COMPLETE line

ELR H3-IES-xx/500AC-x-IFS

Networkable motor starter (CONTACTRON)



Data sheet
106266_en_05

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1 Description

The network-capable 3-phase hybrid motor starter with direct start function and current monitoring provides the following functions.

- Forward running
- Motor overload protection
- EMERGENCY STOP to performance level PLe
- Connection to the Interface system via the DIN rail connector (TBUS)

The control command for forward running is received by a communication interface, an EM-xxx-GATEWAY-IFS.

Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.net/products.

This document is valid for the products listed in the “Ordering data”.

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Networkable hybrid motor starter for starting 3~ AC motors up to 500 V AC, output current: 3 A, emergency stop function, adjustable overload shutdown, and Push-in connection, DIN rail connector provided.	ELR H3-IES-PT/500AC-3-IFS	2905142	1
Networkable hybrid motor starter for starting 3~ AC motors up to 500 V AC, output current: 9 A, emergency stop function, adjustable overload shutdown, and Push-in connection, DIN rail connector provided.	ELR H3-IES-PT/500AC-9-IFS	2905143	1
Networkable hybrid motor starter for starting 3~ AC motors up to 500 V AC, output current: 3 A, emergency stop function, adjustable overload shutdown, and screw connection, DIN rail connector provided.	ELR H3-IES-SC/500AC-3-IFS	2905155	1
Networkable hybrid motor starter for starting 3~ AC motors up to 500 V AC, output current: 9 A, emergency stop function, adjustable overload shutdown, and screw connection, DIN rail connector provided.	ELR H3-IES-SC/500AC-9-IFS	2905156	1

Accessories	Type	Item no.	Pcs./Pkt.
Primary-switched power supply unit, QUINT POWER, Screw connection, DIN rail mounting, input: 1-phase, output: 24 V DC / 2.5 A	QUINT4-SYS-PS/1AC/24DC/ 2.5/SC	2904614	1
DIN rail connector, color: gray, nominal current: 8 A (parallel contacts), rated voltage (III/2): 125 V, number of positions: 5, pitch: 3.81 mm, mounting: DIN rail mounting, locking: without, mounting: without, type of packaging: packed in cardboard, Item with gold-plated contacts, bus connectors for connecting with electronics housings, 5 parallel contacts	ME 22,5 TBUS 1,5/ 5-ST-3,81 GY	2201937	50
DIN rail bus adapter for ME and ME-MAX, design width: 22.5 mm, 5 parallel positions, color: light gray (similar to RAL 7035)	ME 22,5 TBUS ADAPTER KMGY	2201756	50
Plastic label, Card, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, mounting type: adhesive, lettering field size: 15 x 5 mm, Number of individual labels: 189	US-EMLP (15X5)	0828790	10
Plastic label, Sheet, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: adhesive, lettering field size: 15 x 5 mm, Number of individual labels: 10	UC-EMLP (15X5)	0819301	10
For more complex applications with Interface system devices (IFS), the extension module offers digital inputs and outputs for processing additional signals in the field. Easy connection to IFS gateway via the DIN rail connector as the slave.	EM-D-8/4-24DC-IFS	2904473	1

Accessories	Type	Item no.	Pcs./Pkt.
3-phase loop bridge for 1 CONTACTRON module, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 1	1161777	1
3-phase loop bridge for 2 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 2	2904490	1
3-phase loop bridge for 3 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 3	2904491	1
3-phase loop bridge for 4 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 4	2904492	1
3-phase loop bridge for 5 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 5	2904493	1
3-phase loop bridge for 6 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 6	2904494	1
3-phase loop bridge for 7 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 7	2904495	1
3-phase loop bridge for 8 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 8	2904496	1
3-phase loop bridge for 9 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 9	2904497	1
3-phase loop bridge for 10 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-PT 10	2904498	1
3-phase loop bridge for 1 CONTACTRON module, with Push-in connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE-PT 1-1M	1161778	1
3-phase loop bridge for 2 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE-PT-2-1M	1049407	1
3-phase loop bridge for 3 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE-PT-3-1M	1049408	1
3-phase loop bridge for 4 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE-PT-4-1M	1049409	1
3-phase loop bridge for 5 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE-PT-5-1M	1049413	1

Accessories	Type	Item no.	Pcs./Pkt.
3-phase loop bridge for 2 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, cable length between the modules: 0.3 m, connecting cable: 2 m	BRIDGE-PT-2-2M/0,3M	1107649	1
3-phase loop bridge for 3 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, cable length between the modules: 0.3 m, connecting cable: 2 m	BRIDGE-PT-3-2M/0,3M	1107650	1
3-phase loop bridge for 4 CONTACTRON modules, with Push-in connection and 22.5 mm housing width, cable length between the modules: 0.3 m, connecting cable: 2 m	BRIDGE-PT-4-2M/0,3M	1107644	1
The BRIDGE COVER covering hood is used to cover unused plugs on the CONTACTRON bridge that may subsequently be used to extend the system. The hood can be used with the screw and Push-in version of the bridge.	BRIDGE COVER	2906240	10
Gateway for the connection of up to 32 INTERFACE system devices to a higher-level controller via PROFIBUS DP. The INTERFACE system devices are connected to the Gateway via DIN rail connectors, the DIN rail connectors are provided.	EM-PB-GATEWAY-IFS	2297620	1
Gateway for the connection of up to 32 INTERFACE system devices to a higher-level controller via CANopen®. The INTERFACE system devices are connected to the Gateway via DIN rail connectors, the DIN rail connectors are provided.	EM-CAN-GATEWAY-IFS	2901504	1
Gateway for the connection of up to 32 INTERFACE system devices via Modbus/TCP to a higher-level controller. The INTERFACE system devices are connected to the Gateway via DIN rail connectors, the DIN rail connectors are provided.	EM-MODBUS-GATEWAY-IFS	2901528	1
Gateway for the connection of up to 32 INTERFACE system devices via PROFINET to a higher-level controller. The INTERFACE system devices are connected to the Gateway via DIN rail connectors, the DIN rail connectors are provided.	EM-PNET-GATEWAY-IFS	2904472	1
Gateway for the connection of up to 32 INTERFACE system devices to a higher-level controller via EtherNet/IP™. The INTERFACE system devices are connected to the Gateway via DIN rail connectors, the DIN rail connectors are provided.	EM-ETH-GATEWAY-IFS	2901988	1
3-phase loop bridge for CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 2	2900746	1
3-phase loop bridge for 3 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 3	2900747	1
3-phase loop bridge for 4 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 4	2900748	1

Accessories	Type	Item no.	Pcs./Pkt.
3-phase loop bridge for 5 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 5	2900749	1
3-phase loop bridge for 6 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 6	2900750	1
3-phase loop bridge for 7 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 7	2900751	1
3-phase loop bridge for 8 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 8	2900752	1
3-phase loop bridge for 9 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE- 9	2900753	1
3-phase loop bridge for 10 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 0.3 m, with ferrules.	BRIDGE-10	2900754	1
3-phase loop bridge for 2 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE- 2-1M	2901542	1
3-phase loop bridge for 3 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE- 3-1M	2901655	1
3-phase loop bridge for 4 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE- 4-1M	2901658	1
3-phase loop bridge for 5 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE- 5-1M	2901544	1
3-phase loop bridge for 6 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 1 m	BRIDGE- 6-1M	2901649	1
3-phase loop bridge for 2 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 2-3M	2901543	1
3-phase loop bridge for 3 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 3-3M	2901656	1
3-phase loop bridge for 4 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 4-3M	2901659	1
3-phase loop bridge for 5 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 5-3M	2901545	1
3-phase loop bridge for 6 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 6-3M	2901697	1

