

Insulation Guard IW 1000

Monitoring of ungrounded AC- and DC voltage systems up to 690V

Features

- Time optimized pulse measuring method
- Safe monitoring at extreme conditions (frequency converter, phase control, SSR-relays, switching supplies...)
- 2 alarm outputs, relay SPDT
- Switching performance max- or min-, with or without hold function
- Hysteresis 10 ... 100 %
- Setpoint 1 k Ω ... 5 M Ω
- Delay time 0 ... 99 s
- Analog output 0 ... 1 mA
- Automatic and manual self test
- Acoustic alarm in case of malfunction
- Devices for railway vehicles and healthcare facilities available
- Wall- and DIN rail mounting TH35



General

The isolation-guard IW1000 will be used for insulation-monitoring in machines and systems with ungrounded voltage systems. The universal design allows the monitoring of all AC - and DC -Systems.

Short information

Programming	Parameters are programmed via front-side keypad
Alarm outputs	Switching performance of the alarm outputs are programmable as minimum or maximum function. The status of the outputs will be displayed.
Analog output	The IW1000 offers an analog output signal 0 ... 1 mA to show the insulation resistance at an instrument IS96-DS-01(see page 12).
Optical alarm message	An insulation-error will be indicated by a pulsating background-illumination. The corresponding digit of the alarm-output flashes in the display.
Quit insulation error	After elimination of an insulation-error, the alarm-message can be reset by pressing one of the buttons.
Device error	If a device error is recognized during the self-test, the alarm outputs and the intern acoustic alarm will be set. The display shows Function disturbed .
Quit device error	When pushing one of the front-side buttons, the intern acoustic alarm will be turned off. The message in the display continues.

Technische Daten The device corresponds to the basic standard EN 61557-8

Power supply

Supply voltage	: 230 V AC, 115 V AC, 24 V AC $\pm 10\%$; 16.8...33.6 V DC, 10.8...15.6 V DC
Power consumption	: max. 4 VA
Working temperature	: -10 ... +55 °C;
Option 01	: -25 ... +70 °C
Relative humidity	: $\leq 75\%$ for annual mean in accordance with EN 50155, 95 % for 30 days all year continuously, seldom or low humidity doesn't lead to malfunctions or cancellations.
Rated voltage	: 630 V AC between input/relay output, supply voltage, degree of pollution 2, CAT III
Test voltage	: Input 3,3k V~
Conformity	: CE
Option 01 additional	: EN 50155 in following parts: EN 61373, EN 60068-2-27
Fire protection	: fulfill of fire protection of railway vehicles acc. to NFF16-101 in following parts EN 60695-2-12 (glow wire flammability test method, temperature 850 °C) and NFF16-102 in parts 6.2; 6.4; 6.5

Input

System voltage	: 0...690 V AC / DC; if $U_N > 400$ V operation only with cover clamp permitted
Frequency range	: 16 $\frac{2}{3}$... 400 Hz For frequencies $< 16 \frac{2}{3}$ Hz, the max. system voltage decreases acc. to characteristic curve 2 page 10

Measurement (standard) (health care facilities)

Meas. voltage max.	: ± 40 V	± 20 V
Meas. current max.	: ± 220 μ A	± 110 μ A
Intern. resistance DC R _i	: 180 k Ω (2 x 360 k Ω parallel)	
Impedance Z _i at 50 Hz	: 180 k Ω (2 x 360 k Ω parallel)	

Operating values

Value AL1/AL2	: 1(50) k Ω ... 5 M Ω x 1.1 (1.1 k Ω ... 5.5 M Ω) programmable
Accuracy	: $\pm 5\%$ ± 1 k Ω in range 1 k Ω ... 9.9 M Ω
Switching hysteresis	: 10 ... 100 % of the setpoint programmable
Measuring time	: see characteristic curve 1 page 10
System leakage capacity	: max. 500 μ F
Response time when the connection is lost: PE, K: 2 s ; L1, L2: Within self-test detection (IW1000-3)	

Display	: LCD Dot-Matrix 2 lines 8 characters each, character height 5 mm, background lightened
Display range	: 1 k Ω ... 9.9 M Ω
Resolution	
1 M Ω ... 9.9 M Ω	: ± 0.1 M Ω
1 k Ω ... 999 k Ω	: ± 1 k Ω

