

RCM-W8

Residual and Operating Current Monitoring Device



Product Information



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1 Application

The residual and operating current monitoring device RCM-W8 with connections for current transformers is used for the monitoring of residual and operating currents in TN and TT systems (earthed AC systems). It can also be used to monitor operating currents in IT systems. In combination with other devices of the RCM series, display devices or devices for data coupling for third-party systems, it forms a complete monitoring system for residual and operating currents. This monitoring system increases the safety and reliability of a system, e.g. through early detection of faults or of (usually gradual) increases residual currents. This supports preventative maintenance.

The main features of the RCM-W8 are as follows:

- Connection of up to eight current transformers to each RCM-W8 for measurement of residual or operating currents
- Channel-specific transformer and short-circuit monitoring
- True RMS measurement (RMS = root mean square)
- Parallel measurement and data processing (no multiplexing)
- Configurable triggering thresholds for trigger messages, channel-specific
- Configurable warning thresholds (e.g. preliminary warnings) for warning messages, channel-specific
- Configurable delay times for warning and trigger messages
- Configurable reset delay time for trigger and warning messages
- Display for each measuring channel using multicolour LED indicators
- Fault display possible for each measuring channel together with digital I/O-devices (e.g. MPM 16-8) as potential-free contact
- Centralized alarm via signal relay (open-circuit or closed-circuit principle)
- Communication via CAN bus (CAN = Controller Area Network)
- Use of up to 16 devices, such as RCM-W8 (128 channels) on one bus segment
- Evaluation possible using a web browser (e.g. via the web interface MPG-ETH-3) or display and configuration device (e.g. ANZ 05)

2 Functions

2.1 Warning and triggering thresholds

Warning and triggering thresholds are configurable limit values that can be adjusted according to the currents to be measured.

If any of these thresholds are reached, the RCM-W8 sends a message via the CAN bus and the signal relay will be set if configured. This is indicated visually using the status LED indicators on the measuring channel monitoring. Warning and triggering thresholds can be set separately for each channel.

Delay times for warning and trigger messages can be set to prevent a message from being displayed if the value exceeds or falls below the threshold for a short time only (see chapter 2.3 on page 7).

In operating current monitoring, the upper and lower warning thresholds define the normal operating range (window function).

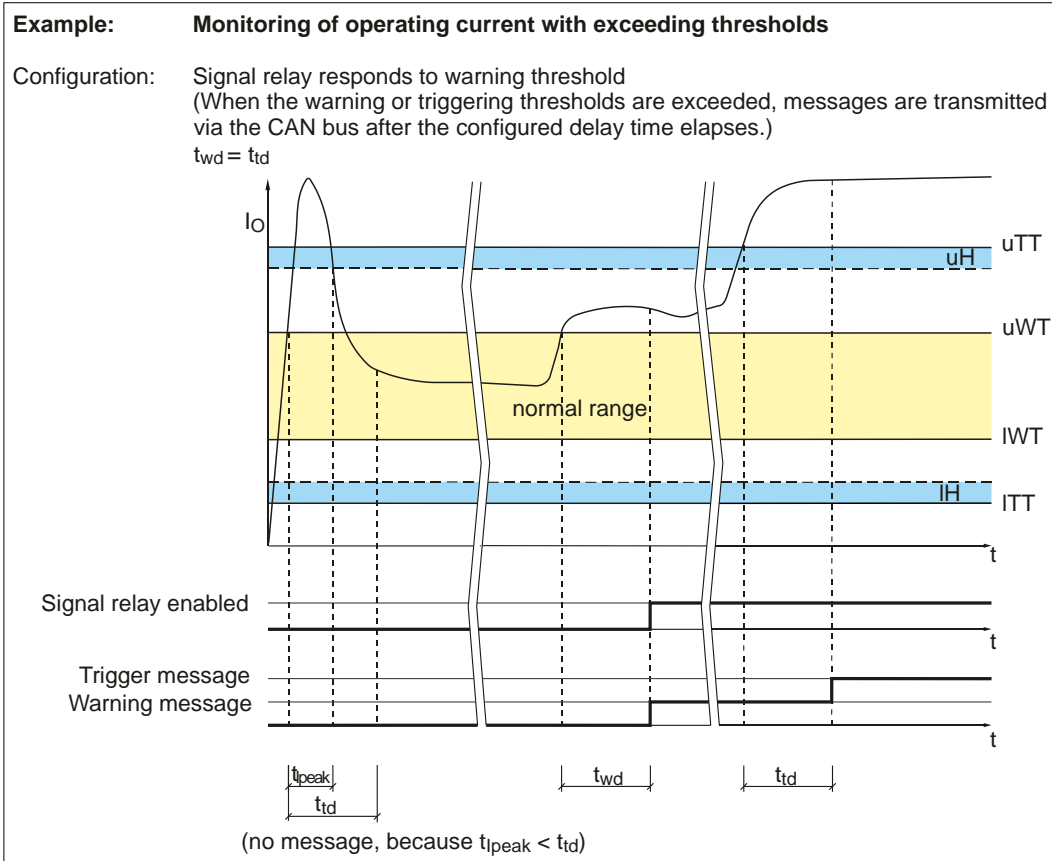


Figure 1: Example operating current curve

- I_o Operating current
- t Time
- t_{peak} Duration of inrush peak current of a consumer
- t_{td} Delay time for trigger messages (configurable), $> t_{peak}$ – otherwise a message is sent!
- t_{wd} Delay time for warning messages (configurable)
- u_{TT} Upper triggering threshold (configurable)
- u_H Upper hysteresis range (configurable, see chapter 2.2 on page 7)
- u_{WT} Upper warning threshold (configurable)
- I_{WT} Lower warning threshold (configurable)
- I_H Lower hysteresis range (configurable, identical to upper hysteresis range)
- I_{TT} Lower triggering threshold (configurable)

For residual current monitoring, only the upper warning and triggering thresholds need to be evaluated for each channel. The lower thresholds should be set to 0 mA.

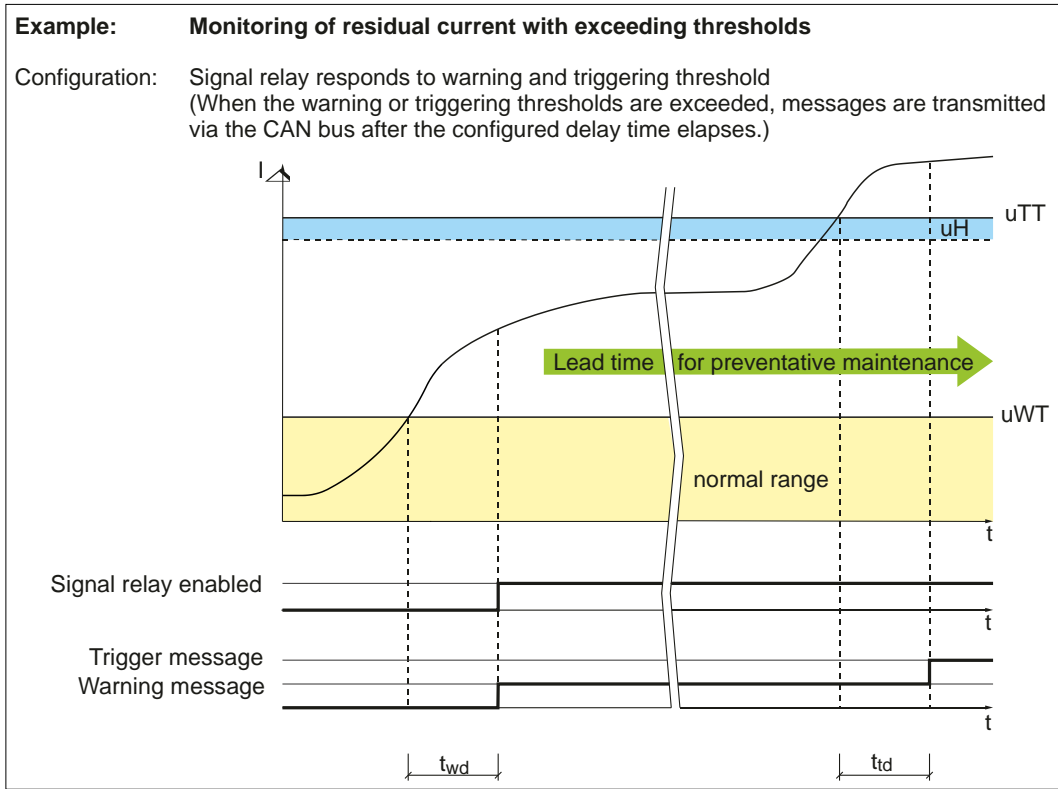


Figure 2: Example residual current curve

I_{Δ}	Residual current
t	Time
t_{td}	Delay time for trigger messages (configurable)
t_{wd}	Delay time for warning messages (configurable)
uTT	Upper triggering threshold (configurable)
uH	Upper hysteresis range (configurable, see chapter 0 on page 7)
uWT	Upper warning threshold (configurable)

2.2 Hysteresis range

The upper and lower triggering thresholds have a configurable hysteresis range. The upper and lower hysteresis ranges are identical in size. The hysteresis ranges can be defined individually for each channel.

