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Hz in Hearts

Medical Insulated System

solution HAKEL ISOULGUARD MIS

Assortment of Hakel products

Insulation monitoring devices (IMD)

Surge protection devices (SPD)

Surge protection devices + EMI filters (SPD+EMI)

Surge protection devices for photovoltaic applications (SPD PV)

Surge protection devices for IT power supply systems (SPD IT)

Voltage limiting devices (VLD)

Gas discharge tubes for equipotential bonding (GDT)

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Introduction

You are now receiving a publication dedicated to the introduction of the HAKEL ISOLGUARD MIS system, designed to monitor (not only) the insulation level of the **Medical IT power supply system (MIS)** so called **Medical Insulated System**. Our intention here is to provide a basic orientation in the subject and in our products. With an emphasis on clarity and user-friendliness without overwhelming you with a summary of all the otherwise readily available data.

Those interested in a wider range of continuously updated data are accommodated by the inclusion of QR codes. These direct you to the online tabs of our products, where you can find not only complete data, but also additional materials such as schematics, drawings, manuals, etc. We believe that hand in hand with our web presentation you will find this catalogue a useful tool.

Hakel spol. s r.o. – company profile

HAKEL spol. s r.o. was founded by Ing. Jaroslav Hudec, Ph.D., on October 18, 1994, in Hradec Kralove. From the very beginning, it has been a purely Czech company, which ranks among the leading manufacturers of surge protection devices and insulation monitoring devices.

We produce surge protection devices not only for residential construction, but they are also used in industry (oil and gas pipelines, photovoltaics, power plants and railways). Our products protect various technologies, machines, appliances and equipment worldwide against overvoltage.

At the same time, we develop and manufacture insulation monitoring devices for isolated IT power supply systems. We provide complete A to Z solutions for insulation monitoring in hospitals, industry and special applications, helping to protect not only equipment, but more importantly human lives.

In addition to its manufacturing and business activities, HAKEL spol. s r.o. supports individuals, foundations, schools, nurseries, theatres and other organisations. Today the company is managed by Bc. Pavel Hudec, son of the founder, as the sole owner.

Contents

Complete solution for Medical IT power supply system (MIS)	2
Overview diagram of the HAKEL ISOLGUARD MIS	5
Insulation monitoring devices	6
Insulation fault location	8
Modules of system's inputs and outputs	10
Power supplies	12
Current measuring transformers	13
Safety isolating transformers	14
Automatic transfer switches	18
Remote monitoring modules	20
Communication GATEWAY for the ISOLGUARD system	24
Testing accessories for medical IT systems	26
Insulation Monitoring Devices at hakel.com	27

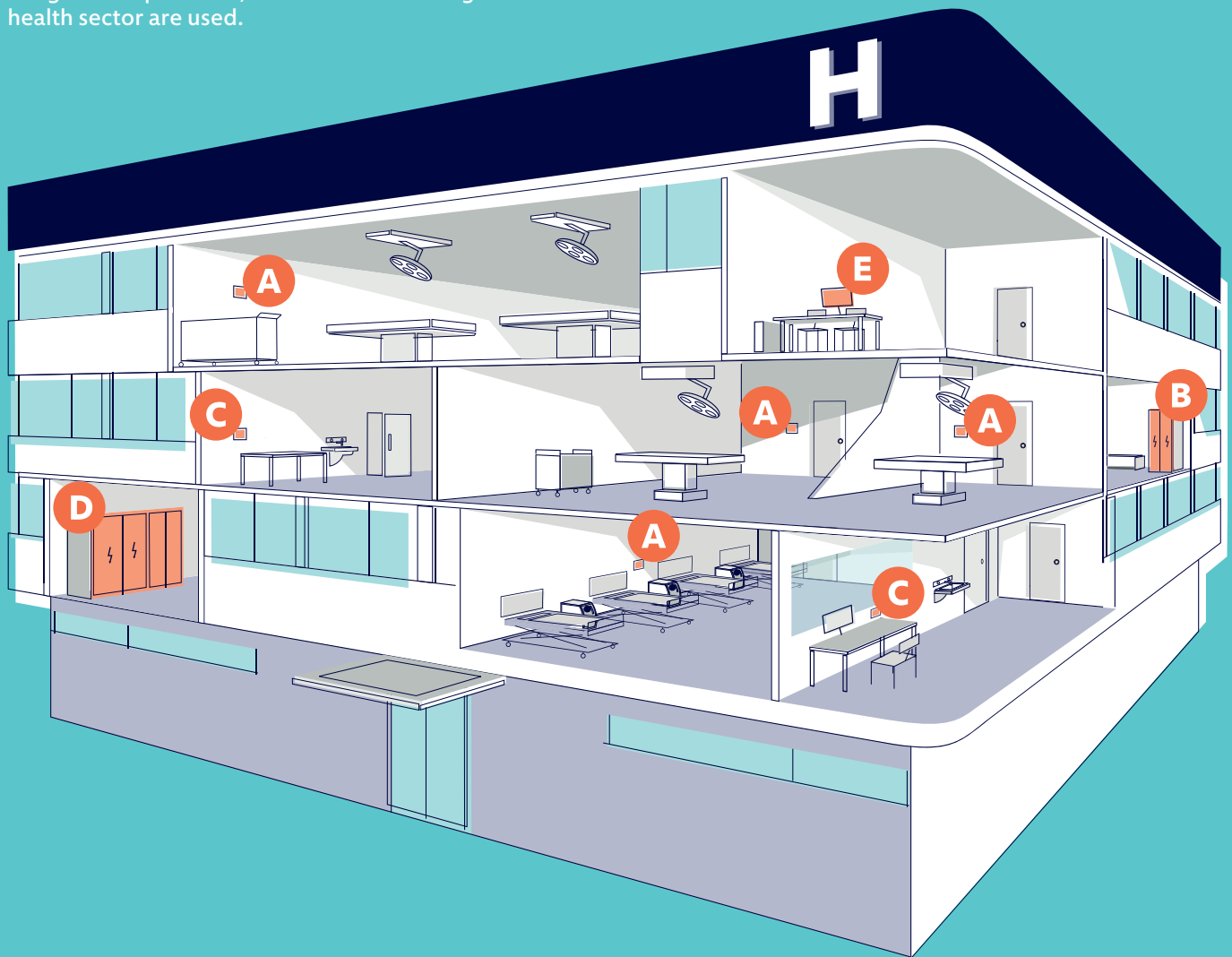
Complete solution for Medical IT power supply system (MIS)

Few applications in our surroundings as medical facilities can be considered so sensitive to power outages. Interruption of the electricity supply at the wrong time can lead to irreversible damage to technical equipment and, in particular, to endanger the health of patients.

For this reason, electrical distribution in operating theatres, intensive care units and in other critical rooms are implemented as ungrounded systems, which in terms of safety brings a huge benefit in the possibility of continuing operation even in the event of the first fault. This means that even where there is an outage of a common TN system, the IT power supply system can continue to supply power. In order to ensure that the medical IT power supply system (MIS) is sufficiently isolated from the ground's potential, insulation monitoring devices for health sector are used.

HAKEL company offers a complete solution for hospital MIS in the form of isolating transformers, insulation monitoring devices and fault location, including an extensive solution to supervise the MIS condition. In supervision, we offer signalling panels for both medical staff and solutions for technical and maintenance staff supervision. In addition, we allow to connect the monitoring system to the ethernet network and thus enable remote access to monitor MIS condition from anywhere.

Medical IT power supply system (MIS)
is a synonym for the mentioned
Medical Insulated System (MIS)



- A** Medical locations of group 2 (operating theatres, ICU)
- B** IPS panel of Medical IT power supply system (MIS)
- C** Medical staff station (nurses' room, doctors' room)
- D** Low voltage substation
- E** Maintenance or power engineer station

In the product pages footer, you will find the indication of belonging to the listed groups: solutions **A B C D E**

A Medical locations of group 2 (operating theatres, ICU)

In medical locations of group 2, the standard HD 60364-7-710:2012 orders to use an isolated system to supply critical circuits. In addition, the standard extends the basic responsibilities of IT power supply system monitoring (defined by the standard HD 60364-4-41:2017) and implement a special type of isolated system, the so-called Medical IT power supply system (MIS).

We usually distinguish between two types of MIS systems. These are IC-MIS type (important circuits) and VIC-MIS type (very important circuits). The basic difference between these circuits is that VIC-MIS power supply systems are equipped with an additional level of backup against power supply outages - usually by a UPS system.

Up to four types of distribution networks can be found at workplaces of group 2 medical locations. LIC (less important circuit) and IC (important circuit) network types are TN type distributions and it is not permitted to supply life support appliances and other critical medical appliances from them. IC-MIS and VIC-MIS systems types are IT power supply system type and it is permitted to supply life support appliances and other critical medical appliances from them. In order to make it clear which network/power supply system it is and with what level of power supply backup, the colours of individual networks/power supply systems are normatively established. LIC type sockets are white. IC type sockets are green. IC-MIS type sockets are yellow and the best backed-up power supply VIC-MIS is orange. Each MIS socket must have a presence of voltage indicator.

In terms of MIS condition monitoring, it is ordered that the supervision of MIS must be carried out in a suitable place, where it must be constantly controlled by medical staff. In practice, an approach is chosen in which a supervisory panel is placed in the operating theatres and ICU locations, so that in the event of an ongoing medical procedure, the medical staff will be informed of a possible threat to the energy supply.

In HAKEL company, we solve supervision, in medical locations of group 2, by using **MDS-DELTA (p. 22)** supervisory panels. These panels meet the requirements for acoustic and optical signalling, while the acoustic signalling can be shut down and the visual cannot. In addition, they contain a button to invoke a remote test of the insulation monitoring device.

These panels are available in a design for a 45x45 mm cable tray or in a design for a switch box (diameter 68 mm). Standard protection is IP20, however a version for rooms with rinsing is also available and has IP44 protection. All versions of signalling panels are made of antimicrobial material and are therefore also intended for direct assembling in operating theatres, requiring maximum sterility.

We recommend to control the insulation resistance function at regular intervals not only with the „TEST“ test push-button, but also with a test plug, which invokes a clearly defined insulation resistance fault. For these purposes, HAKEL company produces a product called **Test Resistor 47 kOhm (p. 26)**.

B IPS panel of Medical IT power supply system (MIS)

The medical IT power supply system is created by a separate and for this purpose dedicated transformer. HD 60364-7-710:2012 standard orders the transformer to be located in the maximum closeness of a separate medical locations of group 2 and strongly recommends that the distance between the output terminals of the transformer and the appliance itself be up to 25 m. It is forbidden to protect the transformers at the input and output against overcurrent, only short-circuit protection (fuse) is allowed. Recommended fuse value is given in the transformer data sheet.

HAKEL company offers safety isolating transformers for healthcare in two series. The **MED STD-line (p. 16)** series is a series of standard single-phase transformers, which is characterized by high reliability and low switch-on currents. The **MED ECO-line (p. 14)** series is a series that takes over the features of the MED STD-line series and extends it with a significant effect of reduced operating losses in iron. We supply transformers in a single-phase design, with an input voltage of 230 V or 400 V and outputs from 2.5 kVA to 10 kVA, with a pair of integrated temperature sensors PT100 type. The transformers are available in IP00 protection or in a steel case with IP23 protection.

In order to be able to operate the transformer in healthcare, it is necessary to monitor its immediate operating temperature and current consumption on the secondary side. This obligation is transferred to the insulation monitoring device, which always monitors at least three quantities in healthcare (MIS insulation resistance, temperature and current of isolating transformer). It is therefore necessary to use special insulation monitoring devices, which are referred

to as "IMD MED". This designation is implemented by the standard IEC 61557-8:2014.

HAKEL company offers **HIG95-DELTA (p. 6)** insulation monitoring device for health sector. It is a modern device that meets all the requirements for the supervision of the Medical IT Power Supply System (MIS). It evaluates the insulation resistance in the range of 5 kΩ to 10 MΩ. The thermal load of the transformer can be sensed by sensors of type PT100, PTC thermistor or NC sensor. The current load is monitored by measuring current transformers of the **HIG-MT (p. 13)** series.

