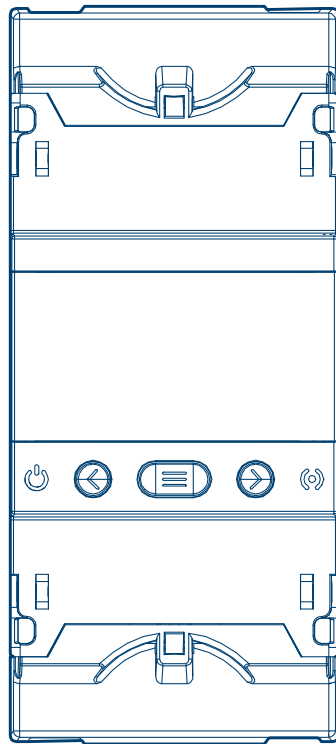**Operating and assembly instructions**

Protection and monitoring relay
Residual current protection relay

Residual current relay 0.03–3 A,
type B, 1-channel
HR551

CE UK CA

:hager

Contents

1   Introduction

1.1   Document content

This document describes how to assemble and commission **HR55x** residual current relays safely and properly, and how to assemble and use **HR72x** toroidal transformers.

The illustrations and descriptions in this manual are for clarification purposes only and may differ from the actual state of the software due to regular improvements being made.

Date	Document	Version
05/2024	Residual current relay_HR55x_Operating instructions_EN_2024-05	Version 1

Residual current protection relay	
HR551	Residual current relay 0.03–3 A, type B, 1-channel
HR554	Residual current relay 0.03–3 A, type B, 4-channel

Toroidal transformers	
HR721	Toroidal transformer ø35
HR722	Toroidal transformer ø55
HR723	Toroidal transformer ø80
HR724	Toroidal transformer ø110

Table 1: Reference list

1.2   Target group

This document is intended for installers, system administrators and electrically trained specialists working with a differential current protection and monitoring relay of type B.

> Electronic devices may only be assembled, installed and configured by a specialist with electrical training and certification in accordance with the relevant installation standards of the country.
>
> The accident prevention regulations valid in the appropriate countries must be complied with.

1.3   Symbols used

• Single-step instruction or any sequence

➊ Multi-step instruction Sequence must be maintained.

– List

	Installation by a qualified electrician		Accessories		Manufacturer's information is in accordance with § 18 Para. 4 of the German Electrical and Electronic Equipment Act.
CE	Suitable for use throughout Europe and Switzerland	UK CA	Suitable for use in the United Kingdom		

Symbol	Warning word	Consequence of non-observance
⚠	Danger	Leads to serious injuries or death.
	Warning	Can lead to serious injuries or death.
	Caution	Can lead to minor injuries.
	Caution	Can lead to device damage.
	Note	Can lead to physical damage.

Symbol	Description
⚠	Warning against electric shock.
⚠	Warning against damage from mechanical stress.

2   Safety instructions

Electrical devices must only be installed and assembled by a qualified electrician in accordance with the relevant installation standards, guidelines, regulations, directives, safety and accident prevention directives of the country.

Failure to comply with these installation instructions may result in damage to the device, fire or other hazards.

Before any maintenance, repair or handling work is performed at the device connections, the device must be disconnected from all power sources, including the device's own power supply and the measuring equipment.

If an anomaly or a malfunction is identified, the device must not perform any measurements.

Contact customer service if you find the device is not functioning correctly.

Hager accepts no liability for damage caused by improper handling or by non-observance of warning information and recommendations.

3   Scope of delivery
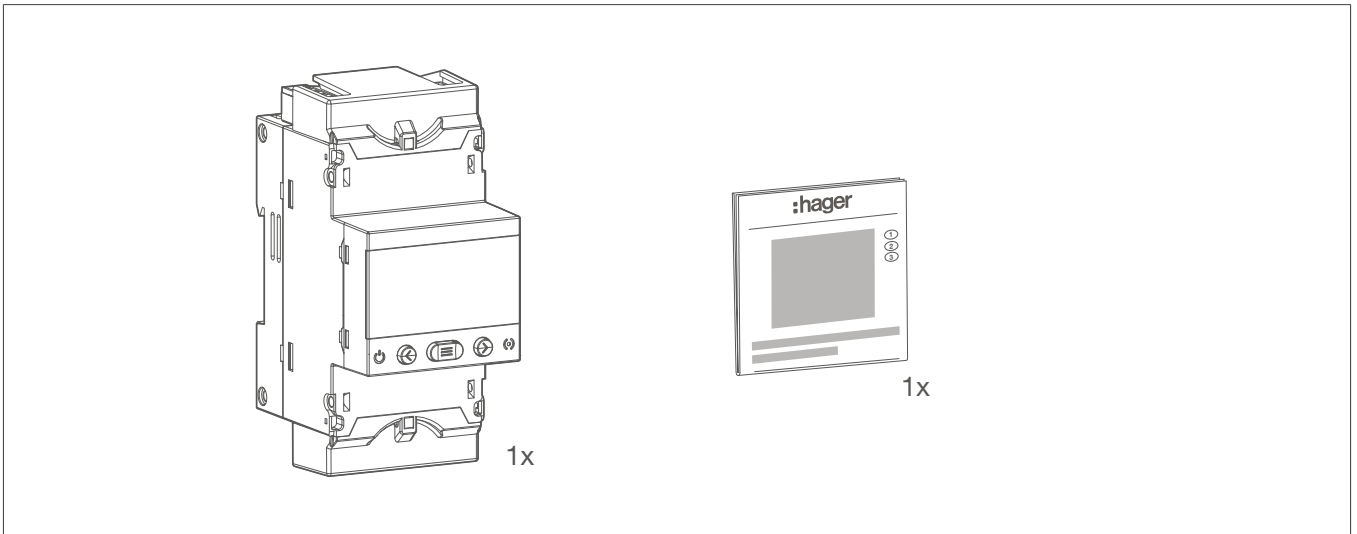
Fig. 1: Scope of delivery HR55x

4 Design and layout of the device

① R1, trip relay, channel 1 (NO)
③ C1, GND channel R1
⑨ A1, power supply L
⑪ A2, power supply N
⑲ Pre-alarm, digital output (NO)
⑳ GND pre-alarm, digital output
㉑ TRIP, input for external trigger
㉒ GND for RS-485 and TRIP input
㉓ B-, RS-485 interface
㉔ A+, RS-485 interface
㉕ RJ45 connector contact for the current transformer connection

⑫ Cover for connecting terminals
⑬ CPU LED
⑭ **T** button
⑮ Menu button
⑯ **R** button
⑰ Alarm LED
⑱ LCD screen

5 Function

5.1 Residual current protection relay HR551

The device is a differential current protection and monitoring relay of type B, with one channel, configurable leakage current pre-alarm and integrated Modbus RS-485 interface, which is compatible with the type B specific differential current transformers of the HR series.

– Residual-current monitoring
– Assembly on DIN rail according to IEC 60715:2017
– Connection to external toroidal transformers (HR72x)

The device enables continuous monitoring of rated fault currents in earthed power grids. The current induced in the external transformer is detected in the device, measured and the effective value (TRMS) is calculated.

– Display to show parameters
– Three buttons for scrolling through the various screens and programming the device
– Digital output as pre-alarm function
– Digital input for external tripping
– RS-485 communication

5.2 Toroidal transformer HR72x

The HR72x series of devices are electronic differential current protection and monitoring transformers of type B (IEC 60755), which can be used together with HR551 and HR554 differential current protection and monitoring relays. Which device to choose depends on the maximum current of the monitored circuit (In):

– **HR721** for In ≤ 80 A
– **HR722** for In ≤ 160 A
– **HR723** for In ≤ 250 A
– **HR724** for In ≤ 400 A

– Assembly on DIN rail according to IEC 60715:2017
– Assembly on mounting plate with clamp
– Connection to residual current relay (HR55x)

The toroidal transformer transforms the measured current into a measurable quantity for the differential current relay.

5.2.1 Description of LEDs for HR72x

The status LED on the front of the device indicates the current operating status.
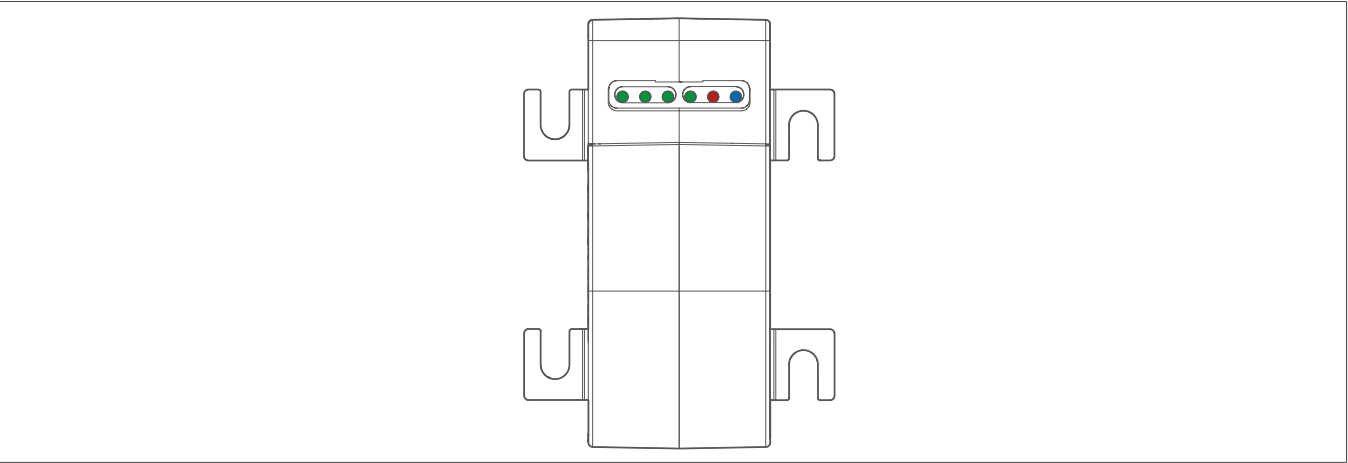
● Blue		Indicates that the device is being supplied with power.
● Red		Indicates that a leakage current error has occurred.
-●- Flashing red		Indicates that a pre-alarm has been triggered.
● Green		Indicates which channel is being used for the toroidal transformer concerned.

Table 2: Description of LEDs

6 Information for qualified electricians

6.1 Installation and electrical connection

6.1.1 Assembly of HR72x

⚠	**Danger**
	Electric shock when live parts are touched!
	An electric shock can lead to death!
	• Isolate all connection cables before working on the device and cover any live parts in the area!

① Fix the plug-in terminals to the device.
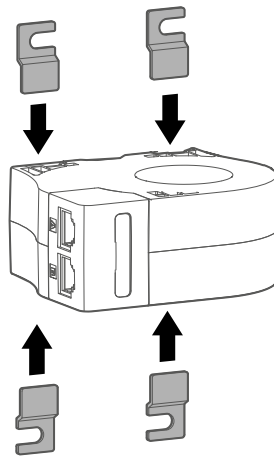
Fig. 2: HR72x – Assembling the plug-in terminals

ⓘ	**Note**
	The device can either be installed on the DIN rail or on a mounting plate.

Assembly option 1: Fixing on the mounting plate
- Align the device horizontally.
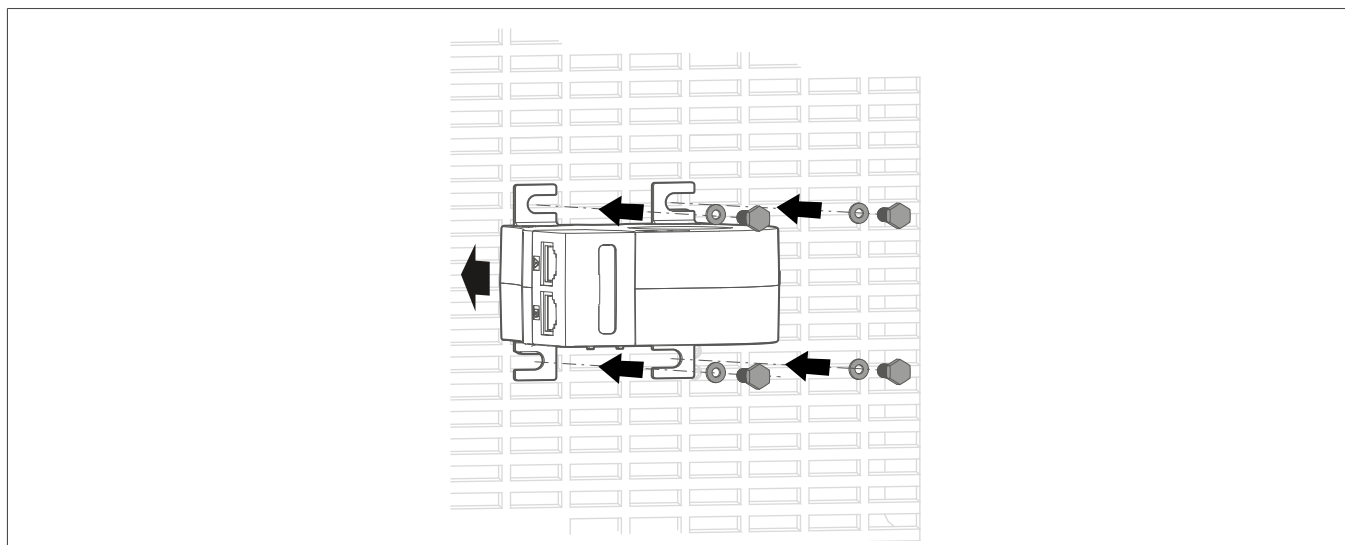- Fix the device to the mounting plate with screws.

