

hakei[®]

Hz in Hearts

**Insulation monitoring
device**



Insulation Monitoring Device - IMD

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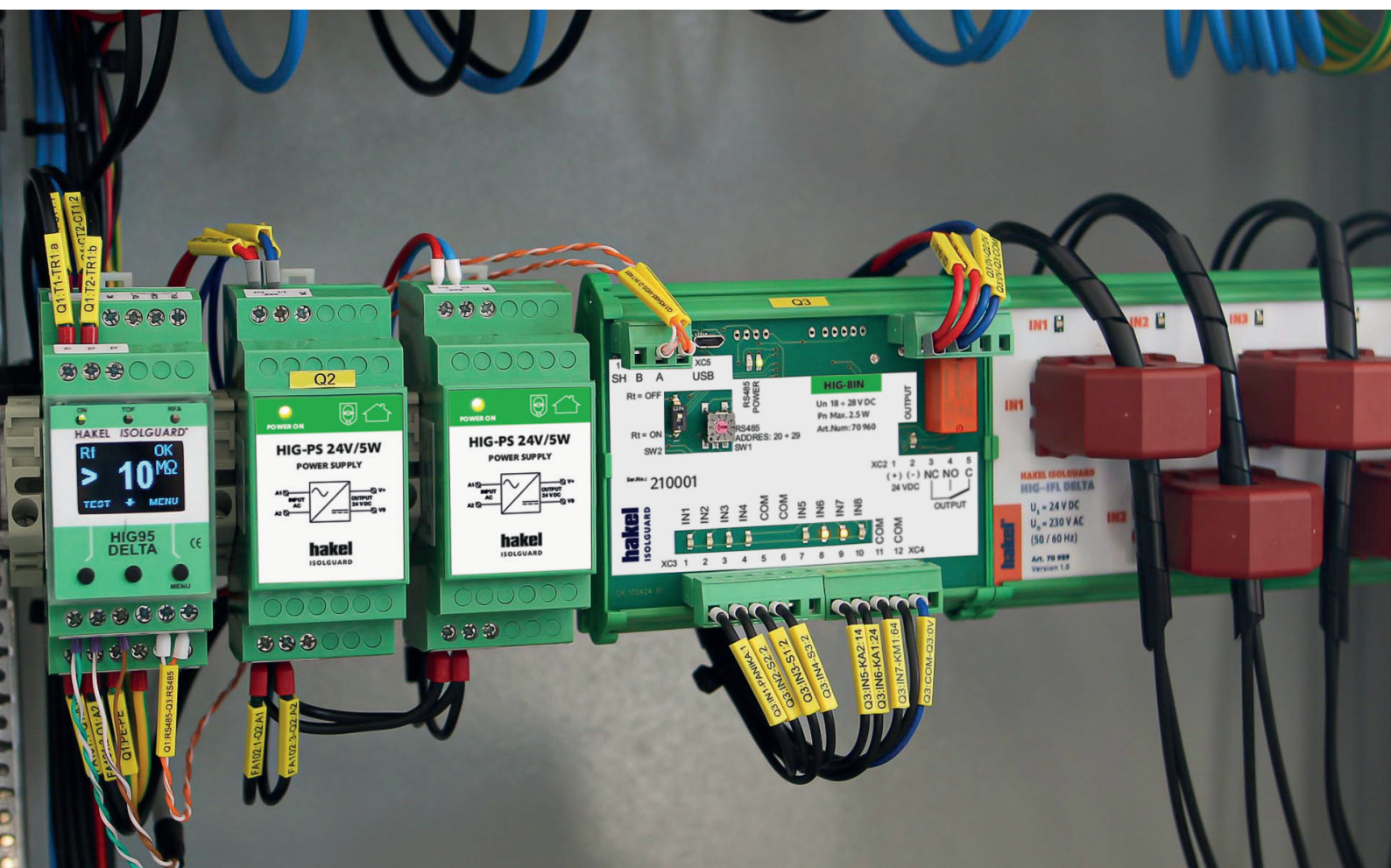
IT power supply system

IT power supply system is an insulated system that has all active parts isolated from the earth or one point of the system grounded via high impedance. Inactive parts of the electrical installation are grounded. Ungrounded system increases the operational reliability and human safety. Therefore it is used in the metallurgy, mechanical engineering, shipbuilding, traction systems, public transport and hospitals. The advantage of the ungrounded system is that the device connected to this system can work continuously even in the case of first fault (so-called earth fault). The phase voltage of the undamaged phase (or phases in the three-phase system) is

increased to the value of the delta voltage during the first fault. The system is safe if inactive parts are properly grounded. The reason is that there occur no bigger than safe current levels. The relevant responsible person must be informed about this failure and the first fault must be eliminated as soon as possible. However, the second fault (double earth fault) must result in immediate disconnection of the power supply system. The insulation monitoring devices or residual current relays are used for monitoring of the ungrounded system. These devices indicate the insulation level decrease below the set value.

IMD (Insulation Monitoring Device) utilization is at every IT power supply system.

- Healthcare
- Manufacturing plants
- Traction systems
- Automation systems
- Control and safety circuits
- Photovoltaic systems
- Special application (e.g. tunnel embossing machine)
- Heavy industry
- DC application
- Mining industry



The main advantages of IT power supply system equipped with insulation monitoring devices:

Operation continuity

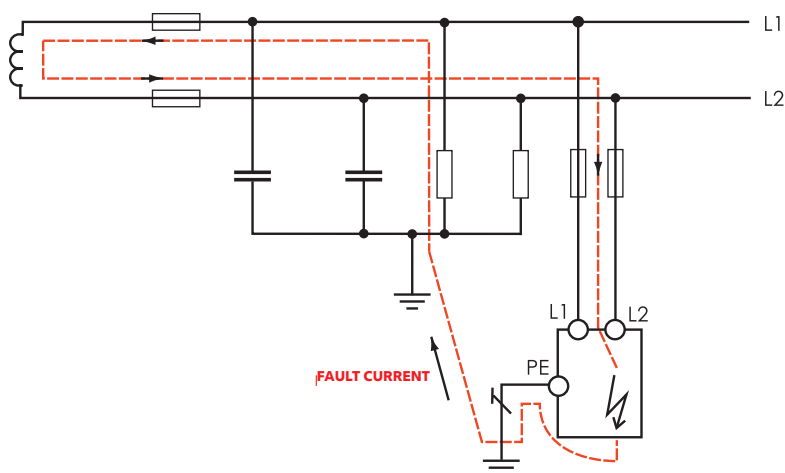
- In case of first fault (connection between IT power supply system and ground - earth fault) the system is still operational

Higher safety of operation:

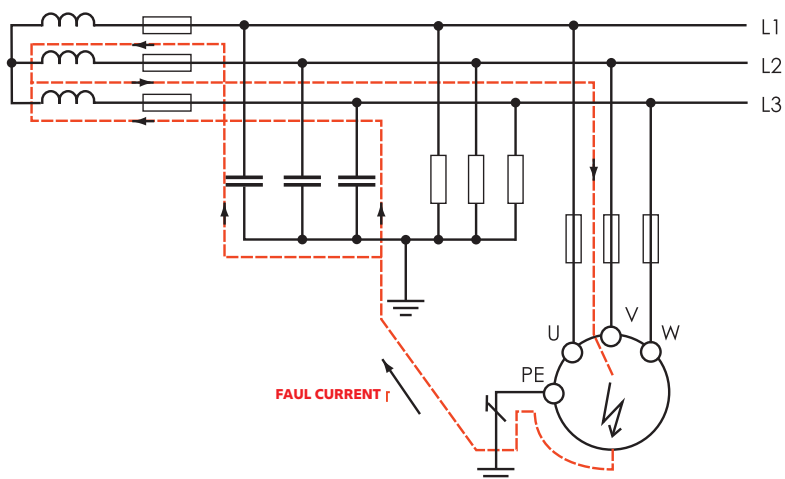
- Immediate overview of system status, continuous monitoring of the insulation level to earth
- Early detection of faulty devices by immediate signalisation by the insulation monitoring device
- Less risk of electric shock for the operator and higher fire safety
- Prevention of production losses and shutdowns, operations can continue in case of a first earth fault

Practice shows that there is an absolute minimum of the earth connections caused by a step change of insulation resistance. The vast majority of them is caused by gradual deterioration of insulation. HAKEL Insulation Monitoring Devices „ISOLGUARD“ are therefore equipped with the display that shows exact numerical values of the insulation resistance and enable to monitor the changing status of the insulation before the origin of the first earth fault.

1-phase IT system

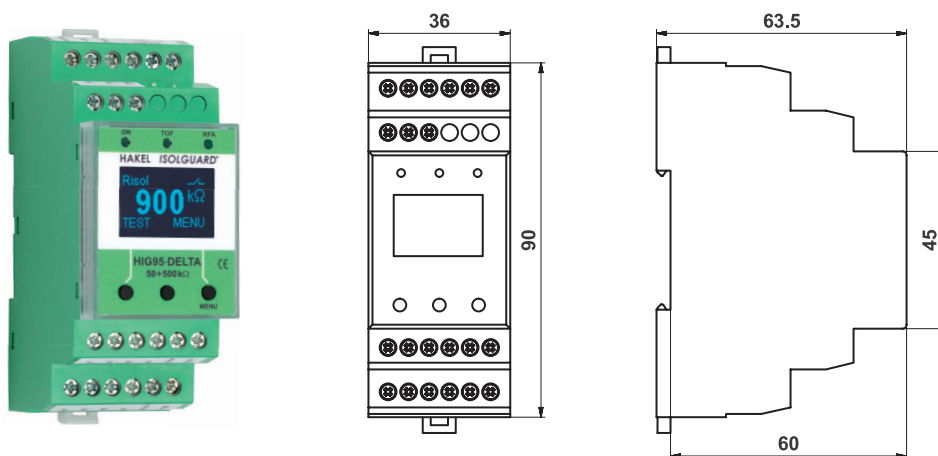


3-phase IT system



Healthcare

ISOLGUARD Insulation monitoring device HIG95-DELTA



ISOLGUARD insulation monitoring device HIG95-DELTA

The insulation monitoring device by HAKEL, type ISOLGUARD HIG95-DELTA, is designed to monitor the insulation resistance of single-phase ungrounded systems in healthcare. The insulation monitoring device enables monitoring of ungrounded IT power supply systems up to a maximum operating voltage of 264 V AC. It can also evaluate thermal and current overloading of the isolation transformer.

The insulation monitoring device is equipped with a display showing the numeric value of the measured insulation resistance as well as the current and thermal overloading of the isolation transformer. In addition, it features control buttons for setting parameters of the insulation monitoring device and signalling LED diodes to display the status of the controlled supply system.

A pair of built-in signalling relays with a switching contact enable remote signalling of insulation status errors in the supply system and transformer overload faults.

HIG95-DELTA is equipped with an RS485 communication bus. Via RS485 bus the insulation monitoring device can be connected to the ISOLGUARD master system. This provides remote monitoring of the IT power supply system status. An MDS-D panel with a touch screen can be used to display the currently measured values and the current setting of the insulation monitoring device. MDS-DELTA remote controlled signalling modules may also be used to observe the status of the checked supply system.

The ISOLGUARD system also includes: isolating transformers, automatic switches of supply systems and auxiliary I/O modules for monitoring logic inputs, e.g., UPS statuses.

Only one insulation monitoring device can be connected to the same ungrounded IT power supply system.

Basic characteristics

- Monitor of insulating resistance of AC networks with a voltage of 85 to 264 V, with a frequency of 50/60 Hz, for medical ungrounded systems
- Indication of losses connected with the measured supply system and the ground
- Display of the measured value of the insulation resistance, thermal and current load of the transformer on the screen
- Temperature scan of the isolation transformer using one of the three sensor types
- Scanning of the current load of the isolation transformer by means of a measuring current transformer
- Signalling relay of the error of the insulating status of the checked site with a switching contact
- Signalling relay of the isolation transformer overload error with a switching contact
- Connection to the RS485 bus, insulation strength 2500 Vef against internal circuits and supply system circuits
- Connection to the ISOLGUARD system by HAKEL - for data collection and display
- Option to connect the HAKEL MDS-D remote monitoring panel with a touch screen
- Option to connect remote signalling MDS-DELTA modules by HAKEL
- Option to set critical values, hysteresis values and other parameters using the buttons of the insulation monitoring device
- Access to setting the insulation monitoring device may be locked, the device can be unlocked using a combination of buttons
- Module of width 2M (36mm) for assembly on rail DIN 35

Type	Art. number	Display menu	Signalling relay	Range of displayed value	Critical insulation resistance	Current load sensor	Temperature sensor	Remote monitoring	IMD type according to IEC 61557-8
HIG95-DELTA	70 940	Yes	2 x SPST	5 kΩ ÷ 10 MΩ	Adjustable 50 kΩ ÷ 500 kΩ	Measuring transformer of the current with conversion to 5 A	One or two temperature sensors PT100 or PTC thermistor or thermal switching contact	MDS-D MDS-DELTA	<div>AC</div> <div>MED</div>

Notes: SPST - signalling relay with one switching contact (type NO)
MDS-DELTA module of remote signalling of the status of the IMD
MDS-D IMD remote monitoring module with a touch screen

Technical data HIG95-DELTA

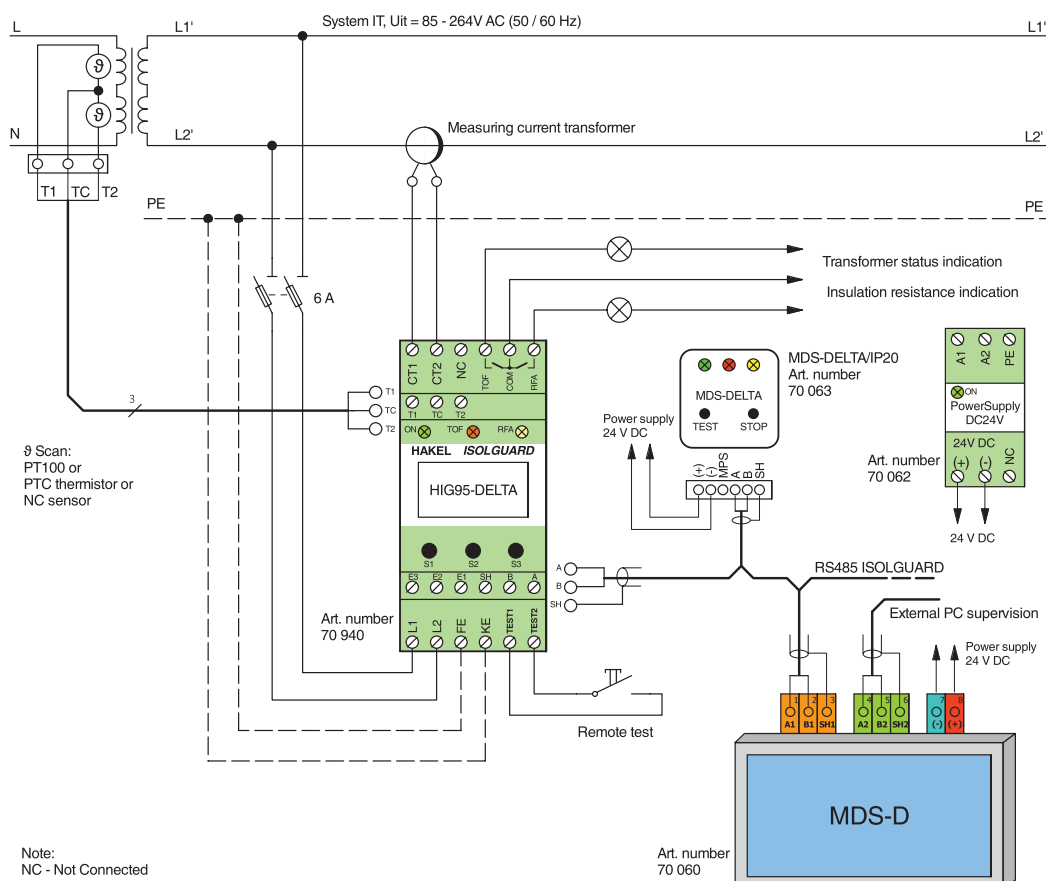
Type	evaluation of the insulation status of the checked power supply system					
Power supply voltage	U_s	85 ÷ 264 V AC (47÷ 63) Hz				
Possible type of IT power supply system		single-phase AC				
Maximum operating voltage of the monitored IT power supply system	U_n	identical to the power supply voltage				
Consumption	P	max. 4 VA				
Measuring voltage	U_m	12 V DC				
Measuring current	I_m	< 0,6 mA				
Internal impedance	Z_i	> 1 MΩ				
Internal DC resistance	R_i	> 32 kΩ				
Response time for insulation status failure	t_{an}	< 5 sec				
Dispersion capacity	C_e	10 uF				
Measuring range	R_F	5 kΩ ÷ 10 MΩ				
Measurement accuracy 5 kΩ ... 10 kΩ 10 kΩ ... 900 kΩ 900kΩ ... 10 MΩ		2 kΩ ± 10 % ± 15 %				
Ran setting range	R_{AN}	adjustable 50 kΩ ÷ 500 kΩ				
Hysteresis of the monitored insulation resistance	R_{hyst}	adjustable 0 ÷ +100 % R_{AN}				
Delay in response in signalling the insulation status	t_{ON}	adjustable 0 ÷ 60 sec, with step 1 sec				
		evaluation of the thermal and current load of the isolation transformer				
Current load scan	CT_{type}	using measuring transformer with a conversion ratio:				
		OFF	25/5 A	30/5 A	50/5 A	100/5 A
Range of the current load displayed on the screen	I_{it}	0,5 A – 100 A (depending on the type of measuring transformer)				
Critical current load value	I_{crit}	adjustable depending on the type of measuring transformer with step 1 A, see table of values range I_{crit} for measuring transformers				
Hysteresis of the current load	I_{hyst}	adjustable 0 ÷ 20% I_{crit}				
Measurement accuracy of the current load		± 5% (excluding the deviation of the measuring transformer)				
Delay in response in signalling the current error	I_{tON}	adjustable 0 ÷ 60 sec, with step 1 sec				
Thermal sensors of the isolation transformer	ϑ_{sensor}	1 to 2 thermal switching contacts or 1 to 2 thermistors or 1 to 2 resistance sensors PT100				
When selecting the type and number of thermal sensors, both sensors must be of the same type		adjustable in the IMD menu				
Range of the isolation transformer temperature displayed	ϑ_1, ϑ_2	5 ÷ 220°C (only for PT100 sensors)				
Critical value of the isolation transformer temperature	ϑ_{crit}	for the PT100 sensor adjustable in the range 50 ÷ 130 ° C , decisive level for the PTC thermistor is 1,6 kΩ decisive level for the switching contact is 1,6 kΩ				
Hysteresis of the isolation transformer temperature	ϑ_{hyst}	adjustable 0 ÷ 20 % ϑ_{crit} (only for PT100)				
Measurement accuracy of the isolation transformer temperature		± 5% (excluding the deviations of sensors)				
Delay in response in signalling the thermal error	ϑ_{tON}	adjustable 0 ÷ 60 sec, with step 1 sec				
Outputs						
Two signalling switching contacts with selectable position NO or NC El. strength against internal circuits El. strength against supply circuits		250 V AC / 1 A 3 000 Vef 3 000 Vef				
Remote signalling		ISOLGUARD RS485 serial communication line with possibility of connecting the MDS-D remote signalling module and MDS-DELTA modules produced by HAKEL				
Communication line: RS485 type MASTER-SLAVE, 9600 Bd, even parity Insulating strength against internal circuits and power supply system circuits		Yes 2500 V _{rms}				

General data		
Protection class according to EN 60 529		front panel IP40 / covers except front panel IP20
Electromagnetic compatibility		IEC 61324-2-4
Weight	m	celkem 154 g
Housing material		PA - UL 94 V0
Assembly method		DIN rail 35
Recommended cross-section of the connected conductors	S	1 mm ²
Catalogue number		70 940

Operating conditions	
Operating temperature	operating temperature -15 °C ÷ +60 °C / storage temperature -25 °C to +70 °C
Relative ambient humidity	28 g H ₂ O /kg of dry air
Atmospheric pressure	86 ÷ 106 kPa
Working position	any
External magnetic and electric field	max. 400 A/m
Category of over-voltage / testing voltage	III according to EN 60664-1 ed.2
Pollution degree	2 according to EN 60664-1 ed.2
Type of operation	Continual

Recommended connection of HIG95-DELTA to monitored ungrounded IT power supply system

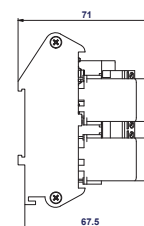
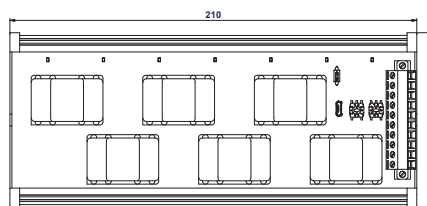
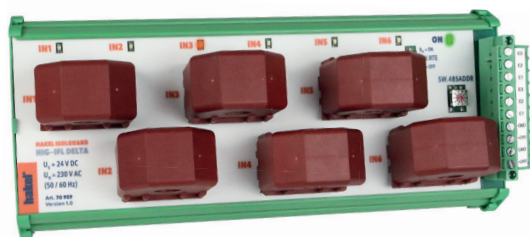
Example of connection of the IT power supply system 2PE ~ 50Hz, 230V/
IT with the HIG95-DELTA isolation monitoring device and remote signalling
modules MDS-D and MDS-DELTA.