In addition, **MDS-DELTA (p. 22)** and **MDS-D (p. 20)** series remote monitoring modules can be connected to this device. A 24 V DC source must be used to supply the remote monitoring modules. It is possible to use sources from the **HIG-PS (p. 12)** series, where there is a source with an output of 5 W and a source with an output of 15 W.

The standards also recommend to apply a so-called insulation fault location system to each MIS outlet. It is a system that can detect the outlet in the event of an insulation fault, in the case of MIS, typically the specific socket on which the insulation resistance was disrupted. For HAKEL company, this product is **HIG-IFL DELTA (p. 8)**. This insulation fault location allows to evaluate up to 6 circuits, and up to 10 products can be used. In total, one supervised isolated system can have 60 outlets.

If it is required to solve the local switching between the supply of primary and backup feeding, it is possible to use **ATyS M (p. 18)** switches, which HAKEL company also offers.



C Medical staff station (nurses' room, doctors' room)

The basic standard for health sector (HD 60364-7-710:2012) orders that the supervision of the Medical IT power supply system (MIS) is carried out by medical staff so that the condition of MIS can be controlled continuously. This can be understood as it is not enough to know the condition of the isolated power supply system only during an ongoing medical procedure, but it is necessary to monitor it continuously. The reason is the finding itself whether it is possible to start and complete the procedure at the given workplace without any restrictions. For this reason, remote monitoring modules are usually duplicated - i.e., one MIS has one isolation monitoring device, but up to several remote monitoring modules in different places.

In practice, we most often encounter a solution where for a certain number of rooms in medical locations of group 2 (e.g., operating theatres, for more see point A) there is at least one room, where medical staff gather, and where someone is always present, regardless of the performance of medical procedures. These are very often the rooms of nurses or doctors. And so, it is appropriate to install a central signalling of all MIS conditions in a similar room. The result is always an early response of medical personnel to insulation status or isolation transformer faults.

In the HAKEL system, it is recommended to apply **MDS-DELTA (p. 22)** remote monitoring modules in operating theatres, where these modules can signal only one MIS. Conversely, it is recommended to

apply **MDS-D (p. 20)** series remote monitoring modules to the rooms of nurses and doctors. These modules enable the display of up to 24 isolated systems on one module. If a project engineer chooses a similar solution, condition of MIS systems, which are directly related to the given room, is signalled in the operating theatres. And conversely, condition of all MIS that fall under a given medical department can be easily and clearly seen in the nurses' room.

MDS-D is a digital display unit with a colour touch LCD. Module meets the requirements for remote signalling according to standards, i.e., the panel has acoustic and visual fault signalling, acoustic can be removed, optical cannot. Due to clarity, the panel allows user naming of individual MIS and displays real-time measured quantities, their values and settings. Modules require a low voltage supply of 24 V. The **HIG-PS (p. 12)** series can be used for this, which offers sources with a power of 5 or 15 W.

MDS-D remote monitoring modules are supplied in two versions, with IP20 protection or IP66 protection. They are always applied on the wall or panel. IP20 design can be assembled on a switch box (diameter 68 mm). Communication with insulation monitoring devices and other HAKEL accessories takes place via RS485 bus. Panels are equipped with a second communication bus, which allows to transmit information to the electrical maintenance or energy department.

D Low voltage substation

LV substation is used to distribute electric energy to secondary switchboards across the hospital pavilion building. This is a basic technical room, where only the technical staff of the hospital maintenance moves.

These substations are very often equipped with a central battery backup system – UPS. Backup power supply units are critical components of the medical infrastructure and they have a direct effect on which parts of the electrical installation remain under voltage in the event of energy supply outage from the distribution system. In order to reduce the risks associated with a UPS system fault, these devices are equipped with control outputs on which they signal their operating conditions.

In order to provide information on the UPS system condition sufficiently (quickly) to both technical and medical personnel, HAKEL company has developed the **HIG-8IN (p. 10)** unit. It is an I/O module

to which any logic signal can be connected. In UPS terms, we very often connect outputs signalling battery operation, the oncoming end of delivery (discharge) limit and information about the UPS internal fault. These conditions are then transmitted via RS485 bus to the **MDS-D (p. 20)** remote monitoring module, where the UPS condition report will be signalled along with the medical IT power supply statuses.

It is often possible to meet with the approach, when the remote monitoring module is installed into the LV substation. The panel is only for hospital technical staff here. Usually, the panel displays information from all MIS in the entire building. A similar MDS-D application then saves maintenance time, that can control the currently measured values for the entire object from one place. If required by the application, MDS-D also includes a bulk test function, when all insulation monitoring devices can be tested at a single touch from one place.

E Maintenance or power engineer station

Modern approaches to diagnostics and control require that the supervision of medical IT power supply systems (MIS) is carried out not only by medical personnel at the place of medical procedure or at the supervisory workplace, but also to make the whole system remotely accessible to maintenance managers or power engineers.

The aim is therefore to be able to transfer information about MIS condition to the command workplace, ideally using the existing infrastructure. Because these workplaces are very often dislocated from the medical locations themselves (another floor, another building, or even another city), data transmission via ethernet network is used. Thanks to this, it is possible to monitor the MIS condition theoretically from any place.

HAKEL company offers **HIG-GW E01 (p. 24)** product for such supervision. It is a communication gateway, which ensures the transmission of information from **MDS-D (p. 20)** remote monitoring modules to standard ethernet. The product allows monitoring of up to 24 MDS-D panels at a time, where each MDS-D panel can monitor up

to 24 insulation monitoring devices (i.e., 24 separate MIS). It is therefore possible to monitor up to 576 medical IT power supply systems via one HIG-GW E01. In addition, HIG-GW E01 allows to monitor faults and alarms history on all connected MIS.

HIG-GW E01 gateway has two integrated ways how to monitor MIS conditions. The basic module is an integrated webserver. This allows to view the monitored system from any device that supports the display of web pages. MIS system can therefore be controlled from a regular PC, tablet or phone. If the investor also requires to assign MIS status monitoring to his own system, the integrated MODBUS TCP protocol can be used. This protocol allows MIS condition monitoring by using systems types BMS (building management system) or SCADA (supervisory control and data acquisition).

HIG-GW E01 is placed in a data switchboard or directly into the IPS panel on a 35 mm DIN rail and it is necessary to supply a small voltage of 24 V DC, with a minimum power of 15 W. We recommend using **HIG-PS 24V/15W (p. 12)** source for power supply.

Overview diagram of the HAKEL ISOLGUARD MIS

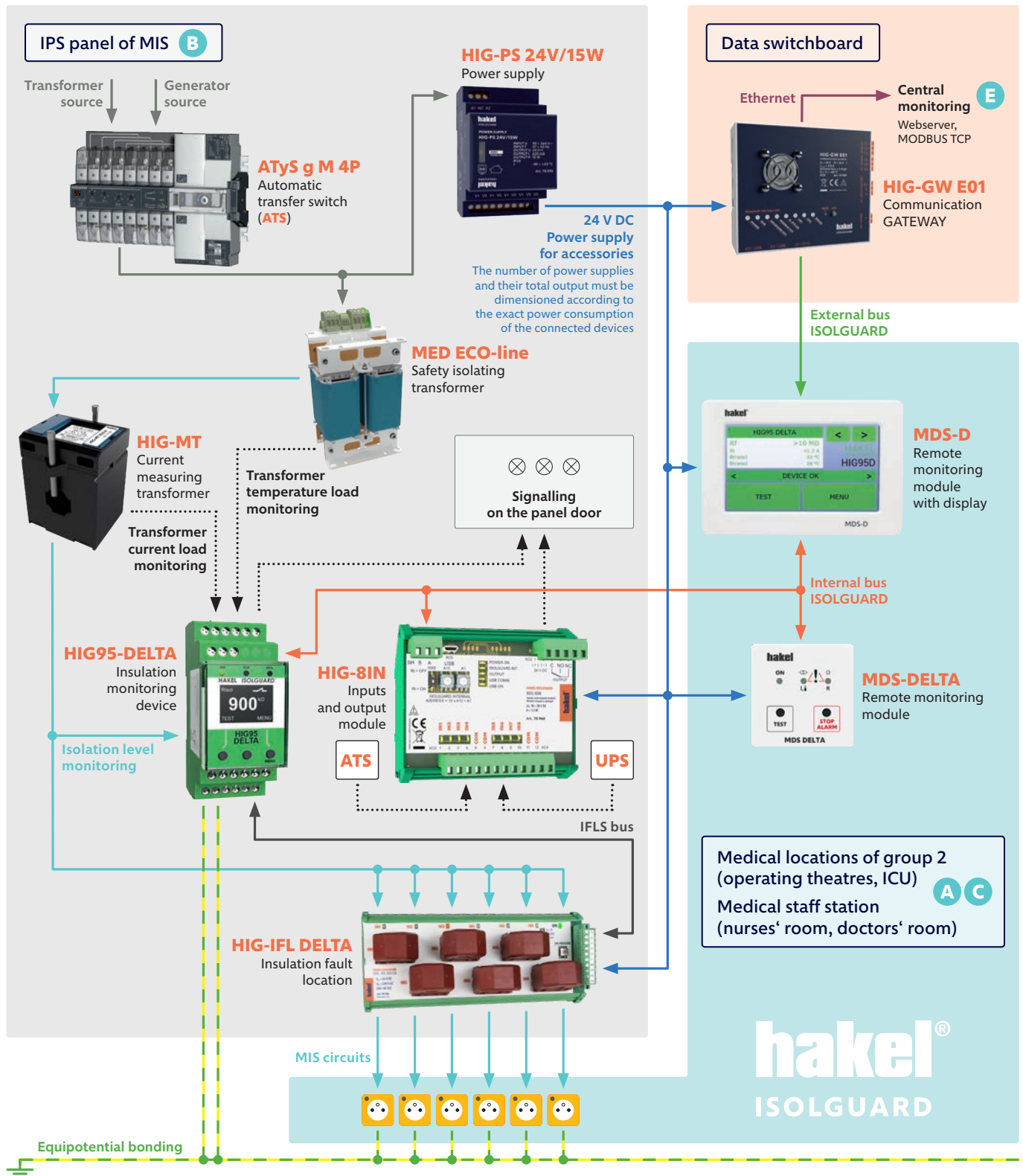
Below you can see an overview diagram of the HAKEL ISOLGUARD MIS system. The diagram is divided into three parts depending on the location of the elements.

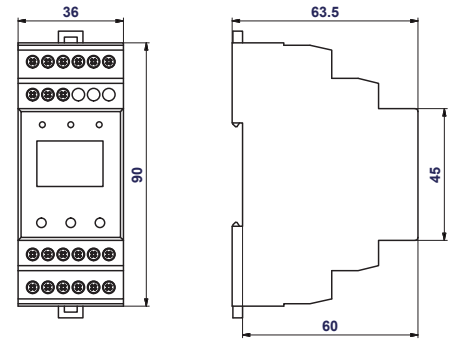
The first part presents the design of the IPS panel of the **Medical IT power supply system (MIS)**. There are two power sources in the panel. Both of these power sources are connected to an automatic transfer switch (**ATS**). The logic outputs from the **ATS** are brought to the inputs of the **HIG-8IN**. The output voltage from the **ATS** is then brought to a protective isolation transformer (**MED**), which forms the MIS itself. The resulting IT system is supervised by the **HIG95-DELTA** device, which monitors not only the insulation condition of the MIS, but also the transformer's temperature load and its current load, using the **HIG-MT** current measuring transformer. The **HIG95-DELTA**

device is connected to the **HIG-IFL DELTA** fault location module to evaluate a specific circuit in insulation failure.