For example, if the measured operating current exceeds the upper triggering threshold and then falls below again, the trigger message will be reset only after the operating current falls below the upper hysteresis range and the configured reset delay time elapses.

The following figure shows an example of the current curve with the corresponding warning and trigger messages.

The configuration in the example (Figure 3) is as follows:

- Monitoring of operating current
- Delay time for trigger messages $t_{td} = 0$ s
- Delay time for warning messages $t_{wd} = 0$ s
- Reset delay time for trigger and warning messages $t_{rd} = 0$ s
- Signal relay responds to triggering threshold

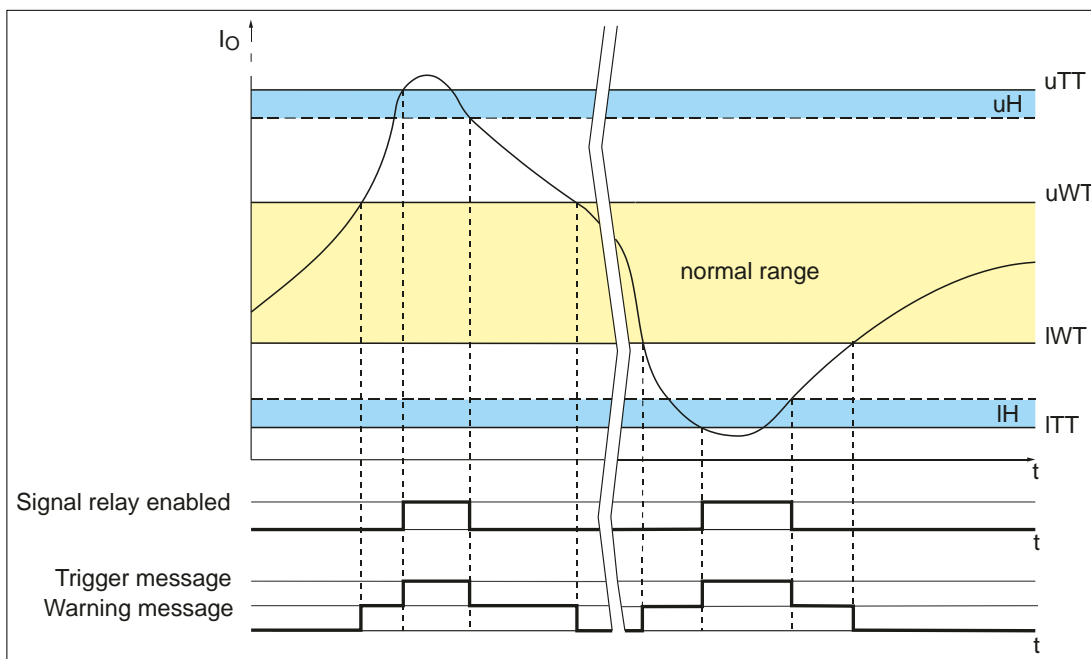


Figure 3: Example of an operating current curve

2.3 Delay times

The following delay times can be set for residual and operating current monitoring:

- Delay time for trigger messages (t_{td}),
- Delay time for warning messages (t_{wd}),
- Reset delay time for trigger and warning messages (t_{rd}).

Delay times for warning and trigger messages

By entering a delay time, messages triggered by short-term current fluctuations can be prevented from being displayed.

For example, no trigger message will be issued if the duration of a device's inrush peak current is shorter than the configured trigger delay time (see Figure 4).

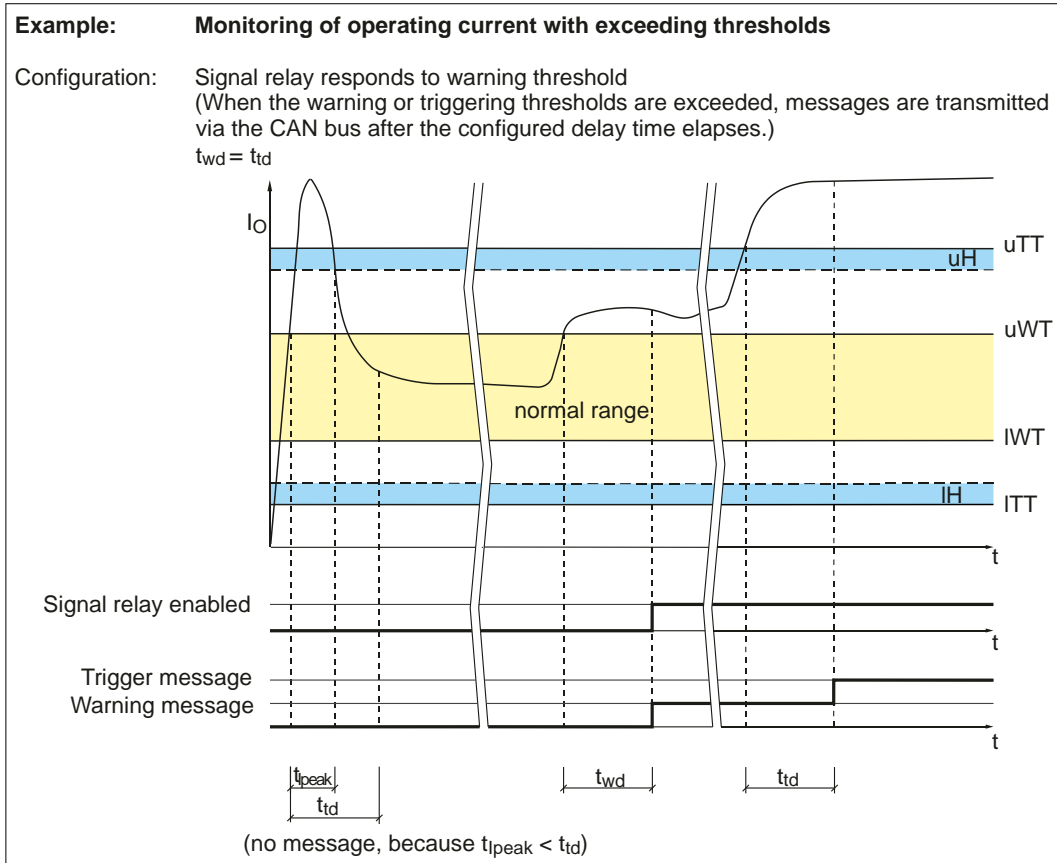


Figure 4: Delay times for warning and trigger messages

Reset delay for trigger and warning messages

The warning and trigger messages are reset when no more messages are pending. The reset delay time (t_{rd}) of the trigger and warning messages can be configured. It is used to ignore short-term fluctuations of a value that already has exceeded or falls below a warning and triggering threshold. The reset delay time is applied equally to the warning and trigger messages of all channels of a RCM-W8. If a message is reset, the same applies to the signal relay that has been set with the message.

The figure (Figure 5) shows an example operating current curve with the corresponding signal curves. The trigger message is displayed after the delay time for the trigger message (t_{td}) has expired. It is displayed and sent to the CAN bus only if the current is still above the upper triggering threshold after the delay time elapses. The signal relay is also set.

When the current falls below the hysteresis range or exceeds the upper warning threshold, the reset delay time (t_{rd}) is activated.

During the reset delay time, the trigger message remains active and the signal relay remains set. The trigger message and the signal relay are reset if the current is still below the hysteresis range after the reset delay time has expired. The warning message is reset after the current falls below the upper warning threshold and the reset delay time has expired.