Notes:

1. The type of measuring current transformer should be selected according to the power of the used isolation transformer
2. Several MDS-DELTA modules can be connected to HIG95-DELTA device
3. Clamps FE and KE must be connected to PE bridge by separate conductors
4. NC (Not Connected) - this clamp should not be connected
5. Recommended types and values of cables for bus RS485 ISOLGUARD are mentioned in the description of MDS-D module
6. When using shielded cable for the RS485 bus ISOLGUARD, the bus shielding has to be connected throughout the whole length and grounded in one point
7. It is necessary to keep the line connection of bus RS485 ISOLGUARD, it is not allowed to create any branch lines

HAKE! ISOLGUARD HIG-IFL DELTA



HAKE! ISOLGUARD HIG-IFL DELTA

Insulation fault location module produced by HAKE!, ISOLGUARD HIG-IFL DELTA type, is designed to identify the location of insulation fault in IT distribution power supplies, mainly in healthcare IT systems.

The HIG-IFL DELTA is equipped with six measuring transformers (LCS, Locating Current Sensor, according to IEC 61557-9), which are part of the product, and enables localization of faults on up to six circuits of the IT power supply system. It is designed for measuring IT power supply systems of the AC type, but mainly for single-phase AC systems, designed according to the standard HD 60364-7-710:2012 (Medical Isolated System - MIS).

The module is supplied with a low voltage of 24 V DC and it is connected to the HAKE! HIG95-DELTA insulation monitoring device by HAKE! IFLS bus. Both devices form together a system for fault location (IFLS, Insulation Fault Location System). HIG95-DELTA device contains locating current injector (LCI, Locating Current Injector).

Up to 10 HIG-IFL DELTA modules can be connected to a single insulation monitoring device to monitor up to 60 circuits. The signalling of the monitored circuits' status is performed by LED diodes on the module, on the insulation monitoring device's display and by the master monitoring system (MDS-D remote monitoring module).

Type	Art. number	Number of localization circuits	Measuring transformers	Compatible with	Supply voltage	Assembling	Width
HIG-IFL DELTA	70 959	6	integrated	HAKE! ISOLGUARD HIG95-DELTA	24 V DC	On 35 DIN rail	12 M

Basic characteristics

- Insulation Fault Locator (IFL) according to IEC 61557-9 for single-phase AC systems with nominal voltage U_n 230 V AC with frequency 50 / 60 Hz.
- Maximal operating voltage 275 V AC.
- Form the system for fault location (IFLS) together with HIG95-DELTA insulation monitoring device.
- HIG-IFL DELTA is equipped with six measuring transformers, which are part of the product, and enables localization of faults on up to six circuits.
- Possibility of setting the user name for individual circuits, either through the insulation monitoring device or a PC computer.
- Connection to the HIG95-DELTA device using the HAKE! IFLS bus.
- Up to 10 HIG-IFL DELTA modules can be connected to a single insulation monitoring device.
- Direct signalling of monitored circuits status by LED diodes on the module.
- Remote monitoring of monitored circuits status on the device display and also on the MDS-D remote monitoring module.
- The module is supplied from 24 V DC independent source.
- 12M (210 mm) module wide for DIN 35 rail assembly.
- HIG95-DELTA device description and its connection to the location module is listed in separate documentation. Documentation designation is "HIG95-DELTA Operating instruction.", documentation number is "DOK-70940-V1.4".

Type		ISOLGUARD HIG-IFL DELTA
Monitored IT power supply system type		AC
Monitored IT power supply voltage	U_n	230 V AC (50 / 60 Hz)
Maximal IT power supply operational voltage		275 V AC
Nominal supply voltage	U_s	24 V DC
Supply voltage range		9 ÷ 36 V DC
Power consumption	P	max. 1,5 VA
Measuring circuit		
Number of measuring inputs		6
Total possible number of inputs		60
Max. locating voltage value	U_L	24 V=
Max. locating current value	I_L	< 0,5 mA
Response sensitivity		50 μ A
Measurement accuracy		±30 %

Outputs		
Communication line		HAKEL IFLS bus
Insulating strength to the internal circuits and to the network circuits		2500 Vrms

General data		HIG-IFL DELTA
Degree of protection provided by the cover according to IEC 60529		IP20 Module without front panel
Weight	m	630 g
Housing material		PA - UL 94 V0
Method of assembly		35 DIN rail
Recommended section of the connected conductors	S	1 mm ²
Recommended protection		6 A
SW version		1.0
Article number		70 959

Operating conditions		HIG-IFL DELTA
Operating temperature		-15 °C ÷ +70 °C
Storage temperature		-25 °C ÷ +70 °C
Shipping temperature		-25 °C ÷ +70 °C
Altitude		Up to 2 000 m a. s. l.
Working position		any
Protection class		II according to IEC 61140:2016
Overvoltage category		III according to IEC 60664-1:2007
Pollution degree		2 according to IEC 60664-1:2007
Operation type		permanent

ISOLGUARD module for remote signalling MDS-D



ISOLGUARD module for remote signalling MDS-D

The remote monitoring module including the display (MDS-D) from the ISOLGUARD range is a device equipped with a touchscreen display showing the status of ungrounded IT power supply systems, monitored by insulation monitoring device HAKEL ISOLGUARD from the HAKEL production. Communication with the insulation monitoring devices takes place via RS485 using the internal protocol.

The MDS-D panel further includes a second RS485 line (external bus), which transfers the collected data to the user master system. The communication protocol on this line is derived from Profibus protocol.

MDS-D type devices are intended primarily for surveillance and monitoring sites to continuously display the status of ungrounded IT power supply systems guarded by insulation monitoring devices type HAKEL ISOLGUARD.

Basic characteristics

- Simultaneous status (isolation resistance, thermal and current overload) of up to 24 ungrounded IT power supply systems, monitored by HAKEL ISOLGUARD IMDs
- Allocating names to insulation monitoring devices for easier identification
- Two variants of MDS-D panel, depending on the panel target location and fitting method
- Sound and visual fault and failure signalization
- Display of the actual measured values from the insulation monitoring devices
- Touch screen control
- English, Czech and Polish menu - other languages can be added
- Protection type up to IP66
- Automatic searching for connected IMDs on the RS485 bus
- External RS485 bus, designed for communication with a master system
- Ability to perform the test of each connected insulation monitoring device
- General visual display of detailed settings of the Insulation Monitoring Devices
- Password-protected access to the panel setting

Type	MDS-D	MDS-D/IP66
Display	TFT LCD 4,3"	
Control method	Screen touching - resistive layer	
Acoustic signalization	Yes - Speaker	
Voltage supply	9-36V DC	
Maximum consumption	2W	
Communication bus type	Internal RS485, External RS485	
Connectable devices	Internal bus HAKEL ISOLGUARD IMDs	
	External bus user system	
Max. connected insulation monitoring devices	24	
Panel location	On the wall, on the panel	
Dimensions (WxHxD mm)	125x84x26	200x110x60
Typical application	Nurses station, Supervisory workplace	Operating room
Assembling method	into round flush-mount box	wall plugs
Protection type	IP20	IP66
Illustrative image		
Article number	70 060	70 061

MDS-D connection

For the MDS-D connection is necessary to bring 9-36 V DC power supply and twisted pair to the panel for internal RS485. External RS485 can be connected by applying another twisted pair.

It is recommended to use FTP cables for connecting the bus in a noisy environment or as a protection against the electromagnetic radiation. The FTP cables contains not only twisted pairs but also the shielding. This shielding is connected to the SH clamps.

It is recommended to use the HAKEL ISOLGUARD Power Supply DC24V as a power supply.

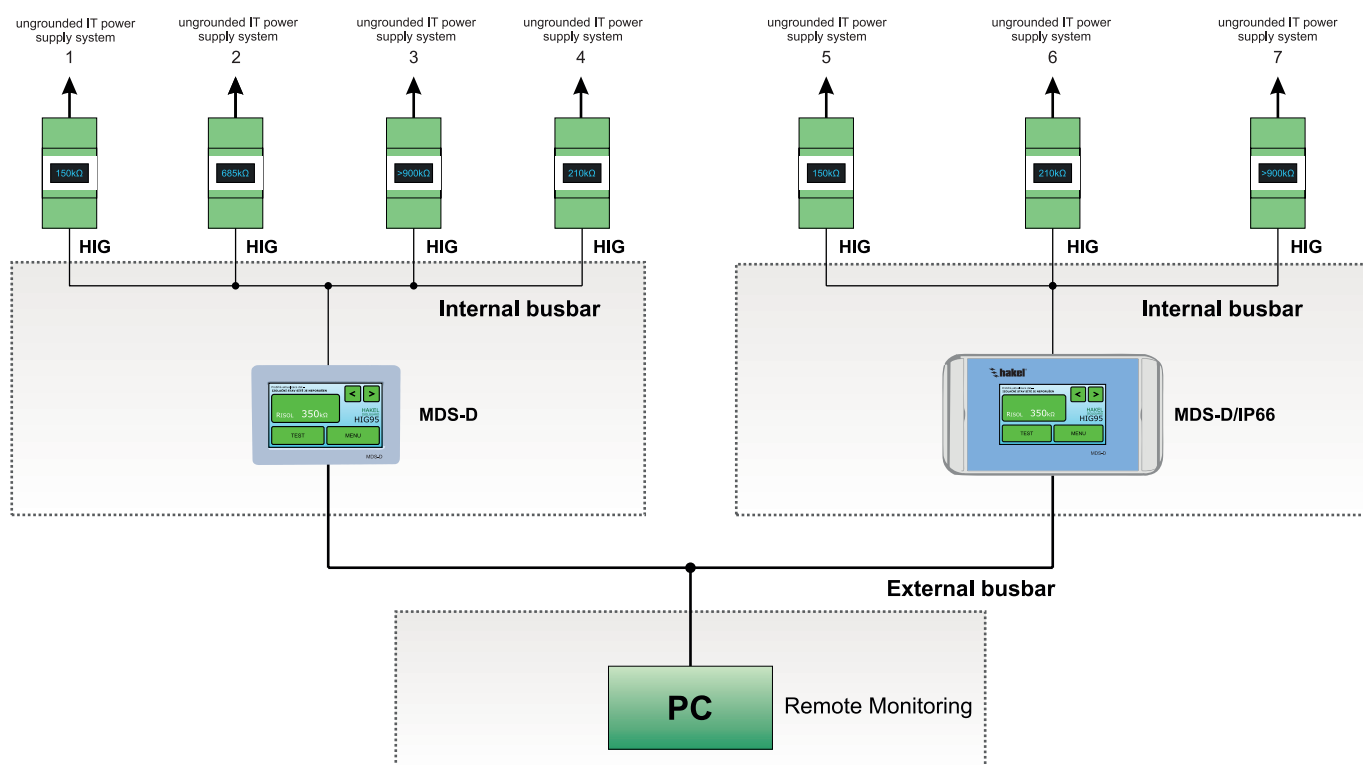
Communication levels of the ISOLGUARD system

System are divided into two:

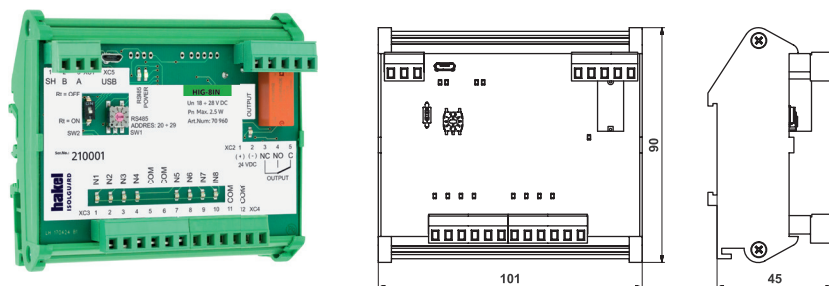
Internal bus – Bus used for collecting the data from individual devices produced by HAKEL, designed to monitor ungrounded IT power supply systems. Communication on this bus is controlled by the MDS-D panel. It is forbidden to affix other devices or otherwise interfere with the prescribed configuration on this line.

External bus – Bus used for connecting the MDS-D panel to a superior system. The MDS-D panel is in the position of the slave station and responds to queries from the master unit. The master unit may be a PC, RS485 data recorder or another user system which is able to communicate via RS485 interface. A description of communication telegrams can be found in a separate External Line RS485 Programming Manual produced by HAKEL.

Connection example



HAKE! ISOLGUARD HIG-8IN



HAKE! ISOLGUARD HIG-8IN

Input and output module HIG-8IN is designed as extension equipment for HAKE! ISOLGUARD insulation status monitoring system. Module allows to complete the IT system control (typically hospital) of any signalling off 8 digital inputs and 1 output switching contact.

Using HIG-8IN can be monitored, for example, UPS or automatic transfer switches status, read pressing of alarm or panic push-buttons or of any other device, which is able to transfer information via logical signal.

Inputs statuses, read by the HIG-8IN, are signalled on HAKE! ISOLGUARD MDS-D remote monitoring module. These statuses are than

displayed on MDS-D as individual lines with the possibility of user's text display settings, input logic, alarm signalling and others. HIG-8IN setting is also done by the MDS-D module.

RS485 data bus bar with ISOLGUARD protocol is used to transfer data between HIG-8IN and MDS-D. Up to 10 HIG-8IN modules can be connected on one RS485 bus bar in a time.

HIG-8IN is mainly used in combination with HAKE! ISOLGUARD MDS-D remote monitoring modules.

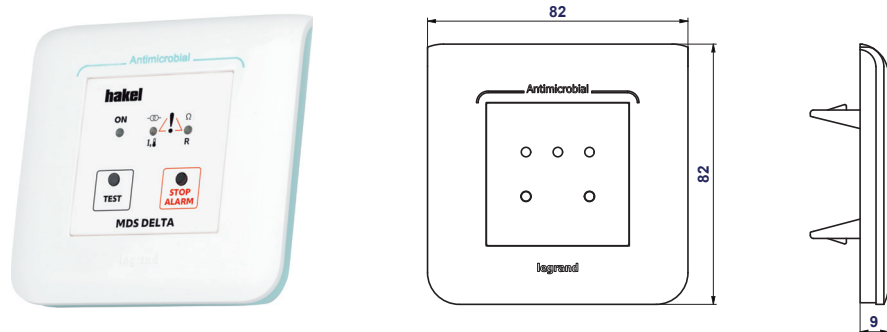
Type	Art. number	Logical inputs	Logical outputs	Supply voltage	Signalling via
HIG-8IN	70 960	8x 18 ÷ 36 V DC 8 mA	1x Potential free relay with switching contact	24 V DC	MDS-D

Note: MDS-D remote monitoring module with display and with communication bus bar RS485 from HAKE! production

Basic characteristics

- HIG-8IN module extends HAKE! ISOLGUARD system's possibilities for logic inputs status signalling
- Inputs status display and setting by HAKE! ISOLGUARD MDS-D module
- It is possible to add any texts that are displayed while on-state and open input status to each input
- Each input can be set as alarm or informative (with start-up the sound signal at fault status or not)
- It is possible to assign a failure colour (red/yellow) to each input
- Input status signalization using 8 LED diodes right on the HIG-8IN module
- Inputs are galvanic isolated by 3 800 V AC insulating barrier from the internal circuits
- All the 8 inputs are connected to the common ground – COM terminals are interconnected
- 24 V DC power supply
- One potential free switching contact with load capacity 230 V AC/1 A is at user's disposal
- Communication with MDS-D panel is done via RS485 data bus bar and ISOLGUARD protocol
- RS485 communication address setting in the range of 20-29 using a switch
- Pinning of the RS485 line's terminator is done using an integrated DIP switch
- Assembling on DIN rail, 101 mm wide module

HAKEI ISOLGUARD MDS-DELTA



HAKEI ISOLGUARD MDS-DELTA

Remote signalling module for ISOLGUARD series products

MDS-DELTA is a signalling module for HAKEL ISOLGUARD series insulation monitoring devices (IMDs). The module is fitted with a visual and acoustic signalling system, warning the user in the event of a fault detected by the ISOLGUARD device. The MDS-DELTA module is designed for supervisory/monitoring sites as a component of systems constantly informing the user of the status of an ungrounded IT power supply system.

The MDS-DELTA module signals the insulation status by means of a yellow control, any current and/or temperature overload, by means of a red control. The module's own function is signalled with a green control. If a fault occurs, the respective control will flash and the piezo siren will be sounded. Acoustic signalling can be stopped by using

the "STOP ALARM" button on the device. Furthermore, the product is equipped with a "TEST" button to initiate remote testing of the IMD. In this manner the MDS-DELTA product meets the requirements for remote signalling of insulation monitoring devices as stipulated by IEC 61557-8. The module design is in a standard profile 45 mm x 45 mm from Legrand, suitable for installation in cable distribution troughs.

One IMD can be interfaced to as many as 10 MDS-DELTA modules. Communication with the IMD proceeds via RS485 line by means of an internal protocol.

The MDS-DELTA modules can be combined with the MDS-D supervisory system.