Output

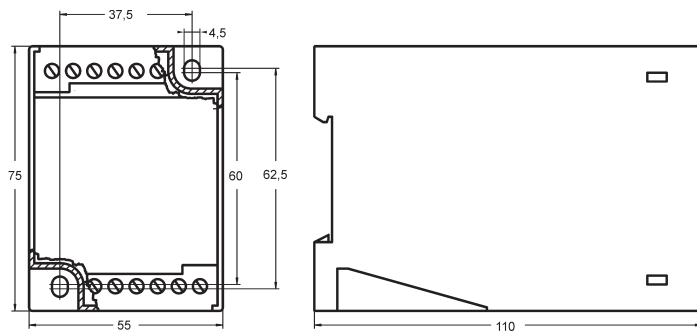
Relay	: 2 contacts SPDT < 250 V AC < 250 VA < 5 A; < 300 V DC < 50 W < 2 A
Analog output	: 0...1 mA, $I = \frac{1 \text{ mA} \times 120 \text{ k}\Omega}{R_F + 120 \text{ k}\Omega}$ R _F [k Ω]

Case

Dimensions	: standard case for DIN rail mounting TH35, or wall mounting
Weight	: floor space 55x75 mm (WxH), mounting depth 110 mm,
Electrical connection	: max. 390 g
Protection	: screw terminals with cover plate, max. 4 mm ²
	: case IP40, terminals IP20, finger safe acc. to German BGV A3

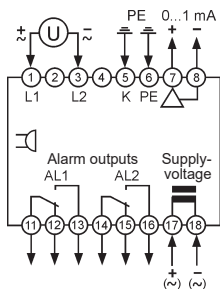
Errors excepted and rights to modifications reserved!

Dimensions

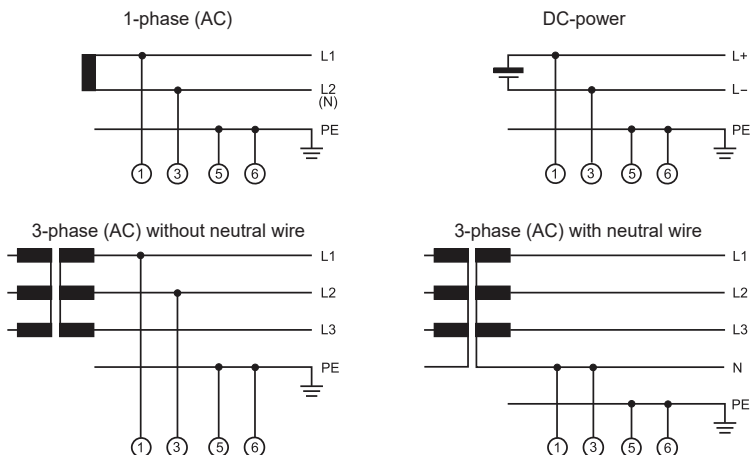


Wall mounting with 2 screws M4 or DIN rail mounting TH35

Connection diagram



Connection examples



General Information to the Insulation guard

In well-insulated IT-systems (new installations) with a lot of connected devices a high leakage capacity may occur due grounded input filters, cable capacities etc. Common insulation guards, working with pulse measuring mode, are running with fixed pulse widths. For well operation, they must be adapted manually to the actual leakage capacity of the system.

There are also insulation guards available, working with self adapting pulse width. However these devices need a long measuring time because the result will be at least available, when loading voltage will find its maximum (no more change in load voltage).

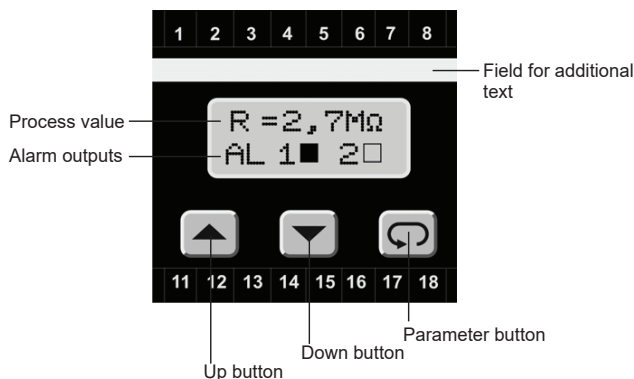
With the time optimized measuring method of the IW1000, insulation resistance and leakage capacity will be calculated after 2-time constants. Therefore the reaction time of the IW1000 is very short.