The **MDS-D** and **MDS-DELTA** remote signalling modules are located in the **medical locations of group 2**. These modules are placed, for example, in operating theatres, ICUs or **medical staff stations**. Their task is to easily and clearly signal the current status of the monitored variables to the medical staff.

The **HIG-GW E01** communication gateway is located in the Ethernet data switchboard, which allows you to monitor the actual status of the entire system from any location using an integrated webserver. In addition, it allows the HAKEL ISOLGUARD MIS system to be linked to a central monitoring system (SCADA) using MODBUS-TCP.





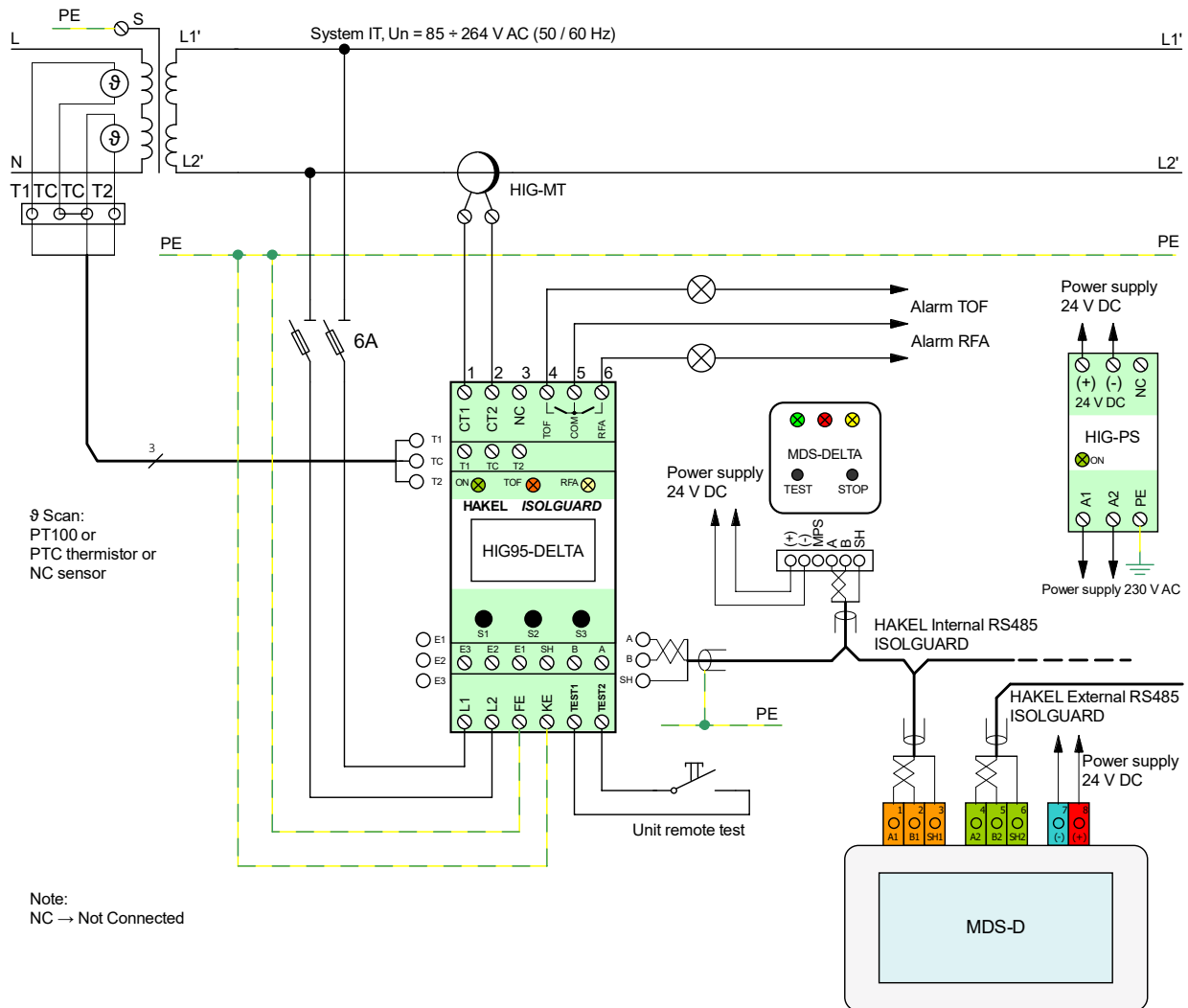
HIG95-DELTA

- Insulation monitoring devices series HIG95 are devices for monitoring the insulation resistance in hospital applications.
- In addition to the insulation resistance, the IMDs also evaluate the current and thermal load of the IT system and thus meet the requirements for monitoring the medical, isolating protective transformer.
- There is also a number of monitoring panels, thanks to which the requirement for remote status signaling can be easily met. This is a series of MDS.
- The IMDs are equipped with a display for displaying currently measured values. The display together with the buttons is also used to set up the device.
- Designed according to standards:** IEC 61557-8:2014; IEC 61557-1:2007; IEC 60664-1:2007; IEC 61557-8:2014 annex A; IEC 61557-8:2014 annex B
- Application standards:** HD 60364-4-41:2017; HD 60364-7-710:2012

Type		HIG95-DELTA
Monitored IT power supply system type according to IEC 61557-8		AC, MED
Measuring range of insulation resistance	R_F	$5 \div 10\,000\text{ k}\Omega$
Adjustable range of critical insulation resistance	R_{an}	$50 \div 500\text{ k}\Omega$
Number of insulation resistance fault levels (R_{an})		1
Rated voltage of monitored IT system	U_n	230 V
IMD power supply		From measured IT system
Supply voltage range		$85 \div 264\text{ V}$
Monitoring of current overload of medical transformer		Yes, using current transformers of the HIG-MT series
Monitoring of thermal overload of medical transformer		Yes, temperature sensor is connected straight to the IMD
Equipped with display		Yes (OLED technology)
Supported module of distant signalisation (MDS)		MDS-D, MDS-DELTA
Communication interface for user		RS485 bus
Operating temperature	ϑ	$-10 \div 60\text{ }^{\circ}\text{C}$
Article number		70 940

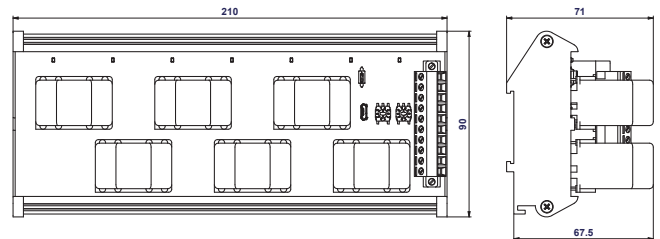


Application wiring diagram (installation) of HIG95-DELTA



Notes:

1. Clamps FE and KE of HIG95-DELTA must be connected to PE bus by separate conductors.
2. Three types of temperature sensors can be used (see diagram). In addition, it is possible to set in the device menu whether one or two sensors of the same type are used.
3. The specific type of HIG-MT current measuring transformer can be selected according to the table in the HIG95-DELTA product manual.
4. The recommended wire cross-section for the current transformer connection and its length is given in one of the tables in the HIG95-DELTA product manual.
5. It is possible to connect several MDS-DELTA and MDS-D modules to HIG95-DELTA device.
6. When using a shielded cable for the HAKEL RS485 ISOLGUARD bus, the bus shielding has to be connected along its entire length and grounded at one point.
7. Only one type of cable is installed along the entire length of the HAKEL RS485 ISOLGUARD bus, wires A and B are realized as a twisted pair and the SH terminals of all devices are interconnected. The shielding is not connected to the A, B or SH potential.
8. It is necessary to keep the linear connection of the HAKEL RS485 ISOLGUARD bus, it is not possible to create branch lines, i.e. the "star" wiring is not allowed.
9. It is necessary to use a galvanically isolated voltage source to power the MDS and to implement the power supply as SELF. Both devices can be powered from the same source. The recommended supply voltage is 24 V DC. The HAKEL HIG-PS 24V series is recommended for powering the devices.



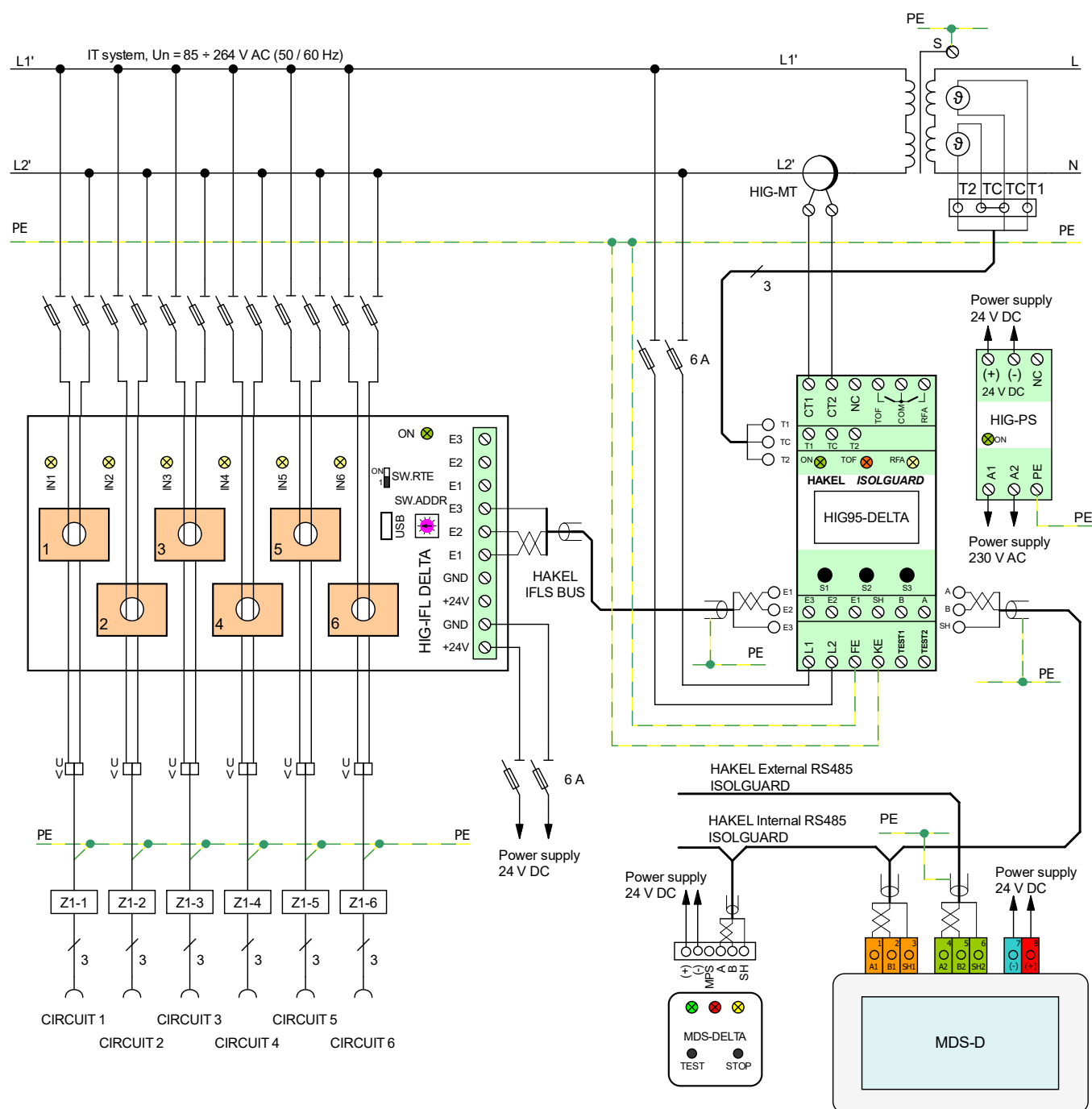
HIG-IFL DELTA

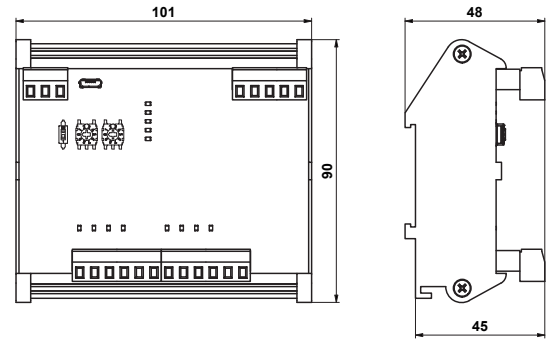
- HIG-IFL DELTA is a fault location module that together with the HAKEL HIG95-DELTA Insulation monitoring device forms a fault location system for health IT systems (MIS).
- HIG-IFL DELTA module is equipped with six sensing sensors that enable the location of the fault on up to 6 MIS pins.
- HIG-IFL DELTA connects itself to the HAKEL HIG95-DELTA via the IFLS BUS with up to 10 pcs of HIG-IFL DELTA per bus.
- Thanks to this, it is possible to implement a fault location system on a single isolated health IT system (MIS) on up to 60 outlets of one system.
- Fault location module HIG-IFL DELTA is powered from an independent low voltage 24 V DC power supply. A suitable source can be HAKEL HIG-PS 24V/5W product range.
- The module is installed on a 35 mm DIN rail and has a width of 12 TE.
- **Designed according to standards:** IEC 61557-9:2014; IEC 61557-8:2014 annex A; IEC 61557-1:2007; IEC 60664-1:2007; IEC 61326-2-4:2012; IEC 60068-2-6:2007; IEC 60068-2-27:2008
- **Application standards:** HD 60364-4-41:2017; HD 60364-7-710:2012