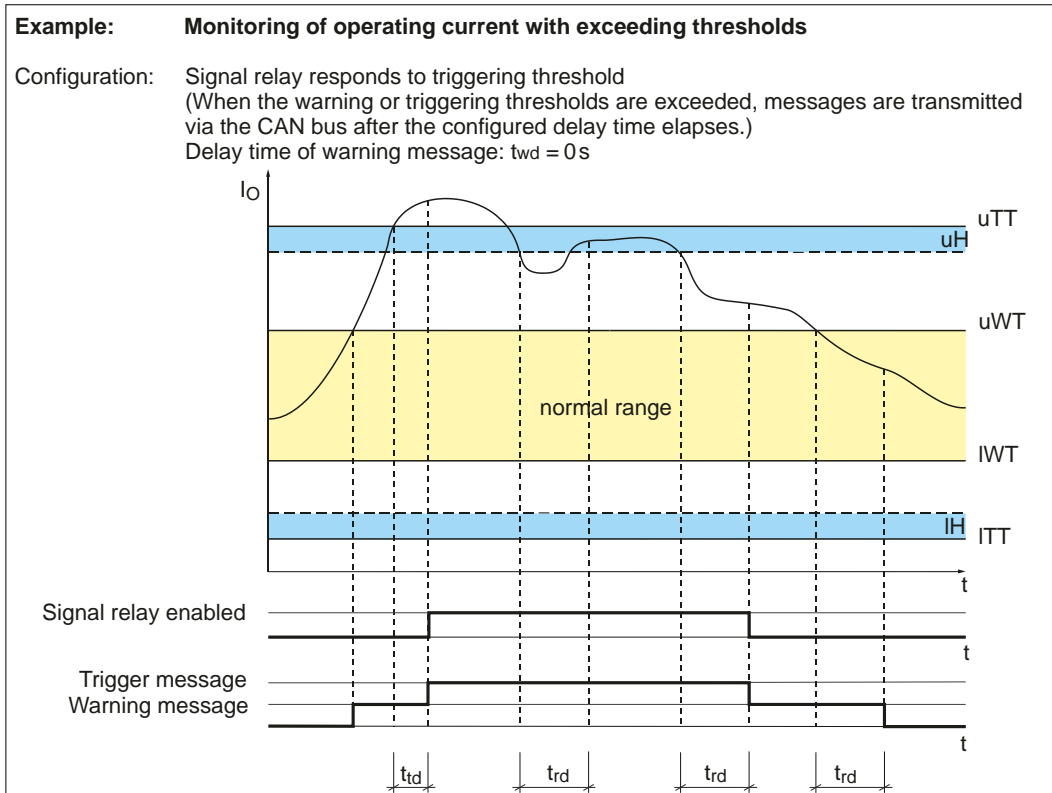


Figure 5: Example current curve illustrating the functional principle of the reset delay time

2.4 Residual current monitoring

Residual currents can be measured on any of the channels of the RCM-W8 using current transformers of the DW or DW-T series. The connected current transformers detect fault currents flowing to earth or through other paths in accordance with IEC 60755, type A, e.g.:

- In the incoming feeders
- In the outgoing feeders (consumers and systems)
- Stray currents in TN-S systems (PEN and N lines)
- At central earthing points

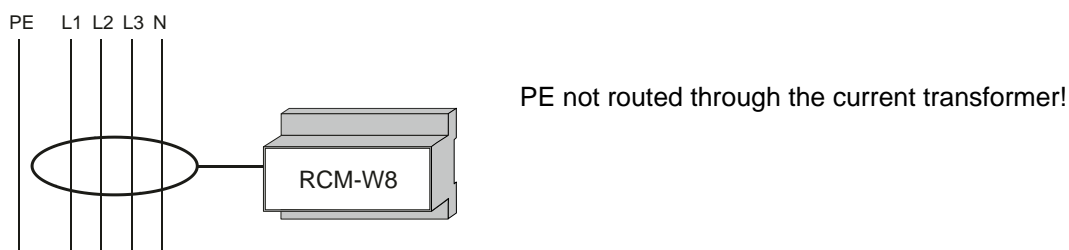


Figure 6: Simplified illustration of residual current monitoring

If the measured residual current exceeds the configured warning or triggering threshold, the affected channel or channels will be indicated by flashing or permanent yellow LED indicators "Fehler Kreis 1 ... 8" (Error Circuit 1 ... 8). Depending on the configuration, the signal relay (centralized alarm) will be set.

The display and configuration device ANZ 05 shows all current warning messages and residual currents. Via the web interface of the MPG-ETH-3 (system gateway as a web server), the channel-specific readings for each field device and the configured warning and triggering thresholds are displayed on a PC / laptop with a web browser.

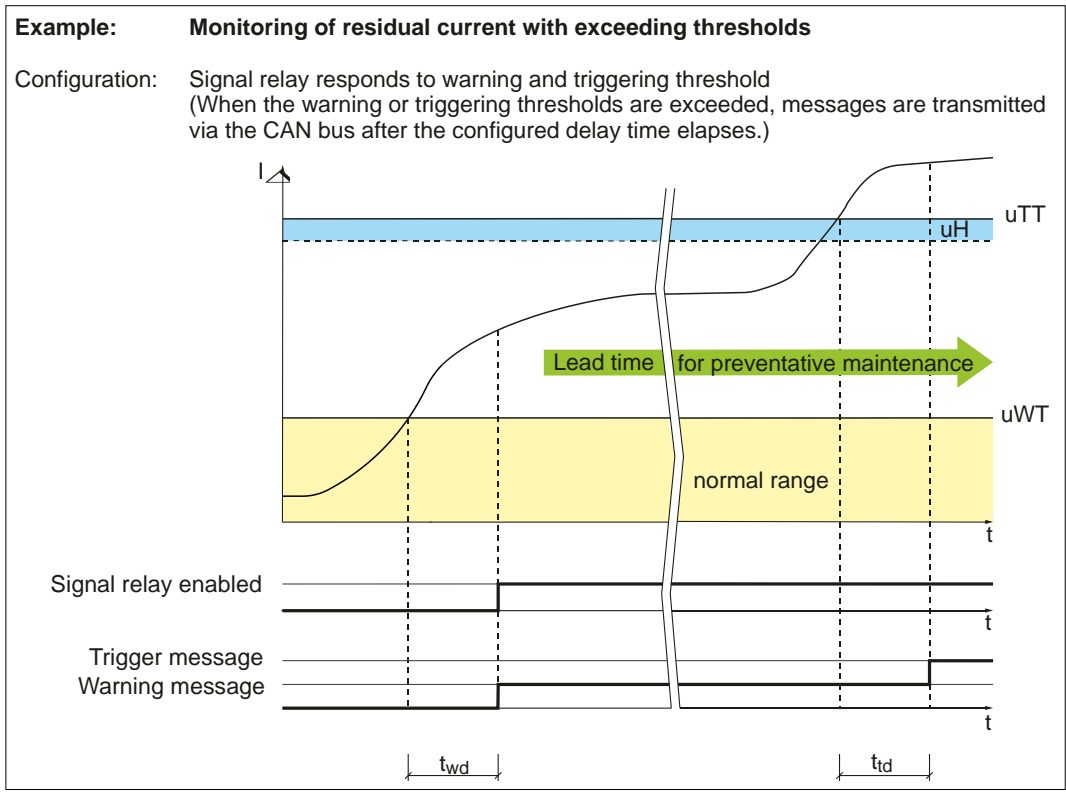


Figure 7: Example for residual current measurement with exceeding thresholds

2.5 Operating current monitoring

Depending on the type of current transformer, operating currents can be measured on each channel of a RCM-W8. The connected current transformers record the currents of the consumers.

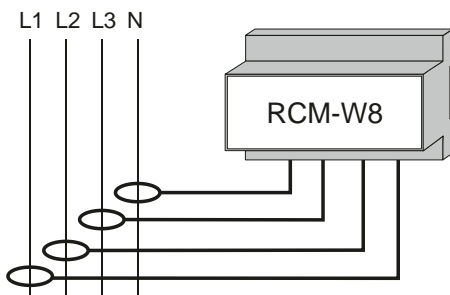


Figure 8: Simplified illustration of residual current monitoring

If the measured operating current exceeds the configured warning or triggering threshold, the affected channel or channels will be indicated by flashing or permanent yellow LED indicators "Fehler Kreis 1 ... 8" (Error Circuit 1 ... 8). Depending on the configuration, the signal relay (centralized alarm) will be set.

The display and configuration device ANZ 05 shows all current warning messages and operating currents. Via the web interface of the MPG-ETH-3 (system gateway as a web server), the channel-specific readings for each field device and the configured warning and triggering thresholds are displayed on a PC / laptop with a web browser.

