

Railway Applications



DOLD 
Our experience. Your safety.

DOLD



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Railway Applications

Project Folder

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* Full EMC Data table included in datasheet.

2. Reference list

This project folder describes several applications where DOLD switching and monitoring relays are currently fitted to railway rolling stock, trackside power supplies and signalling systems. These applications confirm the suitability and performance of the DOLD relays fitted to rail vehicles and stationary trackside systems.

It is our intention to indicate in this folder what features the DOLD units have and the solutions they offer.

This folder makes no claim to be extensive and describes the various applications in general terms only.

Extract from DOLD reference list

- ▶ Ansaldo STS (FR,IT)
- ▶ Areva Transport (Alstom Transport) (FR, GB, IT)
- ▶ Bombardier Transportation (CA, DE, GB, US, SE)
- ▶ Siemens Transportation Systems Signalling (DE, FR)
- ▶ Thales Signalling (AT, DE, IT)
- ▶ and many others

As this is only a small selection of our references, we will be happy to provide you with further examples on request.

3. Relevant Details of EN 50155

This section shows in brief, some of the technical details that are subject to the railway standard EN 50155.

3.1. Ambient temperature (See data in datasheet subsection "Classification to DIN EN 50155")

The ambient conditions are split into different classes T1 –TX and describe the requirements for different types of installation.

Class	Ambient temperature	Cabinet-temperature	Over temperature for 10 min	Temperature around open frame devices
T1	-25 °C – +40 °C	-25 °C – +55 °C	+15 °C	-25 °C – +70 °C
T2	-40 °C – +35 °C	-40 °C – +55 °C	+15 °C	-40 °C – +70 °C
T3	-25 °C – +45 °C	-25 °C – +70 °C	+15 °C	-25 °C – +85 °C
TX	-40 °C – +50 °C	-40 °C – +70 °C	+15 °C	-40 °C – +85 °C

DOLD switchgear is normally built into cabinets or panels. Therefore the column "cabinet temperature" is usually relevant. The general temperature range for DOLD units is -20 ... +60 °C (with some exceptions). With many units -25 °C is possible without any internal changes. In several cases the values -40 °C and +75 °C can also be reached, but a special test will be necessary and in some products special components may have to be used.

3.2. Shock and vibration testing (See data in datasheet subsection "Classification to DIN EN 50155")

DOLD devices are tested for vibration resistance with amplitude of 0.35 mm and a frequency of 10-55 Hz, according to IEC/EN 60058-2-6. The resulting acceleration is approx 5 g at 55 Hz. The vibration testing according to EN 50155 or IEC 61373 is done with a constant acceleration at max. 0.8 g and frequency range 5-150 Hz. Shock tests are not normally made on DOLD devices but it is possible to do the necessary tests on request. For several of our unit's shock and vibration testing has already been made according to EN 50155 or IEC 61373. As no modifications were made to the tested units, this indicates that in general our units are designed and built to a high enough standard to pass the required vibration test for rolling stock applications.

3.3. Battery supply

The following rated voltages are common: 24, 48, 72, 96, 110 V DC
with the following tolerances: min. 0,7 U_N, max. 1,25 U_N

DOLD Devices normally have a voltage range of 0,8 – 1,1 U_N. Some of our devices have special voltage ranges, which fulfil the requirements for rail applications. Please see datasheets for specifications and additional data in datasheet subsection "Classification to DIN EN 50155".

3.4. Inverter supply

Tolerance values: 0,9 – 1,1 U_N

DOLD devices fulfil this demand.

3.5. EMC Test

DOLD Devices are EMC tested according to EN 61000-4-2...6 and EN 55011. The tests quoted in EN 50155 and EN 50121 are normally done. The surge test according to EN 61000-4-5 is slightly different to the test specified in EN 50155 - 10.2.6.2, the testing criteria of EN 61000-4-5 is more severe. If standard testing does not meet the application requirements additional testing can be done on request.

3.6. Further tests or specifications that are not found in the technical data can be provided on request.

4. Applications

In the following section we show some applications where DOLD switchgear has been used on rail vehicles and other railway-based applications.

4.1. Pulse lengthening of a control signal with the DOLD **IK 7817N/200**, for the event recorder on AWS systems. A pushbutton is used to reset the safety stop function and to log the signal in the event recorder when amber lights are passed. By pressing the button for a short period of <math><100\text{ms}</math> the safety override is reset, but the signal is too short for the event recorder. The **IK 7817N/200** was chosen for its compact dimensions and robust design, it allows the push button signal to be reliably lengthened to >120 ms and therefore be consistently logged.



4.2. Safety release delay timing with the DOLD **IK 7817N/200**, for cycle reset of passenger train door obstacle detection circuits. If the door cycle is not completed within a set time, the **IK 7817N/200** resets the system to cycle again. The compact dimensions, high reliability and repeat accuracy of this multifunction timer make it suitable for this application.

4.3. Time delay of PLC output signals with the DOLD **MK 7850N/500**, PLC output signals are delayed in railway rolling stock control systems to generate defined switching signals, this relay is chosen for its compact and reliable two contact design.

▶ Bombardier (SE)



Timers and measuring relays for Rolling Stock applications according to EN 50155 and for Railway Trackside systems



4.4. Safety timed interface with the DOLD **SN 7920**, for the drivers dead mans handle to braking system, Emergency button interface and essential cooling overrun. The **SN 7920** multi function timer was chosen by Merseyrail for its six contacts, 110 VDC switching capacity and accurate reliable programmable timing functions. In addition this product was produced specifically for the railway industry and has passed stringent customer RIA 12 testing to meet the requirements of this application.



4.5 True off delay function, with the DOLD **MK 7873N**, the timing function of the wheel slide protection circuit on the braking systems of MK3 HST carriages, utilise the **MK 7873N** true off delay timer in the place of the original much larger and heavier electro pneumatic timers.



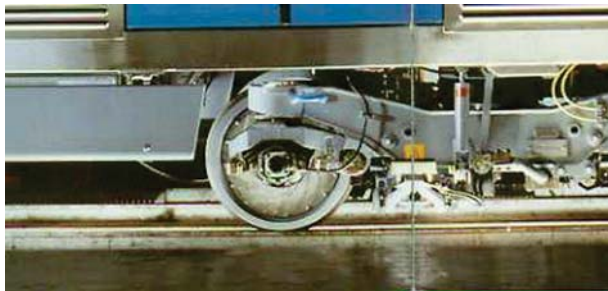
4.6. Frequency measuring of line Voltage, with the DOLD frequency relay **MH 9837**, the line Voltage frequency is monitored to indicate the change between two different Voltage systems for cross boarder traffic e.g. from 15 kV 16/23 Hz to 25 kV 50 Hz and vice versa. The frequency relay detects whatever frequency is connected (25 kV corresponds to 50 Hz), so the secondary Voltage of the 3 phase 400 VAC on board supply can be adjusted by changing the transformer tappings.

▶ Bombardier (SE), Oresund Bridge crossing



4.7. Speed monitoring of diesel engine, with the DOLD **IK 9055**, the RPM of the diesel engine is monitored via a proximity sensor and fed into two DOLD speed-monitoring relays to give switching outputs for the upper and lower engine speed. These signals are used to interface with an automatic oil dosing system. Fast response times and compact dimensions together with good stability made this relay suitable for this application.

▶ Bombardier (GB)



4.8. Monitoring of line Voltage, with the DOLD Voltage relay **BA 9054/020**, the traction Voltage of subway trains is monitored for undervoltage < 450 VDC with the DOLD Voltage relay. The criteria to choose this relay was its accuracy and the high overload capability of the measuring input when over Voltage is present.

▶ Bombardier (SE)
for Trams worldwide



4.9. Monitoring of battery charge, with the DOLD current relay **BA 9053**. A constant current < 5 mA is generated by the load and monitored by the **BA 9053**. This device is sensitive and accurate enough to detect drops in the current due to defective or undercharged battery cells. Also used in several other rolling stock monitoring applications.

▶ Bombardier (SE)





4.10. Monitoring of batteries for under Voltage, with the DOLD IK 9173, the battery Voltage supplies automatic fire extinguishers on diesel engines. A special version of the DOLD IK 9173 is used to monitor the presence and level of the supply Voltage. This device has compact dimensions and a separate auxiliary supply of 24 VDC and monitors for the presence of 10 VDC.

- ▶ Alstom Transportation (Areva Transportation) Coradia DMU (GB)



4.11. 3 Phase Voltage monitoring, with the DOLD BA 9043 for underground train platform supplies. This relay was chosen for its proven long term reliability and stability.



4.12. Tunnel rescue train. The rescue trains of the DB are specially equipped trains that are used at accidents often in tunnels. These trains are always on stand-by and must be ready to start within 5 minutes. Supply panels on the trains are monitored continuously for connection to the mains. When in operation the energy is supplied by the locomotive or by separate generator sets. The supply system must be monitored for Undervoltage, Asymmetry, Phase sequence, Phase failure and loss of Neutral. The device must be self supplied by the monitored Voltage and in addition the following standards must be followed: EN 50121-3-2 EMC, EN 61000-4-5 Surge Voltage, some parts of EN 50155 for rolling stock applications, EN 60068-2-6 vibration resistance. The Dold phase monitor **SL9087.12** with 3ph 400 VAC or 3pn/N 400/230 VAC is the ideal solution to meet these requirements.



4.13. Monitoring of Voltage and Current with the DOLD **BA 9054/034** and **BA 9053/034**, for cooling fan motors in air conditioning systems and heating applications. These relays are used to monitor the Voltage and Current values, to prove the fans are running and prevent critical overheating and fire. The units have a wide aux Voltage range and are factory preset with blank fronts to prevent unwanted on site adjustment.

▶ Alstom Transportation (GB)



4.14. Monitoring of fans, the DOLD IK 9065 Cos-Phi underload monitor monitors the correct operation of fans. If the air stream is interrupted e.g. by blocked filters the fan goes into an under load condition which is reliably detected by IK 9065. In similar applications the under over current relay IL 9277 is used, this unit detects both under and over current.

- ▶ **Bombardier (SE) traction inverter cooling systems**



4.15. Monitoring of 4-20 mA Current loop, with the DOLD BA 9053, an interface was required to give a speed reference to the sander interface. This relay is used to interface with the existing 4-20 mA current loop which drives the train speedometer. This product was chosen due to the low impedance of its current input and the high stability of its measuring circuit.



4.16. Insulation monitoring with the DOLD IL/IP 5880, for isolated 3-phase and DC Voltage systems on diesel trains. The Voltage systems on these vehicles are galvanically separated from the chassis and also from each other, they are also ungrounded. In this application reliable insulation monitoring is necessary to detect potential ground faults. The IL/IP 5880 is used for AC and 3-phase systems and the DOLD IL 5881 for DC systems.





4.17. Monitoring of batteries, with the DOLD IP 5883, for short circuit and earth fault detection. The battery Voltage supplies on London underground battery locos are monitored for cross faults and earth faults with the IP 5883 differential current relay. It monitors the high current DC output of the loco auxiliary sockets via a dedicated core balanced C/T



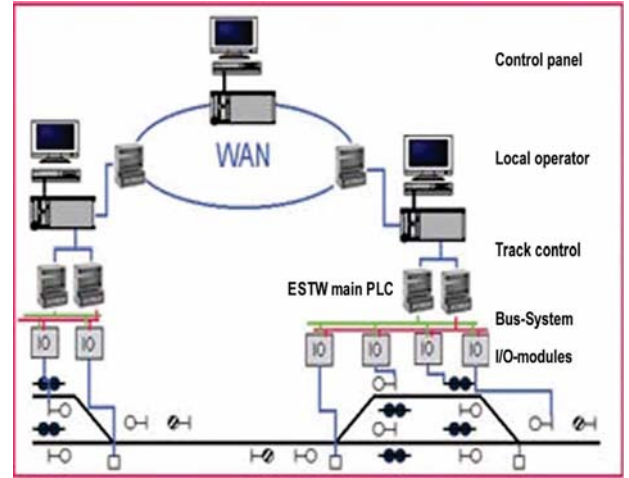
4.18. Monitoring of train control panel temperature, with the DOLD IK 9094, PT 100 temperature monitor. The compact IK 9094 monitors the cabinet temperature and controls the cooling fans.

- ▶ Siemens Transportation (DE)
- ▶ Alstom Transportation (Areva) (FR)



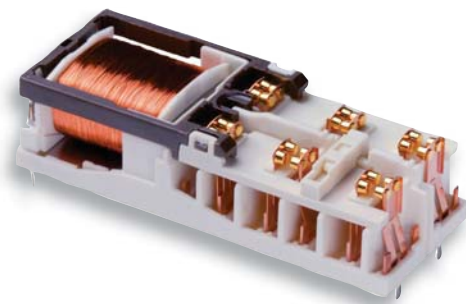
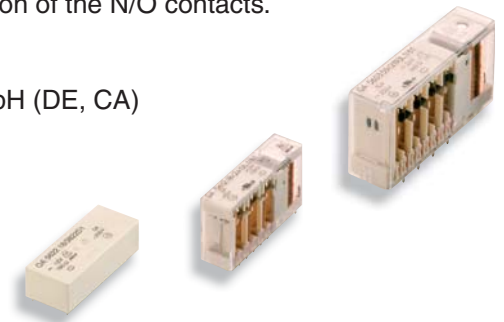
4.19. Interface relays and wireless safety override, between process control and door opening circuits on screen platform door systems, the DOLD OA 5612 Interface relay is used to amplify control signals and provide redundant positive guided control of the door operating systems. The Dold **Safemaster W wireless safety system** is being used to act as a safety door override on Helsinki Metro to safely open station screen doors directly from the drivers cab.





4.20. Safety relays with positive guided contacts, DOLD OA 5669, OA 5611, OA 5612 and OA 5621, OA 5622, OA 5622D, OA 5644, OA 5601, OA 5603 are used for trackside signalling systems, controls for train ABS braking systems and underground station automatic screen door controls. DOLD positive guided safety relays are used for safe separation between control and load signals. They operate between the computer control and the load and due to their proven positive guided design and extensive use in safety orientated control systems, their N/C contacts can be reliably monitored to indicate the function of the N/O contacts.

- ▶ Siemens Transportation (DE)
- ▶ Thales Rail Signalling Solutions GmbH (DE, CA)
- ▶ Alstom Transportation (FR, IT)
- ▶ Ansaldo (FR, IT)



4.21. Safety relay with dual head positive guided contacts, the DOLD OA 5621 OA 5622 D, is used for trackside signalling systems and axle counting circuits. The dual gold plated contact heads of the relay, facilitates extremley reliable switching of low current and low Voltage signals for safety critical trackside and rolling stock signalling applications.

- ▶ Thales Rail Signalling Solutions (DE, CA)



4.22. Positive guided Interface Relays, the DOLD HL 3094 / HL 3094N / HO 3094 / HO 3095 / HC 3096 / HL 3096, are used between process control and peripheral devices, the DOLD Interface modules are used to amplify control signals. They have desirable features like a wide Voltage tolerance, wide temperature range and high DC switching capacity at 110VDC (eg. Load contactor coils). In addition the relay contacts are of proven positive guided design and can be reliably monitored for safe contact function.



► Bombardier (SE, USA, CA)



4.23. Interface Relays, the DOLD IK 3076 is used between process control and peripheral devices. The relay is used to amplify control signals. It has the desirable features of being very compact and light weight but still retaining a good AC or DC switching capacity.



4.24. SMS transmission of Faults, with the DOLD RP 5812 maintenance depots have trailed the DOLD RP 5812 to transmit SMS messages from rolling stock with various intermittent faults, to alert engineering staff that a problem has re occurred. The DOLD RP 5812 was chosen because of its compact dimensions and ease of programming via text messages from a smart phone, i.e. No PC is required.





4.25. Safety switch and trapped key interlock system SAFEMASTER STS, the DOLD STS system provides safe access to dangerous areas e.g. platforms for train maintenance. The access is only enabled when dangerous Voltages are disconnected (e.g. overhead high Voltage lines). Only then are maintenance staff allowed to enter the maintenance area. Every worker can get their own key from the Safemaster STS key exchange unit to open the guards for the platforms. Only when all maintenance staff have finished their work, the platforms are back in position and all keys are back in the key exchange unit, can the train be powered up again and moved out of the maintenance Depot.



4.26. The 2 **OA 5603** relays, which are **signalling relays** according to UIC 736 and EN 50578 are used to interface between electronic and load circuit in SIL 4 applications. A large mechanical relay is controlled by **OA 5603**. This is used in signalling circuits especially to control unoccupied or occupied tracks.



MULTITIMER

Multifunction Relay
IK 7817N/200, SK 7817N/200

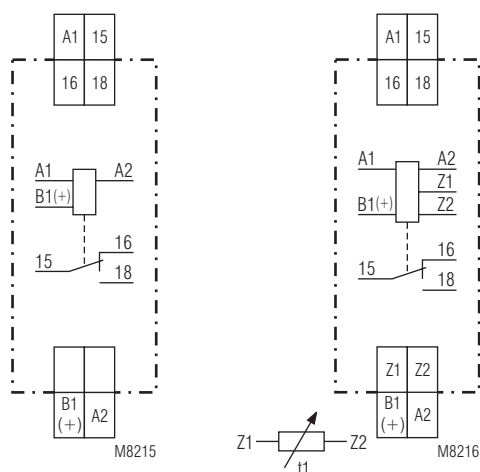


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- According to IEC/EN 61 812-1
 - 8 functions settable via rotational switch:
 - Delay on energisation (AV)
 - Fleeting on make (EW)
 - Delay pulse (IE)
 - Flasher, start with pulse (BI)
 - Delay on de-energisation (RV)
 - Pulse forming function (IF)
 - Fleeting on break (AW)
 - Delay on energisation and de-energisation (AV / RV)
 - 8 time ranges from 0.02 s ... 300 h selectable via rotational switches
 - Voltage range AC/DC 12 ... 240 V
 - With time interruption / time adding input
 - Adjustment aid for quick setting of long time values
 - Suitable for 2-wire proximity sensor control
 - 1 changeover contact
 - LED indicators for operation, contact position and time delay
 - Devices available in 2 enclosure versions:
 - IK 7817N: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
 - SK 7817N: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
 - DIN rail or screw mounting
 - 17.5 mm width
- IK/SK 7817N/500: as IK/SK 7817N/200 but with
- 2 additional functions:
 - Cyclic timer, start with break (TP)
 - Fleeting on make and break (EW / AW)
 - second time setting t_2 for functions
 - Cyclic timer, start with pulse (TI) or break (TP), based on the separate setting of pulse and break time the flasher function can be used as cyclic timer.
 - Fleeting on make and break (EW/AW)
 - Delay on energisation and de-energisation (AV / RV)
 - Delay pulse (IE): setting of pulse length
 - Connection facility for external potentiometer 10 k Ω

Circuit Diagrams



IK 7817N.81/200
SK 7817N.81/200

IK 7817N.81/500
SK 7817N.81/500

Connection Terminals

Terminal designation	Signal designation
A1	L / +
A2	N / -
B1(+)	Control input (different function depending on chosen timing function) control with reference to A2
15, 16, 18	Changeover contact
Z1, Z2 (only at variant /500)	Input to connect a remote potentiometer for time setting t_1

Approvals and Markings



Application

Time dependent controls for industrial and railway applications.

Indicators

green LED:	on, when voltage connected
yellow LED "R/t":	shows status of output relay and time delay:
- Continuously off:	output relay not active; no time delay
- Continuously on:	output relay active; no time delay
- Flashing (short on, long off)	output relay not active; time delay
- Flashing (long on, short off)	output relay active; time delay

Notes

Control of A1-A2 with proximity sensors

The input can be controlled by DC 3 wire or AC/DC 2 wire proximity sensors. For operating voltage > 24 V and usage of sensors without built-in short circuit protection a protection resistor on A1 is recommended to reduce the inrush current. The dimension is as follows:

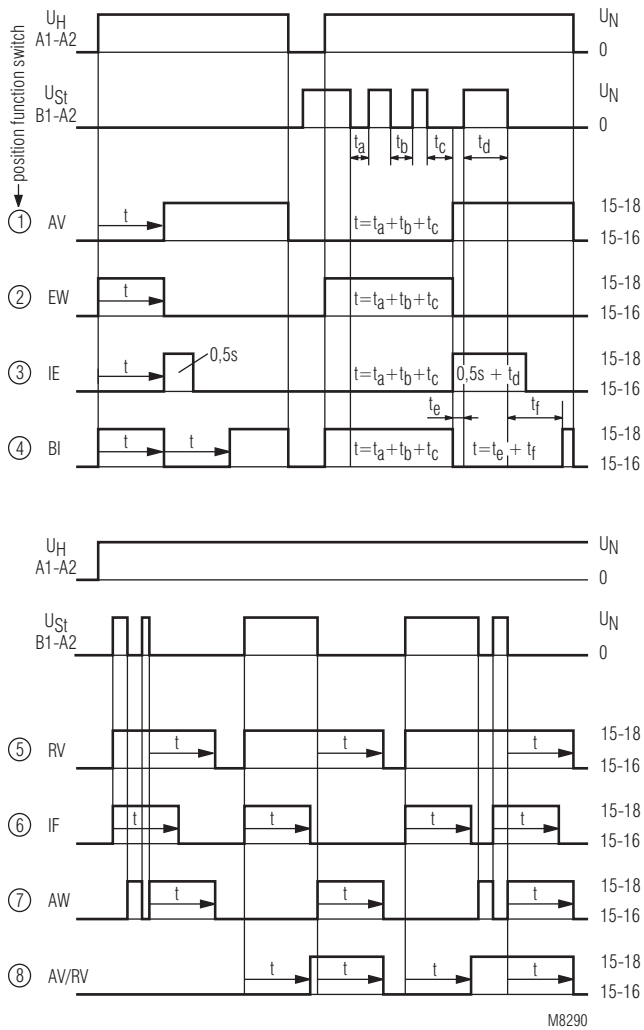
$R_v \approx$ operating voltage / max. switching current of sensor

The series resistor must not be selected higher than necessary.

Max. values are:

Operating voltage: 48 V 60 V 110 V 230 V
Series resistor R_v max: 270 Ω 390 Ω 680 Ω 1.8 k Ω (1 W)

Function Diagram

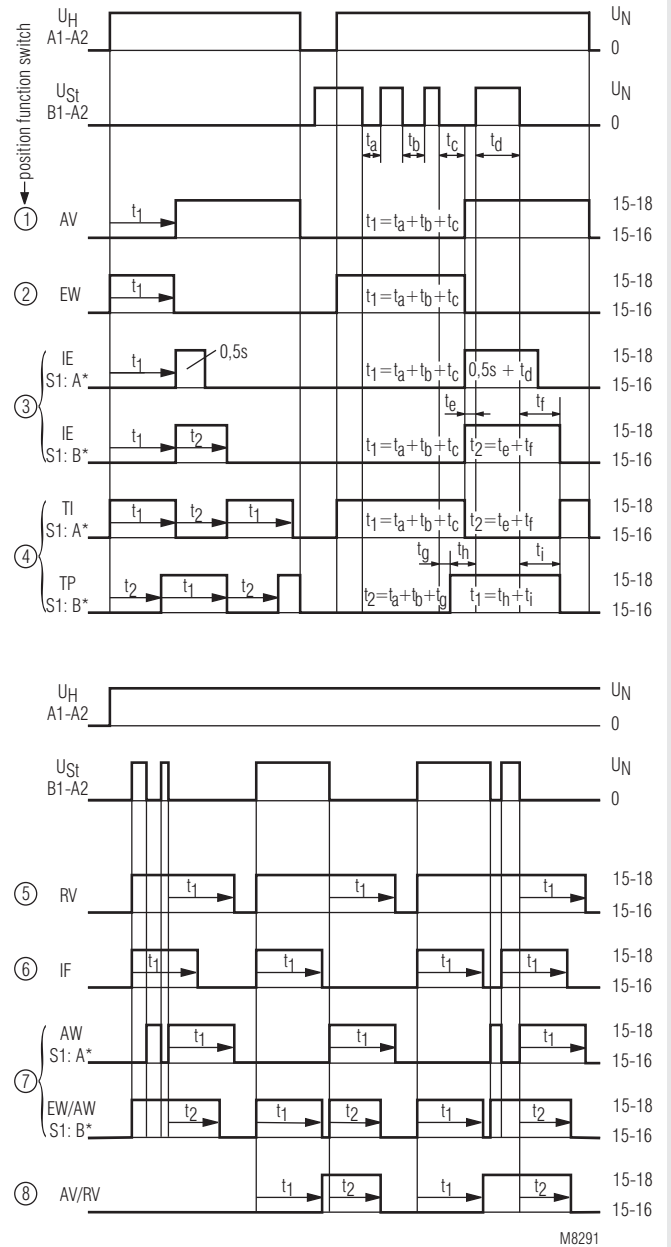


IK 7817N/200, SK 7817N/200

① ... ⑧ = position of function switch

- | | |
|----------------------------------|---|
| ① AV = Delay on energisation | ⑤ RV = Delay on de-energisation |
| ② EW = Fleeting on make | ⑥ IF = Pulse forming function |
| ③ IE = Delayed pulse | ⑦ AW = Fleeting on break |
| ④ BI = Flasher, start with pulse | ⑧ AV/RV = Delay on energisation and de-energisation |

Function Diagram



IK 7817N/500, SK 7817N/500

① ... ⑧ = position of function switch

- | | |
|--|---|
| ① AV = Delay on energisation | ⑤ RV = Delay on de-energisation |
| ② EW = Fleeting on make | ⑥ IF = Pulse forming function |
| ③ IE = Delay pulse | ⑦ AW = Fleeting on break |
| S1 in position A:
t1: adjustable, t2 = 0.5 s fixed | EW/AW = Fleeting on make and break |
| S1 in position B:
t1 and t2 adjustable | S1 in position B |
| ④ TI = Cyclic timer, start with pulse S1 in position A | ⑧ AV/RV = Delay on energisation and de-energisation |
| TP = Cyclic timer, start with break S1 in position B | |

*) A and B indicate the position of function slide switch S1

Notes

Setting

If the function switch is altered during operation, the new setting is valid immediately (like a restart of the relay).

A new adjustment of the time or time range is also immediately valid.

Please note, that a change of function, time range or time setting during elapse of time can lead to unintended switching of the output contacts.

Adjustment assistance

The flashing period of the yellow LED is $1 \text{ s} \pm 4 \%$ and can be used to adjust the time. Especially on the lower end of scale and for long times it is suitable as the multiplication factors between the different time ranges are exact without tolerance.

Example:

The required time is 40 min. It has to be adjusted within range 3 ... 300 min. The time check takes too long as several timing cycles would be necessary for a precise value. For faster adjustment the setting is made to 0.03 ... 3 min. On this range the potentiometer should be set to 0.4 min (= 24 sec.). With the right potentiometer setting the LED must show 24 flashing cycles. After that the time range is switched over to 3 ... 300 min. and the setting is complete.

Time interruption / time adding

With the functions AV, EW, IE and BI the time delay can be interrupted by controlling input B1 (+) with control voltage. Removing the control signal will continue the timing cycle (time addition).

Control input B1

The functions RV, IF, AW, AV / RV have to be controlled via input B1 (+) with voltage against A2. The control signal could be the same as the auxiliary/control voltage of A1 or any other voltage between 12 and 240 V AC or DC. Operating a parallel load between B1 and A2 is also possible.

If with function IF the inputs A1 and B1 are controlled simultaneously a pulse with the adjusted length is started.

With the variant IK/SK 7817N/500 the output pulse can be disabled by setting the slide switch in position "B".