Type		HIG-IFL DELTA
Designed for insulation monitor		HIG95-DELTA
Monitored IT power supply system type according to IEC 61557-8		AC, MED
Rated voltage of monitored IT system	U_n	230 V
Supply voltage range		9 ÷ 36 V
Power source		External power supply SELF 24 V DC
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
Measuring accuracy		± 30 %
Communication interface for user		USB
Degree of protection		IP20
Recommended back-up fuse		6 A/gG
Article number		70 959



Application wiring diagram (installation) of HIG-IFL DELTA





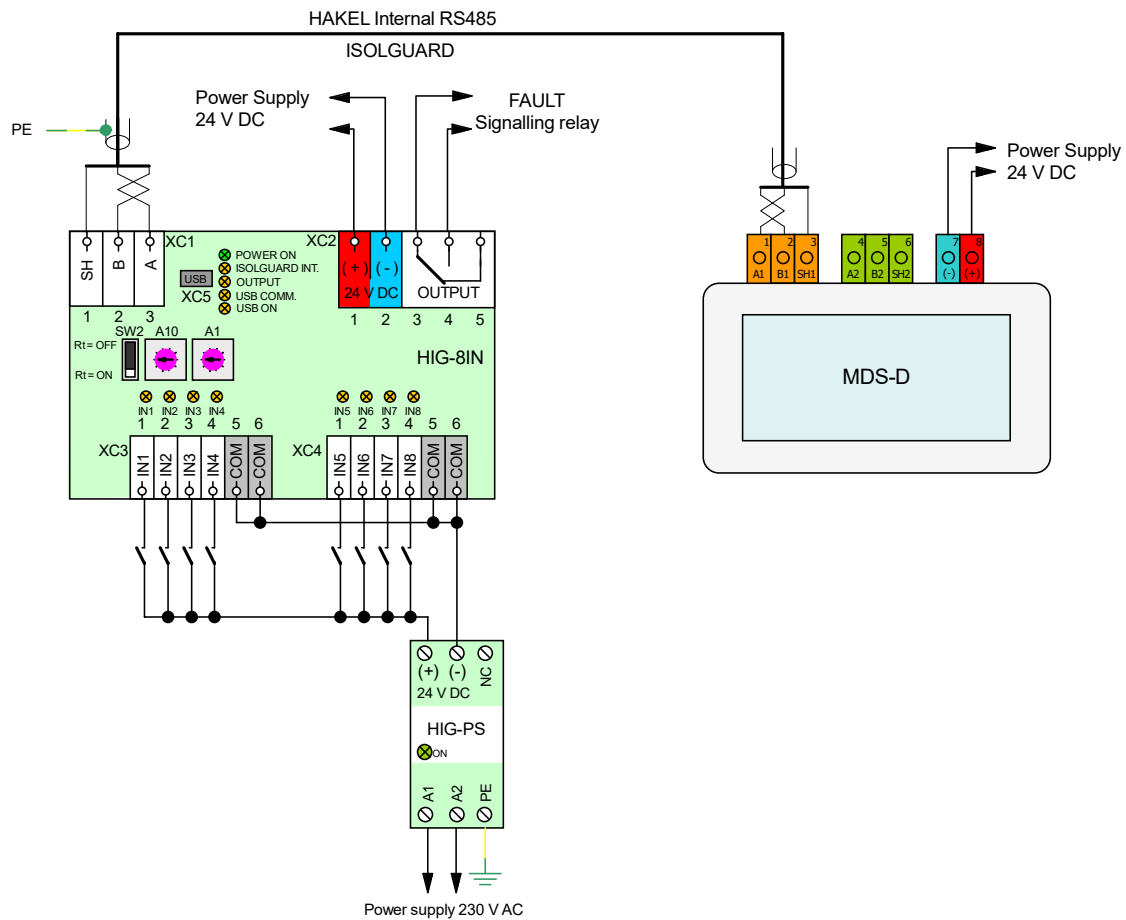
HIG-8IN

- Extension device for the HAKEL ISOLGUARD insulation monitoring system.
- The module allows to complete the control of a (typically hospital) IT system with any signalling using 8 digital inputs and 1 output switching contact.
- HIG-8IN can be used to monitor, for example, the status of UPS or automatic transfer switches and to read the pressing of alarm or panic buttons.
- Input statuses sensed by HIG-8IN are signalled to the HAKEL ISOLGUARD MDS-D remote signalling module. HIG-8IN setting is also done via the MDS-D module.
- RS485 data bus with ISOLGUARD protocol is used for data transfer between HIG-8IN and MDS-D. Up to 10 HIG-8IN modules can be connected to one RS485 bus at a time.
- HIG-8IN is used in combination with HAKEL ISOLGUARD MDS-D remote signalling modules.
- **Designed according to standards:** IEC 61557-1:2007; IEC 61326-2-4:2012; IEC 61000-6-2:2016; IEC 61000-6-3:2020; IEC 60664-1:2007

Type		HIG-8IN
Nominal supply voltage DC	U_s	24 V
Supply voltage range		18 ÷ 28 V
Power consumption	P	1.5 VA
Number of digital inputs		8
Number of digital outputs		1
Digital input operating range	U_i	0 ÷ 36 V DC
Electrical strength against internal circuits		3 800 V
Speed of logic response to opening/closing	t_i	< 0.5 s
Input power consumption in switched state	I_i	Max. 8 mA / 24 V
Supported module of distant signalisation (MDS)		MDS-D
Communication interface for user		RS485 bus, USB
Communication protocol		ISOLGUARD
Degree of protection		IP00
Recommended back-up fuse		6 A/gG
Article number		70 960

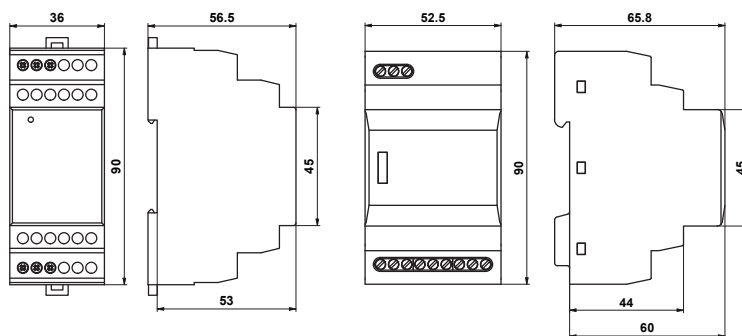


Application wiring diagram (installation) of HIG-8IN



Notes:

1. When using a shielded cable for the HAKEL RS485 ISOLGUARD bus, the bus shielding has to be connected along its entire length and grounded at one point.
2. Only one type of cable is installed along the entire length of the HAKEL RS485 ISOLGUARD bus, wires A and B are realized as a twisted pair and the SH terminals of all devices are interconnected. The shielding is not connected to the A, B or SH potentials.
3. It is necessary to keep the linear connection of the HAKEL RS485 ISOLGUARD bus, it is not possible to create branch lines, i.e. the "star" wiring is not allowed.
4. It is necessary to use a galvanically isolated voltage source to power the MDS and to implement the power supply as SELF. Both devices can be powered from the same source. The recommended supply voltage is 24 V DC. The HAKEL HIG-PS 24V series is recommended for powering the devices.
5. Powering the HIG-8IN logic inputs and the HIG-8IN powering itself can be provided by a common source.
In this case, the isolation barrier between the internal circuits and the logic inputs does not apply.
6. It is possible to use NC contacts to signal the status. The change of the signalling logic is done in the device settings via MDS-D or USB bus.



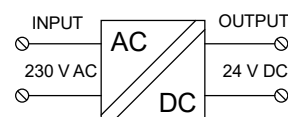
HIG-PS 24V/5W, HIG-PS 24V/15W

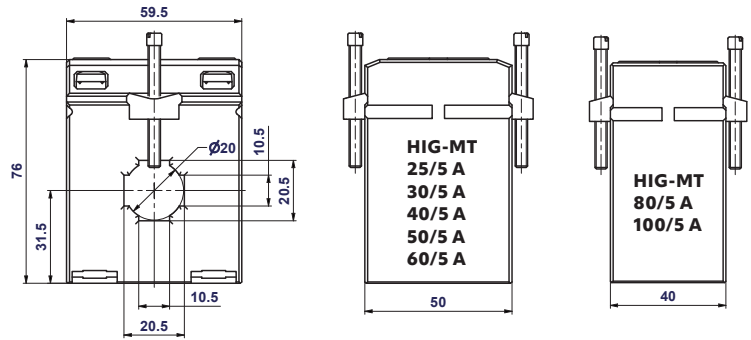
- Universal power supply for mounting on the 35 mm DIN rail, primarily intended for powering the remote monitoring module MDS-D, MDS-DELTA or fault location module HIG-IFL DELTA produced by HAKEL company.
- Output voltage is stabilized 24 V DC.
- The operation of the source is signaled by a green LED on the front panel of the product.
- Integrated output short-circuit protection and thermal fuse with an automatic renewal of the power supply after the fault.
- 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.
- **Designed according to standards:** IEC 61558-1:2005

Type		HIG-PS 24V/5W	HIG-PS 24V/15W
Nominal supply voltage AC	U_s	100 ÷ 265 V	90 ÷ 264 V
Frequency	f	47 ÷ 440 Hz	47 ÷ 63 Hz
Output voltage DC	U_{out}	24 V	
Output current	I_{out}	220 mA	625 mA
Power	P	5 W	15 W
Isolation voltage input / output AC		4 000 V	
Degree of protection		IP20	
Operating temperature	ϑ	-25 ÷ 50 °C	-40 ÷ 50 °C
Recommended cross-section of connected conductors	S	1 mm ²	
Recommended back-up fuse		6 A/gG	
Article number		70 062	70 093



Application wiring diagram (installation)





HIG-MT */5 A

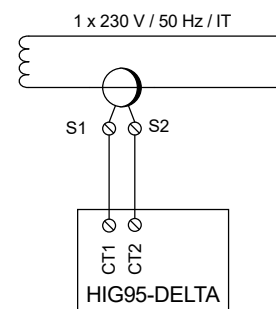
- Used to sense the current load of a medical insulated power supply system, which is monitored by the insulation monitoring device from HAKEL.
- Available in the range of primary current 25 A to 100 A, secondary current 5 A.
- Construction is pluggable, is supplied in two dimensional versions, depending on the primary current.
- Designed for installation in an IPS panel, they can be mounted to the distribution board using reduction brackets (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.
- Work reliably with HAKEL HIG95-DELTA and HIG95+ insulation monitoring devices.
- Designed according to standards:** IEC 61869-1:2007; IEC 61869-2:2012
- Application standards:** HD 60364-7-710:2012; IEC 61557-8:2014 annex A

