **OUT1 (terminals 11-14)** and **OUT2 (terminals 11-24)**.

**P05.n.01** – Select the function of the output (see Programmable output function table).

**P05.n.02** – Index possibly associated to the function programmed under the previous parameter. Example: if the function of the output is set to the Alarm Axx function and this output must be energised when alarm A07 occurs, then P05.n.02 must be set to value 7.

**P05.n.03** – This parameter sets the output status when the associated function is not active: NOR (normal) = de-energised output, REV (reverse) = energised output.

M06 – COMMUNICATION		UoM	Default	Range
<b>P06.01</b>	Serial node address		1	1...255
<b>P06.02</b>	Baudrate	bps	9600	1200 2400 4800 9600 19200 38400
<b>P06.03</b>	Data format		8 BIT - N	8 BIT - N 8 BIT - O 8 BIT - E
<b>P06.04</b>	Stop bit		1	1-2

**Note.** This menu allows the setting of the communication parameters of the optional CX04 RS485 communication module. The protocol used is the Modbus RTU.

**P06.01** – Serial address (node) of the soft starter.

**P06.02** – Communication port transmission speed.

**P06.03** – Data format: 8=8 bit data, N=no parity, O=odd parity, E=even parity.

**P06.04** – Number of stop bit.

M07 – ALARMS (An, n=1...16)		UoM	Default	Range
<b>P07.n</b>	Alarm An (see Alarms table)			

**P07.n** – Configuration of the properties of the alarm number n, where n=1,...16. For details see the chapter 10 ALARMS.

Example – P07.03 allows to configure the properties of the alarm A03 Wrong phase sequence.

10 ALARMS

- When an alarm occurs, the red ALARM LED on the front will blink for as long as an alarm is active. The number of the flashes identify the type of alarm in progress (i.e. 1 flash = alarm A01, 2 flashes = alarm A02, 3 flashes = alarm A03, and so on). The meaning of the alarm is described in the Alarm table.
  - As default, most of the protections are set to OFF. To enable them, it is necessary to set the relative parameter (see menu M03 PROTECTIONS).
  - Some alarms cause the stop of the motor, while others are just signaled but the motor continues to run.
  - The alarms reset can be configured independently as automatic or manual. In case of manual reset, the reset of the alarm must be performed by the user according to the reset mode set in P03.06.
  - In automatic mode, the reset of the alarm is performed when the alarm conditions cease, according with the settings of the menu M03 PROTECTIONS.
- The meaning of the properties that can be associated with the alarms is described below
- **enabled alarm** - Alarm enable. If not enabled, it's like it does not even exist
  - **retaining alarm** - This remains stored even if its cause was removed
  - **global alarm** - This activates the output assigned to this function
  - **stop motor** - in case of active alarm the motor is stopped
  - **deceleration** - If deceleration is programmed, stops the motor with a deceleration. If the property is not enabled, the motor stops immediately with free wheel
  - **auto reset** - The alarm can be reset automatically depending on the criteria defined in P03.07 and P03.08.

10.1 ALARMS PROPERTIES TABLE

The following table shows the alarm codes, with a description and the default properties of each one. The properties can be modified on the ADXNF version with LOVATO NFC App and on the ADXNP version with LOVATO NFC App or SAM1 App or Xpress software.

On the basic version ADXNB the alarms properties are fixed according to the following table, except for the wrong phase sequence alarm (A03) which is disabled as default and can be enabled by following the sequence described at chapter 7.1 Enabling the phase sequence control (ADXNB).

Note. The alarms from A10 to A16 are available only on the advanced version ADXNP. Refer to the table at chapter 7.PROTECTIONS to check the alarms available on each version of ADXN.

ALARM CODE	DESCRIPTION	Enabled	Retentive	Global alarm	Stop motor	Deceleration	Automatic reset
A01	NO POWER LINE	●	Ⓜ	●	● Ⓜ		Ⓜ
A02	PHASE LOSS	●	Ⓜ	●	● Ⓜ		Ⓜ
A03	WRONG PHASE SEQUENCE	●	Ⓜ	●	●		Ⓜ
A04	FREQUENCY OUT OF LIMITS	●	Ⓜ	●	● Ⓜ		Ⓜ
A05	VOLTAGE OUT OF LIMITS	●	Ⓜ	●	●		Ⓜ
A06	SOFT STARTER THERMAL PROTECTION	●		●	●	●	
A07	TEMPERATURE SENSOR FAULT	●	●	●			
A08	BYPASS RELAY FAILURE ⓘ	●	●	●	● Ⓜ		
A09	SYSTEM ERROR	●					
A10	MOTOR THERMAL OVERLOAD PROTECTION	●	●	●	●	●	
A11	OVERCURRENT PROTECTION ⓘ	●	●	●	●		
A12	LOCKED ROTOR	●	●	●	●		
A13	LOAD TOO LOW	●	●	●	●	●	●
A14	CURRENT ASIMMETRY	●	●	●	●	●	●
A15	STARTING TIME TOO LONG	●	●	●	●	●	
A16	PHASE SHORTED ⓘ	●	●	●	● Ⓜ		

ⓘ The properties of these alarms are fixed and cannot be modified.

Ⓜ NOTE. For the alarms related to the line voltage A01, A02, A03, A04 and A05, the properties 'retentive' and 'automatic reset' work according to the following logic.