Accessories	Type	Item no.	Pcs./Pkt.
3-phase loop bridge for 7 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 7-3M	2901698	1
3-phase loop bridge for 8 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 8-3M	2901700	1
3-phase loop bridge for 9 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE- 9-3M	2901701	1
3-phase loop bridge for 10 CONTACTRON modules, with screw connection and 22.5 mm housing width, connecting cable: 3 m	BRIDGE-10-3M	2901702	1
3-phase loop bridge for 2 CONTACTRON modules, with screw connection and 22.5 mm housing width, cable length between the modules: 0.3 m, connecting cable: 2 m	BRIDGE- 2- 2M/0,3M	2909897	1
3-phase loop bridge for 3 CONTACTRON modules, with screw connection and 22.5 mm housing width, cable length between the modules: 0.3 m, connecting cable: 2 m	BRIDGE- 3- 2M/0,3M	2909898	1
3-phase loop bridge for 4 CONTACTRON modules, with screw connection and 22.5 mm housing width, cable length between the modules: 0.3 m, connecting cable: 2 m	BRIDGE- 4- 2M/0,3M	2909899	1

4 Technical data

Device supply	
Rated control circuit supply voltage U_S	24 V DC
Control supply voltage range	19.2 V DC ... 30 V DC
Rated control supply current I_S	60 mA
Protective circuit	Surge protection Reverse polarity protection Parallel polarity protection diode
Enable input	
Rated actuating voltage U_C	24 V DC
Rated actuating current I_C	7 mA
Switching threshold	9.6 V (“0” signal) 19.2 V (“1” signal)
Switching level	< 5 V DC (For EMERGENCY STOP)
Typical turn-off time	< 30 ms
Protective circuit	Reverse polarity protection
AC output	
Rated operating voltage U_e	500 V AC (50/60 Hz)
Operating voltage range	42 V AC ... 550 V AC
Load current range see to derating	180 mA ... 3 A / 1.5 A ... 9 A
Trigger characteristic in acc. with IEC 60947-4-2	Class 10 / Class 10A
Cooling time	20 min. (for auto reset)
Rated operating current I_e AC-51	3 A / 9 A
Rated operating current I_e AC-53a	3 A / 7 A
Leakage current	0 mA / 0 mA
Protective circuit	Surge protection Varistor
Status and diagnostics indicators	
Status display	Yellow LED
Error indication	Red LED
Operating voltage display	Green LED
General data	
Mounting position	vertical (horizontal DIN rail, motor output below)
Mounting	alignable, for spacing see derating
Operating mode	100% operating factor
Degree of protection	IP20
Power dissipation min./max.	0.88 W / 4.1 W ; 0.88 W / 7 W
Dimensions W/H/D	22.5 mm / 107.5 mm / 114 mm

Connection data	Push-in connection	Screw connection
Connection name	**Control circuits**	**Control circuits**
Conductor cross section, rigid	0.2 mm² ... 2.5 mm²	0.2 mm² ... 2.5 mm²
Conductor cross section, flexible	0.2 mm² ... 2.5 mm²	0.2 mm² ... 2.5 mm²
Conductor cross section [AWG]	24 ... 14	24 ... 14
Tightening torque		0.5 Nm ... 0.6 Nm / 5 lb_f-in. ... 7 lb_f-in.
Connection name	**Load circuit**	**Load circuit**
Conductor cross section, rigid	0.2 mm² ... 2.5 mm²	0.2 mm² ... 2.5 mm²
Conductor cross section, flexible	0.2 mm² ... 2.5 mm²	0.2 mm² ... 2.5 mm²
Conductor cross section [AWG]	24 ... 14	24 ... 14
Tightening torque		0.5 Nm ... 0.6 Nm / 5 lb_f-in. ... 7 lb_f-in.
Stripping length	10 mm	8 mm

Ambient conditions	
Ambient temperature (operation)	-5 °C ... 60 °C (observe derating)
Ambient temperature (storage/transport)	-40 °C ... 80 °C

Standards/regulations	
Standards	IEC 60947-1 EN 60947-4-2 IEC 61508 ISO 13849

Insulation characteristics	
Rated insulation voltage	550 V
Rated surge voltage / insulation	6 kV
Insulation characteristics between the control input and control supply voltage, and auxiliary circuit to the main circuit	Safe isolation (IEC 60947-1)
Isolation characteristics between the control input and control supply voltage to auxiliary circuit	Safe isolation (IEC 60947-1) in the auxiliary circuit ≤ 300 V AC
Degree of pollution	2
Overvoltage category	III

Conformance/approvals	
UKCA UKCA-compliant	
ATEX PTB 15 ATEX 3000	Ⓔx II (2) G [Ex eb] [Ex db] [Ex pxb] Ⓔx II (2) D [Ex tb] [Ex pb]
UL approval NLDX.E228652	
Safety Integrity Level (SIL, IEC 61508) Safe shutdown	≤ 3
Safety Integrity Level (SIL, IEC 61508) Motor protection	2
Performance Level (ISO 13849) Safe shutdown	e
Category (ISO 13849) Safe shutdown	≤ 3

5 Safety regulations and installation notes

- When working on the device, observe the national safety and accident prevention regulations.
- Disregarding these safety regulations may result in death, serious personal injury or damage to equipment.
- Startup, mounting, modifications, and upgrades should only be carried out by a skilled electrical engineer!
- Disconnect the power to the module.
- For emergency stop applications, the machine must be prevented from restarting automatically by a higher-level control system.
- During operation, parts of electrical switching devices carry hazardous voltages.
- During operation, the protective covers must not be removed from the electric switchgear.
- Keep the product documentation in a safe place.
- The device is an associated item of equipment. Do not install the device in potentially explosive areas. When installing and operating associated equipment, the applicable safety directives must be observed.
- Observe the safety regulations that are applicable when motors are used in the Ex area (ATEX directive 2014/34/EU).
- If you use the "Automatic RESET" mode, the drive is switched on again after the cooling time has expired - if a control signal is still present. The cooling time is 20 minutes. For applications in the Ex-protection area, automatic restart is not permitted.
- The device may not be exposed to mechanical or thermal influences that exceed the limits as described in the operating instructions. To protect against mechanical or electrical damage, install the device in an appropriate housing with a suitable degree of protection (at least IP54) in accordance with IEC 60529/ EN 60529. Where dust is present, the device must be installed in suitable housing (at least IP64) in accordance with EN 60079-14.
- Install the device according to the instructions in the installation instructions. Access to circuits within the device is not permitted.
- The operating equipment cannot be repaired by the user and must be replaced by an equivalent device. Repairs may only be carried out by the manufacturer.
- Observe the safety information, conditions, and limits of use specified in the product documentation. Comply with them.
- The device performs a diagnosis of the functions when the drive is switched on or has been switched off. In addition, an authorized electrician or a skilled worker who is well acquainted with the relevant standards can conduct the "Motor protection" safety function test. For this test, the drive must be activated, and the current flow in a conductor must be interrupted (e.g. by removing the fuse in the L1 or L3 phase). The hybrid motor starter then switches off the drive within 1.5 to 2 s. The LED for forward running goes off, the DIAG LED is activated, and the confirmation can be retrieved via the bus.
- Secure the device during safety-related applications with an access protection.
- Only use power supply units with safe isolation with SELV / PELV voltage in accordance with EN 60950-1 / EN 60204 (SELV / PELV). They prevent short circuits between primary and secondary sides.
- Observe the minimum permissible load current in safety-related applications:
  ELR H3-.../500AC-3: ≥ 180 mA
  ELR H3-.../500AC-9: ≥ 1.5 A

Area of application

- In circuits in potentially dust-explosive areas of zones 21 and 22, it must be guaranteed that the equipment connected to this circuit complies with category 2D or 3D or is certified as such.
- This is a product for environment A (industry). The device can cause unwanted radio interference if used in Class B environments (household). In this case, the user may be obligated to take the necessary precautionary measures.