By applications of modern signal processing-algorithms in the software and over sampling-mode in connection with high signal-dissolution of the AD-converter, the IW1000 runs with high stability and reliable measurement.

Minimum insulation resistance

Application fields	System voltage [V]	Min. insulation resistance	
		Ω/V	k Ω
Erection of power installations with rated voltage below 1000V	230	100	23
	400	100	40
	500	100	50
Electrical installations of buildings	230	100	23
	400	100	40
	500	100	50
Erection of power installations with nominal voltages up to 1000V	24	100	3
	42	100	5
	48	100	5
	60	100	6
	110	100	12
	230	100	23
Operation of electrical installation	230	50	12
	400	50	20
	500	50	25
Electric equipment of electrical road vehicles	48	50	3
	120	50	6
	240	50	12
Electrical apparatus for potentially explosive atmospheres protection "e"	230	50	11
	400	50	20
	500	50	25
Electrical apparatus for explosive atmospheres	230	50	11
	400	50	20
	500	50	25
VDE specification for electric storage batteries and battery plants	24	50	2
	60	50	3
	110	50	6
	220	50	11
Erection of low-voltage installations Requirements for special installations or locations; Medical locations	230	-	50

Displays and controls



Description

Operation of the device is arranged in 2 levels. While programming, pressing button  saves the current parameter and moves to the next programming step. For Selection within a parameter or for entering data, use buttons  and .

Button combinations:

 +  one parameter back.

After powering up, the device initializes itself. The display shows the message IW1000 and software version. After the initialization a self-test is following and the device is located in the **Working level**. Min and max value of the insulation resistance, system leakage capacity and the manual self-test can be called up. Setpoints of the alarm outputs can be programmed.

Activating the button  longer than 2 seconds, the program jumps into the **Configuration level**. The configuration level provides access to program all device functions. After finishing the configuration or if no button is pressed longer than 2 minutes, the program jumps back to the working level and the display shows the process value. Leaving the configuration level is possible at any time by pushing the button  for 2 seconds.

Notes to representations



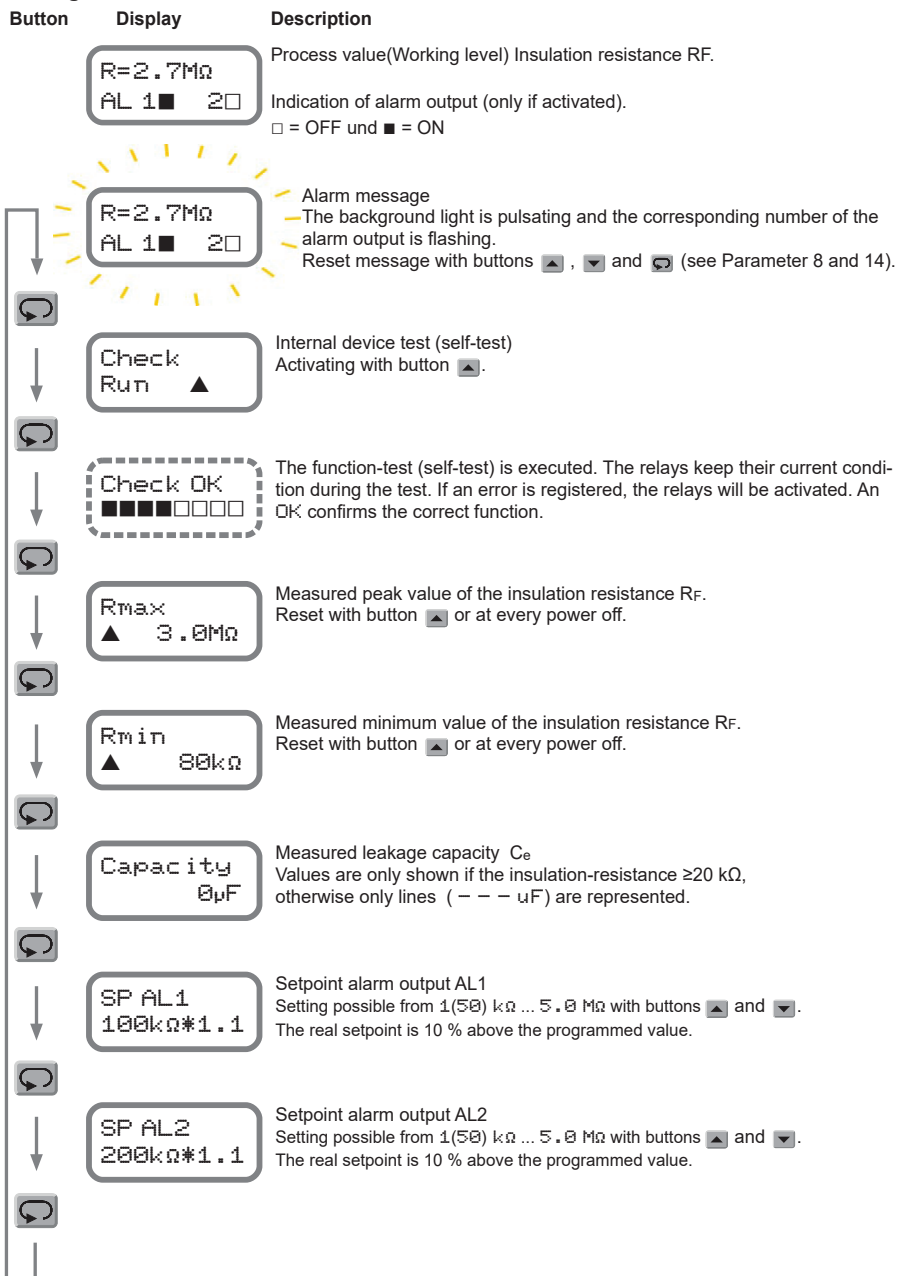
Parameter is only displayed if configured