- With the property 'retentive' enabled (ON):
  - if the property 'automatic reset' = OFF, the alarm remains active as long as the start input ST is closed, even if the condition that generated it ceases.
  - if the property 'automatic reset' = ON, if the start input ST is closed, after the delay P03.08 the alarm is reset and the soft starter performs a restart attempt. This operation is repeated up to a maximum number of attempts specified in P03.07.
- With the property 'retentive' disabled (OFF):
  - if the property 'automatic reset' = OFF, if the start input ST is closed, after a fixed delay of 30 seconds the alarm is reset and the soft starter performs a restart attempt. This operation is repeated for max 5 attempts every 30 seconds, as long as ST input is closed and the alarm is active. If the alarm conditions are still present after 5 attempts, the alarm remains active (retentive) and it is necessary to manually reset it according to the reset mode set in P03.06. Note. This is the mode used for the alarms from A01 to A04 of soft starters type ADXNB (cannot be modified).
  - if the property 'automatic reset' = ON, if the start input ST is closed, after the delay P03.08 the alarm is reset and the soft starter performs a restart attempt. This operation is repeated up to a maximum number of attempts specified in P03.07.

Ⓜ On these alarms the property stop motor is always forced to ON, independently by the setting, because the presence of these alarm conditions is critical for the run of the motor.

10.2 ALARMS DESCRIPTION

CODE	DESCRIPTION	REASON OF THE ALARM
A01	NO POWER LINE	All three phases are not present when start command given or during the motor running.
A02	PHASE LOSS	One phase not present when start command given. Note. For the versions ADXNB and ADXNF the phase loss is detected only at the start command, not during the ramps or in bypass (motor running at full voltage).
A03	WRONG PHASE SEQUENCE	Phase sequence does not match the setting P03.01 (for basic version ADXNB: phase sequence different from L1-L2-L3, if enabled)
A04	FREQUENCY OUT OF LIMITS	Frequency of the line voltage outside of ±5% tolerance around 50Hz or 60Hz in the instant when start command is given.
A05	VOLTAGE OUT OF LIMITS	Line voltage L1-L2 lower than the threshold P03.02 for a time longer than P03.03, or line voltage higher than the threshold P03.04 for a time longer than P03.05
A06	SOFT STARTER THERMAL PROTECTION	Soft starter heatsink temperature greater than maximum allowed value
A07	TEMPERATURE SENSOR FAULT	Integrated NTC temperature sensor interrupted or broken
A08	BYPASS RELAY FAILURE	Bypass relay contacts did not close or open
A09	SYSTEM ERROR	Internal error. Please contact Lovato Electric Technical Support
A10	MOTOR THERMAL OVERLOAD PROTECTION	Motor thermal overload protection tripped. See the parameters P03.09-P03.10-P03.11-P03.12.
A11	OVERCURRENT PROTECTION	Current >600%Ie (Ie=rated soft starter current) for a time longer than 200msec during starting. Note: This alarm cannot be disabled
A12	LOCKED ROTOR	Current >500%In (In=rated motor current) for a time longer than 200msec during bypass
A13	LOAD TOO LOW	Motor load torque lower than the one set in P03.13 for a time longer than P03.14 during bypass
A14	CURRENT ASIMMETRY	Current asymmetry greater than the threshold P03.18 for a time longer than P03.19 during the motor run
A15	STARTING TIME TOO LONG	Starting time (from the start command to the bypass closure) longer than the setting P03.17
A16	PHASE SHORTED	SCR in short circuit or bypass contacts welded

11 PROGRAMMABLE OUTPUTS FUNCTION TABLE

- The following table shows all the functions which can be associated to the programmable digital outputs OUT1 (terminals 11-14) and OUT2 (terminals 11-24) on the soft starters type ADXNF and ADXNP.
- Each output may be configured with normal or reversed function (NOR or REV).
- Some functions require a further numeric parameter defined by index (x) specified by parameter P05.n.02.
- See menu M05 OUTPUTS for more details.
- Note. The function of the relay outputs on the basic soft starters type ADXNB is fixed: OUT1 = LIN.CONT, OUT2 = TOR (Top Of Ramp).

FUNCTION	EXTENDED DESCRIPTION	MEANING
OFF	Off	Output disabled
LIN. CONT.	Line contactor	It controls the line contactor. It is energised immediately after the start and it remains activated as long as there is voltage to the motor, i.e. during the acceleration ramp, run, bypass and deceleration ramp (if enabled).
TOR	Top Of Ramp	Energised when the ramp is completed, with full voltage to the motor. Gives the enable signal to the load.
GLB. ALA	Global alarm	One or more alarms with the Global alarm property enabled are active
ALL Axx	Alarm Axx	Active when a specific alarm is present (index xx defined by parameter P05.n.02)
MAX TORQUE	Maximum torque	It activates when the measured torque overcomes the threshold P03.15 for a time longer than P03.16. Note. This function is available only on the advanced version ADXNP. It is used to signal that the mechanical load is at a guard level and it is not possible to further increase the load

11.1 PROGRAMMABLE OUTPUTS DEFAULT SETTINGS

- The following table shows all the functions which can be associated to the programmable digital outputs.
- If necessary, on soft starters type ADXNF and ADXNP it is possible to change the function of the outputs with menu M05 OUTPUTS.
- The functions of the outputs of the basic version type ADXNB (fixed, not editable) are the same of the default functions of the versions type ADXNF and ADXNP, listed in the following table.

