



PRODUCTS FOR TRACTION SYSTEMS AND VEHICLES

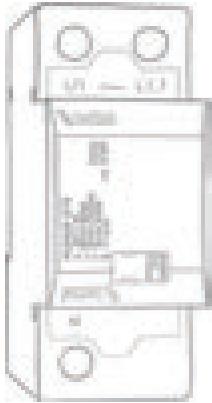


Surge
Protection
Device



Insulation
Monitoring
Device

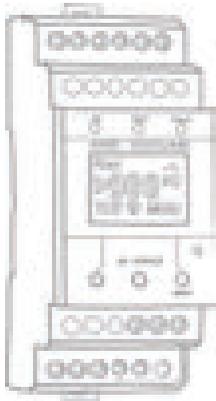
Surge protection devices



We develop and install into these applications

- ⚡ industry, waterworks, power stations
- ⚡ hospitals
- ⚡ pipelines, earthing systems
- ⚡ banks, administrative buildings
- ⚡ photovoltaic systems
- ⚡ residential houses, family houses
- ⚡ railways, traction systems, urban transport
- ⚡ special applications

Insulation monitoring devices



We develop and install into these applications

- ⚡ hospitals and medical IT systems
- ⚡ security and communication technology
- ⚡ ironworks, rolling-mills
- ⚡ mining industry
- ⚡ pipelines
- ⚡ traction IT systems
- ⚡ railway vehicles
- ⚡ special applications

Hakel is a dynamic company which since foundation in 1994 has quickly developed in terms of turnover and the product assortment. This dynamism can also be observed in the approach to developing the quality of the manufacturing products.

Hakel's experience in the use of power electronics in industry, is related to its leading position in the Czech Republic and Europe. Hakel produces and exports to all countries and all continents.

The insulation monitoring devices offered by the company are used for easy application in ungrounded IT power supply systems in metallurgy, civil engineering, shipbuilding, in hospitals and the transport environment.



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.

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 systems is still operational
- Higher safety of operation
 - Immediate overview of network 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.

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IMD - INSULATION MONITORING DEVICE



The insulation monitoring devices HIG93T, HIG93T/L, HIG93T/N, produced by HAKEL for the ISOLGUARD series, are designed for monitoring the insulation resistance of single-phase and 3-phase ungrounded IT power supply systems for traction systems and vehicles.

TL*T serves for the adaption of IMD circuits to 3-phase ungrounded IT power supply system 3 x 400 V AC or 3 x 500 V AC. Devices are designed for use in rail vehicles.



SPD - SURGE PROTECTION DEVICE



PIIM-275/3+1 is a surge arrester Type 2+3 according to EN 61 643-11 ed.2 (IEC 61 643-11:201 1). It consists of metal oxide varistors combined with a gas discharge tube providing zero leakage current in the PE conductor. It's parameters allow complex use. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 and higher according to EN 62305 ed.2 (IEC 62305-2010). They are to be placed into subsidiary switchboards, control boxes or charging stations of electrical vehicles. They can also be used in installations for the protection of automatic railway crossings, traction traffic lights and information panels.



Power source from traction system
600 - 750 VDC/24 VDC (230 VAC)

PSB

Surge arrester
varistor
TYPE 2

PIIM-1000 VDC

Surge arrester
Varistor + gas discharge tube
TYPE 3

PI-k32/24 VDC



Insulation monitoring
devices for traction
systems and vehicles
+ Inductors for traction
systems and vehicles

HIG93T + TL500T
(or by power system type)



Voltage
limiting
device - VLD
HL120

Prague Main Railway Station



PIVM12,5-275/3+1 is a lightning and surge arrester Type 1+2 according to EN 61643-11 ed.2 (IEC 61643-11:2011). It consists of metal oxide varistors combined with gas discharge tube providing zero leakage current in the PE conductor. It's parameters allow use in buildings with the considered LPL III and LPL IV, such as small office buildings, residential buildings, family houses and objects and halls without the presence of persons and interior equipment. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0 - 1 and higher according to EN 62305 ed.2 (IEC 62305:2010) as close as possible to the cable entry to the building - main switchboards. They can also be used in charging stations of electrical vehicles or installations for the protection of automatic railway crossings, traction traffic lights and information panels.



VLD - VOLTAGE LIMITING DEVICE



HL120 is a voltage limiting device (VLD acc. to EN 50122-1 ed. 2) intended for the protection of non-live parts of metal structures in AC or DC traction systems. It is used for the effective protection of people who might come into contact with these parts during a lightning stroke or in the case a fault of traction lines.



Lightning and surge arrester
varistor + gas discharge tube
TYPE 1+2
PIVM12,5-275/3+1
Surge arrester
varistor + gas discharge tube
TYPE 2
PIIM-275/3+1

Insulation monitoring
devices
HIG99

SPD
TYPE 1 - TN/IT
(by power system type)

SPD
TYPE 1+2 - TN/IT
(by power system type)

Inductors
TL400
(by nominal voltage)
Insulation monitoring
devices
HIG93

Voltage
limiting
device - VLD
HL120



IMD - INSULATION MONITORING DEVICE



The insulation monitoring device ISOLGUARD HIG24VDC/T, HIG110VDC/T, produced by HAKEL for the ISOLGUARD series, are designed for monitoring the insulation resistance of IT power supply systems with a nominal voltage of 24 V DC or 110 V DC.



SPD - SURGE PROTECTION DEVICE



PIIM-275/3+1 is a surge arrester Type 2+3 according to EN 61643-11 ed.2 (IEC 61643-11:2011). It consists of metal oxide varistors combined with a gas discharge tube providing zero leakage current in the PE conductor. It's parameters allow complex use. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 and higher according to EN 62305 ed.2 (IEC 62305-2010). They are to be placed into subsidiary switchboards, control boxes or charging stations of electrical vehicles. They can also be used in installations for the protection of automatic railway crossings, traction traffic lights and information panels.



