

Monitoring Relays MRU, MRI, MRM

1 Features

- Voltage supply UC 12 – 48 V or UC 110 – 240 V
- Change-over contact
- Measuring inputs are isolated from the supply
- Measuring range 0.1 ... 480 VAC / 0.1 ... 690 VDC / 0.1 ... 5 A
- Automatic range detection
- Min / Max and window function
- Individual function choice for each output
- Easy configuration
- Parameters adjustable over display
- LED state for each output
- Parameters are safe from supply-shutdown



2 General descriptions

The monitoring relay family MR was developed for the supervision of AC and DC TRMS voltages.

The device is able to measure voltages and currents in 1 and 3-phase systems and determine the best measuring resolution with an automatic range selection. It possesses a permanent self-diagnosis. Therefore it is secured that an alarm will be released in any case of disturbance or failure.

The handling is very easy. Measuring values, user's parameters and the operation status are indicated on a display and can be adjust with the user-friendly service menu (3 keys).

Two outputs with changeover contacts for 6 A, 250 V are available. Both contacts can be switched independently of each other (2 relays). A red LED indicates the alarms.

The devices comply with the DIN standard 43880 and have a mounting width of 35 mm.

Technical specification is subject to change without previous notice

3 Order designation

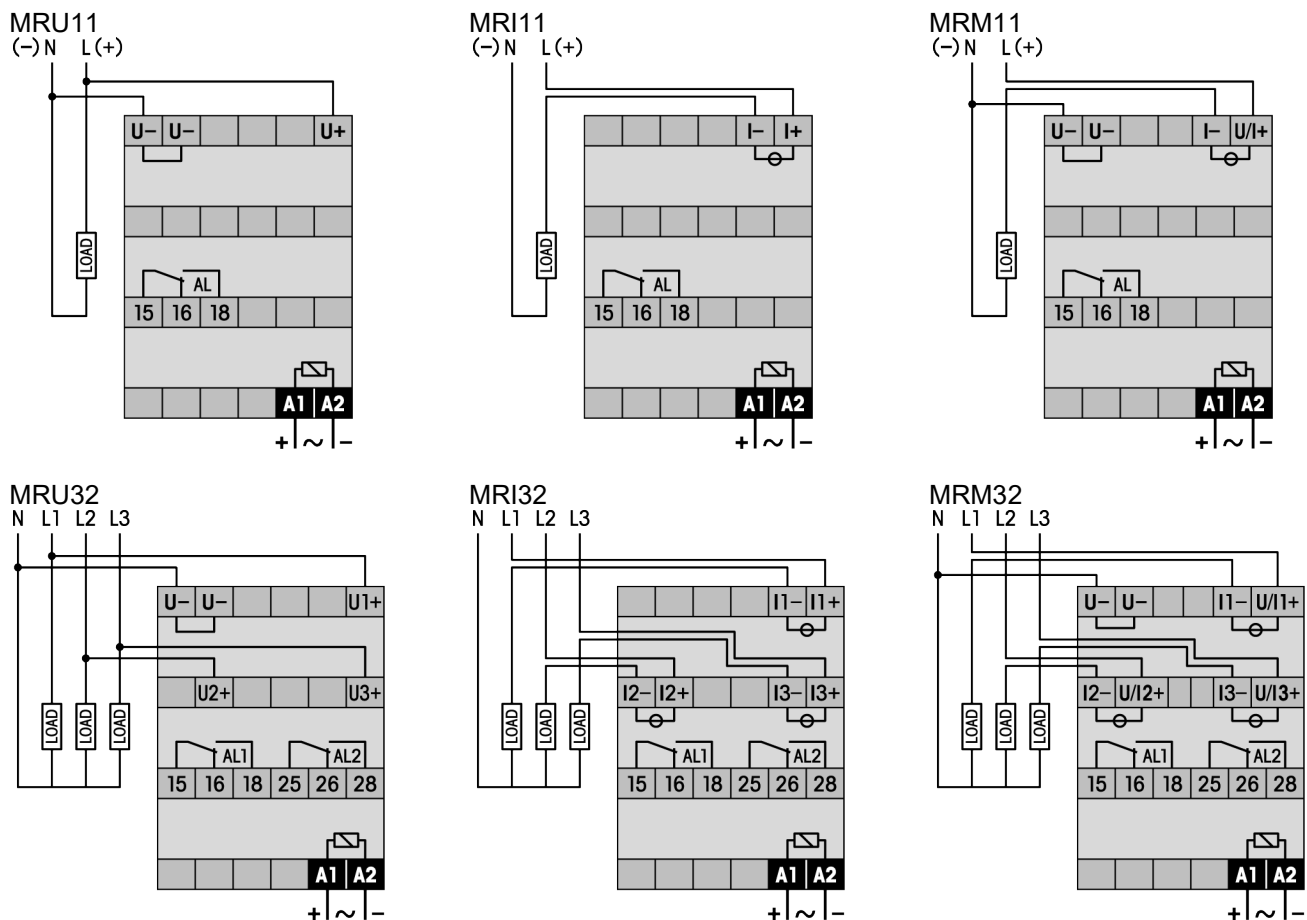
		Standard version	Railway version (EN 50155)
Voltage Monitoring relay	1-phase	MRU11/UC12-48V MRU11/UC110-240V	MRU11R/UC12-48V MRU11R/UC110-240V
	3-phase	MRU32/UC12-48V MRU32/UC110-240V	MRU32R/UC12-48V MRU32R/UC110-240V
Current Monitoring relay	1-phase	MRI11/UC12-48V MRI11/UC110-240V	MRI11R/UC12-48V MRI11R/UC110-240V
	3-phase	MRI32/UC12-48V MRI32/UC110-240V	MRI32R/UC12-48V MRI32R/UC110-240V
Multifunction monitoring relay	1-phase	MRM11/UC12-48V MRM11/UC110-240V	MRM11R/UC12-48V MRM11R/UC110-240V
	3-phase	MRM32/UC12-48V MRM32/UC110-240V	MRM32R/UC12-48V MRM32R/UC110-240V