Basic characteristics

- Remote signalling module for HAKEL ISOLGUARD insulation monitoring devices
- Design in the Legrand 45 x 45 mm standard, for installation in cable troughs
- Antimicrobial surface for use in hospitals
- Protection type up to IP44, for use in harsh conditions
- Visual and acoustic signalling of insulation status faults
- Visual and acoustic signalling of isolating transformer overload
- Connection to the IMD via RS485 communication line
- Power supply 12 - 32 V DC
- Testing button to verify the function of both the IMD and the signalling module
- Button to deactivate sound
- MDS-DELTA can be connected in order to make the visual signalling more alerting
- Up to 10 MDS-DELTA modules can be connected to a one HAKEL ISOLGUARD IMD

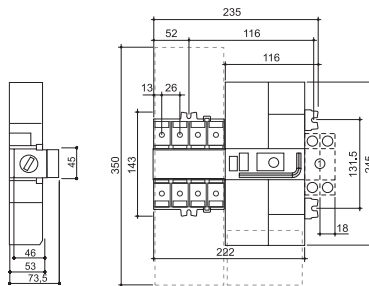
MDS-DELTA module signalling

Type	Art. number	Insulation fault signalling and transformer overload signalling	Mounting on	Supported IMDs	Signalling means	Antimicrobial surface	Protection type
MDS-DELTA	70 065	Yes	Into the wiring cable tray of profile 45 x 45 mm	HAKEL ISOLGUARD with the RS485 communication facility (SW version 5.5 or higher)	Visual (LED controls) Acoustic (piezo siren)	Yes, Legrand Antimicrobial technology	IP 20
MDS-DELTA/IP20	70 063		Onto the box with diameter of 68 mm				IP 44
MDS-DELTA/IP44	70 064						
MDS-DELTA/ IP20+MPS	70 066		Onto the box pair with diameter of 68 mm		Visual (LED controls, module of auxiliary signalization) Acoustic (piezo siren)		IP 20

Automatic transfer switching equipment from 40 to 160A

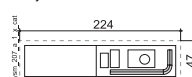


2 pole ATyS M

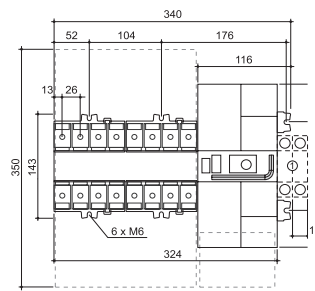


1. Auxiliary contacts (max. 2)

2 pole ATyS M - door cut-out

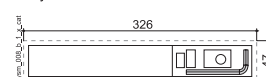


4 pole ATyS M



1. Auxiliary contacts (max. 2)

4 pole ATyS M - door cut-out



Automatic transfer switching equipment from 40 to 160A

ATyS M are 2 pole or 4 pole automatic transfer switches with fully integrated ATS controller. The prior function of the devices is safe transfer of the load supply between normal and alternate source in a case of a power failure. Single types differ in the setting options of each device parameters. ATyS M operate in automatic mode, if necessary it is possible to switch the device manually. They are designed for use in low voltage power supply systems with nominal voltage from 40 to 160 A, for applications where a brief interruption in order 100 ms of

the load supply is acceptable during the transfer. Devices allow setting overvoltage, undervoltage and frequency threshold values.

ATySg M - device adjustable using potentiometers and micro-switches with switching contact for generator operation.

ATySp M - device adjustable using display with exact individual values entry and programmable inputs and outputs, with switching contact for generator operation.

Basic characteristics

- Mechanically interlocked disconnecting switches provide fast switching, excellent features and a high number of cycles
- 3 stable positions that are not affected either by voltage drops or vibrations
- The current position is always visible on the switch, independent from power supply. If necessary, the device can be operated manually by a lever.
- Allows selecting the setting function to the position Ø after a power failure.

ATyS M switches comply with international standards IEC 60947-3, IEC 60947-6-1

ATySg M

Art. number	Rated current (A)	No. of poles	Power supply (V AC)	Bridging bar	Voltage sensing and power supply tap	Terminal shrouds (2 pcs in a package)	Auxiliary contact				
93532004	40 A	2P	230	1 pc - 13092006	2 pcs - 13994006	1 pc - 22944016	1 pc - 13090001 for all three positions I, 0, II				
93532006	63 A										
93532008	80 A			1 pc - 13092016		2 pcs - 22944016					
93532010	100 A										
93532012	125 A										
93532016	160 A	4P	230/400	1 pc - 13094006		2 pcs - 22944016					
93544004	40 A										
93544006	63 A										
93544008	80 A			1 pc - 13094016							
93544010	100 A										
93544012	125 A										
93544016	160 A										

ATySp M

Art. number	Rated current (A)	No. of poles	Power supply (V AC)	Bridging bar	Voltage sensing and power supply tap	Terminal shrouds (2 pcs in a package)	Auxiliary contact	Remote interfaces for ATyS PM
93644004	40 A	4P	230/400	1 pc - 13094006	2 pcs - 13994006	2 pcs - 22944016	1 pc - 13090001 for all three positions I, 0, II	1 pc - 95992010 - D10 or 1 pc - 95992020 - D20
93644006	63 A							
93644008	80 A							
93644010	100 A							
93644012	125 A							
93644016	160 A							
				1 pc - 13094016				

Auxiliary contact



A maximum of two auxiliary contact blocks can be fitted to each product. Each auxiliary contact block integrates 3NO/NC auxiliary contacts, one for each position I, 0, II. ATyS M is equipped with one block as standard

Rated current (A)	40 ... 160 A
Article number	1309 1001

Bridging bar



Used to bridge individual common points on the input or output terminals.

Rated current (A)	40 ... 125 A	160 A	40 ... 125 A	160 A
No. of poles	2 P	2 P	4 P	4 P
Article number	1309 2006	1309 2016	1309 4006	1309 4016

Terminal shrouds



Protection against direct contact with terminals or connecting parts. Possibility of sealing. For complete upstream and downstream protection of 3-phase products it is necessary to order quantity 2, for 1-phase only quantity 1.

Rated current (A)	40 ... 160 A
Position	Top or bottom (*2 pcs in a package)
Article number	2294 4016

Remote interfaces for ATyS PM

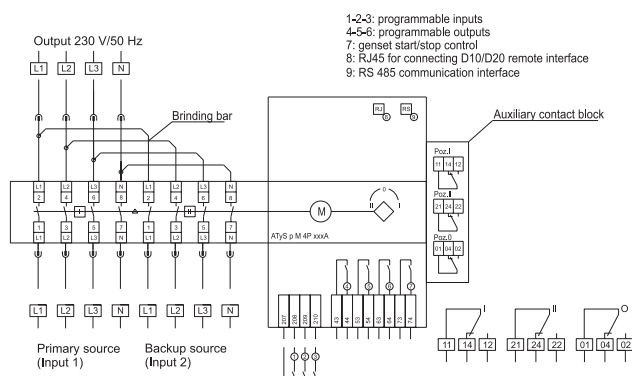
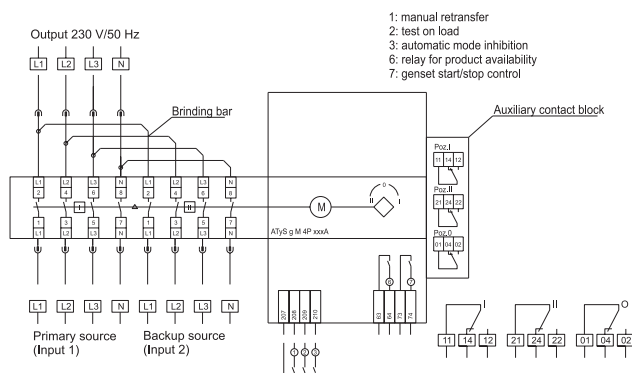
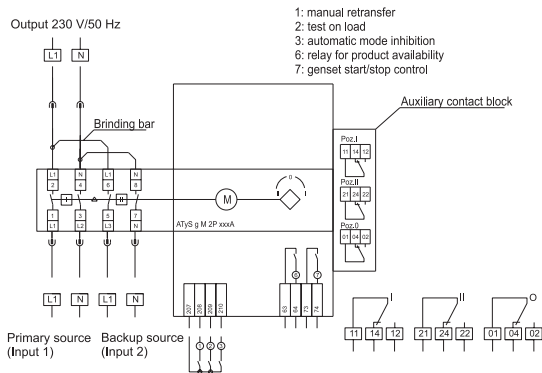


To remotely display source availability and position indication on the switchboard front panel. The remote interface is powered directly from a conductor connected to ATyS M. Maximum cable length is 3 m.

ATyS D10 - displays source availability and position indication (that is position I, 0, II), Degree of protection IP21.

ATyS D20 - enables display of measurements, control, tests and configuration. Degree of protection IP21.

Typ	ATyS D10	ATyS D20
Article number	1599 2010	1599 2020



Technical characteristics according to IEC 60947-3 and IEC 60947-6-1

Rated operational current I_n (A) (IEC60947-3)							
Rated voltage	Utilization category	A/B(1)	A/B(1)	A/B(1)	A/B(1)	A/B(1)	A/B(1)
415 V AC	AC-21A/AC-21B	40/40	63/63	80/80	100/100	125/125	160/160
415 V AC	AC-22A/AC-22B	40/40	63/63	80/80	100/100	125/125	160/160
415 V AC	AC-23A/AC-23B	40/40	63/63	80/80	100/100	125/125	125/160
690 V AC	AC-21A/AC-21B	40/40	63/63	80/80	100/100	125/125	160/160
690 V AC	AC-22A/AC-22B	40/40	63/63	80/80	80/80	100/125	100/125
690 V AC	AC-23A/AC-23B	40/40	63/63	63/63	80/80	80/80	80/80

Rated operational current I_n (A) (IEC60947-6-1)							
Rated voltage	Utilization category	A/B(1)	A/B(1)	A/B(1)	A/B(1)	A/B(1)	A/B(1)
415 V AC	AC-31A/AC-31B	40/40	63/63	80/80	100/100	100/125	100/160
415 V AC	AC-32A/AC-32B	40/40	63/63	80/80	100/100	100/125	100/160
415 V AC	AC-33A/AC-33B	-/40	-/63	-/80	-/80	-/80	-/80

Overload capacity						
Current rated as short-time withstand I_{cw} 1s (kA_{rms})	4	4	4	4	4	4
Rated peak withstand current (kA_{peak}) ⁽²⁾	17	17	17	17	17	17
Conditional short-circuit current (kA_{rms}) ⁽²⁾	50	50	50	50	50	50
Associated fuse rating (A) ⁽²⁾	40	63	80	100	125	160

Connection						
Min. connection cross-section (mm ²)	10	10	10	10	10	10
Min. Cu cable cross-section (mm ²)	70	70	70	70	70	70
Tightening torque (Nm)	5	5	5	5	5	5

Switching time (Basic settings)						
I - 0 or II - 0 (ms) ⁽³⁾	50	50	50	50	50	50
I - II or II - I (ms) ⁽³⁾	180	180	180	180	180	180
Duration of power loss during switching I - II (ms) min. (ATySTM, GM or PM)	90	90	90	90	90	90

Power supply						
Min./max. supply V AC (ATyS DM, GM and TM)	176/288	176/288	176/288	176/288	176/288	176/288
Min./max. supply V AC (ATyS PM)	160/305	160/305	160/305	160/305	160/305	160/305

Control supply power demand						
Rated power (VA)	6	6	6	6	6	6
Max. intensity at 230 V AC (A) - ATyS DM, TM, GM	30	30	30	30	30	30
Max. intensity at 230 V AC (A) - ATyS PM	20	20	20	20	20	20

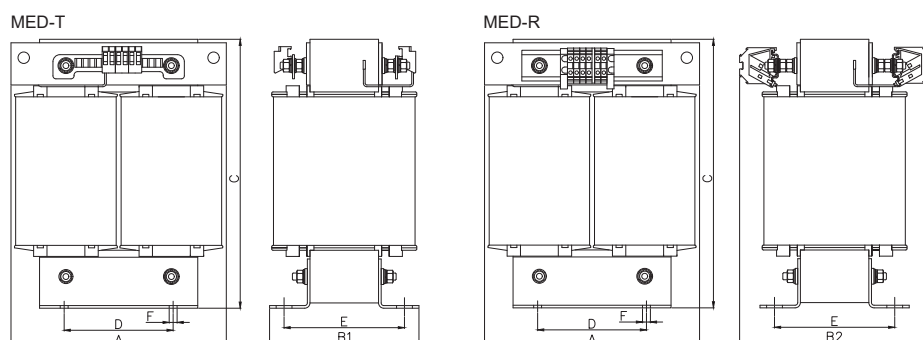
Mechanical specifications						
Durability (number of operating cycles)	10000	10000	10000	10000	10000	10000
Weight (kg)	3.5	3.5	3.5	3.5	3.5	3.5

(1) Category with index A = frequent operation / Category with index B = infrequent operation

(2) For a rated operational voltage $U_n = 400$ V AC

(3) The time between receiving the request and switching to the required position

Single-phase safety isolating transformers



Single-phase safety isolating transformers

Single-phase safety isolating transformers with standard UI shape lamination, composite core and vertical mounting are intended for the supply of equipment in medical locations.

They are produced in accordance with IEC 61 558-2-15:2011, with a voltage transfer of 230 / 230 V or 400 / 230 V, frequency 50 / 60 Hz, protection IP00, terminals IP20, insulation class F (155 °C) and maximum ambient temperature of 40 °C.

Other voltage transfer is also possible at the input voltage of up to 1000 V and output voltage of up to 250 V.

These transformers have reinforced insulation and protective shielding between the primary and secondary winding, no-load current $I_0 < 3\%$,

voltage loss $\Delta U < 5\%$ and trigger current max. 8 times the rated current (peak/peak).

They are equipped with two temperature sensors PT100. Thanks to these PT100 temperature sensors, the transformers are supplied in such a way that they work best with HAKEL ISOLGUARD insulation monitoring devices and provide the best possible basis for measuring the insulation status and transformer heating.

Transformers can be supplied in a steel case with IP23.

Single-phase safety isolating transformers comply with the following standards:

- IEC 61558-2-15:2011

Type	Art. number with IP00 (without steel case)	Art. number with steel case IP23	Voltage at the transformer primary	Voltage at the transformer secondary	Rated power	In-built temperature sensors	Weight without steel case	Weight with steel case
MED STD-line 2,5 kVA	71 131/00	71 131/23	230 V AC	230 V AC	2 500 VA	2 x sensor PT100	38 kg	50 kg
	71 131/00/400	71 131/23/400	400 V AC		3 150 VA		40,5 kg	53 kg
MED STD-line 3,15 kVA	71 132/00	71 132/23	230 V AC		4 000 VA		42 kg	58 kg
	71 132/00/400	71 132/23/400	400 V AC		5 000 VA		51,6 kg	68 kg
MED STD-line 4 kVA	71 133/00	71 133/23	230 V AC		6 300 VA		60,5 kg	79 kg
	71 133/00/400	71 133/23/400	400 V AC		8 000 VA		70 kg	88 kg
MED STD-line 5 kVA	71 134/00	71 134/23	230 V AC		10 000 VA		90 kg	108 kg
	71 134/00/400	71 134/23/400	400 V AC					
MED STD-line 6,3 kVA	71 135/00	71 135/23	230 V AC					
	71 135/00/400	71 135/23/400	400 V AC					
MED STD-line 8 kVA	71 136/00	71 136/23	230 V AC					
	71 136/00/400	71 136/23/400	400 V AC					
MED STD-line 10 kVA	71 137/00	71 137/23	230 V AC					
	71 137/00/400	71 137/23/400	400 V AC					

Type		MED STD-line 2,5 kVA	MED STD-line 3,15 kVA	MED STD-line 4 kVA	MED STD-line 5 kVA	MED STD-line 6,3 kVA	MED STD-line 8 kVA	MED STD-line 10 kVA
Design		MED-T	MED-T	MED-R	MED-R	MED-R	MED-R	MED-R
Dimension A	mm	200	200	245	245	280	280	280
Dimension B1	mm	186	186	-	-	-	-	-
Dimension B2	mm	-	-	220	235	225	240	255
Dimension C	mm	250	250	310	310	385	385	385
Dimension D	mm	124	124	124	124	176	176	176
Dimension E	mm	144	144	137	152	143	158	173
Dimension F	mm	9x18	9x18	9x18	13x20	13x20	13x20	13x20
Terminal block	mm ²	4	4	4	4	6	6	10

Protection class	Degree of protection	Insulation class	Max. ambient temperature	Frequency	No-load current	Short-circuit resistance	Trigger current
I	IP00 (terminals IP20)	F	40 °C	50 / 60 Hz	$I_0 < 3\%$	non resistant	max. 8 times the rated current

Cable routing to PRI and SEC:

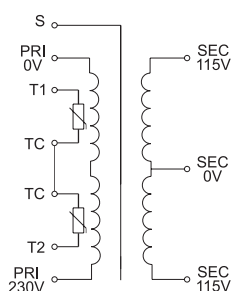
according to IEC 61 558:2011, the conditions for reinforced or double insulation must be complied with (distance across the insulation at least 1 mm, insulation strength 4,2 kV, insulation resistance > 7 MΩ). In addition, the conditions for leakage current must be observed. Surface paths and air distances between input and output circuit terminals up to 6 A - 6 mm, 6 A to 16 A 10 mm, above 16 A 14 mm.

Rated power [VA]	Recommended back-up fuse at PRI	Characteristics			
		$\eta[\%]$	$u_k[\%]$	$\Delta P_0[W]$	$\Delta P[W]$
2 500	DII 16 A gG	95,1	2,8	33	110
3 150	DII 20 A gG	96,1	2,6	35	131
4 000	DII 25 A gG	96,2	3,0	40	158
5 000	DII 50 A gG	95,1	2,9	50	225
6 300	DII 50 A gG	95,1	3,0	60	270
8 000	DII 50 A gG	97,0	2,8	70	290
10 000	DII 63 A gG	97,0	2,5	80	320

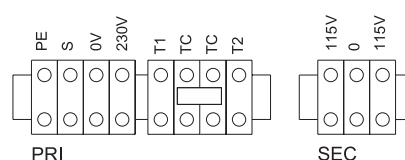
For wiring in the switchboard we recommend cables with insulation for voltage level $U_s = 400$ V and with thermal resistance of min. 70 °C (preferably 90 °C, e.g. H05V2 - K 300/500V or H07V2 - K 450/750V). Select the conductor' cross-section according to the input (I1) and output (I2) current according to the following table. These minimum cross-sections are given by IEC 61558:2011.