OUTPUT	TERMINALS	DEFAULT FUNCTION
OUT1	11-14	LIN. CONT (line contactor)
OUT2	11-24	TOR (Top Of Ramp, motor running at full voltage)

12 OPTIONAL RS485 COMMUNICATION (FOR ADXNP ONLY)

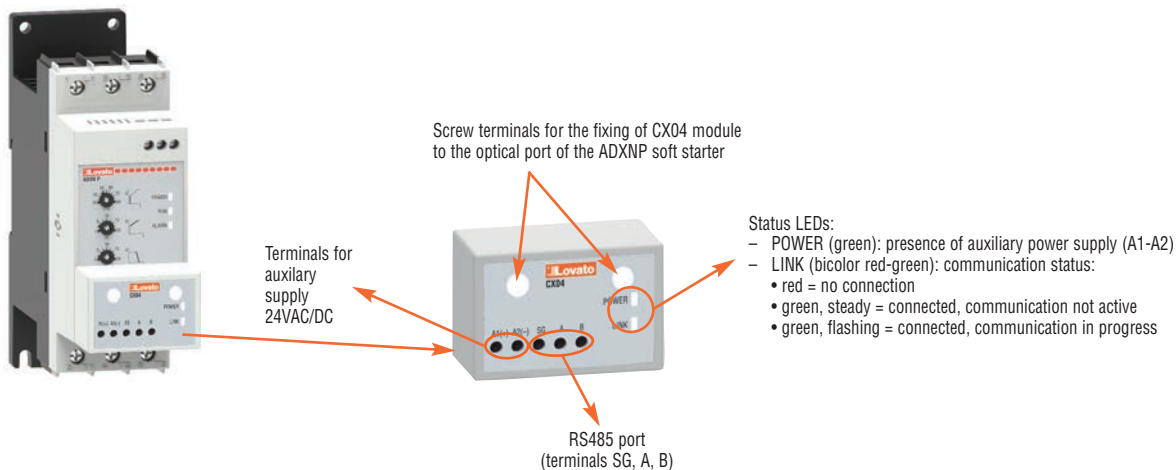
The advanced version ADXNP is provided with IR optical port on front for the connection of the optional RS485 communication module code CX04, compatible with both type ADXNP... (auxiliary supply voltage 100...240VAC) and ADXNP...24 (auxiliary supply voltage 24VAC/DC).

With this module it is possible to equip the soft starter with a serial RS485 communication port with Modbus-RTU protocol to be connected to a Modbus master like a PLC or HMI or, to be integrated in a monitoring and supervision network.

The CX04 module is provided with terminals for the connection of the auxiliary supply voltage 24VAC/DC and it connects to the front optical port of the soft starter with screw fixing.

The communication between the soft starter and the CX04 module occurs through the optical interface, which guarantees electrical safety and the convenience of operating directly from the front.

ADXNP with CX04 module can also be interfaced with the Lovato Electric supervision and energy management software Synergy (for more information consult the website [www.LovatoElectric.com](http://www.LovatoElectric.com)).



The setting of the RS485 communication parameters is done on the ADXNP soft starter (with CX04 module temporarily disconnected) with the LOVATO NFC App or the Xpress software.

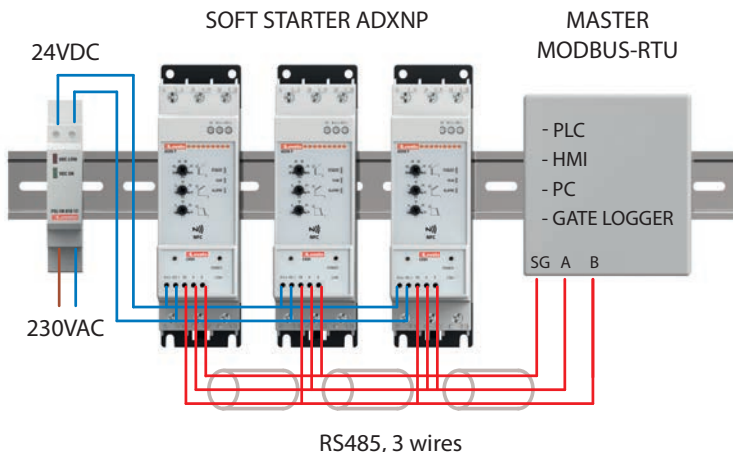
The default settings are the following: serial node address = 1, baudrate = 9600 bps, data format = 8bit-N (no parity), stop bit = 1.

For information about the possible settings see the menu M06 COMMUNICATION.

Once the communication parameters are configured, connect the module CX04 on the optical port of the soft starter ADXNP.

It is possible to connect in series up to 31 soft starters type ADXNP equipped with CX04 module. The soft starters must be all configured with the same communication parameters (baudrate, data format and stop bit), except for the serial node address, which must be different for each ADXNP.

The picture below shows an example of connection of 3 soft starters ADXNP with CX04 module, connected to a Modbus RTU master (i.e. PLC, PC with supervision software, HMI, etc.).



### 12.1 MODBUS ADDRESS TABLE

The soft starters ADXNP equipped with the optional CX04 RS485 module support the communication protocol Modbus RTU ®.

Thanks to this feature it is possible to command or monitor the status and the electric measures of the soft starters with the Lovato Electric supervision software (e.g. Synergy or Xpress) or third parties' software (e.g. SCADA) of via intelligent devices provided with Modbus RTU interface, such as PLC or HMI.

The Modbus RTU protocol rules are the same as the soft starters ADXL series. For more information regarding the reading and writing functions refer to the manual I454-ADXL MODBUS COMMUNICATION PROTOCOL, downloadable from the website [www.LovatoElectric.com](http://www.LovatoElectric.com).


Note. The maximum number of consecutive registers that can be read via Modbus on ADXN is 100.

The communication parameters of the CX04 RS485 module are configurable directly on the soft starter ADXNP (with CX04 module disconnected) with the LOVATO NFC App or Xpress software with the menu M06 COMMUNICATION.

The default settings are the following: serial node address = 1, baudrate = 9600 bps, data format = 8bit-N (no parity), stop bit = 1.

#### 12.1.1 MEASURES AVAILABLE ON THE MODBUS PROTOCOL

Here below the list of the Modbus addresses of the ADXNP, with the measures which can be read from the soft starter using the Modbus functions 03 and 04.