Fig. 3: HR72x – Assembly on the mounting plate

Assembly option 2: Fixing on the DIN rail

- Fix the mounting rail onto the DIN rail in the desired assembly direction.
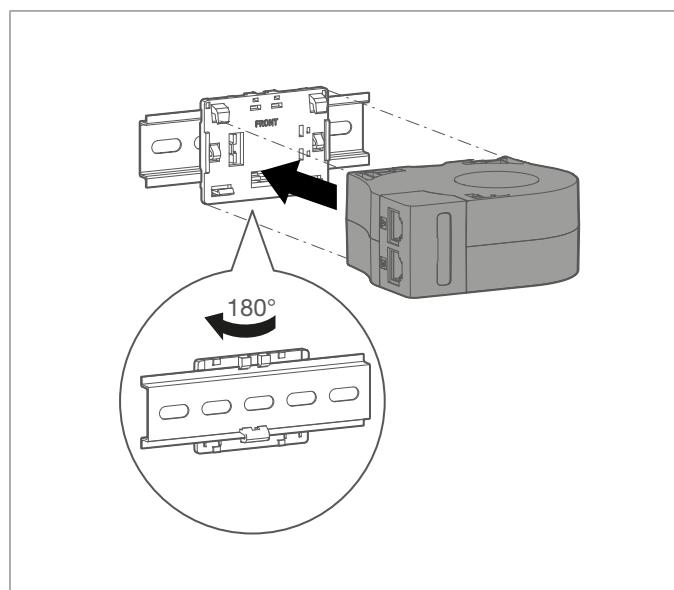- Attach the device to the fixing clamp.

Fig. 4: HR72x – Vertical assembly on the DIN rail
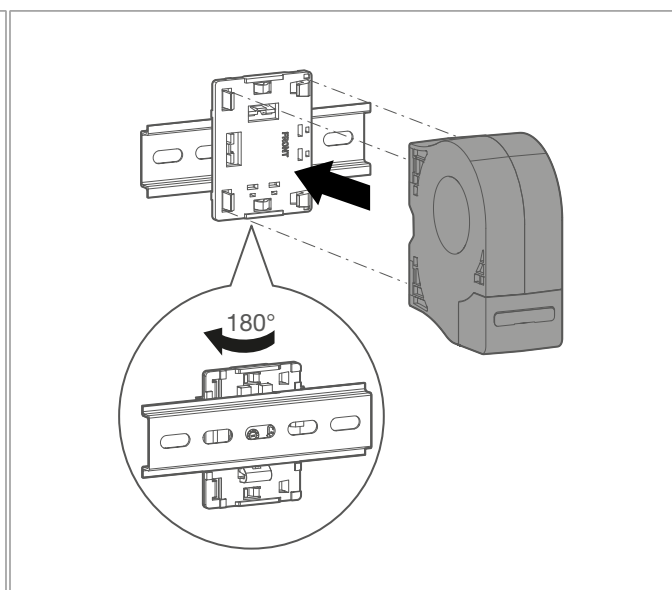
Fig. 5: HR72x – Horizontal assembly on the DIN rail

2 Guide the cables through the device.
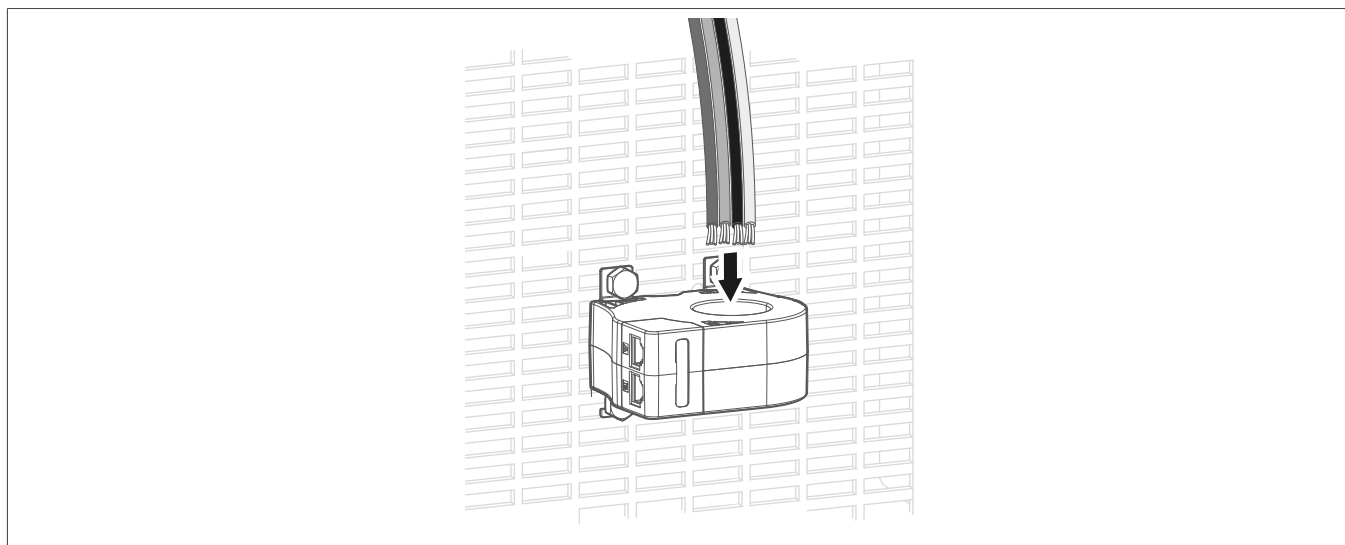
Fig. 6: HR72x – Passing cables through

⚠️ **Warning**

Risk of destruction!

The device may be damaged if the cables are guided through incorrectly.

Guide the cables guided through the centre of the toroidal transformer.
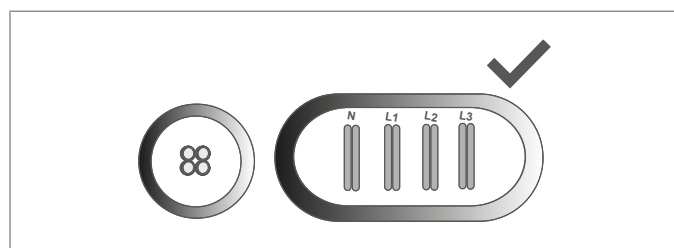
Fig. 7: Correct distribution of cables
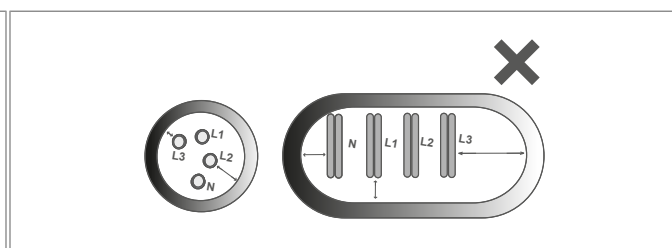
Fig. 8: Incorrect distribution of cables
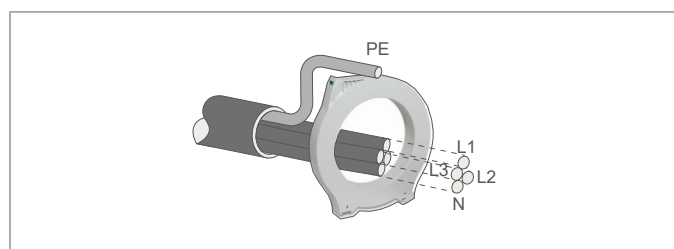
Fig. 9: Cable distribution
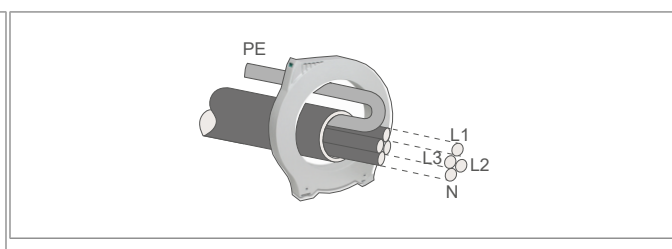
Fig. 10: Cable distribution (cable conduit)

ⓘ **Note**

The length of the cables must be greater than the diameter of the toroid transformer.
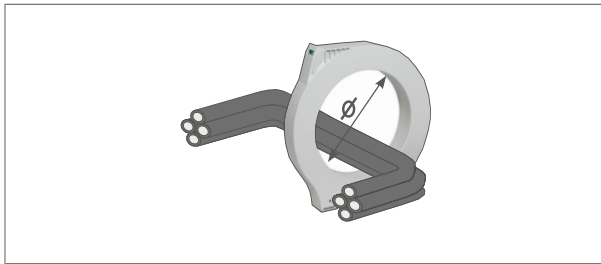
Fig. 11: Avoid cable bends

L>⌀
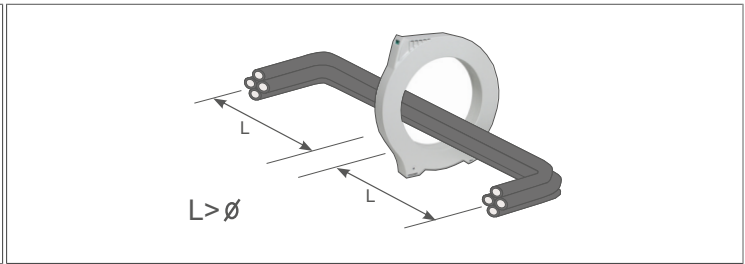
Fig. 12: Avoid cable bends

6.1.2   Assembly of HR55x

| ⚠ | **Danger**

Electric shock when live parts are touched!

An electric shock can lead to death!

• Isolate all connection cables before working on the device and cover any live parts in the area! |

1. Remove the covers of the plug-in connecting terminals.
2. Fix the device on the DIN rail.
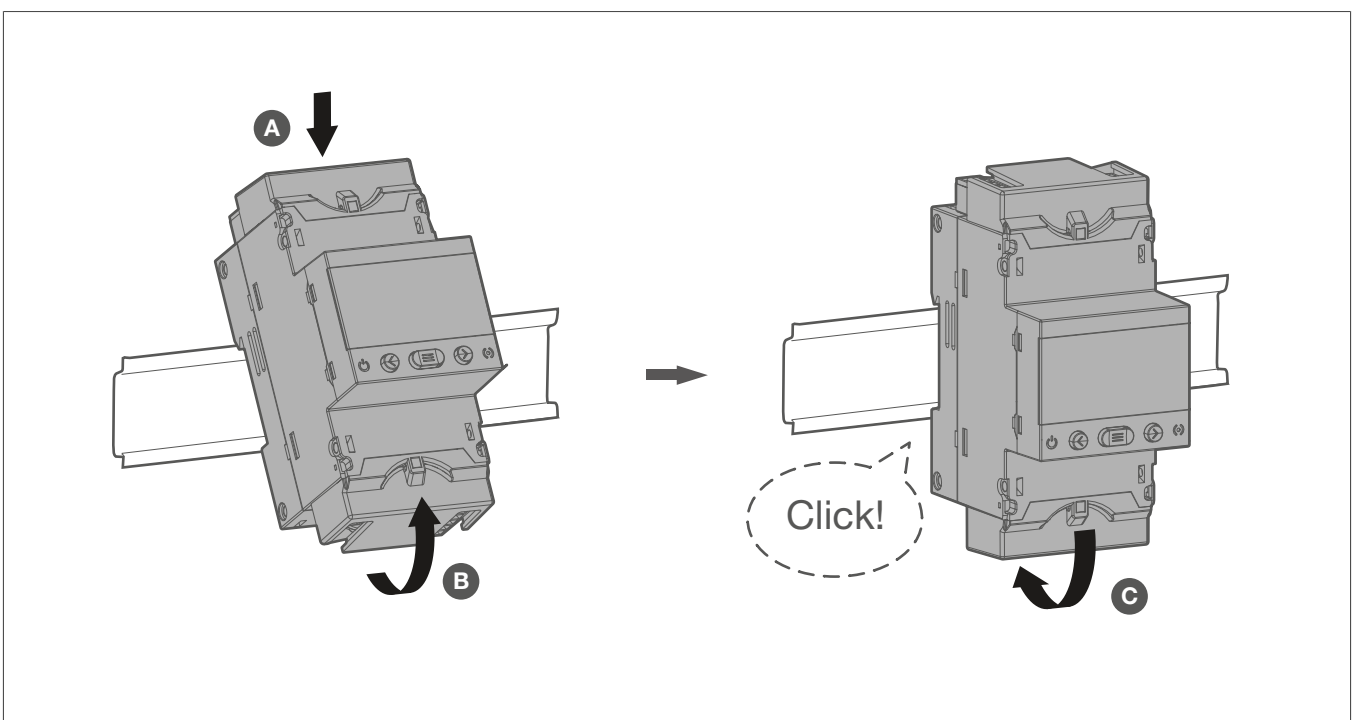
Fig. 13: HR55x – Assembling the device on the DIN rail