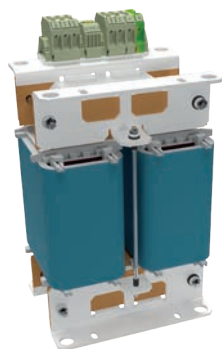
Type		HIG-MT 25/5 A	HIG-MT 30/5 A	HIG-MT 40/5 A	HIG-MT 50/5 A	HIG-MT 60/5 A	HIG-MT 80/5 A	HIG-MT 100/5 A
Primary current		25 A	30 A	40 A	50 A	60 A	80 A	100 A
Secondary side current		5 A						
Power	P	1 W	1.5 W	1 W		2.5 W		5 W
Transformer construction		Pluggable (without interrupting the primary conductor)						
Frequency	f	50 ÷ 60 Hz						
Housing material		Self-extinguishing						
Recommended cross-section of connected conductors	S	1.5 ÷ 2.5 mm ²						
Operating temperature	θ	-25 ÷ 40 °C						
Mass	m	646 g		660 g				520 g
Article number of DIN rail bracket				71 541				71 540
Article number		71 530	71 531	71 532	71 533	71 534	71 535	71 536



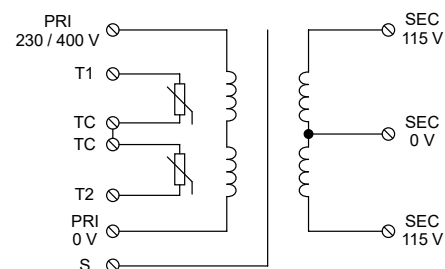
Note: The image illustrates the HIG-MT 25/5 A, other products of this series are either in the same or a similar housing – see the list of types in the front view of the dimensional drawing.

Application wiring diagram (installation)





Internal diagram



MED ECO-line * kVA, MED ECO-line * kVA (400/230)

- Transformers with reduced operational losses, composite core and vertical mounting are intended for the supply of equipment in medical locations.
- Thanks to the higher efficiency of operation, transformers help to significantly save electrical energy and thereby reduce the impact on the economy and ecology of operation.
- Produced 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 55 °C.
- Transformers have reinforced insulation and protective shielding between the primary and secondary winding.
- Equipped with two temperature sensors PT100, thanks to these sensors, the transformers work better 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 IP23, see next page.
- Designed according to standards:** IEC 61558-2-15:2011; IEC 61558-1:2005
- Application standards:** HD 60364-7-710:2012

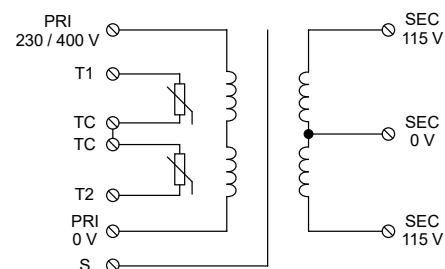
MED ECO-line * kVA			*2,5 kVA	*3,15 kVA	*4 kVA	*5 kVA	*6,3 kVA	*8 kVA	*10 kVA
MED ECO-line * kVA (400/230)									
Primary supply voltage AC			230 V – intended for MED ECO-line * kVA						
			400 V – intended for MED ECO-line * kVA (400/230)						
Secondary voltage AC			230 V						
Power	P		2 500 W	3 150 W	4 000 W	5 000 W	6 300 W	8 000 W	10 000 W
Transformer construction			Less operating losses						
Frequency	f		50 ÷ 60 Hz						
In-built temperature sensor			2 x PT100						
In a steel cover			Ne						
Insulation class			F						
Operating temperature	θ		-25 ÷ 55 °C						
Degree of protection			IP00						
Trigger current			Max. 8 times the rated current						
Recommended cross-section of connected conductors		S	2.5 mm ²		4 mm ²	6 mm ²	10 mm ²		
Short-circuit voltage		U _k	2.3%		2.1%	2%	2.2%		
Efficiency		η	97.3%	97.1%	97.3%	97.6%	97.2%	97.3%	
Recommended back-up fuse for:	*kVA		20 A/gG	25 A/gG	32 A/gG	40 A/gG	50 A/gG		63 A/gG
	*kVA (400/230)		12.5 A/gG	16 A/gG	20 A/gG	25 A/gG	32 A/gG	40 A/gG	50 A/gG
Mass		m	40 kg		45 kg	50 kg	58 kg	67 kg	75 kg
Article number MED ECO-line * kVA			72 231/00	72 232/00	72 233/00	72 234/00	72 235/00	72 236/00	72 237/00
Article number MED ECO-line * kVA (400/230)			72 231/00 /400	72 232/00 /400	72 233/00 /400	72 234/00 /400	72 235/00 /400	72 236/00 /400	72 237/00 /400



Note: The image is illustrative. The dimensions of the individual types differ – see dimensional drawings at hakel.com.



Internal diagram



MED ECO-line * kVA, MED ECO-line * kVA (400/230)

- Transformers with reduced operational losses, composite core and vertical mounting are intended for the supply of equipment in medical locations.
- Thanks to the higher efficiency of operation, transformers help to significantly save electrical energy and thereby reduce the impact on the economy and ecology of operation.
- Produced 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 55 °C.
- Transformers have reinforced insulation and protective shielding between the primary and secondary winding.
- Equipped with two temperature sensors PT100, thanks to these sensors, the transformers work better with HAKEL ISOLGUARD insulation monitoring devices and provide the best possible basis for measuring the insulation status and transformer heating.
- Transformers are supplied in a steel case with IP23.
- Designed according to standards:** IEC 61558-2-15:2011; IEC 61558-1:2005
- Application standards:** HD 60364-7-710:2012

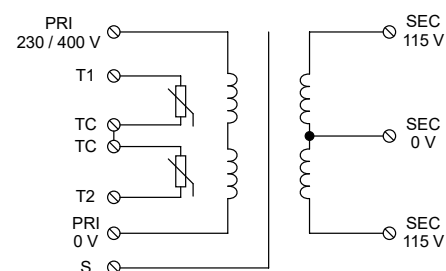
MED ECO-line * kVA			*2,5 kVA	*3,15 kVA	*4 kVA	*5 kVA	*6,3 kVA	*8 kVA	*10 kVA
MED ECO-line * kVA (400/230)									
Primary supply voltage AC			230 V – intended for MED ECO-line * kVA						
			400 V – intended for MED ECO-line * kVA (400/230)						
Secondary voltage AC			230 V						
Power	P		2 500 W	3 150 W	4 000 W	5 000 W	6 300 W	8 000 W	10 000 W
Transformer construction			Less operating losses						
Frequency	f		50 ÷ 60 Hz						
In-built temperature sensor			2 x PT100						
In a steel cover			Ano						
Insulation class			F						
Operating temperature	θ		-25 ÷ 55 °C						
Degree of protection			IP23						
Trigger current			Max. 8 times the rated current						
Recommended cross-section of connected conductors		S	2.5 mm ²		4 mm ²	6 mm ²	10 mm ²		
Short-circuit voltage		U _k	2.3%		2.1%	2%	2.2%		
Efficiency		η	97.3%	97.1%	97.3%	97.6%	97.2%	97.3%	
Recommended back-up fuse for:	*kVA		20 A/gG	25 A/gG	32 A/gG	40 A/gG	50 A/gG		63 A/gG
	*kVA (400/230)		12.5 A/gG	16 A/gG	20 A/gG	25 A/gG	32 A/gG	40 A/gG	50 A/gG
Mass		m	53.2 kg		58.5 kg	63.9 kg	76 kg	85.2 kg	93.5 kg
Article number MED ECO-line * kVA			72 231/23	72 232/23	72 233/23	72 234/23	72 235/23	72 236/23	72 237/23
Article number MED ECO-line * kVA (400/230)			72 231/23 /400	72 232/23 /400	72 233/23 /400	72 234/23 /400	72 235/23 /400	72 236/23 /400	72 237/23 /400



Note: The image is illustrative. The dimensions of the individual types differ – see dimensional drawings at hakel.com.



Internal diagram



MED STD-line * kVA, MED STD-line * kVA (400/230)

- Transformers with reduced operational losses, composite core and vertical mounting are intended for the supply of equipment in medical locations.
- Thanks to the higher efficiency of operation, transformers help to significantly save electrical energy and thereby reduce the impact on the economy and ecology of operation.
- Produced 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 55 °C.
- Transformers have reinforced insulation and protective shielding between the primary and secondary winding.
- Equipped with two temperature sensors PT100, thanks to these sensors, the transformers work better 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 IP23, see next page.
- Designed according to standards:** IEC 61558-2-15:2011; IEC 61558-1:2005
- Application standards:** HD 60364-7-710:2012

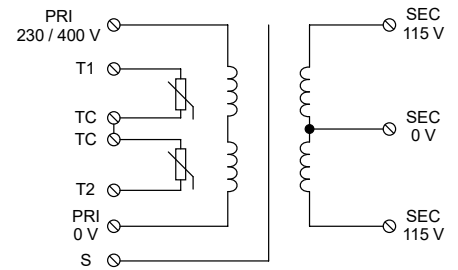
MED STD-line * kVA			*2,5 kVA	*3,15 kVA	*4 kVA	*5 kVA	*6,3 kVA	*8 kVA	*10 kVA
MED STD-line * kVA (400/230)									
Primary supply voltage AC			230 V – intended for MED STD-line * kVA						
			400 V – intended for MED STD-line * kVA (400/230)						
Secondary voltage AC			230 V						
Power	P		2 500 W	3 150 W	4 000 W	5 000 W	6 300 W	8 000 W	10 000 W
Transformer construction			Standard						
Frequency	f		50 ÷ 60 Hz						
In-built temperature sensor			2 x PT100						
In a steel cover			Ne						
Insulation class			F						
Operating temperature	θ		-25 ÷ 40 °C						
Degree of protection			IP00						
Trigger current			Max. 8 times the rated current						
Recommended cross-section of connected conductors		S	2.5 mm ²		4 mm ²	6 mm ²	10 mm ²		
Short-circuit voltage	U _k		2.8%	2.7%	3%		2.8%	2.4%	
Efficiency	η		95.7%	97.3%	95.5%	95.7%	95.9%	96.5%	96.9%
Recommended back-up fuse for:	*kVA		16 A/gG	20 A/gG	25 A/gG	40 A/gG	50 A/gG		63 A/gG
	*kVA (400/230)		12.5 A/gG	16 A/gG	20 A/gG	25 A/gG	32 A/gG	40 A/gG	50 A/gG
Mass	m		38 kg	40.5 kg	42 kg	51.6 kg	60.5 kg	70 kg	90 kg
Article number MED STD-line * kVA			71 131/00	71 132/00	71 133/00	71 134/00	71 135/00	71 136/00	71 137/00
Article number MED STD-line * kVA (400/230)			71 131/00 /400	71 132/00 /400	71 133/00 /400	71 134/00 /400	71 135/00 /400	71 136/00 /400	71 137/00 /400



Note: The image is illustrative. The dimensions of the individual types differ – see dimensional drawings at hake.com.