5.1 UL note

WARNING: Risk of electric shock and fire

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 the other components of the controller should be examined and replaced if damaged.

Failure to follow instructions can result in death, serious injury, or equipment damage.

NOTE

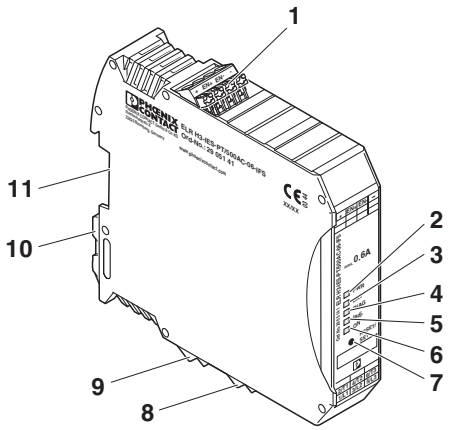
For use with a "low voltage, limited energy, isolated power supply" use copper cables approved to at least 75 °C.

The device is designed for use with a "low voltage, limited energy, isolated power supply".

SCCR (single and group installation)	
Suitable for use on a circuit with a maximum of 5 kA rms symmetrical amperes and ≤ 480 V, with 20 A fuses rated RK5 (coordination type 1).	
Suitable for use on a circuit with a maximum of 100 kA rms symmetrical amperes and ≤ 480 V, with 30 A fuses rated J or rated CC (coordination type 1).	
FLA	0,6 A (480 V AC) / 3 A (480 V AC) / 7,6 A (480 V AC)

6 Operating and indication elements

Figure 1 Operating and indication elements



1 Enable: Safety-related input
2 LED green PWR: Device status
3 LED green DAT: Bus communication
4 LED red/yellow DIAG: Device or process error
5 LED yellow I adj.: Current adjustment
6 LED yellow ON: Forward running
7 Reset button
8 3-phase output voltage
9 3-phase input voltage
10 Metal lock for fixing to DIN rail
11 Connection option for DIN rail connector

7 Connection notes

WARNING: Danger to life by electric shock!
Never carry out work when voltage is present.

7.1 Mains connection and line protection

- When connecting the 3-phase network, it is essential to observe the terminal identification.
- The following specifications apply for the fuses used.

16 A gG / 50 kA / 500 V	Coordination type 1
30 A CCMR30 50 kA / 500 V	Coordination type 1
FAZ-B16/3 2.5 kA / 400 V	Coordination type 1
PKM0-4 50 kA / 415 V	Coordination type 1
PKM0-6,3 15 kA / 415 V	Coordination type 1

- The control supply voltage and control voltage inputs must be operated with power supply modules according to IEC 61131-2 (max. 5 % residual ripple).
- In order to avoid inductive or capacitive coupling of noise emissions where long control wires are used, we recommend the use of shielded conductors.

NOTE: Electrical safety

Screw connection:

Only connect conductors with the same conductor cross section to a terminal point.

Push-in connection:

Only connect a conductor to a terminal point or use conductors with the same conductor cross section ferrules.

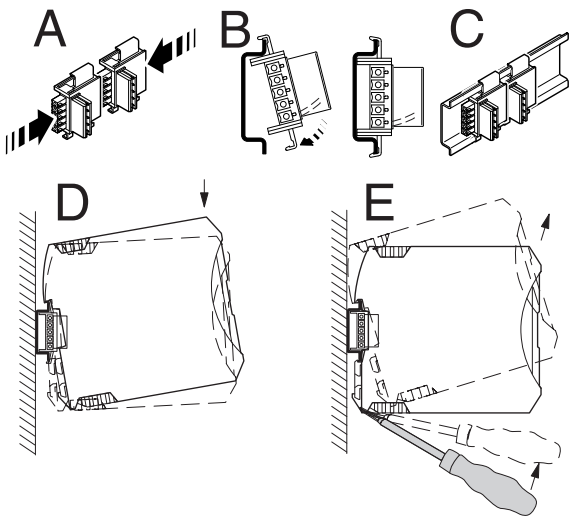
7.2 Mounting

The TBUS DIN rail connector makes the INTERFACE system communication and/or power supply of individual INTERFACE system devices possible.

NOTE

The use of the TBUS DIN rail connector for the supply of modules is only possible with 24 V DC devices.

Figure 2 Mounting



Connect the required number of TBUS DIN rail connectors (Item No. 2707437) together.

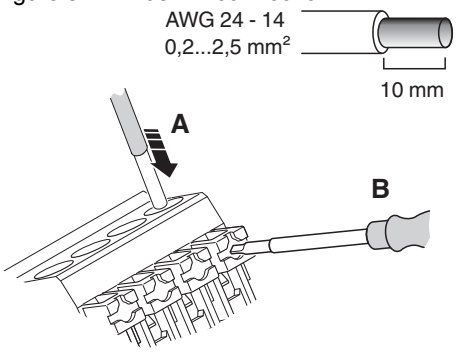
When placing the gateway onto the DIN rail, make sure that it is aligned correctly with the TBUS.

Power is supplied on the gateway or a power terminal. Observe the permissible current carrying capacity.

7.3 Connecting cables

Push-in connection:

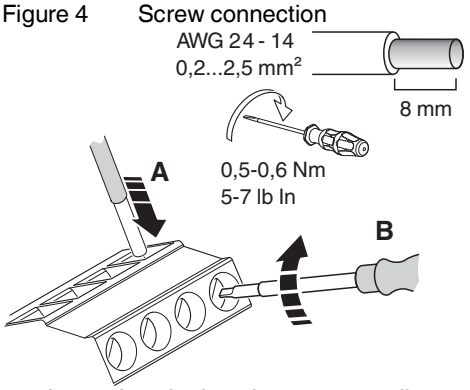
Figure 3 Push-in connection



Insert solid or stranded conductors with ferrules directly in the clamping space (A). Reliable contact can be made with stranded conductors without ferrules by opening the spring beforehand using the pushbutton (B). Press the pushbutton (B) also to release the conductor.