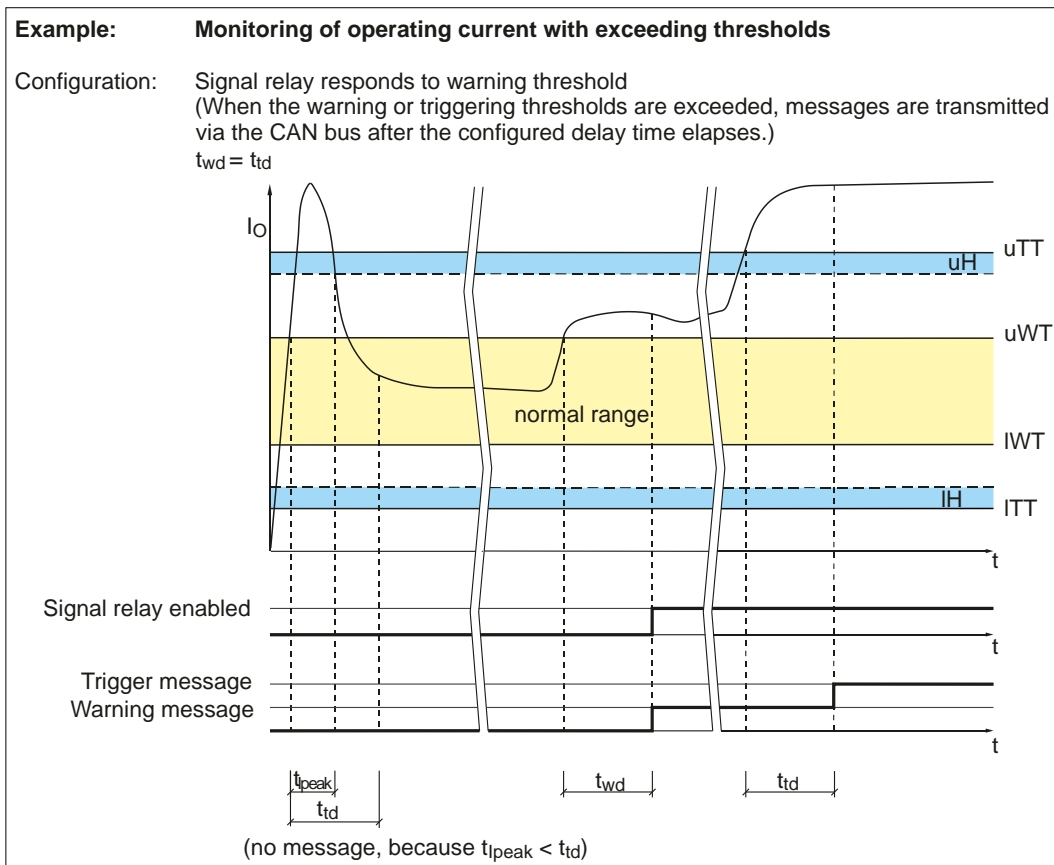


Figure 9: Example for operating current measurement with exceeding thresholds

When one of the monitored consumers is switched off, messages will be transmitted on the CAN bus when the operating current falls below the lower triggering threshold (ITT). The LED of the corresponding measuring channel lights yellow and the signal relay is set. The analysis on whether a consumer is defective or switched off at zero ampere (0 A) is performed in a downstream logic controller (e.g. with MPM devices).

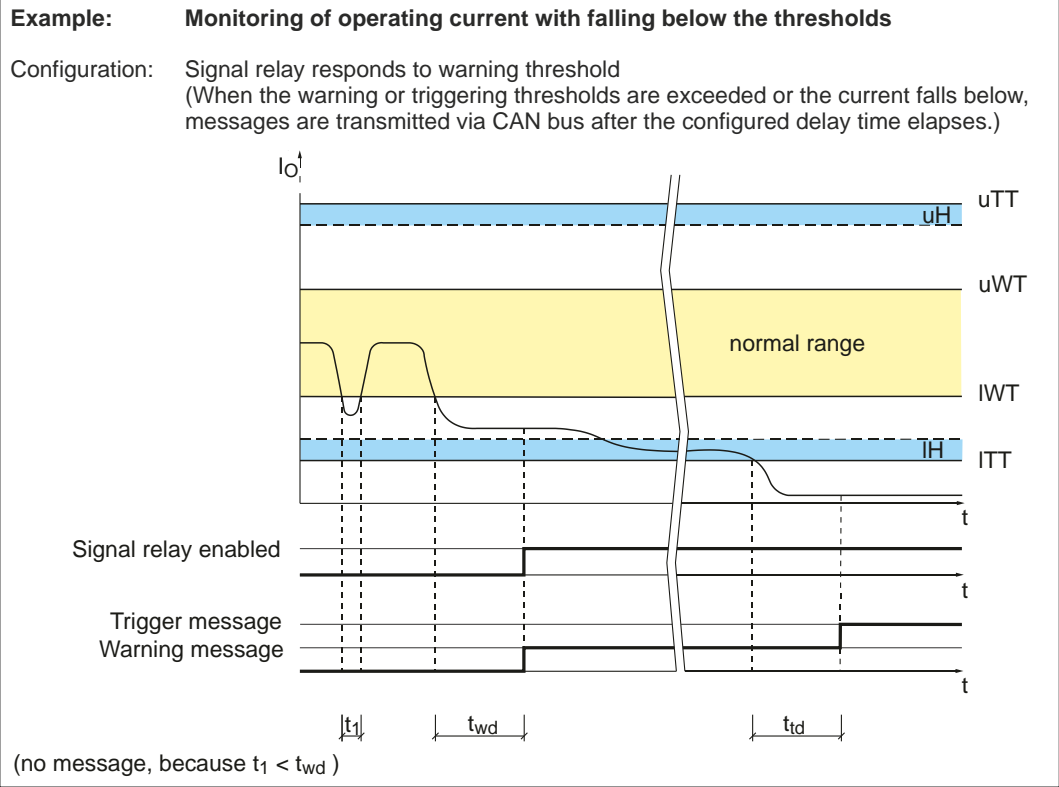


Figure 10: Example of operating current measurement with falling below threshold

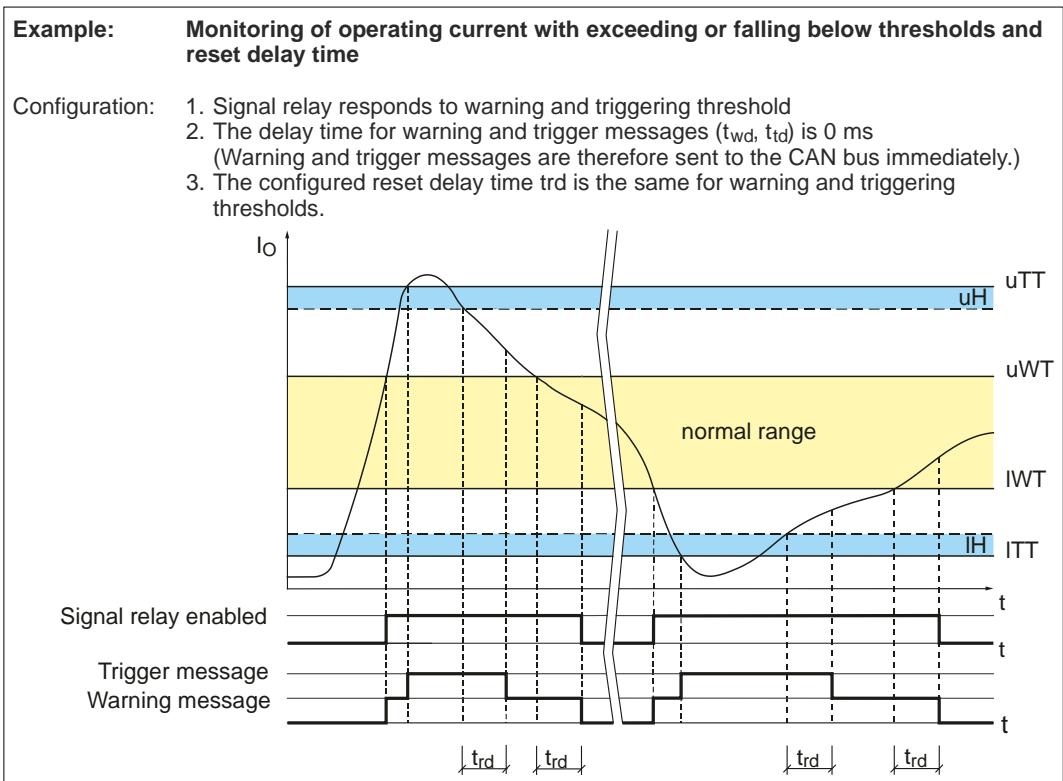


Figure 11: Example of operating current measurement with exceeding or falling below threshold

2.6 Current monitoring at central earthing points

NOTE: To monitor current at central earthing points, operating current transformers are used. They have to be designed for the expected currents.