Current [A]	Minimum cross-section of the conductor [mm ²]
6 ÷ 10	1
10 ÷ 16	1,5
16 ÷ 25	2,5
25 ÷ 32	4
32 ÷ 40	6
40 ÷ 64	10

Winding connection scheme

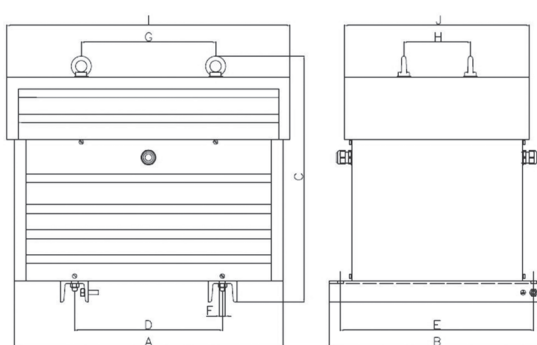


Terminal designation

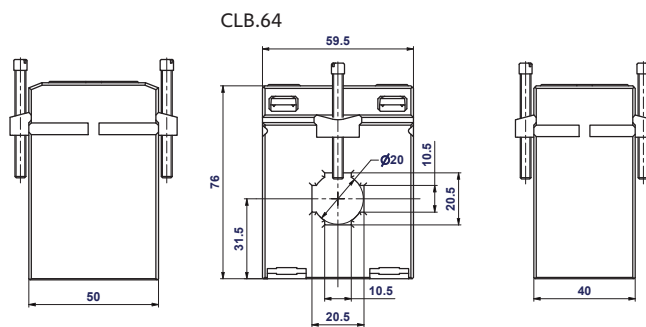
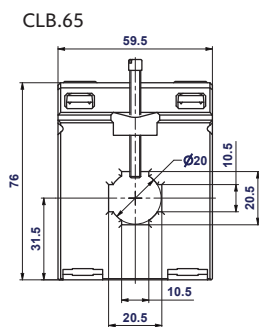


Cross-sections of connected conductors [mm ²]	MED STD-line 2,5 kVA	MED STD-line 3,15 kVA	MED STD-line 4 kVA	MED STD-line 5 kVA	MED STD-line 6,3 kVA	MED STD-line 8 kVA	MED STD-line 10 kVA
Input/output terminals - flexible max.	16	16	16	16	16	16	35
Input/output terminals - solid max.	25	25	25	25	25	25	50
Input/output terminals - minimal	1,5	1,5	1,5	1,5	1,5	1,5	1,5
Temperature sensors terminals	2,5	2,5	2,5	2,5	2,5	2,5	2,5

Steel transformer case with IP23



Rated power TR [VA]	Cable grommets	Dimensions [mm]										Weight [kg]
		A	B	C	D	E	F	G	H	I	J	
2 500, 3 150	M20 × 1,5	300	400	392	124	362	Ø 11	100	143	325	345	12,2
4 000	M20 × 1,5	360	385	439	124	345	Ø 11	120	117	385	330	15,5
5 000	M20 × 1,5	360	400	439	124	360	Ø 11	120	132	385	345	15,9
6 300	M20 × 1,5	420	440	490	176	400	Ø 11	140	114	445	385	16,9
8 000	M20 × 1,5	420	455	490	176	415	Ø 11	140	129	445	400	17,3
10 000	M20 × 1,5	420	470	490	176	430	Ø 11	140	144	445	415	17,7



HAKEL ISOLGUARD HIG-MT

The range of HIG-MT current measuring transformers is primarily used to sense the current load of a medical insulated power supply system, which is monitored by the insulation monitoring device from HAKEL. Measuring transformers are available in the range of primary current 25 A to 100 A, secondary current 5 A. The type of construction is pluggable. Transformers are supplied in two dimensional versions, depending on the primary current.

HIG-MT transformers are designed for installation in a switchboard, they can be mounted to the distribution board using reduction brack-

ets (included), or using a DIN rail bracket (must be purchased separately). Alternatively, the transformer can be mounted directly on the copper profile, up to a maximum size of 20 x 10 mm.

The HIG-MT range is designed to work reliably with HAKEL HIG-95-DELTA and HIG95+ insulation monitoring devices.

Types of current measuring transformers HIG-MT

Type	Article number	Primary current [A]	Sec. Current [A]	Power [VA]	Accuracy class	Overcurrent number (FS)	Mechanical construction	Article number of DIN rail bracket	Weight [g]
HIG-MT 25/5 A	71 530	25	5	1	3	5	CLB.65	71 541	660
HIG-MT 30/5 A	71 531	30		1,5	3	5	CLB.65	71 541	660
HIG-MT 40/5 A	71 532	40		1	1	10	CLB.65	71 541	660
HIG-MT 50/5 A	71 533	50		1	1	10	CLB.65	71 541	660
HIG-MT 60/5 A	71 534	60		2,5	1	5	CLB.65	71 541	660
HIG-MT 80/5 A	71 535	80		2,5	1	5	CLB.64	71 540	520
HIG-MT 100/5 A	71 536	100		5	1	5	CLB.64	71 540	520

Technical data of HIG-MT (applies to the whole range)

Transformer construction		Pluggable (without interrupting the primary conductor)
Maximum continuous overload		120 %
Hole for primary conductor (round)		20 mm
Hole for primary conductor (rectangle)		20 x 10 mm
Highest allowed voltage of the monitored system		0,72 kV
Testing voltage		3 kV AC
Working frequency	f	50 / 60 Hz
Housing material		Self-extinguishing
Winding insulation class		Class E, maximum temperature 120 °C
Rated short-time thermal current ¹	I _{th}	60 x primary current
Rated peak withstand current ²	I _{dyn}	150 x secondary current
Recomm. cross-section of secondary conductors	s	2,5 mm ²
Operating position		Arbitrary
Operating temperature		-25 °C ÷ +40 °C

¹The effective value of the primary current, which the transformer can withstand for 1 s without damaging the transformer.

²The peak value of the highest amplitude of the primary dynamic current, which the transformer can withstand without electrical or mechanical damage by electrodynamic forces, when the secondary winding is short-circuited.

Technical data of HIG-MT DIN CLIP

Type	HIG-MT DIN CLIP 65	HIG-MT DIN CLIP 64
Specification	DIN rail bracket for transformer range HIG-MT	
Intended for mechanical construction	CLB.64	CLB.64
Weight	11 g	10 g
Article number	71 541	71 540

Recommended max. cable lengths for connecting the transformer with the HAKEL HIG insulation monitoring device

Type	Article number	The recommended max. cable length	
		Cable CU, cross-section 2,5 mm2	Cable CU, cross-section 1,5 mm2
HIG-MT 25/5 A	71 530	2,25 m (4,5 m complete sec. loop)	1,35 m (2,75 m complete sec. loop)
HIG-MT 30/5 A	71 531	3,75 m (7,5 m complete sec. loop)	2,25 m (4,5 m complete sec. loop)
HIG-MT 40/5 A	71 532	2,25 m (4,5 m complete sec. loop)	1,35 m (2,75 m complete sec. loop)
HIG-MT 50/5 A	71 533	2,25 m (4,5 m complete sec. loop)	1,35 m (2,75 m complete sec. loop)
HIG-MT 60/5 A	71 534	6,5 m (13 m complete sec. loop)	4 m (8 m complete sec. loop)
HIG-MT 80/5 A	71 535	6,5 m (13 m complete sec. loop)	4 m (8 m complete sec. loop)
HIG-MT 100/5 A	71 536	14 m (28 m complete sec. loop)	8 m (16 m complete sec. loop)

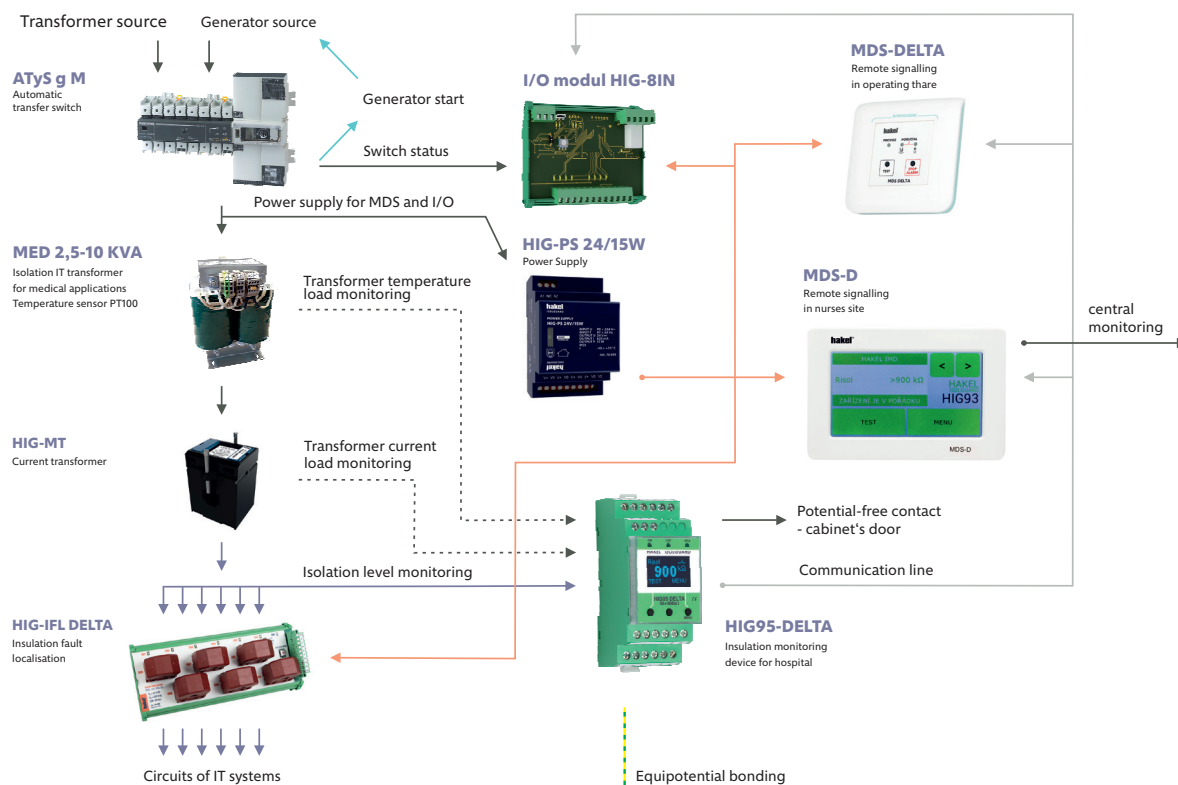
Installation instructions

Operation, installation and maintenance of this equipment may only be performed by qualified personnel in accordance with installation and safety regulations. If the device is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

The HIG-MT device is designed for mounting on a switchboard or DIN rail 35 mm according to EN 60715.

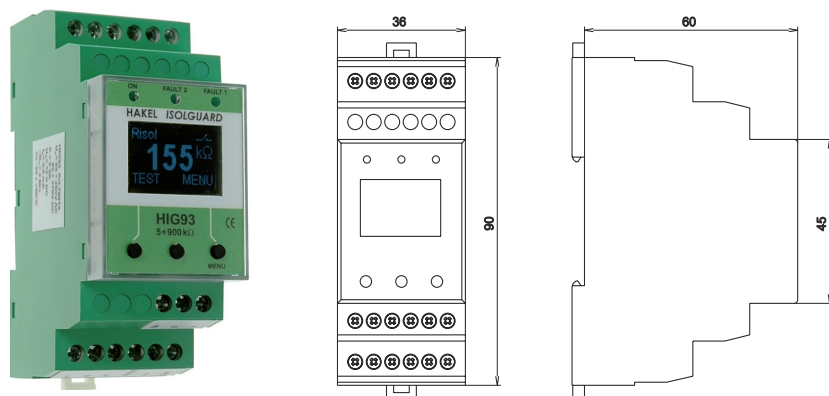
The operating position is arbitrary.

HAKEL ISOLGUARD Healthcare system



Heavy industry

ISOLGUARD insulation monitoring devices HIG93, HIG94



ISOLGUARD insulation monitoring devices HIG93, HIG94

The insulation monitoring devices produced by HAKEL for the ISOLGUARD HIG93, HIG94 series are designed for monitoring the insulation status of single-phase and 3-phase ungrounded IT power supply systems designed and operated according to standards IEC 61010-1:2010, EN 50522, IEC 61936-1:2010.

Enable monitoring of single-phase and 3-phase ungrounded IT power supply systems up to the maximum operating voltage 275 V AC, or 3x275 V AC. If monitoring the insulation status of a single-phase or 3-phase ungrounded IT power supply system with higher operating voltage is required, it is necessary to create an artificial centre using TL400 (Art. number 70504), TL1600 (Art. number 71601) or TL6003 (Art. number 70603). Such a created centre is connected to the terminal of insulation monitoring device HIG93, HIG94.

The insulation monitoring devices are equipped to display the numeric value of the measured insulation resistance. In addition, the control buttons for setting the parameters of insulation monitoring devices and signalling LED diodes can be used to display the status of

the checked network. According to the type, it is possible to connect to the insulation monitoring device modules for remote signalling of the status of the controlled MDS-DELTA or MDS-D network produced by HAKEL.

HIG93, HIG94 insulation monitoring devices communicate with the master computer via the RS485 bus with the protocol derived from the PROFIBUS protocol.

One or two built-in signalling relays with a switch contact enable the connection of equipment for signalling of alarm. The insulation monitoring device has an optional alarm memory function with the option to cancel the alarm using the button on the insulation monitoring device. Local and remote testing of the function of the insulation monitoring device can also be conducted.

Only one insulation monitoring device can be connected to the same ungrounded IT power supply system.

Basic characteristics

- The monitor for insulating statuses of AC networks with the voltage $0 \div 275 \text{ V}$ without additional equipment, higher voltages with additional inductor
- Display of measured value of the R_{isol} insulation resistance on the display within the range $5 \text{ k}\Omega \div 900 \text{ k}\Omega$ or $200 \text{ k}\Omega \div 5 \text{ M}\Omega$
- Signalling relay of the status of the insulating resistance with the switching contact
- Connection to the RS485 bus, insulation strength $2 \text{ 500 V}_{\text{rms}}$ against internal circuits and network circuits
- Optional memory of the activated alarm with option unblocking by button on the insulation monitoring device
- Connection options for remote signalling MDS-DELTA or MDS-D modules produced by HAKEL.
- Option to set the monitored value of the insulating resistance R_{CRIT} using the display and buttons within the range according to the type insulation monitoring devices
- Adjustable hysteresis of the limit value of the insulating resistance within the range $0 \div 100\%$ using the display and buttons
- Adjustable delay t_{ON} response of signalling relay using the displays and buttons within the range $0 \div 60 \text{ sec}$
- Access to setting the insulation monitoring device can be locked, the insulation monitoring device is unlocked by a combination of buttons
- Separated supply voltage enables to also monitor a network which is not under voltage
- Module width 2M for mounting on DIN rail 35

Type	Art. number	Signalling relay 1	Signalling relay 2	Remote monitoring	Range of display	Critical insulation resistance
HIG93	70 915	1P	1P	MDS-D MDS-DELTA	$5 \text{ k}\Omega \div 900 \text{ k}\Omega$	Adjustable $5 \text{ k}\Omega \div 300 \text{ k}\Omega$
HIG94	70 917	1P	1P		$200 \text{ k}\Omega \div 5 \text{ M}\Omega$	Adjustable $200 \text{ k}\Omega \div 900 \text{ k}\Omega$

Note: 1P signalling relay with one switching contact

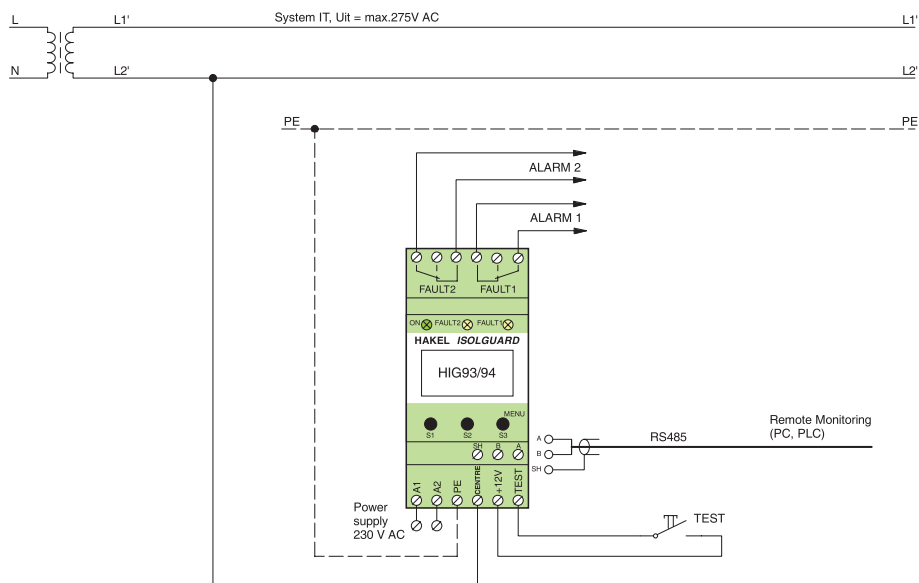
Technical data HIG93, HIG94

Type		HIG93	HIG94
Supply voltage	U _n	90 ÷ 265 V AC or 90 ÷ 370 V DC	
Maximum operating voltage of the monitored ungrounded IT power supply system	U _{it}	275 V AC	
Consumption	P	max. 5 VA	
Measuring voltage	U _M	12 V DC	
Measuring current	I _M	< 0,6 mA	
Alternate inside resistance of the measuring input	R _i	> 2 MΩ	
Range of the value shown on the display	R _{isol}	5 kΩ ÷ 900 kΩ	200 kΩ ÷ 5 MΩ
Precision of measurement 5 kΩ ... 10 kΩ		2 kΩ	
10 kΩ ... 900 kΩ		± 10%	
Precision of measurement 200 kΩ... 1 MΩ			± 10%
1 MΩ ... 5 MΩ			± 15%
Critical insulation resistance	R _{crit}	adjustable 5 kΩ ÷ 300 kΩ	adjustable 200 kΩ ÷ 900 kΩ
Hysteresis of monitored insulation resistance	R _{hyst}	adjustable 0 ÷ +100% R _{crit}	
Delay in response of signalling	t _{ON}	adjustable 0 ÷ 60 sec.	
Outputs			
Signalling potential-free switching contact relay 1		250 V AC / 1A	
Electric strength against internal circuits		3750 V _{rms}	
Electric strength against supply circuits		3750 V _{rms}	
Signalling potential-free switching contact relay 2		250 V AC / 1A	
Electric strength against internal circuits		3 750 V _{rms}	
Electric strength against supply circuits		3 750 V _{rms}	
Remote signalling		Line RS485 and remote monitoring module MDS-D produced by Hakel	
Communication line: RS485 type MASTER-SLAVE, 9 600 Bd, even parity		Yes	
Insulating strength against internal circuits and network circuits		2 500 V _{rms}	
General data			
Protection type according to IEC 60 529		IP20	
Weight	m	160 g	
Housing material		PA-UL94 V0	
Mounting on		DIN rail 35 mm	
Recommended cross-section of connected conductors	S	1 mm²	
Art. number		70 915	70 917

