instruction manual

Motor Starter - 1145929-00000

General information

The diagrams shown in this document may differ from the actual product.
We reserve the right to make technical changes.

The manufacturer does not accept any liability for damage to property or financial losses arising from insignificant defects in the product or insignificant flaws in the documentation, e.g. printing or writing errors, and where the manufacturer has not acted deliberately or been grossly negligent.

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1 Conventions for presentation (Symbols used and warning notices)

This document may contain various warning words and warning symbols that indicate potential hazards:

Important:
This symbol makes the reader aware of important information.

Caution!
This symbol warns of a possible fault. If this is not followed, the unit or systems and equipment connected to it may be disrupted or even fail completely.

Warning!
This symbol warns about a hazard. If this message is not followed, there is a threat that people may be injured or even killed or property may be damaged or destroyed.

1.1 Abbreviations (glossary)

Abbreviation	Description
AS-i	AS-Interface (Actuator Sensor Interface)
SaW	Safety at Work, AS-i safety technology
MG	Module housing

2 General

Please read through all the documentation provided carefully and in full before you use the unit.
Always follow the instructions, information and warnings contained in this documentation and note the technical specifications.

Make sure that all the documents are kept in a legible state and in a suitable place so that they can be consulted again at a later date.

2.1 Functions of this document

These operating instructions provide the technical staff from the machine manufacturer/machine operator or plant manufacturer/plant operator with information on safe installation, electrical installation, configuration and parametrization as well as how to operate and maintain the function.

2.2 Target group

The operating instructions are aimed at the planners, developers and operators of the plants that are supposed to be kept safe by one or more modules. These instructions are also intended for people who integrate the functions into a machine, start it up for the first time or maintain it.

2.3 Specifications

2.3.1 Specification AS-i

The function supports the AS-i specification 3.0, although the earlier specifications (2.1 and 2.0) are compatible.

3 Security

The purpose of this chapter is to ensure your safety and the safety of the plant users. Only use this unit if it is in perfect technical condition and in accordance with the purpose intended, paying attention to safety and hazards.

3.1 Qualified employees

The equipment may only be started up and maintained by knowledgeable personnel. Knowledgeable means anyone who:

- has appropriate technical training
- has been instructed by the machine operator on how to operate the machine and on the current safety guidelines
- has access to the operating instructions.

3.2 Opening the casing cover

Only an authorised person with appropriate technical training, who has been instructed by the machine operator on how to operate the machine and on the current safety guidelines, is allowed to open the housing cover during operation or for maintenance and diagnostic purposes.

3.3 Field of application

3.3.1 General

The function is a decentral module for the safe control of actuators, 3-phase motors and asynchronous motors in the AS-i Safety at Work (SaW) safety bus system.

3.3.2 AS-i not Safe

The function is controlled by a master (AS-i Gateway) integrated in the overall system

3.3.3 Switching characteristic R/L

The function allows switching ON and OFF with integrated clockwise / anticlockwise rotation (reversing operation). Reversing operation of 3-phase three-phase motors is carried out on the one hand automatically by the higher-level control (PLC) or manually (momentary) by a toggle switch provided on the function (optional).

4 Product description

This Chapter provides you with information about the special properties of the function "Protecting, switching – 400VAC/0,6 - 16A as ON/OFF or/and R/L motors".
It describes the function, configuration and parametrization of the module.

Warning!
You must read this chapter before assembling, installing and starting up the unit.

4.1 Product information

These operating instructions apply to the following LQ function:
Protect Switch 400V motors 6,5A 1145929-00000

4.2 Product features

current monitoring: NO
Reversing switch: NO
EXECUTION: ELR
Switching characteristics: Right / Left
communications system: AS-i