Hradec Králové

Insulation monitoring devices for traction systems and vehicles
HIG110VDC/T
(or by power system type)



Insulation monitoring devices
HIG99



Lightning and surge varistor + gas discharge
TYPE 1+2

PIVM12,5-27

Surge arrester varistor + gas discharge
TYPE 2

PIIM-275/3+1



Voltage limiting device - VLD
HGS100 RW





PIVM12,5-275/3+1 is a lightning and surge arrester Type 1+2 according to EN 61643-11 ed.2 (IEC 61643-11:2011). It consists of metal oxide varistors combined with gas discharge tube providing zero leakage current in the PE conductor. It's parameters allow use in buildings with the considered LPL III and LPL IV, such as small office buildings, residential buildings, family houses and objects and halls without the presence of persons and interior equipment. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0 - 1 and higher according to EN 62305 ed.2 (IEC 62305:2010) as close as possible to the cable entry to the building - main switchboards. They can also be used in charging stations of electrical vehicles or installations for the protection of automatic railway crossings, traction traffic lights and information panels.



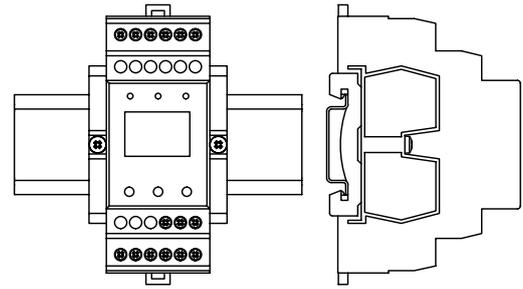
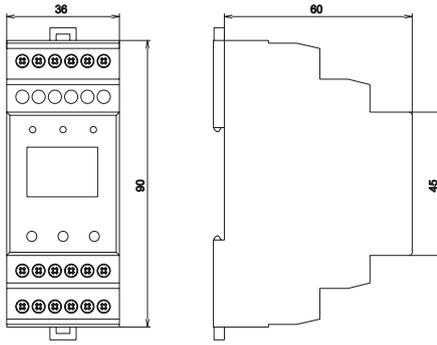
VLD - VOLTAGE LIMITING DEVICE



HGS100 RW - it is range of voltage limiters designed for overvoltage protection of personnel and equipment in DC and AC rail traction systems. It is recommended to install this limiter between the current return path and non-electrified parts of structures laying adjacent to the rails.



Insulation monitoring devices for traction systems and vehicles



Mounting for traction systems acc. EN 50155

ISOLGUARD insulation monitoring devices HIG93T, HIG93T/L, HIG93T/N

The insulation monitoring devices HIG93T, HIG93T/L, HIG93T/N, produced by HAKEL for the ISOLGUARD series, are designed for monitoring the insulation resistance of single-phase and 3-phase ungrounded IT power supply systems for traction systems and vehicles.

Enables monitoring of single-phase and 3-phase ungrounded IT power supply systems up to the maximum operating voltage 275 V AC. If monitoring the insulation resistance 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 inductor TL400T (Art. number 70514) or TL500T inductors (Art. number 70515). Such a created artificial centre is connected to the terminal of insulation monitoring device HIG93T, HIG93T/L, HIG93T/N.

The insulation monitoring devices displays 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 are used to display the status of the checked network.

HIG93T, HIG93T/L, HIG93T/N insulation monitoring devices can communicate with the master computer via the RS485 bus with the protocol derived from the PROFIBUS protocol. Description of the protocol is available on request.

Two inbuilt signalling relays with switching contacts enable alarm signalling for two independently set values of critical insulation resistance. The insulation monitoring device has an optional alarm memory function with the option to terminate the alarm using the button on the insulation monitoring device. Local and remote testing of the insulation monitoring device function can be done.

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

Basic characteristics

- The monitor of insulating resistance of AC networks with the voltage 0 to 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 k Ω to 900 k Ω or 0,1 k Ω to 90 k Ω
- Separated supply voltage enables to monitor a system which is not under voltage
- Signalling relay of the status of the insulating resistance with the switching contact
- Connection to the RS485 bus, insulation strength 2500 V_{rms} against internal circuits and network circuits
- Optional memory of the activated alarm with option unblocking by button on the insulation monitoring device
- Option to set the monitored value of the insulating resistance R_{CRIT} using the display and buttons within the range according to the type of insulation monitoring device
- Adjustable hysteresis of the limit value of the insulating resistance within the range 0 to 100 %
- Adjustable delay t_{ON} response of signalling relay using the displays and buttons 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
- Module width 2M for mounting on DIN rail 35. The package contains a side plate to ensure the product's stability to vibrations

HIG93T, HIG93T/L, HIG93T/N complies with the requirements of the standards:

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)

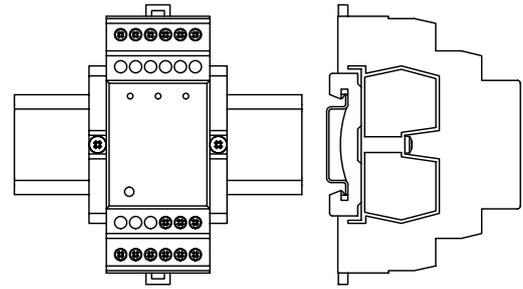
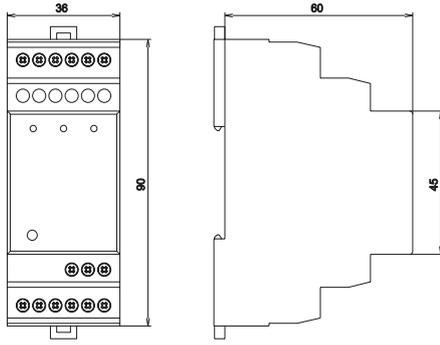
EN 45545-2 Railway applications - fire protection on railway vehicles