Internal diagram



MED STD-line * kVA, MED STD-line * kVA (400/230)

- Transformers with reduced operational losses, composite core and vertical mounting are intended for the supply of equipment in medical locations.
- Thanks to the higher efficiency of operation, transformers help to significantly save electrical energy and thereby reduce the impact on the economy and ecology of operation.
- Produced 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 55 °C.
- Transformers have reinforced insulation and protective shielding between the primary and secondary winding.
- Equipped with two temperature sensors PT100, thanks to these sensors, the transformers work better with HAKEL ISOLGUARD insulation monitoring devices and provide the best possible basis for measuring the insulation status and transformer heating.
- Transformers are supplied in a steel case with IP23.
- Designed according to standards:** IEC 61558-2-15:2011; IEC 61558-1:2005
- Application standards:** HD 60364-7-710:2012

MED STD-line * kVA			*2,5 kVA	*3,15 kVA	*4 kVA	*5 kVA	*6,3 kVA	*8 kVA	*10 kVA
MED STD-line * kVA (400/230)									
Primary supply voltage AC			230 V – intended for MED STD-line * kVA						
			400 V – intended for MED STD-line * kVA (400/230)						
Secondary voltage AC			230 V						
Power	P		2 500 W	3 150 W	4 000 W	5 000 W	6 300 W	8 000 W	10 000 W
Transformer construction			Standard						
Frequency	f		50 ÷ 60 Hz						
In-built temperature sensor			2 x PT100						
In a steel cover			Ano						
Insulation class			F						
Operating temperature	θ		-25 ÷ 40 °C						
Degree of protection			IP23						
Trigger current			Max. 8 times the rated current						
Recommended cross-section of connected conductors		S	2.5 mm ²		4 mm ²	6 mm ²	10 mm ²		
Short-circuit voltage	U _k		2.8%	2.7%		3%		2.8%	2.4%
Efficiency	η		95.7%	97.3%	95.5%	95.7%	95.9%	96.5%	96.9%
Recommended back-up fuse for:	*kVA		16 A/gG	20 A/gG	25 A/gG	40 A/gG	50 A/gG		63 A/gG
	*kVA (400/230)		12.5 A/gG	16 A/gG	20 A/gG	25 A/gG	32 A/gG	40 A/gG	50 A/gG
Mass	m		50 kg	53 kg	58 kg	68 kg	79 kg	88 kg	108 kg
Article number MED STD-line * kVA			71 131/23	71 132/23	71 133/23	71 134/23	71 135/23	71 136/23	71 137/23
Article number MED STD-line * kVA (400/230)			71 131/23 /400	71 132/23 /400	71 133/23 /400	71 134/23 /400	71 135/23 /400	71 136/23 /400	71 137/23 /400



Note: The image is illustrative. The dimensions of the individual types differ – see dimensional drawings at hakel.com.



ATyS g M 2P - set *, ATyS g M 4P - set *, ATyS p M 4P - set *

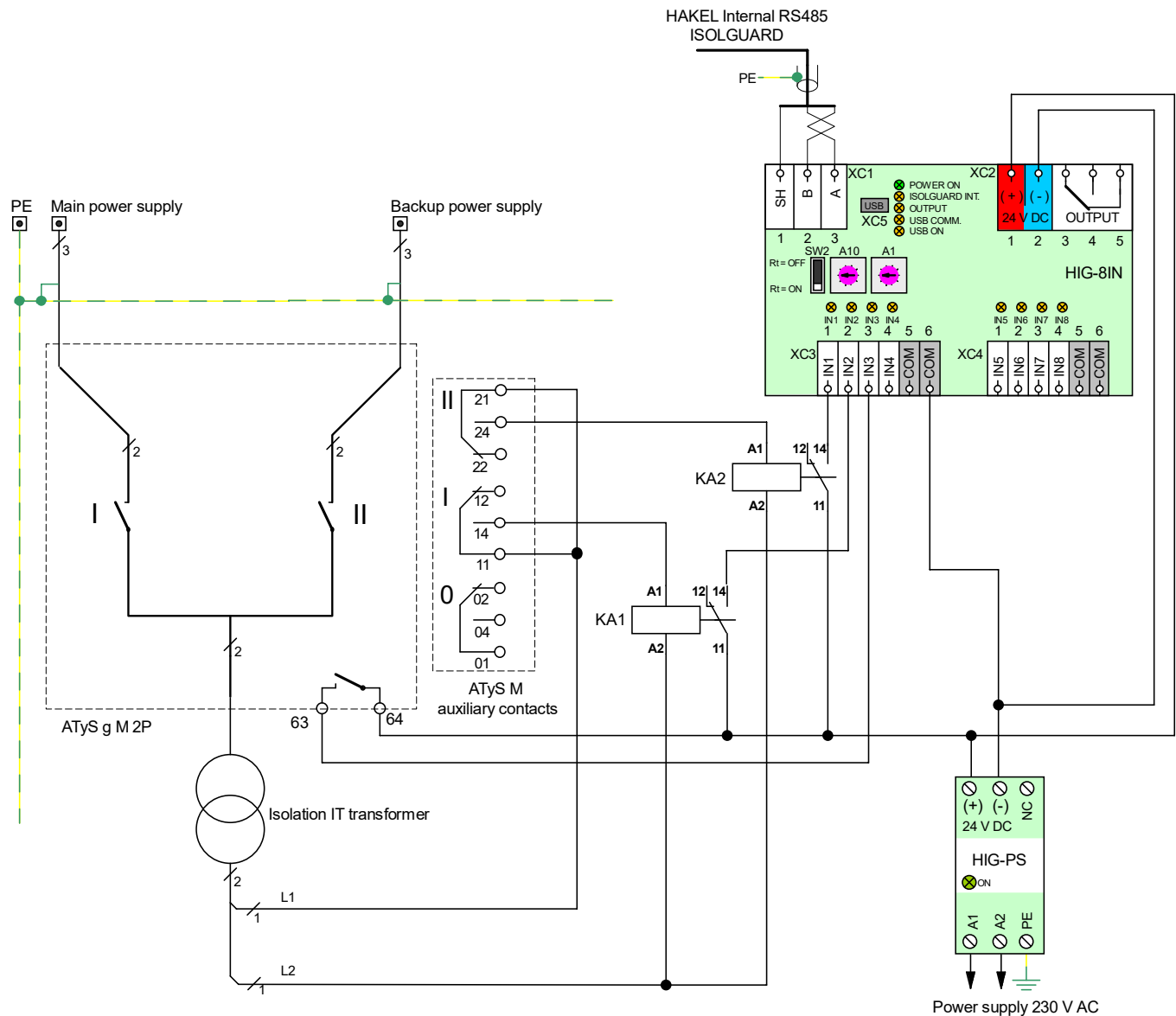
- ATyS M are 2 pole and 4 pole modular automatic transfer switches with an integrated controller.
- Their primary function is to switch between the main and backup supply in case of power failure. They work in automatic mode, if necessary the devices can be switched manually.
- They are designed for low voltage power supply systems with a maximum current of 40 to 160 A for applications where a brief interruption of the load supply is acceptable during transfer.
- They allow the setting of overvoltage, undervoltage and frequency thresholds.
- ATyS g M are set using potentiometers and microswitches with a switching contact to control the generator.
- ATyS p M are set using a display with precise input of individual values and programmable inputs and outputs with a switching contact to control the generator.
- **Designed according to standards:** IEC 60947-3:200; IEC 60947-6-1:2005
- **Application standards:** HD 60364-7-710:2012

ATyS g M 2P - set (* A, 230 V AC)								
ATyS g M 4P - set (* A, 230/400 V AC)			40 A	63 A	80 A	100 A	125 A	160 A
ATyS p M 4P - set (* A, 230/400 V AC)								
No. of poles Designed for power supply systems			2 poles 230 V AC – intended for a series with 2P in the product name					
			4 poles 230/400 V AC – intended for series with 4P in the product name					
Rated load current		I _L	40 A	63 A	40 A	100 A	125 A	160 A
Frequency		f	50 ÷ 60 Hz					
Power consumption		P	6 VA					
Supply voltage range	ATyS g M - set *		176 ÷ 288 V					
	ATyS p M - set *		160 ÷ 305 V					
Rated impulse withstand voltage		U _{imp}	6 kV					
Switching time I-II or II-I			180 ms					
Lifetime (number of changeovers)			10 000					
Changing settings	ATyS g M - set *		Using potentiometers and switches					
	ATyS p M - set *		Using the display and buttons					
Recommended cross-section of connected conductors		S	10 ÷ 70 mm ²					
Operating temperature		ϑ	-20 ÷ 60 °C					
Tightening moment			5 Nm					
Art. number ATyS g M 2P - set (* A, 230 V AC)			70 701	70 702	70 703	70 704	70 705	70 706
Art. number ATyS g M 4P - set (* A, 230/400 V AC)			70 711	70 712	70 713	70 714	70 715	70 716
Art. number ATyS p M 4P - set (* A, 230/400 V AC)			70 741	70 742	70 743	70 744	70 745	70 746

Note: The set consists of the basic device, terminal shrouds, auxiliary contacts and bridging bar. The set therefore contains all necessary accessories for the selected model.

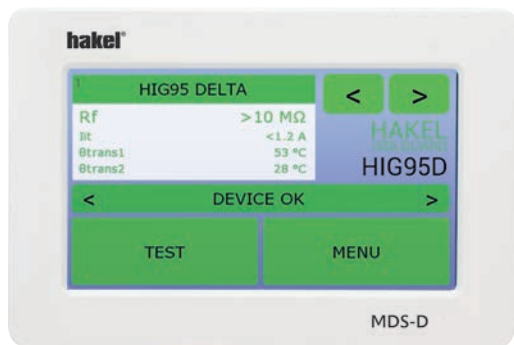


Application wiring diagram (installation) of ATyS M



Notes:

1. The connection used provides information about which source (and if at all) the MIS is powered from.
2. As a result, statuses are signalled on the MDS-D via HIG-8IN:
input IN1: MIS is powered from the main supply X MIS is not powered from the main supply
input IN2: MIS is powered from the backup supply X MIS is not powered from the backup supply
3. Recommended type of auxiliary relays KA1 and KA2 is SCHRACK RT315730 or any other relay with 230 V AC coil and contacts for switching small voltages and currents (HIG-8IN input typically takes 24 V / 8 mA).
4. In addition, the switch in the ATyS M device can be used to signal the operational status of the ATyS device to the IN3 input of the HIG-8IN module:
ATyS g M 2P: terminals 63, 64
ATyS g M 4P: terminals 63, 64
ATyS p M: using any programmable output
5. ATyS p M series is equipped with several programmable outputs that allow you to signal additional statuses to the monitoring system.
6. When using a shielded cable for the HAKEL RS485 ISOLGUARD bus, the bus shielding has to be connected along its entire length and grounded at one point.
7. Only one type of cable is installed along the entire length of the HAKEL RS485 ISOLGUARD bus, wires A and B are realized as a twisted pair and the SH terminals of all devices are interconnected. The shielding is not connected to the A, B or SH potentials.
8. It is necessary to keep the linear connection of the HAKEL RS485 ISOLGUARD bus, it is not possible to create branch lines, i.e. the "star" wiring is not allowed.