4.3 Electrical properties

DESIGNATION	VALUE	UNIT
Line protection back-up fuse	16	A
Input voltage Rated value	400 / 480	V AC
Input current Rated value	6,5	A
Rated frequency	50 / 60 (+/- 10%)	Hz
Surge voltage Rated value	2,5	kV
control voltage	24 (+/-20%)	V DC
Auxiliary current	85	mA
load voltage	42 - 550	V AC
load current	1,5 - 6,5 adjustable	A
starting current	max. 8x In (rated current)	
usage category	6.5A at AC-51 and AC-53a	
dissipation	15	W
switching frequency	<= 2	Hz
current monitoring	NO	
EXECUTION	ELR	
Switching characteristics	Right / Left	
Tripping class according to IEC 60947	Class 10A	
Automatic reset (ready to start)	20 minutes after overload	
Electromagnetic compatibility	in accordance with EN 61000-4-2/3/4/5/6/8/11/29/39, EN 55011 Radiated, EN 55011 Conducted	
communications system	AS-i	
AS-i voltage	26,5 - 31,6	V DC
AS-i specification	3.0	
MTTF at 40°C	39,3	year

4.4 Mechanical properties

DESIGNATION	VALUE	UNIT
Interface Input	1x X-TEC 15 + 1x M12 A-Coded	
Interface Output	X-TEC 15	
Reversing switch	NO	
Installation altitude above normal zero	2000	m
TYPE OF PROTECTION	IP54	
Shock resistance according to EN 60068-2-27	15g/11ms	
Vibration according to EN 60068-2-6	10-500Hz, 0,35mm, 5g	
Vibration according to EN 60068-2-64	5-500Hz, 0,75g RMS	
Impact resistance Housing	IK08 as per DIN EN 5012/VDE 0470 Part 100	

4.5 Thermal properties

DESIGNATION	VALUE	UNIT
Ambient temperature (operation)	5 to +50	°C
Ambient temperature UL (operation)	5 to +40	°C
Ambient temperature (storage)	-25 to +80	°C

4.6 Chemical properties

DESIGNATION	VALUE	UNIT
Housing material	Polycarbonate, glass fibre reinforced	
Burning behaviour Housing	5VA in accordance with UL 50 / UL 746C, V-2 in accordance with UL 94, 960°C in accordance with VDE 0471 / EN 60695	
Max. relative humidity	95% in case of 25°C and 50% in case of 40°C	
stability	UV/weather/weak acid/alcohol/mineral oil/ammonia gaseous/greases	

4.7 Approval

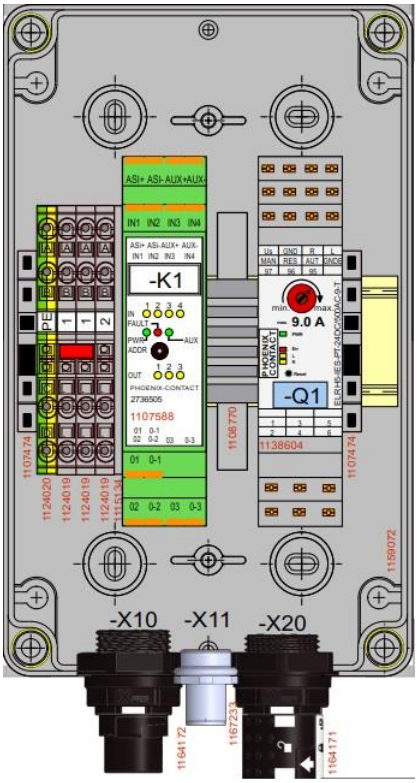
DESIGNATION	VALUE	UNIT
UL/CSA Standards	UL 508 C22.2 No. 14	
UL Certificate Number	NMTR/7.E506682	
SCCR	50kA (480VAC (fuse 30A class CC / 30A class J (High-Fault))), 5kA (480VAC (fuse 20A RK5 (Standard-Fault)))	
policies	RoHS Directives, REACH Regulation	