Screw connection:

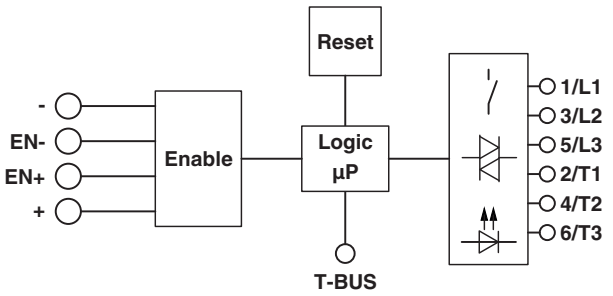
Figure 4 Screw connection



- Insert the wire into the corresponding connection terminal block.
- Use a screwdriver to tighten the screw in the opening above the connection terminal block.

7.4 Block diagram

Figure 5 Block diagram



7.5 Setting and displaying the interface system address

For further information, please refer to the product documentation for the EM-xxx-GATEWAY-IFS modules at phoenixcontact.net/products.

7.6 Enable input

In order make the motor connected to the device operational, you must issue the release to the device via the Enable input.

As soon as a valid signal is applied to the Enable input (terminals EN+ and EN-), the device receives control commands via the bus connection.

With non-safety-related applications, you can also issue the release by bridging terminals (EN-) and (-) and terminals (EN+) and (+).

Voltage interruptions (blanking) ≤ 3 ms or voltage pulse (unblanking) ≤ 4 ms are filtered.

8 Function

8.1 Status and diagnostics indicators

The device visualizes the operating statuses with a total of five LEDs.

LED PWR	Green	Device status
LED DAT	Green	Bus communication
LED DIAG	Red/yellow	Device or process error
LED $I_{adj.}$	Yellow	Current adjustment
LED ON	Yellow	Forward running

After applying the control supply voltage, all LEDs light up once as an LED test.

8.2 Diagnostic function

Various diagnostic functions enable the hybrid motor starter to detect many internal errors and also external errors (I/O errors).

If an error is detected, the device is switched to the safe shutdown state.

You cannot acknowledge internal errors. They are stored in the device. Afterwards the device cannot be started up again.

In case of external errors, an error acknowledgment is required to exit the safe shutdown state.

Explanation: A = LED switched off, Aut = automatic, B = LED flashes, B_r = LED flashes red, B_{ye} = LED flashes yellow, E = LED shines continuously, E_{ye} = LED shines yellow, E_r = LED shines red, Man = manual, Ne = not required, Nm = not possible, X = arbitrary state

Status	Description	PWR	DAT	DIAG	$I_{adj.}$	ON	Acknowledgment
Off	Supply voltage not present	A	A	A	A	A	Ne
Ready to operate, enable = 0	Supply voltage present, release has not been issued	B	X	X	X	X	Ne
Ready to operate, enable = 1	Supply voltage present, release has been issued	E	X	X	X	X	Ne
No bus	Device is not integrated into a bus.	E / B	A	X	X	X	Ne
Data traffic	Device is integrated into bus; cyclic or acyclic communication occurs.	E / B	E	X	X	X	Ne
Parameterization	Parameterization of device occurs	E	B	X	X	X	Ne
Drive switched on	Forward running (ON)	E	E	A	A	E	Ne
Internal error	Internal device error - **device replacement required**	B	B	E_r	B	B	Nm
External error in controller or I/O devices (maintenance requirement)	**Motor protection function**: The motor current is higher than the motor nominal current specification: Cooling time elapsing (20 minutes)						
	Error during forward running	E	X	B_{ye}	A	E	Aut
	A manual reset is possible (after approx. 2 min)						
	Error during forward running	E	X	B_{ye}	A	B	Man
	Error when restoring the system state: Manual acknowledgment possible after 2 min.				Message via bus or DTM		
	Symmetry: The two motor currents deviate from each other by more than 33 %.	E	X	B_{ye}	A	A	Man
	Blocking: The max. measurable motor current is exceeded for more than 2 s.						
	Error during forward running	E	X	B_{ye}	A	E	Man
No current flow with control	No current is measured when power amplifier activated						
	During forward running	E	X	A	A	B	Ne
Configuration errors	It is determined during installation of the device that the configuration is faulty. Load the correct configuration.	E / B	X	B_{ye}	A	A	Nm

Error acknowledgment

The following options are available for error acknowledgment.

Manual (reset button)

Press the reset button on the front of the device.

When pressing the reset button for more than 2 s (approximately), the device returns to the error state.

Manual (remote acknowledgment via the bus)

You can perform the manual reset via the bus.

Automatic (parameterization via the bus)

If you parameterize this function, the device automatically acknowledges motor protection trippings after 20 minutes.

Feedback

As soon as the device detects an error or signals a message, you can retrieve this information via the bus or the DTM.

8.3 Parameterization - Nominal current setting

- During commissioning, configure the device with a nominal current that matches the connected motor either via the bus (all process data permitted) or a DTM.

See also the “Process data > Nominal motor current setting” section.

- Check the current value with the LEDs.

When setting the nominal current, the PWR LED flashes green. The other LEDs (DAT, DIAG, L, R) light up in a specific combination depending on the current setting value.

Bit				Nominal current [mA]		
3	2	1	0			
DAT	DIAG	$I_{adj.}$	ON	0.6 A	3 A	9 A
0	0	0	0	75	180	1500
0	0	0	1	110	300	2000
0	0	1	0	145	440	2500
0	0	1	1	180	600	3000
0	1	0	0	215	680	3500
0	1	0	1	250	880	4000
0	1	1	0	285	1000	4500
0	1	1	1	320	1100	5000
1	0	0	0	355	1200	5500
1	0	0	1	390	1500	6000
1	0	1	0	425	1600	6500
1	0	1	1	460	1900	7000
1	1	0	0	495	2100	7500
1	1	0	1	530	2400	8000
1	1	1	0	565	2700	8500
1	1	1	1	600	3000	9000

- Press the reset button to store the current value. When using a process datum for configuring the nominal current, a reset command via process data is also permitted.
- If you want to acknowledge the new nominal current via a process data item, you must read and check the LED image that shows the desired current value.
- You can then confirm the new nominal current via the process data item.

- Reading must be performed acyclically.
  The target registers are 0x7850 (low word) and 0x7851 (high word).

	Low word	High word	Nominal current [mA]		
Address	**0x7850**	**0x7851**	**0.6 A**	**3 A**	**9 A**
Value	0x0002	0x0000	75	180	1500
	0x0002	0x0100	110	300	2000
	0x0002	0x0010	145	440	2500
	0x0002	0x0110	180	600	3000
	0x0002	0x0001	215	680	3500
	0x0002	0x0101	250	880	4000
	0x0002	0x0011	285	1000	4500
	0x0002	0x0111	320	1100	5000
	0x0102	0x0000	355	1200	5500
	0x0102	0x0100	390	1500	6000
	0x0102	0x0010	425	1600	6500
	0x0102	0x0110	460	1900	7000
	0x0102	0x0001	495	2100	7500
	0x0102	0x0101	530	2400	8000
	0x0102	0x0011	565	2700	8500
	0x0102	0x0111	600	3000	9000

- If you do not press the reset button or send the reset command via a process datum, the current value stored in the device will not change.

