GHM-Messtechnik GmbH • Standort Martens
Kiebitzhörn 18 • D-22885 Barsbüttel / Germany
☎+49-(0)40-670 73-0 • Fax +49-(0)40-670 73-288
✉ info@martens-elektronik.de • www.ghm-messtechnik.de

Insulation Guard IW1000

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 kΩ ... 5 MΩ
- 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 TS35

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 insolation 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.

GHM-Messtechnik GmbH • Standort Martens
Kiebitzhörn 18 • D-22885 Barsbüttel / Germany
☎+49-(0)40-670 73-0 • Fax +49-(0)40-670 73-288
✉ info@martens-elektronik.de • www.ghm-messtechnik.de

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 ±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	:	≤ 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 acc. to EN 60664-1 between input/relay output, supply voltage, degree of pollution 2, CAT III
Test voltage	:	Input 3,3k V~ acc. to EN 61010-2-030
CE - conformity	:	EN 60664-1, EN 61326-2-4, EN 50121-3-2, EN 60068-2-1/2/6/27
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 2/3 ...400 Hz For frequencies <16 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 µA	± 110 µA
Intern. resistance DC R_i	:	180 kΩ (2 x 360 kΩ parallel)	
Impedance Z_i at 50 Hz	:	180 kΩ (2 x 360 kΩ parallel)	

Operating values

Value AL1/AL2	:	1(50) kΩ ... 5 MΩ x 1.1 (1.1 kΩ ... 5.5 MΩ) programmable
Accuracy	:	± 5 % ± 1 kΩ in range 1 kΩ ... 9.9 MΩ
Switching hysteresis	:	10 ... 100 % of the setpoint programmable
Measuring time	:	see characteristic curve 1 page 10
System leakage capacity	:	max. 500 µF

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 kΩ ... 9.9 MΩ
Resolution		
1 MΩ ... 9.9 MΩ	:	± 0.1 MΩ
1 kΩ ... 999 kΩ	:	± 1 kΩ

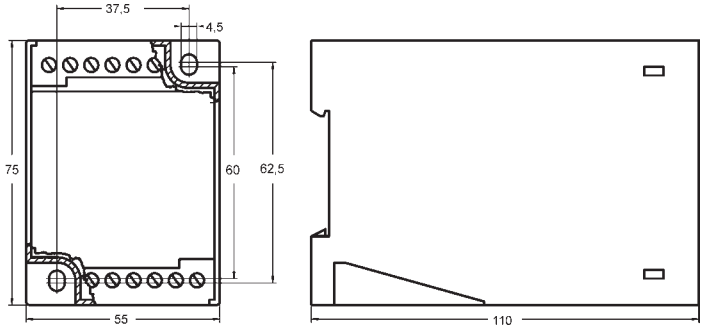
Output

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

Case	:	standard case for DIN rail mounting TS35, or wall mounting
Dimensions	:	floor space 55x75 mm (WxH), mounting depth 110 mm,
Weight	:	max. 390 g
Electrical connection	:	screw terminals with cover plate, max. 4 mm²
Protection	:	case IP40, terminals IP20, finger safe acc. to German BGV A3

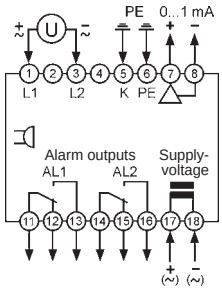
Errors excepted and rights to modifications reserved!

Dimensions

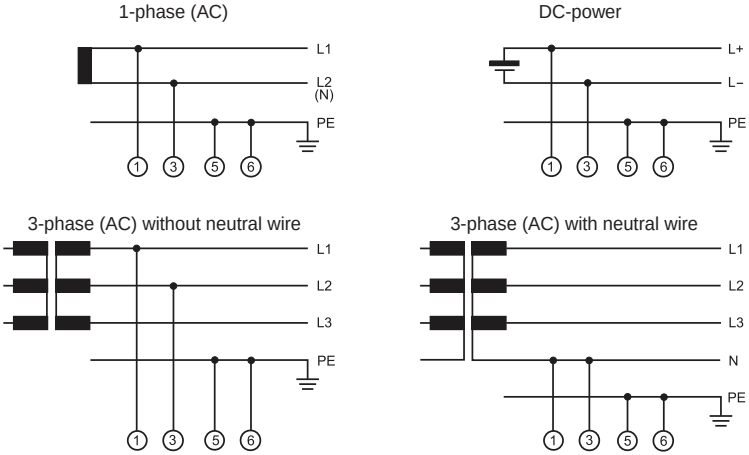


Wall mounting with 2 screws M4 acc. to DIN 46121 / DIN 43660
or DIN rail mounting TS35 acc. to DIN 46277 and DIN EN 50022

Connection diagram



Connection examples



GHM-Messtechnik GmbH • Standort Martens
Kiebitzhörn 18 • D-22885 Barsbüttel / Germany
☎+49-(0)40-670 73-0 • Fax +49-(0)40-670 73-288
✉ info@martens-elektronik.de • www.ghm-messtechnik.de

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).