Parameter is only displayed if included (see order code)

Note: All parameters can be called if they are not blocked by other programmed parameters and if they are available. Factory settings are shown in the **display graphic**.

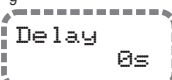
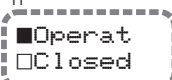
Working level



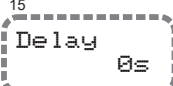
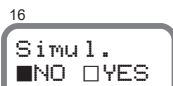
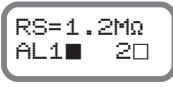
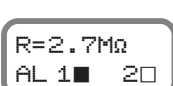
Configuration

Button	Display	Description (displayed values are factory settings)
 press 2s ↓	1 ☒deutsch ☐english	Configuration level Language of the operating instructions deutsch, english Selection with buttons ▲ and ▼.
 ↓	2 Check ☒NO ☐YES	Configuration automatic device test Selection with buttons ▲ and ▼.
 ↓	3 Interval 1 h	Automatic device test with programmable interval. The relay's won't change their status during the test procedure. If an error occurs, the alarm will be activated. Setting possible from 1 ... 24h with buttons ▲ and ▼.
 ↓	4 Conf.AL1 ☒NO ☐YES	Configuration alarm output AL1 Selection with buttons ▲ and ▼.
 ↓	5 ☒Operat ☐Closed	Switching performance alarm output AL1 Operat Operating circuit principle max-function The relay switches on, if the insulation resistance is below the programmed setpoint SP. Closed Closed circuit principle min-function The relay switches off, if the insulation resistance is below the programmed setpoint SP. This function includes the monitoring of the supply voltage Selection with buttons ▲ and ▼.
 ↓	6 ☒Hyst. ☐Hold	Reset function / quit operation alarm output AL1 Hyst. Alarm 1 will be reset if the insulation resistance including the hysteresis is above the programmed setpoint SP. Hold Alarm 1 takes the hold condition and can be reset with the quit function. Quit operation is only possible if the insulation resistance is above the setpoint SP. Selection with buttons ▲ and ▼.

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Button	Display	Description (displayed values are factory settings)
	7  Setpoint 100kΩ*1.1	Setpoint SP alarm output AL1 Setting possible from 1(50)kΩ ... 5.0MΩ with buttons  and  . The real setpoint is 10 % above the programmed value.
		
	8  Hyst. 20%	Hysteresis alarm output AL1 Setting possible from 10 ... 100% of the setpoint with buttons  and  .
		
	9  Delay 0s	Turn-on delay AL1 Setting possible from 0 ... 99 s with buttons  and  . With turn-on delay, it must be checked if the standard EN61557-8 is fulfilled!
		