Address	Words number	Measure	Unit of measure	Format
06h	2	L3-L1 voltage	V/100	Unsigned long
08h	2	L1 current	A/10000	Unsigned long
0Ah	2	L2 current	A/10000	Unsigned long
0Ch	2	L3 current	A/10000	Unsigned long
14h	2	L1 active power	kW/100000	Signed long
16h	2	L2 active power	kW/100000	Signed long
18h	2	L3 active power	kW/100000	Signed long
32h	2	Frequency	Hz/1000	Unsigned long
3Ah	2	Total active power	kW/100000	Signed long
76h	2	Maximum current	A/10000	Unsigned long
78h	2	Torque	%/10	Unsigned long
7Ah	2	Maximum instantaneous current %	%/10	Unsigned long
F94h	2	Status 		Unsigned integer
FB0h	2	Motor thermal status	%	Unsigned long
FB2h	2	Thyristors temperature	°C/10	Signed long
2100h	1	ST start input status	bool	Unsigned integer
2140h	1	Outputs status		Unsigned integer
2141h	1	Output 1 (11-14) status	bool	Unsigned integer
2142h	1	Output 2 (11-24) status	bool	Unsigned integer

 Meaning of the answer of the status register:

Value	Meaning	Value	Meaning
0	No power line	5	Run
1	Soft starter ready	6	Bypass closed
2	Start delay in progress	7	Deceleration ramp
3	Acceleration ramp	8	Alarm
4	Current limit		

#### Example

For instance, to read the value of the soft starter temperature, which resides at location 0FB2h, from the ADXNP with serial address 1, the message to send is the following:

01	04	0F	B1	00	02	22	F8
----	----	----	----	----	----	----	----

where:

01 = slave address

04 = Modbus function 'read input register'

0F B1 = address of the required register (temperature) decreased by one.

00 02 = Number of registers to be read

22 F8 = CRC checksum

The answer of the soft starter is the following:

01	04	04	00	00	01	10	3B	C3
----	----	----	----	----	----	----	----	----

Where:

01 = slave address (slave 01)

04 = Function requested by the master

04 = number of bytes sent by the slave

00 00 01 10 = Hex value of the temperature = 110h = 272d = 27.2°C

3B C3 = CRC checksum

#### 12.1.2 START AND STOP COMMANDS VIA MODBUS

It is also possible to send via Modbus the commands for the start and stop of the motor.

Preconditions

– the parameter P04.04 must be set to ON

– once set P04.04=ON, the start input ST must be maintained always closed to enable the start/stop command writing (if opened, the Modbus commands are ignored, and the motor is stopped).

The address for the start/stop commands is the 1002h, to be used with Modbus write function 06:

– to start the motor write 1 to 1002h

– to stop the motor write 0 to 1002h

#### 12.1.3 PARAMETERS SETTING VIA MODBUS

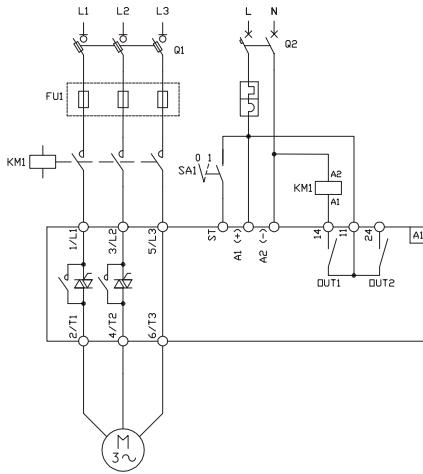
With the CX04 RS485 module it is also possible to modify the parameters of the soft starters ADXNP. For more details see the instruction manual I454-ADXL MODBUS COMMUNICATION PROTOCOL, chapter PARAMETER SETTING, downloadable from the website [www.LovatoElectric.com](http://www.LovatoElectric.com).

13 RECOMMENDATIONS

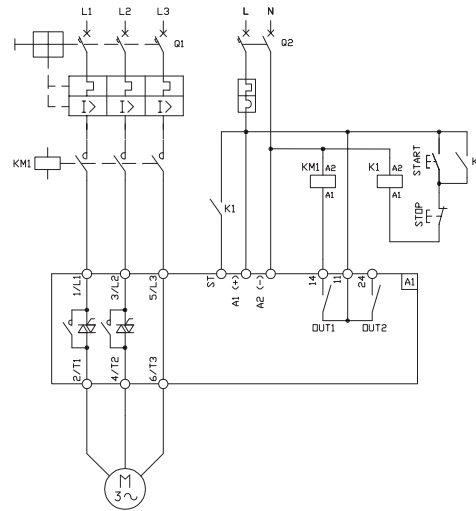
- Switch off power to the soft starter every time you need to work on the electrical or mechanical equipment of the system or machine.
- A disconnecting device, such as switch disconnector, line contactor, etc. must always be included to cut off the power supply.
- It is strongly recommended the installation of the line contactor upstream the soft starter, both for safety reasons, to remove voltage on the motor when the starting is not required, and for the protection of the internal thyristors from any dangerous phenomena which may be present on the network (e.g. overvoltages, uncontrolled current peaks, etc.).
- In case of installation of the soft starter in critical networks which may be affected by overvoltages, provide adequate protections (i.e. surge protection devices).
- Never use the soft starter to drive motor power transformers.
- Do not install the soft starter in areas containing flammable gas or explosives.
- Do not place the soft starter close to sources of heat.
- Do not use insulating enclosures since they are poor heat conductors.
- You can protect the soft starter's SCR properly against short circuit only by using ultra-rapid fuses. To select the fuses, refer to the tables on the last pages of this manual. Note that when the bypass relay is closed (i.e. motor running), the SCR are protected against short circuit, overload and overvoltage.
- If power factor correction capacitors are to be used, they must be installed upstream the soft starter, with a contactor and protection fuses. They must be engaged once the starting is terminated and disengaged before stopping. The contactor dedicated for the capacitors connection can be controlled with a relay output of the soft starter programmed with function TOR (Top Of Ramp).
- Do not perform high potential dielectric test on the soft starter. In case of insulation test on the panel, disconnect the soft starter.