3. Connect and wire the device.
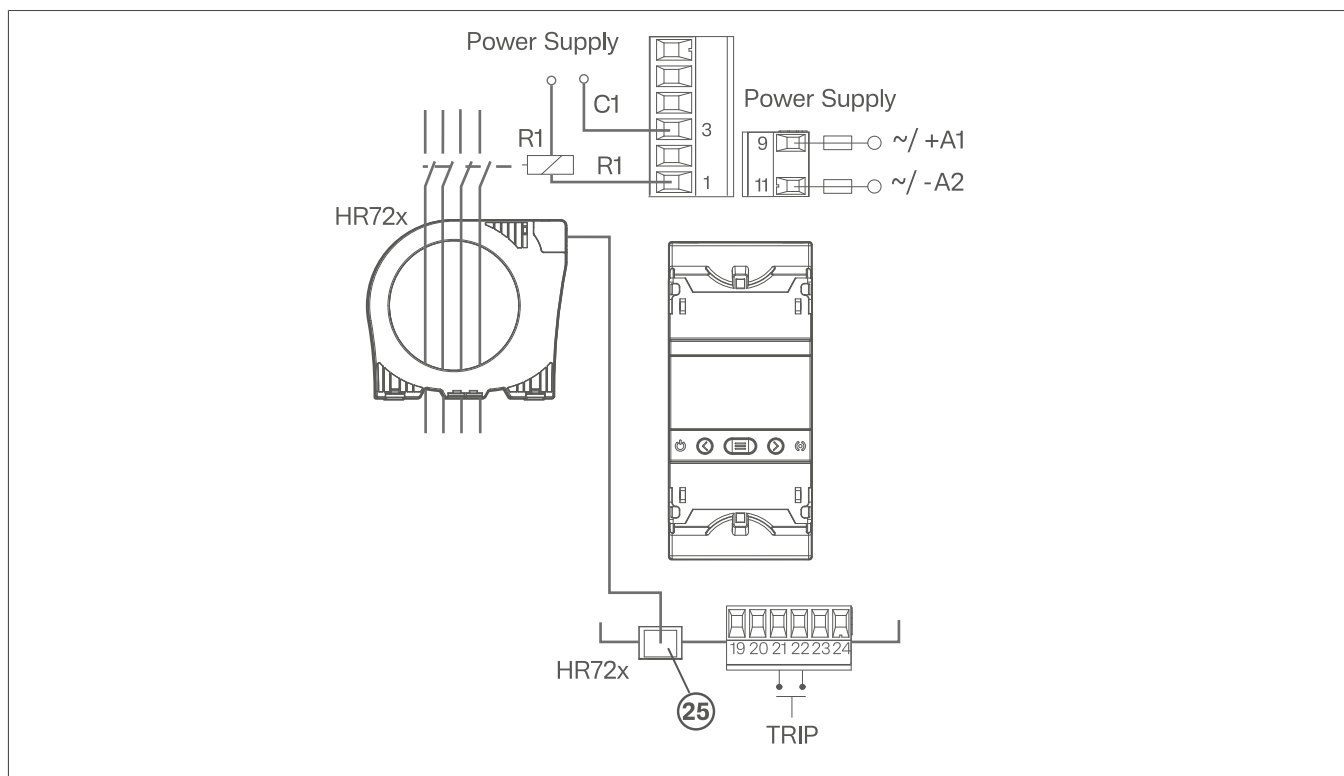
Fig. 14: HR551 – Electrical connection

④ Attach the cover of the connecting terminals.

7 Operation

7.1 Status-LED

The device has two LEDs providing information on the status of the device.

LED	Description
CPU LED (13)	White lit constantly: Indicates that the device is switched on
ALARM LED (17)	Flashing red: Indicates that a pre-alarm has been triggered
	Red lit constantly: Indicates that tripping has occurred

7.2 Buttons

The device has three buttons for navigating through the various screens and programming the device.

Buttons	Function	
⊙T	Short: Change the display or setting	Long (> 3 s): Test the relay
⊙R	Short: Change the display or setting	Long (> 3 s): carry out a reset
☰	Short: Confirm selection	Long (> 3 s): Return to the previous step

7.3 Display

The device has an LCD screen. This LCD screen is divided into two areas.

Data area
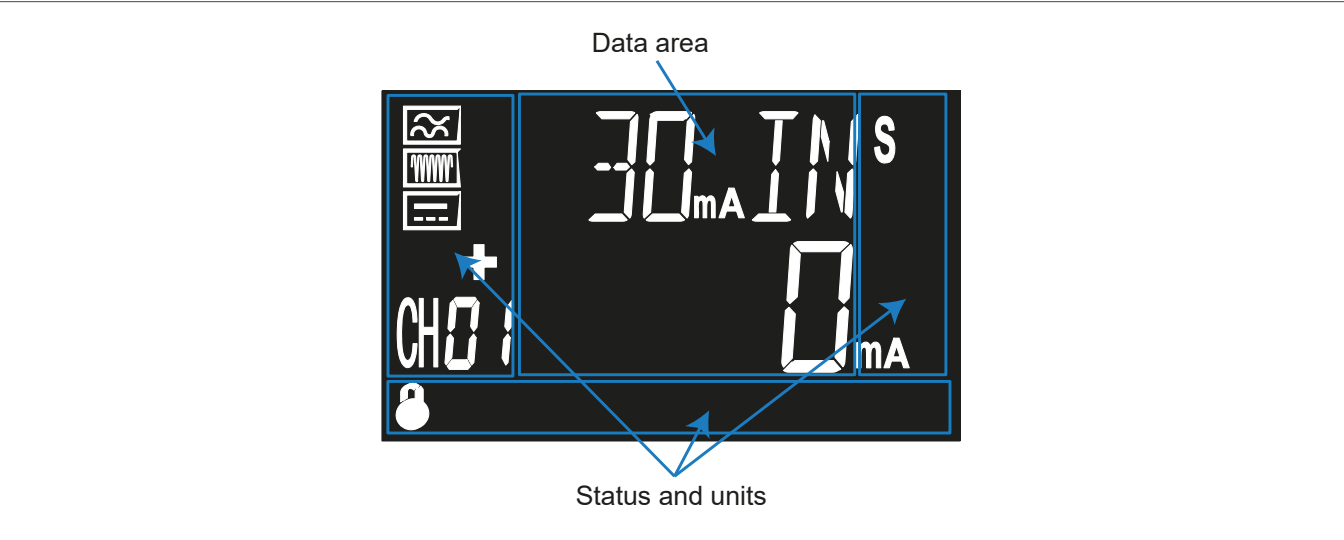
Status and units

Data area: Shows all measured values.

Status and units: Shows the status, units and device information.

Icon	Description	Icon	Description
〰	Alternating current	🔔	Pre-alarm activated
▭	Direct current	**prog**	Programming screen
⎍	High frequency (type F)	**trip**	The relay has tripped
✚	The relay is positively polarised	**CH01**	Channel 1
⚠	Internal device error	🕐	No time setting configured
🔒	Direct settings are locked To unlock the device, see Lock menu .		

Table 3: LCD symbols

7.3.1　LCD screen description
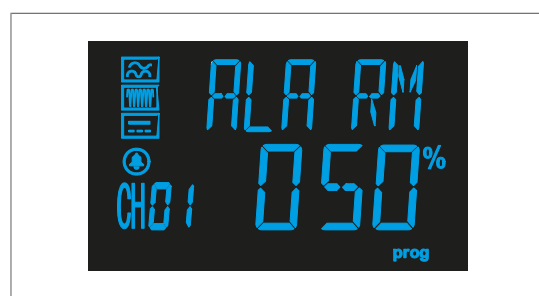
Blue LCD screen:
Settings or set-up menu.

Yellow LCD screen:
Change in the installation.
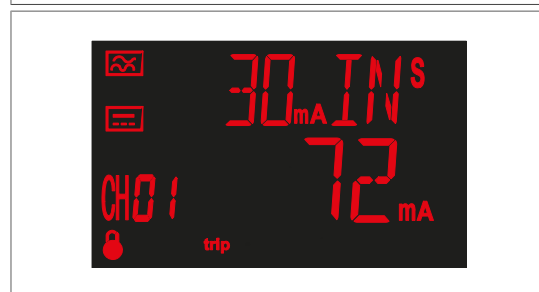
Red LCD screen:
The relay has tripped due to a rated fault current.
An individual test has been performed.
An error has been detected due to a toroidal transformer.

7.3.2　Digital output

The device has a digital output (terminal 19 and terminal 20), which is activated when a pre-alarm is triggered.

7.3.3　Relay

The relay has output relays (terminal 1 and terminal 3), which trip when a certain channel is affected.

7.3.4 Digital input

The device has a digital input (terminal 21 and terminal 22). This is required to perform a trip.

7.3.5 Start screen

The start screen appears after the device has been switched on and the initialisation phase has elapsed. The start screen shows the version of the relay.

Fig. 15: Start screen

Fig. 16: Start screen – Version information

7.3.6 Problems or changes in the installation

If problems arise at the end of a start operation, the following messages may appear on screen:
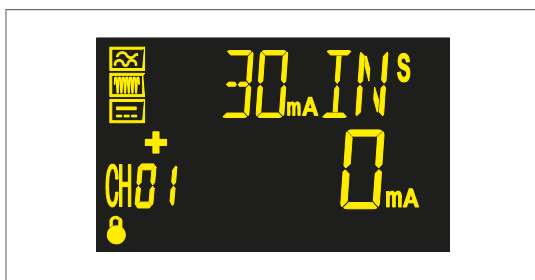
Change in the installation

• Open the set-up menu to save the new installation.

The relay cannot find the toroidal transformer

• Open the set-up menu to save the new installation.

The relay has detected more toroidal transformers than permitted

• Check the installation.

The relay has detected additional toroidal transformers, which are not registered in the installation

● Open the set-up menu to save the new installation.

7.3.7   Channel display screen

The channel display screen shows the present leakage current, the configured trip current values and the eventual configured trip delay of the channel.
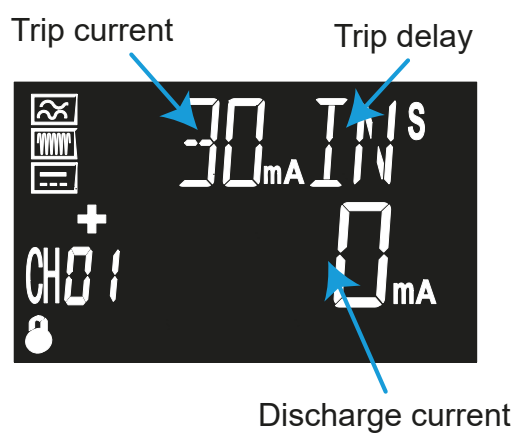
Fig. 17: Channel display screen

The ⟩R and ⟨T buttons can be used to toggle between the various screens.

30mA IN ^{s}
CH01   **0** mA

Channel 1:
Configured tripping current (mA)
Configured tripping delay
Instantaneous total earth leakage current (AC+DC) (mA)
Note: If the relay is locked, it is not possible to access the menu, see Lock menu .

>

<

SET UP

Access to the set-up menu.
Note: If another button is not pressed for 60 seconds, the relay jumps back to the display for channel 1.

>

<
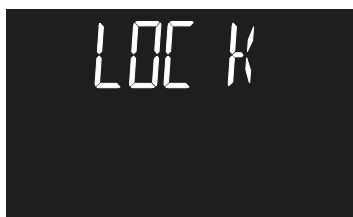
LOC K

Access to the lock menu.
Note: If another button is not pressed for 60 seconds, the relay jumps back to the display for channel 1.

>

<

EVE NT

event

Access to the event menu.
Note: If another button is not pressed for 60 seconds, the relay jumps back to the display for channel 1.

>

HR --
551

Start screen with information on the relay and its version.