Remote potentiometer

The setting of t1 on variant IK/SK 7817N/500 can also be made by a remote potentiometer of 10 kOhms. The connection is made via Z1-Z2. When connecting a remote potentiometer the rotational switch for t1 has to be set to min. If no remote potentiometer is required the terminals Z1-Z2 have to be linked.

The wires to the remote potentiometer should be installed separately from the lines with mains voltage. If this is not possible, a screened cable is recommended where the shield is connected to Z1.

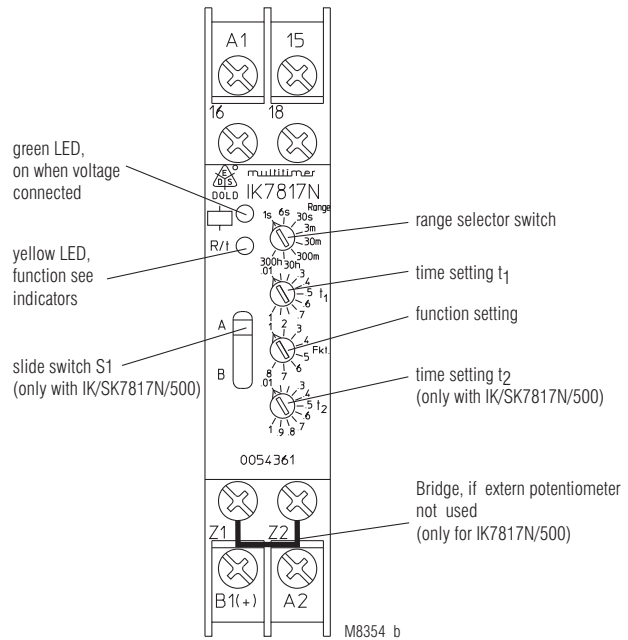
To terminals Z1 and Z2 no external voltage must be connected, as the unit might be damaged.

Terminals Z1-Z2 do not have a galvanic separation to terminals A1 -A2!

Additional function

With the variant IK/SK 7817N/500 additional features can be selected for the functions position 3, 4 and 7 using the slide switch S1 on the relay front in position "B". At the same time a second time setting t2 is available on the lower rotational switch for the functions 3, 4, 7 and 8 (see function Diagram). The time range is the same as for t1.

Setting



Attention

If no remote potentiometer at IK/SK 7817N/500 is required the terminals Z1-Z2 have to be linked.

Technical Data	
Time circuit	
Time ranges:	8 time ranges in one unit, settable via rotational switch 0.02 ... 1 s 0.3 ... 30 min 0.06 ... 6 s 3 ... 300 min 0.3 ... 30 s 0.3 ... 30 h 0.03 ... 3 min 3 ... 300 h
Time setting t1, t2:	continuous, 1:100 on relative scale (t2 only at IK/SK 7817N/500)
Recovery time:	
at DC 24 V:	approx. 15 ms
at DC 240 V:	approx. 50 ms
at AC 230 V:	approx. 80 ms
Repeat accuracy:	± 0.5 % of selected end of scale value + 20 ms
Voltage and temperature influence:	< 1 % with the complete operating range
Input	
Nominal voltage U_N:	AC/DC 12 ... 240 V
Voltage range:	0.8 ... 1.1 U _N
Release voltage (A1/A2)	
AC 50 Hz:	approx. 7.5 V
DC:	approx. 7 V
Max. permitted residual current with 2-wire proximity sensor control (A1-A2)	
up to AC/DC 150 V:	AC resp. DC 5 mA
up to AC/DC 264 V:	AC resp. DC 3 mA
Control current B1:	input resistance approx. 220 kΩ in series with diode
Min. on/off time of control input B1(+):	
AC 50 Hz:	approx. 15 ms / approx. 60 ms
DC:	approx. 5 ms / approx. 60 ms
Release voltage (B1/A2)	
AC 50 Hz:	approx. 5 V
DC:	approx. 4 V
Nominal power consumption	
AC 12 V:	approx. 1.5 VA
AC 24 V:	approx. 2 VA
AC 240 V:	approx. 3 VA
DC 12 V:	approx. 1 W
DC 24 V:	approx. 1 W
DC 240 V:	approx. 1 W
Nominal frequency:	45 ... 400 Hz
Output	
Contacts:	1 changeover contact
Contact material:	AgNi
Measured nominal voltage:	AC 250 V
Thermal current I_{th}:	max. 4 A (see see quadratic total current limit curve)
Switching capacity	
to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life	
to AC 15 at 1 A, AC 230 V:	1.5 x 10 ⁵ switch. cycles IEC/EN 60 947-5-1
Permissible switching frequency	36 000 switching cycles / h
Short circuit strength	
max. fuse rating:	4 A gL IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10 ⁶ switching cycles

Technical Data	
General Data	
Operating mode:	Continuous operation
Temperature range:	
Operation:	- 40 ... + 60 °C (higher temperature with limitations see quadratic total current limit curve)
Storage:	- 40 ... + 70 °C
Relative air humidity:	93 % at 40 °C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1 III
Overvoltage category:	
Insulation test voltage, type test:	2.5 kV; 1 min
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF-irradiation	
80 MHz ... 1 GHz:	20 V / m IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V / m IEC/EN 61 000-4-3
Fast transients:	4 kV IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV IEC/EN 61 000-4-5
between wire and ground:	4 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55011
Degree of protection	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6 40 / 060 / 04 IEC/EN 60 068-1 EN 50 005
Climate resistance:	
Terminal designation:	DIN 46 228/-1/-2/-3/-4
Wire connection:	
Cross section:	2 x 2,5 mm ² solid or 2 x 1,5 mm ² stranded wire with sleeve 10 mm
Stripping length:	
Wire fixing:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1 0.8 Nm
Fixing torque:	
Mounting:	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory
Weight:	
IK 7817N/200:	approx. 65 g
SK 7817N/200:	approx. 84 g
Dimensions	
Width x height x depth:	
IK 7817N/200:	17.5 x 90 x 59 mm
SK 7817N/200:	17.5 x 90 x 98 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B IEC/EN 61 373
Ambient temperature:	T1, T2 compliant T3 and TX with operational limitations
Protective coating of the PCB:	No

Standard Type

IK 7817N.81/200 AC/DC 12 ... 240 V

Article number: 0054359

- Output: 1 changeover contact
- Nominal voltage U_N : AC/DC 12 ... 240 V
- Time ranges: from 0.02 s ... 300 h
- Width: 17.5 mm

SK 7817N.81/200 AC/DC 12 ... 240 V

Article number: 0058364

- Output: 1 changeover contact
- Nominal voltage U_N : AC/DC 12 ... 240 V
- Time ranges: from 0.02 s ... 300 h
- Width: 17.5 mm

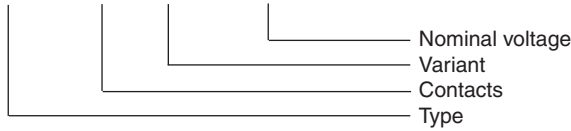
Variant

IK/SK 7817N.81/500: With 2 additional functions selectable via slide switch S1:

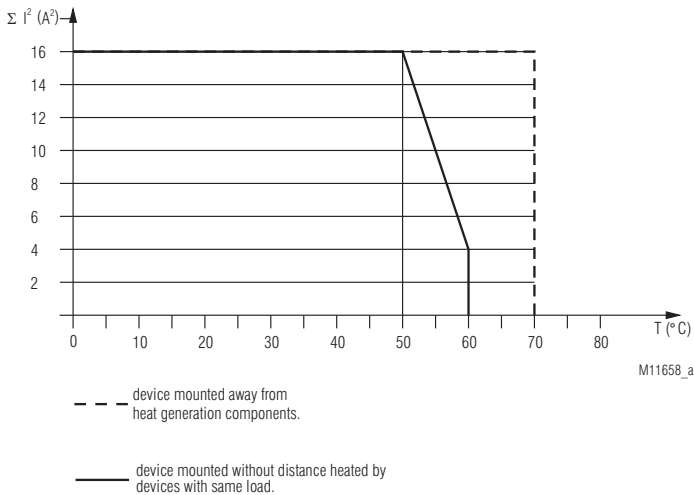
- Cyclic timer, start with break (TP)
 - Fleeting on make and break (EW/AW)
- second time setting t_2 , connection facility for remote potentiometer 10 k Ω (t_1)

Ordering example for variant

IK 7817N .81 / _ _ _ AC/DC 12 ... 240 V



Characteristics



Accessories

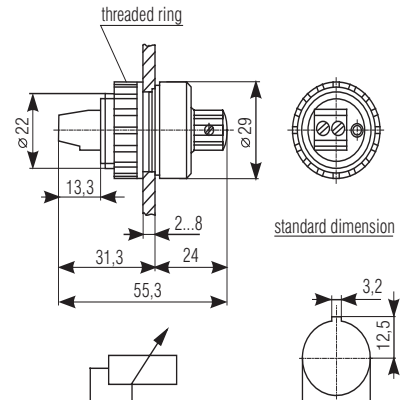
AD 3:

External potentiometer 10 k Ω

Article number: 0028962

The external potentiometer is used for remote setting of the time delay. The internal potentiometer of the timer must be set to min. time delay.

Degree of protection front side: IP 60

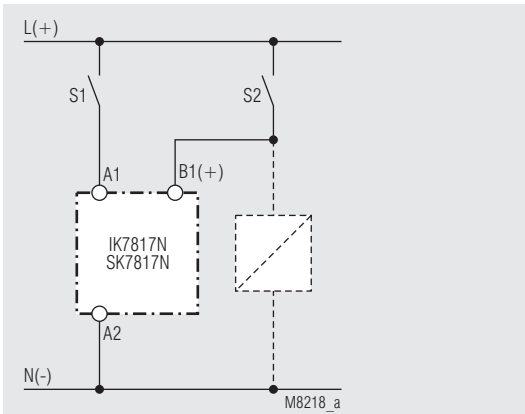
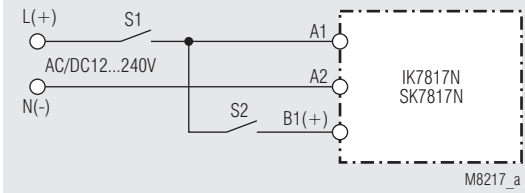


ET 4086-0-2:

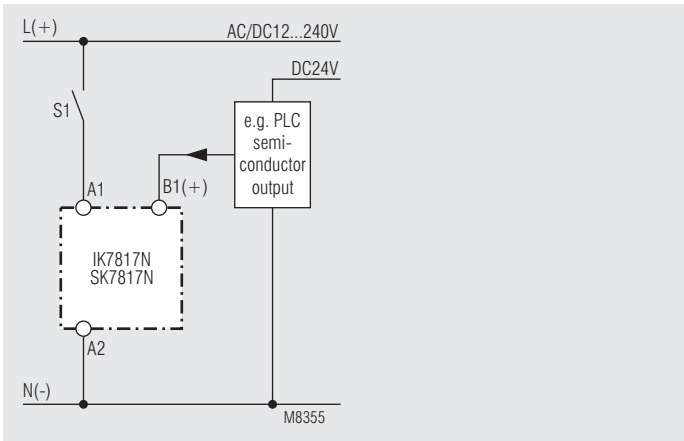
Additional clip for screw mounting

Article number: 0046578

Connection Examples



Control with parallel connected load



Connection with 2 different control voltages.

EMC-Testing of IK 7817N according to EN 50155 Rev 07/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2 kV line to line 4 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	B (2)	6kV contact discharge N/A due to plastic enclosure
Electrostatic discharge	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: „A“ to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	„B“ effect on unit allowed during test but unit must not be affected thereafter
Fast Transients	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	10 V/m 1,4GHZ- 2,1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 2,1Hz- 2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi- peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi- peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
		230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHZ	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of IK 7817N according to EN 50155

	Test Standard	Severity	Performance	DoId Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

MULTITIMER Multifunction Relay MK 7850N/200



0239280



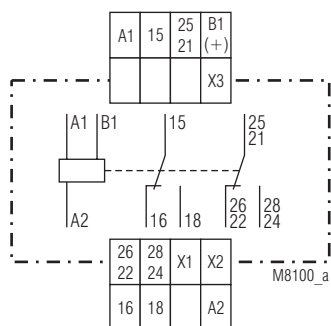
Your Advantages

- Up to 10 functions in one unit
- Simplified storage
- Increased flexibility
- Quick setting of long time values

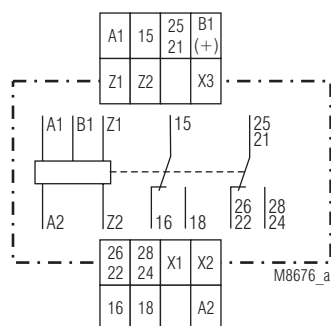
Features

- According to IEC/EN 61 812-1
- 8 functions settable via rotational switch:
 - Delay on energisation (AV)
 - Fleeting on make (EW)
 - Delayed pulse (IE)
 - Flasher, start with pulse (BI)
 - Delay on de-energisation (RV)
 - Pulse forming function (IF)
 - Fleeting on break (AW)
 - Delay on energisation and de-energisation (AV / RV)
- 8 time ranges from 0.02 s to 300 h selectable via rotational switches
- Voltage range AC/DC 12 ... 240 V
- With time interruption / time adding input for all functions
- Suitable for 2-wire proximity sensor control
- 2 changeover contacts, one programmable as instantaneous contact
- LED indicators for operation, contact position and time delay
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- as option with pluggable terminal blocks for easy exchange of devices
 - with screw terminals
 - or with cage clamp terminals
- 22.5 mm width

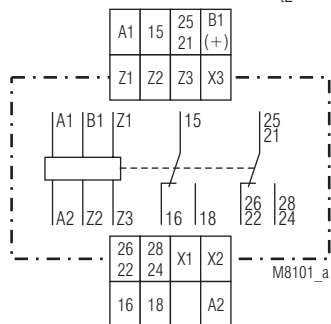
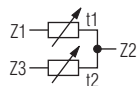
Circuit Diagrams



MK 7850N.82/200



MK 7850N.82/300



MK 7850N.82/500

MK 7850N/500: as MK 7850N/200 but with

- 2 additional functions:
 - Cyclic timer, start with break (TP)
 - Fleeting on make and break (EW / AW)
- second time setting t_2 for functions
 - Cyclic timer, start with pulse (TI) or break (TP), based on the separate setting of pulse and break time the flasher function can be used as cyclic timer
 - Fleeting on make and break (EW/AW)
 - Delay on energisation and de-energisation (AV / RV)
 - Delay pulse (IE) and setting of pulse length
- Connection facility for 2 external potentiometers

Approvals and Markings



* see variants

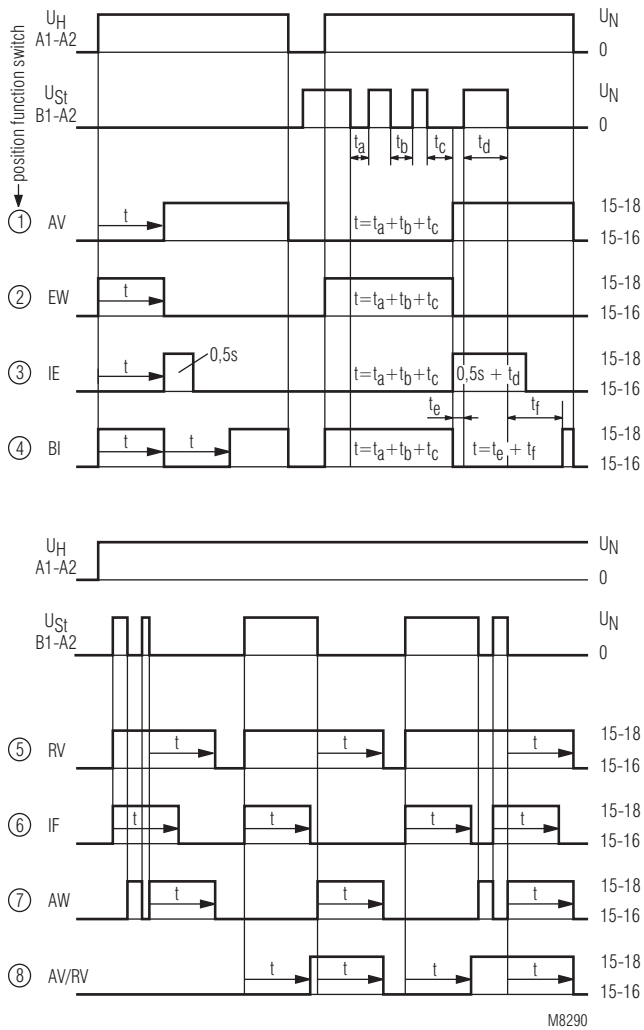
Application

Time dependent controls for industrial and railway applications.

Indicators

green LED:	on when voltage connected
yellow LED "R/t":	shows status of output relay and time delay:
-Continuously off:	output relay not active; no time delay
-Continuously on:	output relay active; no time delay
-Flashing (short on, long off)	output relay not active; time delay
-Flashing (long on, short off)	output relay active; time delay

Function Diagram

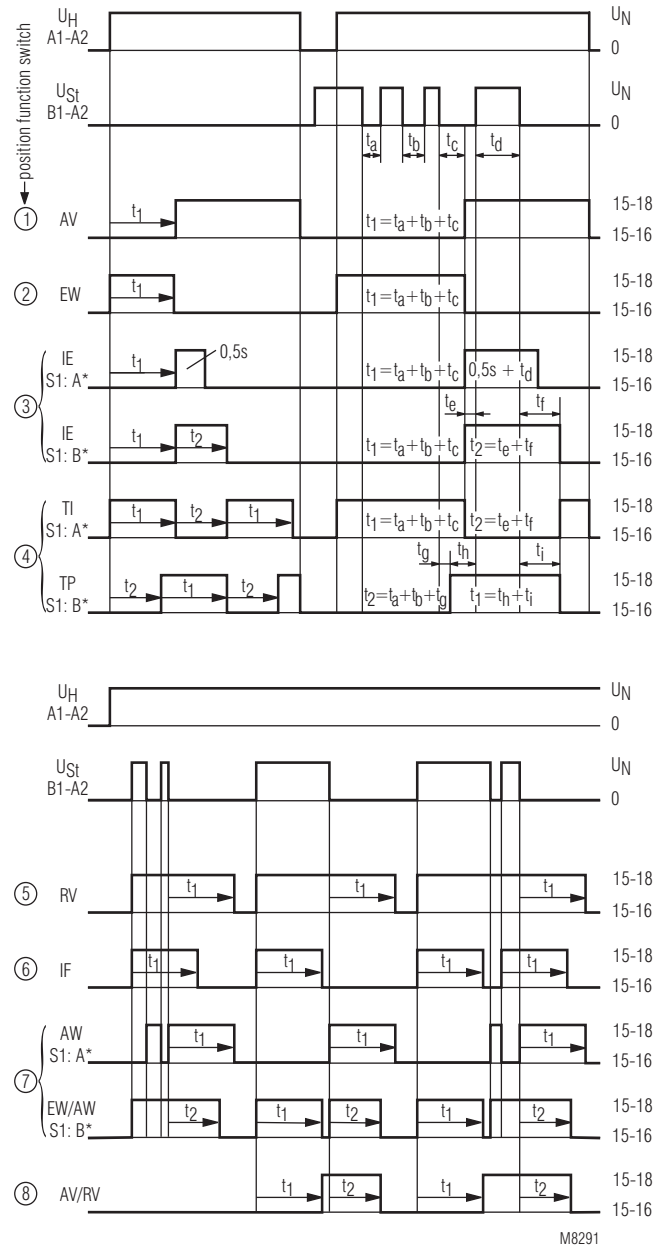


MK 7850N/200

① ... ⑧ = position of function switch

- | | |
|----------------------------------|---|
| ① AV = Delay on energisation | ⑤ RV = Delay on de-energisation |
| ② EW = Fleeting on make | ⑥ IF = Pulse forming function |
| ③ IE = Delayed pulse | ⑦ AW = Fleeting on break |
| ④ BI = Flasher, start with pulse | ⑧ AV/RV = Delay on energisation and de-energisation |

Function Diagram



*) A and B indicate the position of function slide switch S1

MK 7850N/500

① ... ⑧ = position of function switch

- | | |
|--|---|
| ① AV = Delay on energisation | ⑤ RV = Delay on de-energisation |
| ② EW = Fleeting on make | ⑥ IF = Pulse forming function |
| ③ IE = Delayed pulse | ⑦ AW = Fleeting on break |
| S1 in position A:
t_1 : adjustable, $t_2 = 0.5$ s fixed | EW/AW = Fleeting on make and break |
| S1 in position B:
t_1 and t_2 adjustable | S1 in position B |
| ④ TI = Cyclic timer, start with pulse
S1 in position A | ⑧ AV/RV = Delay on energisation and de-energisation |
| TP = Cyclic timer, start with break
S1 in position B | |

Connection Terminals	
Terminal designation	Signal designation
A1, A2	Auxiliary voltage
B1(+), A2	Control input (various control possible, depending on the time function)
X1, X2	Control input (2. delayed C/O contact or instantaneous contact) X1/X2 not bridged: 2 nd delayed C/O contact 25-26-28 X1/X2 bridged: 2 nd instantaneous C/O contact 21-22-24
X3, X2	Control input (Time interruption/time adding) X3/X2 bridged: Time interruption X3/X2 not bridged: continued time delay (with time adding)
Z1, Z2	Input for connection of a external potentiometer for time setting t1
Z3, Z2	Input for connection of a external potentiometer for time setting t2
15, 16, 18	1 st C/O contact (delayed)
21, 22, 24, 25, 26, 28	2 nd C/O contact (delayed), if X1/X2 not bridged 2 nd C/O contact (instantaneous), if X1/X2 bridged

Notes

Control of A1-A2 with proximity sensors

The input can be controlled by DC 3 wire or AC/DC 2 wire proximity sensors. For operating voltage > 24 V and usage of sensors without built-in short circuit protection a protection resistor on A1 is recommended to reduce the inrush current. The dimension is as follows:

$R_v \approx$ operating voltage / max. switching current of sensor

The series resistor must not be selected higher than necessary.

Max. values are:

Operating voltage: 48 V 60 V 110 V 230 V
Series resistor R_v max: 270 Ω 390 Ω 680 Ω 1.8 k Ω (1 W)

Instantaneous contact

By external wire links the output function of the device can be altered from 2 delayed contacts to 1 delayed **and** 1 instantaneous contact. The contact 25-26-28 is delayed without bridge on X1-X2, it is instantaneous with bridge on X1-X2. The legend term is 21-22-24. The instantaneous contact switches when the operating voltage is connected. To terminals X1 and X2 no other voltage potentials must be connected, as the unit might be damaged.

Adjustment assistance

The flashing period of the yellow LED is $1 s \pm 4 \%$ and can be used to adjust the time. Especially on the lower end of scale and for long times it is suitable as the multiplication factors between the different time ranges are exact without tolerance.

Example:

The required time is 40 min. It has to be adjusted within range 3 ... 300 min. The time check takes too long as several timing cycles would be necessary for a precise value. For faster adjustment the setting is made to 0.03 ... 3 min. On this range the potentiometer should be set to 0.4 min (= 24 sec.). With the right potentiometer setting the LED must show 24 flashing cycles. After that the time range is switched over to 3 ... 300 min. and the setting is complete.

Time interruption / time adding with B1

With the functions AV, EW, IE and BI the time delay can be interrupted by controlling input B1 (+) with control voltage. Removing the control signal will continue the timing cycle (time addition).

Notes

Control input B1

The functions RV, IF, AW, AV / RV have to be controlled via input B1 (+) with voltage against A2. The control signal could be the same as the auxiliary/control voltage of A1 or any other voltage between 12 and 240V AC or DC. Operating a parallel load between B1 and A2 is also possible.

If with function IF the inputs A1 and B1 are controlled simultaneously a pulse with the adjusted length is started. With the variant MK 7850N/500 the output pulse can be disabled by setting the slide switch in Position "B".

Time interruption and time addition with X3

On all functions, also with RV, IF, AW (EW/AW) and AB/RV the time delay can be interrupted during timing by bridging the terminals X2 - X3. By opening the bridge the time continues (time addition). While X2 and X3 are bridged the control input is disabled and the yellow LED remains in the state it had at stop. No external voltage must be connected to X2 and X3 as the unit may be damaged.

Remote potentiometers

Both settings on variant MK 7850N/500 can also be made by remote potentiometers of 10 kOhms:

- terminals Z1 - Z2: potentiometer for time t1
- terminals Z2 - Z3: potentiometer for time t2

When connecting a remote potentiometer the corresponding potentiometer has to be set to min. If no remote potentiometers are required the terminals Z1-Z2 resp. Z2-Z3 have to be linked.

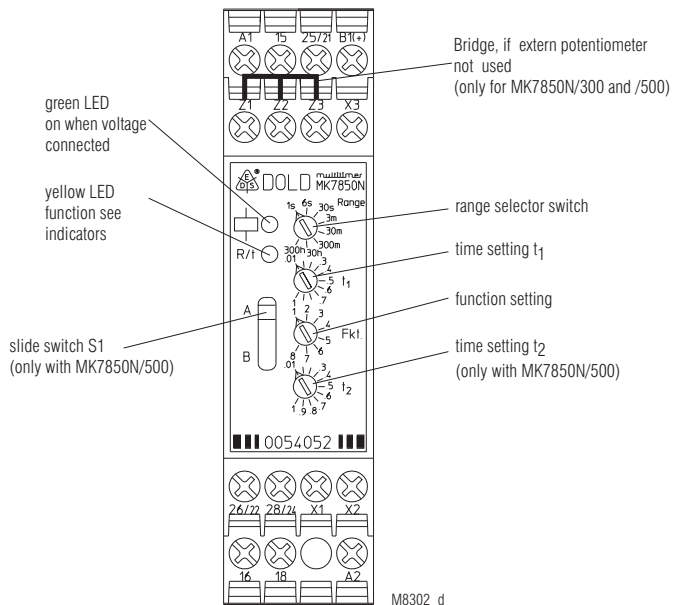
The wires to the remote potentiometers should be installed separately from the lines with mains voltage. If this is not possible, a screened cable is recommended where the shield is connected to Z2.

To terminals Z1, Z2 and Z3 no external voltage must be connected, as the unit might be damaged.

Additional function

With the variant MK 7850N/500 additional features can be selected for the functions position 3, 4 and 7 using the slide switch S1 on the relay front in position "B". At the same time a second time setting t2 is available on the lower potentiometer (see Function Diagram) the time range is the same as for t1.

Setting



Attention

If no remote potentiometers at MK 7850N/500 are required the terminals Z1-Z2 resp. Z2-Z3 have to be linked.