14 WIRING DIAGRAMS

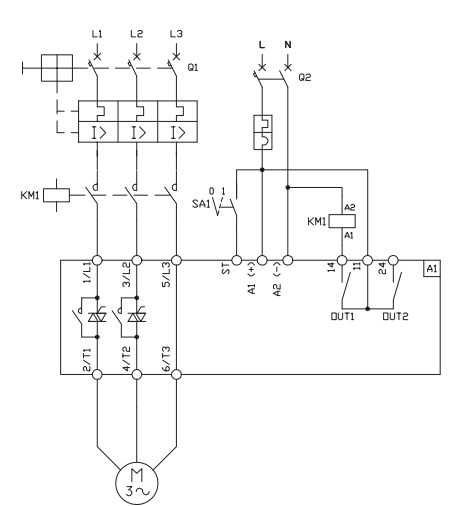
Switch disconnector + fuses + contactor, control by switch (type 0-1)



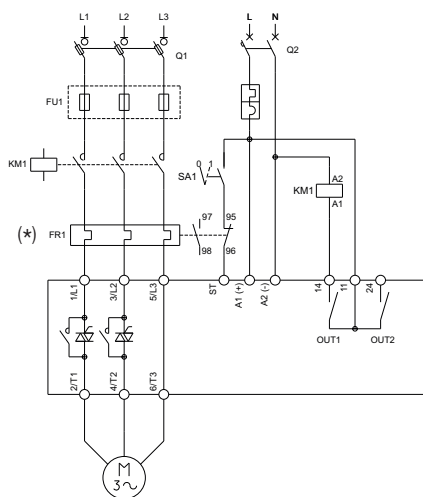
MPCB + contactor, control by pushbuttons



MPCB + contactor, control by switch (type 0-1)



Switch disconnector + fuses + contactor + thermal overload relay, control by switch (type 0-1)



Terminals	Function	Description	Settings
A1, A2	Auxiliary power supply	- For version ADXN...24 connect auxiliary supply voltage 24VAC/DC. In case of supply 24VDC respect the polarity indicated on the terminals A1(+), A2(-). - For version ADXN... connect auxiliary supply voltage 100...240VAC	-
L1, L2, L3	Line voltage	Connect the three phase line voltage 208...600VAC	-
T1, T2, T3	Motor output	Connect the cables which supply the motor	-
ST	Start input	Connect the start input (free voltage contact) according to the wiring diagrams. The starting of the motor is performed by closing the terminals ST-A1.	-
11-14	OUT1 relay output	Output for the control of the line contactor. Note. For the versions ADXNF and ADXNP it is possible to modify the function of the output with parameter P05.01.01, for ADXNB the function is fixed to line contactor.	LIN. CONT.
11-24	OUT2 relay output	Output for the signaling of the end of ramp (Top Of Ramp, full voltage reached). Note. For the versions ADXNF and ADXNP it is possible to modify the function of the output with parameter P05.02.01, for ADXNB the function is fixed to TOR.	TOR

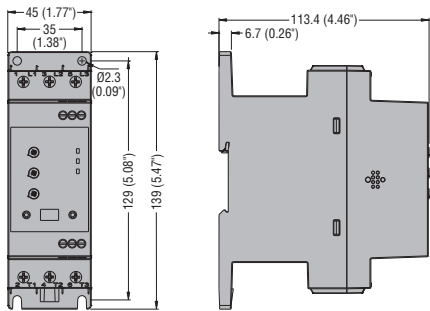
**(\*) WARNING!**  
In case of use of thermal relay type Lovato RF38, cut off the copper pin as shown in the image below.

The diagram illustrates the correct installation of a Lovato RF38 thermal relay. Step 1 shows the relay being inserted into the terminal block. Step 2 shows the removal of the copper pin from the relay's base to ensure proper contact with the terminal block.

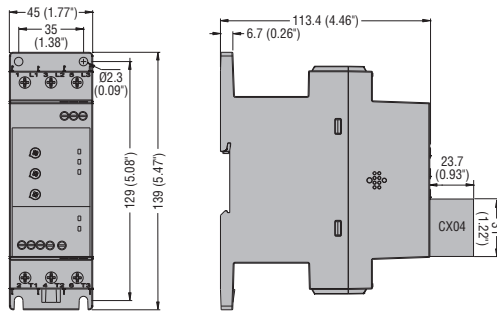


15 MECHANICAL DIMENSIONS [mm (in)]

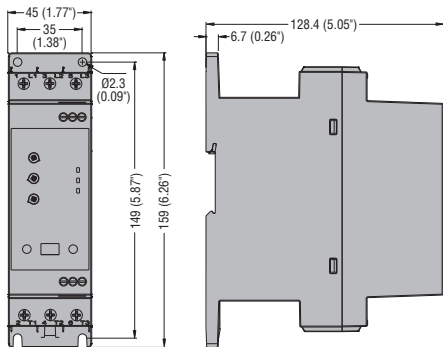
ADNX...006... - ADNX...018...



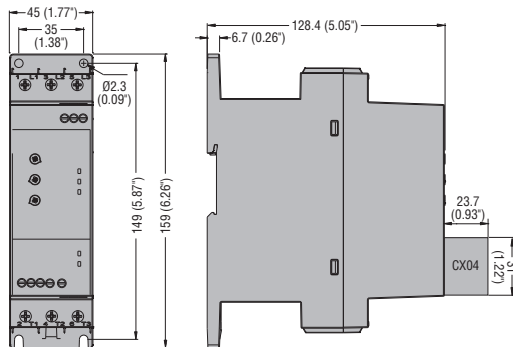
ADXNP006... - ADXNP018... with CX04 RS485 communication module.