7.3.8   Screen when the relay trips

If the relay trips, the red alarm LED lights up. The screen shows precise information on the current value from the last cycle.
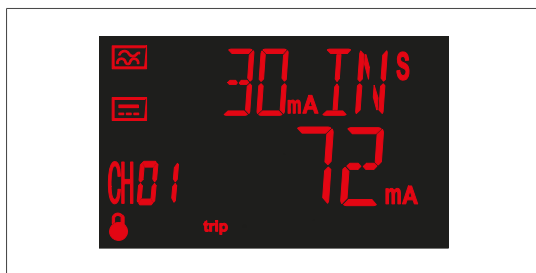
Configured tripping current (mA)

Configured tripping delay

Total earth leakage current fault (AC+DC), which has caused the relay to trip (mA)
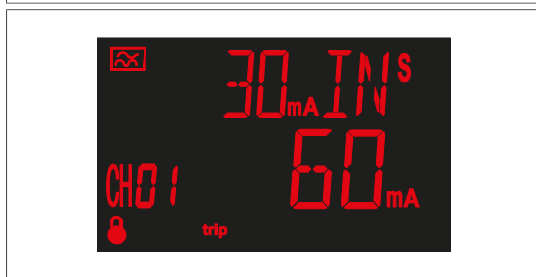
Configured tripping current (mA)

Configured tripping delay

Alternative earth leakage current fault, which has caused the relay to trip (mA)
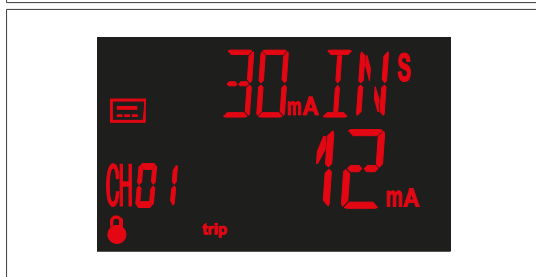
Configured tripping current (mA)

Configured tripping delay

Direct earth leakage current fault, which has caused the relay to trip (mA)

> **Note**
>
> Press the ⊙R button for > 3 seconds to return the relay to its initial state.

7.3.9   Lock menu

The lock menu allows to activate or deactivate the device lock.

- Open the lock menu.
- Press the ≣ button to edit the lock menu.

Fig. 18: Lock menu

- Use the > R and < T buttons to toggle between the options and find the required value.

Possible values	YES: The device lock is activated
	NO: The device lock is deactivated

- Press and hold the ≣ button for > 3 seconds to confirm the entry.

Fig. 19: Device lock activated

7.3.10 Event menu

The event menu allows you to view the last 20 events for the device.

Fig. 20: Event menu

- Open the event menu.
- Press the ☰ button.

  The last 20 events open and are shown on screen.

  Press the ⟩ and ⟨ buttons to toggle between the events.

The device can show four different types of event:

– **TRI**, channel relay trip
– **ALA**, active pre-alarm
– **TST**, individual test
– **TRA**, transformer error

ⓘ	**Note**
	To exit the event menu, press the ☰ button for > 3 seconds.

Three different screens are shown to visualise an active pre-alarm (ALA), an individual test (TST), and transformer errors (TRA). These differ with respect to their time, year, and month and day data.

Hour	Year	Month and day
ALA 10 CHO1 17:10 prog event	ALA 10 CHO1 2024 prog event	ALA 10 CHO1 02-12 prog event

Hour	Year	Month and day
TST 1 CHO1 08:25 prog event	TST 1 CHO1 2004 prog event	TST 1 CHO1 01-11 prog event

Hour	Year	Month and day
TRA 2 CHO1 09.30 prog event	TRA 2 CHO1 2024 prog event	TRA 2 CHO1 03-05 prog event

The channel relay trip (TRA) is visualised on six screens.

Hour	Year	Month and day
TRI 12 CHO1 17:10 prog event	TRI 12 CHO1 2024 prog event	TRI 12 CHO1 03-27 prog event

Trip information (AC, DC)	Trip information (AC)	Trip information (DC)
2.0 A 0 ms CHO1 1502 mA trip prog event	2.0 A 0 ms CHO1 1000 mA trip prog event	2.0 A 0 ms CHO1 502 mA trip prog event
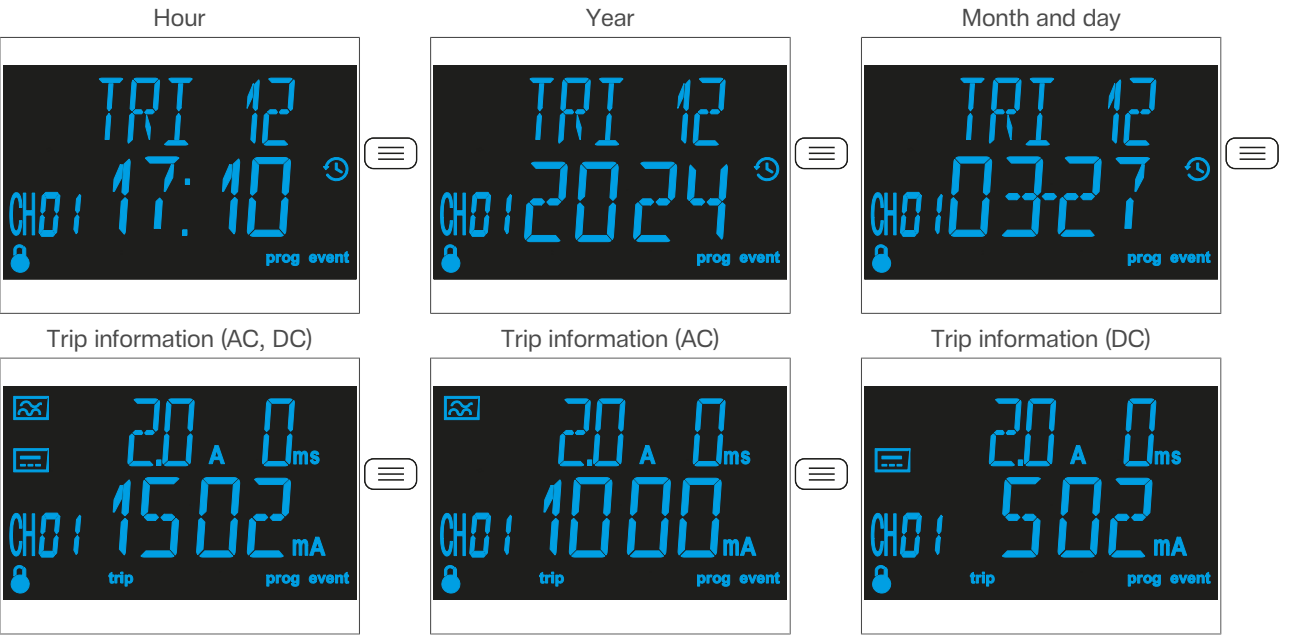
> **Note**
>
> The event log can be reset through the Modbus communication.

7.3.11 Individual test

An individual channel test allows to check the correct operation of the relay.

☑ The channel display screen is shown.
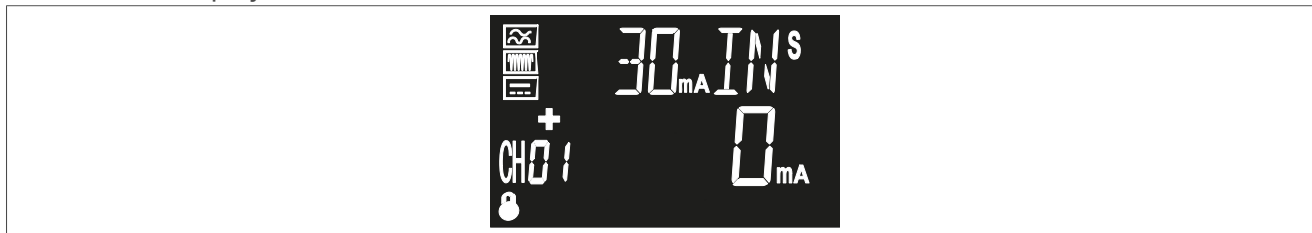
Fig. 21: Channel 1 display screen

- Press the ⊙ **T** button for > 3 seconds.
  If the relay has tripped correctly, the red screen is shown and the alarm LED lights up red.
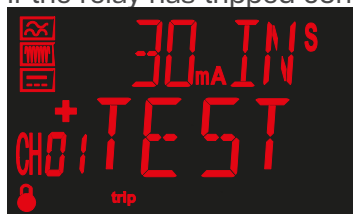
- Press the ⊙**R** button to reset the status of the relay

ⓘ	If the relay has not tripped, an error is displayed for 3 seconds. The screen then switches to the channel display screen.
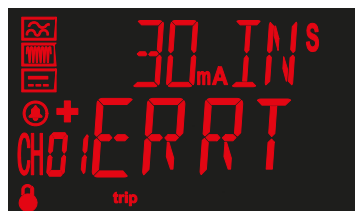
 3 s

7.3.12   Setting the trip current and trip delay

Direct settings

The trip current and trip delay be set on the channel display screen.
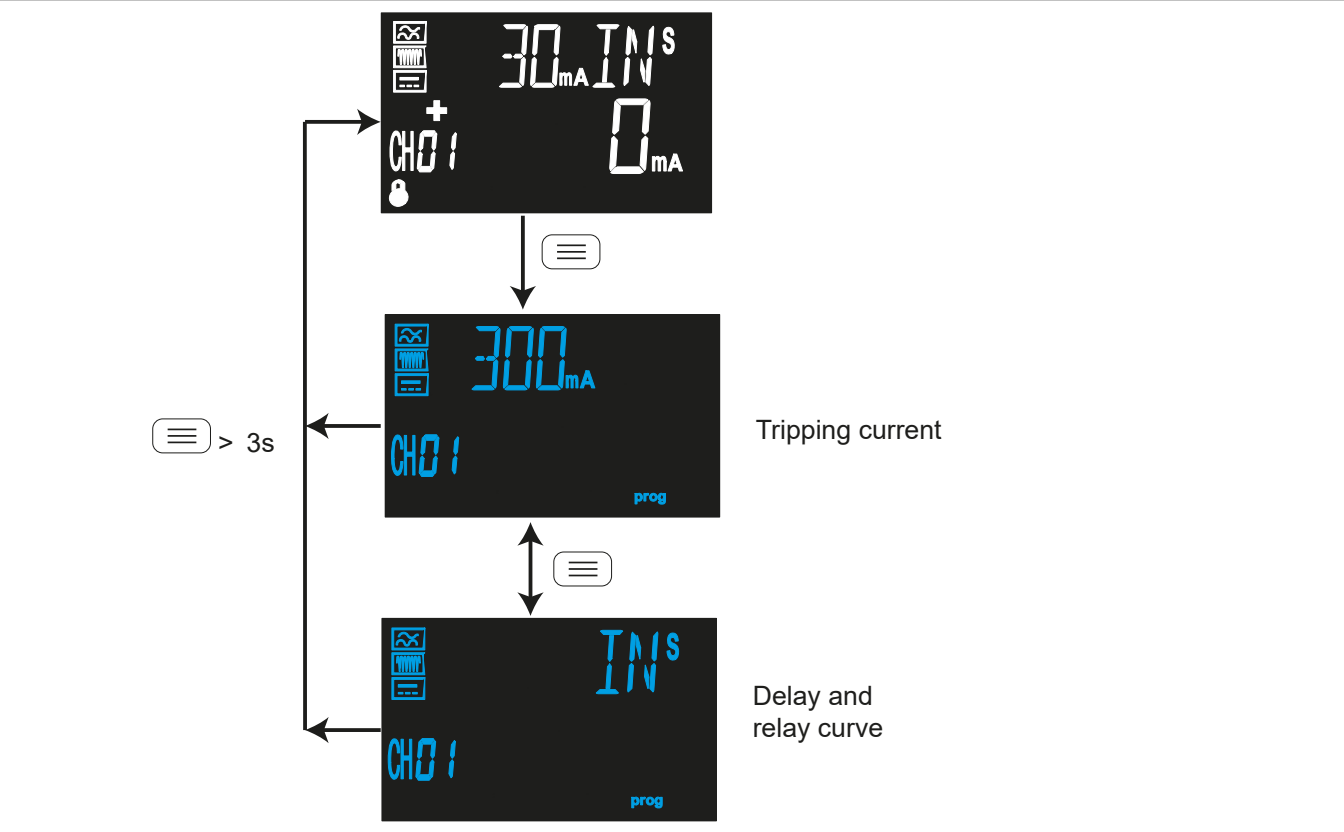
Fig. 22: Overview of direct settings for the trip current and trip delay

Setting the trip current

☑ The screen for the trip current (Fig. 23: Screen for the trip current) has been opened
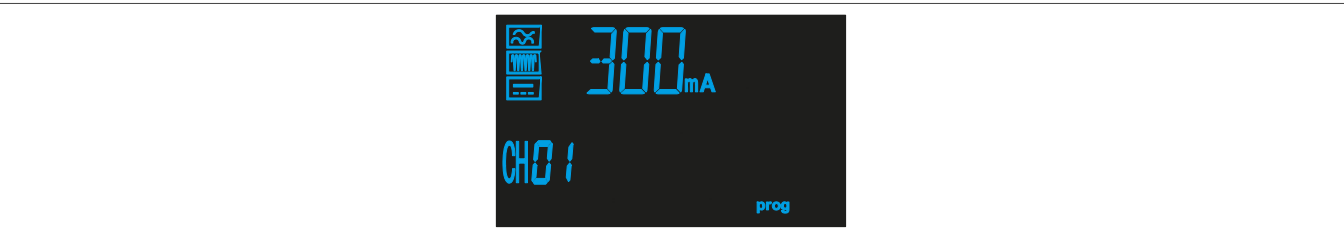
Fig. 23: Screen for the trip current

- Press the ⊙R or ⊙T button to choose between the different trip currents.
- Press the ≡ button to jump to the next programming point.
- Press the ≡ button for > 3 seconds to confirm the setting.
   The channel display screen is shown.