3.1 Type designation code

1.	2.	3.	4.	5.	6.	7.
MR	M	3	2	R	/	UC 12-48V

1. Product Series Name MR	5. Options = Standard version R = Railway version
2. Type U = Voltage monitoring I = Current monitoring M = Multifunction monitoring	6. Power Supply Type UC = AC / DC
3. Monitoring 1 = 1-phase monitoring 3 = 3-phase monitoring	7. Nominal Operating Voltage 12-48V 110-240V
4. Output 1 = One relay output c.o. 2 = Two relay output c.o.	

4 Connection diagram



5 Specifications

5.1 General data

5.1.1 Mechanical data

Outside dimensions	Housing system DIN, B x H x T: 36 x 90 x 57 mm	
Connector	Screw terminal 2.5 mm ²	
Screw tightening torque min.	0.5 Nm	
Screw tightening torque max.	0.6 Nm	
Protection	IP20	
Case material	Lexan EXL 9330	
Weight	MRx11: 107 g	MRx32: 125 g
Fastening	TS35 DIN/EN 60715	

5.1.2 Ambient conditions

Ambient temperature storage	-40 °C ... +85 °C
Ambient temperature operation	-40 °C ... +60 °C (Railway: -40 °C ... +70 °C; Display -20 ... +60 °C)
Ambient temperature operation UL max.	+60 °C
Relative humidity	10 % ... +95 % (not condensing)
Pollution degree	2

5.1.3 Life cycle

Life cycle	> 100 000 h (at 25 °C)
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5.2 Electrical data

5.2.1 Supply

	.../UC110-240V	.../UC12-48V
Version	110...240 V	12...48 V
Nominal operating voltage (AC/DC)	85...250 V	10...60 V
Operating voltage (AC/DC)	16...63 Hz	16...63 Hz
Frequency range	18 mA	180 mA
Current consumption	2.6 VA / 1.5 W	3.2 VA / 1.6 W
Power consumption		

5.2.2 Voltage inputs

Input range DC (U+/U-) nom.	± 0.1 ... 690 VDC
Input range AC (L/L) nom.	0.1 ... 480 VAC
Input voltage (U+/U-) according to UL max.	300 VDC / 300 VAC
Frequency range (Fast / Slow mode)	46...150 Hz / 15...150 Hz
Measuring error	see chapter 6
Display resolution	0.1 V
Input impedance	1 MΩ