EN 50121-3-2 Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus

technical characteristics

Type		HIG93T	HIG93T/L	HIG93T/N
Supply voltage range	U_n	90 to 264 V AC or 90 to 370 V DC		18 to 28 V DC
Maximum IT power supply system operating voltage	U_{it}	275 V AC		
Power consumption	P	max. 5 VA		
Measuring voltage	U_M	12 V DC		
Measuring current	I_M	< 0,6 mA		
Alternate internal resistance of the measuring input	Z_i	> 220 k Ω		
Displayed values range of insulation resistance	R_{isol}	5 k Ω to 900 k Ω	0,1 k Ω to 90 k Ω	5 k Ω to 900 k Ω
Measuring accuracy	5 k Ω ... 10 k Ω	2 k Ω	---	2 k Ω
	10 k Ω ... 900 k Ω	$\pm 10 \%$		$\pm 10 \%$
Measuring accuracy	0,1 k Ω ... 10 k Ω	---	0,2 k Ω	---
	10 k Ω ... 90 k Ω		$\pm 10 \%$	
Critical insulation resistance	R_{crit}	adjustable 5 k Ω to 300 k Ω	adjustable 0,1 k Ω to 90 k Ω	adjustable 5 k Ω to 300 k Ω
Insulation resistance hysteresis	R_{hyst}	adjustable 0 to +100 % R_{crit}		
Delay in response for signalling the insulation status	t_{ON}	adjustable 0 to 60 sec.		
Outputs				
Signalling potential-free switching contact relay 1, relay 2		250 V AC / 1 A		
Electric strength to the internal circuits		3750 V _{rms}		
Electric strength to the supply circuits		3750 V _{rms}		
Remote monitoring		RS485 line		
Communication line: RS485 type MASTER-SLAVE, 9600 Bd, even count parity		Yes		
Insulating strength to the internal circuits and system circuits		2500 V _{rms}		
General data				
Degree of protection according to EN 60 529		IP20		
Weight	m	160 g		
Housing material		PA66-UL94 V0 according to EN 45545		
Method of assembly		DIN rail 35 mm, the product must be fasten by means of the enclosed side plates		
Recommended section of connected conductors	S	1 mm ²		
Category according to EN 61373		1, Class B		
Article number		70 927	70 927/L	70 927/N
Operating conditions				
Operating temperature		- 25 °C ÷ + 60 °C		
Atmospheric pressure		86 kPa to 106 kPa		
Operating position		any		
External magnetic and electric field		according to EN 61326-2-4		
Category over-voltage / testing voltage		III according to EN 60664-1		
Pollution degree		2 according to EN 60664-1		
Operation mode		permanent		

Insulation monitoring devices for traction systems and vehicles



Mounting for traction systems acc. EN 50155

ISOLGUARD insulation monitoring devices HIG93T/24, HIG93T/24L

The insulation monitoring devices HIG93T/24, HIG93T/24L, produced by HAKEL for the ISOLGUARD series, are designed for monitoring the insulation resistance of single-phase and 3-phase ungrounded IT power supply systems for traction systems and vehicles.

It enables monitoring of single-phase and 3-phase ungrounded IT power supplies systems up to the maximum operating voltage 275 V AC. If the insulation resistance monitoring 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 TL400T or TL500T inductors produced by HAKEL. Such a created artificial centre is connected to the terminal of insulation monitoring device HIG93T/24, HIG93T/24L.

There are LED diodes for signalling the status of monitored power supply system and the device.

HIG93T/24, HIG93T/24L devices are equipped with RS485 communication line and can communicate with the master computer via RS485 bus with the protocol based on the PROFIBUS protocol. Description of the protocol is available on request.

Two inbuilt signalling relays with switching contacts enable alarm signalling for two independently set values of critical insulation resistance. The insulation monitoring device has an optional alarm memory function with the option to terminate the alarm using the button on the insulation monitoring device. Local and remote testing of the insulation monitoring device function can be done.

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

Basic characteristics

- The monitor of insulating resistance of AC networks with the voltage 0 to 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 k Ω to 900 k Ω or 0,1 k Ω to 90 k Ω
- Isolated supply voltage 24 V DC enables to monitor a system which is not under voltage
- Signalling relay of the status of the insulating resistance with the switching contact
- Connection to the RS485 bus, insulation strength 2500 V_{rms} against internal circuits and network circuits
- Option to set the monitored value of the insulating resistance R_{CRIT} using RS485 bus
- Adjustable hysteresis of the limit value of the insulating resistance within the range 0 to 100 % using RS485 bus
- Adjustable delay t_{ON} response of signalling relay using RS485 bus within the range 0 to 60 sec
- Module width 2M for mounting on DIN rail 35. The package contains a side plate to ensure the product's stability to vibrations

HIG93T/24, HIG93T/24L complies with the requirements of the standards:

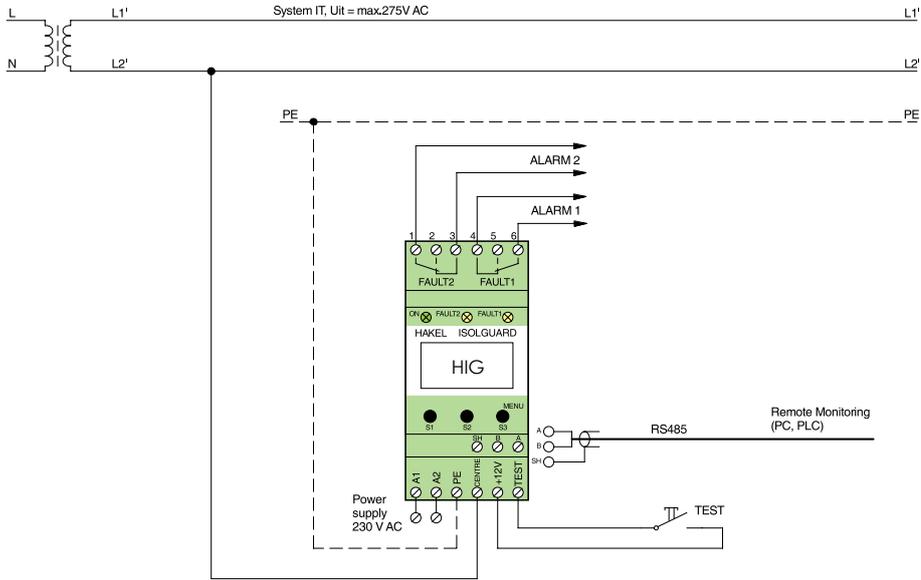
- EN 50155 Railway applications - electronic equipment used on rolling stock (IEC 60571)
- EN 61373 Railway applications - rolling stock equipment - shock and vibration test (IEC 61373)
- EN 45545-2 Railway applications - fire protection on railway vehicles
- EN 50121-3-2 Railway applications - Electromagnetic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