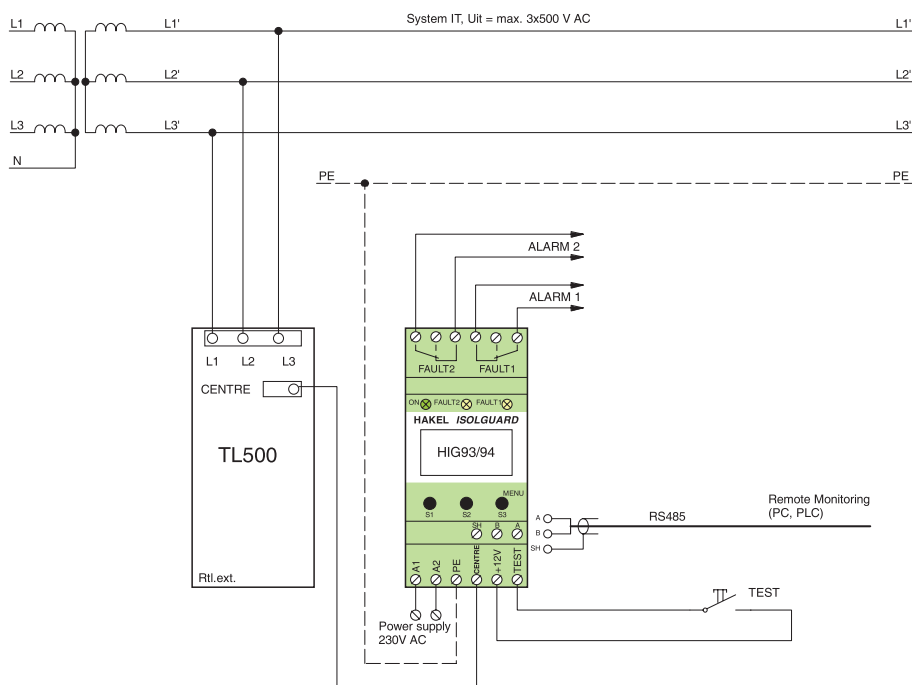
Operating conditions		
Working temperature		-10°C ~ +60°C
Atmospheric pressure		86 ÷ 106 kPa
Working position		any
External magnetic and electric field		according IEC 61326-24
Category of over-voltage / testing voltage		III according IEC 60664-1:2007
Pollution degree		2 according IEC 60664-1:2007
Type of operation		permanent

Recommended connection of HIG93, HIG94 to monitored ungrounded IT power supply system

1-phase ungrounded IT power supply system, module HIG93, HIG94 with the signalling of the alarm and remote testing button

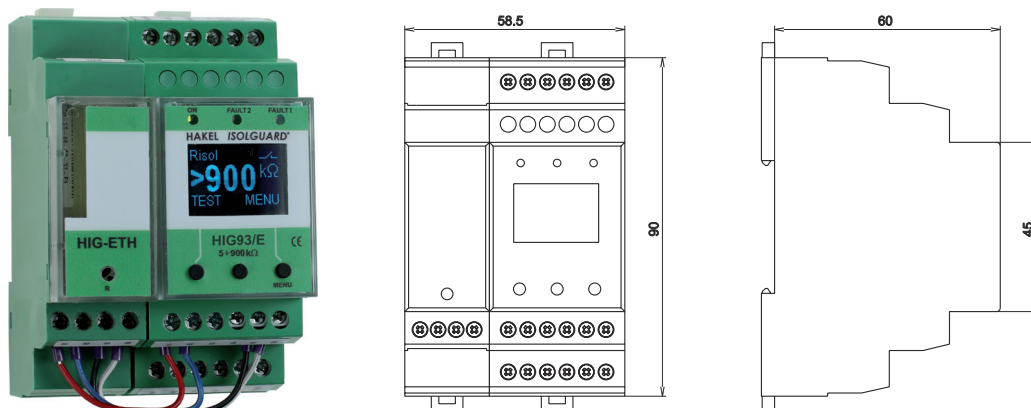


3-phase ungrounded IT power supply system (3x440 V AC), module HIG93, HIG94 with signalling of the alarm and remote testing button



Heavy industry with ETH

ISOLGUARD insulation monitoring devices HIG93/E, HIG94/E



ISOLGUARD insulation monitoring devices HIG93/E, HIG94/E

The insulation monitoring devices produced by HAKEL in the ISOLGUARD HIG93/E, HIG94/E4 series are designed for monitoring the insulating status of single-phase and 3-phase ungrounded IT power supply systems, designed and operated according to standards IEC 61010-1:2010, EN 50522, IEC 61936-1:2010.

Enable monitoring of single-phase and 3-phase ungrounded IT power supply systems up to the maximum operating voltage of 275 V AC, or 3x275 V AC. If monitoring the insulation status of a single-phase or 3-phase ungrounded IT power supply system with higher operating voltage is required, it is necessary to create an artificial centre using TL400 (Art. number 70 504), TL600 inductor (Art. number 70 601), TL1600 (Art. number 71 601) or TL6003 (Art. number 70 603). Such a created centre is connected to insulation monitoring device terminal HIG93/E, HIG94/E.

The insulation monitoring devices are equipped to display the numeric value of the measured insulation resistance. In addition, the control buttons for setting the parameters of the insulation monitoring

devices and signalling LED diodes display the status of the checked network and the insulation monitoring device.

HIG93/E, HIG94E insulation monitoring devices are fitted with the HIG-ETH module, which enables direct connection of the insulation monitoring device to the ETHERNET computer network, on which it is possible to communicate with PC.

One or two built-in signalling relays with a switch contact enable the connection of equipment for signalling of alarm. The insulation monitoring device has an optional alarm memory function with the option to cancel the alarm using the button on the insulation monitoring device. Local and remote testing of the function of the insulation monitoring device can also be conducted.

Only one insulating status insulation monitoring device can be connected to the same ungrounded IT power supply system.

Basic characteristics

- The monitor for insulating statuses of AC networks with the voltage 0 ÷ 275 V without additional equipment, higher voltages with additional inductor
- Display of measured value of the R_{isol} insulation resistance on the display within the range 5 kΩ ÷ 900 kΩ or 200 kΩ ÷ 5 MΩ
- Signalling relay of the status of the insulating resistance with the switching contact
- Connection to the computer network ETHERNET 10Base-T or 100Base TX (automatic recognition), connector RJ45
- Communication protocols HTTP (WEB, XML), SNMP, MODBUS TCP
- Internal web pages for displaying actual values and configurations
- Optional memory of the alarm called with the option to unlock with the button on the insulation monitoring device
- Option to set the monitored value of insulating resistance R_{crit} by means of the display and buttons within the range 5 kΩ ÷ 300 kΩ or 200 kΩ ÷ 900 kΩ according to the type of insulation monitoring device
- Adjustable hysteresis of the limit value of the insulating resistance within the range 0 ÷ 100% by means of the display and buttons
- Adjustable delay t_{ON} signalling relay response use the displays and buttons within the range 0 ÷ 60 sec
- Access to setting the insulation monitoring device can be locked. The insulation monitoring device is unlocked by a combination of buttons.
- Separated supply voltage enables to also monitor a network which is not under voltage
- Modules for assembly on the DIN rail 35 mm, the total width of both modules is 59 mm

Type	Art. number	Signalling relay 1	Signalling relay 2	Remote monitoring	Range of displayed value	Critical insulation resistance
HIG93/E	70 924	1P	1P	Ethernet	5 kΩ ÷ 900 kΩ	Adjustable 5 kΩ ÷ 300 kΩ
HIG94/E	70 926	1P	1P	Ethernet	200 kΩ ÷ 5 MΩ	Adjustable 200 kΩ ÷ 900 kΩ

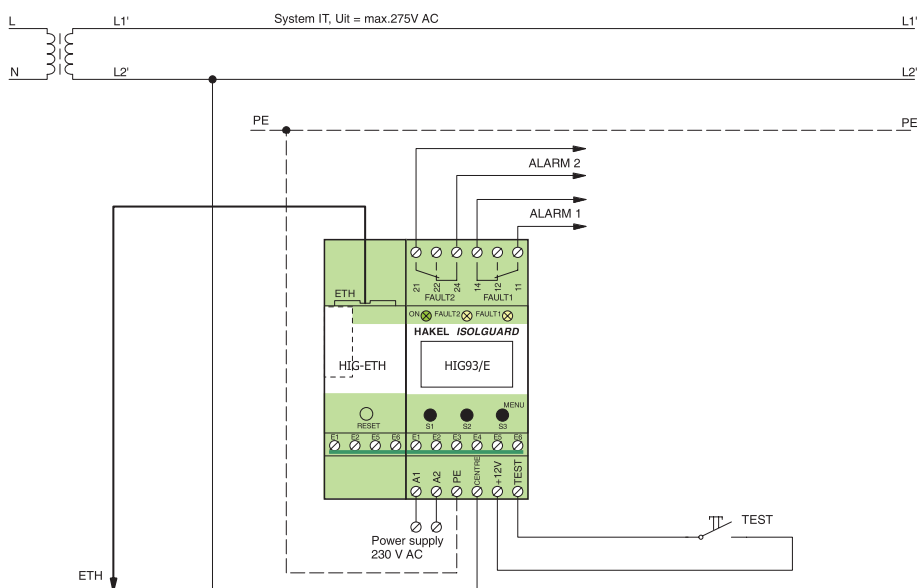
Note: 1P signalling relay with one switching contact.

Technical data HIG93/E, HIG94/E

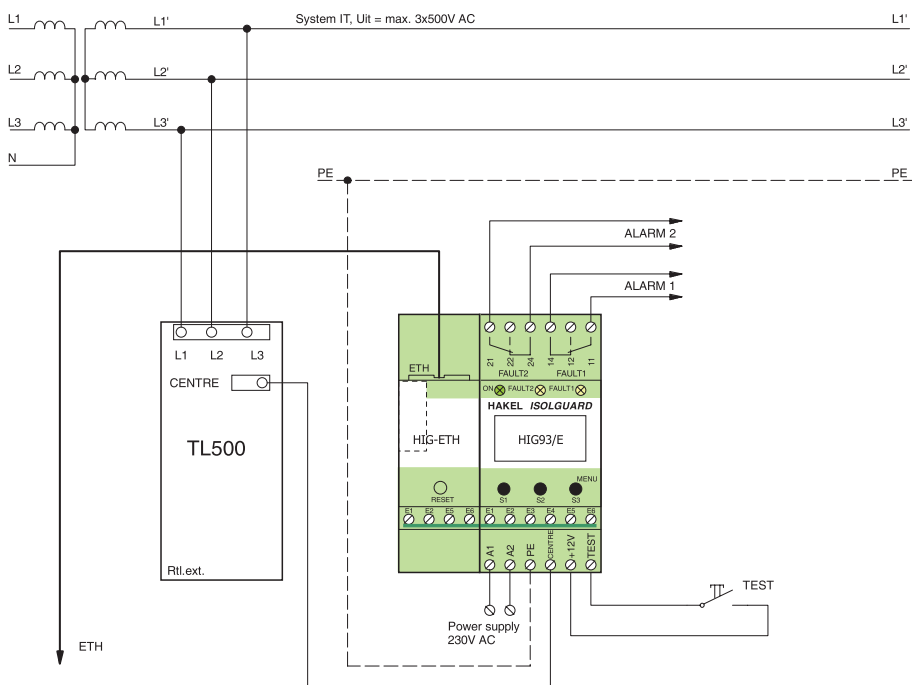
Type		HIG93/E	HIG94/E
Supply voltage	U _n	90 ÷ 265 V AC or 90 ÷ 370 V DC	
Maximum operating voltage of the monitored ungrounded IT power supply system	U _{it}	275 V AC	
Consumption	P	max. 5 VA	
Measuring voltage	U _M	12 V DC	
Measuring current	I _M	< 0,6 mA	
Alternative internal resistance of the measuring input	R _i	> 2 MΩ	
Range of the value shown on the display	R _{isol}	5 kΩ ÷ 900 kΩ	200 kΩ ÷ 5 MΩ
Precision of measurement 5 kΩ ... 10 kΩ 10 kΩ ... 900 kΩ		2 kΩ ± 10%	-
Precision of measurement 200 kΩ ... 1 MΩ 1 MΩ ... 5 MΩ		-	± 10% ± 15%
Critical insulation resistance	R _{crit}	adjustable 5 kΩ ÷ 300 kΩ	adjustable 200 kΩ ÷ 900 kΩ
Hysteresis of monitored insulation resistance	R _{hyst}	adjustable 0 ÷ +100% R _{crit}	
Delay in response of signalling	t _{ON}	adjustable 0 ÷ 60 sec.	
Outputs			
Signalling potential-free switching contact relay 1		250 V AC / 1A	
Electric strength against internal circuits		3 750 V _{rms}	
Electric strength against supply circuits		3 750 V _{rms}	
Signalling potential-free switching contact relay 2		250 V AC / 1A	
Electric strength against internal circuits		3 750 V _{rms}	
Electric strength against supply circuits		3 750 V _{rms}	
Remote monitoring		Ethernet interface	
Communication line: RJ45 Ethernet 10BASE-T/100BASE-TX Ethernet: Version 2.0/IEEE802.3		Yes	
Insulating strength against internal circuits		3 000 V _{rms}	
General data			
Protection type according to IEC 60 529		IP20	
Weight	m	220 g	
Housing material		PA-UL94 V0	
Mounting on		DIN rail 35 mm	
Recommended cross-section of connected conductors	S	1 mm²	
Art. number		70 924	70 926
Operating conditions			
Working temperature		-10°C ~ +60°C	
Atmospheric pressure		86 ÷ 106 kPa	
Working position		any	
External magnetic and electric field		according IEC 61326-24	
Category of over-voltage / testing voltage		III according IEC 60664-1:2007	
Pollution degree		2 according IEC 60664-1:2007	
Type of operation		permanent	

Recommended connection of HIG93/E, HIG94/E to monitored ungrounded IT power supply system

1-phase ungrounded IT power supply system, module HIG93/E, HIG94/E with the signalling of the alarm and remote testing button

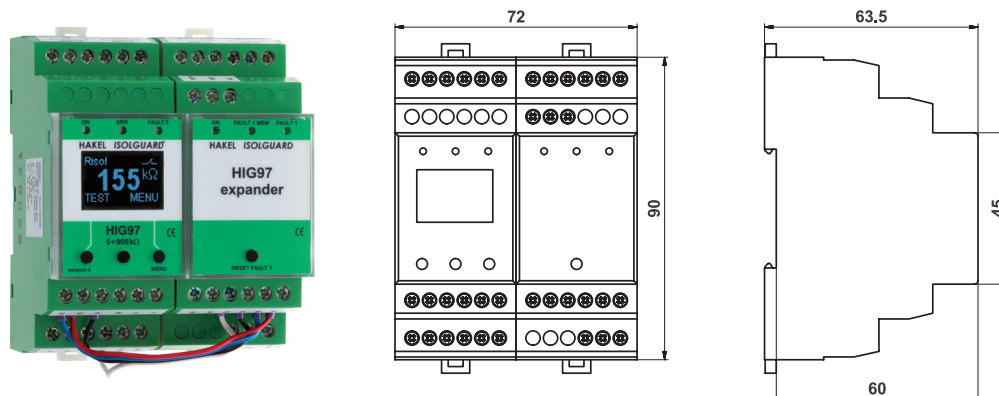


3-phase ungrounded IT power supply system (3x440 V AC), module HIG93/E, HIG94/E module



Mining industry

ISOLGUARD insulation monitoring device HIG97



ISOLGUARD insulation monitoring device HIG97

Insulation monitoring device HIG97 produced by HAKEL is designed for monitoring the insulation status of 3-phase insulated IT-systems with extremely fast evaluation and signalling of the status of the inspected network. With the use of external inductor TL1200 for the creation of the artificial centre, the insulation monitoring device enables to monitor 3-phase ungrounded IT power supply systems up to the maximum operating voltage of 3x1 000V AC. Such created centre is connected to insulation monitoring device terminal HIG97.

The insulation monitoring devices display the value of the measured insulation resistance. In addition, the control buttons for setting the parameters of the insulation monitoring devices and signalling LED diodes display the status of the checked network and the insulation monitoring device.

HIG97 insulation monitoring devices communicate with the master computer via the RS485 industrial bus with the protocol derived from the PROFIBUS protocol. The built-in signalling relay enables the connection of the equipment for the supervision and signalling of the status of the supervised ungrounded IT power supply system.

The insulation monitoring device contains four signalling relays.

The signalling relay with fast response FAULT1 signals the actual status of the inspected network.

Basic characteristics

- Monitor for insulating status of AC networks with the voltage 230 V AC/500 V AC or 1000 V AC with fast response.
- Signalling relay of the actual status of the insulating resistance with a fast response.
- The signalling relay of the insulation value with fast response and memory, de-blocking of the error status by the button on the insulation monitoring device or the remote button.
- Signalling relay of the status of insulating resistance with slow response and optional alarm memory. Unblocking of the button on the insulation monitoring device or by remote button.
- Signalling relay of the function of insulation monitoring device
- Display of the measured value of R_{isol} insulation resistance on the display within the range 5 kΩ to 900 kΩ.
- Connection to the bus RS485, insulation strength 2 500 V_{rms} against internal circuits and network circuits
- Option to set the monitored value of the insulating resistance R_{CRIT} use the display and buttons within the range 5 kΩ to 300 kΩ.
- Adjustable hysteresis of the limit value of the insulating resistance within the range 0 to 100% by means of the display and buttons
- Adjustable delay t_{ON} signalling relay response FAULT2 with slow response within the range 0 to 60 sec.
- Access to setting the insulation monitoring device can be locked, the insulation monitoring device is unlocked by a combination of buttons
- Separate supply voltage enables to also monitor the network which is not under voltage
- Two modules for assembly on the DIN 35 bar with the total width 4M (72mm).

Signalling relay with fast response and memory FAULT1 MEM, signals the origination of the first error of the inspected network. Operator action is required to remove the erroneous status. This signalling relay does not change the status even in the case of activation and deactivation of the insulation monitoring device supply.

The signalling relay with fast response FAULT2 signals the actual status of the inspected network. In the insulation monitoring device menu, it is possible to select the function of this relay with or without the memory. If the operator selects the function with memory, operator intervention is required for the cancellation of the signalling. In the case of disconnection of the supply, the FAULT2 relay is set in the basic position.

The ERROR signalling relay signals the function of the insulation monitoring device. The relay is equipped if the insulation monitoring device is active and there is measurement of the inspected network.

Local and remote testing of the function of the insulation monitoring device can also be conducted.

Only one insulation monitoring device can be connected to the same ungrounded IT power supply system.