	10  Conf.AL2 ■NO □YES	Configuration alarm output AL2 Selection with buttons  and  .
		
	11  ■Operat □Closed	Switching performance alarm output AL2 Operat Operating circuit principle max-function The relay switches on, if the insulation resistance is below the programmed setpoint SP. Closed Closed circuit principle min-function The relay switches off, if the insulation resistance is below the programmed setpoint SP. This function includes the mon- itoring of the supply voltage
		Selection with buttons  and  .
	12  ■Hyst. □Hold	Reset function / quit operation alarm output AL2 Hyst. Alarm 2 will be reset if the insulation resistance including the hysteresis is above the programmed setpoint SP. Hold Alarm 2 takes the hold condition and can be reset with the quit function. Quit operation is only possible if the insulation resistance is above the setpoint SP.
		Selection with buttons  and  .

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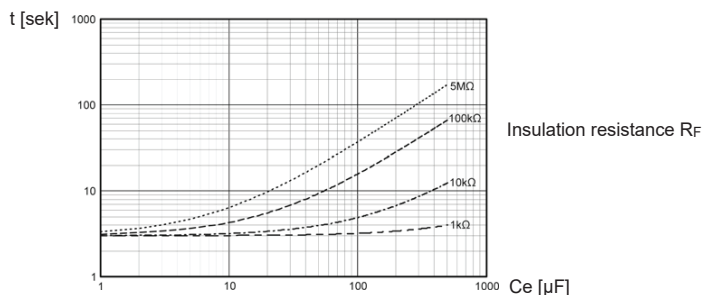
Button	Display	Description (displayed values are factory settings)
	13 	Setpoint SP alarm output AL2 Setting possible from 1(50)kΩ ... 5.0MΩ with buttons  and  . The real setpoint is 10 % above the programmed value.
		
	14 	Hysteresis alarm output AL2 Setting possible from 10 ... 100% of the setpoint with buttons  and  .
		
	15 	Turn-on delay AL1 Setting possible from 0 ... 99 s with buttons  and  . With turn-on delay, it must be checked if the standard EN61557-8 is fulfilled!
		
	16 	Activation simulation mode of the insulation resistance Selection with buttons  and  .
		
	17 	Simulation insulation resistance setting possible from 0(50)kΩ ... 9.9MΩ with buttons  and  . The switch-condition of the alarm-outputs is shown in accordance with the programmed function and setpoints. If no button is activated longer than 1 hour, the program returns into the working-level.
		
	18 	Parameter lock OFF : no lockout CONF IG : configuration level locked ALL : all parameters locked Selection with buttons  and  .
		
	19 	Code for factory settings
		
		Back to the working level

Error messages

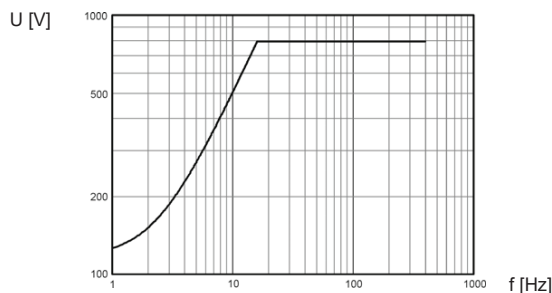
Connect. PE, K?	Check electrical connection at terminal 5 and 6. See connection diagram page 3	Function disturb.	An error occurs during the internal test procedure. The device must be checked at factory.
Connect. L1, L2?	Check connection system voltage at terminal 2 and 3. See connection diagram page 3	CE>500µF	Capacity $C_e > 500\mu\text{F}$
W-Error	The device must be calibrated at factory	P-Sperre	Parameter-lock active
P-Error	Parameter error, Check the programmed parameter.	M-Error	Measuring values not stable