NOTE

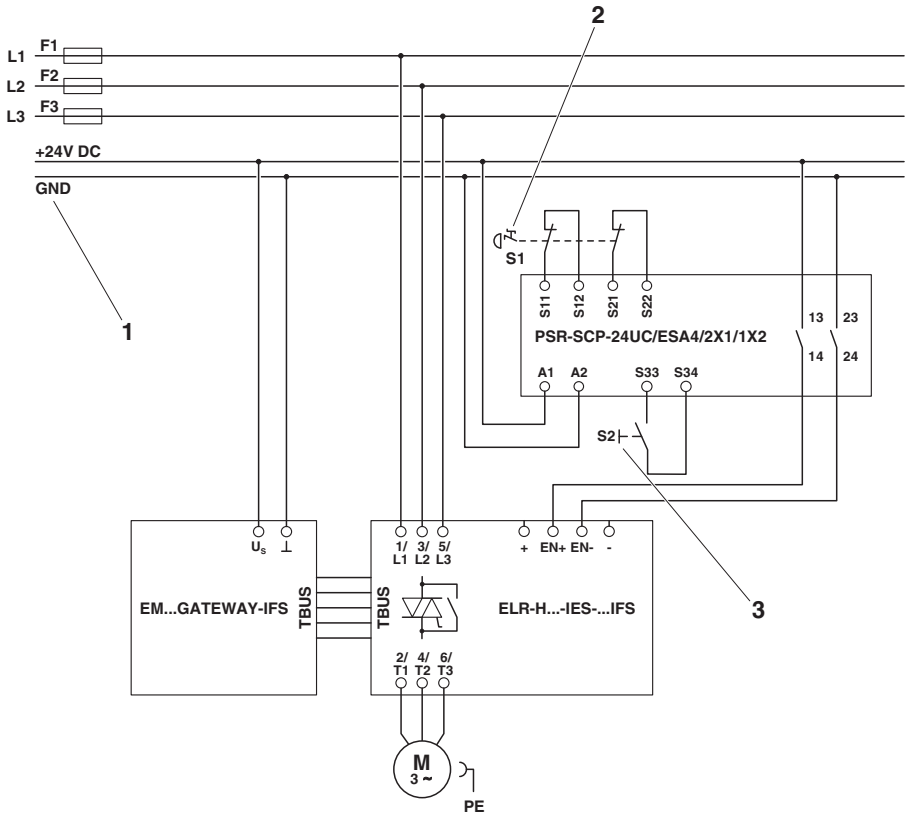
Lock monitoring is activated from a motor current of 56 A.

9 Application examples

9.1 Emergency stop/safety door monitoring

The hybrid motor starter can be integrated in an emergency stop chain or in applications where safety shutdown is a normal operating state, e.g., for safety door or two-hand applications.

Figure 6 Emergency stop



1 Supply 1

2 Emergency stop

3 Reset button

The enable inputs are switched off via a safety relay as soon as the emergency stop button is actuated.

If shutdown is performed, e.g., from a “safe controller” with semiconductor outputs, the residual voltage must be < 5 V DC.

Voltage interruptions (blanking) ≤ 3 ms or voltage pulse (unblanking) ≤ 4 ms are filtered.

9.2 Motor protection

All safety-related functions are implemented by the hybrid motor starter without external influences. Special circuit technology is not required.

If the motor currents deviate by ≥ 33%, the device shuts the motor down within 2 minutes.

If the motor currents deviate by ≥ 67% (e.g. phase failure), the device shuts the motor down within 2 seconds.

The deviation can be calculated using the following formulas.

Value (I_{max}) > I_{nom} ⇒ (I_{max} - I_{min})/I_{max}

Value (I_{max}) < I_{nom} ⇒ (I_{max} - I_{min})/I_{nom}

In the event of high clock rates, the motor protection function may trip due to the increased switch-on currents

9.3 Motor with brake

If a motor with brake (connection in the motor terminal board) is connected, the 400 V AC brake must be linked to the 2/T1 and 6/T3 terminals. A 230 V AC brake must be connected to the 4/T2 terminals and the star point of the motor.

NOTE

Increase motor current monitoring to the nominal brake current. This should be set accordingly on the hybrid motor starter.

9.4 Auxiliary relay connection

Auxiliary relay (e. g. PLC RSC 230UC/21,
Item No.: 2966207) for activating external brakes or acknowledgements, e. g. to the PLC, must be connected to the 4T2 and N connections of the system.

10 Configuration

You can either configure the module via the controller used or via the S-PORT on the connected EM-xx-GATEWAY-IFS using the CONTACTRON-DTM-IFS software.

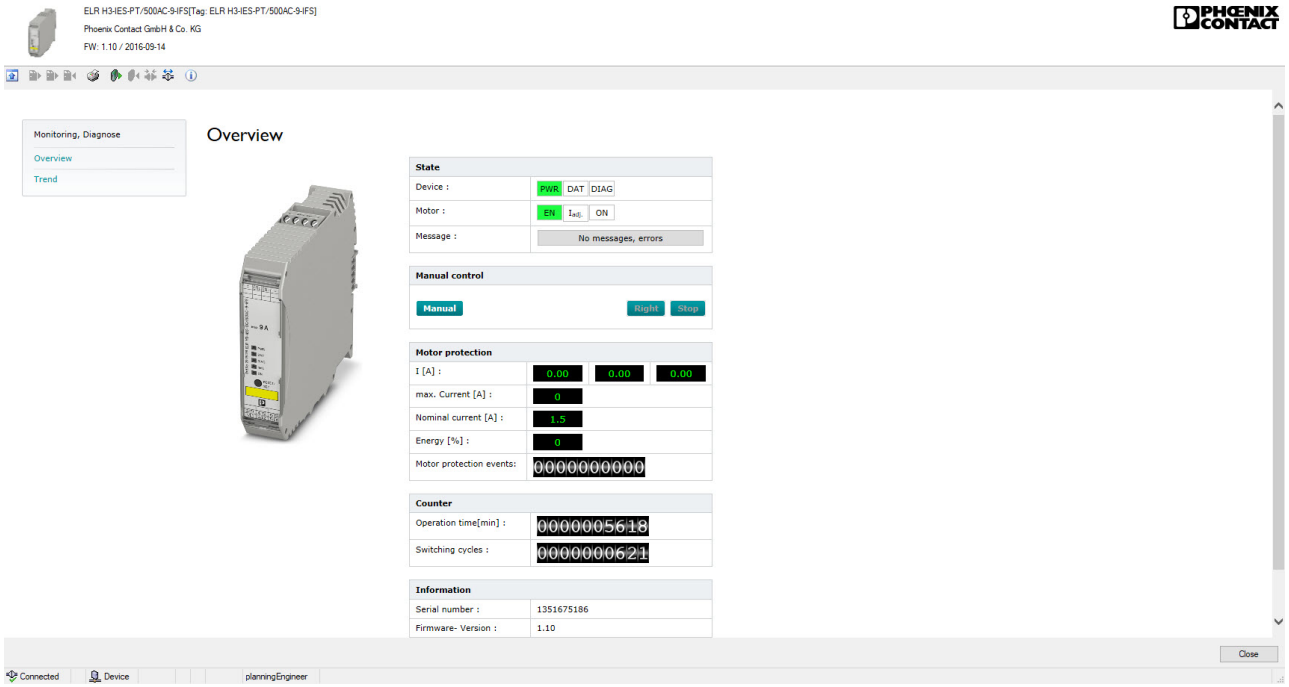
This section describes the CONTACTRON-DTM-IFS software.

A quick start guide can be downloaded for the product at phoenixcontact.net/products.