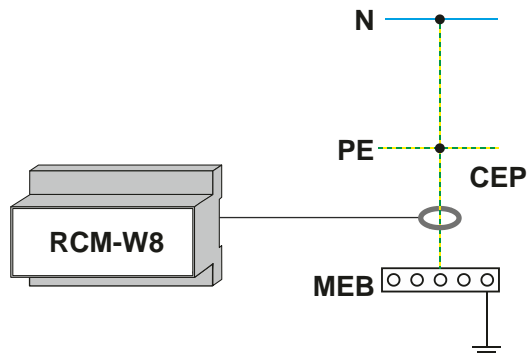


Figure 12: Simplified illustration of current monitoring at central earthing point

N	Neutral conductor
PE	Protective earth
CEP	Central earthing point
MEB	Main equipotential bonding

2.7 Monitoring current transformers

The RCM-W8 can be used for simultaneously analysing up to eight current transformers. For each activated channel, the connected current transformers are continuously monitored (short circuit / wire breakage).

3 Connections

3.1 Connections of a RCM-W8

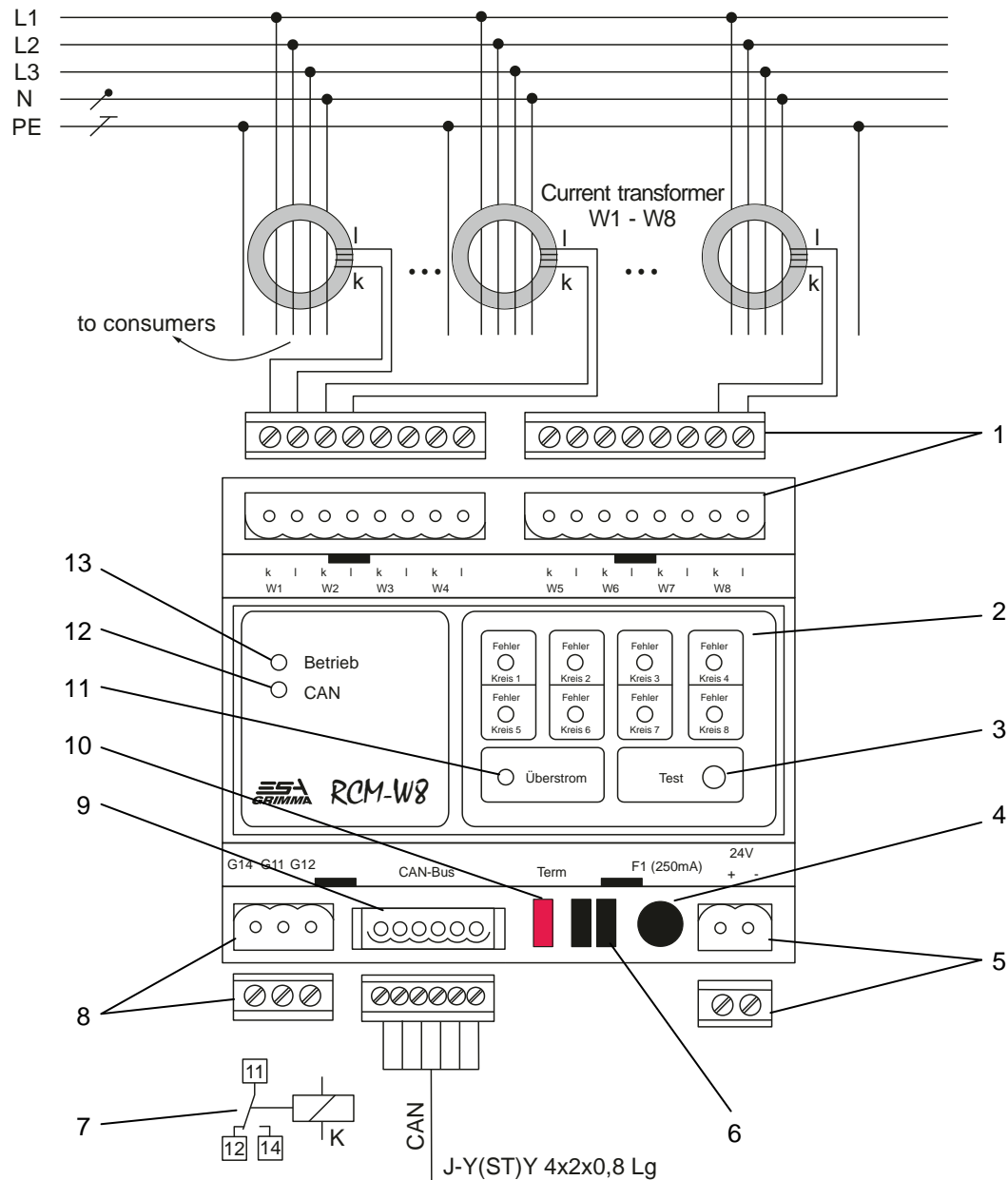


Figure 13: Connection diagram

- | | | | |
|---|--|----|---|
| 1 | Port / contact plug for current transformer (altogether 2) | 8 | Port / contact plug for potential-free exchanger (signal relay) |
| 2 | Status LED indicators of measuring channels | 9 | Port / contact plug for CAN bus |
| 3 | Button "Test" (service) | 10 | Jumper for bus termination |
| 4 | Internal back-up fuse | 11 | LED "Überstrom" (overcurrent, service) |
| 5 | Port / contact plug for 24 V DC power supply | 12 | Status LED "CAN" |
| 6 | Jumper for incoming feeder (altogether 2) | 13 | Status LED "Betrieb" (ready) |
| 7 | Signal relay (centralized alarm) | | |





Description	Jumper
Bus termination on (applies to first and last CAN bus devices)	 Inserted
Bus termination off (default)	 Removed
Feeding via CAN bus	 Inserted
Feeding via 24 V DC power supply (see No. 5 in Figure 13)	 Removed

Table 1: Jumper for bus termination and feeding

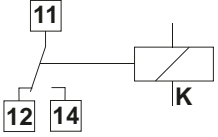
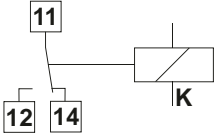
Signal relay	State	Contacts (closed)	
		11	12
Open-circuit principle (NO = normally open): 	Device off	11	12
	Device on / no messages or faults	11	12
	Device on / warning or trigger message active or fault is present	11	14
Closed-circuit principle (NC = normally closed): 	Device off	11	12
	Device on / no messages or faults	11	14
	Device on / warning or trigger message active or fault is present	11	12

Table 2: Open-circuit or closed-circuit principle of signal relay (see no. 7 in Figure 13)

3.2 Application examples

Figure 14 shows a simplified representation of a residual current measurement using several RCM-W8 devices. The display and configuration device ANZ 05 shows the measured values, messages and device faults from all RCM-W8 devices initialised on the CAN bus.

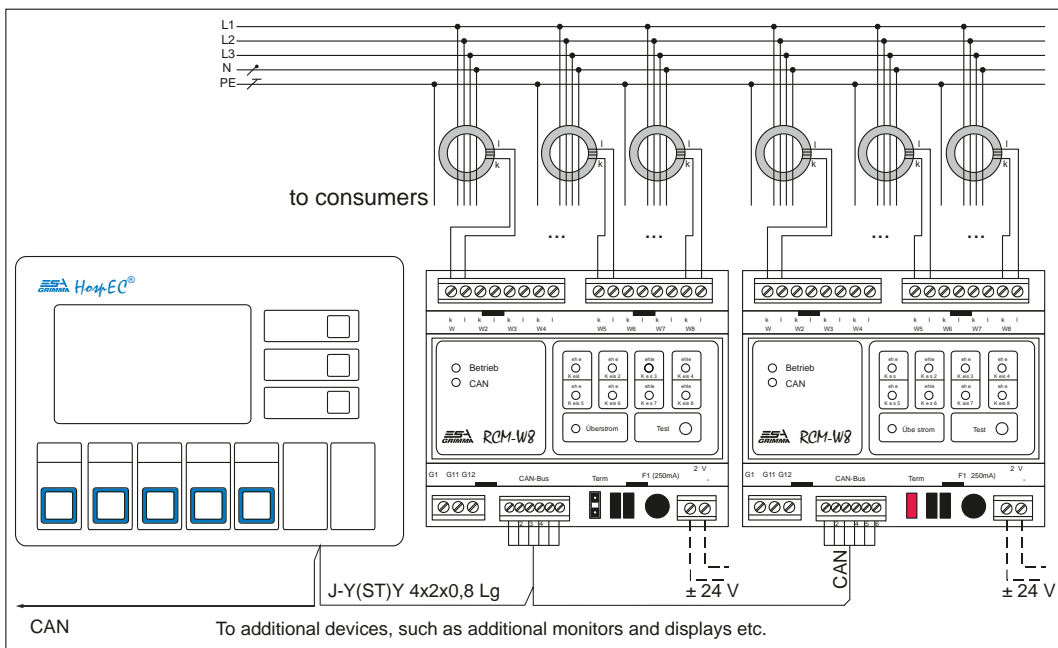


Figure 14: Overview of residual current measurement using multiple RCM-W8 devices