technical characteristics

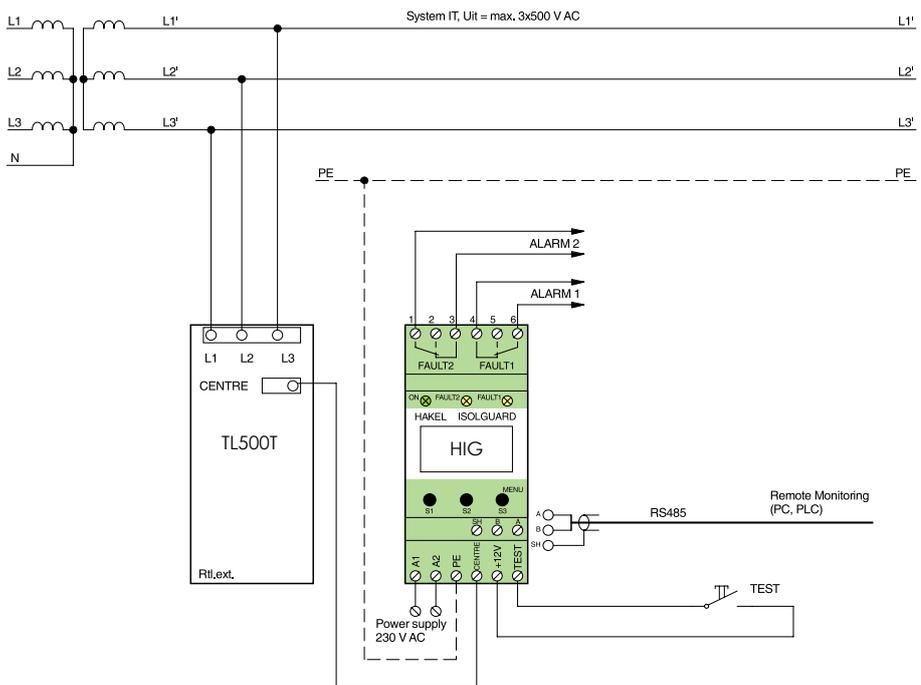
Type		HIG93T/24	HIG93T/24L
Supply voltage range	U_n	12 ÷ 28 V DC	
Maximum IT power supply system operating voltage	U_{if}	275 V / 50 Hz	
Power consumption	P	max. 5 VA	
Measuring voltage	U_M	12 V DC	
Measuring current	I_M	< 0,6 mA	
Alternate internal resistance of the measuring input	Z_i	> 220 k Ω	
Displayed values range of insulation resistance	R_{isol}	5 k Ω to 900 k Ω	0,1 k Ω to 90 k Ω
Measuring accuracy		2 k Ω $\pm 10\%$	---
Measuring accuracy		---	0,2 k Ω $\pm 10\%$
Critical insulation resistance	R_{crit}	adjustable 5 k Ω to 300 k Ω	adjustable 0,1 k Ω to 90 k Ω
Insulation resistance hysteresis	R_{hyst}	adjustable 0 to +100 % R_{crit}	
Delay in response for signalling the insulation status	t_{ON}	adjustable 0 to 60 sec.	
Outputs			
Signalling potential-free switching contact relay 1, relay 2		250 V AC / 1 A	
Electric strength to the internal circuits		3750 V _{rms}	
Electric strength to the supply circuits		3750 V _{rms}	
Remote monitoring		RS485 line	
Communication line: RS485 type MASTER-SLAVE, 9600 Bd, even count parity		Yes	
Insulating strength to the internal circuits and system circuits		2500 V _{rms}	
General data			
Degree of protection according to EN 60 529		IP20	
Weight	m	160 g	
Housing material		PA66-UL94 V0 according to EN 45545	
Method of assembly		DIN rail 35 mm, the product must be fasten by means of the enclosed side plates	
Recommended section of connected conductors	S	1 mm ²	
Category according to EN 61373		1, Class B	
Article number		70 927/24	70 927/24L
Operating conditions			
Operating temperature		- 25 °C ÷ + 60 °C	
Atmospheric pressure		86 kPa to 106 kPa	
Operating position		any	
External magnetic and electric field		according to EN 61326-2-4	
Category over-voltage / testing voltage		III according to EN 60664-1	
Pollution degree		2 according to EN 60664-1	
Operation mode		permanent	

Recommended connection of HIG93T, HIG93T/L to monitored ungrounded IT power supply system

1-phase ungrounded IT power supply system, module HIG93T, HIG93T/L with the signalling of the alarm and remote testing button

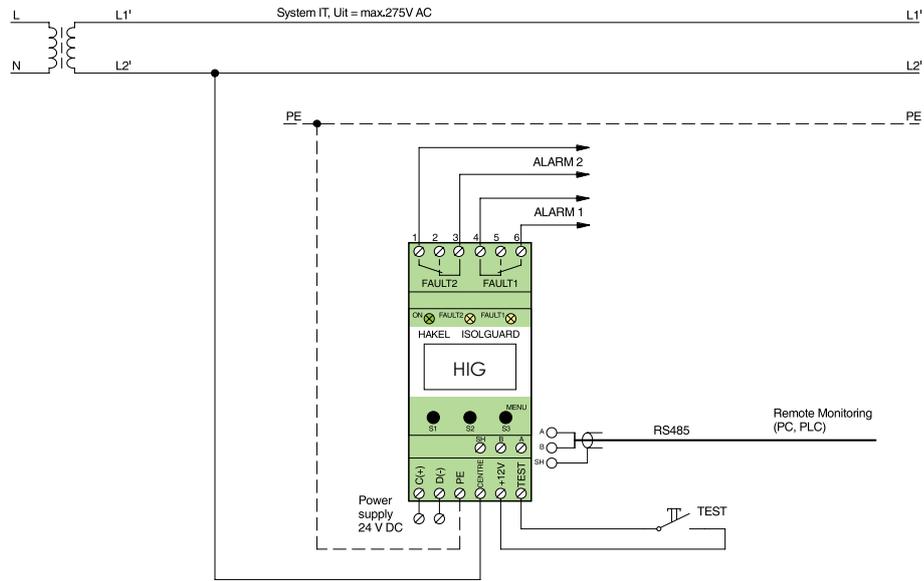


3-phase ungrounded IT power supply system (3x440 V AC), module HIG93T, HIG93T/L with signalling of the alarm and remote testing button