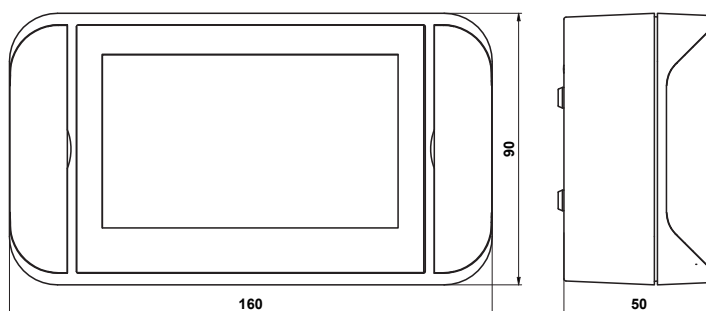
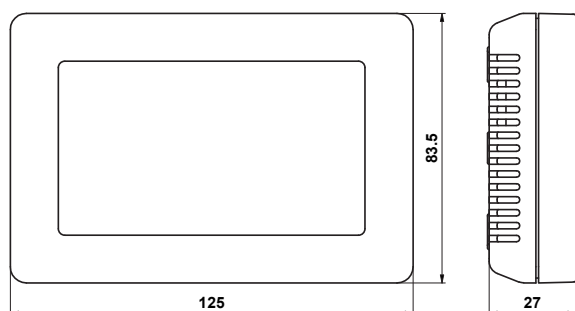


MDS-D, MDS-D/IP66

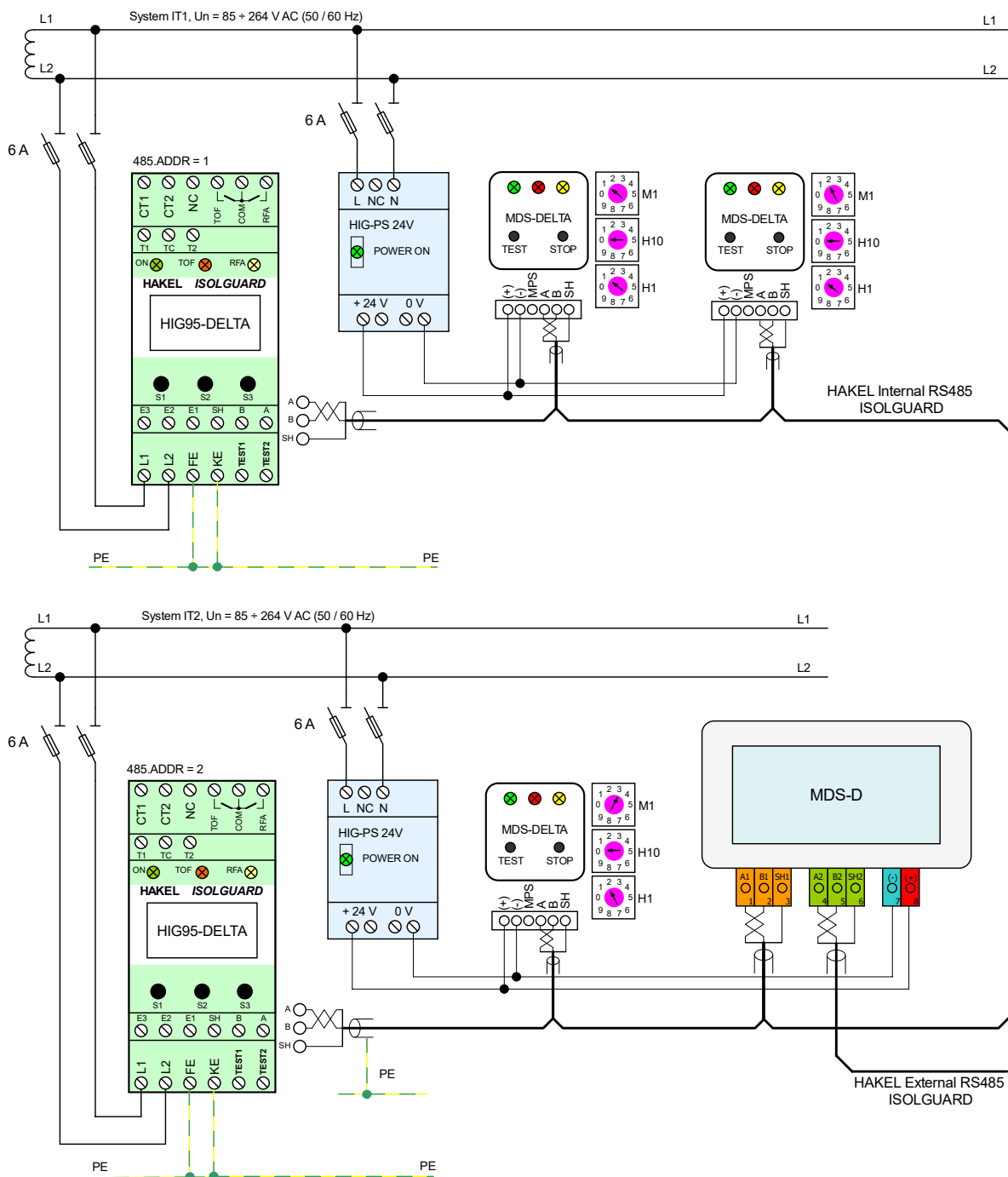
- Remote monitoring modules for medical staff to supervisory workplaces.
- Display the status of ungrounded IT power supply systems monitored by HAKEL insulation monitoring devices (IMDs).
- Display the current insulation status, or current and temperature overload of the isolating transformer.
- Modules are equipped with a STOP ALARM button to stop the acoustic fault signaling.
- Modules are equipped with a TEST button to initiate testing of signalization and internal circuits of the IMD.
- Remote monitoring modules meet the standard requirements relating to supervision signalization of the medical insulated power supply system included in the medical premises of group 2. This includes acoustic and optical signaling also.
- Versions are available for surface mounting and also onto a switch box.
- **Designed according to standards:** IEC 61557-8:2014; IEC 61557-8:2014 annex A; IEC 61000-6-2:2005; IEC 61000-6-3:2006; IEC 60664-1:2007
- **Application standards:** HD 60364-7-710:2012

Type		MDS-D	MDS-D/IP66
Designed for insulation monitor		HIG95, HIG95+, HIG95-DELTA	
Power source		External power supply SELF 24 V DC	
Nominal supply voltage DC	U _s	24 V	
Visual signaling of insulation fault		Yes	
Visual signaling of thermal and current overload of the isolating transformer		Yes	
Acoustic fault signaling		Yes	
Maximum number of connectable insulation level monitors		24	
Degree of protection		IP20	IP66
Operating temperature	θ	-5 ÷ 55 °C	
Method of connecting the insulation condition monitor		RS485 bus (ISOLGUARD protocol)	
Recommended cross-section of connected conductors	S	0.25 ÷ 0.75 mm ²	
Power consumption	P	2 VA	
Article number		70 060	70 061

Note: The images and drawings on the page are in the same order as in the table.



Application wiring diagram (installation) of MDS-D



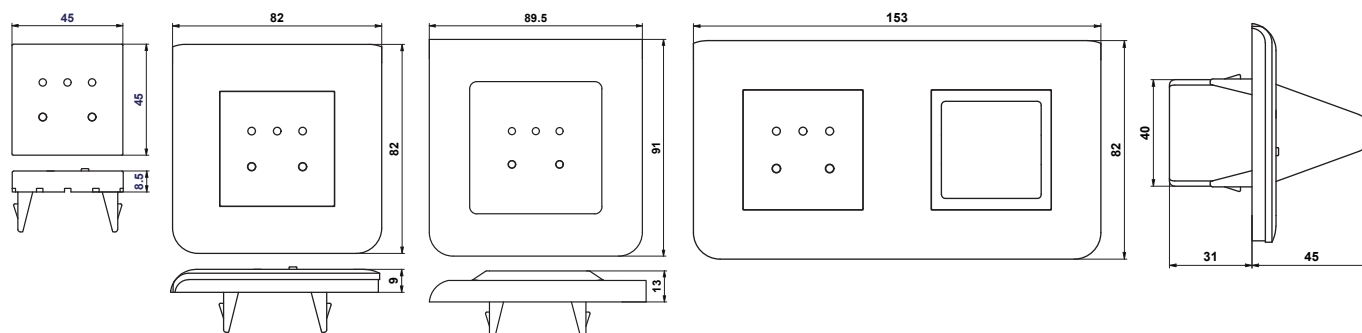


MDS-DELTA, MDS-DELTA/IP20, MDS-DELTA/IP44, MDS-DELTA/IP20+MPS

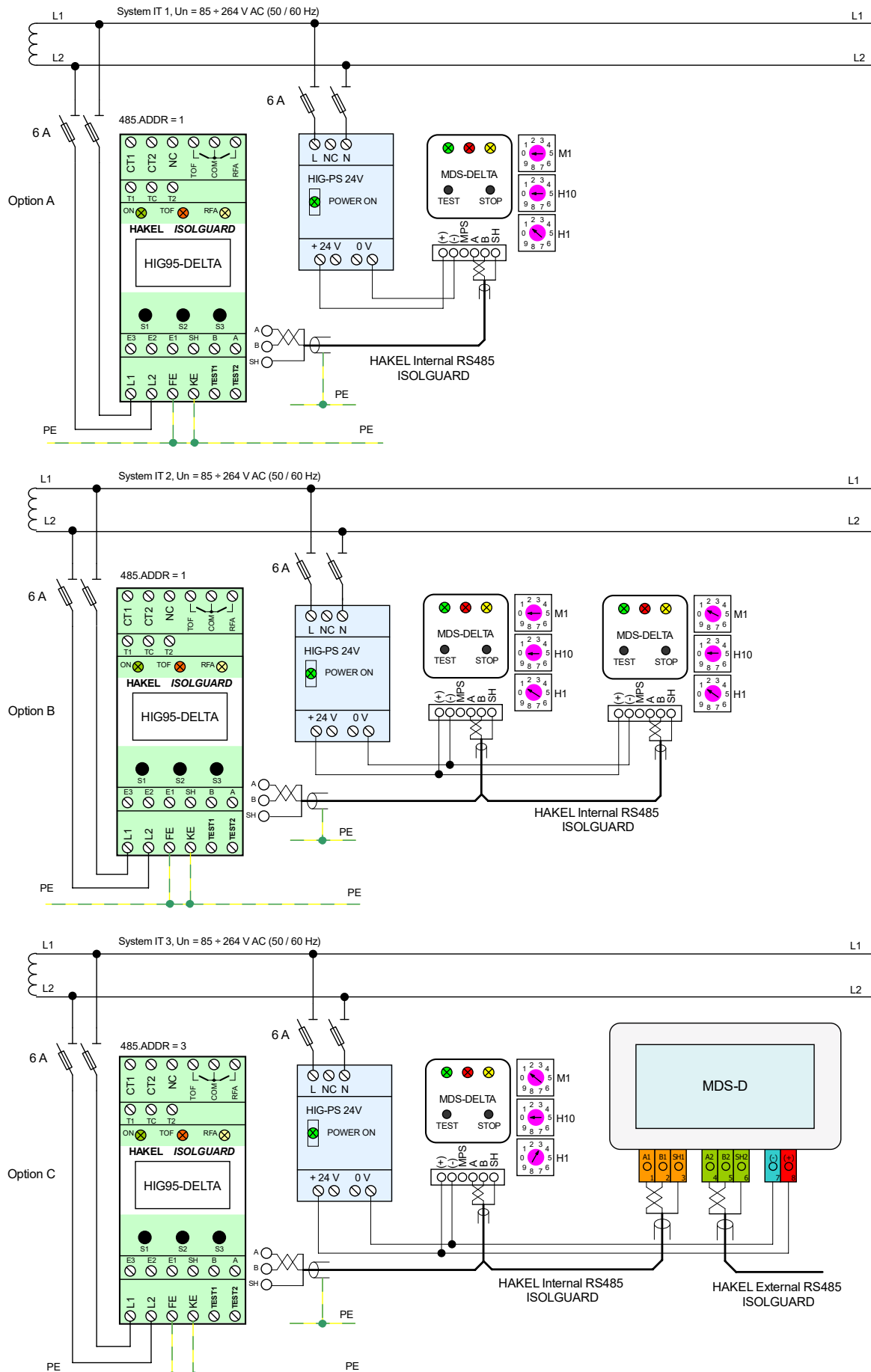
- Remote monitoring modules for medical staff to supervisory workplaces.
- Display the status of ungrounded IT power supply systems monitored by HAKEL insulation monitoring devices (IMDs).
- Display the current insulation status, or current and temperature overload of the isolating transformer.
- Modules are equipped with a STOP ALARM button to stop the acoustic fault signaling.
- Modules are equipped with a TEST button to initiate testing of signalization and internal circuits of the IMD.
- Remote monitoring modules meet the standard requirements relating to supervision signalization of the medical insulated power supply system included in the medical premises of group 2. This includes acoustic and optical signaling also.
- Versions are available for mounting onto a switch box and also in a 45 x 45 mm cable tray.
- Designed according to standards:** IEC 61557-8:2014; IEC 61557-8:2014 annex A; IEC 61000-6-2:2005; IEC 61000-6-3:2006; IEC 60664-1:2007
- Application standards:** HD 60364-7-710:2012

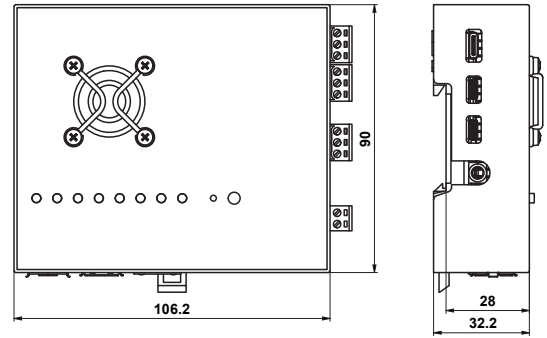
Type		MDS-DELTA	MDS-DELTA /IP20	MDS-DELTA /IP44	MDS-DELTA /IP20+MPS
Designed for insulation monitor		HIG95, HIG95+, HIG95-DELTA			
Power source		External power supply SELF 24 V DC			
Nominal supply voltage DC	U_s	24 V			
Visual signaling of insulation fault		Yes			
Visual signaling of thermal and current overload of the isolating transformer		Yes			
Acoustic fault signaling		Yes			
Maximum number of connectable insulation level monitors		1			
Degree of protection		IP20		IP44	IP20
Operating temperature	θ	$-5 \div 55^\circ\text{C}$			
Method of connecting the insulation condition monitor		RS485 bus (ISOLGUARD protocol)			
Recommended cross-section of connected conductors	S	$0.75 \div 1 \text{ mm}^2$			
Power consumption	P	0.5 VA		1.5 VA	
Article number		70 065	70 063	70 064	70 066

Note: The images and drawings on the page are in the same order as in the table.