	Trip current		
Possible values	30 mA	100 mA	300 mA

Table 4: Setting options for the trip current

	Trip current		
	500 mA	1.0 A	3.0 A

Table 4: Setting options for the trip current

Setting the trip delay

☑ The screen for the trip delay (Fig. 24: Screen for the trip delay) has been opened

Fig. 24: Screen for the trip delay

- Press the ⊙R or ⊙T button to choose between the different values.
- Press the ☰ button for > 3 seconds to confirm the setting.
  The channel display screen is shown.

	Configured tripping delay					
Possible values	0.1 s	0.2 s	0.3 s	0.4 s	0.5 s	0.8 s
	1 s	3 s	5 s	**INS**, curve INS	**[S]**, curve SEL	

Table 5: Setting options for the trip delay

8   Configuration

Overview of all configurable parameters

Five main configurations can be set up: **Communication**, **Time setting**, **Pre-alarm**, **Trip relay** and **Installation**. These main configurations can be managed using the symbols shown (Fig. 25: Set-up menu).
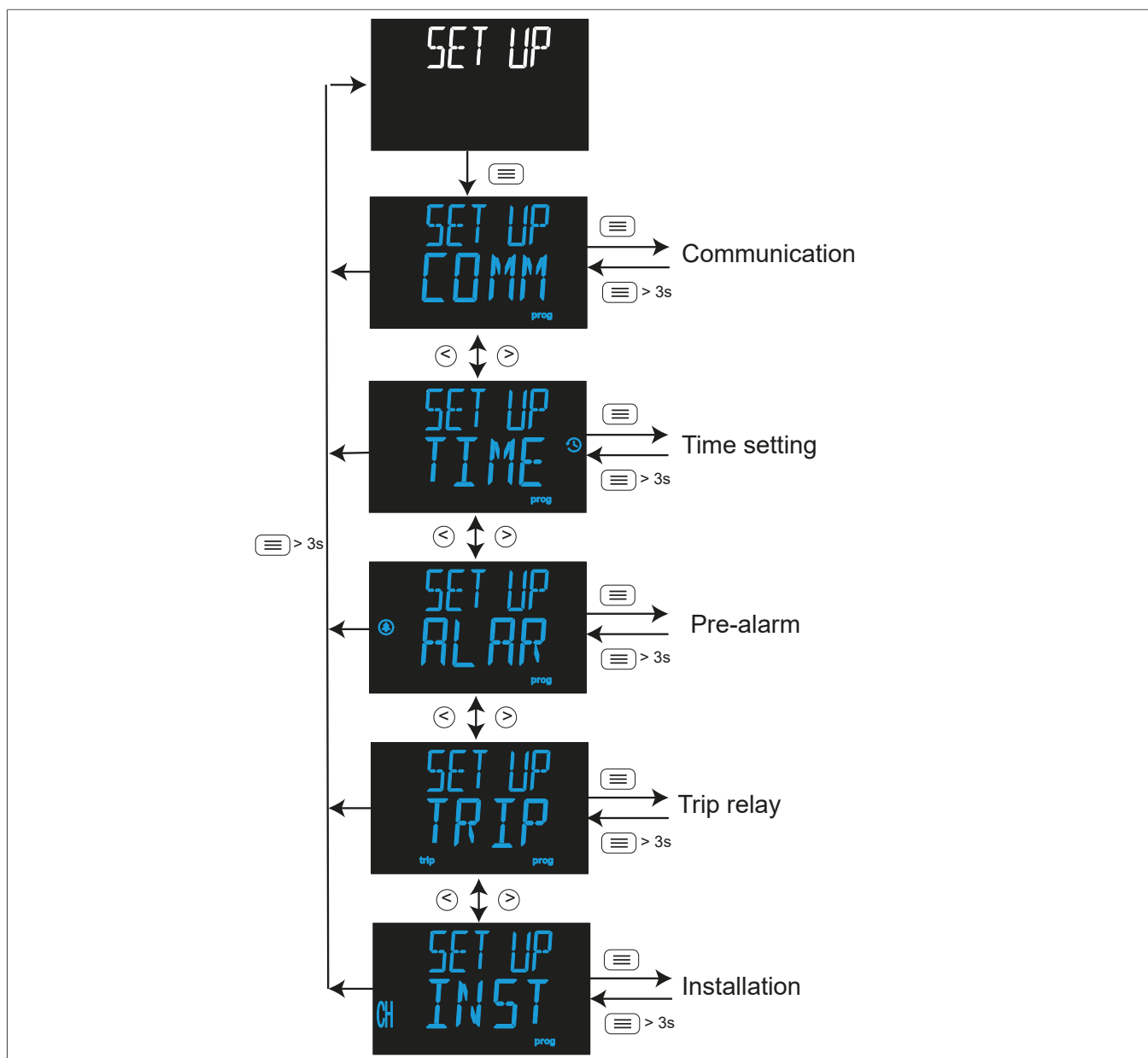
Fig. 25: Set-up menu

8.1 Communication

The **Communication** set-up menu is used to edit the settings for RS-485 communication.

Fig. 26: Communication set-up menu

The **Transmission speed**, **Peripheral device no.** and **Parity** parameters can be configured here.
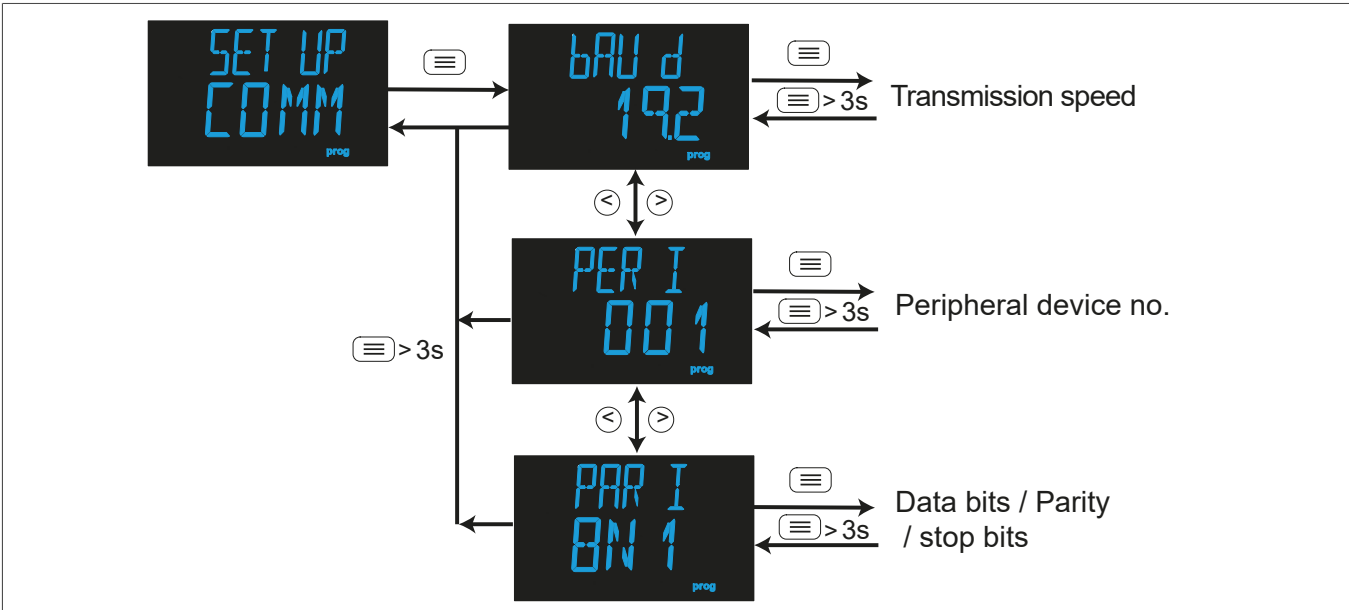
Fig. 27: Communication set-up menu

8.1.1 Transmission speed

The transmission speed for the RS-485 interface can be set via the baud rate.

Fig. 28: Baud rate

- Press the ≡ button to edit the baud rate.
  The programming value flashes.

	Transmission speed [baud]		
Possible values	4.8, 4800 bps	38.4, 38400 bps	19.2, 19200 bps

Table 6: Setting options for the baud rate

	Transmission speed [baud]		
	38.4, 38400 bps	57.6, 57600 bps	115.2, 115200 bps

Table 6: Setting options for the baud rate

- Press the ⊙R or ⊙T button to choose between the different values.
- Press the ☰ button to jump to the next programming point.
- Press the ☰ button for > 3 seconds to confirm the setting.
  The channel display screen is shown.

8.1.2 Peripheral no.

The peripheral no. is set in this step.

Fig. 29: Peripheral no.

- Press the ☰ button to edit the peripheral no.
  The programming value flashes.

Peripheral number	
Minimum value	1
Maximum value	247

Table 7: Setting options for the peripheral number

- Press the ⊙R or ⊙T button to choose between the different values.
- Press the ☰ button to jump to the next programming point.
- Press the ☰ button for > 3 seconds to confirm the setting.
  The channel display screen is shown.

8.1.3 Data bits, stop bits and parity

The data bits, stop bits and parity are set for RS-485 communication in this step.

Fig. 30: Data bits, stop bits and parity

- Press the (≡) button to edit the baud rate.
  The programming value flashes.

Data bits, stop bits and parity

	8N1, 8 data bits, no parity, 1 stop bit
	8E1, 8 data bits, even parity, 1 stop bit
	8O1, 8 data bits, odd parity, 1 stop bit
Possible values	8N2, 8 data bits, no parity, 2 stop bits
	8E2, 8 data bits, even parity, 2 stop bits
	8O2, 8 data bits, odd parity, 2 stop bits

Table 8: Setting options for the data bits, stop bits and parity

- Press the (>)R or (<)T button to choose between the different values.
- Press the (≡) button to jump to the next programming point.
- Press the (≡) button for > 3 seconds to confirm the setting.
  The channel display screen is shown.

8.2   Time setting

The **Time setting** set-up menu can be used to edit the time.
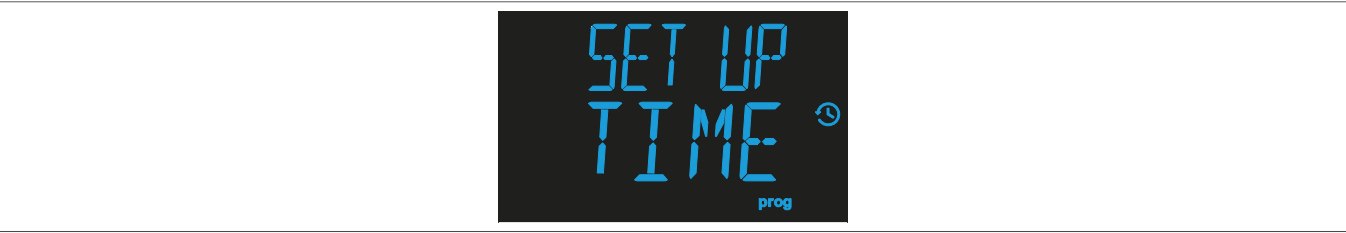
Fig. 31: Time setting set-up menu

You can set the year, month, day and hour.
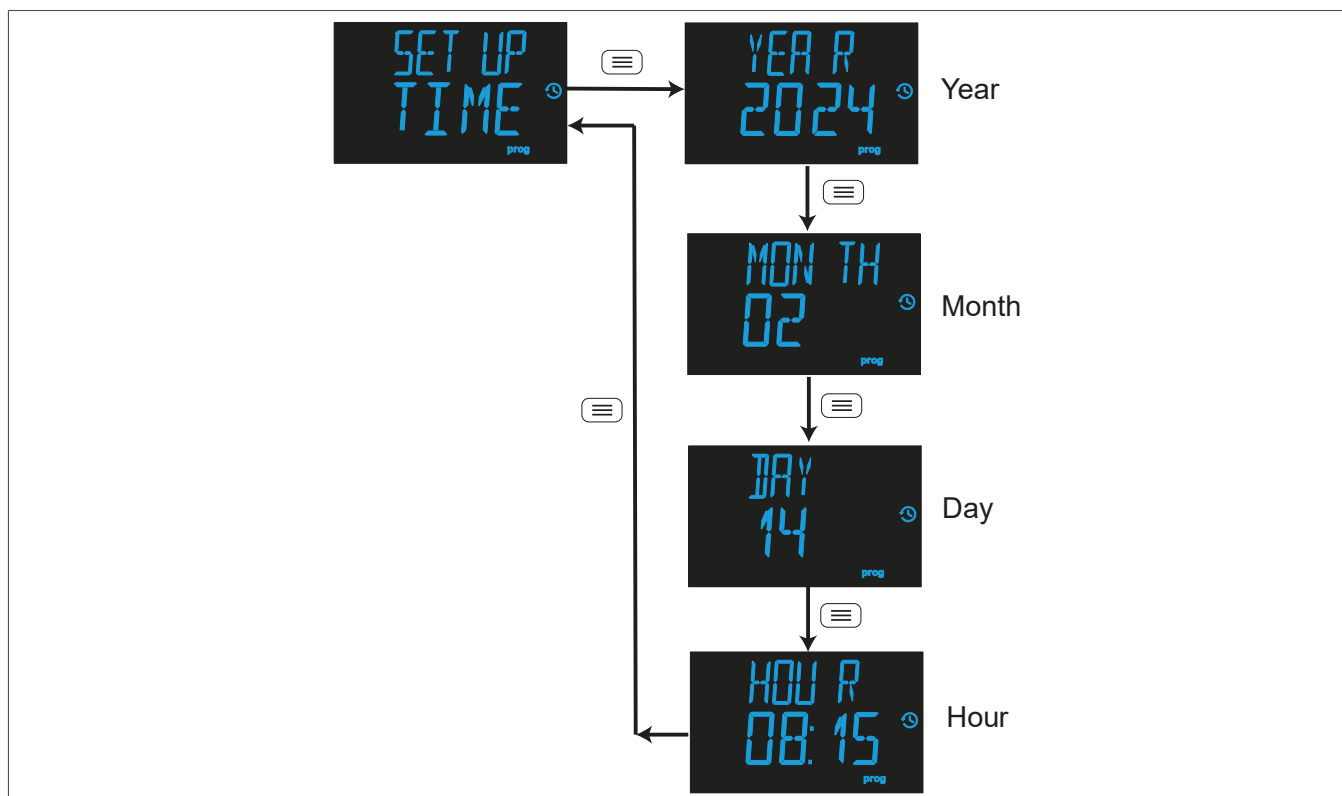
Fig. 32: Time setting menu

8.2.1 Year

Configure the year here.