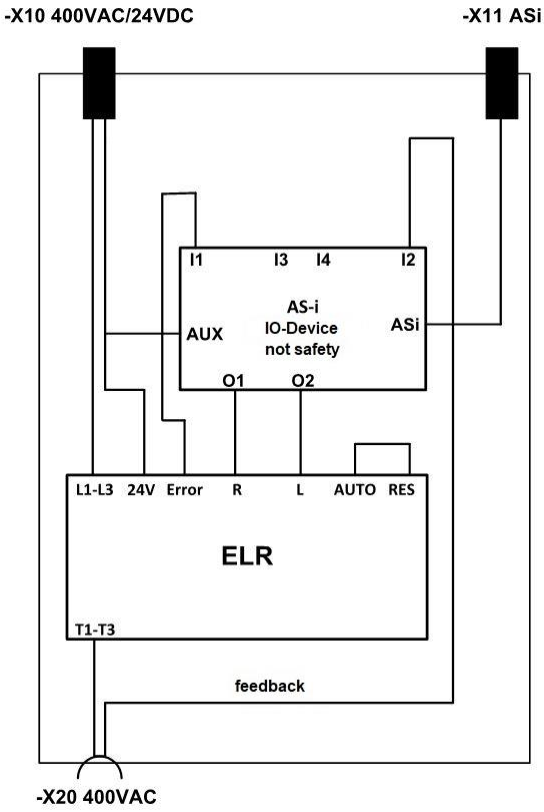
5 Parameterisation

5.1 Parametrization of the function

Before starting up, various settings must be made on different components within the module.
The cover must be removed from the module to do this. When doing this, all information in the document and on the module housing must be noted and complied with.
During parameterization the module must be in operating condition with operating voltage (24VDC) applied at –X10.

5.1.1 Overview and arrangement of components (schematic circuit diagram)





-K1 -> AS-i
-Q1 -> ELR(2,4A/6,5A)

5.1.2 AS-i Device not Safe

General description of the data of a non-safe AS-i participant

The function has an AS-i address

AS-i address	Description of the function
X	address (4 x In / 3 x Out)

The AS-i participant (address) has 4-bit data each (bidirectional)

Bit	Meaning / Data bit Master -> Node	Meaning / Data bit Node -> Master
0	Output 1	Input 1
1	Output 2	Input 2
2	Output 3	Input 3
3		Input 4

Below, the data bits are each shown as a function of the address as follows::

Adress.Bit
Example for address X bit 1, which represents one input or output:
X.0 (Out1/In1)

5.1.2.1 General description of the AS-i functionn

The module has an AS-i station that fulfills the following functions.
The function is described by an own AS-i address.
The addressing of the AS-i device is described in chapter 5.1.2.3.

5.1.2.1.1 Outputs Out1 - Out3
The participant has 3 outputs which are used in the function for switching on and off including reversing operation by a three-phase motor.

Function output	Bit (output)
Clockwise	X.0 (Out1) = 1 | X.1 (Out2) = 0
Anti-clockwise	X.0 (Out1) = 0 | X.1 (Out2) = 1
Motor off	X.0 (Out1) = 0 | X.1 (Out2) = 0

5.1.2.1.2 Inputs In1 – In4
The participant has 4 inputs on the address, which are used in the function as follows

Function	Bit (input)
Motor overload tripped	X.0 = 1
Temperature switch, motor	X.1 = 1
Automatic (auto) mode*[1]	X.2 = 1 | X.3 = 0
Manual (man) mode*[1]	X.2 = 0 | X.3 = 1
Motor off*[1]	X.2 = 0 | X.3 = 0
Current monitoring[2]	X.2 = 1 | X.3 = 0

*1 optional with knob-operated control
*2 optional with current monitoring
*1 and *2 in combination not possible