Technical Data	
Time circuit	
Time ranges:	8 time ranges in one unit, settable via rotational switch 0.02 ... 1 s 0.3 ... 30 min 0.06 ... 6 s 3 ... 300 min 0.3 ... 30 s 0.3 ... 30 h 0.03 ... 3 min 3 ... 300 h continuous, 1:100 on relative scale (t2 only at MK 7850N/500)
Time setting t1, t2:	
Recovery time:	
at DC 24 V:	approx. 15 ms
at DC 240 V:	approx. 50 ms
at AC 230 V:	approx. 80 ms
Repeat accuracy:	± 0.5 % of selected end of scale value + 20 ms
Voltage and temperature influence:	< 1 % with the complete operating range
Input	
Nominal voltage U_N:	AC/DC 12 ... 240 V
Voltage range:	0.8 ... 1.1 U _N
Release voltage (A1/A2)	
	Delayed contact
AC 50 Hz:	approx. 7.5 V
DC:	approx. 7 V
	Instantaneous contact
AC 50 Hz:	approx. 3 V
DC:	approx. 3.3 V
Max. permitted residual current with 2-wire proximity sensor control (A1-A2)	
up to AC/DC 150 V:	AC resp. DC 5 mA
up to AC/DC 264 V:	AC resp. DC 3 mA
Control current B1:	approx. 1mA, over complete voltage range
Min. on/off time of control input B1(+):	
AC 50 Hz:	approx. 15 ms / approx. 60 ms
DC:	approx. 5 ms / approx. 60 ms
Release voltage (B1/A2)	
AC 50 Hz:	approx. 3.5 V
DC:	approx. 3 V
Nominal power consumption	
AC 12 V:	approx. 1.5 VA
AC 24 V:	approx. 2 VA
AC 240 V:	approx. 3 VA
DC 12 V:	approx. 1 W
DC 24 V:	approx. 1 W
DC 240 V:	approx. 1 W
Nominal frequency:	45 ... 400 Hz
Output	
Contacts	
MK 7850N.82:	2 changeover contacts, one programmable as instantaneous contact:
without bridge X1-X2:	25-26-28 delayed changeover contact
with bridge X1-X2:	21-22-24 instantaneous contact at U _N on A1-A2
Contact material:	AgNi
Measured nominal voltage:	AC 250 V
Thermal current I_{th}:	see quadratic total current limit curve (max. 4 A per contact)
Switching capacity	
to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life	IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	1.5 x 10 ⁵ switching cycles
Permissible switching frequency:	36 000 switching cycles / h
Short circuit strength	
max. fuse rating:	4 A gL IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10 ⁶ switching cycles

Technical Data	
General Data	
Operating mode:	Continuous operation
Temperature range	
Operation:	- 40 ... + 60 °C (higher temperature see quadratic total current limit curve)
Storage:	- 40 ... + 70 °C
Relative air humidity:	93 % at 40 °C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree:	4 kV / 2 IEC 60 664-1
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF-irradiation	
80 MHz ... 1 GHz:	20 V / m IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V / m IEC/EN 61 000-4-3
Fast transients:	2 kV IEC/EN 61 000-4-4
Surge voltages between	
wires for power supply:	2 kV IEC/EN 61 000-4-5
between wire and ground:	4 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55 011
Degree of protection	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6 40 / 060 / 04 IEC/EN 60 068-1
Climate resistance:	
Terminal designation:	EN 50 005
Wire connection	DIN 46 228-1/-2/-3/-4
Screw terminals (integrated):	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled or 2 x 1.5 mm ² stranded ferruled or 2 x 2.5 mm ² solid
Insulation of wires or sleeve length:	8 mm
Plug in with screw terminals	
max. cross section for connection:	1 x 2.5 mm ² solid or 1 x 2.5 mm ² stranded ferruled
Insulation of wires or sleeve length:	8 mm
Plug in with cage clamp terminals	
max. cross section for connection:	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled
min. cross section for connection:	0.5 mm ²
Insulation of wires or sleeve length:	12 ±0.5 mm
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Wire fixing:	Box terminals with wire protection
Fixing torque:	0.8 Nm
Mounting:	DIN rail IEC/EN 60 715
Weight:	approx. 150 g
Dimensions	
Width x height x depth	
MK 7850N/200:	22.5 x 90 x 97 mm
MK 7850N/200 PC:	22.5 x 111 x 97 mm
MK 7850N/200 PS:	22.5 x 104 x 97 mm

Classification to DIN EN 50155

Vibration and shock resistance: Category 1, Class B IEC/EN 61 373
Ambient temperature: T1, T2 compliant
 T3 and TX with operational limitations
Protective coating of the PCB: No

UL-Data

Switching capacity:
 Ambient temperature 60°C: Pilot duty B300
 5A 250Vac G.P.
 60°C / 75°C copper conductors only
Wire connection:
 Screw terminals fixed: AWG 20 - 12 Sol/Str Torque 0.8 Nm
 Plug in screw: AWG 20 - 14 Sol Torque 0.8 Nm
 AWG 20 - 16 Str Torque 0.8 Nm
 Plug in cage clamp: AWG 20 - 12 Sol/Str



Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Switching capacity:
 to AC 15
 NO contact: 1.5 A / AC 230 V



Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

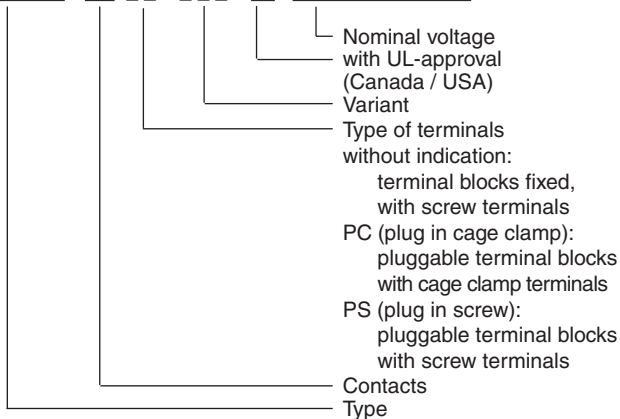
MK 7850N.82/200/61 AC/DC 12 ... 240 V
 Article number: 0056618
 • Output: 2 changeover contacts, one programmable as instantaneous contact
 • Nominal voltage U_N : AC/DC 12 ... 240 V
 • Time ranges: from 0.02 s ... 300 h
 • Width: 22.5 mm

Variants

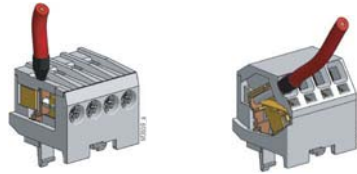
MK 7850N.82/300: 8 functions with connection facility for 1 remote potentiometer 10 k Ω (t1).
 MK 7850N.82/500: second time setting t2, connection facility for 2 remote potentiometers 10 k Ω to adjust t1 and t2,
 2 additional functions selectable via slide switch S1:
 - Cyclic timer, start with break (TP)
 - Fleeting on make and break (EW/AW)

Ordering example for variants

MK 7850N .82 _ _ / _ _ _ /61 AC/DC 12 ... 240 V



Options with Pluggable Terminal Blocks

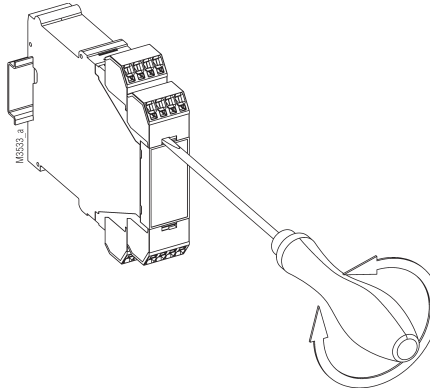


Screw terminal (PS/plugin screw) Cage clamp (PC/plugin cage clamp)

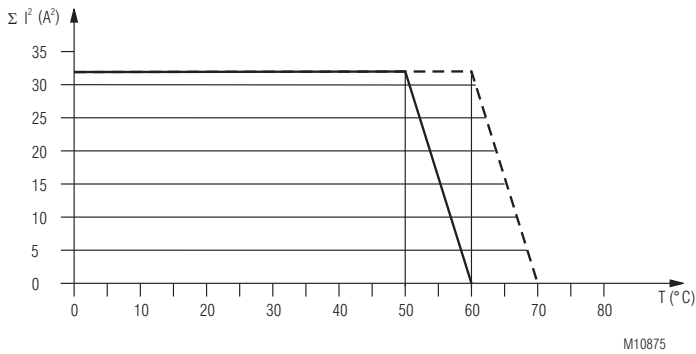
Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Characteristic



--- device mounted away from heat generation components.

— device mounted without distance heated by devices with same load.

quadratic total current limit curve

Accessories

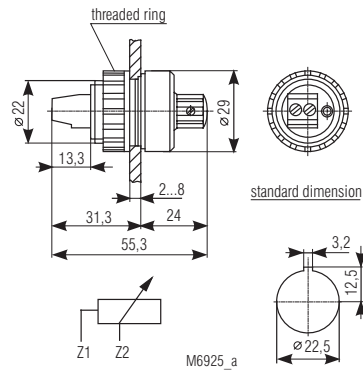
AD 3:

External potentiometer 10 kΩ
Article number: 0028962

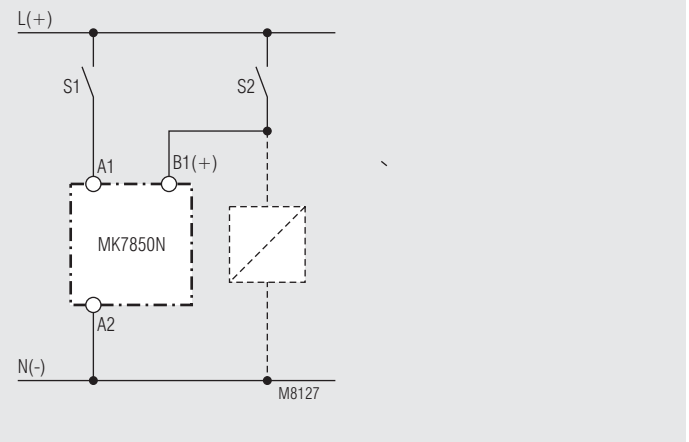
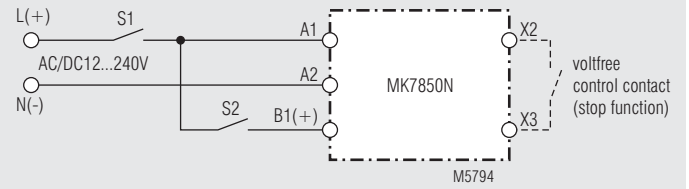
The external potentiometer is used for remote setting of the time delay. The internal potentiometer of the timer must be set to min. time delay.

Degree of protection front side:

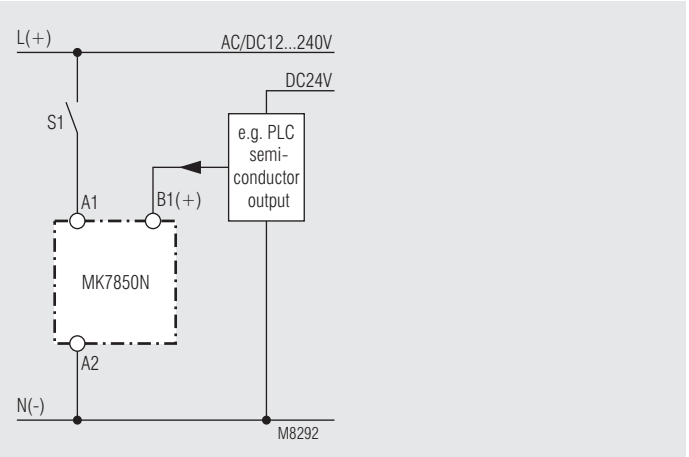
IP 60



Connection Examples



Control with parallel connected load



Connection with 2 different control voltages.

EMC-Testing of MK7850N according to EN 50155 Rev 07/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1-1.2/50µs source impedance 42 Ohm EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2 kV line to line, 1.2/50µs source impedance 2 Ohm 4 kV line to ground 1.2/50µs source impedance 12 Ohm	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2-EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	
Fast Transients	EN50155part 12.2.7.3-EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	
RF immunity	EN50155part 12.2.8.1-EN50121-3-2 table 7+8 EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	10 V/m 1GHZ-2,7GHZ	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1GHZ-2,5GHZ	A	EN 61000-4-3	10 V/m 1GHZ-2,7GHZ	A (1)	
RF emission	Test Standard EN50155part 12.2.8.2-EN50121-3-2 table 4+5 EN 55011	Frequency range 9kHz to 150kHz	Limits No limits	Dold Type test Test Standard EN 55011	Frequency range 9kHz to 150kHz	Limits No limits	Remarks
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
	EN50155part 12.2.8.2-EN50121-3-2 table 6 EN 55011	230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHZ	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of MK 7850N according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.8 kV at rated Voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC50 to 90V	No flashover allowed	IEC 60-1	2.8 kV at rated Voltage 300V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.8 kV at rated Voltage 300V	No flashover allowed

MULTITIMER Multifunction Relay SN 7920



02-49658



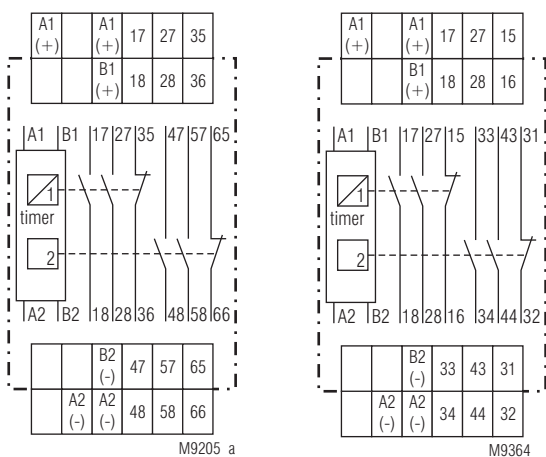
Your Advantages

- Higher flexibility (8 function in one unit)
- To switch high DC-loads (DC 110 V) with mechanically forcibly guided contacts according to EN 50205

Features

- According to IEC/EN 61 812-1
- 8 functions settable via rotational switch:
 - Delay on energisation (AV)
 - Fleeting on make (EW)
 - Delay pulse (IE)
 - Flasher, start with pulse (BI)
 - Delay on de-energisation (RV)
 - Pulse forming function (IF)
 - Fleeting on break (AW)
 - Delay on energisation and de-energisation (AV / RV)
- 8 time ranges from 0.05 s ... 300 h selectable via rotational switches
- Voltage range AC/DC 24 ... 230 V
- High DC switching capacity
- With time interruption / time adding input
- Adjustment aid for quick setting of long time values
- Contacts:
 - 1 NC + 2 NO delayed
 - 1 NC + 2 NO delayed or instantaneous
- LED indicators for operation, contact position and time delay
- DIN rail or screw mounting
- 52.5 mm width

Circuit Diagrams



SN 7920

SN 7920/001

Connection Terminals

Terminal designation	Signal designation
A1(+)/ A2(-)	Auxiliary voltage
B1(+)/ B2(-)	Control input, dependent of 3position rotational switch
17, 18 ; 27, 28	Forcibly guided NO contacts Relay 1
35, 36	Forcibly guided NC, Relay 1
47, 48 ; 57, 58	Forcibly guided NO contacts Relay 2
65, 66	Forcibly guided NC, Relay 2

Approvals and Markings



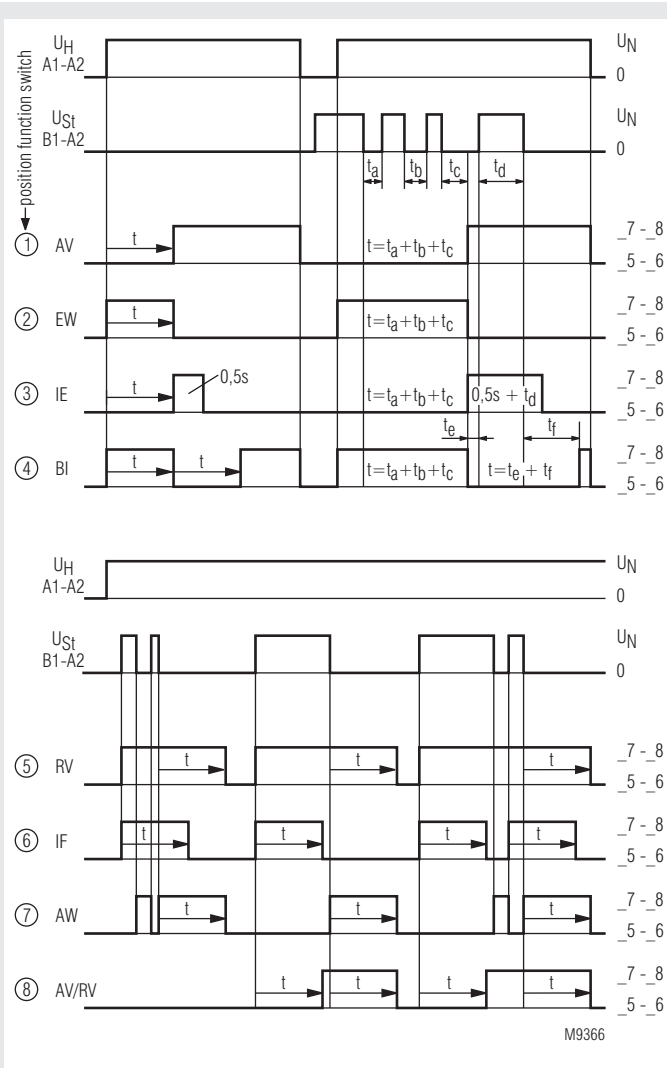
Applications

Time dependent controls for industrial and railway applications.

Indicators

- | | |
|--|--|
| green LED: | on, when voltage connected |
| yellow LED "R/t": | shows status of output relay and time delay: |
| - Continuously off: | output relay not active; |
| | no time delay |
| - Continuously on: | output relay active; |
| | no time delay |
| - Flashing (short on, long off) | output relay not active; time delay |
| - Flashing (long on, short off) | output relay active; time delay |
| yellow LED (right) 1 : | shows status of delayed relay |
| yellow LED (right) 2 : | shows status of delayed/instantaneous relay |

Function Diagram for delayed output relay (relay 1)



① ... ⑧ = position of function switch

- | | |
|----------------------------------|---|
| ① AV = Delay on energisation | ⑤ RV = Delay on de-energisation |
| ② EW = Fleeting on make | ⑥ IF = Pulse forming function |
| ③ IE = Delayed pulse | ⑦ AW = Fleeting on break |
| ④ BI = Flasher, start with pulse | ⑧ AV/RV = Delay on energisation and de-energisation |

Function of Relay 2

The function of relay 2 can be altered with the 3position rotational switch:
 Timer: relay 2 has function of relay 1
 A1/A2: relay 2 functions as instantaneous relay controlled by A1/A2
 B1/B2: relay 2 functions as instantaneous relay controlled by B1/B2

Notes

Adjustment assistance

The flashing period of the yellow LED is $1 s \pm 4 \%$ and can be used to adjust the time. Especially on the lower end of scale and for long times it is suitable as the multiplication factors between the different time ranges are exact without tolerance.

Example:

The required time is 40 min. It has to be adjusted within range 3 ... 300 min. The time check takes too long as several timing cycles would be necessary for a precise value. For faster adjustment the setting is made to 0.03 ... 3 min. On this range the potentiometer should be set to 0.4 min (= 24 sec.). With the right potentiometer setting the LED must show 24 flashing cycles. After that the time range is switched over to 3 ... 300 min. and the setting is complete.

Time interruption / time adding

With the functions AV, EW, IE and BI the time delay can be interrupted by controlling input B1 (+) with control voltage. Removing the control signal will continue the timing cycle (time addition).

Control input B1(+) / B2(-) (galvanic separated)

The functions RV, IF, AW, AV / RV have to be controlled via control input B1(+)/B2(-). With external link A2(-) / B2(-) input B1(+) can be operated with positive voltage against A1(+) or with external link A1(+) / B1(+) input B2(-) can be operated with negative voltage against A2(-).

If with function IF the inputs A1 and B1 are controlled simultaneously, a pulse with the adjusted length is started.

Technical Data

Time circuit

Time ranges:	8 time ranges in one unit, settable via rotational switch
	0.05 ... 1 s 0.3 ... 30 min
	0.06 ... 6 s 3 ... 300 min
	0.3 ... 30 s 0.3 ... 30 h
	0.03 ... 3 min 3 ... 300 h

Time setting t: continuous, 1:100 on relative scale

Recovery time:

at DC 24 V: approx. 15 ms
 at DC 110 V: approx. 50 ms
 at AC 110 V: approx. 80 ms

Repeat accuracy:

$\pm 0.5 \%$ of selected end of scale value + 20 ms

Voltage and

temperature influence:

< 1 % with the complete operating range

Input

Auxiliary voltage

Nominal voltage U_N : AC/DC 24 ... 230 V

Voltage range: 0.7 ... 1.1 U_N

Frequency at AC voltage: 45 ... 400 Hz

Control input B1 / B1: galvanic separated

Voltage range: AC/DC 10 ... 270 V

Control current B1(+) / B1(-): 1 mA

Reverse polarity protection: 1 kV

Min. on/off time of control input B1(+) / B1(-):

AC 50 Hz: approx. 15 ms / approx. 30 ms
 DC: approx. 5 ms / approx. 30 ms

Release voltage (B1/B2)

AC 50 Hz: approx. 6 V

DC: approx. 9 V

Nominal power consumption

AC 24 V: approx. 2.5 VA

AC 110 V: approx. 6 VA

DC 24 V: approx. 3 W

DC 110 V: approx. 3 W

Nominal frequency: 45 ... 400 Hz

Technical Data	
Output	
Contacts:	2 NO contacts, 1 NC contact delayed 2 NO contacts, 1 NC contact delayed or as instantaneous contact programmable AgNi
Contact material:	AgNi
Measured nominal voltage:	AC 250 V
Thermal current I_{th}:	max. 6 A (see quadratic total current limit curve)
Switching capacity	
to AC 15	
NO contacts:	3 A / AC 230 V
NC contacts:	2 A / AC 230 V
nach DC 13:	1 A / DC 110 V IEC/EN 60 947-5-1 6 A / DC 24 V IEC/EN 60 947-5-1
Electrical life	
NO contacts	
at 3 A, AC 230 V:	1 x 10 ⁵ switching cycles IEC/EN 60 947-5-1
at 2 A, AC 230 V:	2.5 x 10 ⁵ switch.cycl. IEC/EN 60 947-5-1
at 1 A, AC 230 V:	1 x 10 ⁶ switching cycles IEC/EN 60 947-5-1
NC contacts	
at 2 A, AC 230 V:	50000 switching cycles IEC/EN 60 947-5-1
at 0.5 A, AC 230 V:	1 x 10 ⁶ switching cycles IEC/EN 60 947-5-1
at 5 A, AC 230 V resistive load cos φ = 1:	2 x 10 ⁵ switching cycles
to DC 1 at 2 A, DC 110 V:	5 x 10 ⁵ switching cycles IEC/EN 60 947-5-1
to DC 13 at 0.5 A, DC 110 V:	1 x 10 ⁶ switching cycles IEC/EN 60 947-5-1
Short circuit strength	
max. fuse rating:	6 A gL; machine C8 IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10 ⁶ switching cycles

General Data

Operating:	Continuous	
Temperature range		
Operation:	- 40 ... + 75 °C	
Storage:	- 40 ... + 75 °C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:		
Contacts, auxiliary voltage, control input B1/B2:	4 kV / 2 (basis insulation)	IEC 60 664-1
Overvoltage category:	III	
Insulation test voltage, type test:	2.8 kV; 1 min	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:		
Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6 40 / 060 / 04 IEC/EN 60 068-1		
Climate resistance:		
Terminal designation: EN 50 005		
Wire connection: 2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded wire with sleeve DIN 46 228/-1/-2/-3/-4		
Insulation of wires or sleeve length: 10 mm		
Wire fixing:	Flat terminal with self-lifting clamping piece IEC/EN 60 999-1	
Fixing torque: 0,8 Nm		
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight: 260 g		

Dimensions

Width x height x depth: 52.5 x 90 x 98 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2, T3, TX compliant	
Protective coating of the PCB:	No	

Standard Type

SN 7920 AC/DC 24 ... 230 V	
Article number:	0058785
• Output:	2 x 2 NO, 2 NC contacts
• Nominal voltage U_N :	AC/DC 24 ... 230 V
• Time ranges:	from 0.05 s ... 300 h
• Width:	52.5 mm

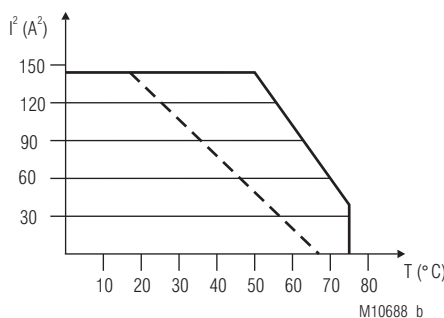
Variant

SN 7920/001	different terminal designation see Circuit Diagram
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Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578
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Characteristic



— device mounted on distance with air circulation

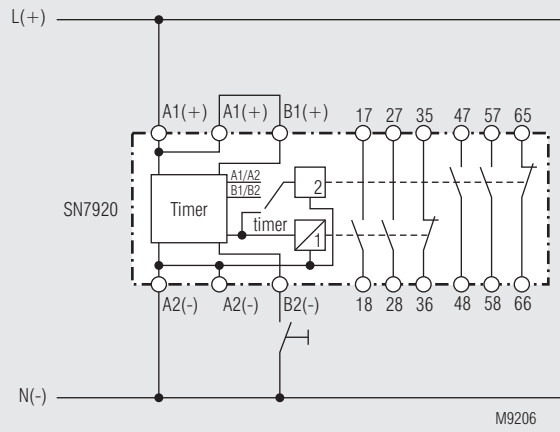
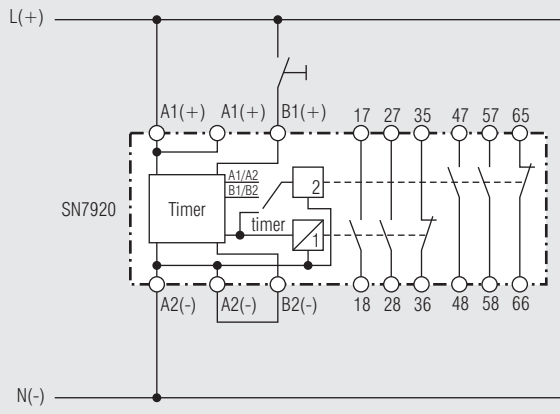
- - - device mounted without distance heated by
devices with same load

$$\sum I_{th}^2 = I_{th1}^2 + I_{th2}^2 + I_{th3}^2 + I_{th4}^2$$

I_{th1} , I_{th2} , I_{th3} , I_{th4} : current in contact paths

Quadratic total current limit curve

Application Examples



EMC-Testing of SN 7920 according to EN 50155 Rev 13/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1-1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2 kV line to line 4 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz- 1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ- 2,1GHZ	A	EN 61000-4-3	10 V/m 1,4GHZ- 2,1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 2,1Hz-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHz	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of SN 7920 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.8 kV	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.8 kV	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.8 kV	No flashover allowed

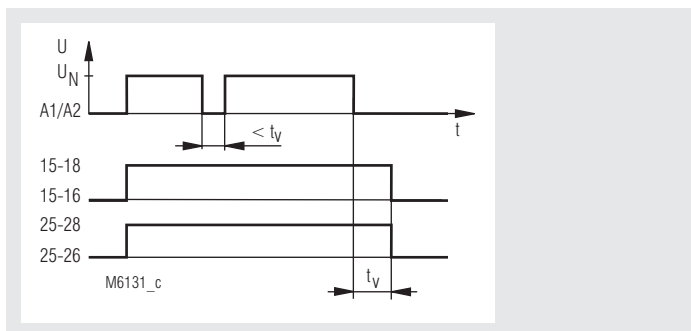
Time Control Technique

MINITIMER Timer, Release Delay MK 7873N



- According to IEC/EN 61 812-1
- Delay up to 300 s
- Repeat accuracy $\leq \pm 0.5 \%$
- Without auxiliary voltage
- No recovery time
- With large voltage range AC/DC 24 ... 240 V
- LED display for power supply
- 2 changeover contacts
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- With pluggable terminal blocks for easy exchange of devices
 - with screw terminals
 - or with cage clamp terminals
- Width 22.5 mm

Function Diagram



Approvals and Markings



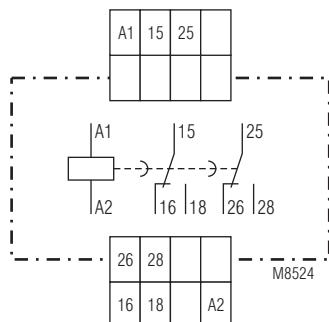
Application

Time dependent controls for industrial and railway applications.