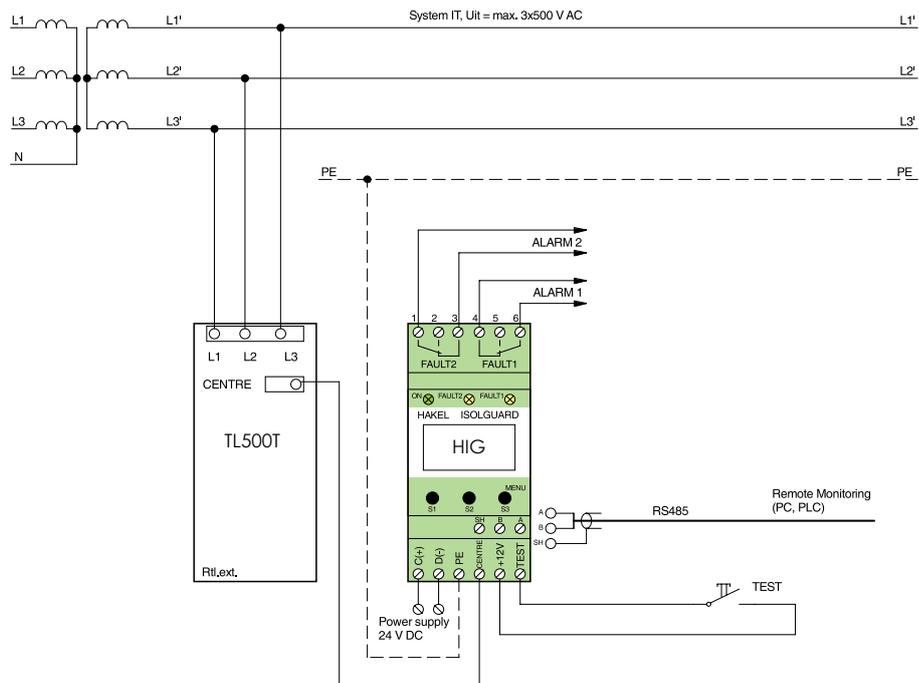


Recommended connection of HIG93T/N, HIG93T/24, HIG93T/24L to monitored ungrounded IT power supply system

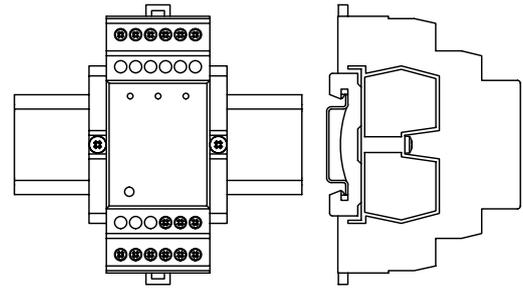
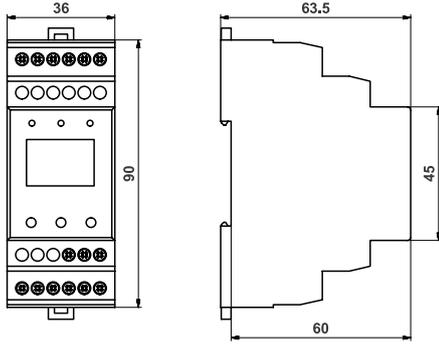
1-phase ungrounded IT power supply system, module HIG93T/N, HIG93T/24, HIG93T/24L with the signalling of the alarm and remote testing button



3-phase ungrounded IT power supply system (3x440 VAC), module HIG93T/N, HIG93T/24, HIG93T/24L with signalling of the alarm and remote testing button



Insulation monitoring devices for traction systems and vehicles



Mounting for traction systems acc. EN 50155

ISOLGUARD insulation monitoring device HIG24VDC/T, HIG110VDC/T

The insulation monitoring device ISOLGUARD HIG24VDC/T, HIG110VDC/T, produced by HAKEL for the ISOLGUARD series, are designed for monitoring the insulation resistance of IT power supply systems with a nominal voltage of 24 V DC or 110 V DC. The devices continuously monitors the insulation resistance of the positive and negative output of an insulation power supply system against the base point. For stationary devices base point usually is PE conductor. The potential free switching contact of the signalization relay will switch during the insulation resistance decrease of + or – output. A fault is also indicated by LEDs on the front panel.

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 network and the device itself.

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

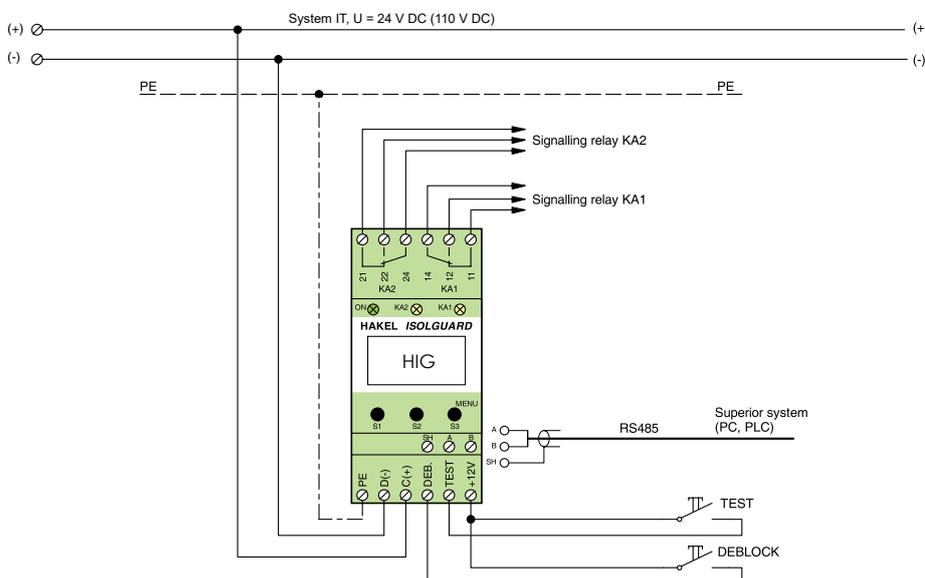
Basic characteristics

- The monitor for insulating resistance of DC systems with the nominal voltage 24 V DC or 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 on the insulation monitoring device
- 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 width 2M for mounting on DIN rail 35. The package contains a side plate to ensure the product's stability to vibrations

HIG24VDC/T, HIG110VDC/T complies with the requirements of the standards:

- 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

Recommended connection of HIG24VDC/T or HIG110VDC/T to ungrounded IT system with TEST and DEBLOCK remote buttons