Figure 15 shows simplified representation of a measurement channel-specific evaluation using digital input/output devices of the MPM series. The digital I/O-devices of the MPM series can be used to provide a CAN bus system with binary signals specific to any monitoring channel, e.g. to indicate threshold exceeding. These signals can be used for further controlling purposes. The unique and programmable logic functions of the MPM devices can be used for analysis purposes, e.g. when a consumer is defective or switched off at zero ampere (0 A) operating current.

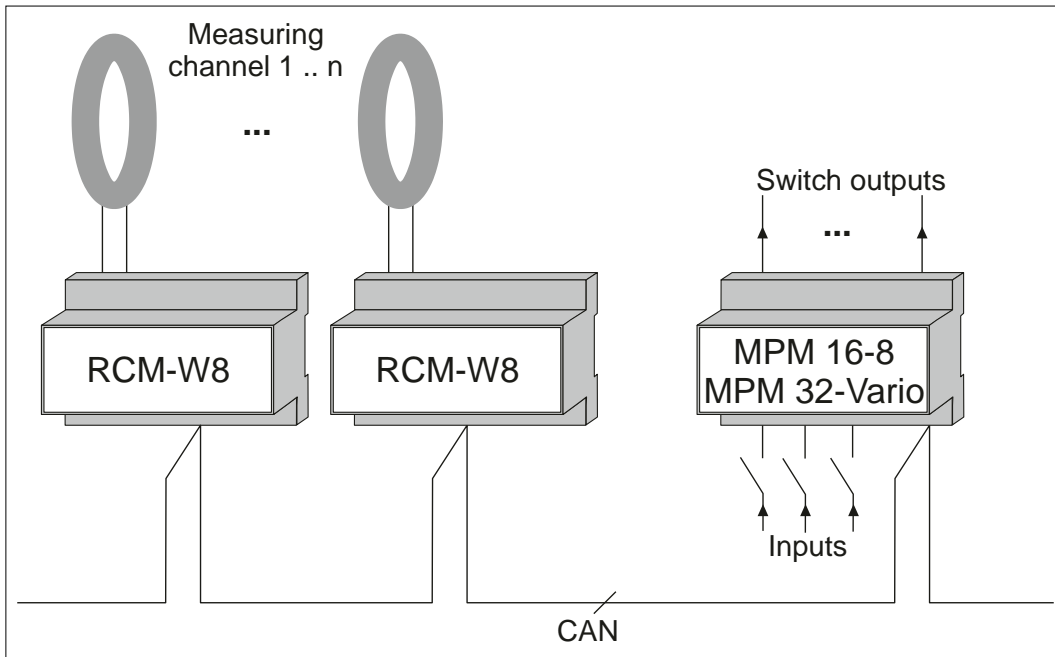


Figure 15: Simplified representation of a measurement channel-specific evaluation using digital I/O-devices of the MPM series

4 Assembly, connection, start-up, maintenance and testing

The RCM-W8 is installed in distribution boards (DIN 43871) on top-hat rails (DIN EN 60715).

Qualified electricians may only carry out assembly, connection and start-up of the RCM-W8. All relevant safety regulations and standards have to be observed.

The device automatically monitors all internal functions and the states of the connected current transformers as well as of the communication interface. Regular maintenance is therefore not required.

4.1 Connection of the RCM-W8

The RCM-W8 is connected in accordance with the connection diagram and the individual connection specifications (see chapter 3 on page 14). Observe the technical specifications of the device (see chapter 8 on page 24). A separate documentation is provided with information about the CAN bus.

If the RCM-W8 is connected to a CAN bus, the bus terminator on the XCAN terminal adapter must be adjusted accordingly.

4.2 Connection to current transformers

Different types of current transformers can be used. Only use DW/DW-T transformers for monitoring residual currents. The type of current transformer to use depends on the geometric dimensions of the conductors to be monitored amongst other factors. Note that some current transformers may require the use of a shunt. Table 3 displays examples of the current monitoring ranges, examples of the various types of current transformers, their corresponding shunt sizes and the values to be entered for configuration purposes.

NOTE: Additional technical information and dimensions are listed in the current transformer specifications and have to be observed.

	Monitoring range	Current transformer type	N/S	External Shunt in Ω	Internal diameter in mm	Values to be entered (HospEC Configurator, MPG-ETH-3)		
						"BA" (OM)	N/S	R
Residual current	10 ... 1000 mA	DW-13/700	700/1	-	18	"Diff." (Res.)	700/1	100 Ohm
		DW-28/700			28			
		DW-35/700			35			
		DW-80/700			80			
		DW-110/700			110			
		DW-140/700			140			
		DW-210/700			210			
		DW-T-110/700			110			
		DW-T150/700			150			
		DW-T300/700			300			
Operating current	0 ... 50 A	ASR20.3	100/1	0.22	21	"Betr." (Oper.)	100/1	0.22 Ohm
		ASK51.6		0.22	□*			
		ASR201.3		0.22	21			
		ASR22.3		0.22	22.5			
		KBU 23		0.22	□*			
	0 ... 100 A	ASK41.3	200/1	0.22	□*	"Betr." (Oper.)	200/1	0.22 Ohm
		KBU 23		0.22	□*			
Other current transformers available on request.								

□* Rectangular internal cross-section

Table 3: Overview of the current transformers to be used and their analysis areas

5 Buttons and display

5.1 Indication of the operation and communication status of the RCM-W8

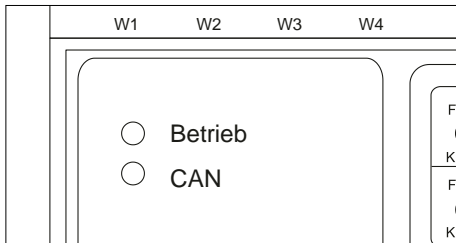


Figure 16: Status LED indicators for operation and communication status

Status LED “Betrieb” (Ready)

Off	No power supply
Green	Normal operation
Yellow	Configuration in progress
Red	Device fault or transformer connection fault

Status LED “CAN”

Off	No power supply
Flashes green	CAN bus is all right (communication is all right).
Green	Configuration in progress
Red	CAN bus fault (communication fault)

5.2 Status LED indicators for monitoring of measurement channel

One LED per measurement channel (“Fehler Kreis 1 ... 8” (Fault Circuit 1 ... 8)) shows the status of the operating or residual current being monitored as well as the status of the connected current transformer.

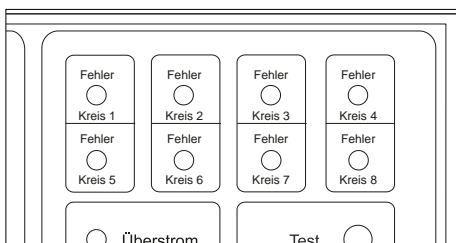


Figure 17: Status LED indicators for monitoring of measurement channel

Status LED “Fehler Kreis 1 ... 8” (Fault Circuit 1 ... 8)

Off	Normal operation
Flashes yellow	Warning message active
Yellow	Trigger message active
Flashes red or red	Transformer connection fault, wire breakage or short-circuit

5.3 Button “Test” and status LED “Überstrom” (Overcurrent)

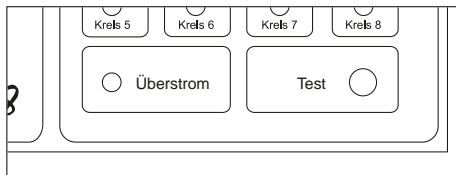


Figure 18: Status LED “Überstrom” (Overcurrent) and button “Test”

NOTE: Only authorised service technicians from ESA Elektroschaltanlagen Grimma GmbH are permitted to use the button “Test” for any other purposes.