Indicators

LED: on, when supply connected

Circuit Diagram



Connection Terminals

Terminal designation	Signal designation
A1, A2	Supply voltage
15, 16, 18, 25, 26, 28	Changeover contacts

MK 7873N.82

Technical Data	
Time circuit	
Time ranges:	0.05 ... 1 s 0.15 ... 3 s 0.5 ... 10 s 1.5 ... 30 s 5 ... 100 s 15 ... 300 s
Time setting:	steppless
Minimum switch-on time of the control input for DC 24 V:	150 ms
for UC 220 V:	25 ms
Recovery time tw 50 / 100:	0
Repeat accuracy:	≤ ± 0.5 % of set value
Voltage influence:	≤ 0.5 %
Temperature influence:	< 0.2 % / K
Input	

Nominal voltage U_N:	AC/DC 24 ... 240 V
Voltage range:	AC 19.2 ... 264 V DC 21.6 ... 300 V
Nominal consumption	
Effective power:	0.8 W
Frequency range:	45 ... 400 Hz
Release voltage:	10 V
Output	

Contacts:	2 delayed changeover contacts	
Contact material:	AgSnO ₂ + 0.2 μm Au	
Measured nominal voltage:	AC 250 V	
Thermal current I_{th}:	5 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life to AC 15 at 3 A, AC 230 V:	8 x 10 ⁵ switching cycles	
Permissible operating frequency:		
for time ranges ≤ 10 s:	1 400 switching cycles / h	
for time ranges ≥ 30 s:	700 switching cycles / h	
Short circuit strength max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10 ⁶ switching cycles	

General Data		
Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60°C	
Storage:	- 25 ... + 60°C	
Relative air humidity:	93 % at 40°C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 3 (basis insulation) IEC 60 664-1 III	
Overvoltage category:	III	
Insulation test voltage, type test:	2.5 kV; 1 min	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1 GHz:	12 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	5 V / m	IEC/EN 61 000-4-3
Fast transients	2 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:	Housing: IP 40	IEC/EN 60 529
	Terminals: IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data	
Wire connection	DIN 46 228-1/-2/-3/-4
Screw terminals (integrated):	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled or 2 x 1.5 mm ² stranded ferruled or 2 x 2.5 mm ² solid
Insulation of wires or sleeve length:	8 mm
Plug in with screw terminals	
max. cross section for connection:	1 x 2.5 mm ² solid or 1 x 2.5 mm ² stranded ferruled
Insulation of wires or sleeve length:	8 mm
Plug in with cage clamp terminals	
max. cross section for connection:	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled
min. cross section for connection:	0.5 mm ²
Insulation of wires or sleeve length:	12 ±0.5 mm
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Fixing torque:	0.8 Nm
Mounting:	DIN rail
Weight:	132 g
	IEC/EN 60 715
Dimensions	
Width x height x depth:	
MK 7873N:	22.5 x 90 x 97 mm
MK 7873N PC:	22.5 x 111 x 97 mm
MK 7873N PS:	22.5 x 104 x 97 mm
Classification to DIN EN 50155	
Vibration and shock resistance:	Category 1, Class B IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations
Protective coating of the PCB:	No
UL-Data	
Switching capacity:	
Ambient temperature 60°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc G.P.
Wire connection:	60°C / 75°C copper conductors only
Screw terminals fixed:	AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw:	AWG 20 - 14 Sol Torque 0.8 Nm AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp:	AWG 20 - 12 Sol/Str

Dimensions	
Width x height x depth:	
MK 7873N:	22.5 x 90 x 97 mm
MK 7873N PC:	22.5 x 111 x 97 mm
MK 7873N PS:	22.5 x 104 x 97 mm

Classification to DIN EN 50155	
Vibration and shock resistance:	Category 1, Class B IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations
Protective coating of the PCB:	No

UL-Data	
Switching capacity:	
Ambient temperature 60°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc G.P.
Wire connection:	60°C / 75°C copper conductors only
Screw terminals fixed:	AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw:	AWG 20 - 14 Sol Torque 0.8 Nm AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp:	AWG 20 - 12 Sol/Str



Technical data that is not stated in the UL-Data, can be found in the technical data section.

Standard Type

MK 7873N.82/61 AC/DC 24 ... 240V 1.5 ... 30 s

Article number: 0054462

• Output: 2 changeover contacts

• Nominal voltage U_N : AC/DC 24 ... 240 V

• Time range: 1.5 ... 30 s

• Width: 22.5 mm

Ordering Example

MK 7873N .82 /61 AC/DC 24 ... 240 V 5 ... 100 s

Time range
Nominal voltage
UL-approval
Type of terminals
without indication:
terminal blocks fixed
with screw terminals
PC (plug in cage clamp):
pluggable terminal blocks
with cage clamp terminals
PS (plug in screw):
pluggable terminal blocks
with screw terminals
Contacts
Type

Options with Pluggable Terminal Blocks



Screw terminal
(PS/plugin screw)

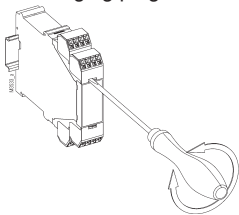


Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



EMC-Testing of MK 7873N according to EN 50155 Rev 25/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2kV 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance and shorter rise time
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	"B" effect on unit allowed during test but unit must not be affected thereafter
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	12 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	12 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHZ	A	EN 61000-4-3	5 V/m 1GHz-2,1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	5 V/m 2,1Hz-2,7GHZ	A (1)	
	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B	
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	230MHz to 1GHz	Limit value class B	

Voltage-Testing of MK 7873N according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

VARIMETER

Frequency Relay
MK 9837N, MH 9837



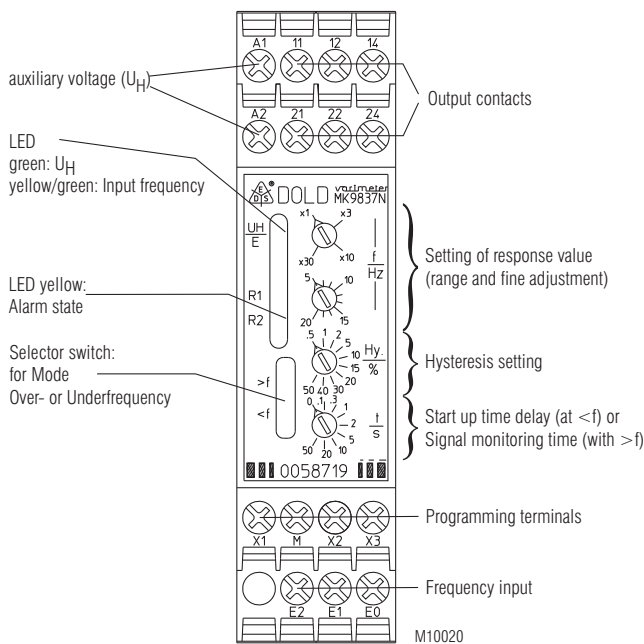
Your Advantages

- Universal usage
- Easy handling

Features

- According to IEC/EN 60 255-1
- Detection of over- or underfrequency of alternating voltage (adjustable function)
- Fast reaction time by measuring duration of cycle of input frequency
- Universal measuring input for AC-voltages of 15 ... 280 V as well as 30 ... 550 V
- As option with measuring input for inverters
- 4 ranges adjustable response value 1,5 ... 200 Hz or 5 ... 600 Hz
- Adjustable hysteresis
- Adjustable start up time delay 0 ... 50 s at function underfrequency
- Adjustable monitoring time for missing input signal at function overfrequency
- Response delay programmable via terminals 0 ... 100 s
- Alarm storing or auto-reset programmable via terminals
- Galvanic separation between measuring input, auxiliary voltage and output contacts
- MH 9837 available with wide input range for auxiliary supply (AC/DC 24 ... 60 V or AC/DC 110 ... 230 V)
- 2 changeover contacts, closed circuit operation
- Open circuit operation on request
- LED indication for auxiliary voltage, measuring voltage and alarm status
- MH 9837.12/008: with galvanic separated analogue output (current/voltage) and 11 step LED chain for the actual frequency
- Device available with 2 response values and separately controlled outputrelays for under- and overfrequency see MK 9837N/500
- 2 possible compact designs:
MK 9837N: Width 22,5 mm
MH 9837: Width 45 mm

Setting



Approvals and Markings

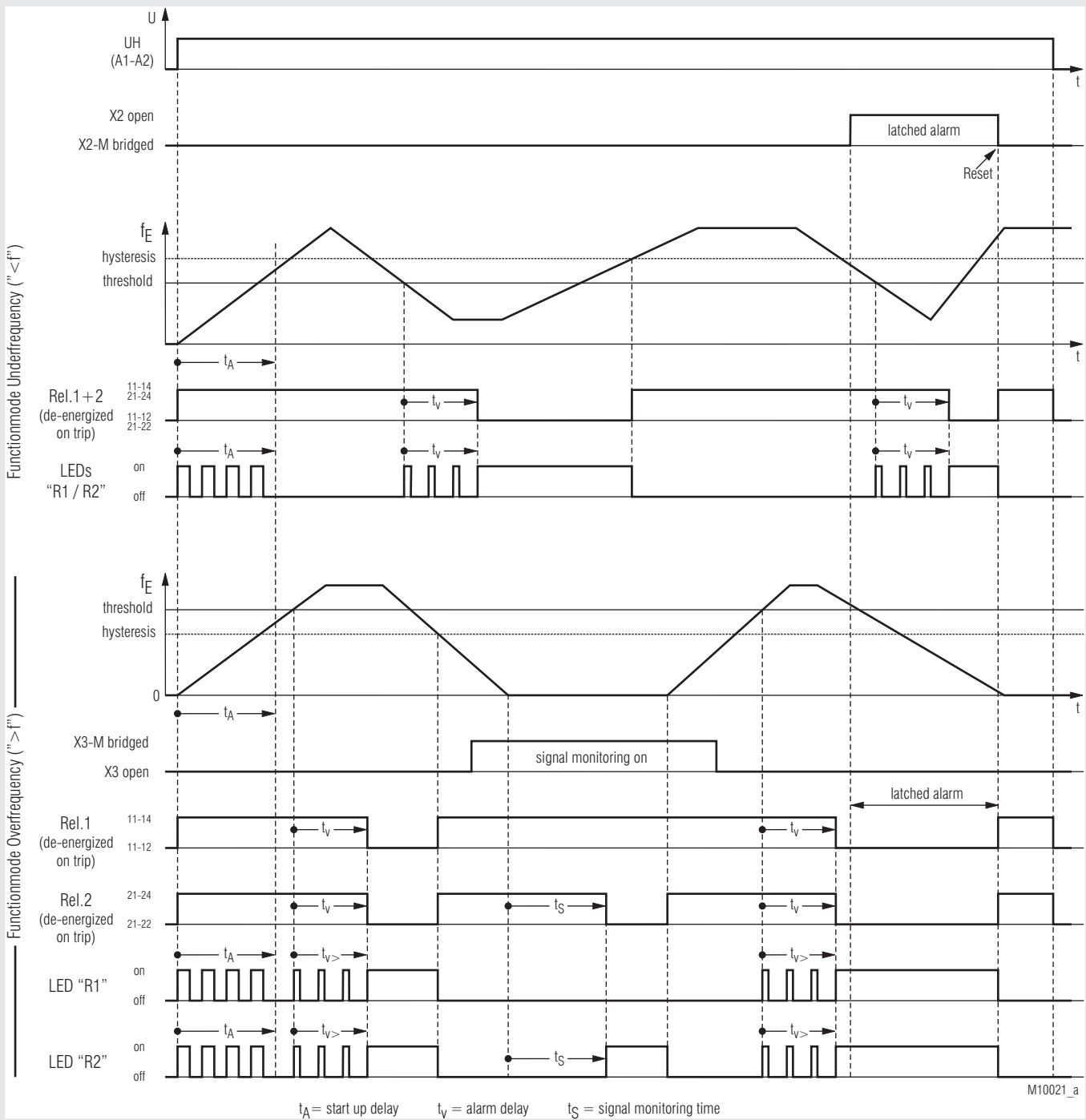


*) only MK 9837N

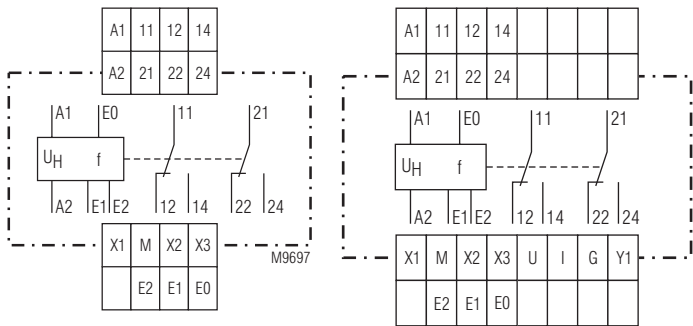
Applications

- Monitoring of frequency in AC systems
- Monitoring of rotor frequency on slip ring motors
- Control and monitoring of motors in sewage water treatment plants
- Monitoring of output voltage on inverters (variant /050)
- Monitoring of supply voltage frequency on railway rolling stock

Function Diagram



Circuit Diagrams



MK 9837N

MH 9837/008

Connection Terminals

Terminal designation	Signal designation
A1+, A1	+ / L
A2	- / N
E0, E1, E2	Frequency input
X1, X2, X3	Programming terminals
M	Reference for programming terminals
U	Analogue output voltage
I	Analogue output current
G	Reference for analogue output
Y1	Range selection for analogue output
11, 12, 14, 21, 22, 24	"monitoring output frequency failure (2 changeover contacts)"

Functions

The auxiliary supply is connected to terminals A1-A2.

Terminals E0-E1-E2 form the measuring input. For low voltages the measuring voltage is connected to E1-E0 and for higher voltages to E2-E0 (see section technical data).

The input frequency is compared to the setting value (response value = fine tunig x range).

As the device measures the cycle duration the fastest frequency measurement is possible (reaction time = cycle time + 10 ms).

In overfrequency mode (switch on front in pos. ">f") the output relay switches to alarm state if the input frequency rises above the response value for a longer time then selected on the terminals. If the measuring frequency drops again under the hysteresis value, the output relay switches back to good state without delay.

In underfrequency mode (switch on front in pos. "<f") the output relay switches to alarm state, if the input frequency drops below the response value for a longer time then selected on the terminals. If the measuring frequency rises again above the hysteresis value, the output relay switches back to good state without delay.

If manual reset is chosen, the output relay stays in tripped position, even if the frequency is back to normal. The reset is made by bridging terminals X2-M or by disconnecting the auxiliary supply.

In alarm state the yellow LEDs „R1“ / „R2“ are continuously on, during time delay they flash with short pulse.

In de-energized on trip mode the output relay is energized in good state (contacts 11-14 etc. closed).

In energized on trip mode the output relay is energized in alarm state (contacts 11-14 etc. closed).

If start up delay is selected a timer is started after connection of auxiliary supply that disables the measuring circuit for the adjusted time. This start up delay avoids an alarm e.g. when starting a generator or motor.

When measuring overfrequency, monitoring of the signal on E0-E1-E2 can be selected. If the signal is missing longer then the selected monitoring time, relay 2 (contacts 21-22-24) and LED "R2" indicate alarm.

Indicators

- Upper LED „UH/E“:
- green, when only auxiliary voltage connected to A1 - A2
 - yellow/green, when measuring frequency is detected on E0-E1-E2
- Lower LED „R1“ (yellow):
- On, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active
- Lower LED „R2“ (yellow):
- On, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active
 - additional flashes at signal monitoring alarm LEDs "R1" and "R2" flash together during start up delay

Notes

Frequency measuring input

The standard measuring input is divided up in to voltage ranges (E1-E0 AC 15... 280 V and E2-E0 AC 30 ... 550 V). If the measuring voltage is always higher then AC 30 V, the higher range should be used. To measure the output frequency on inverters the variant /_5_ has to be used. A special dimensioned measuring input with low pass characteristic avoids the measuring of the pulse frequency. In addition the input sensitivity is adapted to the voltage-/frequency-characteristic of inverters (see diagram in technical data).

Visual indication of measuring voltage: If the voltage on the measuring input is to low for correct function on inputs E0-E1-E2 the upper 2-colour LED "UH/E" shows green continuous light. If underfrequency is selected the unit indicates underfrequency alarm, if overfrequency is selected together with measuring signal monitoring the unit indicates measuring signal alarm. If the voltage on the measuring input is high enough the LED "UH/E" flashes yellow/green.

Notes

Start up delay / monitoring of measuring signal.

The start up time delay (tA) can be adjusted with the lowest potentiometer on the front side of the unit and is activated when connecting the auxiliary supply.

In underfrequency mode ("<f") the start up delay can be extended/restarted at any time with a control contact between terminals X3-M. As long as X3-M is bridged the start up delay is continuously on and the frequency is not measured. When the link on X3-M is opened the start up delay time restarts.

In overfrequency mode (">f") with a bridge on X3-M, the lowest potentiometer sets the measuring signal monitoring time (tS) (The adjusted time values tA/tS are identically).

When signal monitoring in mode ">f" is selected by bridging X3-M the measuring input is monitored as follows: If during the adjusted monitoring time interval no measuring signal is detected, measuring signal alarm is indicated. As soon as the measuring signal returns the alarm status is reset (auto reset selected) and the monitoring interval tS starts again.

The alarm status is indicated on relay 2 (contacts 21-22-24) and LED "R2" and can be easily differentiated from under/over frequency alarm where both relays (contacts 11-12-14and 21-22-24) and LEDs "R1"and "R2") are active.

The detection of missing measuring signal can increase the safety in critical applications on overfrequency. It detects if the measuring signal is connected to the input of the device and works correctly

Programming terminals (M-X1-X2-X3):

Attention! The terminals M-X1-X2-X3 have no galvanic separation to the measuring circuit, and must be operated potential free.

- M: Common connection (Ground) of the programming terminals
- X1: A response delay of 0...100 s after connection of auxiliary supply is achieved by connecting a X1 to M with a potentiometer or fixed resistor (see technical data). The delay can be stopped by bridging X1 to M at any time.
- X2: Manual reset with NO contact push button on X2-M, auto reset with terminals X2-M bridged.
- X3: When X3-M is bridged in mode "underfrequency" the start up delay is continuously active or the time is restarted. In mode overfrequency the monitoring of the measuring signal is switched on by bridging X3-M.

Adjustment aid for start up delay and alarm delay

During the elapse of start up delay and alarm delay the yellow LED „R1“ and „R2“ is flashing with a frequency of 2 Hz. To set a specific time value in seconds the number of flash pulses can be used to check the setting: Number of flash pulses divided by 2 = time delay in seconds.

Variant MH 9837.12/008: 45 mm width

Identically to MK 9837N.12, but with 11 step LED chain indicator and galvanic separated analogue output to display the actual measured frequency.

On terminals U/G of the analogue output 0-10 V are provided, on terminals I/G 0-20 mA are available. By bridging terminals Y1 and G the output can be switched over to 2-10 V and 4-20 mA. The max. value of the analogue output is indicating 2 times of the max. value of the selected range this allows also to indicate overfrequency values. The scaling is linear to the input frequency (lowest analogue value is 0 Hz). The LED chain indicator shows on 10 LEDs the actual frequency (≤ 10% ... 100% of the setting range). If the frequency exceeds the maximum value of the range the indicator is switched over to 2 x max value and the top LED (red) is on.

Technical Data**Frequency Measuring Input (E0-E1-E2)****Standard-frequency measuring****Voltage range**

E0-E1: AC 15 ... 280 V,
E0-E2: AC 30 ... 550 V

Input resistance

E0-E1: approx. 300 kΩ
E0-E2: approx. 850 kΩ

Frequency Measuring Input for Inverters (variant / 5_)

Max. input voltage: AC 550 V
Min. measuring voltage: see characteristic M9349
Input resistance: approx. 900 kΩ

Common Data for Both Measuring Inputs

Galvanic separation: Frequency measuring input to auxiliary voltage and output contacts

Frequency ranges:

1,5 ... 6 Hz	5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz or
5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz	150 ... 600 Hz 4 ranges selectable

Response time

(response value): continuously variable;
1:4 in each response value

Tolerances of the adjusted tripping values at variation of auxiliary supply and temperature:

Hysteresis: better than ± 1 %
continuously variable: 0,5 ... 50 %
of adjustable response value

Reaction time of

Frequency monitoring: (Alarm delay set to 0)
Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms
adjustable 0 ... 100 s with resistor/potentiometer across terminals X1-M:

R / kΩ:	0	15	22	33	47	68	100	150	220	470	∞
t _r / s:	0	0.3	0.7	1.3	2.3	5	9	15	25	50	100

Time between connection of auxiliary supply and ready to measure:

approx. 0,4 s (with start up delay is 0)

Start up time delay /

Signal monitoring time: 20 ms ... 50 s continuously variable
on logarithmic scale

Auxiliary Circuit (A1-A2)**Auxiliary voltage U_H**
(galvanic separation):

AC 115, 230, 400 V
DC 12, 24, 48 V
AC/DC 24 ... 60, 110 ... 230 V (only for MH-version possible)

Voltage range

AC: 0,8 ... 1,1 U_H
DC: 0,9 ... 1,2 U_H
AC/DC: 0,75 ... 1,2 U_H

Frequency range

AC: 45 ... 440 Hz

Nominal consumption:

AC: approx. 4 VA
DC: approx. 2 W

Output (11-12-14, 21-22-24)

Contacts: 2 changeover contacts
Thermal current I_{th}: 4 A

Switching capacity

according to AC 15

NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1

according to DC 13

NO contact: 1 A / DC 24 V IEC/EN 60 947-5-1
NC contact: 1 A / DC 24 V IEC/EN 60 947-5-1

Electrical life

acc. to AC 15 at 1 A, AC 230 V: 1,5 x 10⁵ switching cycles IEC/EN 60 947-5-1

Short circuit strength

max. fuse rating: 4 A gL IEC/EN 60 947-5-1

Mechanical life: ≥ 30 x 10⁶ switching cycles

Technical Data**Analogue Output with MH 9837.12/008****galvanic separation AC 3750V****to auxiliary supply, measuring circuit and relay outputs**

terminal U(+) / G(-): 0 ... 10 V, max. 10 mA
terminal I (+) / G(-): 0 ... 20 mA, max. burden 500 Ohm
change to 2 ... 10 V or 4 ... 20 mA by bridging terminal Y1 and G.
scaling is linear with frequency (lowest value at f = 0, highest value at 2 x max setting value)

General Data

Nominal operating mode: continuous operation

Temperature range

Operation: - 20 ... + 60°C
(higher temperature with limitations on request)

Storage: - 25 ... + 60°C

Altitude: < 2,000 m

Clearance and creepage distance

rated impulse voltage /

pollution degree:

output to measuring circuit: 4 kV / 2 IEC 60 664-1

output to auxiliary circuit: 4 kV / 2 IEC 60 664-1

output to output: 4 kV / 2 IEC 60 664-1

auxiliary circuit to measuring input: 4 kV / 2 IEC 60 664-1

Programming terminals

M-X1-X2-X3: without galv. separation to measuring circuit

EMV

Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2

HF-irradiation

80 MHz ... 1 GHz: 20 V/m IEC/EN 61 000-4-3

1 GHz ... 2.5 GHz: 10 V/m IEC/EN 61 000-4-3

2.4 GHz ... 2.7 GHz: 1 V/m IEC/EN 61 000-4-3

Fast transients: 2 kV IEC/EN 61 000-4-4

Surge voltage

between

wires for power supply: 1 kV IEC/EN 61 000-4-5

between wire and ground: 2 kV IEC/EN 61 000-4-5

HF-wire guided: 10 V IEC/EN 61 000-4-6

Interference suppression: Limit value class B EN 55 011

Degree of protection:

Housing: IP 40 IEC/EN 60 529

Terminals: IP 20 IEC/EN 60 529

Housing:

thermoplastic with V0 behaviour

according to UL subject 94

Vibration resistance: Amplitude 0,35 mm IEC/EN 60 068-2-6

Frequency 10 ... 55 Hz IEC/EN 60 068-1

20 / 060 / 04 IEC/EN 60 068-1

EN 50 005

Wire connection: 1 x 4 mm² solid or

2 x 1,5 mm² solid or

1 x 2,5 mm² stranded wire with sleeve

DIN 46 228-1/-2/-3/-4 or

2 x 1,5 mm² stranded wire with sleeve

DIN 46 228-1/-2/-3/

Plus-minus terminal screws

M3,5 box terminals with wire protection

0,8 Nm

DIN rail IEC/EN 60 715

Mounting:

Weight: MK 9837N: approx. 210 g

MH 9837: approx. 350 g

Dimensions**Width x height x depth:**

MK 9837N: 22,5 x 90 x 97 mm

MH 9837: 45 x 90 x 97 mm

Classification to DIN EN 50155

Vibration and shock resistance: Category 1, Class B IEC/EN 61 373
Ambient temperature: T1 compliant
 T2, T3 and TX with operational limitations
Protective coating of the PCB: No

CCC-Data

Auxiliary voltage U_N :
 MK 9837N: AC 115, 230 V
 DC 12, 24, 48 V

Switching capacity
 to AC 15
 NO contact: 1,5 A / AC 230 V IEC/EN 60 947-5-1



Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

MK 9837N.12 5 ... 600 Hz U_H AC 230 V
 Article number: 0058719

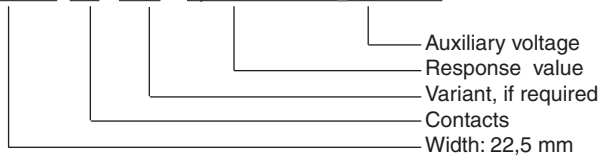
- Switchable monitoring modus: over- or underfrequency
- Closed circuit operation
- Mode overfrequency with selectable signal monitoring
- 4 settable frequency ranges are possible:
 5 ... 20 Hz, 15 ... 60 Hz, 50 ... 200 Hz, 150 ... 600 Hz
- Settable hysteresis of 0,5 ... 50 %
- Start up time delay / signal monitoring time:
 settable to 0 ... 50 s
- Response delay: settable with external resistor to 0 ... 100 s
- Alarm storing or auto-reset selectable
- Frequency measuring input: AC 15 ... 280 V / AC 30 ... 550 V
- Auxiliary voltage U_H : AC 230 V
- Output: 2 changeover contacts
- Width: 22,5 mm

Variants

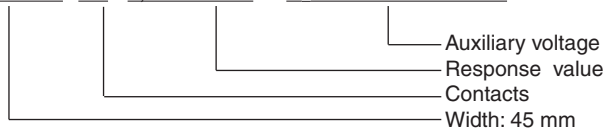
MK 9837N.12/050: as MK 9837N.12, but with measuring input for inverters
 MH 9837.12: as MK 9837N.12, but for variants with wide auxiliary voltage range
 Width: 45 mm
 MH 9837.12/008: similar to MK 9837N.12, but with galvanic separated analogue output (current/voltage) and 11 step LED chain.
 Width: 45 mm