Characteristic curves

- Measuring time in dependence of the system leakage capacity



- Max system voltage below $<16 \frac{2}{3}$ Hz



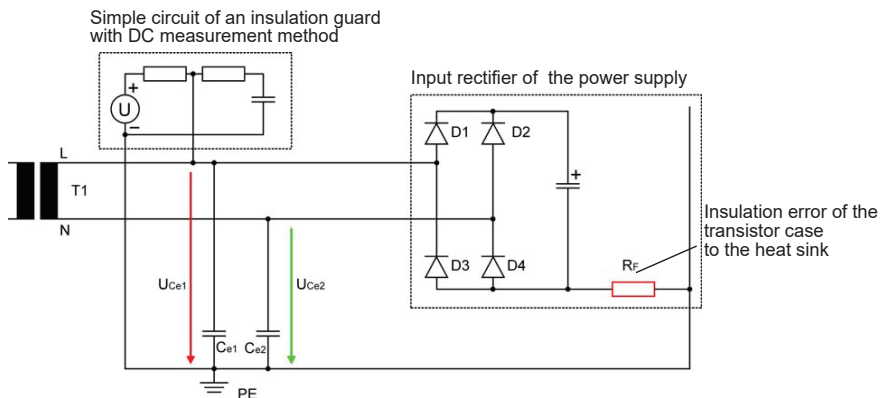
Comparison of the DC-measuring procedure with the time optimized pulse measuring procedure

It is possible in AC systems, that with insulation errors in the attached consumers rectified pulsating currents with double system frequency arise. Depending upon polarity lead these currents to a positive or negative loading of all leakage capacitances. This voltage overlays to the DC measuring voltage of simply developed devices with the DC measuring procedure. Thus these devices release a false alarm or don't switch even in case of an error.

In insulation guards, operating with DC-measuring method a fail-alarm will be released.

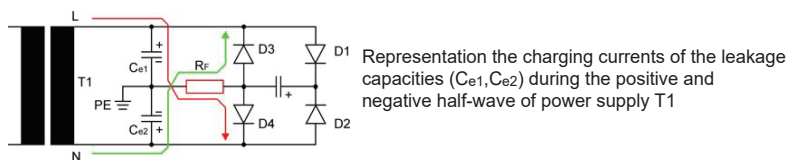
In the following example, the beginning of rectified fault current based of an insulation error in a switching power supply is shown.

Illustration 1



In order to be able to recognize the way of charging currents of the leakage capacities in illustration 1, the electronic components are better spaced in illustration 2.

Illustration 2



DC-components of the leakage currents could be appear without insulation error in case of an asymmetric load during positive and negatives half-waves.

For example: Power controlled devices which are operating in phase-angle control or as zero-crossing switch (SSR-relays). Even frequency converters produce high DC-leakage currents.

With time optimized pulse measuring method of the IW1000, DC-voltage-shares at the leakage capacities measured during positive and negative voltage pulses will be eliminated automatically by calculation:

$$(+U_{\text{process}} + U_{\text{CeDC}}) - (-U_{\text{process}} + U_{\text{CeDC}}) = 2 \times U_{\text{process}}$$

Therefore measuring method is qualified for AC- AC/DC and true DC-systems.

Ordering code

IW1000 - 1. - 2. - 3. - 4.

1. Model

- 1 2 inputs L1+ L2 for IT-systems
3(N)AC-, AC/DC- and DC-systems up to 690V AC/DC,
Analog output 0...1 mA
for connection of the measuring instrument IS96-DS-01
Scale unit k Ω (insulation resistance). AL1, AL2: ≥ 1 k Ω .
- 3 as 1, but for operation in health care facilities
measuring voltage ± 20 V, additional
monitoring of connected terminals L1, L2
in connection with the self-test. AL1, AL2: ≥ 50 k Ω .

2. Supply voltage

- | | | | |
|---|----------|-------------|----------|
| 0 | 230 V AC | $\pm 10 \%$ | 50-60 Hz |
| 1 | 115 V AC | $\pm 10 \%$ | 50-60 Hz |
| 4 | 24 V AC | $\pm 10 \%$ | 50-60 Hz |
| 5 | 24 V DC | $\pm 15 \%$ | |

3. Option

- 00 no option
- 01 model for railway vehicles in accordance to the standard
EN 61373, EN 60068-2-27
- 02 reaction time ≤ 1 s ($C_{\text{emax}} < 200 \mu\text{F}$)

4. Additional text (appears on the face plate in the field additional text, max. size 3 x 50 mm, WxH)

Custom factory settings

Accessories

Terminal cover KA-IW1000-1
necessary with system voltage > 400 V

Measuring instrument IS96-DS-01
(Insulation resistance) connected to IW1000
Scale unit k Ω , middle scale mark 120 k Ω , instrument movement 1 mA
case DIN 96x96 mm, mounting depth incl. terminal cover 63 mm