- Press the **>R** or **<T** button to choose between the different values.
- Press the ≡ button to confirm the setting and jump to the next programming point.

8.2.2 Month
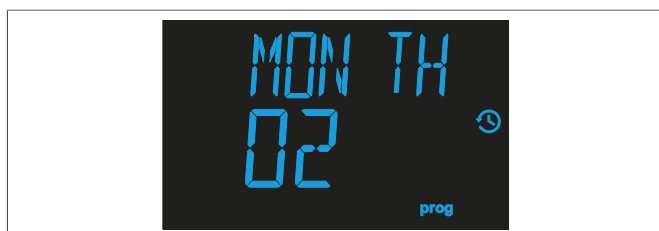
Configure the month here.

- Press the **>R** or **<T** button to choose between the different values.
- Press the ≡ button to confirm the setting and jump to the next programming point.

8.2.3 Day

Configure the day here.

- Press the **>R** or **<T** button to choose between the different values.
- Press the ≡ button to confirm the setting and jump to the next programming point.

8.2.4 Hour
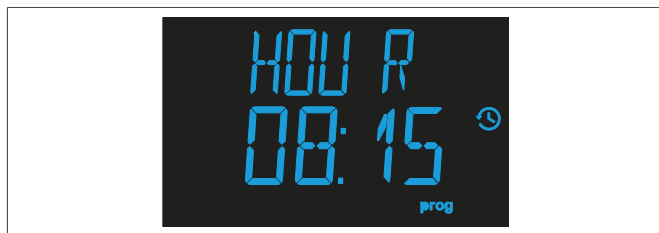
Configure the time here.

- Press the >R button to increase the time in one-hour increments.
- Press the <T button to decrease the time in one-hour increments.
- Press the ☰ button to confirm the setting.
- Set the minutes as in steps 1 and 2.
- Press the ☰ button to confirm the setting and go back to the Time setting set-up menu.

8.3 Pre-alarm

The **Pre-alarm** set-up menu

Fig. 33: Pre-alarm set-up menu

The **Current**, **Operation** and **Pre-alarm polarity** parameters can be configured here.

Pre-alarm current

Pre-alarm operation

Pre-alarm polarity
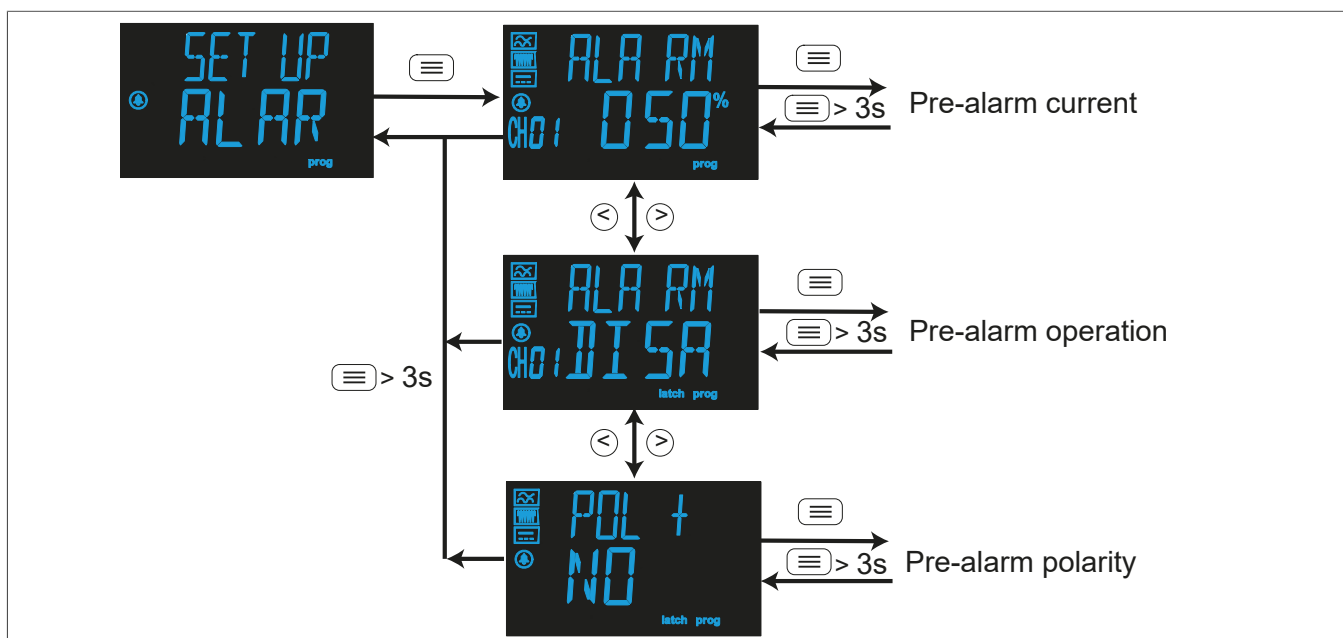
Fig. 34: Pre-alarm menu

8.3.1   Pre-alarm trip current

The current at which the pre-alarm is activated according to the percentage of the relay's trip current is set in this step.

Fig. 35: Pre-alarm trip current

- Press the ⊜ button to set the percentage of the trip current.
  The programming value flashes.
- Press the ⊙R or ⊙T button to choose between the different values.

Pre-alarm trip current

Minimum value	25%
Maximum value	100%

Table 9: Setting options for the trip current of a pre-alarm

- Press the ⊜ button for > 3 seconds to confirm the setting.
- Press the ⊙R button to go to the next configuration point.

8.3.2   Pre-alarm operation

Pre-alarm operation is configured in this step.

Fig. 36: Pre-alarm operation

- Press the ⊜ button to set the operating mode for the trip current.
  The programming value flashes.
- Press the ⊙R or ⊙T button to choose between the different values.

Pre-alarm operation

Possible values	DISA: Pre-alarm disabled.
	AUTO: Pre-alarm activated with deactivated interlock; when the pre-alarm condition is no longer met, the pre-alarm is disabled.

Table 10: Setting options for the operation of a pre-alarm

Pre-alarm operation

	MANU: Pre-alarm activated with activated interlock; pre-alarm disappears on keyboard reset or communication reset.

Table 10: Setting options for the operation of a pre-alarm

- Press the ☰ button for > 3 seconds to confirm the setting.
- Press the ⟩R button to go to the next configuration point.

8.3.3 Pre-alarm polarity

The pre-alarm polarity is configured in this step.

Fig. 37: Pre-alarm operation

- Press the ☰ button to set the percentage of the trip current.
  The programming value flashes.
- Press the ⟩R or ⟨T button to choose between the different values.

Pre-alarm polarity

Possible values	YES, the pre-alarm works with positive polarity. Digital output with NC contact.
	NO: The pre-alarm works with standard polarity. Digital output with NO contact.

Table 11: Setting options for the polarity of a pre-alarm

- Press the ☰ button for > 3 seconds to confirm the setting.
- Press the ☰ button again for > 3 seconds to go to the Pre-alarm set-up menu.

8.4 Trip relay

The **Trip relay** set-up menu

Fig. 38: Trip relay set-up menu

The Polarity parameter can be configured here.
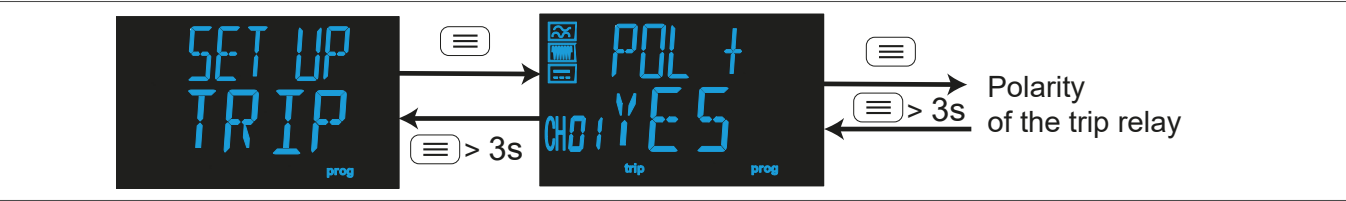
Fig. 39: Polarity menu

8.4.1 Polarity

The polarity is configured in this step.
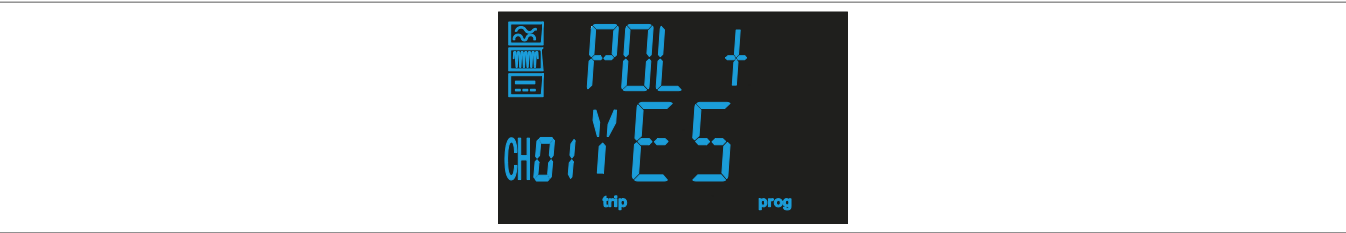
Fig. 40: Polarity

- Press the ☰ button to set the polarity.

  The programming value flashes.
- Press the >R or <T button to choose between the different values.

Polarity

Possible values	YES: The trip relay works with positive polarity. The + symbol appears on the display. Relay output with NC contact.
	NO: The trip relay works with standard polarity. Relay output with NO contact.

Table 12: Setting options for the polarity

- Press the ☰ button for > 3 seconds to confirm the setting and exit programming mode.
- To go to the Trip relay set-up menu, press and hold the ☰ button for > 3 seconds.

8.5 Installation

The **Installation** set-up menu can be used to save the installation.

Fig. 41: Installation menu

Fig. 42: Installation menu
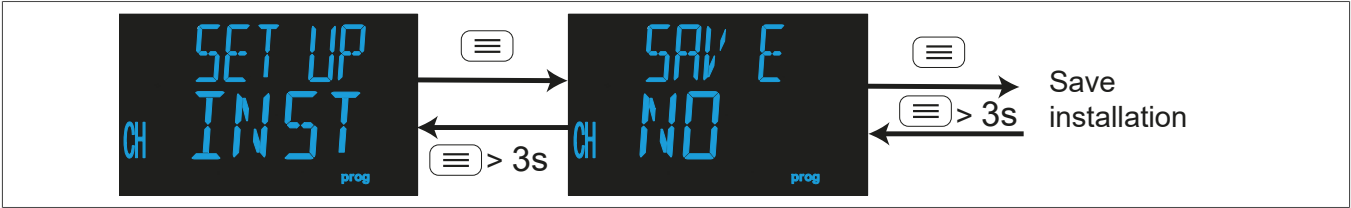
Fig. 43: Save installation menu

8.5.1   Saving the installation

- Press the ≡ button to go to programming mode.

  The programming value flashes.

- Press the >R or <T button to choose between the different options.

Saving the installation

Possible values	YES: The device installation is saved.
	NO: The device installation is not saved.

Table 13: Setting options for saving the installation

- Press the ≡ button for > 3 seconds to confirm the setting and exit the mode.

9   RS-485 communication

The device has an RS-485 communication connection and features the Modbus® RTU communication protocol.

9.1   Connecting devices with RS-485

Requirements for the RS-485 cable

☑ Twisted cable
☑ With mesh shielding
☑ Minimum 3 wires

ⓘ   **Note**

The maximum distance between the device and master device is 1200 m.

Up to 32 devices can be connected.