Ordering example for variants

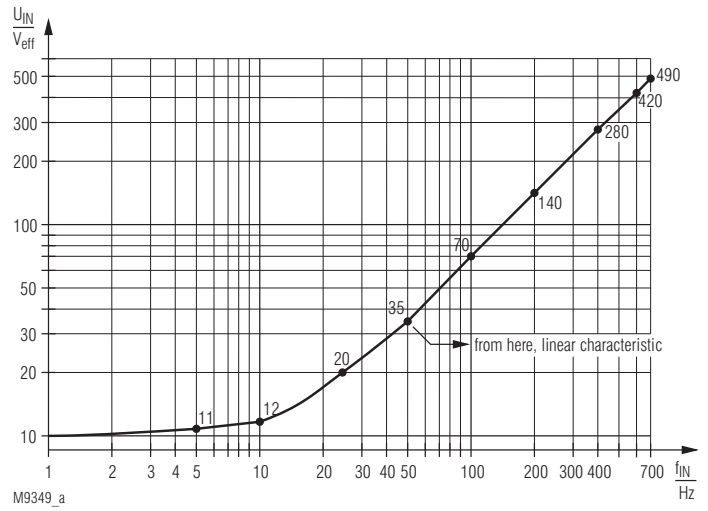
MK 9837N .12 /050 1,5 ... 200 Hz U_H AC 230 V



MH 9837 .12 1,5 ... 200 Hz U_H AC/DC 110 ... 230 V



Characteristic



Typical sensitivity of the measuring input at variant MK 9837N.12/_5_

EMC-Testing of MH9837 according to EN 50155 Rev. 25/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1-EN50121-3-2 table 7	"1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm"	B	EN 61000-4-5	"1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm"	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2-EN50121-3-2 table 9	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Electrostatic discharge	EN 61000-4-2						
	EN50155part 12.2.7.3-EN50121-3-2 table 7+8	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
Fast Transients	EN 61000-4-4						
	EN50155part 12.2.8.1-EN50121-3-2 table 7+8	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN 61000-4-6						
	EN50155part 12.2.8.1-EN50121-3-2 table 9	20/10 V/m 80MHz-1GHz	A	EN 61000-4-3	20 V/m 80MHz-1GHz	A (1)	
	EN 61000-4-3						
	EN50155part 12.2.8.1-EN50121-3-2 table 9	20 V/m 800MHz-1GHz	A	EN 61000-4-3	20 V/m 80MHz-1GHz	A (1)	
	EN 61000-4-3						
	EN50155part 12.2.8.1-EN50121-3-2 table 9	10 V/m 1,4GHz-2,1GHz	A	EN 61000-4-3	10 V/m 1GHz-2,1GHz	A (1)	
	EN 61000-4-3						
	EN50155part 12.2.8.1-EN50121-3-2 table 9	5 V/m 2,1Hz-2,5GHz	A	EN 61000-4-3	10 V/m 2,1GHz-2,5GHz	A (1)	
	EN 61000-4-3						
	EN 61000-4-3						
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2-EN50121-3-2 table 4+5	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
	EN 55011						
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B	
	EN50155part 12.2.8.2-EN50121-3-2 table 6	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B	
	EN 55011						
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	230MHz to 1GHz	Limit value class B	

Voltage-Testing of MH 9837 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

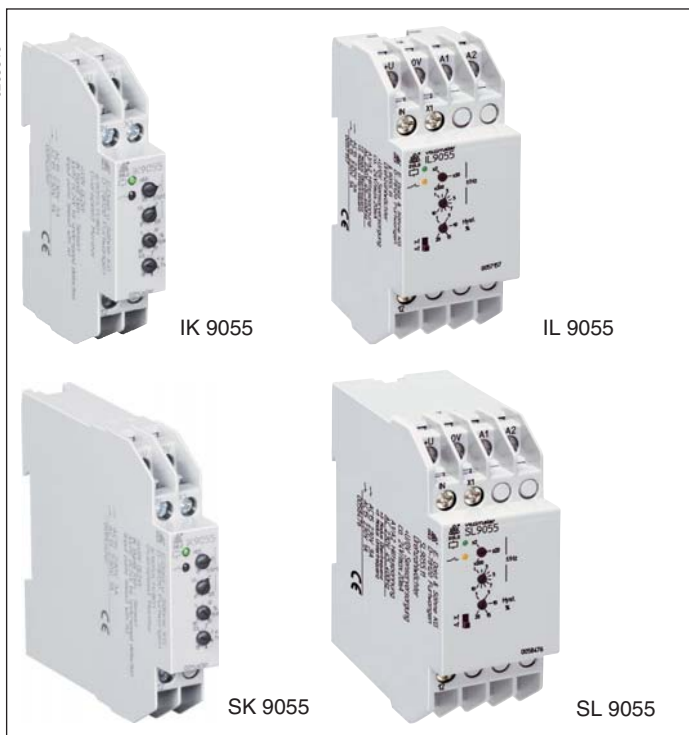
VARIMETER

Speed Monitor

IK 9055, IL 9055, SK 9055, SL 9055



0265348



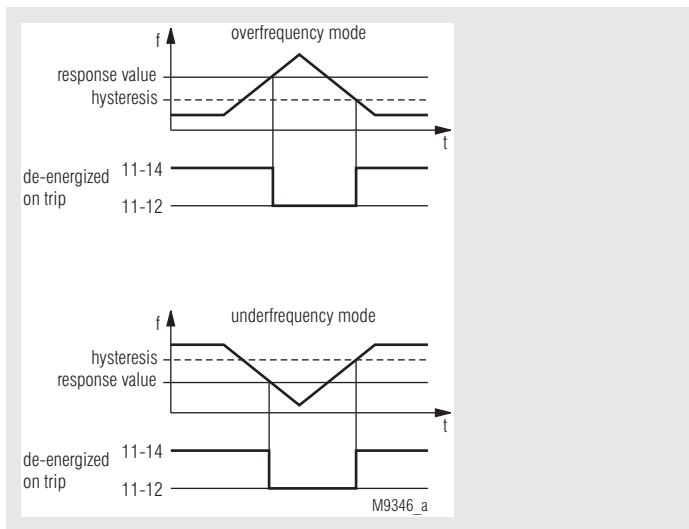
Your Advantage

- Protection of persons, machines and products
- Easy setting
- Universal input, for configuration of different sensors (PNP, NPN, 2-wire, contact, voltage)

Features

- According to IEC/EN 60 255-1
- Detection of over- or underspeed or frequency, function selectable
- 3 selectable ranges for frequency or speed, adjustable tripping value
- Ranges up to 10 kHz (\approx 600.000 ipm) available, therefore suitable for turbines, centrifuges and similar applications
- Adjustable hysteresis
- Input also suitable for SKF sensor bearings
- As option for Namur sensors
- As option for permanent magnet sensors
- As option with adjustable switching delay/start up delay
- On request with manual reset
- IK 9055 and SK 9055: compact version for DC 24 V auxiliary supply
- IL 9055 and SL 9055: for auxiliary supply up to AC 400 V with galvanic separation to sensor input
- De-energized on trip (Energized on trip on request)
- LED indicators for auxiliary supply, sensor pulses and contact position
- 1 changeover contact (2 changeover on request)
- Devices available in 2 enclosure versions:
 - IK/IL 9055: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
 - SK/SL 9055: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- DIN rail or screw mounting
- IK 9055, SK 9055: width 17.5 mm
- IL 9055, SL 9055: width 35 mm

Function Diagram



Approvals and Markings



Applications

Speed monitoring on rotating machine parts, monitoring of cyclic movements, general monitoring of pulse sequences (transportation, conveyors production systems), monitoring of pulse frequency (e.g. flow sensors, anemometers), pulse monitoring on railway rolling stock

Function

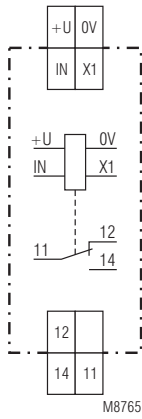
The frequency to be monitored is connected to the input terminal IN. It is compared to the adjusted tripping value.

In overfrequency mode, the output relay switches into alarm position when the preset response value is exceeded. When the system frequency once more falls below the response value minus the preset hysteresis, the output relay will switch back into normal position.

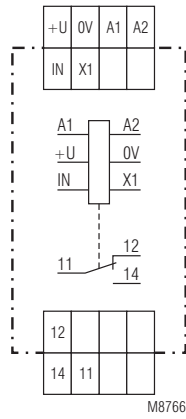
In underfrequency mode, the output relay switches into alarm position when the actual value falls below the preset response value. When the system frequency once more exceeds the response value plus hysteresis, the output relay will switch back into normal position.

If de-energized on trip is selected, the output relay is energized (11-14 closed) in normal status. If energized on trip is selected, the output relay is energized (11-12 closed) in alarm status.

Circuit Diagrams



IK 9055, SK 9055



IL 9055, SL 9055

Connection Terminals

Terminal designation	Signal designation
U+, 0V	Supply voltage device and sensor
A1, A2 (only at IL/SL)	Auxiliary voltage input
X1, IN	Connection sensor (see application example)
11, 12, 14	Changeover contact

Indicators

Green LED:	On, when only auxiliary voltage connected to A1-A2, intermittent red/green flashing when pulses are on the input IN
Yellow LED:	On, when the output relay is energized (contacts 11-14 closed)

Notes

To the universal input of the speed monitor (terminals +U, X1, IN, 0V) a wide range of different sensors can be connected (capacitive, inductive, ultrasonic, hall effect, optical, reed, etc.) The input is suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660, part 208).

Depending on the type of sensor (3-wire PNP or NPN, 2-wire, contact, voltage) the connection is made to different terminals (see Connection Examples). The models IL and SL 9055 have a galvanic separation between Input Circuit (+U, X1, IN, 0V) and auxiliary supply (A1, A2 e.g. 230 V AC).

24 V DC with up to 20 mA is provided on the terminals U+/0V for the supply of the sensor.

If sensors with higher power consumption are used, the model IK and SK 9055 is suitable, where the sensors and the speed monitor are supplied by DC 24 V from an external power supply.

The speed monitors can be operated with SKF sensor bearings. Sensor bearings include ball bearing and speed sensor in a compact way. The actual sensors are hall effect sensors with NPN output. The connection is made as with NPN proximity sensors.

The model /200 is optimised for Namur proximity sensors according to IEC 60 947-5-6 (VDE 0660 part 212, previously EN 50 227/ DIN 19 234). Namur sensors are 2-wire sensors with defined current in on and off state.

The model /300 is designed to connect permanent magnet sensors. Permanent sensors are simple, robust 2-wire sensors without voltage supply and electronic circuits. They generate an induced voltage while the permanent magnet passes. They are very cost effective and can be used also with high temperature and hard ambient conditions.

Monitoring indicator of sensor input

The upper 2-coloure LED shows the connected supply voltage and the status of the sensor:

Green:	input IN on LOW level
Red:	input IN on HIGH level
Green/Red:	pulses on input IN

Several devices on one sensor

A parallel connection of several monitors to one sensor is possible without problems on the universal input, when several tripping values are required or a range between two limits should be monitored. The corresponding terminals are connected in parallel.

Monitoring function over- or underfrequency

The function can be changed by a slide switch on the front of the unit. Energized on trip or de-energized on trip remains the same when changing the function, also the tripping value remains unchanged. No calculations with hysteresis are necessary.

Hysteresis setting

When the setting value is very low in the lowest range, the hysteresis should not be adjusted to the minimum in order to avoid cycling of the output relay.

In the operating mode underfrequency (<f) at setting values near to the end of the range the hysteresis can only be set to 4 ... 10 % due to the internal circuit. When there are problems, the next higher range should be selected.

Reaction time

The unit work with an integrating measuring principle, where the mean value of several input pulse periods is calculated. This avoids problems with interference pulses, but the reaction time gets longer. The reaction time relates to the lowest adjustable frequency on the actual unit.

An approximate calculation is: Time constant (τ) $\approx \frac{2.5}{f_{\min}}$

Notes

The time constant (τ) is the time after which a change of the input frequency with 63% influences the calculation. If the input frequency before the change is near to the switching value or the change of the frequency is very low, the reaction time can be shorter than the time constant. The technical data will show always the time constant.

Special models with shorter time constant (limited frequency range) on request.

Maximum input frequency, minimum pulse and space time

Every frequency measuring device detects input pulses only up to a certain maximum input frequency. (This is also a result of a proper interference suppression.) If the input frequency is higher than the maximum value, the input pulses are not longer detected. The monitor detects frequency 0.

The maximum frequency is always much higher than the maximum setting value of the highest setting range (see technical data).

Also the maximum switching frequency of the sensors must be observed. In addition every frequency input needs a certain minimum pulse and space duration of the connected sensor to react properly. This is very important with high frequency and a low or high pulse/space ratio (e.g. a small active area on big diameter or a small gap on big diameter at high rotation speed). If a frequency near to the maximum speed should be detected a pulse/space ratio of 1:1 should be provided by designing the rotating part accordingly. Pulse time is the time the high signal is present at the IN terminal, space time is the time the low signal is present on the IN terminal.

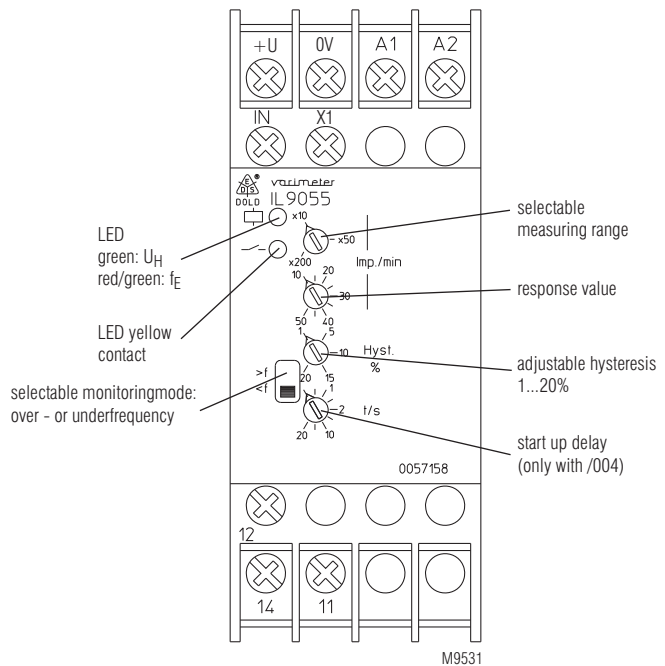
When using PNP sensors or contacts connected to +U the pulse time is identically with the on time of the sensor or contact.

The minimum pulse or space time are very short on these modules, so that most applications are uncritical (see technical data).

Variants with delay or start up delay

Devices with adjustable switching delay or start up delay can be made. The start up delay is started when connecting the auxiliary supply, during this time no frequency measurement is done. This may be useful in application for underspeed monitoring when the speed monitor is started up with the motor which needs some time to get on operation speed. Without start up delay there would be an alarm when before the motor is on speed. Compared with the standard switching delay a start up delay has the advantage that it only works one time on start up, but after that a change is detected immediately. If the start up delay is not required, (e.g. on function overspeed), the potentiometer "t/s" is set to left end (minimum).

Setting



Technical Data

Input Circuit

Universal input:	for PNP-, NPN-, 2-wire sensors, contacts and voltage suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660 part 208)
IK 9055, SK 9055:	sensor supply by external auxiliary voltage DC 24 V
IL 9055, SL 9055:	built in power supply approx. DC 24 V, max. 20 mA
Max. residual current of 2-wire sensors:	2 mA (OFF)
Max. voltage drop of 2-wire sensors:	8 V (ON)
Voltage drive input resistance:	approx. 17 k Ω
Threshold Low	
IK 9055, SK 9055:	approx. 9.2 V
IL 9055, SL 9055:	approx. 8.4 V
Threshold High	
IK 9055, SK 9055:	approx. 11 V
IL 9055, SL 9055:	approx. 10.2 V

NAMUR Input

IK 9055/200, SK 9055/200, IL 9055/200, SL 9055/200:	für NAMUR-sensors according to IEC/EN 60 947-5-6 (VDE 0660 part 212) (previously EN 50227/DIN 19234)
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No-load operation voltage:	approx. 8.2 V
Input resistance:	1 k Ω
Short circuit current:	approx. 8 mA
Switching thresholds:	Low approx. 1.5 mA High approx. 1.8 mA

Input

IK 9055/300, SK 9055/300, IL 9055/300, SL 9055/300:	for permanent magnet sensors
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Input resistance at f < 100 Hz:	approx. 50 k Ω
at f = 2 kHz:	approx. k Ω

Input sensitivity standard:	approx. 50 mV _{eff.} (at f < 500 Hz)
high:	approx. 20 mV _{eff.} (at f < 250 Hz)
Max. input voltage:	80 V _{eff.}

Monitoring mode:	overfrequency („>f“) or underfrequency („<f“) selectable via slide switch
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Response value:	frequency ranges each 3-fold, selectable via rotary switch
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Technical Data

Frequency range:

100 ... 500	50 ... 500	2 ... 20	10 ... 100
500 ... 2500	500 ... 5000	20 ... 200	100 ... 1000
2000 ... 10000	5000 ... 50000	200 ... 2000	1000 ... 10000
Impulse/min	Impulse/min	Hz	Hz

Fineadjustment range:

infinitely 1:5	infinitely 1:10	infinitely 1:10	infinitely 1:10
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Max. input frequency

(Pulse: break = 1:1):			
5 kHz	5 kHz	5 kHz	15 kHz

Min. pulse- and breaktime:

150 μ s	150 μ s	150 μ s	50 μ s
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Time constant τ measuring circuit:

approx. 1.4 s	approx. 3 s	approx. 1.4 s	approx. 0.2 s
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Hysteresis

adjustable infinitely:	1... 20 % of the adjusted response value
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Start up delay

IK 9055/004, SK 9055/004, IL 9055/004, SL 9055/004	
adjustable logarithmically:	0.1 ... 20 s

Auxiliary Circuit

IK 9055, SK 9055

(terminal connection +U/0V):	
Nominal voltage U_H:	DC 24 V
Voltage range:	19.2 ... 30 V
Nominal consumption:	max. approx. 0.5 W

IL 9055, SL 9055

(terminal connection A1/A2):	
Nominal voltage U_H:	AC 24 V, 48 V, 230 V (others on request)
Voltage range:	0.8 ... 1.1 U _H
Nominal consumption:	approx. 4 VA
Frequency range:	45 ... 400 Hz

Output

Contacts:	1 changeover contact
Thermal current I_{th}:	4 A
Switching capacity to AC 15	
NO contacts:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V IEC/EN 60 947-5-1
nach DC 13	
NO contacts:	1 A / DC 24 V IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life to AC 15 at 1 A / 230 V:	1.5 x 10 ⁶ switching cycles IEC/EN 60 947-5-1
Short circuit strength	
max. fuse rating:	4 A gL IEC/EN 60 941-5-1
Mechanical life:	≥ 30 x 10 ⁶ switching cycles

General Data

Operating mode:	Continuous operation
Temperature range	
Operation:	- 20 ... + 60°C
Storage:	- 20 ... + 60°C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage/ pollution degree:	4 kV / 2 IEC 60 664-1
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF irradiation	
80 MHz ... 1 GHz:	20 V/m IEC/EN 61000-4-3
1 GHz ... 2 GHz:	10 V/m IEC/EN 61000-4-3
2 GHz ... 2.7 GHz:	1 V/m IEC/EN 61000-4-3
Fast transients:	4 kV IEC/EN 61 000-4-4
Surge voltage between wires for power supply:	1 kV IEC/EN 61 000-4-5
between wire and ground:	2 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55 011

Technical Data

Degree of protection

Housing: IP 40
Terminals: IP 20 IEC/EN 60 529

Housing: Thermoplastic with V0 behaviour according to UL subject 94

Vibration resistance: Amplitude 0.35 mm, Frequency 10...55Hz, IEC/EN 60 068-2-6 20 / 060 / 04 IEC/EN 60 068-1

Climate resistance: IEC/EN 60 068-1

Terminal designation: DIN EN 50 005

Wire connection: DIN 46 228-1/-2/-3/-4

Cross section: 2 x 0.6 ... 2.5 mm² solid or 2 x 0.28 ... 1.5 mm² stranded wire with and without ferrules

Stripping length: 10 mm

Wire fixing: Plus-Minus-terminal screws M3,5 with self-lifting clamping piece

Fixing torque: 0.8 Nm

Mounting: DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory

Weight

IK 9055: approx. 65 g

SK 9055: approx. 85 g

IL 9055: approx. 140 g

SL 9055: approx. 160 g

Dimensions

Width x height x depth

IK 9055: 17.5 x 90 x 59 mm

SK 9055: 17.5 x 90 x 98 mm

IL 9055: 35 x 90 x 59 mm

SL 9055: 35 x 90 x 98 mm

CSA-Data

Nominal voltage U_N :

IK 9055, SK 9055: DC 24 V

IL 9055, SL 9055: AC 24 V, AC 48 V, AC 230 V

Ambient temperature: -20 ... +60°C

Switching capacity: 3A 240Vac

Wire connection: 60°C / 75°C copper conductors only
AWG 20 - 14 Sol Torque 0.6 Nm
AWG 20 - 16 Str Torque 0.6 Nm



Technical data that is not stated in the CSA-Data, can be found in the technical data section.

Classification to DIN EN 50155 for IK 9055

Vibration and

shock resistance: Category 1, Class B IEC/EN 61 373

Ambient temperature: T1 compliant
T2, T3 and TX with operational limitations

Protective coating of the PCB: No

Standard Types

IK 9055.11/60 50 ... 50000 lpm U_H DC 24 V Hysteresis 1 ... 20 %

Article number: 0059786

- Universal input for PNP-, NPN-, 2-wire sensors, contacts, voltage
- Selectable function: over- or underfrequency
- 3-fold selectable ranges 50 ... 500 lpm, 500 ... 5000 lpm, 5000 ... 50000 lpm
- Response value unfinately adjustable 1:10
- Hysteresis adjustable: 1 ... 20 %
- Auxiliary voltage U_H : DC 24 V
- De-energized on trip
- Output: 1 changeover contact

IL 9055.11/60 2 ... 2000 Hz U_H AC 230 V Hysteresis 1 ... 20 %

Article number: 0057157

- Universal input for PNP-, NPN-, 2-wire sensors, contacts, voltage
- Selectable function: over- or underfrequency
- 3-fold selectable ranges 2 ... 20 Hz, 20 ... 200 Hz, 200 ... 2000 Hz
- Response value unfinately adjustable 1:10
- Hysteresis adjustable: 1 ... 20 %
- Auxiliary voltage U_H : AC 230 V
- De-energized on trip
- Output: 1 changeover contact

Variants

IK 9055. __ /60,

SK 9055. __ /60,

IL 9055. __ /60,

SL 9055. __ /60: with CSA-approval

IK 9055.11/004,

SK 9055.11/004,

IL 9055.11/004,

SL 9055.11/004: with adjustable start up delay
0.1 ... 20 s

IK 9055.11/200,

SK 9055.11/200,

IL 9055.11/200,

SL 9055.11/200: input for NAMUR sensors

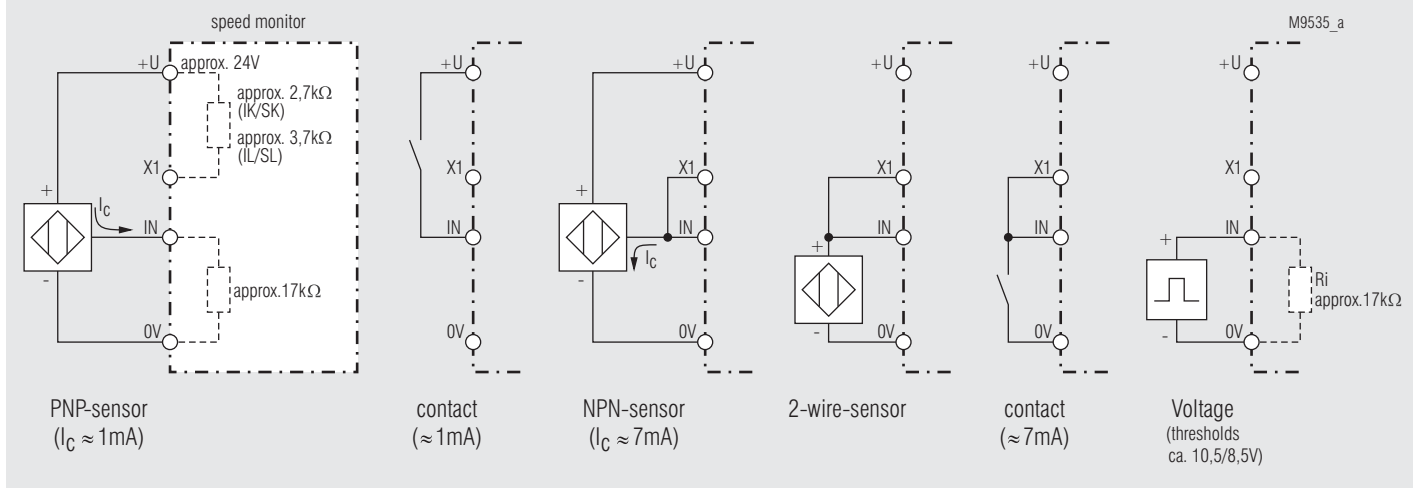
IK 9055.11/300,

SK 9055.11/300,

IL 9055.11/300,

SL 9055.11/300: input for permanent magnet sensors

Application Example Universal Input



Note: For IK-models the auxiliary voltage (DC 24 V) must be additionally connected to terminals +U/0V

EMC-Testing of IK 9055 according to EN 50155 Rev. 13/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Electrostatic discharge	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: „A“ to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
RF emission	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHZ	A	EN 61000-4-3	10 V/m 1,4GHz-2,1GHZ	A (1)	
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	1 V/m 2,1Hz-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 10.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
		230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	to be tested externally	
				EN 55011	230MHz to 1GHZ	to be tested externally	

Voltage-Testing of IK 9055 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 10.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

VARIMETER

Voltage Relay

BA 9054, MK 9054N



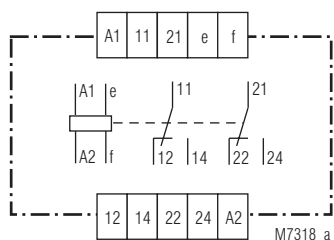
Your Advantages

- Protection against defect by overvoltage
- Preventive maintenance
- For better productivity
- Quicker fault locating
- Precise and reliable

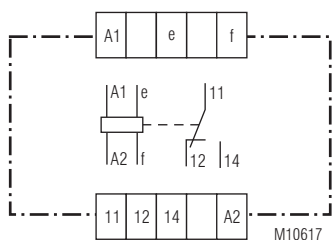
Features

- According to IEC/EN 60255-1, IEC/EN 60947-1
- to: monitor DC and AC
- BA 9054 with measuring ranges from 15 mV to 1000 V
- MK 9054N with measuring ranges from 15 mV to 500 V
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between Auxiliary Circuit – measuring circuit
- Auxiliary supply AC/DC; BA 9054 with AC
- BA 9054 optionally with start-up delay (MK = standard)
- with time delay, up to max. 100 sec
- BA 9054 optionally with safe separation to IEC/EN 61140
- MK 9054N optionally with remote potentiometer
- As option with manual reset
- Option with fixed settings possible
- LED indicators for operation and contact position
- MK 9054N as option with pluggable terminal blocks for easy exchange of devices
 - with screw terminals
 - or with cage clamp terminals
- Width BA 9054: 45 mm
- Width MK 9054N: 22.5 mm

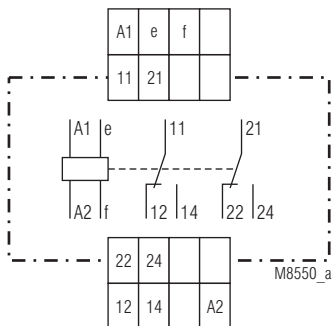
Circuit Diagrams



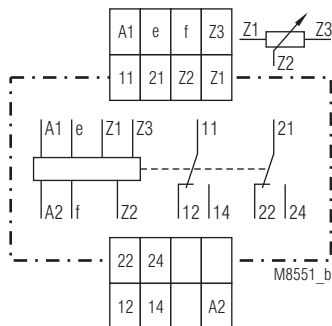
BA 9054



BA 9054/_ 2 _



MK 9054N



MK 9054N/1 _ _

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
e, f	Voltage measuring input
11, 12, 14	1st changeover contact
21, 22, 24	2nd changeover contact
at MK 9054/1 _ _: Z1, Z2, Z3	remote potentiometer for response value

Safety Notes

Please observe when connecting a remote potentiometer to MK 9054N/1 _ _:



WARNING

Measuring circuit and remote potentiometer not galvanically separated. The remote potentiometer on terminals Z1, Z2, Z3 is related to terminal "e". Therefore "e" should be connected to "N", "-" or GND, so that the remote potentiometer is not connected to the Phase voltage. The remote potentiometer has to be connected volt- and ground-free.