5.2.3 Current inputs

Nominal input range	0.1 ... 5 A
Input current max	7 A
Frequency range (Fast / Slow mode)	46...150 Hz / 15...150 Hz
Measuring error	see chapter 6
Display resolution	0.1 A
Input impedance	5 mΩ
Scaling factor for ext. current transformer	0.1 ... 100

5.3 Time response

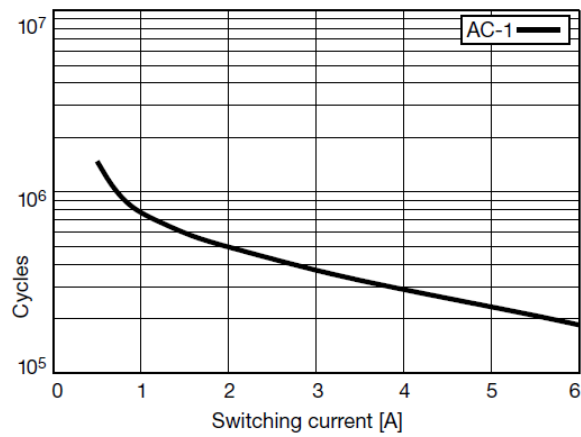
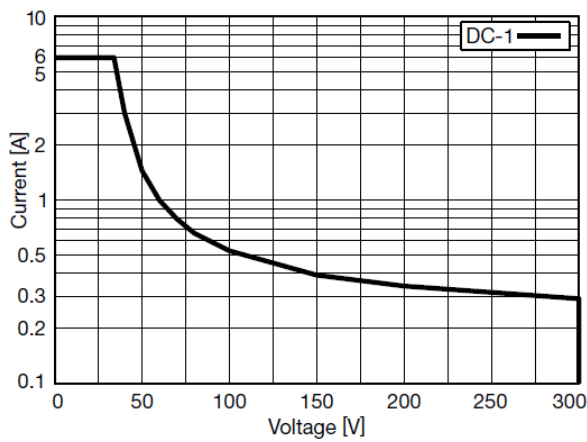
Time response	Fast mode	Slow mode
MRU11 / MRI11	Min. 60 ms ... max. 120 ms	Min. 120 ms ... max. 150 ms
MRI32	Min. 60 ms ... max. 150 ms	Min. 120 ms ... max. 400 ms
MRM11	Min. 60 ms ... max. 120 ms	Min. 120 ms ... max. 210 ms
MRU32 / MRM32	Min. 60 ms ... max. 210 ms	Min. 120 ms ... max. 660 ms

5.3.1 Alarm delay

Adjust range (ton / toff)	0.5 ... 999.9 s
Adjust and display resolution	0.1 s
Startup delay min	2.5 s (adjustable)
Parameter storage time typ	1 s

5.4 Outputs

Contact	1 or 2 CO
Contact material	AgNi 0.15
Switching voltage	250 V AC
Switching power AC-1	1250 VA
Switching current	6 A
Recommended minimum load	10 mA / 10 V
Mechanical life time	30 x 10 ⁶



5.5 Insulation

Withstand voltages	Impuls voltage (1.2 / 50 us) / Test voltage (RMS, 1 min)
Measuring input – Measuring input	2.5 kV / 1.5 kV
Measuring input – Supply	4.0 kV / 2.0 kV
Measuring input – Contact	4.0 kV / 2.0 kV
Supply – Contact	4.0 kV / 2.0 kV
Contact set – Contact set	4.0 kV / 1.5 kV
Insulation resistance min. (500 V DC)	100 MΩ

6 Measurement parameters – ranges – accuracy

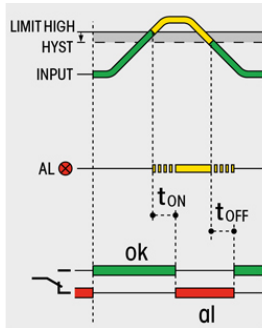
Measuring		Unit	MRU11	MRI11	MRM11	MRU32	MRI32	MRM32	Measuring range AC per phase		Measuring range DC per phase		Adjustable range		Adjustment	Max. measuring error AC		Max. measuring error DC	
									Min	Max	Min	Max	Min	Max	Resolution	+/- % Mv.	+/- Unit	+/- % Mv.	+/- Unit
U	Voltage	V	X		X	X		X	0.0	480.0	-690.0	690.0	-700.0	700.0	0.1	2.0	0.2	0.5	0.1
I	Current	A		X	X		X	X	0.0	5.0	-5.0	5.0	-6.0	6.0	0.1	5.0	0.1	2.5	0.1
f	Frequency	Hz	X	X	X	X	X	X	16	100			15	150	1	5.0	0.1		
$\Delta\phi$	Phase angle	°				X		X	0	359			0	359	1	f * 0.2	1.0		
P	Active power	W			X			X	0	2400	-3450	3450	-4200	4200	1	5.0	0.2	2.5	0.2
S	Apparent power	VA			X			X	0	500			-4200	4200	1	5.0	0.2	2.5	0.2
$\cos\phi$	Power factor				X			X	0.00	1.00			0.00	1.00	0.05	5.0	0.1		
Measuring inputs			1	1	1	3	3	3											
Relay outputs			1	1	1	2	2	2											