10.1 Overview

The overview dialog box displays all the operating data and status messages that provide initial information. This overview provides a quick and comprehensive summary of the system state.

Figure 7 Overview dialog box



Area	Value	Description
Status	PWR	Device status
	DAT	Bus communication
	DIAG	Device or process error
	EN	Status enable input
	$I_{adj.}$	Current adjustment
	ON	Forward running
Manual control	Manual	Manual control
	Right	Manual control, forward running
Motor protection	I [A]	Display of the current of the three phases
	max. current [A]	Display of the currently highest motor current of the three phases
	Nominal current [A]	Display of the set nominal motor current
	Power [%]	Display of the thermal replica of the motor
	Motor protection events	Display of the number of motor protection trips
Counter	Operating time [min]	Display of operating times
	Cycles	Display of cycles
Information	Serial number	Display of the serial number of the module used
	Firmware version	Display of the firmware version of the module in use
	Hardware version	Display of the hardware version of the module used

10.2 Trend

The trend dialog box displays the current flow of the motor.

Figure 8 Trend dialog box

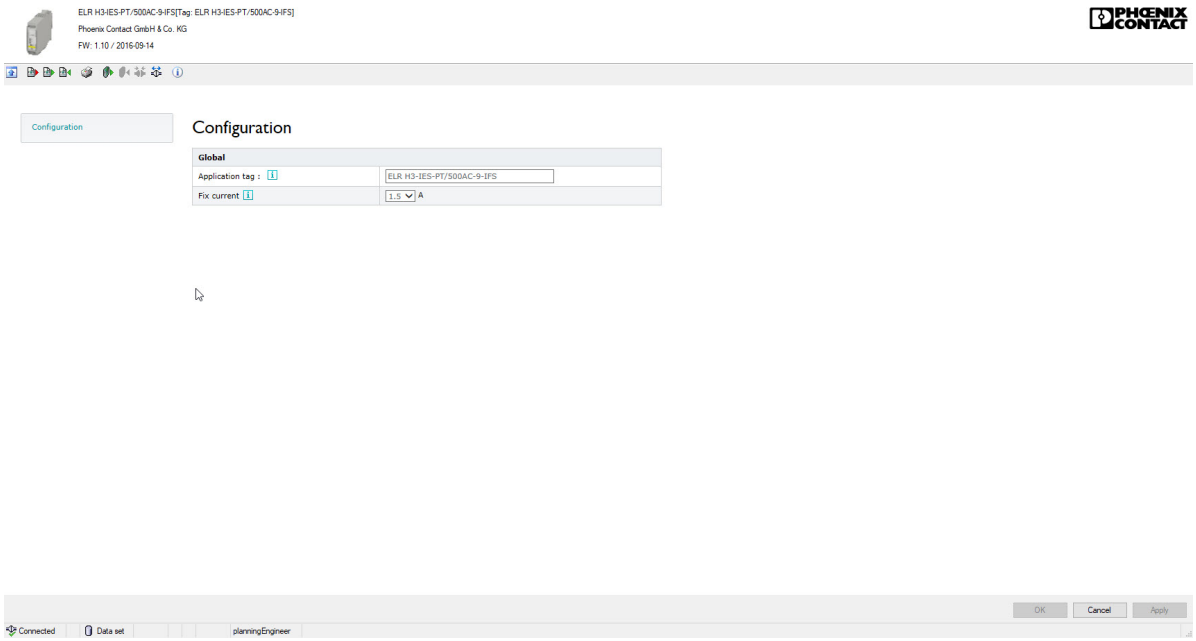


Area	Value	Description
Trend	Motor current	Current current flow of the three phases

10.3 Configuration

You can make the settings for the configuration in the configuration dialog box and confirm them with “OK”.

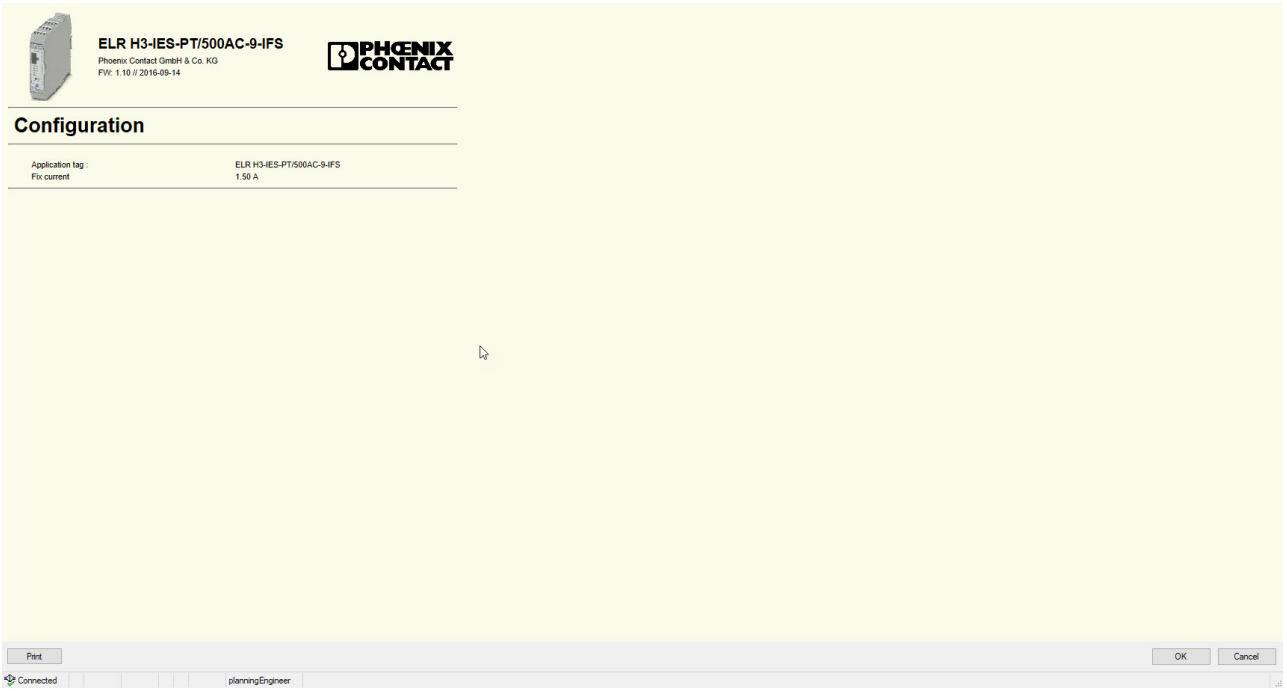
Figure 9 Configuration



Area	Value	Description
General	AKZ	System ID, max. 32 characters
	Nominal motor current	Nominal motor current setting - you must confirm the value on the device by pressing the reset button

A window appears containing an overview of your configuration.

Figure 10 Configuration



Confirm this configuration with “OK” and the data will be transferred to the device.

The data from the device is applied by pressing the reset button.

If the supply voltage is interrupted before the reset button is pressed, the device restarts at the same point on the next startup and waits for confirmation.

“Cancel” makes the configuration in the device invalid and the device enters the “Invalid configuration” error state.

A voltage reset must be performed in order to remove this error state.

11 Process data

In addition to the cyclical input and output bytes, acyclic objects can also be read out/written via the electronic hybrid motor starter.

11.1 Firmware Version 1.0

The following process data is available as of firmware version 1.0.