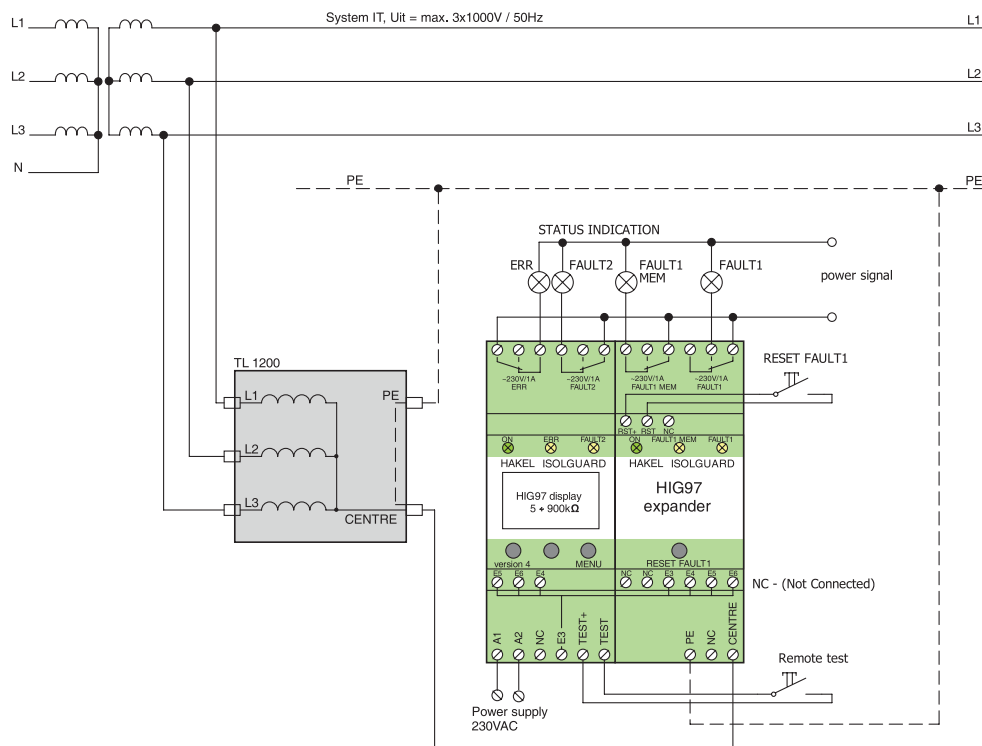
Type	Art. number	Signalling relay	Range of displayed value	Critical insulation resistance
HIG97	70 936	4 relay 1P	5 kΩ ÷ 900 kΩ	Adjustable 5 kΩ ÷ 300 kΩ

Technical data HIG97

Type		HIG97
Supply voltage	U_n	80 ÷ 305 V AC or 113 ÷ 430 V DC
Maximum operating voltage of the monitored ungrounded IT power supply system (with external inductor)	U_{it}	optional 230 V AC/500 V AC/1 000 V AC
Consumption	P	max. 5 VA
Measuring voltage	U_M	18 V DC
Measuring current	I_M	< 0,48 mA
Alternative internal resistance of the measuring input	R_i	> 100 kΩ
Range of the value shown on the display	R_{isol}	5 kΩ ÷ 900 kΩ
Precision of measurement 5 kΩ ... 100 kΩ		10 kΩ
100 kΩ ... 900 kΩ		± 10%
Properties of signalling with fast response		
Critical insulation resistances with fast response	R_{crit1}	adjustable 5 kΩ ÷ 300 kΩ
Basic time of response for signalling with fast response	t	(80 ÷ 500 msec) According to the adjustment of service parameters
Basic time of delay for signalling with fast response	t_{ON1}	adjustable 0 ÷ 9,99 sec. with the step 0,01 sec
Signalling properties with slow response		
Critical insulation resistances with slow response	R_{crit2}	adjustable 5 kΩ ÷ 300 kΩ
Basic signalling response with slow response	t	< 3 sec
Additional time of delay of signalling with slow response	t_{ON2}	adjustable 0 sec ÷ 60 sec. with the step 1 sec
Hysteresis of monitored insulation resistance	R_{hyst}	adjustable 0 ÷ +100% R_{crit}
Outputs		
Signalling FAULT1 MEM with fast response and memory of the status potential-free switching contact: electric strength against internal circuits and against supply circuits		250 V AC / 1A 3 750 V _{rms}
Signalling FAULT1 with fast response without memory of the status of potential-free switching contact:electric strength against internal circuits and against supply circuits		250 V AC / 1A 3 750 V _{rms}
Signalling FAULT2 with slow response Potential-free switching contact:electric strength against internal circuits and against supply circuits		250 V AC / 1A 3 750 V _{rms}
Signalling ERROR insulation monitoring device function Potential-free switching contact:electric strength against internal circuits and against supply circuits		250 V AC / 1A 3 750 V _{rms}
Communication line: RS485 type MASTER-SLAVE, 9600 Bd, even parity Insulating strength against internal circuits and network circuits		Yes 2 500 V _{rms}
General data		
Protection type according to IEC 60 529		IP20
Weight	m	290 g
Housing material		PA-UL94 V0
Mounting on		DIN rail 35 mm
Recommended cross-section of connected conductors	S	1 mm ²
Art. number		70 936
Operating conditions		
Working temperature		-10°C ~ +60°C
Atmospheric pressure		86 ÷ 106 kPa
Working position		any
External magnetic and electric field		according IEC 61326-24
Category of over-voltage / testing voltage		III according IEC 60664-1:2007
Pollution degree		2 according IEC 60664-1:2007
Type of operation		permanent

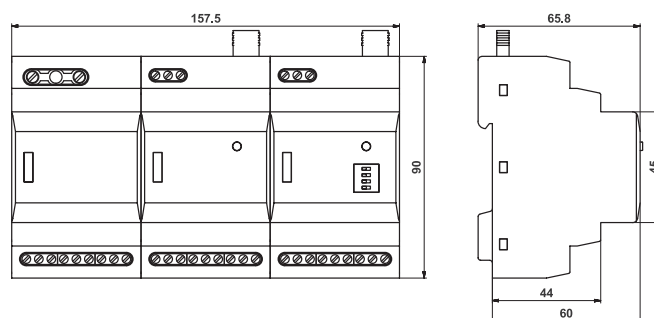
Recommended connection of HIG97 to monitored ungrounded IT power supply system

3-phase ungrounded IT power supply system (max. 3x1000 VAC), module HIG97 in connection with inductor TL1200



Transportation

Insulation monitoring device ISOLGUARD HIG99



Insulation monitoring device ISOLGUARD HIG99

The insulation monitoring device, type ISOLGUARD HIG99, is designed for monitoring the insulation status of single-phase, multiphase and direct ungrounded IT power supply systems. Device is also able to monitor combined IT power supply systems, type AC/DC according to standard IEC 61557-8. HIG99 is mainly designed for use on rail vehicles and industrial systems containing rectifiers, inverters and frequency converters.

Maximum operating voltage of monitored IT power supply system is 1000 V DC / 710 V AC. Device is directly connected to the monitored IT power supply system, no additional inductor is needed.

This device is also equipped with a blocking function thanks to which it is possible to disconnect HIG99 from the monitored system.

HIG99 monitors two insulation status's critical levels, it is equipped with signalling diodes for local status of the device and IT power supply system signalization. Local signalization is complemented by a pair of switching relays for IT power supply fault status signalization. It is possible to realize remote signalization using communication module type HIG99 KM by CAN interface with CAN OPEN protocol.

Using the CAN communication module, numerical information on the status and value of the insulation resistance can be read, the device's settings can be checked and changed or test cycles can be performed.

Only one insulation monitoring device can be connected to the same ungrounded IT power supply system.

HIG99 module complies with standard:

- IEC 61557-8:2014 – Insulation monitoring devices for IT systems
- IEC 61557-1:2007 – Equipment for testing measuring or monitoring of protective measures
- IEC 61010-1:2010 – Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 50155:2017 – Rolling stock – Electronic equipment
- EN 45545-2:2013 – Railway applications – Fire protection on railway vehicles
- EN 50121-3-2:2016 – Railway applications – Electromagnetic compatibility
- EN 50125-1:2014 – Railway applications – Environmental conditions for equipment
- IEC 61373:2010 – Railway applications – Rolling stock equipment – Shock and vibration tests

HIG99 basic characteristics:

- Insulation monitoring device for AC, DC, AC/DC systems with 9 to 1000 V DC / 710 V AC voltage, direct or with 10 – 440 Hz frequency.
- Device is designed for use on rail vehicles and industrial systems containing rectifiers, inverters and frequency converters.
- Device is powered from an independent 24 V DC power supply.
- Loss of connection indication with the measured power supply system and the ground.
- Automatic internal test for unfunctional device detection.
- Device evaluates two insulation resistance critical limits.
- Two monitored power supply system's insulation resistance status signalling relays with switching contact for two insulation resistance critical limits.
- Option to start device test by push-button on the module.
- Option to connect communication module, type HIG99 KM, for device's connection to master bus-bar system.
- Option to set critical values, hysteresis values and other parameters by KM type module.
- HIG99, in connection with any HIG99 KM module, is 9TE (158 mm) wide and is designed for assembling on 35 mm DIN rail.

HIG99 KM CAN basic characteristics:

- Communication module for HIG99 device.
- Enables HIG99 device connection on CAN industrial bus-bar.
- Module is equipped with CAN OPEN protocol according to EN 50325-4.
- Basic communication speed is 250 kbit/s or 500 kbit/s, can be modified after agreement.
- Enables information forwarding about insulation resistance value and its faults as PDO/SDO information.
- Enables to read and change device's settings as SDO command.
- Enables CAN bus-bar termination by integrated switch in four different modes.
- Enables device functions block and device disconnection from monitored power supply system by external input.
- Enables device test using external input.
- Module is powered from the device.

HAKEL ISOLGUARD HIG99 – basic technical characteristic

Type	Display menu	Signalling relay	Range of displayed value	Critical insulation resistance	Remote signalization	Device type according to IEC 61557-8
HIG99	No	2x SPST	1 kΩ ÷ 10 MΩ	Adjustable 1 ÷ 500 kΩ	Communication modules type HIG99 KM	AC/DC
Art. no. 70 970						

Notes: SPST – signalling relay with one switching contact (type NO)

Communication modules ISOLGUARD HIG99 – basic technical characteristic

Type	Communication interface type	Protocol	Insulation voltage	Other features		
HIG99 KM CAN	CAN	CAN OPEN 2.0	3 kV DC	Bus-bar communication speed 250, 500 kbit/s	Possible bus-bar termination by switch	The node address number is assigned via the bus
Art. no. 70 972						

Technical characteristics ISOLGUARD HIG99

Type		ISOLGUARD HIG99
Monitored IT power supply system type		AC, DC, AC/DC
Voltage of monitored IT system	U_n	9 ÷ 1 000 V DC / 9 ÷ 710 V AC (10 ÷ 440 Hz)
Nominal supply voltage	U_s	24 V DC
Supply voltage range		9 ÷ 36 V DC
Power consumption	P	max. 5 VA
Measuring circuit		
Measuring voltage	U_m	40 V–
Measuring current	I_m	< 0.5 mA
Measuring input's internal impedance	Z_i	> 1 MΩ
Internal direct resistance	R_i	> 1 MΩ
Permissible system leakage capacitance	C_e	10 μF
Measuring range	R_F	1 kΩ ÷ 10 MΩ
Measuring accuracy		± 15 %
Reaction value's setting range R_{an}	R_{an}	adjustable 1 kΩ ÷ 500 kΩ
Insulation resistance hysteresis	R_{hyst}	adjustable 0 ÷ +100 % R_{an}
Outputs		
Two signalling switching contacts with optional position NO or NC Electrical strength to the internal circuits and supply circuits		24 V~ / 1 A 24 V= / 1 A 3 kV DC 3 kV DC
Remote signalization		Using communication modules type HIG99 KM.

Communication module		ISOLGUARD HIG99 KM CAN
Module supply		Provided by HIG99
Communication interface for user		CAN bus-bar
Communication protocol		CAN OPEN
Communication speed		250, 500 kbit/s (can be modified after agreement)
Bus-bar termination		Can be realized by integrated switch R_{te}
Bus-bar's electrical strength to internal module circuits, operational inputs		3 kV DC
Operational inputs		E.Blck or remote device's disconnection from monitored power supply system E.Test for remote device test
Voltage for operational inputs logical 1		9 ÷ 36 V DC
Operational inputs electrical strength to internal module circuits, CAN bus-bar and HIG99		3 kV DC

General data		HIG99	HIG99 KM CAN
Degree of protection according to IEC 60529		front panel IP40 protection except front panel IP20	
Weight	m	222 g	112 g
Housing material		PA - UL 94 V0	
Method of assembly		On the 35 DIN rail	
Recommended section of the connected conductors	S	Terminal box X1: 2.5 mm ² Other: 1 mm ²	1 mm ²
Recommended protection		6 A	–
Article number		70 970	70 972

Operating conditions	HIG99, HIG99 KM CAN
Operating temperature	-40 °C ÷ +70 °C (OT4 according to EN 50155)
Storage temperature	-40 °C ÷ +70 °C
Transport temperature	-40 °C ÷ +70 °C
Altitude	up to 2000 meters above sea level
Operating position	any
Duty type	permanent

Recommended connection of HIG99 and HIG99 KM CAN to the monitored It power supply system

HIG99 and HIG99 KM CAN terminals meaning:

- **Terminals X1:**
Used to device's connection to monitored power supply system.
- **Terminals X2:**
Used to connect connection module to monitoring module.
- **Terminals X3:**
Two potential free relays with switching contact and COM common pole. Serves to forward information about insulation resistance status.
- **Terminals X4:**
Used to connect the connection module to the monitoring module. Furthermore, it is used to supply a low voltage for HIG device and to provide functional and control grounding.
- **Terminals X5, X7:**
Serves to HIG99 and HIG99 KM CAN connection. Other uses are excluded.
- **Terminals X6:**
Galvanically separated inputs for device commanding. Used for device test and device's disconnection and connection from monitored power supply system. The inputs have a common ground potential – terminal E.COM.
- **Terminals X8:**
CAN bus-bar's output. NC terminals are not used, V+ and SH terminals are not internally connected, they can be used for bus-bar connection.

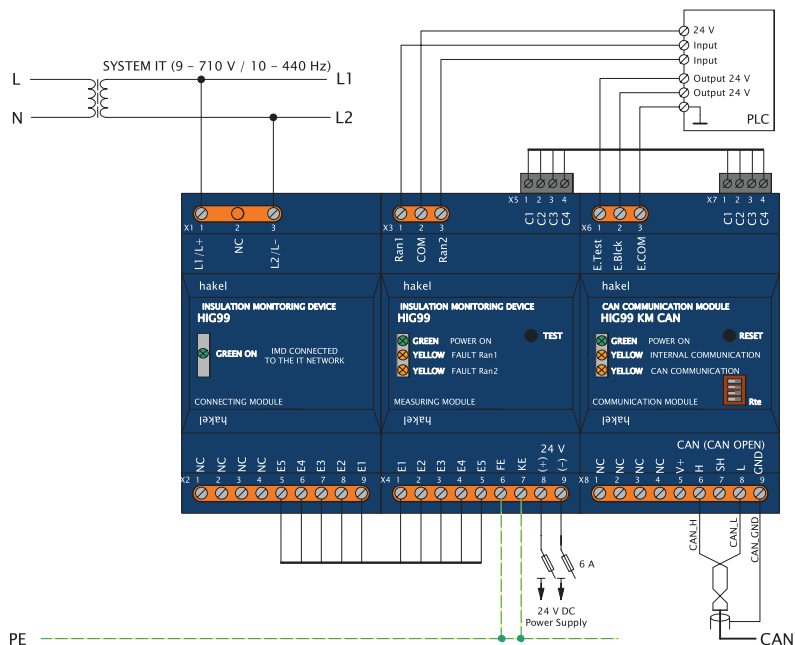
Installation instructions:

- NC terminals (Not Connected) are not connected, it is forbidden to connect them.
- FE and KE terminals are necessary to connect by separate conductors to PE bridge.
- It is possible to use Rte switch for CAN bus-bar termination.
- Keep linear CAN bus-bar connection, turns cannot be created.
- Install only one cable type along the CAN bus-bar entire length.

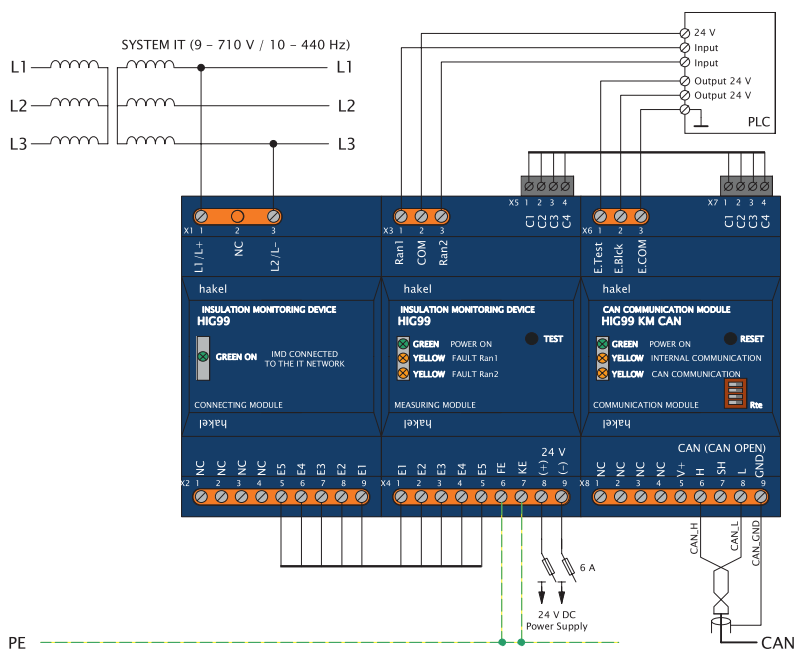
Maintenance and service

It is necessary to follow specified conditions for reliable operation, do not expose the device to rough handling, keep it clean and ensure maximum admissible temperature of environment.

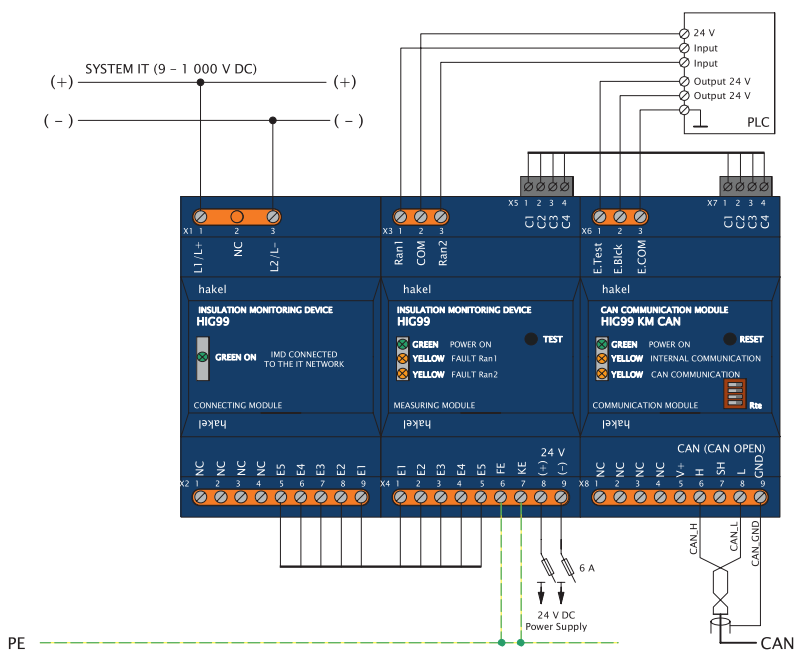
Only qualified personnel are allowed to install and set up the device. Only the producer provides repairs of the device. No personnel are needed to operate the insulation monitoring device. Technology service is during the operation informed by local and remote signalization about the monitored power supply.