- It is also possible to monitoring the phase sequence (rolling direction) with the measurement of the phase angle.
The recommended settings are: Delta phi – Under – 100°
- The measurement error applies over the entire temperature range.
- The measurement error applies to the slow mode.

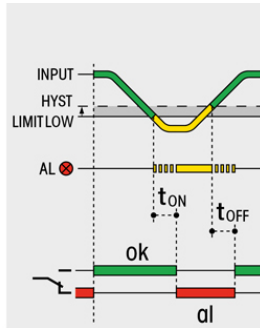
7 Functions

This device is providing four monitoring functions.

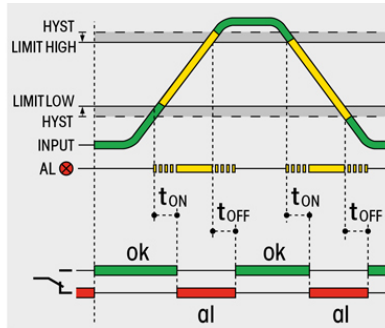
Over



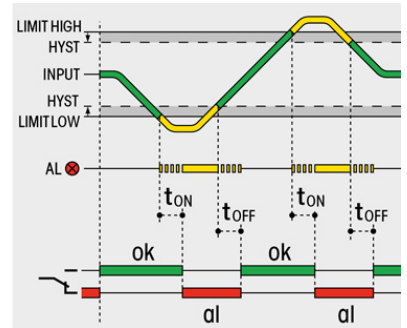
Under



Inside



Outside



Legend: █ ok █ fail █ alarm Alarm delay: t_{OFF} , t_{ON}

7.1 Switching state display

LED		Alarm state	Relays
Not glowing	_____	OK (no Alarm)	On
Glowing constantly		Alarm	Off
Flashing short	▬▬▬▬▬	Alarm t_{ON} run	On
Flashing long	▬▬▬▬▬	no Alarm t_{OFF} run	Off

Same behavior for the second output.