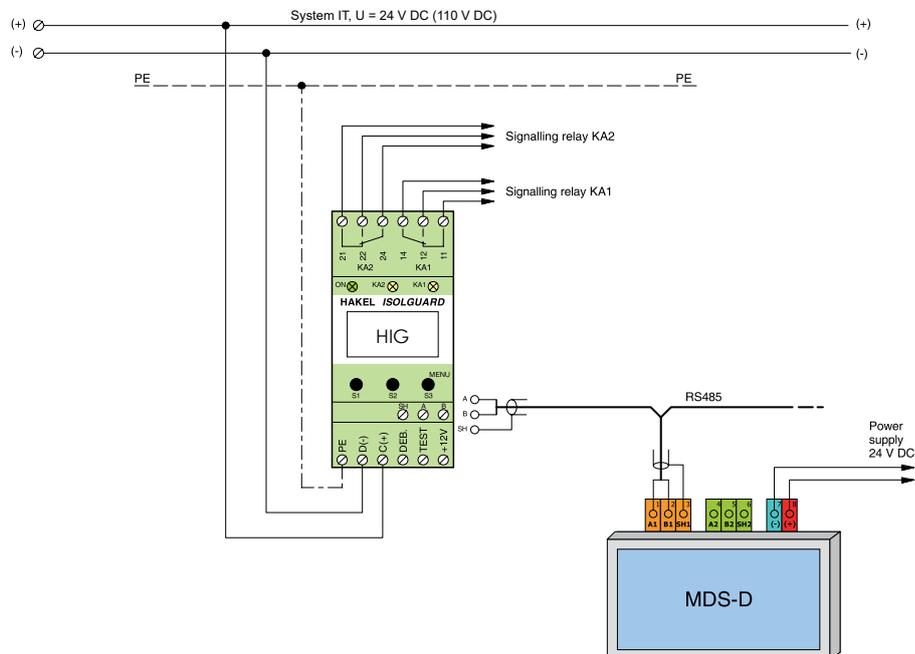


technical characteristics

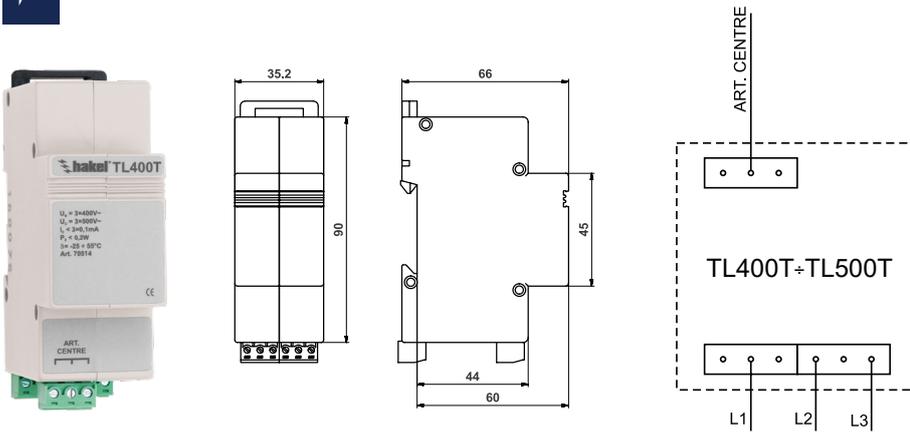
Type		HIG24VDC/T	HIG110VDC/T
Maximum operating voltage of the monitored ungrounded IT power supply system	U_{if}	12 ÷ 28 V DC	80 ÷ 120 V DC
Consumption	P	max. 2 VA	
Internal impedance of the measuring input	R_i	> 200k Ω	
Displayed values range of insulation resistance	R_{isol}	5 k Ω ÷ 990 k Ω	
Measuring accuracy		± 10%	
Critical insulation resistance	R_{crit}	adjustable 5 k Ω ÷ 500 k Ω	
Insulation resistance hysteresis	R_{hyst}	adjustable 0 ÷ +100 % R_{crit}	
Delay in response for signalling the insulation status	t_{ON}	adjustable 0 ÷ 60 sec, with the step 1 sec	
Outputs			
Signalling relay KA1 Potential-free switching contact: Electric strength against internal circuits and supply circuits		250 V AC / 1 A 3750 V _{rms}	
Signalling relay KA2 Potential-free switching contact: Electric strength against internal circuits and supply circuits		250 V AC / 1 A 3750 V _{rms}	
Communication line: RS485 type MASTER-SLAVE, 9600 Bd, even parity Insulating strength against internal circuits		Yes 2500 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	
Article number		70 933/T	70 934/T

Operating conditions	
Working temperature	- 25 °C ~ + 70 °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
Level of pollution	2 according IEC 60664-1:2007
Type of operation	permanent

Recommended connection of HIG24VDC/T or HIG110VDC/T to ungrounded IT system with MDS-D remote control panel



Inductors for traction systems and vehicles



Inductors TL400T, TL500T

TL*T serves for the adaptation of IMD circuits to 3-phase ungrounded IT power supply system 3 x 400 V AC or 3 x 500 V AC. Devices are designed for use in rail vehicles.

Type		TL400T	TL500T
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
Housing material		LATAMID 6H-V0 according to EN 45545-2	
Weight	m	330 g	
Art. number		70 514	70 515

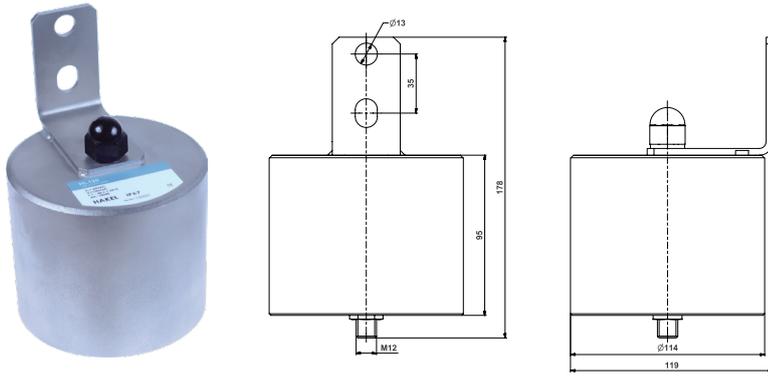
TL400T - TL500T series complies with the requirements of the device standards:

EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use

- Part 1: general requirements (IEC 61010-1)