5.1.2.2 Addressing the non-safe AS-i node (-K1))

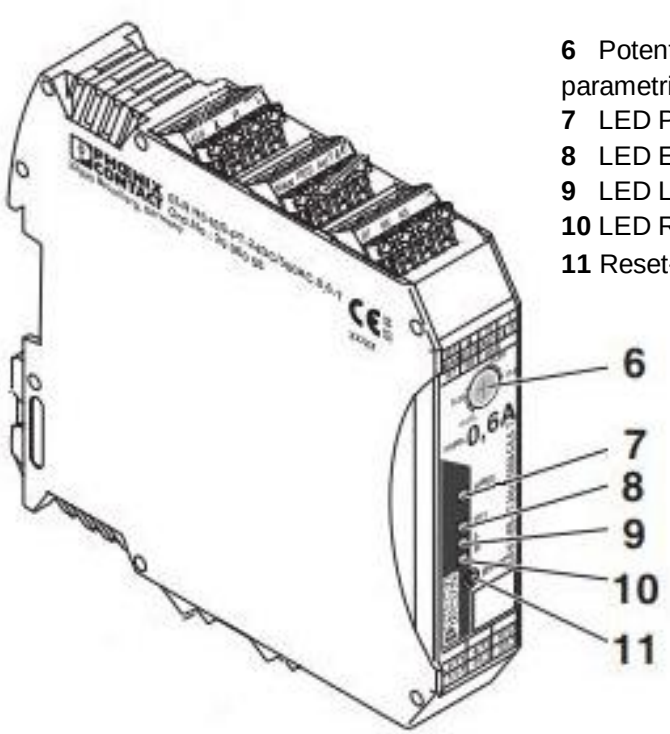
The non-safe AS-i device uses only 7 data bits. The 8th bit is used for the address extension of the AS-i participant address. This means that instead of 32 participants, 64 participants can be connected to the bus and addressed.
The double addressing possibility is achieved by dividing the AS-i participant addresses into an A and B address.
In this way, 32 A-addresses and 32 B-addresses can be assigned for a total of 64 participants.
The prerequisite is that the participant is designed for this addressing option and that the 8th data bit is provided as the participant address.

A participant who does not have the option of using a half address always occupies a full address, i.e. the B address is no longer available to the system for this address.

Note!
Addressing is done directly on the component and is described here in the document exclusively with a manual addressing device.

5.1.3 Motor protection ELR (-Q1)

5.1.3.1 Overview of component with description of the individual lamps and switches



6 Potentiometer for rated current parametrization
7 LED PWR: Control supply voltage
8 LED ERR: Message/fault
9 LED L: Anti-clockwise
10 LED R: Clockwise
11 Reset-button

5.1.3.2 Setting current limitation (parametrization – rated current setting)

- Press the reset button (11) for longer than 6 s to enter the "Parameterization" operating mode. The green PWR LED (7) flashes once.
- To differentiate from other operating states, the LEDs are switched off for 0.3 s at intervals of 2 s in parameter assignment mode.
- Adjust the rated voltage of the drive using the 240°potentiometer (6).
- The rated current is specified in 16 stages. The four LEDs display the set rated voltage.
- Store the value by pressing the Reset button (11) again (non-volatile area of the data memory).
- If you press the reset button for longer than 2 s (and less than 6 s), the set current is displayed for 3 s. This function is only possible if the component is not triggered and there is no error on the component.

5.1.3.3 Parametrization of the current value

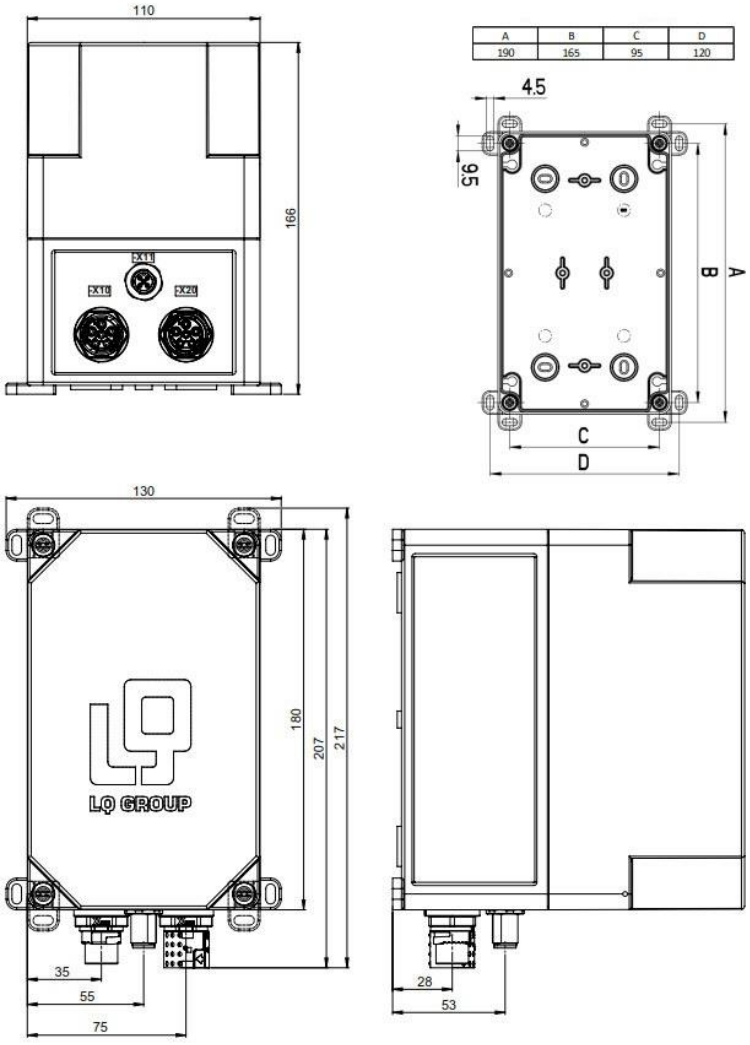
Code				Nominal current [mA]		
PWR	ERR	L	R	Fct. to 0.6A	Fct. to 2.4A	Fct. to 6.5A
0	0	0	0	75	180	1500
0	0	0	1	110	250	2000
0	0	1	0	145	410	2500
0	0	1	1	180	560	3000
0	1	0	0	215	710	3500
0	1	0	1	250	870	4000
0	1	1	0	185	1020	4500
0	1	1	1	320	1170	5000
1	0	0	0	355	1330	5500
1	0	0	1	390	1480	6000
1	0	1	0	425	1630	6500
1	0	1	1	460	1790	
1	1	0	0	495	1940	
1	1	0	1	530	2090	
1	1	1	0	565	2250	
1	1	1	1	600	2400	