Approvals and Markings



* see variants

Applications

- Monitoring voltage in AC or DC systems
- For industrial and railway applications

Function

The relays measure the arithmetic mean value of the rectified measuring voltage. The AC units are adjusted to the r.m.s value. They have settings for response value and hysteresis. The units work as overvoltage relays but can also be used for undervoltage detection. The hysteresis is dependent on the response value.

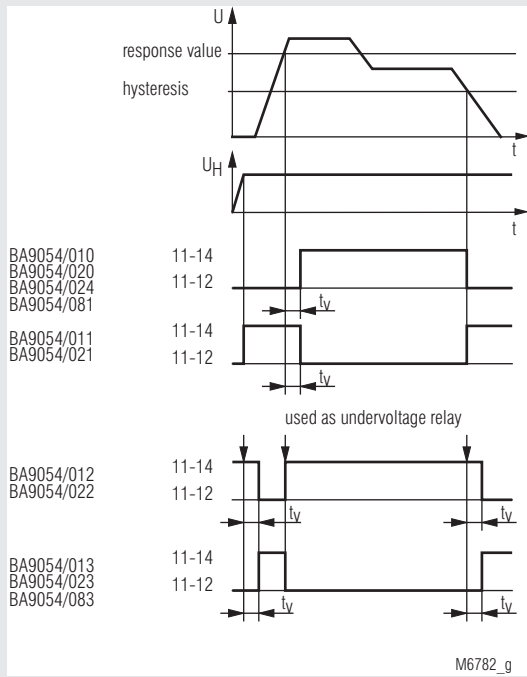
2 time delays are possible in different variants:

The start up delay t_a operates only when connecting the auxiliary supply. The response delay t_v is active after exceeding a response value. On overvoltage relays the delay is active when the voltage goes over the tripping value, on undervoltage relays when the voltage drops below the hysteresis value.

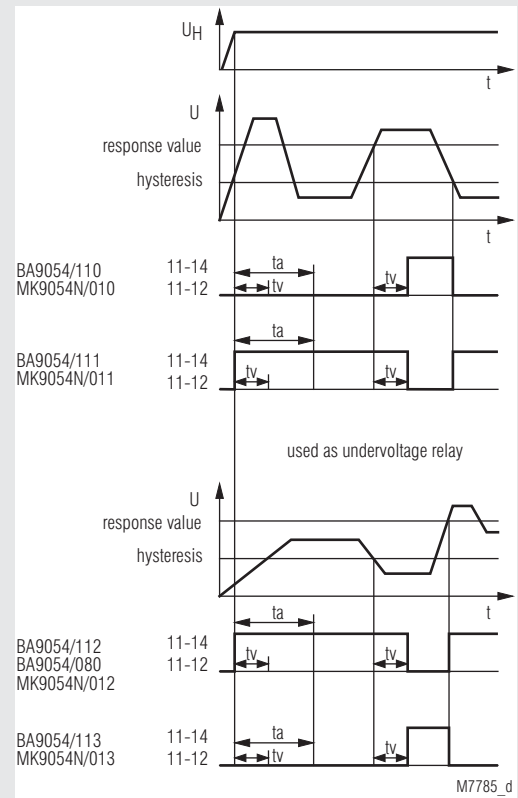
Indicators

green upper LED: on, when auxiliary supply connected
yellow lower LED: on, when output relay activated

Function Diagram without Start-up Delay



Function Diagram with Start-up Delay



Version BA 9054/_1_: 2 changeover contacts

Version BA 9054/_20, /_21, /_22, /_23, /_24: 1 changeover contact, measuring range $\geq 70 \dots 700 \text{ V}$

At version BA 9054/6__ with manual reset the contacts remain in the fault state after detecting a fault or after t_a has elapsed. The contacts are reset by disconnecting the supply voltage.

Technical Data

Input (e, f)

BA 9054 with 1 Measuring range for AC and DC			
Measuring range ¹⁾		internal resistance	max. permissible contin. voltage
AC	DC		
6 ... 60 mV	5.4 ... 54 mV	20 kΩ	10 V
15 ... 150 mV	13.5 ... 135 mV	40 kΩ	100 V
50 ... 500 mV	45 ... 450 mV	270 kΩ	250 V
0.5 ... 5 V	0.45 ... 4.5 V	500 kΩ	300 V
1 ... 10 V	0.9 ... 9.0 V	1 MΩ	300 V
5 ... 50 V	4.5 ... 45 V	2 MΩ	500 V ²⁾
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V ²⁾
50 ... 500 V	45 ... 450 V	2 MΩ	500 V ²⁾
70 ... 700 V ³⁾	63 ... 630 V	3 MΩ	700 V ⁴⁾
100 ... 1000 V ³⁾	90 ... 900 V	3 MΩ	1000 V ⁴⁾

¹⁾ DC or AC voltage 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 ²/₃ Hz on request)

²⁾ at Overvoltage category II: 600 V

³⁾ only with BA 9054/_20; /_21; /_22; /_23; /_24
(Version: 1 changeover contact)

⁴⁾ at overvoltage category II: 1000 V

Please note:
Measuring ranges 6 ... 60 mV only available at variant BA 9054/08_
(Using only for current sensing via shunt!)

MK 9054N with 1 Measuring range for AC and DC			
Measuring range ¹⁾		internal resistance	max. permissible contin. voltage
AC	DC		
6 ... 60 mV	5.4 ... 54 mV	20 kΩ	10 V
15 ... 150 mV	13.5 ... 135 mV	40 kΩ	100 V
50 ... 500 mV	45 ... 450 mV	270 kΩ	250 V
0.5 ... 5 V	0.45 ... 4.5 V	500 kΩ	300 V
1 ... 10 V	0.9 ... 9.0 V	1 MΩ	300 V
5 ... 50 V	4.5 ... 45 V	2 MΩ	500 V ²⁾
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V ²⁾
50 ... 500 V	45 ... 450 V	2 MΩ	500 V ²⁾

¹⁾ DC or AC voltage 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 ²/₃ Hz on request)

²⁾ Not suitable for 400 / 690 V-mains (systems)

Please note:
To avoid measuring mistakes, on units with mV input the input must always be terminated. In addition screened wires should be used..

Measuring ranges 6 ... 60 mV + 15 ... 150 mV
(Using only for current sensing via shunt!)

Measuring principle: arithmetic mean value

Adjustment: The AC-devices can also monitor DC-voltage. The scale offset in this case is ($\bar{U} = 0.90 U_{eff}$)

Temperature influence: < 0.05 % / K

Technical Data

Setting Ranges

Setting

Response value: infinite variable 0.1 U_N ... 1 U_N
relative scale

Hysteresis at AC: infinite variable 0.5 ... 0.98 of setting value
at DC: infinite variable 0.5 ... 0.96 of setting value

Accuracy:
Response value at Potentiometer right stop (max): 0 ... + 8 %
Potentiometer left stop (min): - 10 ... + 8 %

Repeat accuracy: ≤ ± 0.5 %

Recovery time
at devices with manual reset (Reset by braking of the auxiliary voltage)
BA 9054/6_...; MK 9054N/6_...: ≤ 1 s
(dependent to function and auxiliary voltage)

Time delay t_v : infinite variable at logarithmic scale from 0 ... 20 s, 0 ... 30 s, 0 ... 60 s, 0 ... 100 s
setting 0 s = without time delay

Start-up delay t_a :
BA 9054/1_...: 1 ... 20 s; 1 ... 60 s; 1 ... 100 s, adjustable on logarithmic scale.
 t_a is started when the supply voltage is connected. During elapse of time the output contact is in good state

MK 9054N: 0.1 ... 20 s; 0.1 ... 60 s; 0.1 ... 100 s

Auxiliary Circuit BA 9054 and MK 9054N

Auxiliary voltage U_H (A1, A2)

BA 9054, Nominal voltage: AC 24, 42, 110, 127, 230, 400 V

Voltage range: 0.8 ... 1.1 U_H

Nominal frequency: 50 / 60 Hz

Frequency range: ± 5 %

Nominal consumption: 2.5 VA

BA 9054, MK 9054N:		
Nominal voltage	Voltage range	Frequency range
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 ... 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 40 ... 265 V	45 ... 400 Hz; DC 48 % W
	DC 40 ... 300 V	W ≤ 5 %

BA 9054		
Nominal voltage	Voltage range	Frequency range
DC 12 V	DC 10 ... 18 V	battery voltage

Nominal consumption: 4 VA; 1.5 W at AC 230 V Rel. energized
1 W at DC 80 V Rel. energized

Output

Contacts

BA 9054: 2 changeover contacts

MK 9054N: 2 changeover contacts

Thermal current I_{th}

BA 9054: 2 x 5 A

MK 9054N: 2 x 4 A

Switching capacity

BA 9054

to AC 15: 2 A / AC 230 V IEC/EN 60 947-5-1

NO contact: 1 A / AC 230 V IEC/EN 60 947-5-1

MK 9054N

to AC 15: 1.5 A / AC 230 V IEC/EN 60 947-5-1

BA 9054, MK 9054N

to DC 13: 1 A / DC 24 V IEC/EN 60 947-5-1

IEC/EN 60 947-5-1

Electrical life

BA 9054

to AC 15 at 3 A, AC 230 V: 5 x 10⁵ switching cycles

MK 9054N:

to AC 15 at 3 A, AC 230 V: 10⁵ switching cycles

Short-circuit strength

max. fuse rating: 6A gG (gL) IEC/EN 60 947-5-1

Mechanical life

BA 9054: 50 x 10⁶ switching cycles

MK 9054N: 30 x 10⁶ switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 40 ... + 60°C (higher temperature with limitations on request)	
Operation:	- 40 ... + 70°C	
Storage:	< 2.000 m	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
BA 9054:	6 kV / 2	IEC 60 664-1
MK 9054N	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz	
Climate resistance:	40 / 060 / 04 IEC/EN 60 068-1	
Terminal designation:	EN 50 005	
Wire connection		
BA 9054:	2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded wire with sleeve	
MK 9054N		
Screw terminals (integrated):	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled (isolated) or 2 x 1.5 mm ² stranded ferruled (isolated) or 2 x 2.5 mm ² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm ² solid or 1 x 2.5 mm ² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled (isolated)	
min. cross section for connection:	0.5 mm ²	
Insulation of wires or sleeve length:	12 ±0.5 mm	
Wire fixing		
BA 9054:	Plus-minus terminal screws M3.5 with self-lifting clamping piece IEC/EN 60 999-1	
MK 9054N:	Plus-minus terminal screws M3.5 box terminals with wire protection or cage clamp terminals	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Mounting:	DIN-rail IEC/EN 60 715	
Weight		
BA 9054:	AC-device: 280 g AC/DC-fdevice: 200 g	
MK 9054N:	150 g	

Dimensions

Width x height x depth	
BA 9054:	45 x 75 x 120 mm
MK 9054N:	22.5 x 90 x 97 mm

Classification to DIN EN 50155 for BA 9054

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2 compliant	
	T3 and TX with operational limitations	
Protective coating of the PCB:	No	

UL-Data

Auxiliary voltage U_H(A1, A2)		
BA 9054:	AC 24, 42, 48, 110, 115, 120 V	
Thermal current I_{th}:		
BA 9054:	2 x 5 A	
MK 9054N:	2 x 4 A	
Clearance and creepage distances		
BA 9054, MK 9054N:	4 kV / 2	IEC 60 664-1
HF irradiation		
BA 9054 (80 MHz ... 2.7 GHz)	10 V/m	IEC/EN 61 000-4-3
Switching capacity:	Pilot duty B150	
Ambient temperature:	- 40 ... + 60°C	



Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Switching capacity		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1



Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

BA 9054/010	AC 25 ... 250 V	AC 230 V
Article number:	0053639	
• for Overvoltage monitoring		
• Measuring range:	AC 25 ... 250 V	
• Auxiliary voltage U _H :	AC 230 V	
• Time delay t _v by U _{an} :	0 ... 20 s	
• Width:	45 mm	
BA 9054/012	AC 25 ... 250 V	AC 230 V
Article number:	0053711	
• for Undervoltage monitoring		
• Measuring range:	AC 25 ... 250 V	
• Auxiliary voltage U _H :	AC 230 V	
• Time delay t _v by U _{ab} :	0 ... 20 s	
• Width:	45 mm	
MK 9054N.12/010	AC 25 ... 250 V	AC/DC 80 ... 230 V t _v 0 ... 20 s t _a 0.1 ... 20 s
Article number:		
• for Overvoltage monitoring		
• Measuring range:	AC 25 ... 250 V	
• Auxiliary voltage U _H :	AC/DC 80 ... 230 V	
• Time delay t _v by U _{an} :	0 ... 20 s	
• Start up delay t _a :	0.1 ... 20 s	
• Width:	22.5 mm	

Options with Pluggable Terminal Blocks



Screw terminal
(PS/plugin screw)

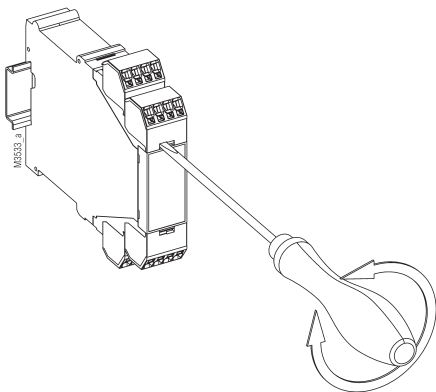


Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Accessories

AD 3: Remote potentiometer 470 kW
Article number: 0050174

Setting

Example:
Voltage relay BA 9054 / MK 9054N AC 25 ... 250 V

AC according to type plate:
i.e. the unit is adjusted to AC voltage
25 ... 250 V = measuring range

Response value AC 150 V
Hysteresis AC 75 V

Settings:
upper potentiometer: 0.6 (0.6 x 250 V = 150 V)
lower potentiometer: 0.5 (0.5 x 150 V = 75 V)

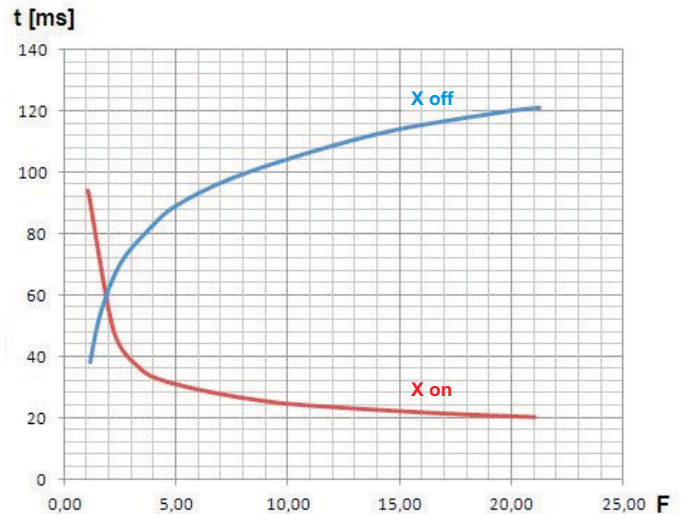
The AC-devices can also monitor DC voltage. The scale offset in this case is: $\bar{U} = 0.9 \times U_{\text{eff}}$.

AC 25 ... 250 V is equivalent to DC 22.5 ... 225 V

Response value DC 150 V
Hysteresis DC 75 V

Settings:
upper potentiometer: 0.66 (0.66 x 225 V = 150 V)
lower potentiometer: 0.5 (0.5 x 150 V = 75 V)

Characteristic



M11504 a

Time delay of measuring circuit

X on: Measured value rises $F = \frac{\text{Meas. value (after rise of meas. value)}}{\text{Setting value}}$

X off: Measured value drops $F = \frac{\text{Meas. value (befor meas. value drops)}}{\text{Setting value (hysteresis)}}$

The diagram shows the typical delay of a standard devices depending on the measured values "X on and X off" at sudden rise or drop of the signal. At slow change of the measured value the delay is shorter. The total reaction time of the device results from the adjustable delay t_d and the delay created by the measuring circuit.

The diagram shows an average delay. The delay times could differ on the different variants.

Example for "X on" (overvoltage detection with BA9054/010):

Adjusted setting value X on = 230 V.

Caused by a missing neutral the voltage rises suddenly to 400 V

$$F = \frac{\text{Measured value (after rise of meas. value)}}{\text{Setting value}} = \frac{400 \text{ V}}{230 \text{ V}} = 1,74$$

Reading from the diagram:

The output relay switches on after 64 ms at a setting $t_d=0$.

Example for "X off" (undervoltage detection with BA9054/012):

Adjusted hysteresis setting value is 100 V.

Caused by a broken wire the voltage drops suddenly from 230 V to 0 V.

$$F = \frac{\text{Measured value (befor meas. value drops)}}{\text{Setting value (hysteresis)}} = \frac{230 \text{ V}}{100 \text{ V}} = 2,3$$

Reading from the diagram:

The output relay switches off after 70 ms at a setting $t_d=0$.

EMC-Testing of BA9054 according to EN 50155 Rev 13/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1-EN50121-3-2 table 7	"1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm"	B	EN 61000-4-5	2 kV line to line 4 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance and shorter rise time
	EN50155part 12.2.7.2-EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	
Electrostatic discharge	EN50155part 12.2.7.3-EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
Fast Transients	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHz	A	EN 61000-4-3	20 V/m 80MHz-1GHz	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHz	A	EN 61000-4-3	20 V/m 80MHz-1GHz	A (1)	
RF immunity	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHz	A	EN 61000-4-3	10 V/m 1GHz-2,1GHz	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHz	A	EN 61000-4-3	10 V/m 2,1Hz-2,7GHz	A (1)	
RF emission	EN50155part 12.2.8.2-EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
	EN50155part 12.2.8.2-EN50121-3-2 table 6 EN 55011	150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHz	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of BA 9054 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	6 kV at rated voltage 1000V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	6 kV at rated voltage 1000V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	6 kV at rated voltage 1000V	No flashover allowed

VARIMETER

Current Relay

BA 9053, MK 9053N



BA 9053

MK 9053N

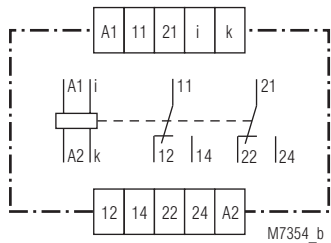
Your Advantages

- Preventive maintenance
- For better productivity
- Quicker fault locating
- Precise and reliable

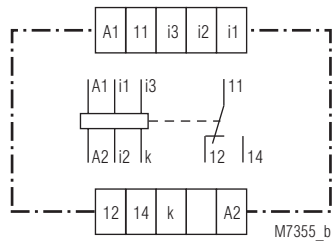
Features

- According to IEC/EN 60 255-1, IEC/EN 60 947-1
- to: monitor DC and AC
- BA 9053 with measuring ranges from 2 mA to 25 A
- BA 9053 optionally with 3 measuring ranges 0.1 up to 25 A
- MK 9053N with measuring ranges from 2 mA up to 10 A
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between auxiliary circuit - measuring circuit
- Auxiliary supply AC/DC; BA 9053 with AC
- BA 9053 optionally with start-up delay (MK = standard)
- with time delay, up to max. 100 sec
- BA 9053 optionally with safe separation to IEC/EN 61140
- MK 9053N optionally with remote potentiometer
- As option with manual reset
- Option with fixed settings possible
- LED indicators for operation and contact position
- MK 9053N as option with pluggable terminal blocks for easy exchange of devices
 - with screw terminals
 - or with cage clamp terminals
- Width BA 9053: 45 mm
- Width MK 9053N: 22.5 mm

Circuit Diagrams

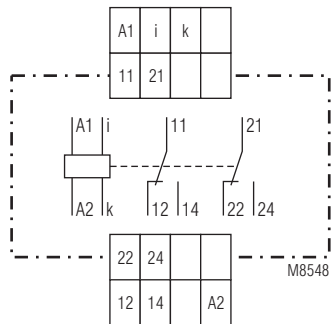


BA 9053

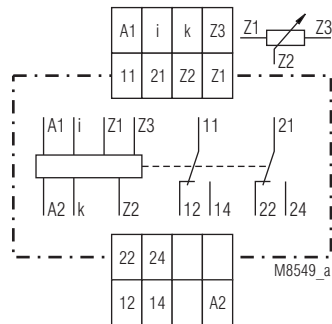


BA 9053/4 __ z. B.:

Terminals i1/k: 0.1 ... 1 A
 Terminals i2/k: 0.5 ... 5 A
 Terminals i3/k: 1 ... 10 A



MK 9053N



MK 9053N/1 __

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
i, k	Current measuring input
11, 12, 14	1st changeover contact
21, 22, 24	2nd changeover contact
at MK 9053/1 __ : Z1, Z2, Z3	Remote potentiometer for response value

Safety Notes

Please observe when connecting a remote potentiometer to MK 9053N/1 __:

Measuring circuit and remote potentiometer not galvanically separated. The voltage on measuring circuit i, k / PE has connection to the remote potentiometer. The remote potentiometer has to be connected volt- and ground-free.

Approvals and Markings



* see variants

Applications

- Monitoring current in AC or DC systems
- For industrial and railway applications

Function

The relays measure the arithmetic mean value of the rectified measuring current. The AC units are adjusted to the r.m.s. value. They have settings for response value and hysteresis. The units work as overcurrent relays but can also be used for undercurrent detection. The hysteresis is dependent on the response value.

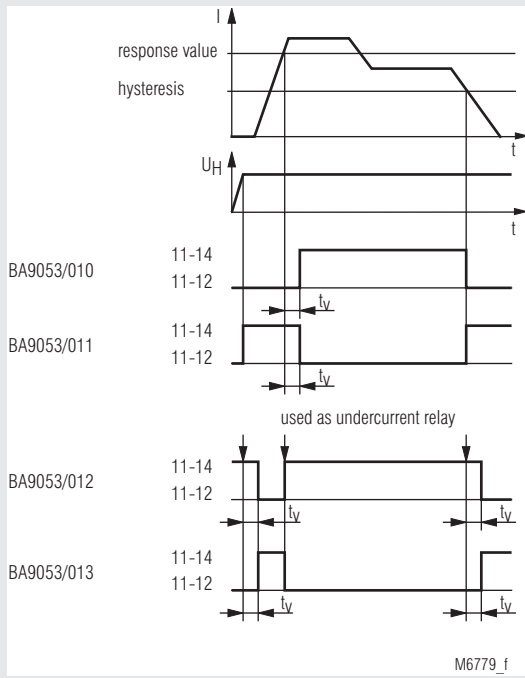
2 time delays are possible in different variants:

The start up delay t_a operates only when connecting the auxiliary supply. It disables tripping e.g. caused by an increased starting current of a motor. The response delay t_r is active after exceeding a response value. On overcurrent relays the delay is active when the current goes over the tripping value, on undercurrent relays when the current drops below the hysteresis value.

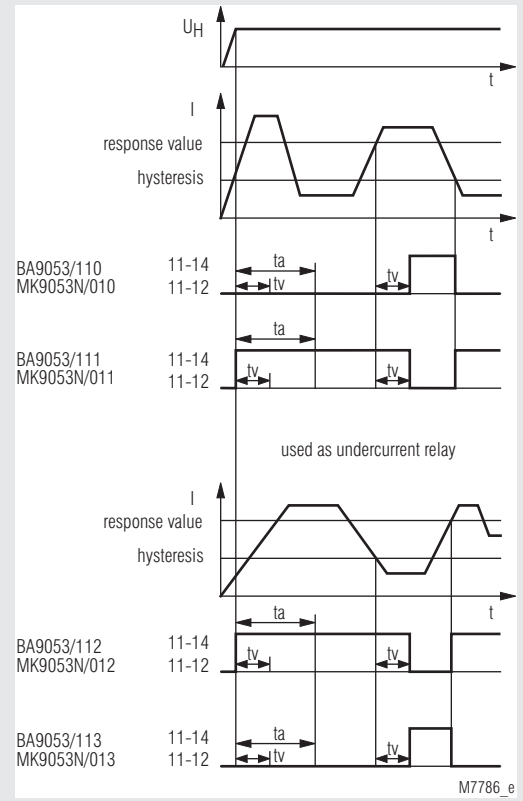
Indicators

green LED: on, when auxiliary supply connected
 yellow LED: on, when output relay activated

Function Diagram without Start-up Delay



Function Diagram with Start-up Delay



On model BA 9053/6__ with manual reset the contacts remain in the fault state after detecting a fault or after t_o has elapsed. The contacts are reset by disconnecting the supply voltage.

Technical Data

Input (i, k)

BA 9053 for AC and DC					
Measuring range*)		internal resistance	max. perm. cont. current		max. permiss. current 3 s On, 100 s Off
AC	DC		Device mounted without distance		
2 - 20 mA	1.8 - 18 mA	1.5 Ω	0.7 A		1 A
20 - 200 mA	18 - 180 mA	0.15 Ω	2 A		4 A
30 - 300 mA	27 - 270 mA	0.1 Ω	2.5 A		8 A
50 - 500 mA	45 - 450 mA	0.1 Ω	2.5 A		8 A
80 - 800 mA	72 - 720 mA	40 mΩ	4 A		12 A
0.1- 1 A	0.09- 0.9 A	30 mΩ	4 A		12 A
0.5- 5 A	0.45- 4.5 A	6 mΩ	10 A		30 A
1 - 10 A	0.9 - 9 A	3 mΩ	20 A		40 A
1.5- 15 A	1.35- 13.5 A	3 mΩ	25 A		40 A
2 - 20 A	1.8 - 18 A	3 mΩ	25 A		40 A
2.5 - 25 A	2.25 - 22.5 A	3 mΩ	25 A		40 A

* DC or AC current 50 ... 5000 Hz
(other frequency ranges of 10 ... 5000 Hz, e.g. 16^{2/3} Hz on request)

BA 9053/4_ _ with 3 measuring ranges:			
Range:	Terminals i1/k	Terminals i2/k	Terminals i3/k
AC 20 mA / 200 mA / 1A:	AC 2.0 ... 20 mA	AC 20 ... 200 mA	AC 0.1 ... 1 A
	DC 1.8 ... 18 mA	DC 18 ... 180 mA	DC 0.09 ... 0.9 A
AC 1 / 5 / 10A:	AC 0.1 ... 1 A	AC 0.5 ... 5 A	AC 1.0 ... 10 A
	DC 0.09 ... 0.9 A	DC 0.45 ... 4.5 A	DC 0.9 ... 9 A
AC 5 / 10 / 25A:	AC 0.5 ... 5 A	AC 1.0 ... 10 A	AC 2.5 ... 25 A
	DC 0.45 ... 4.5 A	DC 0.9 ... 9 A	DC 2.25 ... 22.5 A

MK 9053N with 1 Measuring range for AC and DC					
Measuring rang*)		internal resistance	max. perm. cont. current		max. permiss. current 3 s On, 100 s Off
AC	DC		Device mount. without distance		
			with 5 mm distance		
2 - 20 mA	1.8 - 18 mA	1.5 Ω	0.5 A	0.7 A	1 A
20 - 200 mA	18 - 180 mA	0.15 Ω	1.5 A	2 A	4 A
30 - 300 mA	27 - 270 mA	0.1 Ω	2 A	2.5 A	8 A
50 - 500 mA	45 - 450 mA	0.1 Ω	2 A	2.5 A	8 A
0.1- 1 A	0.09- 0.9 A	30 mΩ	3 A	4 A	8 A
0.5- 5 A	0.45- 4.5 A	6 mΩ	8 A	11 A	20 A
1 - 10 A	0.9 - 9 A	3 mΩ	12 A	15 A	20 A

* DC or AC current 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16^{2/3} Hz on request)

Extending of measuring range:

For DC-current higher then the highest measuring range the voltage relay BA 9054 or MK 9054N measuring range 15 ... 150 mV or 6 ... 60 mV can be used with external Shunt.