EN 45545-2 Railway applications - fire protection on railway vehicles

Voltage limiting device – VLD

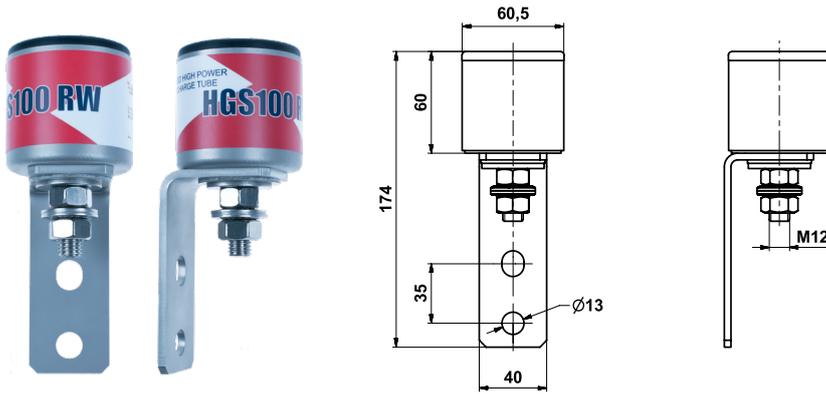


HL120* is a voltage limiting device (VLD acc. to EN 50122-1:2011) intended for the protection of non-live parts of metal structures in AC or DC traction systems. It is used for the effective protection of people who might come into contact with these parts during a lightning stroke or in the case a fault of traction lines. HL is installed directly on the protected construction structure (using two M12 bolts) so that if it is activated it creates a conductive connection between this structure and the tracks. The principle of the HL construction is based on the parallel connection of three non-linear elements (1 high power metal oxide varistor MOV plus 2 high-performance thyristors) built into a stainless steel cover. If the HL is activated by lightning current or current from the contact of the protected metal structure with for example a fallen trolley line, this current is instantly shorted to the track by the fast reaction of the MOV (the standardly given time of its reaction is 25 nsec). The maximum value of this current's amplitude may be 40 kA (10/350). For the duration of activation of the MOV a voltage protection level about 500 V is formed on it. So that the heat released in the MOV does not damage its structure, a delay element is built into the HL hardware which for approximately 1 msec ignites both the built-in high performance thyristors, and this moment is derived from the VPL on the varistor. According to the polarity of voltage on the MOV, the relevant thyristor from the built-in pair is activated and it takes up current which to that time have been conducted by the activated MOV. Depending on the immediate current value of the passing current, the voltage level on this thyristor can be in the range 1÷3 V. If the arising activation current is significantly lower than the maximum working current of the used thyristor, this process can last up to tens of seconds (for the HL120 this process is characterised by the typical value 105 A/60 min... reversibly), which corresponds to the charge passing through of 378 000 Asec. A large power loss is on the thyristor for the time of its activation, and so the construction of the HL sleeve is based on the principle of conducting the released heat to its metal outer casing and then via this casing to the construction building structure. One important requirement of the HL is the assumption of the creation of an internal short circuit in the case of the voltage, current or heat overloading of the built-in MOV, which is met in the case of the HL internal construction described above.

Advantages - vandal resistant, weather proof, long lifetime

Type	HL120
Class to EN 50526-2	2.2
Maximum withstand voltage U_w	60 VAC
Maximum spark voltage U_s	120 VDC
Nominal short-term withstand current	4,7 kA / 0,023 sec (repeatable)
	20 kA / 0,1 sec (unrepeatable)
Reversible current I_{rev}	105 A / 60 min
Technical data of built-in metal-oxide varistors acc. to EN 61643-11:2012 and EN 60099-4:2014	
Nominal discharge current I_n	40 kA (8/20 μ s)
Lightning impulse current I_{imp}	40 kA (10/350 μ s)
Maximum operational voltage U_c	115 VAC
Varistor voltage $U_v@1mA$	180 VDC
Voltage protection level U_p at nominal discharge current I_n	500 V
Operating conditions:	
Temperature	-40°C to + 55°C
Tightening torque	16 Nm
Height above sea level	without restriction
Protection type	IP 67
Weight / Dimensions	c. 4,65 kg / \varnothing 114 mm, l = 95 mm
Article number	10 240

Low voltage limiter for railway application



HGS100 RW 250V, HGS100 RW

It is range of voltage limiters designed for overvoltage protection of personnel and equipment in DC and AC rail traction systems. It is recommended to install this limiter between the current return path and non-electrified parts of structures laying adjacent to the rails. Internal construction of HGS is based at application of high power gas-filled gas discharge tube (GDT), which is built in to stainless steel box. In case of overvoltage, HGS100 RW generates a durable conductive path between the overloaded area and the railway's substation. This results in increased current loads that are sensed at the substation, tripping the safety switch and thus protecting personnel and equipment. In addition, all overvoltages generated by lightning are effectively limited by Hake!s internal construction of HGS100 RW. All requirements given by EN 50122-1 and EN 61643-11 relating to electrical safety earthing for this specific use are also fulfilled.

Type	HGS100 RW 250V	HGS100 RW
Examinations according to	EN 61643-11, EN 50122-1	
DC Spark-Over Voltage ¹⁾	250 V	500 V
AC Spark-Over Voltage	> 250 V _{rms}	
Impulse Spark-Over Voltage at 5 kV/μs - for 99% of measured values (wave 1,2/50 μs, 6 kV)	< 1200 V	
Max. Impulse Discharge Current I _{max} (8/20 μs)	200 kA	
Nominal Impulse Discharge Current I _n (8/20 μs)	100 kA	
Max. Lightning Impulse Current I _{imp} (10/350 μs)	150 kA	
Charge	75 As	
Specific Energy	5500 kJ/Ω	
Rated withstand current	up to 8 kA _{rms} / 100 msec (AC - mode) up to 20kA / 30 msec (DC - mode)	
Behaviour after substantial overloading	internal short circuit inside HGS body	
Insulation Resistance at 100 VDC	> 1 GΩ	
Capacitance at 1 MHz	< 35 pF	
Housing	IP66	
Operating and Storage Temperature	- 40 ÷ + 90°C	
Weight	950 g	
Climatic Category (IEC 60068-1)	40/90/21	
Article number	10 003	10 002