6 Assembly

6.1 Housing dimensions

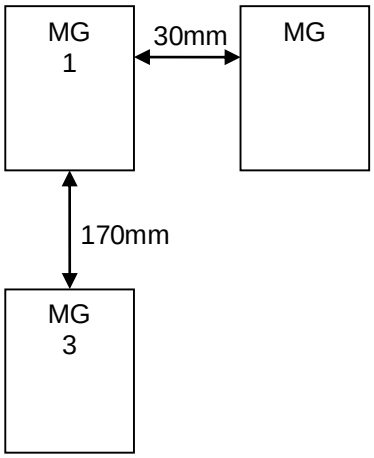
DESIGNATION	VALUE	UNIT
Size of construction (Width x Height x Depth)	130 x 217 x 166	mm
Distance to be maintained below	170	mm
Distance to be maintained laterally	30	mm
installation type	screw fastening	
installation position	vertical installation	

6.2 Dimensional drawing



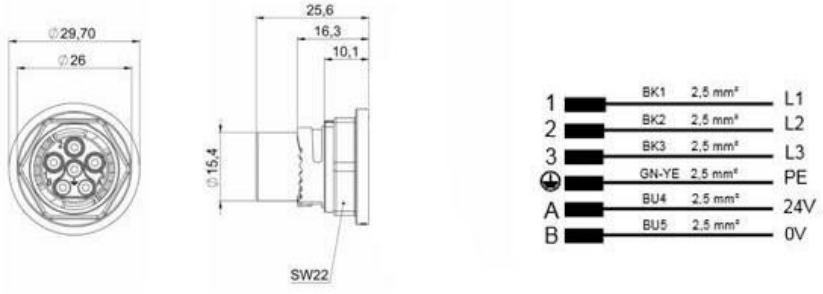
6.3 Assembly of several modules next to each other

When assembling several module housings (MG) next to each other, minimum clearance of 30mm is required; when assembling several module housings next to each other vertically, a minimum clearance from the upper edge of the housing (MG3) to the lower edge of the housing (MG1) of 170 mm must be complied with so that, first, the thermal characteristics are not affected and, second, so that the connecting lines can be routed correctly.