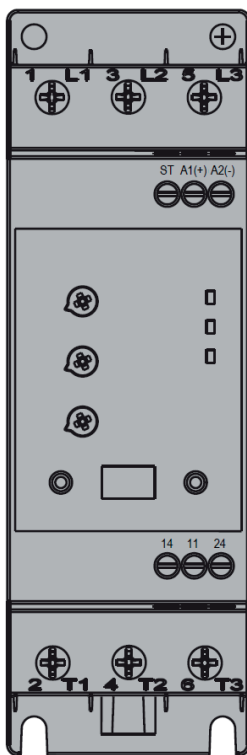
ADNX...025... - ADNX...045...



ADXNP025... - ADXNP045... with CX04 RS485 communication module.



16 TERMINALS LAYOUT



## 17 FAN

It is possible to add on the ADXN up to size 30 A the optional fan EXP8007, to improve the heating dissipation performances and increase the number of operations per hour. The fan, already integrated as standard for the sizes 38 and 45 A, is supplied directly by the soft starter through a pre-wired cable which is hidden inside the soft starter box. The presence of the fan doesn't affect the dimensions of the soft starter ensuring the maintenance of compact dimensions.



EXP8007



## 18 NUMBER OF STARTS PER HOUR

The following data are based on an ambient temperature of 40°C, starting current of 4\*In and ramp time 6 seconds. In=Rated motor current.

Number of starts/hour WITHOUT FAN																					
In	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
3A	ADXN006																				
6A	ADXN006												ADXN012								
9A	ADXN012										ADXN018										
12A	ADXN012 - ADXN018																				
18A	ADXN018			ADXN025			ADXN030														
25A	ADXN025			ADXN030																	
30A	ADXN030																				
38A																					
45A	ADXN038... and ADXN045... have built-in fan																				

Number of starts/hour WITH FAN																					
In	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
3A	ADXN006																				
6A	ADXN006																		ADXN012		
9A	ADXN012																		ADXN018		
12A	ADXN012												ADXN018						ADXN025		
18A	ADXN018										ADXN025					ADXN030					
25A	ADXN025															ADXN030					
30A	ADXN030												ADXN038			ADXN045					
38A	ADXN038										ADXN045										
45A	ADXN045																				

## 19 CHOOSING THE SOFT STARTER

CODE	Soft starter rated current Ie [A]	Rated motor power IEC [kW]			FLA [A]	Rated motor power UL [HP]				
		230VAC	400VAC	500VAC		208VAC	220-240VAC	380-415VAC	440-480VAC	550-600VAC
ADXN...006...	6	1.1	2.2	3	6.1	1	1.5	2	3	5
ADXN...012...	12	3	5.5	5.5	11	3	3	5	7.5	10
ADXN...018...	18	4	7.5	11	18	5	5	10	10	15
ADXN...025...	25	5.5	11	15	24.2	7.5	7.5	10	15	20
ADXN...030...	30	7.5	15	18.5	28	7.5	10	15	20	25
ADXN...038...	38	11	18.5	22	34	10	10	20	25	30
ADXN...045...	45	11	22	30	44	10	15	25	30	40

Attention! The data in the table, relative to the rated operational power, were obtained in accordance with IEC/EN/BS 60947-4-1: 2012-05, so the data in kW and HP are not linked together by the relation 1HP=kW\*1.36.

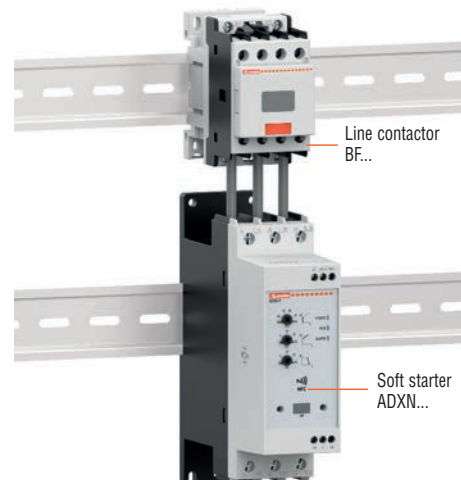
20 COORDINATION TABLES

20.1 COORDINATION WITH LINE CONTACTOR

The line contactor installed upstream the soft starter is strongly suggested to open the circuit in the event of an anomaly on the plant (e.g. short circuit, overload, alarm, etc.) and to protect the internal thyristors against undesired phenomena which may affect the power supply line (e.g. overvoltages or uncontrolled current peaks) when the motor is not required to start. The command of the line contactor is done with a relay output of the soft starter ADXN, programmed with the dedicated function LIN.CONT. (line contactor), which remains active from the starting command up to the end of the deceleration ramp (if enabled). The line contactor must be sized with an AC-3 current greater or equal than the motor rated current. The following table shows the line contactor suggested for each size of ADXN soft starter.

SOFT STARTER	Ie [A]	LINE CONTACTOR
ADXN..006...	6	BF09 (9A AC-3)
ADXN..012...	12	BF12 (12A AC-3)
ADXN..018...	18	BF18 (18A AC-3)
ADXN..025...	25	BF25 (25A AC-3)
ADXN..030...	30	BF32 (32A AC-3)
ADXN..038...	38	BF38 (38A AC-3)
ADXN..045...	45	BF50 (50A AC-3)

Note. The code of the contactor must be completed with the coil voltage. For the complete code refer to the Chapter 2-Contactors of the Lovato Electric general catalog.