¹⁾ In ionised mode

Terms in accordance with ITU-T Rec. K-12, DIN 57845/VDE 0845 and EN 61643-11:2002

recommended HAKEL products for TN supply system

1) switchboard can be equipped

TYPE 1+2



HLSA12,5-275/3+0 M
 $U_C = 275 \text{ V}$
 $I_C = 50 \text{ kA (8/20)}$
 $I_{max} = 12,5 \text{ kA (10/350)}$
 $I_{imp} = 25 \text{ kA (8/20)}$
 $U_p < 1,25 \text{ kV}$
 $U_r = 337 \text{ V/5 sec}$
 3-pole arrester
 3-phases system TN-C
 $I_{total} = 37,5 \text{ kA}$
 M - replaceable module
 DS - remote monitoring (optional)

DECOUPLING
INDUCTOR



3 x PI-L xxx
 $U_N = 500 \text{ V}$
 $I_N = xxx \text{ A}$

TYPE 2+3



HSA-275/3+0 M
 $U_C = 275 \text{ V}$
 $I_C = 20 \text{ kA (8/20)}$
 $U_p < 1,2 \text{ kV}$
 3-pole arrester
 3-phases system TN-C
 $I_{max} = 50 \text{ kA}$
 M - replaceable module
 DS - remote monitoring (optional)

DECOUPLING
INDUCTOR



3 x PI-L xxx
 $U_N = 500 \text{ V}$
 $I_N = xxx \text{ A}$

TYPE 3



PI-3k xxx
 $U_C = 275 \text{ V}$
 $I_N = (xxx) \text{ A}^*$
 $U_{OC} = 6 \text{ kV}$
 $U_p < 850 \text{ V}$

TYPE 3



P-3k230
 $U_C = 275 \text{ V}$
 $U_{OC} = 6 \text{ kV (8/20)}$
 $U_p < 1,2 \text{ kV}$

2) switchboard can be equipped

TYPE 1+2



HLSA25-275/3+0
 $U_C = 275 \text{ V}$
 $I_C = 50 \text{ kA (8/20)}$
 $I_{max} = 25 \text{ kA (10/350)}$
 $I_{imp} = 25 \text{ kA (8/20)}$
 $U_p < 1,2 \text{ kV}$
 $U_r = 337 \text{ V/5 sec}$
 3-pole arrester
 3-phases system TN-C
 $I_{total} = 150 \text{ kA}$
 $I_{V^{11}} = \text{connection } 125 \text{ A}$
 DS - remote monitoring (optional)

DECOUPLING
INDUCTOR



3 x PI-L xxx
 $U_N = 500 \text{ V}$
 $I_N = xxx \text{ A}$

TYPE 3



PI-3k xxx
 $U_C = 275 \text{ V}$
 $I_N = (xxx) \text{ A}^*$
 $U_{OC} = 6 \text{ kV}$
 $U_p < 850 \text{ V}$

TYPE 3



P-3k230
 $U_C = 275 \text{ V}$
 $U_{OC} = 6 \text{ kV (8/20)}$
 $U_p < 1,2 \text{ kV}$

1) switchboard can be equipped

TYPE 1+2



HLSA 21-600/3+1 M S IT
 $U_N = 500 \text{ V} / 50\text{Hz}$
 $U_C = 600 \text{ V} / 50\text{Hz}$
 $I_n = 50 \text{ kA} (8/20)$
 $I_{max} = 21 \text{ kA} (10/350)$
 $U_p < 2,5 \text{ kV}$
 M - replaceable module
 DS - remote monitoring (optional)

DECOUPLING INDUCTOR



3 x PI-L xxx
 $U_N = 500 \text{ V}$
 $I_N = \text{xxx A}$

TYPE 3



PI-k8 IT
 $U_N = 230 \text{ V} / 50\text{Hz}$
 $U_C = 275 \text{ V} / 50\text{Hz}$
 $I_N = 8 \text{ A}$
 $I_{max} = 8 \text{ kA} (8/20)$
 $U_p < 840 \text{ V}$
 DS - remote monitoring (optional)

TYPE 3



ZS 1-230 IT
 $U_N = 230 \text{ V} / 50\text{Hz}$
 $U_C = 275 \text{ V} / 50\text{Hz}$
 $I_{max} = 8 \text{ kA} (8/20)$
 $U_p < 2,2 \text{ kV}$

2) switchboard can be equipped

TYPE 1



3 x HZ110
 $U_C = 255 \text{ V}$
 $I_n = 50 \text{ kA} (8/20)$
 $U_p < 2,5 \text{ kV}$

DECOUPLING INDUCTOR



3 x PI-L xxx
 $U_N = 500 \text{ V}$
 $I_N = \text{xxx A}$

TYPE 2+3



HSA-275/3+1 M
 $U_C = 275 \text{ V}$
 $I_n = 20 \text{ kA} (8/20)$
 $U_p < 1,25 \text{ kV}$
 4-pole arrester
 3-phases system TN-S, TT
 $I_{max} = 50 \text{ kA}$
 M - replaceable module
 DS - remote monitoring (optional)

DECOUPLING INDUCTOR



3 x PI-L xxx
 $U_N = 500 \text{ V}$
 $I_N = \text{xxx A}$

TYPE 3



PI-k8 IT
 $U_N = 230 \text{ V} / 50\text{Hz}$
 $U_C = 275 \text{ V} / 50\text{Hz}$
 $I_N = 8 \text{ A}$
 $I_{max} = 8 \text{ kA} (8/20)$
 $U_p < 840 \text{ V}$
 DS - remote monitoring (optional)

TYPE 3



ZS 1-230 IT
 $U_N = 230 \text{ V} / 50\text{Hz}$
 $U_C = 275 \text{ V} / 50\text{Hz}$
 $I_{max} = 8 \text{ kA} (8/20)$
 $U_p < 2,2 \text{ kV}$

3) switchboard can be equipped

TYPE 1



HLA50-255/3+0
 $U_C = 255 \text{ V}$
 $I_n = 50 \text{ kA} (8/20)$
 $U_p < 2 \text{ kV}$

DECOUPLING INDUCTOR



3 x PI-L xxx
 $U_N = 500 \text{ V}$
 $I_N = \text{xxx A}$

TYPE 2+3



HSA-275/3+1 M
 $U_C = 275 \text{ V}$
 $I_n = 20 \text{ kA} (8/20)$
 $U_p < 1,25 \text{ kV}$
 4-pole arrester
 3-phases system TN-S, TT
 $I_{max} = 50 \text{ kA}$
 M - replaceable module
 DS - remote monitoring (optional)

DECOUPLING INDUCTOR



TYPE 3



TYPE 3



H-HIST-31-08-2018-EN-sales



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