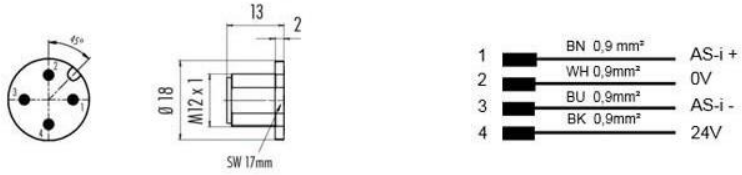


7 Interface description

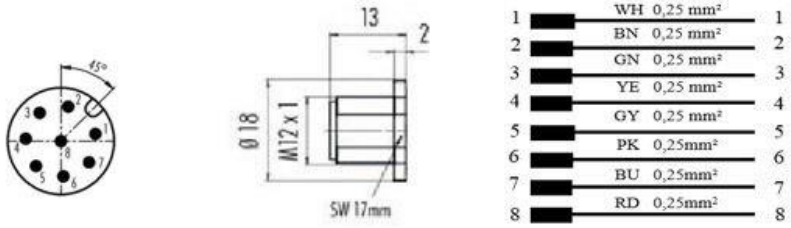
7.1 -X10 X-TEC15 male - Input 400V AC / 24V DC



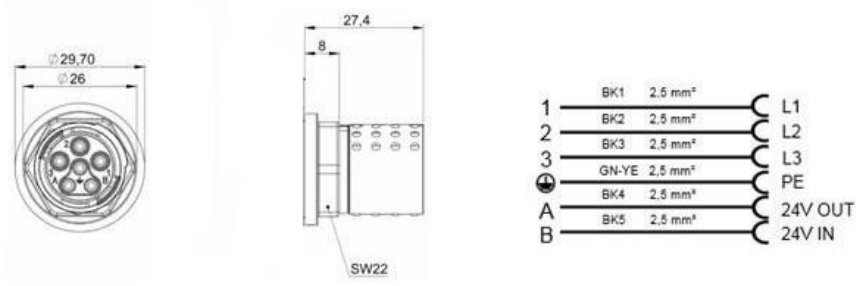
7.2 -X11 M12 A- Coded - Communication AS-i



7.3 -X11 M12 A- Coded - Communication Parallel



7.4 -X20 X-TEC15 female - Output 400V AC



Pin A/B in interface -X20 is used for thermal monitoring of the motor temperature via a bimetal.

8 Diagnosis

8.1 General description of Service Levels 1 and 2

8.1.1 Service Level 1

In Level 1, all possible causes of faults are described for which it is not necessary to open the module cover (no specialist electrical knowledge required).

8.1.2 Motor (consumer) does not work

- ✓ Are all the necessary connecting cables
  - --X10 400V input
  - -X20 400V output and
  - -X11 Communication bus (AS-i or parallel)

  connected at the module and latched in position correctly?
- ✓ Is the –X10 400V input cable properly connected to the intended power source and are all fuses switched on there?
- ✓ Is the –X20 400V output cable properly connected to the intended consumer?
- ✓ Is the AS-i Bus connecting cable –X11 properly connected at the bus?
- ✓ Is one of the properly connected connecting cables –X10, -X11 and –X20 damaged?

8.1.3 Service Level 2

In Service Level 2, the cover must be opened in order to evaluate the diagnostic displays of the individual components.
Depending on the type of function, the components may be different and are described below.
No specialist electrical knowledge is required.
The safety guidelines in chapter 3 *Safety* must be observed.

When the module lid is open, diagnostic messages of the individual components can be read and evaluated as follows

Component overview

- Safe AS-i participant
- Non-safe AS-i participant
- Electronic load relay ELR
- current monitoring
- motor-protective circuit-breaker
- line contactor

8.1.3.1 Status LEDs AS-i device

AS-i not safety

LEDs		Status	Signal | Description
PWR	green	AS-i operating voltage	
		○	No operating voltage
		☀	Operating voltage available
FAULT	red	Error display	
		○	No error
		☀	Communication error or AS-i address = 0.
		☀	Overload of the outputs
AUX	green/ red	External auxiliary voltage	
		○	Auxiliary voltage not available.
		☀	Auxiliary voltage available.
		☀	Auxiliary voltage reverse polarity.
I1, I2, I3, I4	yellow	Status of the inputs	
		○	Input not active.
		☀	Input active.
O1, O2, O3	yellow	Status of the outputs	
		○	Output not active.
		☀	Output active.
	○ LED off ☼ LED flashing ☀ LED on		