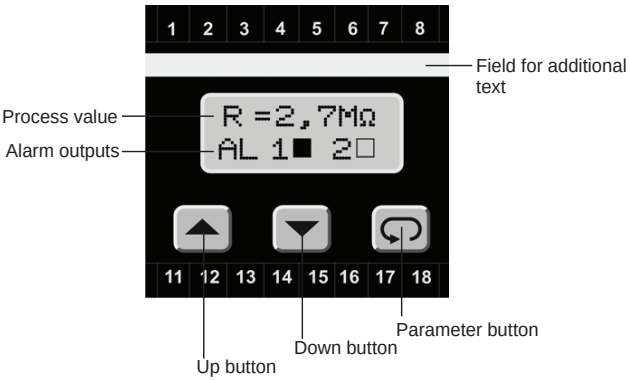
With the time optimized measuring method of the IW1000, insulation resistance and leakage capacity will be calculated after 2-time constants. Therefor the reaction time of the IW1000 is very short.

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	kΩ
Erection of power installations with rated voltage below 1000V	230 400 500	100 100 100	23 40 50
Electrical installations of buildings	230 400 500	100 100 100	23 40 50
Erection of power installations with nominal voltages up to 1000V	24 42 48 60 110 230	100 100 100 100 100 100	3 5 5 6 12 23
Operation of electrical installation	230 400 500	50 50 50	12 20 25
Electric equipment of electrical road vehicles	48 120 240	50 50 50	3 6 12
Electrical apparatus for potentially explosive atmospheres protection “e”	230 400 500	50 50 50	11 20 25
Electrical apparatus for explosive atmospheres	230 400 500	50 50 50	11 20 25
VDE specification for electric storage batteries and battery plants	24 60 110 220	50 50 50 50	2 3 6 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**.

GHM-Messtechnik GmbH • Standort Martens
Kiebitzhörn 18 • D-22885 Barsbüttel / Germany
☎+49-(0)40-670 73-0 • Fax +49-(0)40-670 73-288
✉ info@martens-elektronik.de • www.ghm-messtechnik.de

Working level

Button	Display	Description
	R=2.7MΩ AL 1■ 2□	Process value(Working level) Insulation resistance RF. Indication of alarm output (only if activated). □ = OFF und ■ = ON
	R=2.7MΩ AL 1■ 2□	Alarm message The background light is pulsating and the corresponding number of the alarm output is flashing. Reset message with buttons ▲ , ▼ and ↺ (see Parameter 8 and 14).
↺	Check Run ▲	Internal device test (self-test) Activating with button ▲.
↺	Check OK ■■■■□□□□	The function-test (self-test) is executed. The relays keep their current condition during the test. If an error is registered, the relays will be activated. An OK confirms the correct function.
↺	Rmax ▲ 3.0MΩ	Measured peak value of the insulation resistance R_F. Reset with button ▲ or at every power off.
↺	Rmin ▲ 80kΩ	Measured minimum value of the insulation resistance R_F. Reset with button ▲ or at every power off.
↺	Capacity 0µF	Measured leakage capacity C_e Values are only shown if the insulation-resistance ≥20 kΩ, otherwise only lines (– – – uF) are represented.
↺	SP AL1 100kΩ*1.1	Setpoint alarm output AL1 Setting possible from 1(50) kΩ ... 5.0 MΩ with buttons ▲ and ▼. The real setpoint is 10 % above the programmed value.
↺	SP AL2 200kΩ*1.1	Setpoint alarm output AL2 Setting possible from 1(50) kΩ ... 5.0 MΩ with buttons ▲ and ▼. The real setpoint is 10 % above the programmed value.
↺		

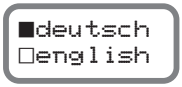
Configuration

Button | **Display** | **Description** (displayed values are factory settings)

press 2s

Configuration level

1



Language of the operating instructions
deutsch, english
Selection with buttons ▲ and ▼.

2

Configuration automatic device test
Selection with buttons ▲ and ▼.

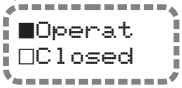
3

Automatic device test with programmable interval.
The relay's wońt 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

Configuration alarm output AL1
Selection with buttons ▲ and ▼.

5



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

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 ▼.

continue page 8

GHM-Messtechnik GmbH • Standort Martens
Kiebitzhörn 18 • D-22885 Barsbüttel / Germany
☎+49-(0)40-670 73-0 • Fax +49-(0)40-670 73-288
✉ info@martens-elektronik.de • www.ghm-messtechnik.de

Button **Display** **Description** (displayed values are factory settings)

7

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

Hysteresis alarm output AL1
Setting possible from 10 ... 100% of the setpoint
with buttons ▲ and ▼.

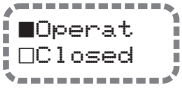
9

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

Configuration alarm output AL2
Selection with buttons ▲ and ▼.

11



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 monitoring of the supply voltage
Selection with buttons ▲ and ▼.