After initialising the RCM-W8, an automatic LED test is performed. The LED “Überstrom” (Overcurrent) briefly lights up red and green. Otherwise, the LED is important for the service technician of ESA Elektroschaltanlagen Grimma GmbH of importance.

5.4 Display for a non-configured RCM-W8

If a non-configured RCM-W8 is connected to power, the LED indicators on the device will show this status as follows:

Status LED “Betrieb” (Ready):	Green
Status LED “CAN”:	Green
Status LED indicators “Fehler Kreis 1 ... 8” (Fault Circuit 1 ... 8):	Flash green (all LED indicators)
Status LED “Überstrom” (Overcurrent):	Flashes green

6 Messages / communication interface

Messages are given by the LED indicators and can be transmitted via the potential-free exchanger of the integrated signal relay.

The CAN interface can be used to transmit measured values as well as the current operational and fault status to external peripheral equipment and to connect the device to the building services control system. For example, messages such as device fault or triggering threshold exceeding can be indicated visually or acoustically using the display and configuration device ANZ 05.

7 Configuration of the RCM-W8

7.1 Configurable values

NOTE: When the warning or triggering thresholds are exceeded, messages are transmitted via the CAN bus after the configured delay time elapses.

The following settings can be configured on the RCM-W8:

- Address on the CAN bus
- Activation of the corresponding channels
- Monitoring of operating or residual currents depending on current transformer of each channel
- Lower and upper triggering threshold (ITT/uTT) for each channel
- Lower and upper warning threshold (IWT/uWT) for each channel
- Lower and upper hysteresis range (IH/uH) for each channel
- Relay control
- Reset delay time (t_{rd}) for trigger and warning messages (resetting signal relay)
- Delay time (t_{td}) of trigger messages
- Delay time for warning messages (t_{wd})

7.2 Configuration using the software HospEC[®] Configurator

The software “HospEC[®] Configurator” can be used to configure the RCM-W8 and other devices in the system HospEC[®]. The final configuration is transmitted to the devices (CAN devices) from a PC / laptop connected to the CAN bus. The PC is connected to the CAN bus via an USB-CAN adapter. The previously stored data from the field devices can be read out and displayed with the HospEC[®] Configurator.

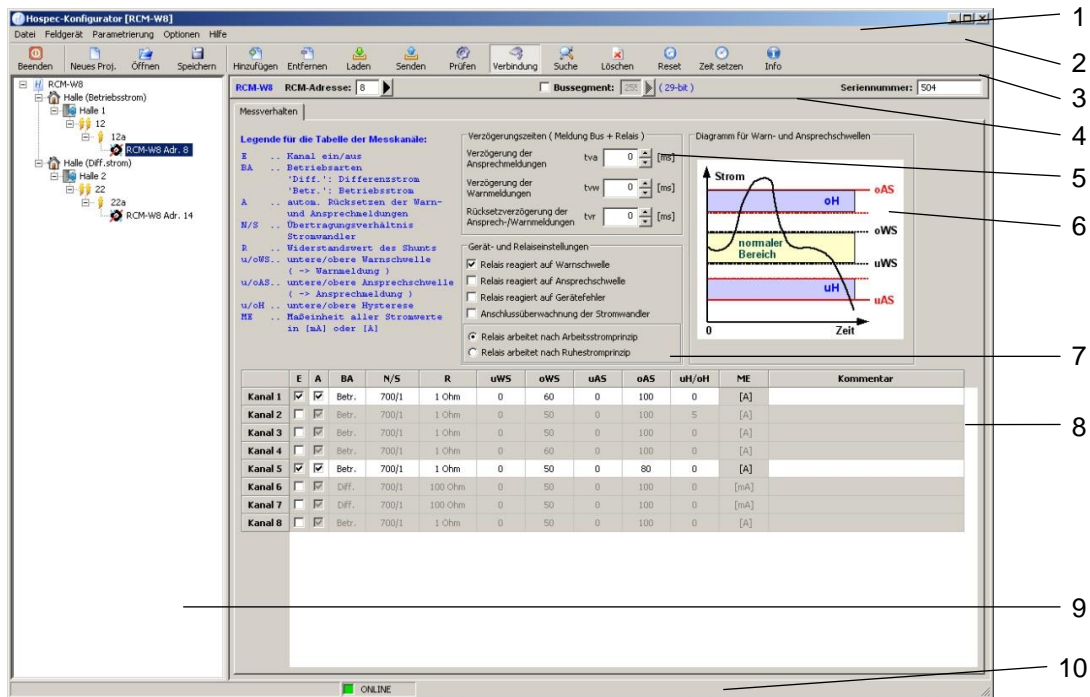


Figure 19: Configuration of the RCM-W8 measurement channels

- | | |
|---|--|
| 1 Title bar | 6 Warning and triggering threshold diagram |
| 2 Menu bar | 7 Relay settings (signal relay) |
| 3 Tool bar | 8 Configuration table of the eight channels (current transformers) of the RCM-W8 |
| 4 Display of the RCM address on the CAN bus and serial number of the RCM-W8 | 9 Project tree with connected field devices |
| 5 Delay time settings | 10 CAN status bar |

The following settings can be made:

- Operating or residual current measurement depending on connected current transformer for each channel
- Configurations of the current transformer type using a suitable shunt (see current transformer specifications)
- Lower and upper hysteresis range for each channel
- Lower and upper triggering threshold for each channel
- Lower and upper warning threshold for each channel
- Activation of the corresponding channels
- Delay time for trigger messages
- Delay time for warning messages
- Reset delay time for trigger or warning messages
- Relay control for warning threshold (centralized alarm)
- Relay control for triggering threshold (centralized alarm)
- Relay control for device fault
- Setting the signal relay as normally open (NO) contact (see Table 2 on page 15)
- Setting the signal relay as normally closed (NC) contact (see Table 2 on page 15)
- Changing the CAN address

7.3 Configuration using the display and configuration device ANZ 05

The measured values of each channel of a RCM-W8 connected via CAN bus can be shown on the display and configuration device ANZ 05. The ANZ 05 can also display incoming status messages from connected devices using freely configurable messages.

When warning or fault messages occur, the ANZ 05 automatically hides the measured values and displays the relevant messages. The ANZ 05 is also equipped with an acoustic alarm.

The ANZ 05 can be used to configure residual and operating current monitoring devices of the series RCM-Wx. In this case the devices have to be connected to the CAN bus and ready to operate.

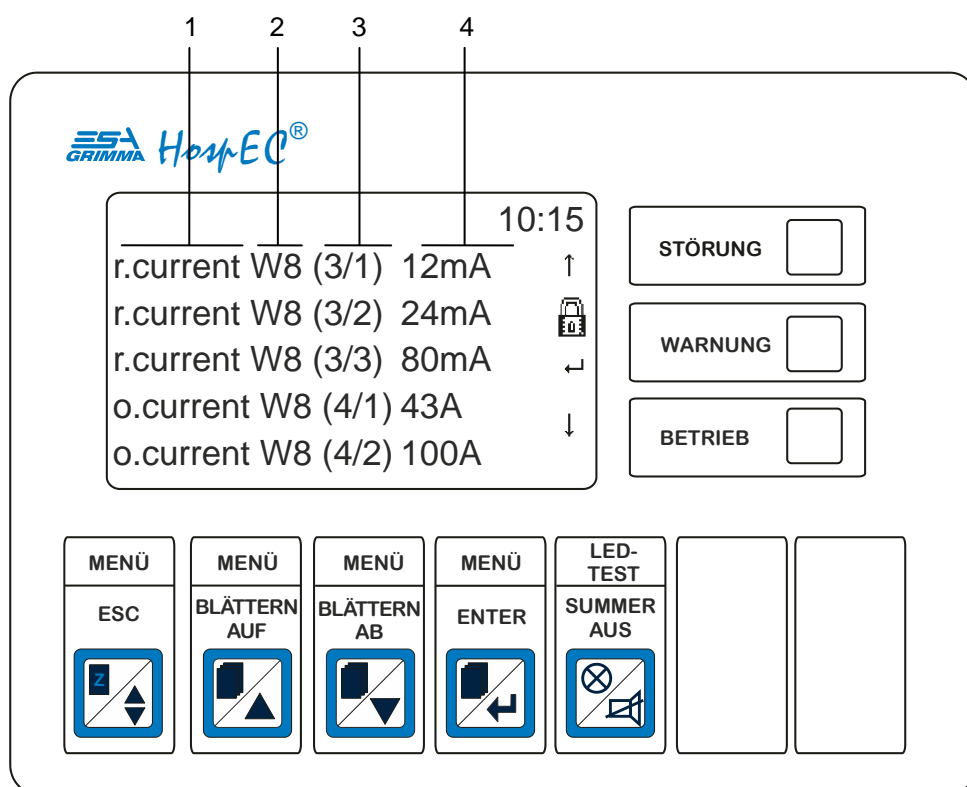


Figure 20: Example: Display of two RCM-W8 devices using the ANZ 05

- | | |
|--|-------------------------------------|
| 1 Residual current (r.current) or
Operating current (o.current) | 3 CAN address / measurement channel |
| 2 Device type (RCM-W8) | 4 Current measured value |