**Connection for monitoring
of single-phase
IT power supply system**



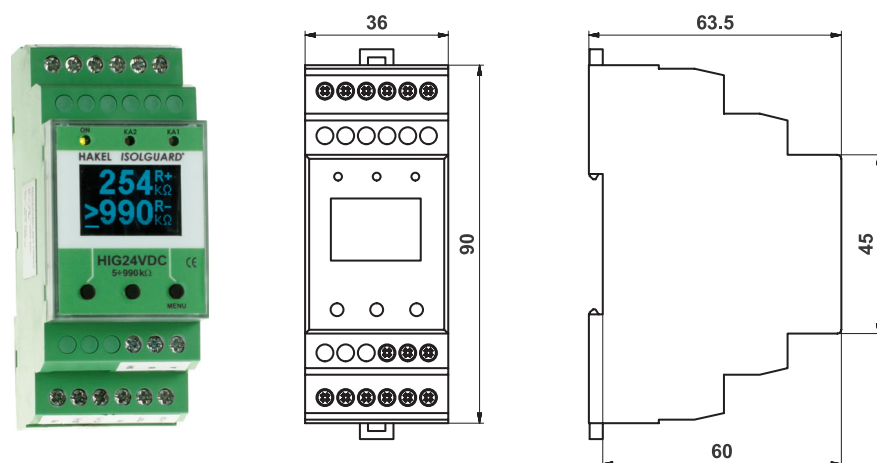
**Connection for monitoring
of 3-phase/multiphase
IT power supply system**



**Connection for monitoring
of DC IT power supply system**

DC systems

ISOLGUARD insulation monitoring device HIG24VDC



ISOLGUARD insulation monitoring device HIG24VDC

The insulation monitoring device ISOLGUARD HIG24VDC produced by HAKEL is designed for monitoring the insulation resistance of direct current IT power supply systems with a nominal voltage of 24 V DC. The device continuously monitors the insulation resistance of both lines of the insulation power supply system against the base point. For stationary devices, it is usually PE conductor. Decrease of insulation resistance in the positive line R+ or in negative line R- is signalled by the relay KA1/KA2. The fault condition is also indicated by a LED diode on the front panel.

The insulation monitoring device is equipped with a display for displaying the numeric value of the measured insulation resistance. The measured value of the insulation resistance in both lines of the monitored system is displayed on the device's display. There

are control buttons for setting the parameters of the insulation monitoring device and signalling LEDs to display the status of the monitored system and the device itself.

Using the RS485 bus, the remote signalling module MDS-DELTA or MDS-D panel with a touch screen can be connected to the HIG device to display the currently measured values and the current settings of the device. HIG24VDC can communicate with the master computer via the RS485 industrial bus with the protocol derived from the PROFIBUS protocol.

Only one insulation monitoring device can be connected to the same ungrounded IT power supply system.

According to:

- EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
- HD 60364-4-41 Low voltage electrical installations, Part 4-41: Protection for safety - Protection against electric shock
- IEC 6157-8 Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - equipment for testing, measuring or monitoring protective measures - Part 8: Insulation monitoring devices for IT systems
- EN 50155 Railway applications - electronic equipment used on rolling stock (IEC 60571)
- EN 61373 Railway applications - rolling stock equipment - shock and vibration test (IEC 61373)
- EN 45545-2 Railway applications - fire protection on railway vehicles
- EN 50121-3-2 Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus

Basic characteristics

- Insulation monitoring device for DC systems with the voltage 24 V DC
- Displaying the measured values of the positive and negative line of a controlled network on the device's screen
- Two signalling relays with switching contacts
- The function of signalling relay is to be set in the user's menu of the device
- Optional insulation resistance fault memory. It is possible to cancel the fault memory by pressing the button on the device or by remote button
- Connection to the RS485 bus, insulation strength 2 500 V against internal circuits and network circuits
- Option to set the critical values, hysteresis values and other parameters using the insulation monitoring device buttons
- Access to setting the insulation monitoring device by button can be locked, the insulation monitoring device is unlocked by a combination of buttons
- Module for assembly on the DIN rail 35 mm with the total width 2M (36 mm)

Type	Art. number	Signalling relay	Range of displayed value	Critical insulation resistance	RS485
HIG24VDC	70 933	2 relays 1P	5 kΩ ÷ 990 kΩ	Adjustable 5 kΩ ÷ 500 kΩ	Yes

Technical data HIG24VDC

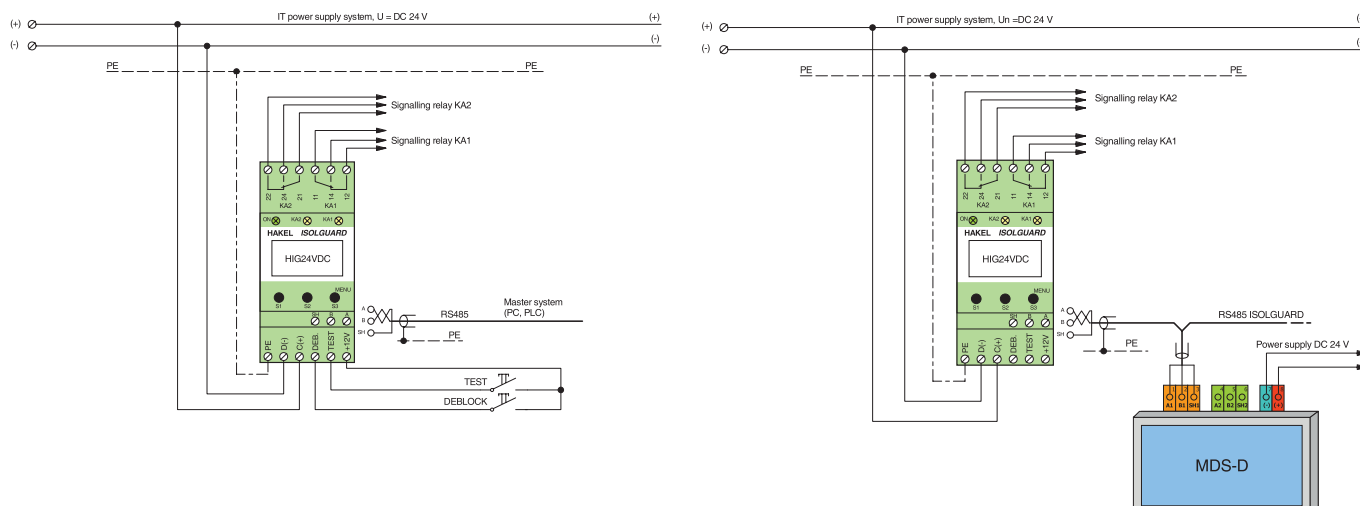
Type		HIG24VDC
Type of monitored IT system		DC
Nominal voltage of monitored IT system /*1	U_n	24 V=
Nominal supply voltage /*1	U_s	$U_s = U_n$
Supply voltage range		12 ÷ 36 V=
Measuring circuit		
Consumption	P	max. 2 VA
Internal impedance of the measuring input	R_i	> 200kΩ
Range of the value shown on the display	R+/R-	5 kΩ ÷ 990 kΩ
Precision of measurement		± 10%
Critical insulation resistance	R_{crit}	adjustable 5 kΩ ÷ 500 kΩ
Hysteresis of monitored insulation resistance	R_{hyst}	adjustable 0 ÷ +100% R_{crit}
Additional time of delay of signalling the insulation fault	t_{ON}	adjustable 0 ÷ 60 sec, with the step 1 sec
Outputs		
Output relay KA1 Potential-free switching contact: Electric strength against internal circuits and supply circuits		250 V AC / 1A 3 750 V _{rms}
Output relay KA2 Potential-free switching contact: Electric strength against internal circuits and supply circuits		250 V AC / 1A 3 750 V _{rms}
Communication line: RS485 type MASTER-SLAVE, 9600 Bd, even parity Insulating strength against internal circuits		Yes 2 500 V _{rms}
General data		
Protection type according to IEC 60 529		IP20
Weight	m	110 g
Housing material		PA-UL94 V0
Mounting on		DIN rail 35 mm
Recommended cross-section of connected conductors	S	1 mm ²

Notes: /*1 The HIG device is supplied from a monitored IT systems

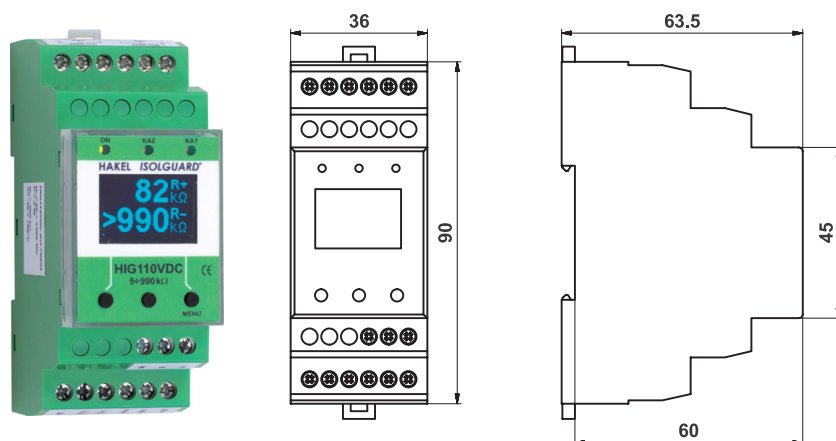
/*2 For use of the HIG24VDC in rolling stock applications it is supplied as HIG24VDC/T, Art.No.: 70933/T

Operating conditions	
Working temperature	operating temperature -25 °C ~ +70 °C storage temperature -40 °C ÷ +70 °C
Atmospheric pressure	86 ÷ 106 kPa
Working position	any
External magnetic and electric field	according IEC 61326-2-4
Category of over-voltage / testing voltage	III according IEC 60664-1:2007
Level of pollution	2 according IEC 60664-1:2007
Type of operation	permanent

Recommended connection of HIG24VDC to monitored ungrounded IT power supply system



ISOLGUARD insulation monitoring device HIG110VDC



ISOLGUARD insulation monitoring device HIG110VDC

The insulation monitoring device ISOLGUARD HIG110VDC produced by HAKEL is designed for monitoring the insulation status of direct current IT power supply systems with a nominal voltage of 110 V DC. The device continuously monitors the insulation state of the positive and negative output of an insulation power supply system against the base point. For stationary devices it is usually PE conductor.

The insulation monitoring device is equipped to display the numeric values of the measured insulation resistance. The measured resistance

value of the positive and negative output of a controlled network is displayed on the device's screen. There are buttons for setting the parameters of the insulation monitoring device and signalling LEDs to display the status of the controlled system or the device itself.

Only one insulation monitoring device can be connected to the same ungrounded IT power supply system.

According to:

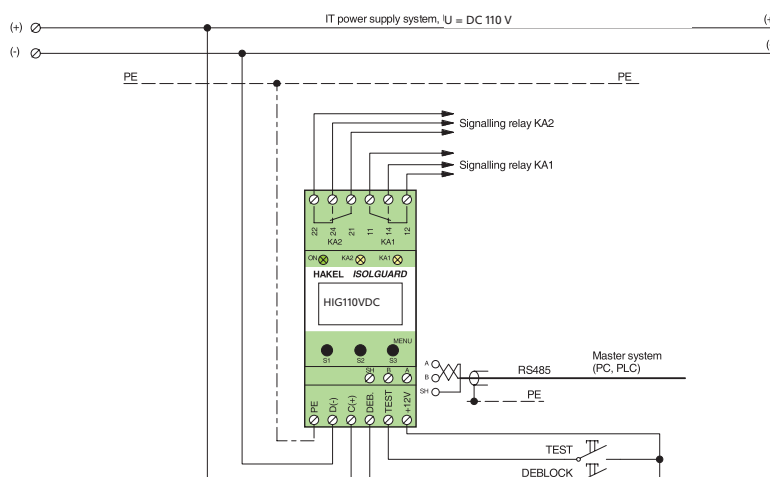
- EN 50155 Railway applications - electronic equipment used on rolling stock (IEC 60571)
- EN 61373 Railway applications - rolling stock equipment - shock and vibration test (IEC 61373)
- EN 45545-2 Railway applications - fire protection on railway vehicles
- EN 50121-3-2 Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus

Basic characteristics

- The monitor for insulating resistance of DC systems with the nominal voltage 110 V DC
- Displaying the measured values of the positive and negative output of a controlled network on the device's screen
- Two signalling relays of the IMD status and status of monitored system
- Optional memory of the alarm called with the option to unblock with the button
- Connection to the RS485 bus, insulation strength 2500 V against internal circuits and network circuits
- Option to set the critical values, hysteresis values and other parameters using the insulation monitoring device buttons
- Access to setting the insulation monitoring device by button can be locked, the insulation monitoring device is unlocked by a combination of buttons
- Module for assembly on the DIN rail 35 mm with the total width 2M (36 mm)

Type	Art. number	Signalling relay	Range of displayed value	Critical insulation resistance	RS485
HIG110VDC	70 934	2 x 1P	5 kΩ ÷ 990 kΩ	Adjustable 5 kΩ ÷ 500 kΩ	Yes

Recommended connection of HIG110VDC to monitored ungrounded IT power supply system

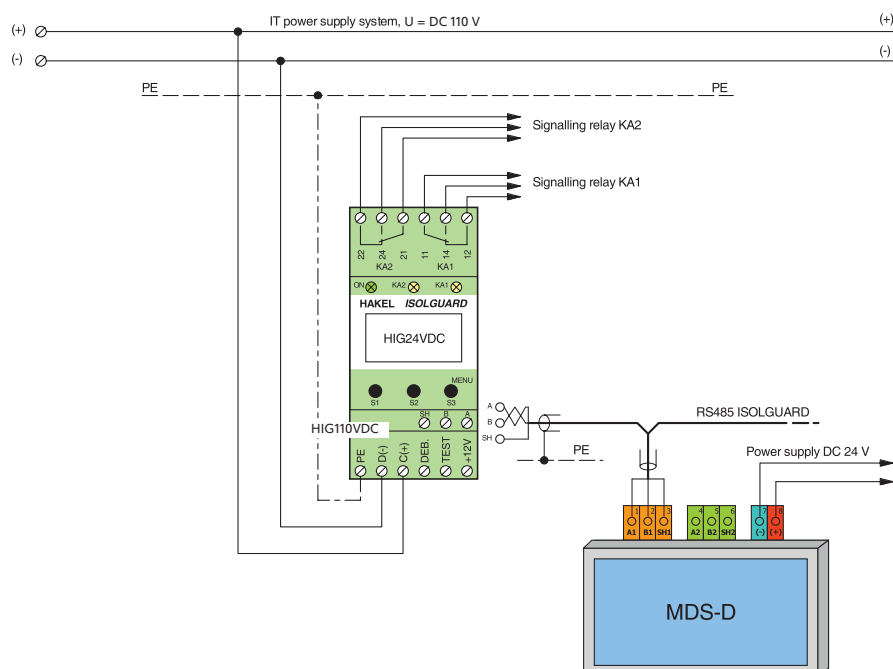


Technical data HIG110VDC

Type		HIG110VDC
Maximum operating voltage of the monitored ungrounded IT power supply system	U_{it}	80 ÷ 120 V DC
Consumption	P	max. 2 VA
Internal impedance of the measuring input	R_v	> 200 k Ω
Range of the value shown on the display	R_{isol}	5 k Ω ÷ 990 k Ω
Precision of measurement		± 10%
Critical insulation resistance	R_{crit}	adjustable 5 k Ω ÷ 500 k Ω
Hysteresis of monitored insulation resistance	R_{hyst}	adjustable 0 ÷ +100% R_{crit}
Delay of response signalling the insulation status	t_{ON}	adjustable 0 ÷ 60 sec, with the step 1 sec
Outputs		
Signalling of the insulation status FAULT Potential-free switching contact: Electric strength against internal circuits and supply circuits		250 V AC / 1A 3 750 V _{rms}
Signalling of the insulation monitoring device function ERR Potential-free switching contact: Electric strength against internal circuits and supply circuits		250 V AC / 1A 3 750 V _{rms}
Communication line: RS485 type MASTER-SLAVE, 9 600 Bd, even parity Insulating strength against internal circuits		Yes 2 500 V _{rms}
General data		
Degree of protection according to IEC 60529:1989		IP20
Weight	m	110 g
Housing material		PA-UL94 V0
Mounting on		DIN rail 35 mm
Recommended cross-section of connected conductors	S	1 mm ²

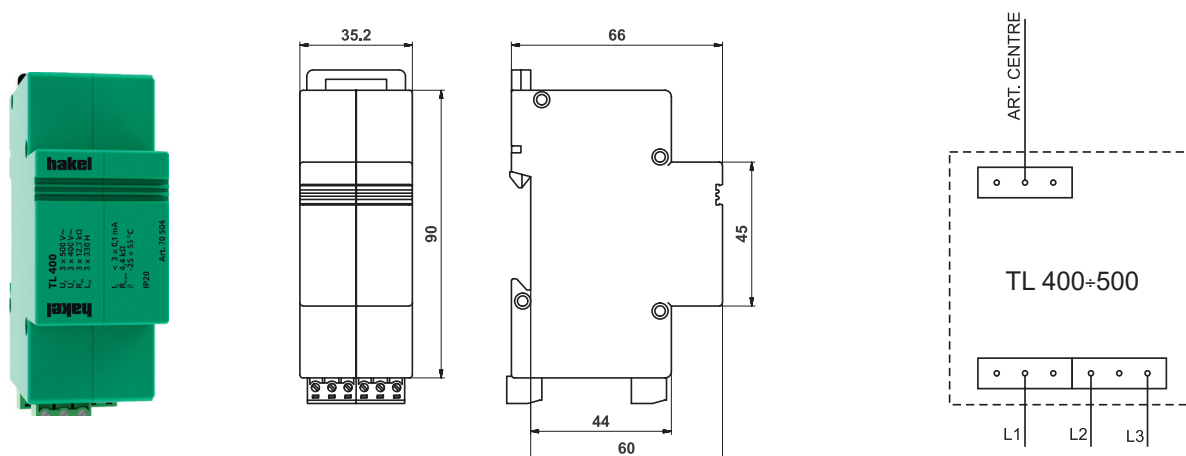
Operating conditions	
Working temperature	operating temperature -25 °C ~ +70 °C storage temperature -40 °C ÷ +70 °C
Relative moisture of the environment	28 g H ₂ O /kg of dry air
Atmospheric pressure	86 to 106 kPa
Working position	any
External magnetic and electric field	max. 400 A/m
Category of over-voltage / testing voltage	III according IEC 60664-1:2007
Pollution degree	2 according IEC 60664-1:2007
Type of operation	permanent

Recommended connection of HIG110VDC to monitored ungrounded IT power supply system



Accessories

Inductors TL400, TL500

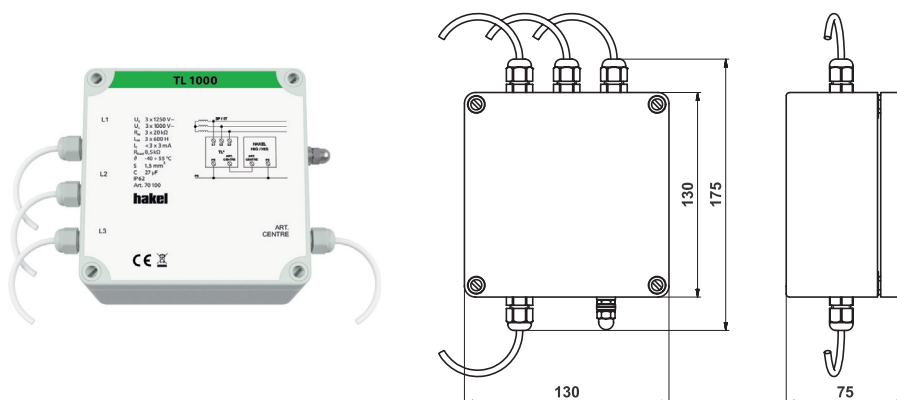


Inductors TL400, TL500

TL* serves for the adaption of IMD circuits to 3-phase ungrounded IT power supply system 3 x 400 V AC (or 500 V AC).