12

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 ▼.

continue
page 9

Button	Display	**Description** (displayed values are factory settings)
	13 Setpoint 200kΩ*1.1	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 Hyst. 20%	Hysteresis alarm output AL2 Setting possible from 10 ... 100% of the setpoint with buttons ▲ and ▼.
	15 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!
	16 Simul. ■NO □YES	Activation simulation mode of the insulation resistance Selection with buttons ▲ and ▼.
	17 RS=1.2MΩ AL1■ 2□	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 P-Lock ▲ OFF	Parameter lock OFF : no lockout CONFIG : configuration level locked ALL : all parameters locked Selection with buttons ▲ and ▼.
	19 FactCode 0	Code for factory settings
	R=2.7MΩ AL 1■ 2□	Back to the working level

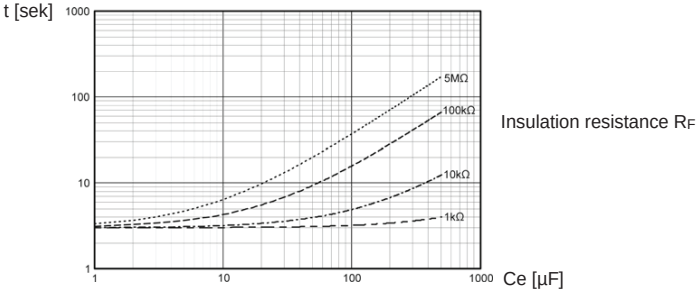
GHM-Messtechnik GmbH • Standort Martens
Kiebitzhörn 18 • D-22885 Barsbüttel / Germany
☎+49-(0)40-670 73-0 • Fax +49-(0)40-670 73-288
✉ info@martens-elektronik.de • www.ghm-messtechnik.de

Error messages

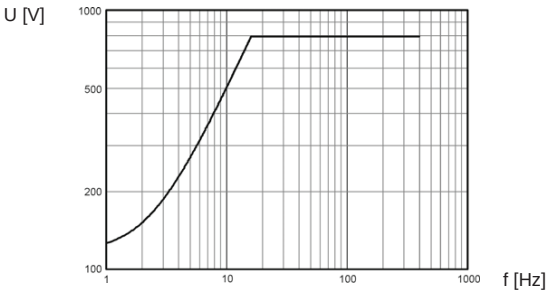
Connect. PE, K?	Check electrical connection at terminal 5 and 6. See connection diagram page 3	Function disturb.	An error occurs during the internal test procedure. The device must be checked at factory.
Connect. L1, L2?	Check connection system voltage at terminal 2 and 3. See connection diagram page 3	CE>500µF	Capacity Ce>500µF
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

1. Measuring time in dependence of the system leakage capacity



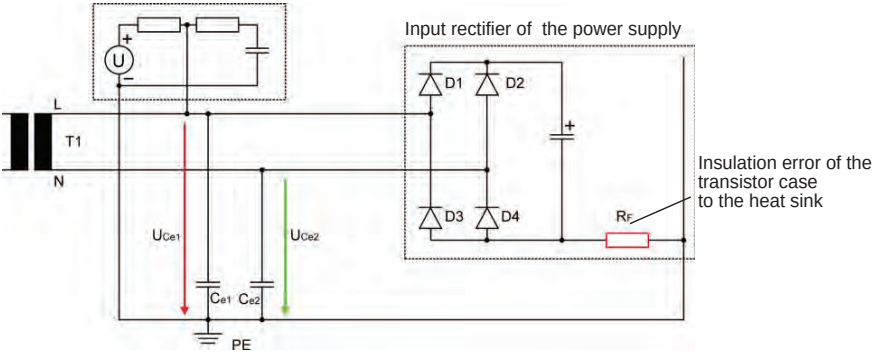
2. Max system voltage below <16 2/3 Hz



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 dońt 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.

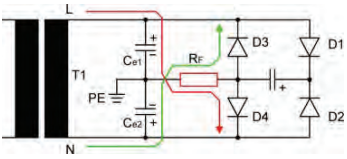
Illustration 1

Simple circuit of an insulation guard
with DC measurement method



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



Representation the charging currents of the leakage capacities (C_{e1},C_{e2}) during the positive and negative half-wave of power supply T1

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:

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

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

GHM-Messtechnik GmbH • Standort Martens
Kiebitzhörn 18 • D-22885 Barsbüttel / Germany
☎+49-(0)40-670 73-0 • Fax +49-(0)40-670 73-288
✉ info@martens-elektronik.de • www.ghm-messtechnik.de

Ordering code

IW1000 - 1. [ ] - 2. [ ] - 3. [ ] - 4. [ ]

1. Model

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

2. Supply voltage

0	230 V AC	± 10 %	50-60 Hz
1	115 V AC	± 10 %	50-60 Hz
4	24 V AC	± 10 %	50-60 Hz
5	24 V DC	± 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 ≤ 1s (C_{emax} <200 µF)

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 > 400V

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