8 Application notes

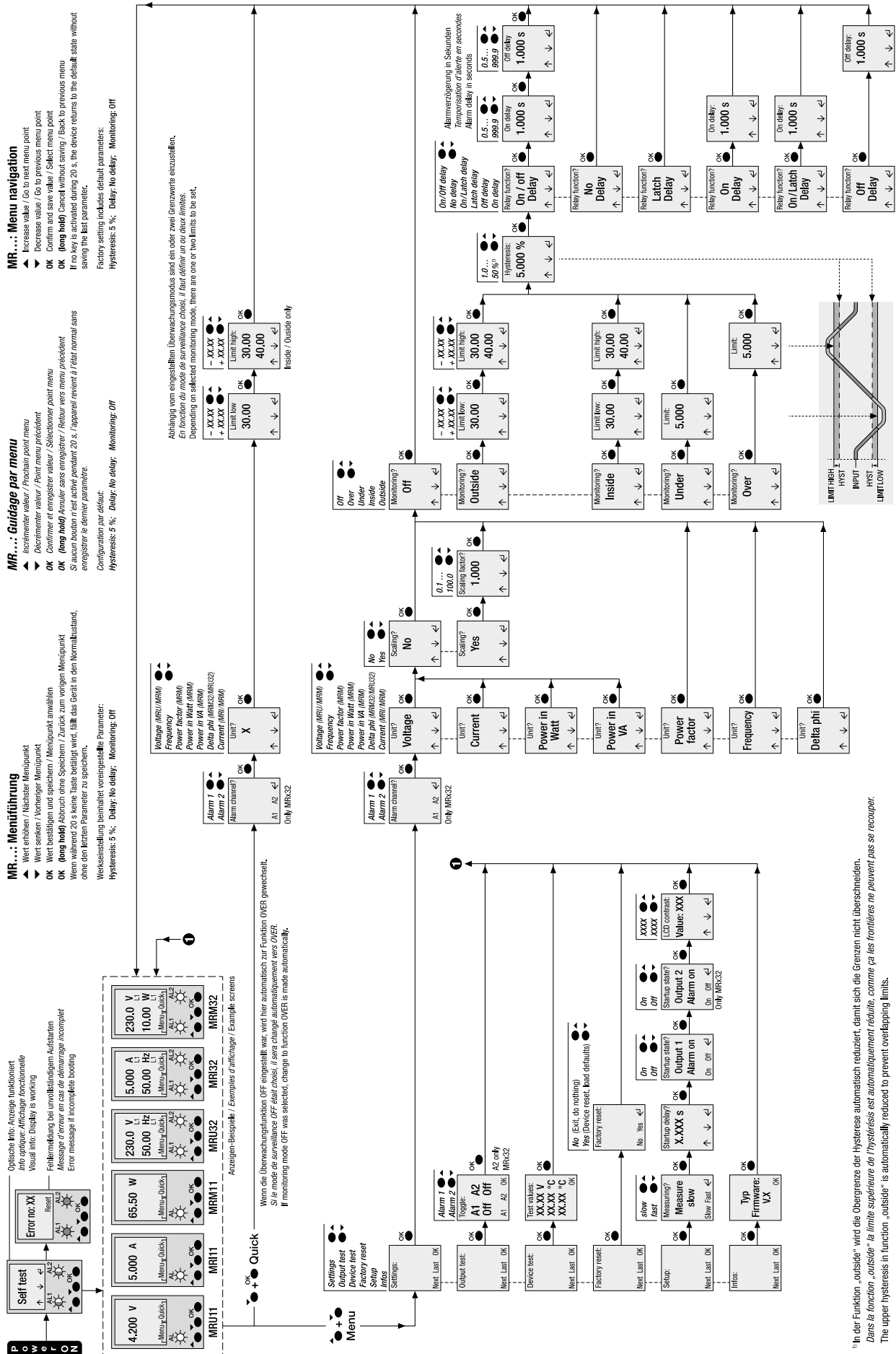
8.1 Installation instructions

- The devices comply with the DIN standard 43880 and have a mounting width of 35 mm.
- The current measurement of monitoring relays MRI and MRM is realized with Hall elements. Therefore, other devices that produce magnetic fields (e.g., contactors) should be mounted with at least a distance of 50 mm to the monitoring relay. Otherwise, the magnetic field could influence the measurement of the current.