8.1.3.2 Status LEDs Motor protection ELR (-Q1)

Status	Signal | Description	PWR	ERR	L	R	Fault acknowledgement
		Green	Red	Yellow		
Off	No supply voltage present	○	○	○	○	-
Ready for operation	Supply voltage present	☼	○	○	○	-
Drive switched on	Anti-clockwise (L)	☼	○	☼	○	-
	Clockwise (R)	☼	○	○	☼	-
Internal error	Internal equipment fault - **Equipment must be changed**	☼	☼	○	○	Nm
External fault in control circuit or peripherals (need for maintenance)	Motor protection function: The motor current is greater than the specified motor rated current: Cooling down time runs (20 mins.)					
	Fault during anti-clockwise	☼	☼	☼	○	Aut
	Fault during clockwise	☼	☼	☼	○	Aut
	"L" or "R" flash after 2 mins. have passed: Manual reset possible					
	Fault during anti-clockwise	☼	☼	☼	○	Man
	Fault during clockwise	☼	☼	○	☼	
	Fault when restoring system status: Manual acknowledgement after 2 mins. possible	☼	☼	☼	☼	Man
	Symmetry: The variation between the two motor currents is more than 33 %	☼	☼	○	○	Man
	Blocking: The maximum measurable motor current is exceeded for more than 2 secs.					
	Fault during anti-clockwise	☼	☼	☼	○	Man
	Fault during clockwise	☼	☼	○	☼	Man
Message: Power transmission path remains connected	Message with control signal applied: - 2 or more phases missing - No motor connected - Motor current on at least two phases > 2 secs. less than the minimum settable current value					
	Message for anti-clockwise	☼	☼	☼	○	Ne
	Message for clockwise	☼	☼	○	☼	Ne
Explanation: ○ LED off ☼ LED flashing ☼ LED on Aut = Automatic / Man = Manual / Nm = Not possible / Ne = Not required						

8.1.3.3 Resetting the motor protection (acknowledging faults)

There are two possibilities to acknowledge the tripped motor protection and to reset the component to the operating state.

8.1.3.3.1 Manual (Reset button)
Press the reset button (11) on the front panel of the ELR (see chapter 5.1.3.1).

8.1.3.3.2 Automatic reset
The device performs an automatic acknowledgement after the motor protection monitoring responds and then cools down.
This function is guaranteed by the correct wiring of the component.Function maintained through correct circuit.

If the higher-level control system (PLC) does not switch off the affected output for controlling the motor after detecting the overload by evaluating the input bit Y.0 = 1 or, in the case of the "parallel interface" variant pin 2, the connected consumer (motor) is restarted immediately after the automatic reset

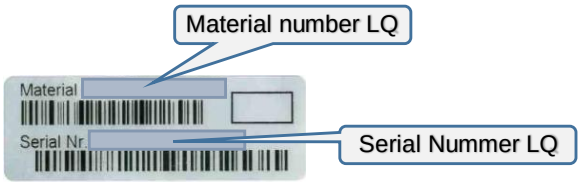
8.1.3.4 Symmetry identification

Motor currents are measured at phases L1 and L3 and monitored for symmetry.
If the motor currents differ by >= 33 %, the motor switches off within 2 minutes.
If the motor currents differ by >= 67 % (e.g. phase failure), the motor switches off within 2 seconds.

9 Markings / labels Case

9.1 Label "Serial number" on the side of the module

The diagram describes the shape and structure of the label. The illustration serves only as an example.



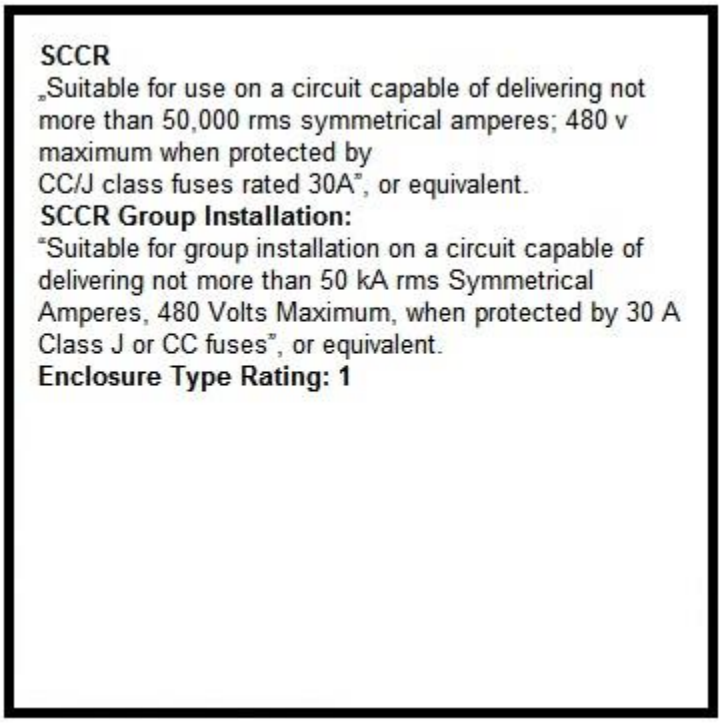
9.2 "WARNING" label on the side of the module