The following settings can be made:

- Upper and lower warning threshold for each channel
- Upper and lower triggering threshold for each channel
- Delay time for trigger messages
- Delay time for warning messages
- Reset delay time for trigger and warning messages
- Lower and upper hysteresis range for each channel
- Activation of the corresponding channels
- Changing the CAN address

7.4 Configuration using the MPG-ETH-3

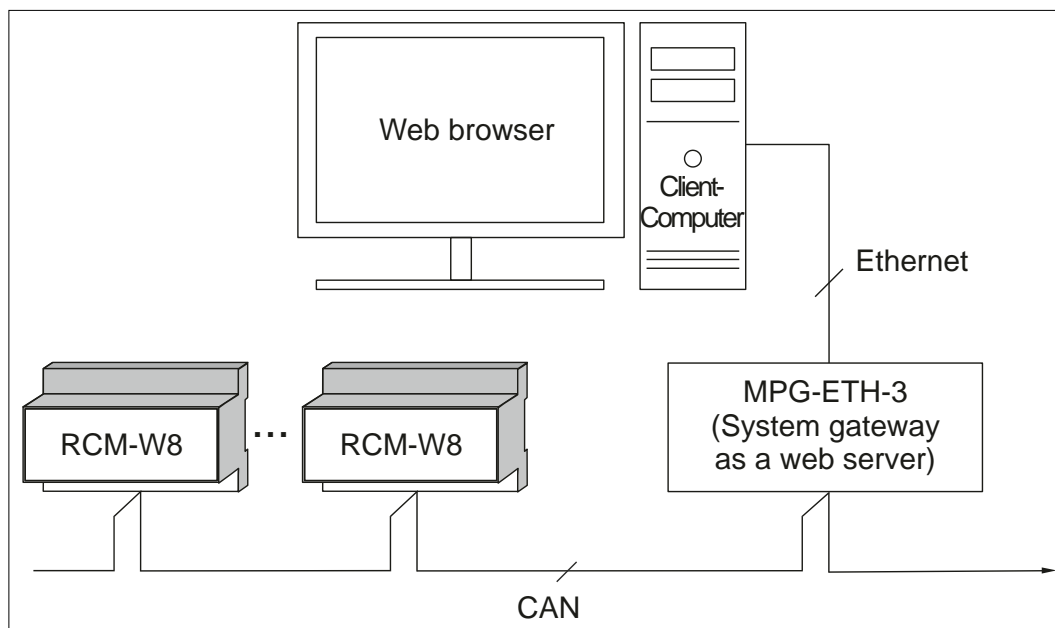


Figure 21: Schematic overview of an application using the MPG-ETH-3

The MPG-ETH-3 (system gateway as a web server) and its web interface can be used to configure the RCM-W8 and other devices. The configuration is done via web pages provided by the MPG-ETH-3 with the web interface. Stored field device data can be read out. Furthermore, the measured values of the respective channels of the connected RCM-W8 and the incoming fault, warning and trigger messages can be displayed.

The following settings can be made:

- Operating or residual current measurement depending on connected current transformer for each channel.
- Configurations of the current transformer type using a suitable shunt (see current transformer specifications).
- Lower and upper hysteresis range for each channel
- Lower and upper triggering threshold for each channel
- Lower and upper warning threshold for each channel
- Activation of the corresponding channels
- Delay time for trigger messages
- Delay time for warning messages
- Reset delay time for trigger or warning messages
- Relay control for warning threshold (centralized alarm)
- Relay control for triggering threshold (centralized alarm)
- Relay control for device fault
- Setting the signal relay as normally open (NO) contact (see Table 2 on page 15)
- Setting the signal relay as normally closed (NC) contact (see Table 2 on page 15)
- Changing the CAN address
- Notification via e-mail

8 Technical specifications

Operation	
Rated voltage (insulation coordination acc. to IEC 60664-1)	250 V AC
Rated impulse withstand voltage	4 kV
Pollution degree	3
Supply voltage	24 V DC (PELV)
Internal consumption	approx. 5 W
Monitored system	
Transformer types / transformation ratio:	
Residual current transformer	DW series or DW-T / 700/1
Operating current transformer	e.g. ASK series or KBU / 100/1 to 4000/1
Current transformer rated voltage	AC 20 ... 720 V
Current transformer rated frequency	50 ... 60 Hz
Current transformer rated current	1 ... 4000 A (depends on type)
Measuring channels	
Number of measuring channels	8 (current transformer connectable to RCM-W8)
Number of measuring channels on the bus	max. 128 (per bus segment)
Measurement value logging	parallel, true RMS (root mean square)
Evaluation	residual and operating currents (channels freely useable)
Residual current evaluation	IEC 60755, type A
Evaluation range of residual current	10 ... 1000 mA
Evaluation range of operating current	1 ... 4000 A (depends on current transformer)
Configuration	
Configurable values per channel	warning and triggering thresholds / hysteresis range for triggering thresholds
Delay times	delay times for warning and trigger messages t_{wd} , t_{td} (0 ... 10 s) reset delay time for trigger and warning messages t_{rd} (0 ... 10 s)
Configuration	PC software "HospEC [®] Configurator" (via USB-CAN adapter), display and configuration device ANZ 05 (via CAN field bus), MPG-ETH-3 (system gateway as a web server; via Ethernet and CAN field bus)
Display and messages	
Displays	LED
Messages	LED / signal relay / CAN bus
Inputs	
Interface	CAN
Connection to current transformers	loop resistance max. 2 Ω
Examples:	
cable shield 0.75 mm ² (shield at I)	length max. 20 m
Cable type J-Y(ST)Y \varnothing 0.6 mm	length max. 15 m

Signal relay (centralized alarm)

Switching elements	1 exchanger
Rated contact voltage.....	250 V AC / 30 V DC
Making capacity.....	AC/DC 5 A
Breaking capacity for 230 V AC, cos phi 0.4.....	2 A
Breaking capacity for 220 V DC, L/R = 0.04 s	0.2 A
Electrical service life.....	approx. 12,000 switching cycles
Contact category	IIB (IEC 60255-0-20)
Functionality	configurable, normally open or normally closed
Time-delayed triggering (for specific messages)	configurable 0 ... 10 s

Communication interface / protocol

Interface / protocol.....	CAN / CAN (2.0) acc. to ISO 11898
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Electromagnetic compatibility (EMC)

Immunity acc. to EN 61000-6-2: March 2000, (EMC) Generic standards – Immunity for industrial environments	
Emissions acc. to EN 50081-1	
Emissions acc. to EN 55011/CISPR11	Limit class B
..... (suitability for use in industrial and household applications)	

Environmental conditions

Ambient temperature (operation) acc. to EN 61557-8: 1997	-5 ... +55°C
Ambient temperature (storage) acc. to EN 61557-8: 1997	-25 ... +70°C
Climatic conditions acc. to IEC 721	3K5, no condensation or icing

Installation specifications

Installation position.....	any
Type of connection / cable	modular terminal blocks / copper
Wire size / single-wire / fine-wire.....	0.2 ... 4 mm ² / 0.2 ... 2.5 mm ² (AWG 24-12)
Protection class acc. to EN 60259 for installations / terminals	IP 30 / IP 20
Flammability class	UL94V-0
Weight	approx. 270 g
Device dimensions in mm (H x W x D).....	90 x 105 x 73 (6 TE)
Assembly	top-hat rail acc. to DIN EN 60715

Order information

RCM-W8.....	Item no.: 0080070
Residual current transformer, types from series DW/DW-T.....	Item no.: on request by type
Operating current transformer	Item no.: on request by type

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RCM-W8

Residual and operating current
monitoring device,
Product information (PI)

Published by:

ESA Elektroschaltanlagen
Grimma GmbH

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Revision date: 01-2010