For AC current higher then the highest measuring range can be used a current transformer e. g. with secondary winding of 1 A or 5 A together with BA 9053 or MK 9053N. The nominal load of the CT should be ≥ 0.5 VA.

Measuring principle:

arithmetic mean value

Adjustment:

The AC - devices can also monitor DC current. The scale offset in this case is:

$$(I = 0.90 I_{\text{eff}})$$

Temperature influence::

$$< 0.05 \% / K$$

Technical Data

Setting Ranges

Setting

Response value: infinite variable 0.1 I_N ... 1 I_N
relative scale

Hysteresis

at AC: infinite variable 0.5 ... 0.98 of setting value
at DC: infinite variable 0.5 ... 0.96 of setting value

Accuracy:

Response value at
Potentiometer right stop (max): 0 ... + 8 %
Potentiometer left stop (min): - 10 ... + 8 %
Repeat accuracy: ± 0.5 %

Recovery time

at devices with manual reset

(Reset by braking of the auxiliary voltage)

BA 9053/6_ _; MK 9053N/6_ _; ≤ 1 s

(dependent to function and auxiliary voltage)

Time delay t_v:

infinite variable at logarithmic scale
from 0 ... 20 s, 0 ... 30 s, 0 ... 60 s, 0 ... 100 s
setting 0 s = without time delay

Start-up delay t_a:

BA 9053/1_ _:

1 ... 20 s; 1 ... 60 s; 1 ... 100 s,
adjustable on logarithmic scale.

t_a is started when the supply voltage is connected. During elapse of time the output contact is in good state

MK 9053N:

0.1 ... 20 s; 0.1 ... 60 s; 0.1 ... 100 s

Auxiliary Circuit BA 9053 and MK 9053N

Auxiliary voltage U_H (A1, A2)

BA 9053, Nominal voltages: AC 24, 42, 110, 127, 230, 400 V

Voltage range: 0.8 ... 1.1 U_H

Nominal frequency: 50 / 60 Hz

Frequency range: ± 5 %

Nominal consumption: 2.5 VA

BA 9053:		
Nominal voltage	Voltage range	Frequency range
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 ... 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 40 ... 265 V	45 ... 400 Hz; DC 48 % W
	DC 40 ... 300 V	W ≤ 5 %
DC 12 V	DC 10 ... 18 V	battery voltage

MK 9053N:		
Nominal voltage	Voltage range	Frequency range
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 ... 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 60 ... 265 V	45 ... 400 Hz; DC 48 % W
	DC 60 ... 300 V	W ≤ 5 %

Nominal consumption:

4 VA; 1.5 W at AC 230 V Rel. energized
1 W at DC 80 V Rel. energized

Technical Data		
Output		
Contacts		
BA 9053:	2 changeover contacts	
MK 9053N:	2 changeover contacts	
Thermal current I_{th}:		
BA 9053:	2 x 5 A	
MK 9053N:	2 x 4 A	
Switching capacity		
BA 9053		
to AC 15:		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
MK 9053N		
to AC 15:		
BA 9053, MK 9053N	1.5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
BA 9053	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
BA 9053		
to AC 15 at 3 A, AC 230 V:	5 x 10 ⁵ switch. cycl.	IEC/EN 60 947-5-1
MK 9053N		
to AC 15 at 3 A, AC 230 V:	10 ⁵ switching cycles	IEC/EN 60 947-5-1
Short-circuit strength		
max. fuse rating:	6 A gG (gL)	IEC/EN 60 947-5-1
Mechanical life		
BA 9053:	50 x 10 ⁶ switching cycles	
MK 9053N:	30 x 10 ⁶ switching cycles	
General Data		
Operating mode: Continuous operation		
Temperature range:		
BA 9053 (operation):		
≤ 10 A:	- 40 ... + 60°C	
≥ 15 A:	- 40 ... + 50°C	
(higher temperature with limitations on request)		
MK 9053N (operation):		
	- 20 ... + 50°C	
(higher temperature with limitations on request)		
BA 9053, MK 9053N (storage):		
	- 40 ... + 70°C	
Altitude: < 2,000 m		
Clearance and creepage distances		
rated impulse voltage / pollution degree		
BA 9053 meas. range ≤ 10 A:	6 kV / 2	IEC 60 664-1
BA 9053 meas. range ≥ 15 A:	4 kV / 2	IEC 60 664-1
MK 9053N:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages		
between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94		
Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz		
Climate resistance		
BA 9053		
≤ 10 A:	40 / 060 / 04	IEC/EN 60 068-1
≥ 15 A:	40 / 050 / 04	IEC/EN 60 068-1
MK 9053N:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data	
Wire connection	
BA 9053:	2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded wire with sleeve
MK 9053N:	
Screw terminals (integrated):	
	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled (isolated) or 2 x 1.5 mm ² stranded ferruled (isolated) or 2 x 2.5 mm ² solid
Insulation of wires or sleeve length:	
	8 mm
Plug in with screw terminals	
max. cross section for connection:	1 x 2.5 mm ² solid or 1 x 2.5 mm ² stranded ferruled (isolated)
Insulation of wires or sleeve length:	
	8 mm
Plug in with cage clamp terminals	
max. cross section for connection:	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled (isolated)
min. cross section for connection:	0.5 mm ²
Insulation of wires or sleeve length:	
	12 ±0.5 mm
Wire fixing:	
BA 9053:	Plus-minus terminal screws M3.5 with self-lifting clamping piece IEC/EN 60 999-1
MK 9053N:	
	Plus-minus terminal screws M3.5 box terminals with wire protection or cage clamp terminals
Stripping length: 10 mm	
Fixing torque: 0.8 Nm	
Mounting: DIN-rail IEC/EN 60 715	
Weight	
BA 9053:	AC-device: 280 g AC/DC-device: 200 g
MK 9053N:	
	150 g
Dimensions	
Width x height x depth	
BA 9053:	45 x 75 x 120 mm
MK 9053N:	22.5 x 90 x 97 mm

Classification to DIN EN 50155 for BA 9053

Vibration and shock resistance: Category 1, Class B IEC/EN 61 373
Ambient temperature: T1, T2 compliant
T3 and TX with operational limitations
Protective coating of the PCB: No

UL-Data

Auxiliary voltage U_H (A1, A2)

BA 9053: AC 24, 42, 48, 110, 115, 120 V

Thermal current I_{th} :

BA 9053: 2 x 5 A

MK 9053N: 2 x 4 A

Clearance and creepage distances

BA 9053, MK 9053N: 4 kV / 2 IEC 60 664-1

HF irradiation

BA 9053 (80 MHz ... 2.7 GHz) 10 V/m IEC/EN 61 000-4-3

Switching capacity: Pilot duty B150

Ambient temperature: - 40 ... + 60°C



Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Switching capacity

to AC 15: 1.5 A / AC 230 V IEC/EN 60 947-5-1

to DC 13: 1 A / DC 24 V IEC/EN 60 947-5-1



Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

BA 9053/010 AC 0.5 ... 5 A AC 230 V

Article number: 0053128

• for Overcurrent monitoring

• Measuring range: AC 0.5 ... 5 A

• Auxiliary voltage U_H : AC 230 V

• Time delay by I_{an} : 0 ... 20 s

• Width: 45 mm

BA 9053/012 AC 0.5 ... 5 A AC 230 V

Article number: 0053192

• for Undercurrent monitoring

• Measuring range: AC 0.5 ... 5 A

• Auxiliary voltage U_H : AC 230 V

• Time delay by I_{ab} : 0 ... 20 s

• Width: 45 mm

MK 9053N.12/010 AC 0.5 ... 5 A AC/DC 80 ... 230 V t_v 0 ... 20 s t_a 0.1 ... 20 s

Article number: 0063176

• for Overcurrent monitoring

• Measuring range: AC 0.5 ... 5 A

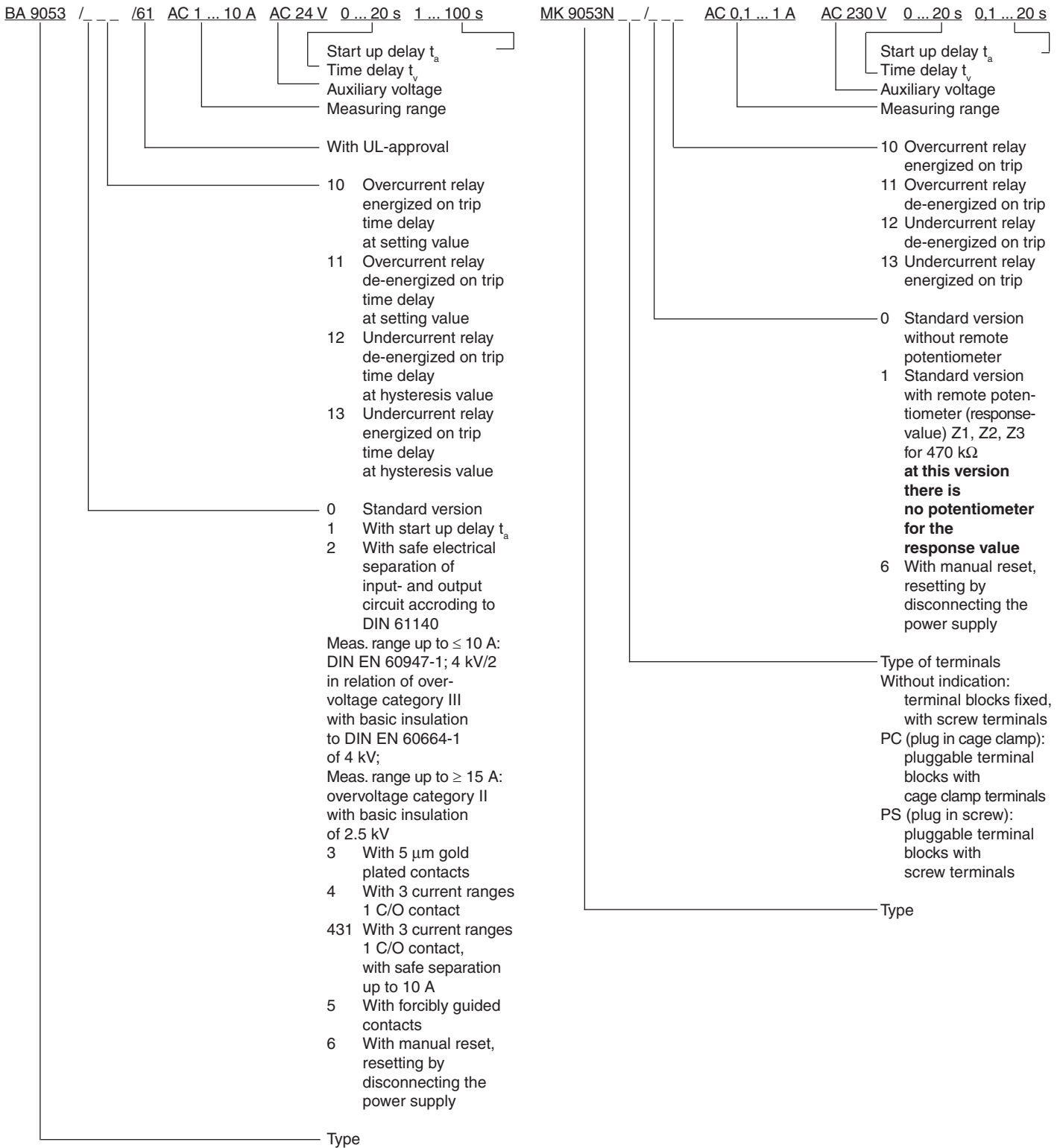
• Auxiliary voltage U_H : AC/DC 80 ... 230 V

• Time delay by t_v : 0 ... 20 s

• Start up delay t_a : 0.1 ... 20 s

• Width: 22.5 mm

Ordering Example for Variants



Options with Pluggable Terminal Blocks



Screw terminal
(PS/plugin screw)

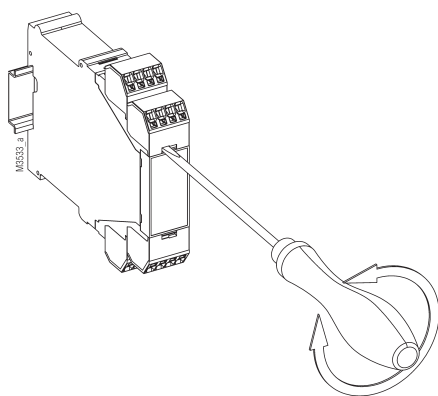


Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Accessories

AD 3: Remote potentiometer 470 K Ω
Article number: 0050174

Setting

Example:
Current relay BA 9053 / MK 9053N AC 0.5 ... 5 A

AC according to type plate:
i.e. the unit is calibrated for AC
0.5 ... 5 A = measuring range

Response value AC 3 A
Hysteresis AC 1.5 A

Settings:
upper potentiometer: 0.6 (0.6 x 5 A = 3 A)
lower potentiometer: 0.5 (0.5 x 3 A = 1.5 A)

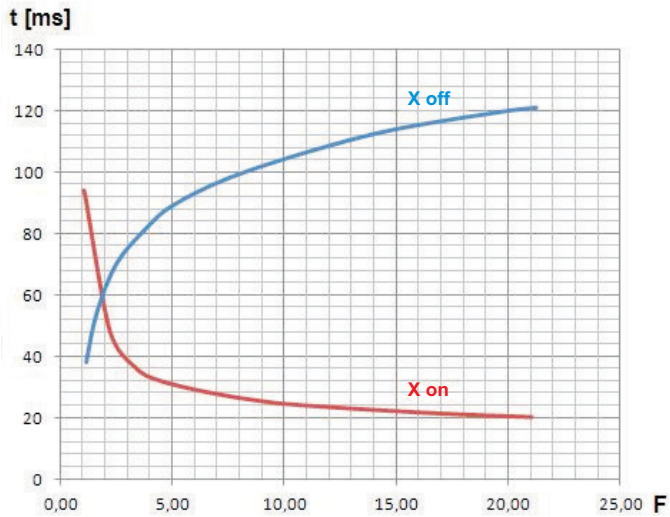
The AC - devices can also monitor DC current. The scale offset in this case is: $\bar{I} = 0.90 \times I_{\text{eff}}$

AC 0.5 ... 5 A is equivalent to DC 0.45 ... 4.5 A

Response value DC 3 A
Hysteresis DC 1.5 A

Settings:
upper potentiometer: 0.66 (0.66 x 4.5 A = 3 A)
lower potentiometer: 0.5 (0.5 x 3 A = 1.5 A)

Characteristic



M11504 a

Time delay of measuring circuit

$$\text{X on: Measured value rise } F = \frac{\text{Measured value (after rise of measured value)}}{\text{Setting value}}$$

$$\text{X off: Measured value drops } F = \frac{\text{Measured value (before measured value drops)}}{\text{Setting value (hysteresis)}}$$

The diagram shows the typical delay of a standard device depending on the measured values "X on and X off" at sudden rise or drop of the signal. At slow change of the measured value the delay is shorter.

The total reaction time of the device results from the adjustable delay t_v and the delay created by the measuring circuit.

The diagram shows an average delay. The delay times could differ on the different variants.

Example for "X on" (overcurrent detection with BA9053/010):

Adjusted setting value $X_{on} = 2 \text{ A}$.

Due to a stalled motor the current rises suddenly to 10 A .

$$F = \frac{\text{Measured value (after rise of measured value)}}{\text{Setting value}} = \frac{10 \text{ A}}{2 \text{ A}} = 5$$

Reading from the diagram:

The output relay switches on after 31 ms at a setting $t_v = 0$.

Example for "X off" (undercurrent detection with BA9053/012):

Adjusted hysteresis setting value is 10 A .

The current drops suddenly from 23 A to 0 A .

$$F = \frac{\text{Measured value (before measured value drops)}}{\text{Setting value (hysteresis)}} = \frac{23 \text{ A}}{10 \text{ A}} = 2.3$$

Reading from the diagram:

The output relay switches off after 70 ms at a setting $t_v = 0$.

EMC-Testing of BA9053 according to EN 50155 Rev 13/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2 kV line to line 4 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1.4GHz-2,1GHZ	A	EN 61000-4-3	10 V/m 1.4GHz-2,1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 2,1Hz-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
		230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHZ	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of BA 9053 according to EN 50155

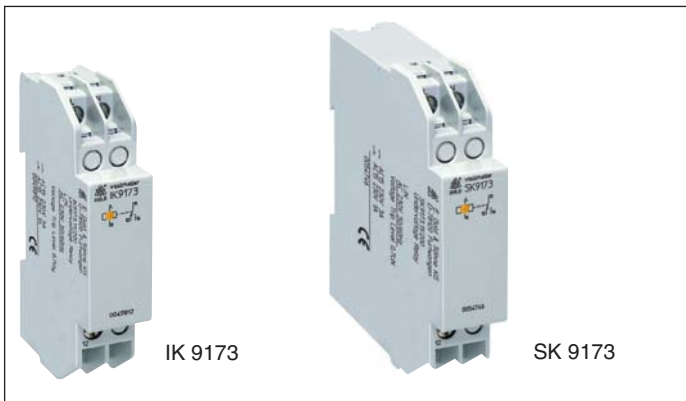
	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72Vor AC 50V	No flashover allowed	IEC 60-1	4 kV	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	4 kV	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	4 kV	No flashover allowed

VARIMETER

Undervoltage Relay, Single-Phase
IK 9173, SK 9173

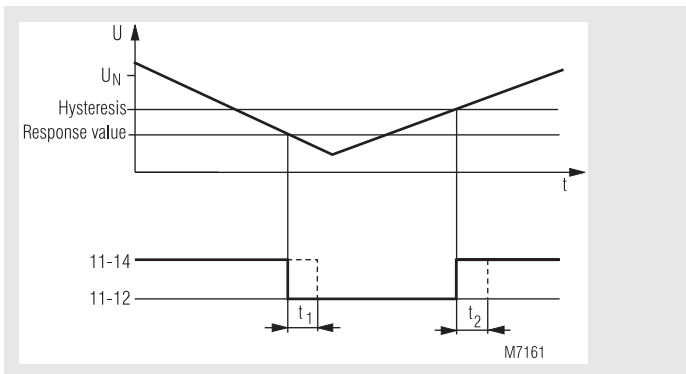


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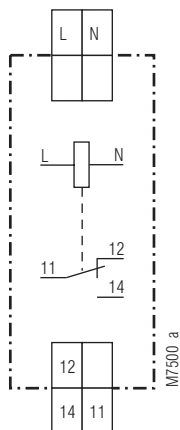


- According to IEC/EN 60 255, DIN VDE 0435-303
- Monitoring of undervoltage
- Without auxiliary supply
- Optionally fixed or settable response value
- N.C. circuit operation
- Optionally with off-delay t_1
- Optionally with on-delay t_2
- LED indicator for state of output relay
- 1 changeover contact
- Devices available in 2 enclosure versions:
IK 9173: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
SK 9173: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Circuit Diagram



IK 9173.11, SK 9173.11

Approvals and Markings



Applications

Monitoring of voltage systems on undervoltage. Automatic switching to emergency supply or of emergency light in the case of phase loss according to DIN VDE 100-710, or DIN VDE 0108.

Variant with t_2 is used in unstable voltage systems, where after phase failure detection the consumers should be energized one after the other. This is done by setting the operate delay of the different relays to different values. This variant is also used where a consumer after only short phase failure should not be started immediately (e.g. compressors).

Suitable for industrial and railway applications.

Function

The arithmetic mean value of the voltage L-N is measured.

Indication

yellow LED: output contact active (11-14 closed)

Notes

The time delay for the models with delay t_1 is only active as long as the phase voltage L-N is above $0.5 U_N$.

Technical Data

Input Circuit

Nominal voltage U_N:	AC 24, 42, 110, 230 V DC 24, 48, 60, 110, 125 V
Max. overload:	1.15 U_N continuously
Nominal consumption:	approx. 6 VA / DC 1 W
Frequency range:	45 ... 65 Hz

Setting Ranges

Response value:	fixed: 0.7 or 0.85 U_N adjustable: 0.55 ... 1.05 U_N (0.7 ... 1.0 U_N at DC 24 V)
Hysteresis:	approx. 4 % of setting value
Time delay t_1 / t_2:	0.5 ... 20 s
Reaction time of the measuring input at phase failure:	approx. 100 ms

Output

Contacts	IK 9173.11, SK 9173.11: 1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity	to AC 15:	
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life	at AC 230 V, 1 A ($\cos \varphi = 0.5$): $\geq 3 \times 10^5$ switching cycles	
Short circuit strength	max. fuse rating: 4 A gL IEC/EN 60 947-5-1	
Mechanical life:	$\geq 30 \times 10^6$ switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60 °C	
Clearance and creepage distances	rated impulse voltage/ pollution degree: 4 kV / 2 IEC 60 664-1	
EMC	Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2	
HF irradiation	80 MHz ... 1 GHz: 20 V / m IEC/EN 61 000-4-3	
	1 GHz ... 2 GHz: 20 V / m IEC/EN 61 000-4-3	
	2 GHz ... 2.7 GHz: 1 V / m IEC/EN 61 000-4-3	
Fast transients:	2 kV IEC/EN 61 000-4-4	
Surge voltages between wires for power supply:	2 kV IEC/EN 61 000-4-5	
between wire and ground:	4 kV IEC/EN 61 000-4-5	
Interference suppression:	Limit value class B EN 55 011	
Degree of protection	Housing: IP 40 IEC/EN 60 529	
	Terminals: IP 20 IEC/EN 60 529	
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04 IEC/EN 60 068-1	
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight	IK 9173: 65 g	
	SK 9173: 83 g	

Dimensions

Width x height x depth	
IK 9173:	17.5 x 90 x 59 mm
SK 9173:	17.5 x 90 x 98 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Standard Types

IK 9173.11/200, AC 230 V, 0.7 U_N	
Article number:	0049812
SK 9173.11/200, AC 230 , 0.7 U_N	
Article number:	0054746
• Detection of undervoltage at < 0.7 U_N	
• Fixed response value	
• Without time delay	
• Output:	1 changeover contact
• Nominal voltage U_N :	AC 230 V
• Width:	17.5 mm

Variants

IK 9173.11/000	
0	NC circuit operation
0	without time delay
3	settable time delay t_1
4	settable time delay t_2
0	settable response value
2	fixed response value

Ordering example for variants

IK 9173	.11	/	---	AC 230 V	50/60 Hz	0.55 ... 1.05 U_N	0.5 ... 20 s
							Time delay t_2
							Response value
							Nominal frequency
							Nominal voltage
							Variant, if required
							Contacts
							Type

EMC-Testing of IK 9173 according to EN 50155 Rev. 13/10/16

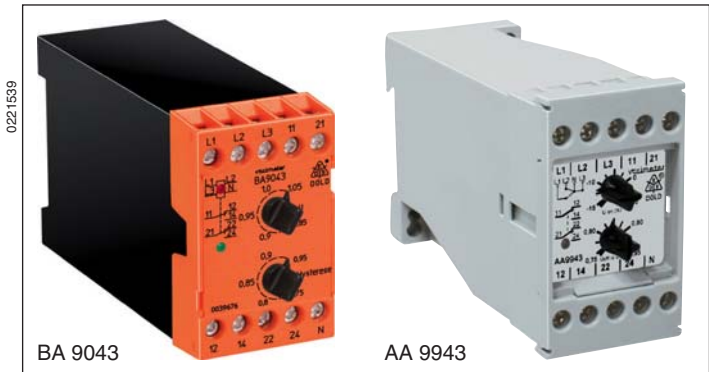
EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1-EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2-EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3-EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: „A“ to have no effect unit during or after test
RF immunity	EN50155part 12.2.8.1-EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	20 V/m 1GHZ-2,0GHZ	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1HZ-2,5GHZ	A	EN 61000-4-3	1 V/m 2,0GHZ-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2-EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class A, 79dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class A, 73dBµV quasi-peak	
	EN50155part 12.2.8.2-EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class A, 73dBµV quasi-peak	
		230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B	
				EN 55011	230MHz to 1GHZ	Limit value class B	

Voltage-Testing of IK 7173 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

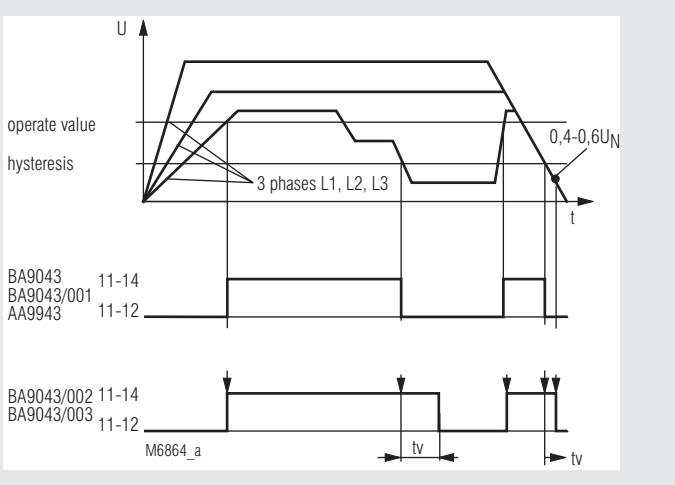
Monitoring Technique

VARIMETER Undervoltage Relay BA 9043, AA 9943



- According to EC/EN 60255-1
- 3-phase
- For nominal voltage of 3 AC 100 / 57 to 690 / 400 V
- Measures arithmetic mean value
- Adjustable operate and release value
- For 3p3w or 3p4w systems
- BA 9043 with optionally adjustable time delay
- De-energized on trip operation
- LED indicator for operation and state of contact
- Insensitive to harmonics
- Frequency up to 400 Hz
- Width 45 mm

Function Diagram



Approvals and Markings



Application

- Undervoltage detection in 3 phase systems
- For industrial and railway applications

Indicators

- upper LED (only BA 9043): on, when voltage connected
- lower LED: on, when output contact activated

Notes

For determination of the arithmetic mean value of the voltage the 3 phases are measured against N. The variants without N (/001 and /003) measure L1 and L2 against L3. delay the delay is only active at $U \geq 0,6 U_N$. At $< 0,4 U_N$ the relay switches off without delay.