Type		TL 400	TL 500
Nominal voltage	U_n	3 x 400 V	3 x 500 V
Max. continuous operating voltage	U_c	3 x 500 V	3 x 600 V
Art. number		70 504	70 501

Inductors TL1000



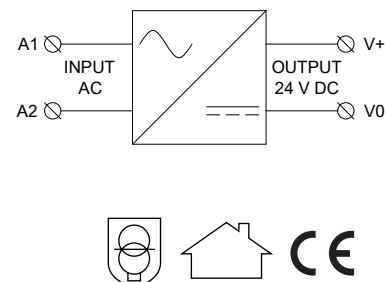
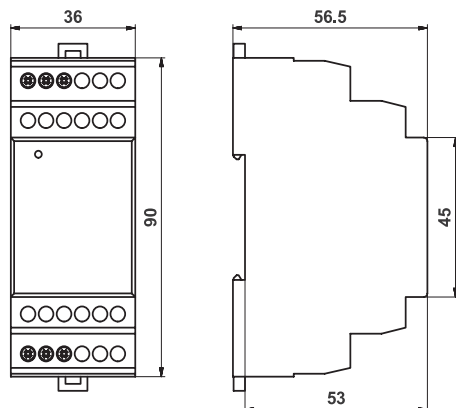
Inductors TL1000

TL* serves for the adaption of IMD circuits to 3-phase ungrounded IT power supply system 3 x 1 000 V AC.

Commonly, these 3-phase inductors are produced on the basis of special requirement up to the voltage $U_c = 3 \times 6\,000$ V AC. These inductors are produced in different sizes.

Type		TL 1000
Nominal voltage	U_n	3 x 1 000 V
Max. continuous operating voltage	U_c	3 x 1 250 V
Art. number		70 100

Power Supply HIG-PS 24V/5W



Power Supply ISOLGUARD HIG-PS 24V/5W

HIG-PS 24V/5W, ISOLGUARD series is an universal power supply for mounting on the 35mm DIN rail. The product is primarily intended for powering the remote monitoring module MDS-D, MDS-DELTA or fault location module HIG-IFL DELTA produced by HAKEL company.

Output voltage is stabilized 24 V DC. The supply voltage can be DC or AC in the ranges written below in the specification table.

This power supply source is also designed for industrial use such as current loop power supply of the two-wire transmitters, sensors power supply, indication devices power supply etc.

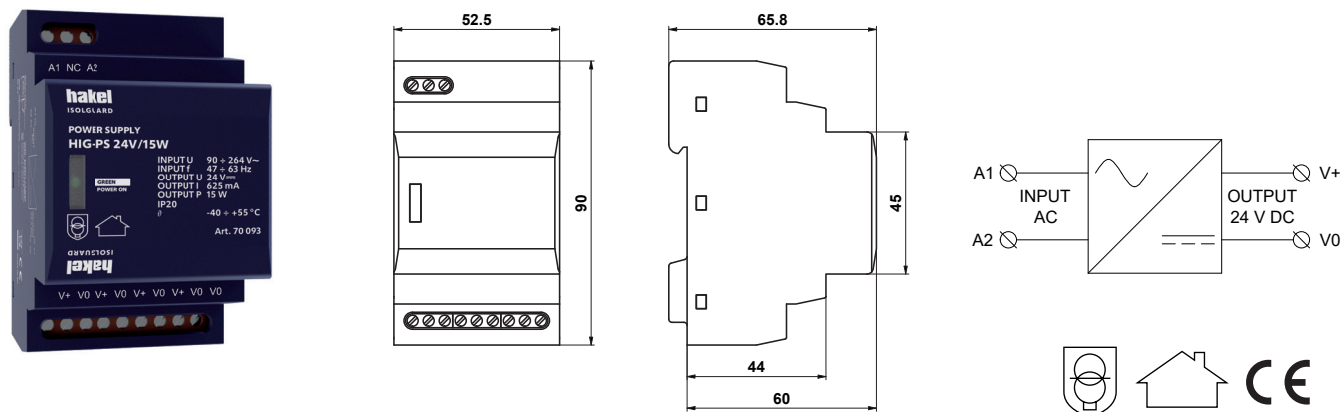
Operation of HIG-PS 24V/5W is signalled by a green LED "POWER ON" on the top of the product.

HIG-PS 24V/5W complies with standard:

- IEC 61558-1
- IEC 61558-2-1
- IEC 60950-1

Type		HIG-PS 24V/5W
Supply voltage AC	U_{SAC}	100 ÷ 265 V AC (47 ÷ 440 Hz)
Supply voltage DC	U_{SDC}	100 ÷ 265 V DC
Output voltage	U_{out}	24 V DC
Maximum output current	I_{max}	220 mA
Power	P	5 W
Operation signalling		green LED
Short-circuit protection		yes, with an automatic renewal of the power supply after the fault
Thermal fuse		yes, with an automatic renewal of the power supply after the fault
Isolation voltage input / output		4 000 V AC
General data		
Protection type		IP20
Weight	m	95 g
Mounting on		DIN rail 35 mm
Cross-section of the connected conductors	S	1 mm ²
Art. number		70 062
Operating conditions		
Operating temperature		-25°C ÷ +50°C
Altitude		up to 2 000 m. a. s. l.
Working position		any
Protection class		II according to IEC 61140
Pollution degree		2 according to IEC 60664
Type of operation		permanent
Recommended back-up fuse		6 A/gG

Power Supply HIG-PS 24V/15W



Power Supply ISOLGUARD HIG-PS 24V/15W

HIG-PS 24V/15W, ISOLGUARD series is an universal power supply for mounting on the 35mm DIN rail. The product is primarily intended for powering the remote monitoring module MDS-D, MDS-DELTA or fault location module HIG-IFL DELTA produced by HAKEL company.

Output voltage is stabilized 24 V DC. The supply voltage can be AC in the ranges written below in the specification table.

This power supply source is also designed for industrial use such as current loop power supply of the two-wire transmitters, sensors power supply, indication devices power supply etc.

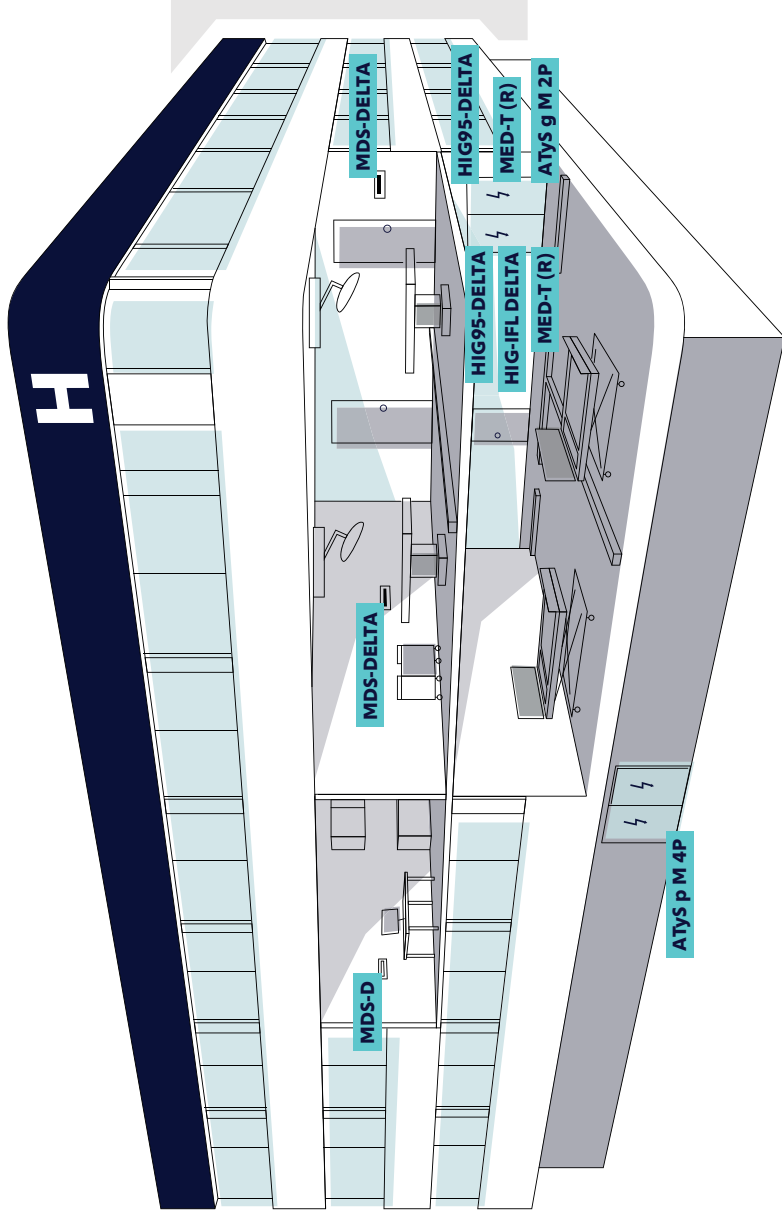
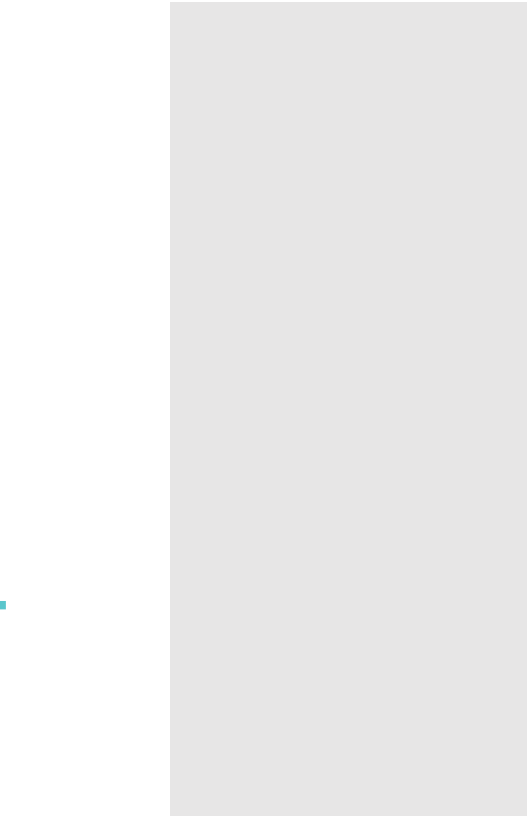
Operation of HIG-PS 24V/15W is signalled by a green LED "POWER ON" on the top of the product. The device is certified according to IEC 60601-1 guaranteeing the safety of medical electrical equipment.

HIG-PS 24V/15W complies with standard:

- IEC 61558-1
- IEC 61558-2-16
- IEC 60601-1

Type		HIG-PS 24V/15W
Supply voltage AC	$U_{S\ AC}$	$90 \div 264\ V\ AC\ (47 \div 63\ Hz)$
Output voltage	U_{out}	24 V DC
Maximum output current	I_{max}	625 mA
Power	P	15 W
Operation signalling		green LED
Short-circuit protection		yes, with an automatic renewal of the power supply after the fault
Thermal fuse		yes, with an automatic renewal of the power supply after the fault
Isolation voltage input / output		4 000 V AC
General data		
Protection type		IP20
Weight	m	101 g
Mounting on		DIN rail 35 mm
Cross-section of the connected conductors	S	1 mm ²
Art. number		70 093
Operating conditions		
Operating temperature		-40°C ÷ +50°C
Altitude		up to 5 000 m. a. s. l.
Working position		any
Protection class		II according to IEC 61140
Pollution degree		2 according to IEC 60664
Type of operation		permanent
Recommended back-up fuse		6 A/gG

Wherever **SECURITY** and **CONTINUITY**
the operation of the electrical IT network is decisive.

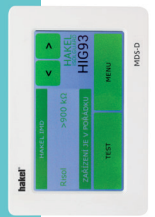


IMD – insulation monitoring devices

Insulation monitoring devices

Modules for remote signalling MDS-D

MDS-D



Modules for remote signalling MDS-DELTA

MDS-DELTA



Insulation monitoring device for healthcare

HIG95-DELTA



New fault location for healthcare

HIG-IFL DELTA



Single-phase safety isolating transformers

MED-T (R)



Automatic transfer switching equipment ATys p M 4P

ATys p M 4P



Automatic transfer switching equipment ATys g M 2P

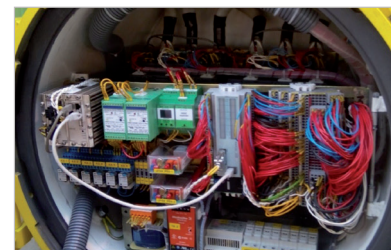
ATys g M 2P



References

OKD coal mines - HIG97

Czech State Mining Administration Regulation No. 22/1989 stipulates that the low-voltage side of the mine transformer stations must be equipped with a monitoring system measuring the outlet cable insulation status both during operation and before switching-on. HIG97 insulation monitoring devices (IMDs) manufactured by HAKEL s.r.o. were for OKD coal mines chosen based on cooperation with REPOS TECHNIK s.r.o. and following successful tests. This device type not only meets the frequent requirement of response time <80 ms but also includes suitable signalling and control terminals, features reliable operation, is substantially smaller in size than other comparable devices, and offers convenient connection to the system monitored.



Steelmaking company Moravia Steel - HIG97

The HIG97 monitoring device was developed specifically to satisfy customers' demand for very rapid network status evaluation and signalling. In this product, an additional microprocessor (in the expander module) is used in order to achieve a rapid response. This concept enabled the engineers to design a network status evaluation algorithm which is not only significantly faster but is also more precise and can be adjusted to suit the particular customer's application. As a result, the monitoring device's reaction time was suppressed to below 80 ms. Extremely rapid signalling at the output terminals is required, e.g., in some applications in the mining industry. The HIG 97 has been tested and then deployed in the heavy industry of continuous steel casting at Moravia Steel, where the previously used monitoring devices were unable to reliably measure the network insulation resistance because of frequent transients and interferences from frequency converters. The monitoring device is installed in the distribution box, where it is connected to a 3x500 V AC / IT power supply system via a TL 500 inductor.



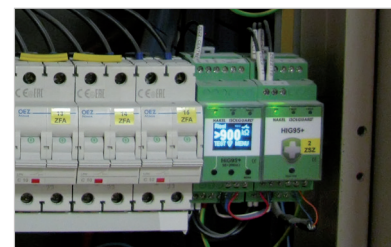
Railway tunnel under the hill Homolka and Chlum near Pilsen - HIG97

The largest railway tunnel in the Czech Republic started to be built at the Ejpvovice site under the Homolka and Chlum hills in late January 2015. It is driven by using the biggest driving shield in the Czech Republic, TBM S-799, christened "Viktorie". HAKEL s.r.o. in cooperation with REPOS TECHNIK s.r.o. developed a solution for monitoring the 22 kV line insulation status within the segment from the isolation transformer to the transformers on the driving machine. The 22 kV / 22 kV isolation transformer has an outlet in the secondary winding junction to which a TL22001 HV inductor is connected through an HV cable. To the TL22001 inductor is connected an ISOLGUARD HIG97 version 22 insulation monitoring device (IMD), which is specifically modified and adjusted for this application.



Hospitals - HIG95-DELTA, HIG-IFL1, HIG95 or HIG95+

GENERAL UNIVERSITY HOSPITAL PRAGUE - Czech Republic
SILESIAN HOSPITAL OPAVA - Czech Republic
UNIVERSITY HOSPITAL OSTRAVA - Czech Republic
UNIVERSITY HOSPITAL BRATISLAVA - Slovakia
UNIVERSITY HOSPITAL OLOMOUC - Czech Republic
UNIVERSITY HOSPITAL PARDUBICE - Czech Republic
and more



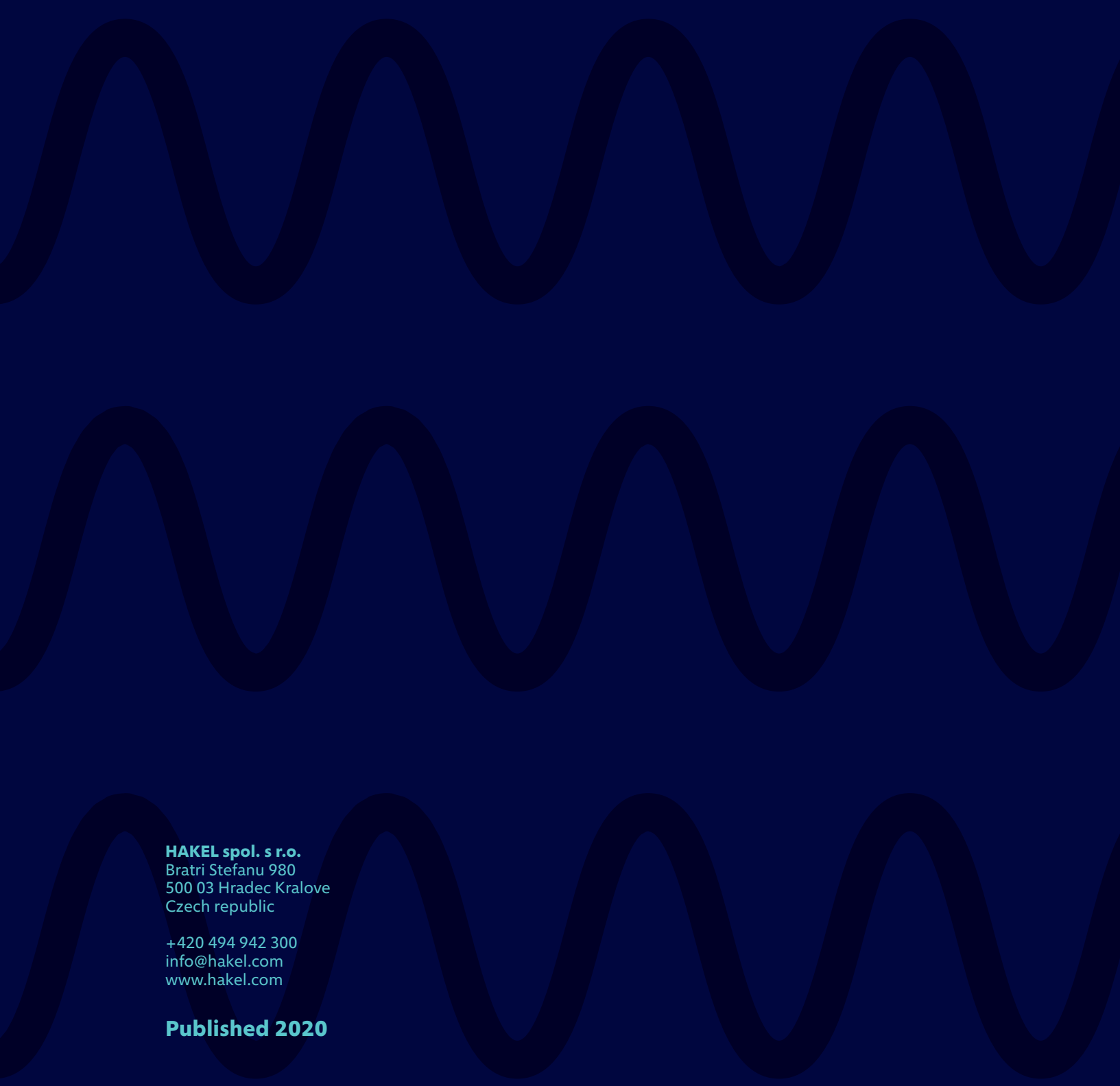
PESA Bydgoszcz SA

Monitoring of internal 3x400 V AC and 3x500 V AC power supply systems used for air-conditioning, heating etc. of trams.



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