An intelligent RS-232-to-RS-485 network protocol converter must be used to communicate with the master device

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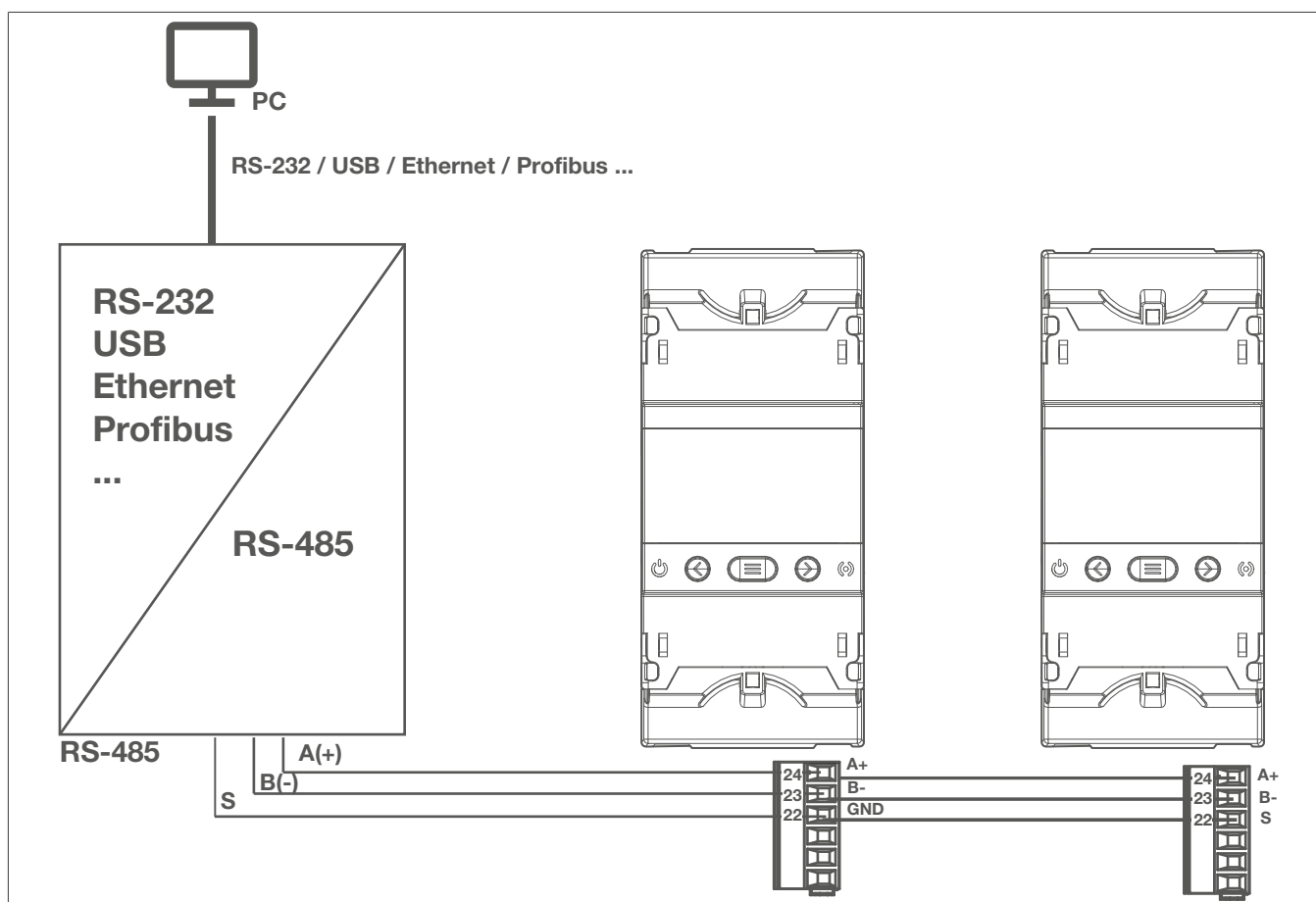
Fig. 44: Connecting Modbus RS-485

9.2 Modbus® protocol

The device uses **RTU** mode (Remote Terminal Unit) within the Modbus® protocol.

The Modbus® functions implemented in the device:

- **Function 0x01**: Read a relay.
- **Function 0x02**: Read the input status.
- **Functions 0x03** and **0x04**: Read integer registers.
- **Function 0x05**: Write a relay.
- **Function 0x10**: Write several registers.

9.3 Modbus® commands

> **Note**
>
> All Modbus® addresses are in hexadecimal format.

9.3.1 Device and installation variables

Functions 0x01 and **0x05** are relevant for saving the new installation variables.

Function 0x02

Parameter	Format	Address	Value
The installation was tripped by the **TRIP** input.	bool	5DC	**0:** Not tripped - **1:** Tripped
The installation has changed.	bool	7CE	**0:** Not changed - **1:** Changed
Internal error was detected in the **HR551**.	bool	7CF	**0:** Not detected - **1:** Detected
Saving the new installation.	bool	F9F	**1:** Save the installation

Table 14: Modbus memory mapping: HR551

Function 0x04

Parameter	Format	Address	Value
Device date and time	Unit [32]	283C - 283D	Device date (epoch format)
Serial no. of the **HR72x** registered in the system channel	String	3458...345E	-
Status of the installation	Unit [16]	3583	**0...5** (Tab. 16)
Status of the **HR551**	Unit [16]	3584	**0...2** (Tab. 17)
ID no. of the **HR551**	Unit [32]	35E8 - 35E9	-
Serial no. of the **HR551**	Unit [16]	364C...3652	-

Table 15: Modbus memory mapping: HR551

Possible installation statuses

Value	Description
0	Correct installation
1	A new **HR72x** was detected and added to the system.
2	The **HR72x** registered in the system is not detected.
3	An **HR72x** that is not registered in the system was detected.
4	More **HR72x** than the system can accommodate were detected.
5	No **HR72x** is registered in the system.

Table 16: Installation statuses

Possible status of HR55x

Value	Description
0	Equipment in preparation process
1	Equipment in the idle state
2	Device is tripped by activating the TRIP input

Table 17: Status of the device

9.3.2 Channel variables

Function 0x04: Read registers

Configuration variables	Format	Address	Units/Format
Model **HR72x**	String	FA0-FA1	-
Serial no. of the **HR72x**	String	FA2...FA8	-
Firmware version (part 1)	Unit [16]	FA9	-
Firmware version (part 2)	Unit [16]	FAA	-
Revision of the firmware version	Unit [16]	FAB	-
HR72x status	Unit [16]	FAC	**0...6** (Tab. 19)
HR72x channel	Unit [16]	FAD	**1:** Channel 1
Programmed tripping curve or delay	Unit [16]	FAE	ms
Programmed trip current	Unit [16]	FAF	mA
Instantaneous total discharge current	Unit [16]	FB0	mA

Table 18: Modbus memory mapping: Channel variables

Function 0x04: Read registers

Configuration variables	Format	Address	Units/Format
Instantaneous alternating discharge current	Unit [16]	FB1	mA
Instantaneous direct discharge current	Unit [16]	FB2	mA
Total discharge current which trips the relay	Unit [16]	FB3	mA
Alternating discharge current which trips the relay	Unit [16]	FB4	mA
Direct discharge current which trips the relay	Unit [16]	FB5	mA
Programmed pre-alarm current	Unit [16]	FB6	%
Pre-alarm operation	Unit [16]	FB7	**0:** Deactivated **1:** Activated with deactivated interlock **2:** Activated with activated interlock

Table 18: Modbus memory mapping: Channel variables

Possible status of HR72x

Value	Description
0	**HR72x** in the start phase
1	**HR72x** in the idle state
2	**HR72x** was tripped due to a detected discharge current
3	**HR72x** tripped by TEST with an error test result
4	**HR72x** tripped by TEST with a successful test result
5	**HR72x** was tripped due to communication
6	**HR72x** tripped by **TRIP** input

Table 19: Status of HR72x

Function 0x02

Parameter	Format	Address	Value
Internal error detected in the **HR72x**	bool	0000	**0:** Not detected **1:** Detected

Table 20: Modbus memory mapping: Channel status

Function 0x02

Parameter	Format	Address	Value
Pre-alarm activated	bool	0001	**0:** Deactivated **1:** Activated
Channel tripped	bool	0002	**0:** Not tripped **1:** Tripped
Channel tripped due to discharge current	bool	0003	
Channel was tripped due to an error in the **HR72x**	bool	0004	
Channel is tripped by a test	bool	0005	
Channel tripped due to **TRIP** input	bool	0006	
Tripped channel due to communication	bool	0007	
HR72x not connected	bool	0008	**0:** Not detected **1:** Detected
Error when writing to the **HR72x**	bool	0009	
HR72x does not respond to requests	bool	000A	

Table 20: Modbus memory mapping: Channel status

9.3.3 Variables of the trip unit for a test or communication

Functions 0x01 and 0x05

Configuration variables	Format	Address	Valid data range	Standard value
Trip due to **TEST** of the channel	bool	07D0	**FF00:** Initiate test of the channel **0000:** End TEST	0000
Trip due to communication of the channel	bool	07D1	**FF00:** Channel trip **0000:** Channel reset	0000

Table 21: Modbus memory mapping: Configuration of the trip and the pre-alarm

9.3.4 Event parameters

1. Read the **Number of events** in the channel you want to query.
2. Enter the number of the channel you want to query into the Channel selection: 1.
3. Enter the number of the event you want to query into the **Event selection**.
4. Read the eight **Event** registers to query the details of the events.

Parameter	Format	Address	Function	Value
Number of events in channel	Unit [16]	13BA	0x04	0...100
Channel selection	Unit [16]	1388	0x03 0x10	1
Event selection	Unit [16]	1389		1...10

Table 22: Modbus memory mapping: Events

Parameter	Format	Address	Function	Value
Event	Unit [16]	1388	0x04	Type of event: **0**: Trip the channel relay **1**: Pre-alarm activated **2**: Individual test **3**: Error in transformer
	Unit [16]	1388-138A		Event date (epoch format)
	Unit [16]	138B		Programmed trip current
	Unit [16]	138C		Programmed trip delay or tripping curve
	Unit [16]	138D [2]		Total trip current (alternating + direct current)
	Unit [16]	138E [2]		Constant trip current
	Unit [16]	138F [2]		Alternating trip current
Delete events	bool	FA0	0x01 0x05	**1**: Deletes saved events

Table 22: Modbus memory mapping: Events

9.3.5 Trigger and pre-alarm configuration variables

Function 0x03: Read registers

Function 0x10: Write several registers

Configuration of the trip and the pre-alarm				
Configuration variables	**Format**	**Address**	**Valid data range**	**Standard value**
Relay curve or delay [3]	Unit [16]	3714	see Fig. X	0
Trip current [3]	Unit [16]	3715	see Fig. X	30 mA
Pre-alarm current	Unit [16]	3716	1 ... 100%	50%
Pre-alarm operation	Unit [16]	3717	**0**: Deactivated **1**: Activated with deactivated interlock **2**: Activated with activated interlock	1
Pre-alarm polarity	Unit [16]	36CE	**0**: Standard polarity **1**: Positive polarity	0
Polarity of the trip relay	Unit [16]	3718		

Table 23: Modbus memory mapping: Configuration of the trip and the pre-alarm

---

[2]   Applicable register if the read event is a relay trip.

[3]   To program the relay delay and the trip current, you first need to read off the possible values for every **HR72x**.

Relay curve or delay table

Parameter	Format	Function	Address	Value
Value 1	Unit [16]	0x04	1004	**1**: Curve INS – **0** [4]
Value 2	Unit [16]	0x04	1005	**2**: Curve SEL – **0** [4]
Value 3	Unit [16]	0x04	1006	**100** ms – **0** [4]
Value 4	Unit [16]	0x04	1007	**200** ms – **0** [4]
Value 5	Unit [16]	0x04	1008	**300** ms – **0** [4]
Value 6	Unit [16]	0x04	1009	**400** ms – **0** [4]
Value 7	Unit [16]	0x04	100A	**500** ms – **0** [4]
Value 8	Unit [16]	0x04	100B	**800** ms – **0** [4]
Value 9	Unit [16]	0x04	100C	**1000** ms – **0** [4]
Value 10	Unit [16]	0x04	100D	**3000** ms – **0** [4]
Value 11	Unit [16]	0x04	100E	**5000** ms – **0** [4]
Value 12	Unit [16]	0x04	100F	**0** [4]
Value 13	Unit [16]	0x04	1010	**0** [4]
Value 14	Unit [16]	0x04	1011	**0** [4]
Value 15	Unit [16]	0x04	1012	**0** [4]
Value 16	Unit [16]	0x04	1013	**0** [4]

Table 24: Modbus memory mapping: Relay curve or delay table

Trip current

Parameter	Format	Function	Address	Value
Value 1	Unit [16]	0x04	1014	**30** mA – **0** [5]
Value 2	Unit [16]	0x04	1015	**100** mA – **0** [5]
Value 3	Unit [16]	0x04	1016	**300** mA – **0** [5]
Value 4	Unit [16]	0x04	1017	**500** mA – **0** [5]
Value 5	Unit [16]	0x04	1018	**1000** mA – **0** [5]
Value 6	Unit [16]	0x04	1019	**3000** mA – **0** [5]
Value 7	Unit [16]	0x04	101A	**0** [5]

Table 25: Modbus memory mapping: Trip current table

[4]   **0**: Indicates that the value is not available.