20.2 COORDINATION WITH THERMAL OVERLOAD RELAY (ADXNB AND ADXNF)

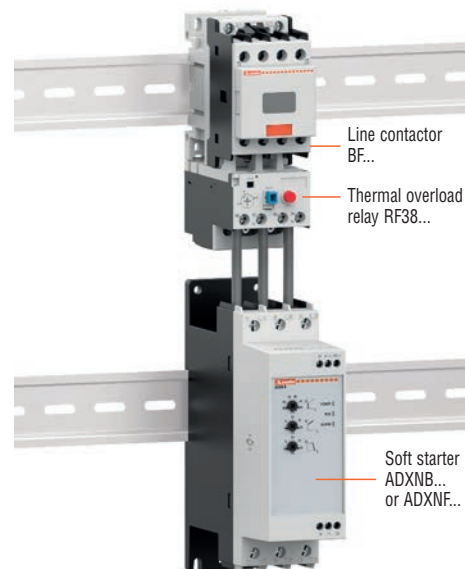
The soft starter type ADXNB and ADXNF don't integrated the function of motor thermal overload protection, which is present instead in the advanced soft starter type ADXNP. For the protection of the motor against overload it is suggested the installation of a thermal overload relay (in alternative to a motor protection circuit breaker), typically installed upstream the soft starter, connected to the line contactor.

The following table shows the thermal overload relay suggested for each size of ADXN soft starter.

Note! The selection of the correct thermal overload relay must be done according to the rated motor current (In) indicated on the motor nameplate, which could be lower compared to the rated current of the soft starter (Ie). Choose a thermal overload relay which includes the rated motor current in its adjustment range.

SOFT STARTER	Ie [A]	THERMAL OVERLOAD RELAY	ADJUSTMENT RANGE [A]
ADXN...006...	6	RF380650	4...6.5
ADXN...012...	12	RF381400	9...14
ADXN...018...	18	RF381800	13...18
ADXN...025...	25	RF382500	20...25
ADXN...030...	30	RF383200	24...32
ADXN...038...	38	RF383800	32...38
ADXN...045...	45	RF825000	35...50

For more information about thermal overload relay see the Chapter 3-Motor protection relays of the Lovato Electric general catalog.



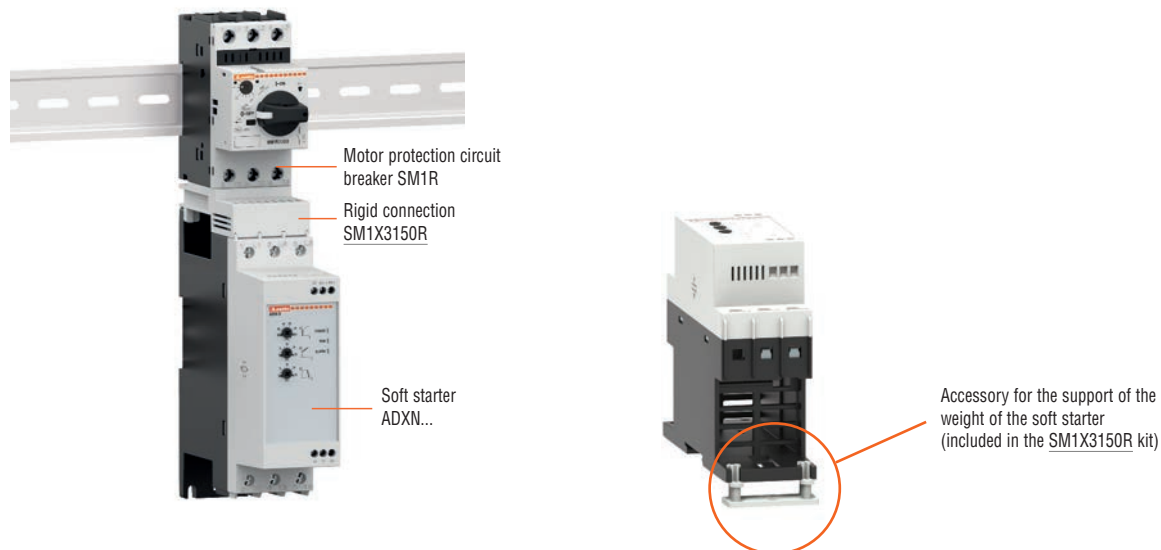
**(\*) WARNING!**  
In case of use of thermal relay type Lovato RF38, cut off the copper pin as shown in the image below.

### 20.3 TYPE 1 COORDINATION WITH MOTOR PROTECTION CIRCUIT BREAKER

It is possible to install upstream the ADXN soft starter a motor protection circuit breaker for the protection against the short circuit and the overload (for the versions ADXNB and ADXNF, which don't integrate the motor current thermal overload protection).

To simplify the wiring, it is available for ADXN from size 6A to 38A the optional rigid connection SM1X3150R, which allows the direct mounting of the ADXN soft starter to a motor protection circuit breaker type SM1R (rotary knob type), allowing the realization of compact starters and reducing the installation time.

SM1X3150R includes also an accessory for the support of the weight of the soft starter when hooked to the MPCB, to be fixed with screws to the panel. This support can be used with high or low DIN rail and it can be mounted even with soft starter already installed without need to modify the drillings.



The following table shows the motor protection circuit breaker suggested for each size of ADXN soft starter.

Note. For the correct selection of the MPCB, check the rated motor current ( $I_n$ ), which must be included in the thermal trip adjustment range of the MPCB.

Soft starter	Motor protection circuit breaker (MPCB)	MPCB thermal trip adjustment range	Maximum voltage [VAC]
ADXN...006...	SM1R0650	4...6.5	600
ADXN...012...	SM1R1400	9...14	600
ADXN...018...	SM1R1800	13...18	600
ADXN...025...	SM1R2500	20...25	600
ADXN...030...	SM1R3200	24...32	600
ADXN...038...	SM1R4000	30...40	600
ADXN...045...	SM2R5000 ①	34...50	600

① size not compatible with the rigid connection SM1X3150R.