11.1.1 Device state

PDC	Bit	Description	Value
DEVICE_STATE	0	Device in controllable state	0: device can be controlled
			1: device cannot be controlled (motor protection has been tripped or an internal error has occurred)
	1	Right direction of rotation is activated	0: no device control for forward running
			1: device control for forward running
	2	Reserved	
	3	Enable signal	0: the external enable signal is not available or an internal device error is present
			1: the external enable signal is available (high)
	4	Acknowledgment of the nominal current via the bus	0: Acknowledgment not permitted
			1: Acknowledgment permitted
	6 ... 5	Reserved	
	7	Internal device error	0: device has no internal error
			1: device is in an internal device error state
	15 ... 8	Reserved	

11.1.2 Set nominal motor current

PDC	Bit	Description	Value
FIX_CURRENT	3 ... 0	Query set nominal motor current	0000: smallest value overload trip
			1111: largest value overload trip

11.1.3 Largest phase current [%]

PDC	Bit	Description	Value
CURRENT_MAX_PERC	7 ... 0	Current largest current of the three phases as a percentage, in relation to the set nominal current	0 % ... 255 %

11.1.4 Thermal load

PDC	Bit	Description	Value
THERMAL_LOAD	7 ... 0	Current load of the motor model as a percentage (max. 255 %)	0 % ... 255 %

11.1.5 Largest phase current [A]

PDC	Bit	Description	Value
CURRENT_MAX_AMP	15 ... 0	Current largest current of the three phases in amps	Current value in 10 mA, e.g.: 1267 = 12.67 A

11.1.6 Phase current L1 [%]

PDC	Bit	Description	Value
CURRENT_L1	7 ... 0	Current current of phase L1 as a percentage, in relation to the set nominal motor current	0 % ... 255 %

11.1.7 Phase current L2 [%]

PDC	Bit	Description	Value
CURRENT_L2	7 ... 0	Current current of phase L2 as a percentage, in relation to the set nominal motor current	0 % ... 255 %

11.1.8 Phase current L3 [%]

PDC	Bit	Description	Value
CURRENT_L3	7 ... 0	Current current of phase L3 as a percentage, in relation to the set nominal motor current	0 % ... 255 %

11.1.9 Channel status

PDC	Bit	Description	Value
CHN_STATE_HI	14 ... 0	Reserved	
	15	Current channel status high word, reset status	0: channel status reset is not possible
			1: Channel status reset is possible
CHN_STATE_LO	0	Overload pre-warning	0: no overload pre-warning (thermal load < 105%)
			1: Overload advance warning (thermal load > 105%)
	1	Overload	0: no overload (thermal load < 115%)
			1: overload (thermal load > 115%)
	2	Blocking	0: no blocking
			1: blocking
	3	Phase imbalance ≥33% and < 67%	0: phase imbalance < 33%
			1: phase imbalance ≥ 33% and < 67%
	4	Phase imbalance ≥67%	0: phase imbalance ≥67%
			1: phase imbalance ≥67%
	5	Phase failure	0: all phases present
			1: Phase failure
	6	Mains power failure	0: all phases present
			1: Failure of all three phases
	15 ... 7	Reserved	

11.1.10 Counter overload trips

PDC	Bit	Description	Value
TRIP_CNT_LO	15 ... 0	Counter for overload trips low word (32-bit)	0000: smallest value overload trip
			1111: largest value overload trip
TRIP_CNT_HI	31 ... 16	Counter for overload trips high word (32-bit)	0000: smallest value overload trip
			1111: largest value overload trip

11.1.11 Operating cycle counters

PDC	Bit	Description	Value
SWITCH_CNT_LO	15 ... 0	Operating cycle counter low word (32-bit)	0000: smallest value operating cycle counter
			1111: largest value operating cycle counter
SWITCH_CNT_HI	31 ... 16	Operating cycle counter high word (32-bit)	0000: smallest value operating cycle counter
			1111: largest value operating cycle counter

11.1.12 Emergency tripping counter

PDC	Bit	Description	Value
BLOCK_CNT_LO	15 ... 0	Counter for emergency tripping low word (32-bit)	0000: smallest value emergency tripping
			1111: largest value emergency tripping
BLOCK_CNT_HI	31 ... 16	Emergency tripping counter high word (32-bit)	0000: smallest value emergency tripping
			1111: largest value emergency tripping

11.1.13 Motor control and reset (level-triggered)

PDC	Bit	Description	Value
CONTROL_SWITCH	0	Forward running (level-triggered/switch)	0: forward running stop
			1: forward running start
	1	Reserved	
	2	Manual reset	0: no function
			1: manual reset
	3	Automatic reset	0: no function
			1: automatic reset
	15 ... 4	Reserved	

11.1.14 Nominal motor current setting

See also the “Parameterization: nominal current setting” section.

PDC	Bit	Description	Value
SET_FIX_CURRENT	3 ... 0	Nominal motor current setting	0000: smallest nominal current setting
			1111: largest nominal current setting
	14 ... 4	Reserved	
	15	Identification for valid nominal current setting	0: no valid nominal current setting
			1: valid nominal current setting

11.1.15 Motor control and reset (edge-triggered)

PDC	Bit	Description	Value
CONTROL_BUTTON	0	Reserved	
	1	Stop (edge-controlled/button)	0: no stop
			1: stop
	2	Forward running (edge-controlled/button)	0: no forward running start
			1: forward running start
	3	Automatic reset	0: no automatic reset
			1: automatic reset
	5 ... 4	Reserved	
	6	Manual reset	0: no function
			1: manual reset
	15 ... 7	Reserved	

11.2 Firmware Version 1.1

The following process data is available as of firmware version 1.1.

11.2.1 Extended device state

PDC	Bit	Description	Value
DEVICE_STATE_ALL	0	Device in controllable state	0: device can be controlled
			1: device cannot be controlled (motor protection has been tripped or an internal error has occurred)
	1	Right direction of rotation is activated	0: no device control for forward running
			1: device control for forward running
	2	Reserved	
	3	Enable signal	0: the external enable signal is not available or an internal device error is present
			1: the external enable signal is available (high)
	4	Acknowledgment of the nominal current via the bus	0: Acknowledgment not permitted
			1: Acknowledgment permitted
	5	Reset command	0: A reset is not possible or not required
			1: A reset is possible or required
	6	Acknowledgment for nominal current 1 expected	0: nominal current 1 acknowledged
			1: acknowledgment for nominal current 1 expected
	7	Internal device error	0: device has no internal error
			1: device is in an internal device error state
	8	Reserved	
	9	Overload pre-warning	0: no overload pre-warning (thermal load < 105%)
			1: Overload advance warning (thermal load > 105%)
	10	Overload	0: no overload (thermal load < 115%)
			1: overload (thermal load > 115%)
	11	Blocking	0: no blocking
			1: blocking
	12	Phase imbalance ≥33% and < 67%	0: phase imbalance < 33%
			1: phase imbalance ≥ 33% and < 67%
	13	Phase imbalance ≥67%	0: phase imbalance ≥67%
			1: phase imbalance ≥67%
	14	Phase failure	0: all phases present
			1: Phase failure
	15	Mains power failure	0: all phases present
			1: Failure of all three phases