[5]   **0**: Indicates that the value is not available.

Trip current

Parameter	Format	Function	Address	Value
Value 8	Unit [16]	0x04	101B	**0** [5]
Value 9	Unit [16]	0x04	101C	**0** [5]
Value 10	Unit [16]	0x04	101D	**0** [5]
Value 11	Unit [16]	0x04	101E	**0** [5]
Value 12	Unit [16]	0x04	101F	**0** [5]
Value 13	Unit [16]	0x04	1020	**0** [5]
Value 14	Unit [16]	0x04	1021	**0** [5]
Value 15	Unit [16]	0x04	1022	**0** [5]
Value 16	Unit [16]	0x04	1023	**0** [5]

Table 25: Modbus memory mapping: Trip current table

9.3.6 RS-485

RS-485 communication

Configuration variables	Format	Address	Valid data range	Standard value
Peripheral device number	Unit [16]	36B0	1...247	1
Baud rate	Unit [32]	36B1 - 36B2	4800, 9600, 19200, 38400, 57600, 115200	9600
Data format	Unit [16]	36B3	**0**: 8N1, **1**: 8E1, **2**: 8O1 **3**: 8N2, **4**: 8E2, **5**: 8O2	**0**

Table 26: Modbus memory mapping: RS-485 communication

9.3.7 Cange of channel

Cange of channel

Channels	Format	Address	Possible setting values	Standard value
Channel 1	Unit [16]	3718	1 ... 4	1
Channel 2	Unit [16]	37E0	1 ... 4	2
Channel 3	Unit [16]	38A8	1 ... 4	3
Channel 4	Unit [16]	3970	1 ... 4	4

Table 27: Cange of channel

9.3.8   Time setting

Time setting

	Format	Address	Possible set-ting values	Standard value
Time setting	Unit [32]	283C - 283D	The date and time are displayed in epoch format.	

9.3.9   Password

Password

	Format	Address	Possible set-ting values	Standard value
Password	Unit [16]	2A97	0000 ... 9999 [1]	0000

[1]   If the value is set to 0000, the device deactivates the configuration password.

10 Appendix

10.1 Technical data

Nominal voltage	230 V~, +/- 15%
Frequency	50/60 Hz
Power	7.5 VA
Category of the installation	CAT III 300 V

Monitoring functions

Degree of protection	Type B
Sensitivity (I∆n)	0.03 – 0.1 – 0.2 – 0.3 – 0.5 – 0.75 – 1 – 1.5 – 2 – 3 A
Settable trigger delay	INS [S] – 0.1 – 0.2 – 0.3 – 0.4 – 0.5 – 0.8 – 1 – 3 – 5 – 10 s
Rated frequency of monitored circuit	50/60 Hz
Rated differential current (non-operating)	0.8 I∆n
Rated short-time withstand current (Icw)	According to the protection
Conditional short-circuit differential current (I∆c)	According to the protection
Uimp of the voltage source	4 kV (CAT III)
Compatible converter	HR721, HR722, HR723, HR724

Relay output

Number	1
Max. voltage of open contacts	230 V ~+/- 15%
Maximum current	6 A
Maximum switching capacity	1500 VA

Service life

Electrical (250 V ~ /5 A)	60×10^3 switching operations
Mechanical	10×10^6 switching operations

TRIP input

Type	Voltage 230 V~
Insulation	5.3 kV
Input resistance	2 kΩ
Operating temperature	-10°C/+50°C
Storage temperature	-20°C/+70°C
Relative humidity	5/95%

RS-485 interface

Communication protocol	Modbus® RTU
Baud rate	4.8 - 9.6 - 19.2 - 34.8 - 57.6 - 115.2 kBd
Data bits	8
Stop Bits	1 - 2
Parity	without, even, odd

Cable type between the device and HR converter

Connector type	RJ45 Standard according to EIA/TIA-485-A
Cable type	Cat.6 U/UTP - 4 x 2 x AWG24/7
Cable length	Max. 9 m

Digital output

Type	Galvanically separated
Voltage	Max. 230 V~
Current	Max 0.1 A

Other data

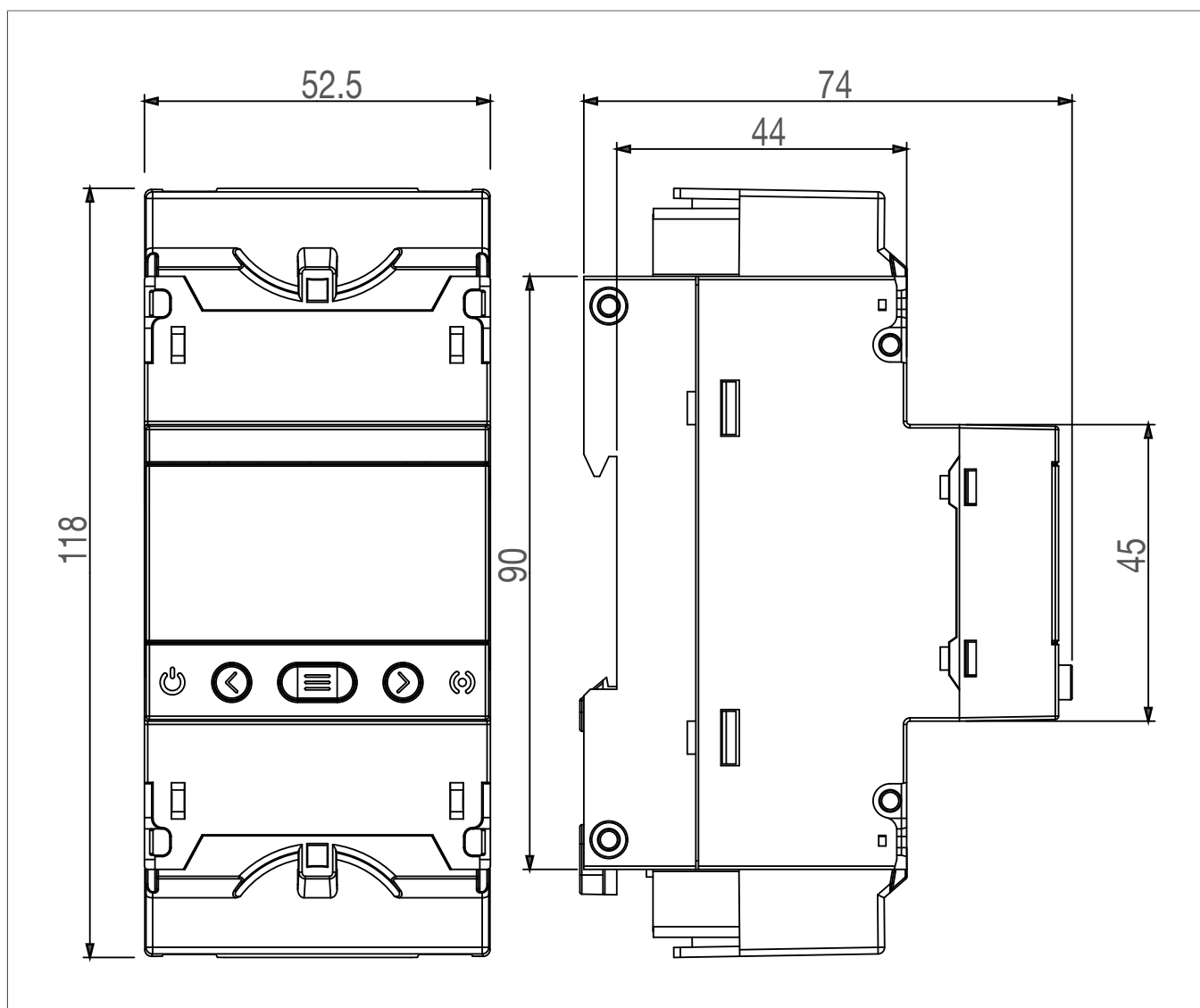|	
Maximum height	2000 m
Degree of protection	IP30
Conductor cross-section	2.5 mm²
Dimensions	52.5 x 118 x 74 mm
Standard	IEC 60947-2-M/IEC 60755

10.2 Dimensions

Dimensions for HR55x
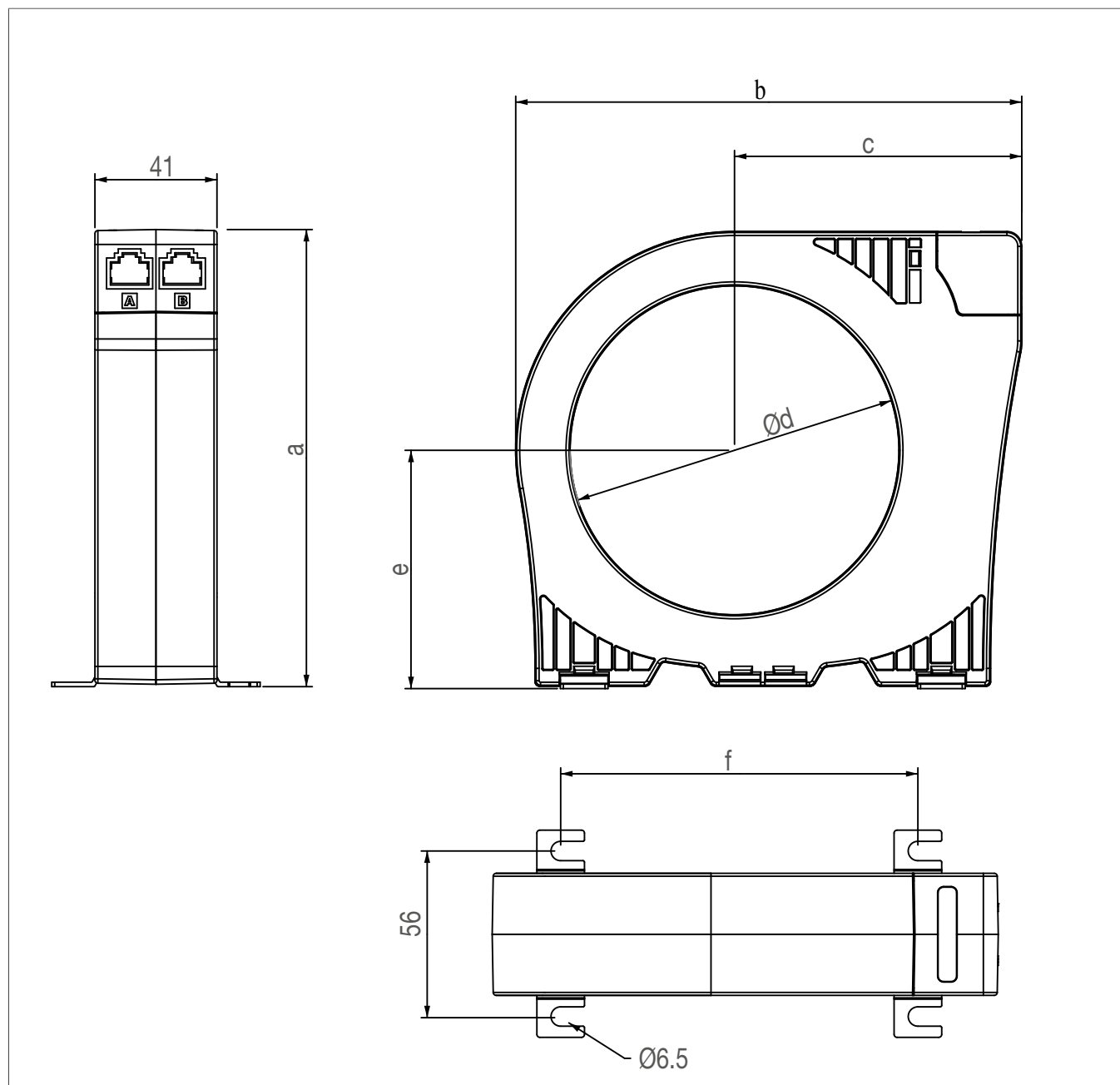

Fig. 45: Dimensions for HR55x

Dimensions for HR72x

Fig. 46: Dimensions for HR72x

Device dimensions for HR72x

	a	b	c	d	e	f	Copper cable (3P+N)
HR721	80	97	61.5	35.5	44.5	54	4x25 mm^2
HR722	98.5	118	72	55.5	52.5	81.5	4x70 mm^2
HR723	123.5	140	81.5	80.5	65	101.5	4x120 mm^2
HR724	153.5	170	96.5	110.5	80	120	4x240 mm^2

10.3   Disposal note

Correct disposal of this product (electrical waste).

(Applicable in the European Union and other European countries with separate collection systems).

This marking shown on the product or its documentation indicates that it should not be disposed of with other household waste at the end of its working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this device from other types of waste. Recycle the device responsibly to promote the sustainable reuse of material resources.

Household users should contact either the dealer where they purchased this product, or their local government office, for details of where and how they can take this device for environmentally safe disposal.

Commercial users should contact their supplier and check the terms and conditions of the purchase contract. This product should not be mixed with other commercial waste for disposal.

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