WARNING:
The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller shall be examined and replaced if damaged.
AVERTISSEMENT :
Le déclenchement du dispositif de protection de la dérivation peut signifier qu'un courant de fuite a été interrompu. Pour réduire les risques d'incendie et de choc électrique, les pièces porteuses de courant et autres pièces de la commande doivent être examinées et remplacées au besoin.

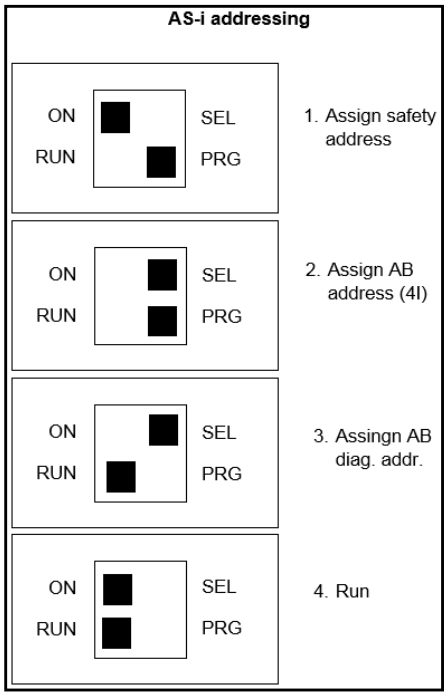
9.3 Label "Name, Ratings, Approvals" on the front of the module

The diagram describes the shape and structure of the label. The illustration serves only as an example. The data can be determined either from the properties or directly from the label on the module

9.4 Ratings "label" (UL-SCCR and Enclosure)



9.5 Label Operating note AS-i module on the inside of the cover



9.6 Label Operating instructions Hybrid motor starter with reversing function on the inside of the cover

Settings Hybrid motor starter

Parameterization - Nominal current setting

- Press the reset button for more than 6 s to change to the „Parameterization" mode. The green PWR LED flashes once.

In the Parameterization mode, the LEDs are switched off every 2 s for 0.3 s to distinguish this mode from other operating modes.

- Set the nominal drive current with the 240° potntiometer. The nominal current is specified in 16 stages. The four LEDs show the set current.
- Store this value by pressing the reset button again (non-volatile area of the mass storage).
- Press the reset button for more than 2 s (and less than 6 s) to display the set current for 3 s. This function is only possible if 1) the device is not activated, and 2) there is no error at the device.

Code				Nominal current [mA]		
PWR	ERR	L	R	ELR H5-...-06	ELR H5-...-2	ELR H5-...-9
0	0	0	0	75	180	1500
0	0	0	1	110	250	2000
0	0	1	0	145	410	2500
0	0	1	1	180	560	3000
0	1	0	0	215	710	3500
0	1	0	1	250	870	4000
0	1	1	0	285	1020	4500
0	1	1	1	320	1170	5000
1	0	0	0	355	1330	5500
1	0	0	1	390	1480	6000
1	0	1	0	425	1630	6500
1	0	1	1	460	1790	7000
1	1	0	0	495	1940	7500
1	1	0	1	530	2090	8000
1	1	1	0	565	2250	8500
1	1	1	1	600	2400	9000

10 Disposal

Important:
Handle and dispose of the equipment and components used correctly.
Dispose of equipment that can no longer be used as special waste.
Comply with national and local directives for disposal.