Application wiring diagram (installation) of MDS-DELTA





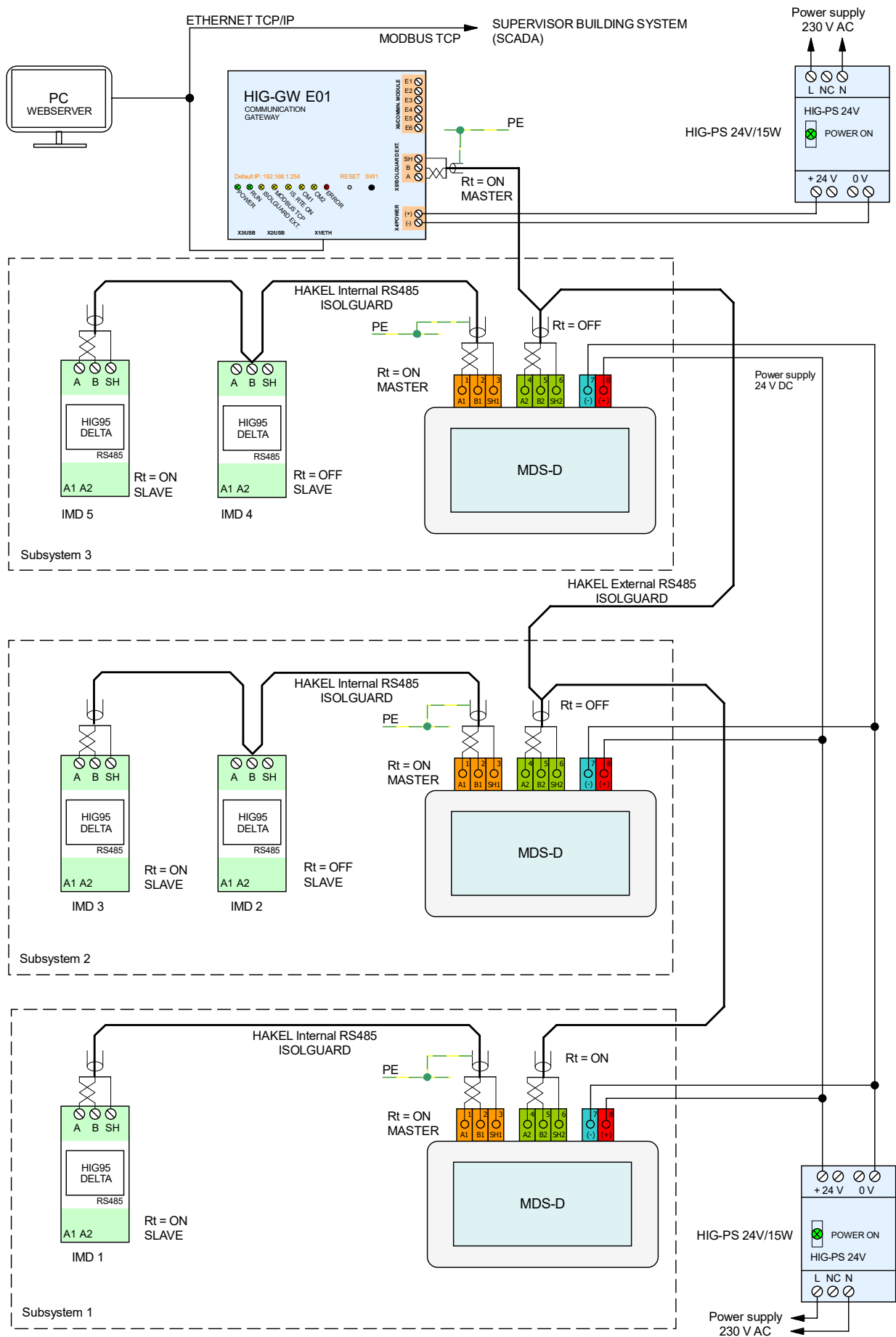
HIG-GW E01

- The HIG-GW series products are communication gateways that enable remote monitoring of the HAKEL insulation monitoring system.
- The products are connected to the External RS485 bus of the MDS-D remote signaling module and allow remote access to all devices connected to this unit.
- Visualization is prepared for users using the integrated web server (web pages). The product can therefore be accessed from any device and operating system.
- There is also the option to transfer data to another system (typically to a central intelligent building control system) using the MODBUS TCP protocol.
- **Designed according to standards:** IEC 60664-1:2007

Type		HIG-GW E01
Nominal supply voltage DC	U_s	24 V
Supply voltage range		9 ÷ 32 V
Power consumption	P	15 VA
Electrical strength against internal circuits		1 500 V
Power source		External power supply SELF 24 V DC
Supported module of distant signalisation (MDS)		MDS-D
Communication interface for user		Ethernet bus, Webserver
Communication protocol		MODBUS TCP
Connector type		Screw terminals, RJ45
Operating temperature	ϑ	-5 ÷ 60 °C
Recommended cross-section of connected conductors	S	0.75 mm ²
Degree of protection		IP20
Installation		On DIN rail 35 mm
Article number		70 980



Application wiring diagram (installation) of HIG-GW E01





Testing resistor 47 kOhm

- The testing resistor with a nominal value of 47 k Ω is used to create a well defined fault of insulation resistance of a single-phase isolated IT power supply system.
- The use of the resistor meets the requirements for testing the response value of insulation monitoring devices in healthcare.
- The resistor creates a symmetrical fault of the insulation resistance.
- **Designed according to standards:** IEC 61557-8:2014 annex A
- **Application standards:** HD 60364-7-710:2012

Type		Testing resistor 47 kOhm
Rated operating AC voltage	U_N	230 V
Internal DC resistance	R_i	47 k Ω
Measuring input's internal impedance	Z_i	47 k Ω
Tolerance		1 %
Article number		70 110



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Insulation Monitoring

The Insulation Monitoring Devices are designed to detect a drop in insulation resistance. These devices signal a drop in insulation resistance by a visual or acoustic signal.

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Remote signalling modules for healthcare

Remote signalling modules are connected to insulation monitoring devices intended for healthcare and meet the requirements for acoustic and optical signalling. While the acoustic signalling can be switched off, the visual signalling cannot be stopped. In addition, they contain a button for a remote testing of the insulation monitoring device.

Designed for insulation monitor

Maximum number of connectable insulation level monitors

Degree of protection

☐ HIS71

☐ HIS75

☐ HIG95

☐ HIG95+

☒ HIG95-DELTA

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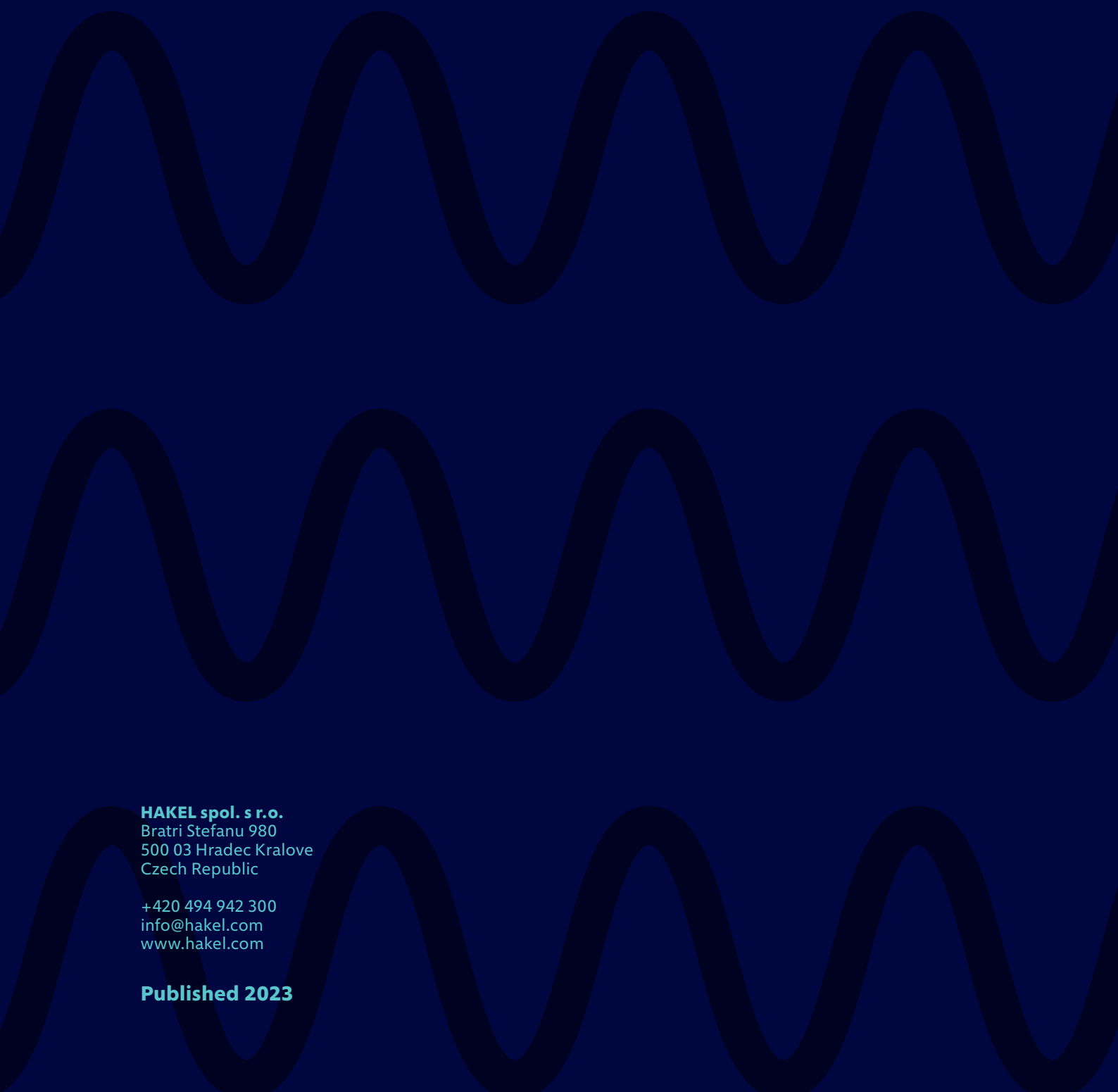
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