### 20.4 TYPE 2 COORDINATION (IEC/EN/BS 60947-4-2)

Soft starter	Max fuses size Class aR [A]	Max voltage [VAC]	Fuses Bussman FWP	Fuses British BS 88 Bussman
ADXN..006...	20	600	FWP-20B	20CT
ADXN..012...	35	600	FWP-35B	35ET
ADXN..018...	50	600	FWP-50B	45FE
ADXN..025...	70	600	FWP-70B	71FE
ADXN..030...	80	600	FWP-80B	80FE
ADXN..038...	100	600	FWP-100B	100FEE
ADXN..045...	120	600	FWP-125B	120FEE

### 20.5 COORDINATION ACCORDING TO UL60947-4-2

Soft starter	Fault current [kA] *	Max voltage [VAC] **	Fuses class RK5 [A] ***
ADXN..006...	5	600	20
ADXN..012...	5	600	20
ADXN..018...	5	600	20
ADXN..025...	5	600	35
ADXN..030...	5	600	35
ADXN..038...	5	600	60
ADXN..045...	5	600	60

#### NOTE FOR UL

ADXN is suitable for use on a circuit of delivering not more than \* kA symmetrical Amperes, \*\* V Volts maximum when protected by \*\*\* A RK5 class fuses. Refer to the above table for corresponding current level and corresponding voltage level for a given device.

## 21 TECHNICAL CHARACTERISTICS

**Auxiliary power supply: terminals A1-A2**

Rated voltage Us	ADZN...:	100...240VAC -15%/+10%		
	ADZN...24:	24VAC/DC -15%/+10%		
Rated frequency	50/60Hz ±5%			
Drawn/dissipated power	ADZN	100VAC	45mA	1.70W
	6...18A	240VAC	27mA	2.40W
	(w/o fan)	24VAC	135mA	1.85W
		24VDC	75mA	1.80W
	ADZN	100VAC	55mA	2.55W
	25...30A	240VAC	33mA	3.20W
(w/o fan)	24VAC	210mA	2.75W	
	24VDC	110mA	2.64W	
(with fan)	ADZN	100VAC	90mA	4.45W
	38...45A	240VAC	55mA	5.00W
	(with fan)	24VAC	315mA	4.55W
		24VDC	175mA	4.20W

Micro-interruption immunity time ≤40ms

**Power connections: L1-L2-L3 (line terminals), T1-T2-T3 (motor terminals)**

Contact type	2 x 1NO with the same common
Operating frequency	50/60Hz ±5%
Rated current and power	See table Soft starter selection

**Relay outputs: terminals 11-14 (OUT1) and 11-24 (OUT2)**

Contact type	2 x 1NO with the same common
Operating voltage	250VAC
Rating	5A 250VAC AC1 / 5A 30VDC
UL use data	C300
Maximum usage voltage	250VAC
Electrical life	1 x 10 <sup>5</sup> operations
Mechanical life	1 x 10 <sup>6</sup> operations

Insulation voltage	Power line	Relay outputs	Aux. supply 100-240V	Aux. supply 24V
Rated insulation voltage Ui	600VAC	250VAC	250VAC	25VAC
Rated impulse withstand voltage Uimp	6kV	4kV	4kV	0.8kV

**Ambient operating conditions**

Operating temperature	-20...+40°C (up to +60°C with current derating)
Storage temperature	-30...+80°C
Cooling	Natural for ADZN...006... - ADZN...030... Forced for ADZN...038... - ADZN...045..., optional for ADZN...006... - ADZN...030... with fan EXP8007
Relative humidity	<80% (IEC/EN/BS 60068-2-78)
Maximum altitude	1000m without derating
Pollution degree	2
Overtvoltage category	III
Climate sequence	Z/ABDM (IEC/EN/BS 60068-2-61)
Shock resistance	15g (IEC/EN/BS 60068-2-27)
Vibration resistance	0.7g (IEC/EN/BS 60068-2-6)

**Connections of auxiliary supply (A1-A2), start input (ST) and relay outputs (14-11-24)**

Terminal types	Screw type (fixed)
Wire cross-section (min. and max.)	0.2...2.5mm <sup>2</sup> (22...14AWG)
Tightening torque	0.4Nm / 3.54lb.in
Type of conductor	Use copper conductors only, 75°C

**Power connections (line input L1-L2-L3 and motor output T1-T2-T3)**

Terminal types	Screw type (fixed)
Wire cross-section (min. and max.)	Size 1 (6-18A): 1.5...4mm <sup>2</sup> (16...10 AWG – solid or stranded) Size 2 (25-45A): 4...10mm <sup>2</sup> (10...8 AWG – 8 stranded only)
Imprint	Size 1 (6-18A): PH1 (M4 screw) Size 2 (25-45A): PH2 (M5 screw)
Tightening torque	Size 1 (6-18A): 1Nm / 8.85lb.in Size 2 (25-45A): 2Nm / 17.7lb.in
Type of conductor	Use copper conductors only, 75°C

**Housing**

Installation	Internal panel version	
Installation position	Vertical	
Material	Polycarbonate RAL 7035	
Protection degree	IP20	
Mounting	Screw fixing or 35 mm DIN rail mounting (IEC/EN/BS 60715)	
Weight	ADXNB 6-18A:	450g
	ADXNB 25-30A:	630g
	ADXNB 38-45A:	660g
	ADXNF 6-18A:	450g
	ADXNF 25-30A:	640g
	ADXNF 38-45A:	670g
	ADXNP 6-18A:	470g
	ADXNP 25-30A:	660g
	ADXNP 38-45A:	690g

**Certifications and compliance**

Certifications	cULus, EAC, RCM
Compliant to standards	IEC/EN/BS 60947-1, IEC/EN/BS 60947-4-2, UL60947-4-2, CSA C22.2 n° 60947-4-2