11.2.2 Extended motor control (level-triggered) with reset and nominal current setting

PDC	Bit	Description	Value
CTRL_SWITCH_ALL	0	Forward running (level-triggered/switch)	0: forward running stop
			1: forward running start
	1	Reserved	
	2	Manual reset	0: no function
			1: manual reset
	3	Automatic reset	0: no automatic reset
			1: automatic reset
	7 ... 4	Reserved	
	11 ... 8	Nominal motor current setting	0000: smallest nominal current setting
			1111: largest nominal current setting
	14 ... 12	Reserved	
	15	Identification for valid nominal current setting	0: no valid nominal current setting
			1: valid nominal current setting

11.2.3 Extended motor control (edge-controlled) with reset and nominal current setting

PDC	Bit	Description	Value
CTRL_BUTTON_ALL	0	Reserved	
	1	Stop (edge-controlled/button)	0: no stop
			1: stop
	2	Forward running (edge-controlled/button)	0: no forward running start
			1: forward running start
	3	Automatic reset	0: no automatic reset
			1: automatic reset
	5 ... 4	Reserved	
	6	Manual reset	0: no function
			1: manual reset
	7	Reserved	
	11 ... 8	Nominal motor current setting	0000: smallest nominal current setting
			1111: largest nominal current setting
	14 ... 12	Reserved	
	15	Identification for valid nominal current setting	0: no valid nominal current setting
			1: valid nominal current setting

12 Safety functions

System conditions	
Database for failure rates	SN 29500
System type (consisting of subsystems)	Type B
Standard used	IEC 61508
Beta factor	1 %
MTTF [years] (mean time to failure at ambient temperature of 40°C)	36

12.1 Safe shutdown

HFT (hardware fault tolerance)	1
Ambient temperature	40 °C
$MTTF_D$ [years] - mean time to dangerous failure	164
Shutdown time [ms]	200
λsu [FIT] - safe, undetectable	1311
λdd [FIT] - dangerous, detectable	694
λdu [FIT] - dangerous, undetectable	0.1
SFF [%] - safe failure fraction	99
DC [%] - diagnostic coverage	99
PFH_D [FIT] probability of a dangerous failure per hour	0.1
PFD_{avg} (6 months/36 months) Average Probability of Failure on Demand	$0{:}5 * 10^{-6}$ / $2{:}9 * 10^{-6}$
Safety level according to	IEC/CEI 61508-1: up to SIL 3
	ISO 13849-1: up to category 3 PL e

12.2 Motor protection

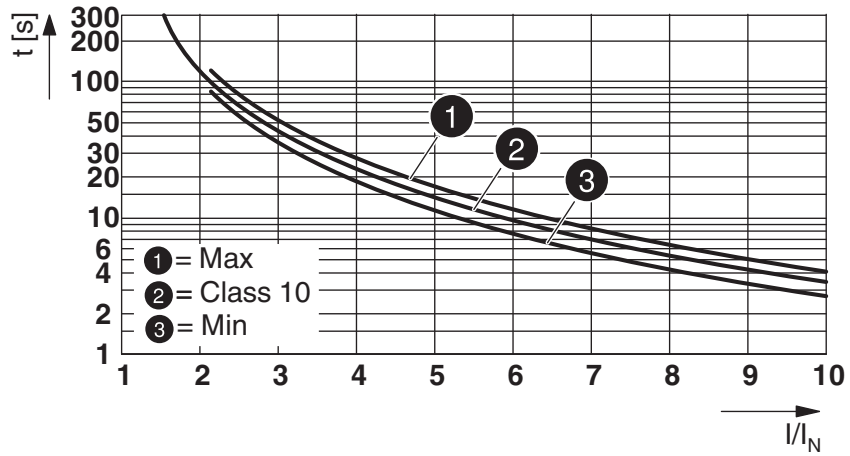
HFT (hardware fault tolerance)	0
Ambient temperature	40 °C
$MTTF_D$ [years] - mean time to dangerous failure	201
Shutdown time [ms]	According to Class 10/10A, IEC/CEI 60947
λsu [FIT] - safe, undetectable	1044
λdd [FIT] - dangerous, detectable	558
λdu [FIT] - dangerous, undetectable	9
SFF [%] - safe failure fraction	99
DC [%] - diagnostic coverage	98
PFD_{avg} (6 months/36 months) Average Probability of Failure on Demand	$0.04 * 10^{-3}$ / $0.24 * 10^{-3}$
Safety level according to	IEC/CEI 61508-1: up to SIL 2

Additional safety data is available on request.

13 Trigger characteristic

0.6 A and 3 A modules

Figure 11 Trigger characteristic

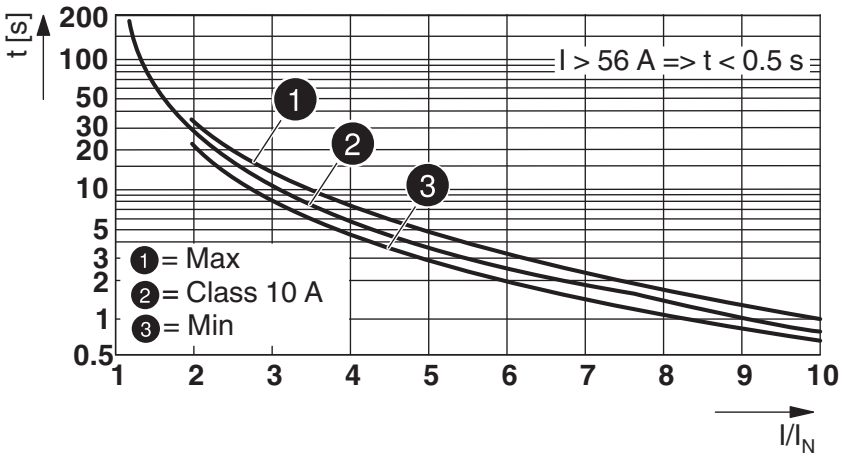


t [s] Release time in seconds

I/I_N Overcurrent factor: the ratio between the actual current and the parameterized nominal current

9 A modules

Figure 12 Trigger characteristic



t [s] Release time in seconds

I/I_N Overcurrent factor: the ratio between the actual current and the parameterized nominal current

14 Derating at 100% operating time

Additional data is available on request.

Ambient temperature [°C]	24	40	45	50	55	60
Max load current [A], aligned with 20 mm spacing	9	9	9	7.6	7.6	6.5
Max load current [A], aligned without spacing	6.5	6.5	6.1	5.2	4,6	3

The adjustment factors described here refer to hybrid motor starters with a maximum load current of 9 A. You can determine the maximum permissible rated current of the motor using the load current, the overcurrent factor (see data sheet of the relevant motor), and the derating table.

Derating table										
Overcurrent factor I_A/I_N	1	2	3	4	5	6	7	8	9	10
Adjustment factor K	1	1	1	1	1	1	0.88	0.77	0.69	0.62

Example 1	
Motor with overcurrent factor I_A/I_N (from motor data sheet)	8
Adjustment factor K	0.77
Max. permissible load current I_L at 45°C, aligned (from derating table)	9 A
Max. permissible rated current I_N of the motor	6.9 A

Example 2	
Motor with overcurrent factor I_A/I_N (from motor data sheet)	5
Adjustment factor K	1
Max. permissible load current I_L at 55°C, aligned (from derating table)	4.6 A
Max. permissible rated current I_N of the motor	4.6 A