8.2 Operating instructions

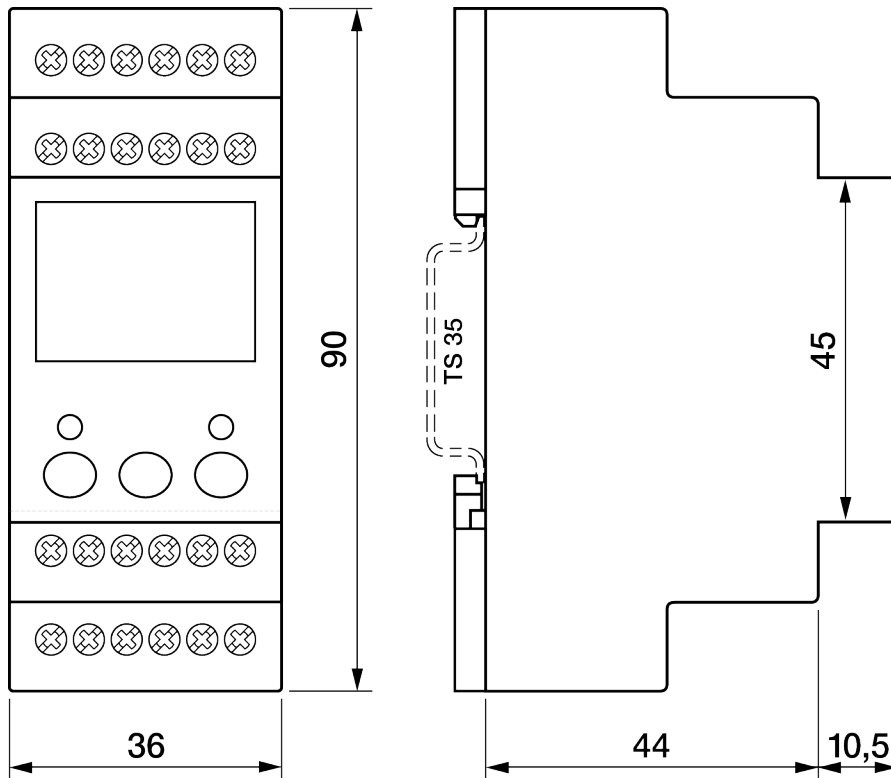
- ▲  Increase the numeric value or select the next parameter. Toggle function on simulation mode.
- ▼  Decrease the numeric value or select the previous parameter. Toggle function on simulation mode.
- OK  Takes over the selected value and jumps to the next menu point.
By pushing and holding this button, it jumps back to the previous menu point or the main display without saving.
- Menu timeout is 20 s. If no button is pushed within this period, the device will jump back to the home screen.
- Every 5 seconds, the display is doing a reset. Therefore, a flickering on the screen will occur.
- The display of the MRx32 will change the displayed values every 2 seconds.
- The default parameters are set as follows:
Hysteresis: 5 %, Alarm delay: No delay, Monitoring function: Off
- In the quick menu: If the monitoring function was set to OFF, the function will automatically change to OVER.
- When leaving the menu, the parameters are stored. During this time (typ. 1 s), no monitoring is executed and the relay state remains unchanged. The LED flashes during the parameter storage process.
- The device disposes of a permanent self-diagnosis. Therefore it is secured that an alarm will be released in any case of disturbance or failure. An error will be indicated with a specific numeric code on the display.
- In MRU and MRM devices, the frequency is detected on L1 when the voltage is higher than 1 V (TRMS). In MRI devices when current on L1 exceeds 0.1 A (TRMS).
- The power P (only MRM devices) is calculated if $U > 1 \text{ V}$ and $I > 0.1 \text{ A}$, otherwise $S = P$ and $PF = 1$.
- If no zero-crossing at voltage or current exist, a minus sign is indicated if the values are negative (TRMS is positive by definition). Every phase is checked separately.
- The calculation of the effective power is, based on the low sample rate, not precise when the measured voltage or current are not sine-shaped. The accuracy of the power factor also depends on it.
- The power factor is determined with apparent and effective power. If the frequency is zero, the effective power will be equalized to the apparent power. Therefore $PF = 1$.
- Values greater than 1000 are indicated with one, k' (kilo sign). Therefore the biggest displayable number is 9999 k (Thousand). The smallest displayed value therefore is 0.001.
- The sum of the phase angle is 360° . L1 and L2 are measured; L3 is then calculated ($360^\circ - L1 - L2$).
- When switching the relays, the measuring cycle time and the switch time of the relays are compensated.

8.3 Menu navigation



In der Funktion „outside“ wird die Obergrenze der Hysterese automatisch reduziert, damit sich die Grenzen nicht überschneiden. Dans la fonction „outside“ la limite supérieure de l’hystérésis est automatiquement réduite, comme ça les frontières ne peuvent pas se chevaucher. The upper hysteresis in function „outside“ is automatically reduced to prevent overlapping limits.

9 Dimensions



10 Standards

Low voltage guidelines	EN 60730-1:2000 EN 60947-1:2007
Installation devices	DIN 43880
Interference immunity	EN 61000-6-2:2005 EN 50121-3-2:2006
Interference emission	EN 61000-6-3:2007 EN 50121-3-2:2006
Approval, Identification	CE UL Listed NRNT/7 E120922

11 Revision history

Version	Revision date	Responsible	Modifications
55005-38-57-401	23.03.2012	Hy/Li	Version 1
55005-038-57-002	13.07.2012	Cp	Reference to scaling factor and phase sequence, Voltage stability
55005-038-57-003	06.05.2014	Vs	New Layout
55005-038-57-004	20.10.2014	Mi	Firmware V1.7
55005-038-57-005	07.04.2015	Mi	Firmware V1.8
55005-038-57-006	27.05.2015	Cp	Insulation