Technical Data

Input

- Nominal voltage U_N**
 BA 9043, BA 9043/002
 AA 9943: 3/N AC 100/57 V; 220/127 V; 400/230 V
 415/240 V; 440/254 V; 500/290 V
- BA 9043, BA9043/002:
 BA 9043/001, BA 9043/003,
 AA 9943/001: 3/N AC 690/400 V
- BA 9043/001, BA 9043/003:
 3 AC 100 V; 220 V; 400 V; 415 V, 440 V;
 500 V
 3 AC 690 V

Max. overload

- BA 9043: 1.2 U_N continuously
- AA 9943: 1.1 U_N continuously

Nominal consumption:

AC 4 VA

Nominal frequency:

50 ... 400 Hz

Frequency range:

$\pm 5 \%$

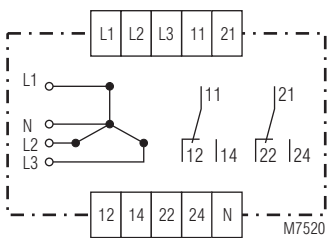
Temperature influence:

$< 0,05 \%$ / K

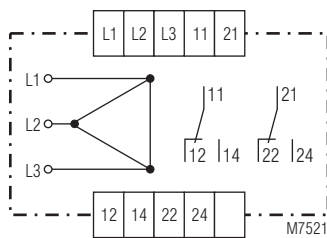
Setting Ranges

- Response value:** 0.85 ... 1.05 U_N , infinite variable with upper potentiometer
- Hysteresis:** 0.75 ... 0.95 of operate value
- Setting accuracy:** $\leq \pm 10 \%$
- Switching delay t_M :** see diagram switching delay
- Time delay t_V :** infinite variable from 0.5 ... 10 sec for BA 9043/002, BA 9043/003
 Between 0.4 and 0.6 U_N the contacts fall back according to the diagram without additional delay

Circuit Diagrams



BA 9043, BA 9043/002
AA 9943



BA 9043/001, BA 9043/003
AA 9943/001

Technical Data

Output

Contacts

BA 9043:	2 changeover contacts
AA 9943.11:	1 changeover contact
AA 9943.12:	2 changeover contacts
Thermal current I_{th}:	6 A; see diagramm
	Continuous current limit curve

Switching capacity

to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1

Electrical life

to AC 15 at 3 A, AC 230 V:	3 x 10 ⁵ switching cycles
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Short circuit strength

max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
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Mechanical life:

> 30 x 10⁶ switching cycles

General Data

Operating mode:

Continuous operation

Temperature range

Operation: - 20 ... + 60°C

Storage: - 25 ... + 60°C

Altitude:

< 2.000 m

Clearance and creepage distances

rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
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EMC

Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
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HF irradiation

80 MHz ... 1 GHz:	10 V/m	IEC/EN 61 000-4-3
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1 GHz ... 2.5 GHz:	3 V/m	IEC/EN 61 000-4-3
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2.5 GHz ... 2.7 GHz:	3 V/m	IEC/EN 61 000-4-3
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Fast transients:	2 kV	IEC/EN 61 000-4-4
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Surge voltages

between

wires for power supply:	1 kV	IEC/EN 61 000-4-5
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between wire and ground:	2 kV	IEC/EN 61 000-4-5
--------------------------	------	-------------------

HF wire guided:	10 V	IEC/EN 61 000-4-6
-----------------	------	-------------------

Interference suppression:	Limit value class B	EN 55 011
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Degree of protection

Housing:	IP 40	IEC/EN 60 529
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Terminals:	IP 20	IEC/EN 60 529
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Housing:

Thermoplastic with V0 behaviour according to UL subject 94

Vibration resistance:	Amplitude 0.35 mm	IEC/EN 60 068-2-6
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frequency 10 ... 55 Hz

Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
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Terminal designation:

DIN EN 50 005

Wire connection:

2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve

DIN 46 228-1/-2/-3/-4

Wire fixing:

Flat terminals with self-lifting

clamping piece IEC/EN 60 999-1

Fixing torque:

0.8 Nm

Mounting:

DIN rail IEC/EN 60 715

Weight

BA 9043:	310 g
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AA 9943:	300 g
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Dimensions

Width x height x depth

BA 9043:	45 x 73 x 132 mm
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AA 9943:	45 x 77 x 127 mm
----------	------------------

CCC-Data

Thermal current I_{th}:	5 A
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Switching capacity

to AC 15:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1



Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Classification to DIN EN 50155 for BA 9043

Vibration and

shock resistance: Category 1, Class B IEC/EN 61 373

Ambient temperature: T1 compliant

T2, T3 and TX with operational limitations

Protective coating of the PCB: No

Standard Type

BA 9043 3/N AC 400 / 230 V 50 ... 400 Hz

Article number: 0039676

- for 3p4w systems
- Nominal voltage U_N : 3/N AC 400 / 230 V
- Output: 2 changeover contacts
- Width: 45 mm

Variants

AA 9943/001:	without neutral
AA 9943/175:	for nuclear power plants
BA 9043/001:	without neutral
BA 9043/002:	with neutral, adjustable time delay

$t_v = 0.5 \dots 10$ sec

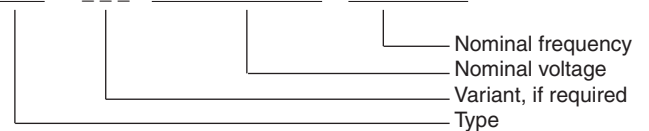
BA 9043/003:	without neutral, adjustable time delay
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$t_v = 0.5 \dots 10$ sec

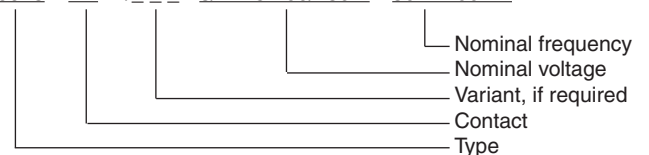
BA 9043:	with CCC-approval on request
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Ordering example for variants

BA 9043 / _ _ _ 3/N AC 400/230 V 50 ... 400 Hz



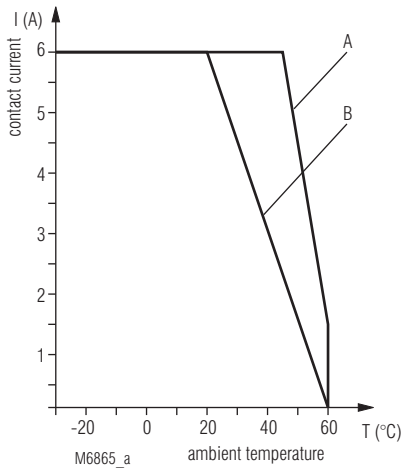
AA 9943 .11 / _ _ _ 3/N AC 400/230 V 50 ... 400 Hz



Accessories

AA 9943:	Cover
K 70-34	Article number: 0011790

Characteristics



Continuous current limit curve

A = Devices mounted with 2 cm distance

B = Devices mounted without distance

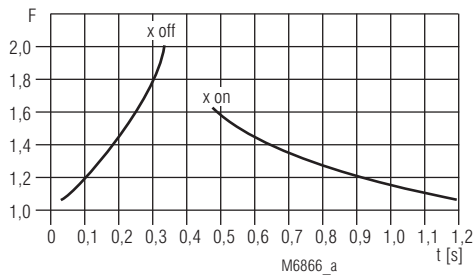


Diagram switching delay

Switching delay t_M :

When the voltage changes fast on the measuring input, the arithmetic mean value can only adjust after a short delay.

Example:

$$F = \frac{U_{\text{applied}}}{U_{\text{setting}}} \quad F = \frac{240 \text{ V}}{190 \text{ V}} = 1.26$$

U setting = 190 V

U applied = 240 V

according to diagram:

$t_{M, \text{on}}$ = approx. 800 ms

$t_{M, \text{off}}$ = approx. 100 ms

EMC-Testing of BA 9043 according to EN 50155 Rev 13/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance and shorter rise time
Electrostatic discharge	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHZ	A	EN 61000-4-3	3 V/m 1GHz-2,0GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	3 V/m 2,0Hz-2,7GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi- peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi- peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	230MHz to 1GHZ	< 47 dBµV/m quasi- peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHZ	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of BA 9043 according to EN 50155

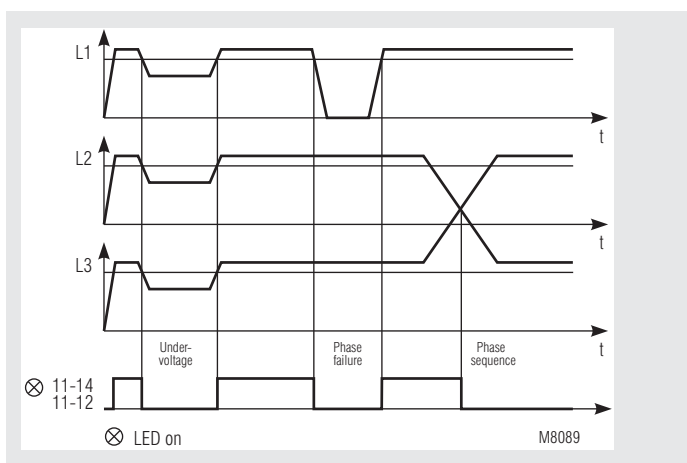
	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	4 kV at rated voltage 500V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	4 kV at rated voltage 500 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	4 kV at rated voltage 500V	No flashover allowed

VARIMETER PRO Phase Monitor IL 9087, SL 9087



- According to IEC/EN 60 255-1
- Monitoring of phase failure
 - Undervoltage 3-phase 3 or 4 wire
 - Phase failure
 - Phase sequence
 - Loss of neutral
 - Phase asymmetry
- Without auxiliary supply
- De-energized on trip
- LED indication
 - Supply voltage
 - Phase failure
- 1 or 2 changeover contacts
- Devices available in 2 enclosure versions:
 - IL 9087: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
 - SL 9087: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 35 mm

Function Diagram



Voltage

Approvals and Markings



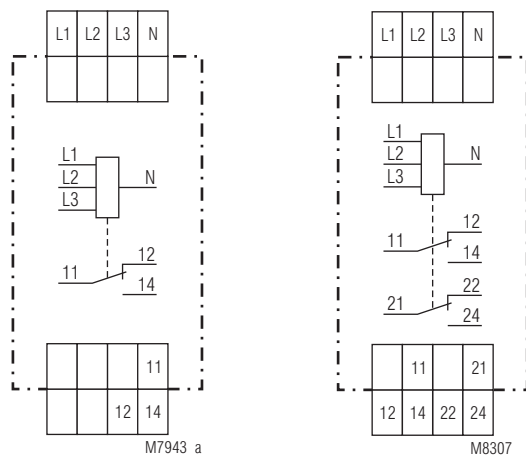
Applications

Monitoring of 3-phase systems with motors, e. g. for elevators.

Function

On a healthy voltage system both LEDs are on. If a voltage failure occurs the contact 11-14, 21-24 opens. In 3-phase voltage systems with unbalanced load the unit can also detect the loss of neutral on the input line of the system. If a neutral is not used the N-terminal remains unconnected.

Circuit Diagrams



IL 9087.11,
SL 9087.11

IL 9087.12,
SL 9087.12

Indicators

left green LED: on when voltage connected
right green LED: on when measuring voltage correct

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3, N	Measuring- or supply input
11, 12, 14; 21, 22, 24	Changeover contacts

Technical Data

Input

Nominal voltage U_N:	3 / N AC 400 / 230 V (other voltages on request)
Voltage range:	0.8 ... 1.1 U_N
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 65 Hz
Undervoltage detection:	approx. $0.7 \pm 0.15 \times U_N$
Asymmetry detection:	approx. 20° phase asymmetry
Hysteresis:	$\leq 6\% \times U_N$
Response delay:	100 ... 300 ms
Operate delay:	15 ... 30 ms ($0V \Rightarrow U_N$)

Output

Contacts	
IL/SL 9087.11:	1 changeover contact
IL/SL 9087.12:	2 changeover contacts
Contact material:	AgNi 0.15 + 0.3 μm AU
Thermal current I_{th}:	2 x 4 A
Switching capacity to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life:	IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	6 x 10 ⁵ switching cycles
Switching voltage:	min. 10 V ; max. DC 120 V / AC 250 V
Switching current:	min. 0.1 A ; max. 5 A
Switching capacity:	min. 1 W, 1 VA; max. 120 W, 1250 VA
Short circuit strength max. fuse rating:	4 A gG / gL IEC/EN 60947-5-1
Mechanical life:	> 10 ⁸ switching cycles

General Data

Operating mode:	Continuous operation
Temperature range	
Operation:	- 20 ... + 60 °C
Storage:	- 25 ... + 60 °C
Altitude:	< 2.000 m
Input current	
L1:	approx. 7 mA
L2:	approx. 7 mA
L3:	approx. 1.5 mA
Nominal consumption:	approx. 3.5 VA
Clearance and creepage distances	
Rated impulse voltage / pollution degree	
Input/Output:	4 kV / 2 IEC 60 664-1
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF-irradiation	
80 MHz ... 2.7 GHz:	10 V/m IEC/EN 61 000-4-3
Fast transients:	4 kV IEC/EN 61 000-4-4
Surge voltages between	
wires for power supply:	1 kV IEC/EN 61 000-4-5
between wire and ground:	2 kV IEC/EN 61 000-4-5
HF wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55 011
Degree of protection:	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL Subj. 94
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04 IEC/EN 60 068-1
Wire connection max. cross section:	2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
Stripping length:	10 mm
Fixing torque:	0,8 Nm

Technical Data

Mounting:	DIN-rail	IEC/EN 60 715
Weight		
IL 9087:	185 g	
SL 9087:	230 g	

Dimensions

Width x height x depth	
IL 9087:	35 x 90 x 59 mm
SL 9087:	35 x 90 x 98 mm

Classification to DIN EN 50155 for SL 9087

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

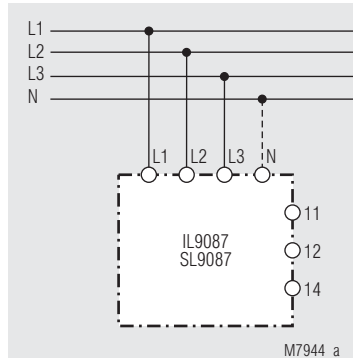
Standard Types

IL 9087.12	3 AC 400 V and 3 / N AC 400 / 230 V
Article number:	0054502
• Output:	2 changeover contacts
• Nominal voltage U_N :	3 AC 400 V and 3 / N AC 400 / 230 V
• Width:	35 mm
SL 9087.12	3 AC 400 V and 3 / N AC 400 / 230 V
Article number:	
• Output:	2 changeover contacts
• Nominal voltage U_N :	3 AC 400 V and 3 / N AC 400 / 230 V
• Width:	35 mm

Ordering Example

IL 9087	.11	3/N AC 400 / 230 V	50 / 60 Hz	
				Nominal frequency
				Measuring voltage
				Contacts
				Type

Connection Examples



EMC-Testing of IL 9087 according to EN 50155 Rev. 25/10/2016

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHz	A	EN 61000-4-3	10 V/m 80MHz-1GHz	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHz	A	EN 61000-4-3	10 V/m 80MHz-1GHz	A (1)	
RF emission	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHz	A	EN 61000-4-3	10 V/m 1GHz-2,1GHz	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHz	A	EN 61000-4-3	10 V/m 2,7GHz- 2,5GHz	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	Limit value Class B	
		150kHz to 500kHz	< 99dBµV quasi- peak	EN 55011	150kHz to 500kHz	Limit value Class B	
				EN 55011	500kHz to 5MHz	Limit value Class B	
				EN 55011	5MHz to 30MHz	Limit value Class B	
				EN 55011	30MHz to 230MHz	Limit value Class B	
				EN 55011	230MHz to 1GHz	Limit value Class B	

Voltage-Testing of IL 9087 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

Monitoring Technique

VARIMETER

Underload Monitor (cos φ Monitor)

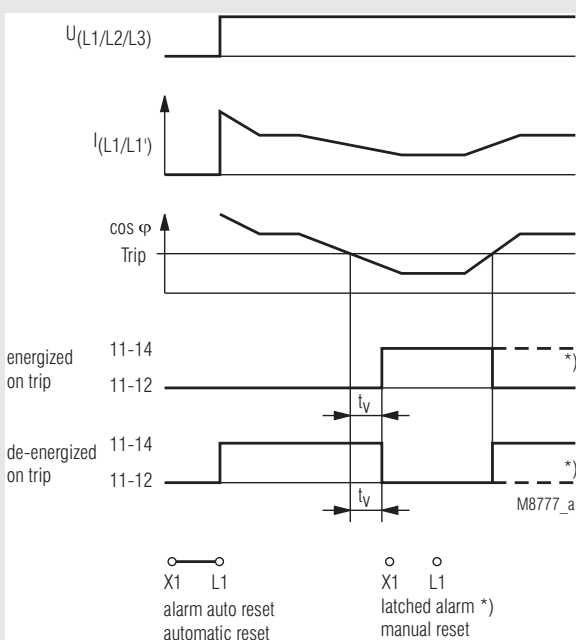
IK 9065, SK 9065, SL 9065CT



0246036

- According to EN 60 255-1
- Detection of underload (cos φ)
- Without auxiliary supply
- Current up to 8 A
- Motors up to 5 A nominal current can be connected directly
- Higher currents via current transformer
- SL 9065CT with integrated current transformer for currents up to 100 A
- Adjustable response value
- Automatic reset (Alarm auto reset)
- Adjustable operate delay up to 100 s
- De-energized on trip
- For single and 3-phase loads e.g. motors
- Independent of phase sequence
- 1 changeover contact
- LED indicator voltage supply and alarm
- DIN rail or screw mounting
- Devices available in 2 enclosure versions:
 IK 9065: depth 58 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
 SK 9065, SL 9065CT: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- IK 9065, SK 9065 width 17.5 mm
 SL 9065CT width 35 mm

Function Diagram



IK/SK 9065/100: as IK/SK 9065 but:

- programmable for
 - automatic reset or manual reset (latched alarm)
 - energized or de-energized on trip
- With reset button
- Remote reset

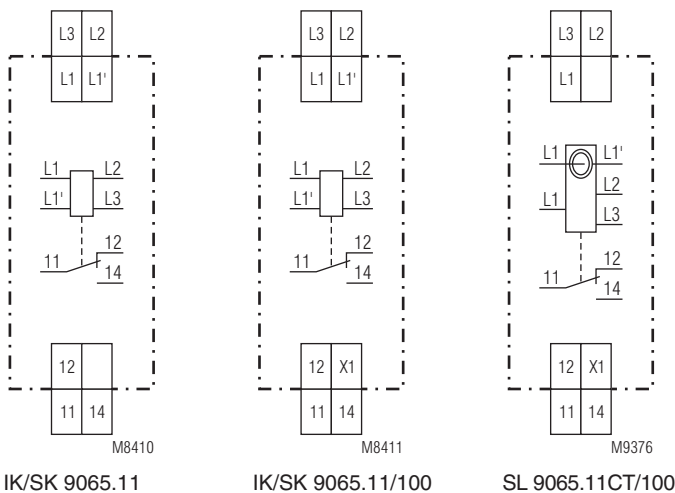
Approvals and Markings



Applications

- Monitors underload and no load on squirrel cage motors e.g.
- fan monitoring (broken belt)
 - filter monitoring (blocked filter)
 - pump monitoring (blocked valve, dry running)
 - general cos phi monitoring
 - for industrial and railway applications

Circuit Diagrams



Function

The underload monitor IK/SK/SL 9065 measures the phase shift between voltage and current. The phase angle changes with changing load. This measuring method is suitable to monitor asynchronous motors on underload and no load independent of motor size. In some cases the cos φ does not change much with load change on the motor, e.g.:

- small load change on oversized motor
- single phase chaded-pole and collector motors

In these cases we recommend the use of motor load monitor BA 9067 or BH 9097.

If a cos phi value lower then the adjusted value is detected the output relay changes into alarm state after the adjusted time delay t_v and the red LED "Alarm" lights up. If the underload monitor is in auto reset mode it changes back to normal state without delay when the cos phi rises above the adjusted cos phi value.

Indicators

- green LED: on, when supply connected to L1-L2
- red LED: on, when underload detected (Alarm)

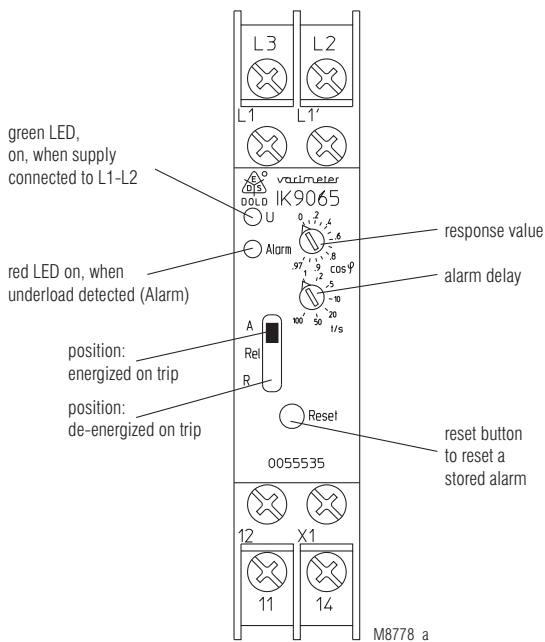
Connection Terminals

Terminal designation	Signal designation
L1, L2, L3	Connection for 3-phase systems
L1', L1 ¹⁾	Current measuring circuit, connection for external current transformer possible ¹⁾
X1, L1 ²⁾	Control input (manual reset / auto-Reset) ²⁾ X1/L1 not bridged: manual reset X1/L1 bridged: auto-reset
11, 12, 14	Changeover contact

¹⁾ Only at IK/SK 9065

²⁾ Only at IK/SK/SL 9065.11/100

Setting



Notes

Monitoring of single phase load is also possible. The terminal L3 is not connected in this case (see connection diagram). The underload monitor must be ordered for the right voltage e.g. a unit for 3 AC 230 V for a single phase 230 V application.

When the underload monitor IK/SK 9065 is connected to the supply voltage L1-L2-L3 and no current is flowing in the current path L1-L1' the unit changes also in alarm state.

The current path L1-L1' allows to connect currents up to 8 A directly at IK/SK 9065. When connecting asynchronous motors not only the nominal current is important, but also the much higher starting current. The overload characteristic of the current input allows to connect motors with nominal current up to 4..5 A depending on the starting conditions. This is at 3 AC 400 V a motor load of 1.5 ... 2.2 kW.

It is important that the motor is connected to L1' and **not** to L1. On wrong connection the phase angle will be measured in a wrong way and the underload monitor IK/SK 9065 will not work.

For higher currents over 8 A (nominal motor current over 5 A) external current transformers can be used (see Connection Examples). Also here the current transformers have to be connected with the right polarity. All standard current transformers of class 3 or better can be used (1 A or 5 A types). The integrated current transformer at SL 9065CT allows to connect currents up to 100 A directly.

The variant IK/SK/SL 9065.11/100 allows the following settings:

Bridge

X1-L1

- Automatic restart (Alarm auto reset)
- ● Manual restart (Latched Alarm), reset with built in push button, external push button on X1-L1 or by disconnecting the supply voltage.

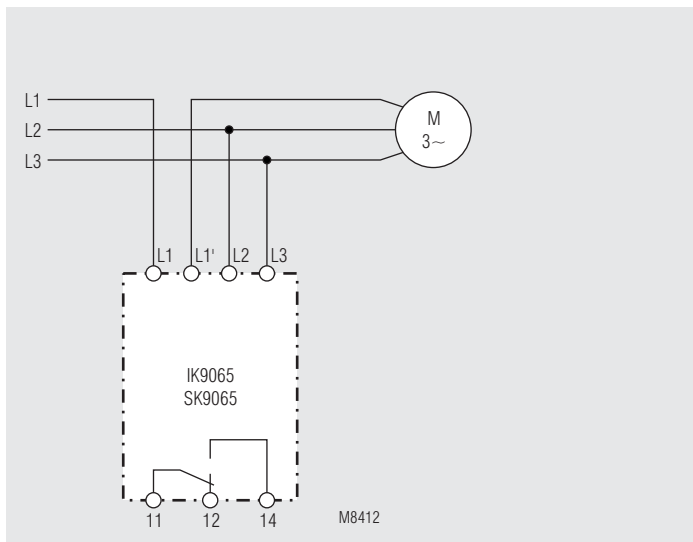
Switch "REL" on front side

- Position "A": energized on trip (relay energizes on underload-alarm)
- Position "R": de-energized on trip (relay de-energizes on under load-alarm)

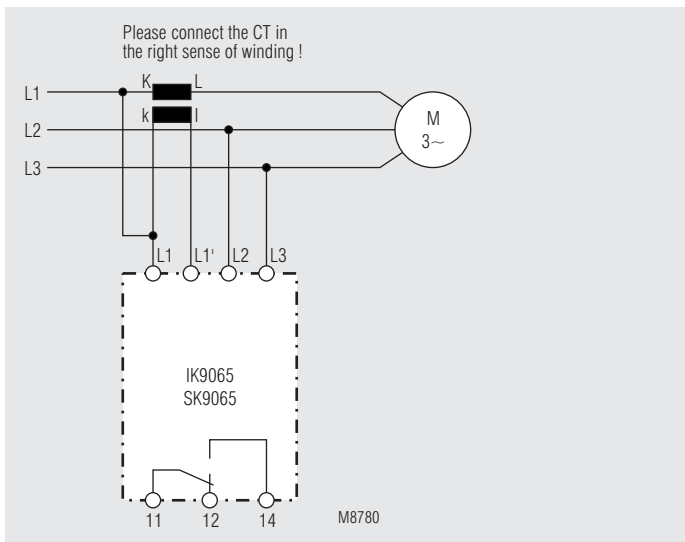
Technical Data	
Input	
Nominal voltage U_N:	(= Motor voltage) 3 AC (or AC) 110, 230, 400 V
Voltage range:	0.8 ... 1.1 U_N
Nominal frequency of U_N:	45 ... 65 Hz
Nominal consumption (L1-L2):	max. approx. 11 VA
Current Path	
Current range	
IK 9065, SK 9065:	0.1 ... 2 A 0.5 ... 8 A*
Internal resistance:	approx. 30 m Ω approx. 10 m Ω
Consumption:	max. 0.14 VA max. 0.7 VA
	* (for higher currents use external current transformer see connection diagram)
Short time overload:	2.5 x I_{max} for 2 s, 5 x I_{max} for 0.5 s
Suitable current transformers:	1 A or 5 A types, class 3, with necessary load capacity
Current range SL 9065CT:	5 ... 100 A via integrated current transformer in the base (max. wire-diameter: 10 mm)
Setting range $\cos \varphi$:	0 ... 0.97 infinite variable
Operate delay t_v:	1 ... 100 s infinite variable
Output	
Contacts:	1 changeover contact
Thermal current I_{th}:	4 A
Switching capacity to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life to AC 15 at 1 A, AC 230 V:	1.5 x 10 ⁵ switching cycles IEC/EC 60 947-5-1
Short-circuit strength max. fuse rating:	4 A gL IEC/EN 60 947-5-1
Mechanical life:	30 x 10 ⁶ switching cycles
General Data	
Operating mode:	Continuous operation
Temperature range	
Operation:	- 25 ... + 60°C
Storage:	- 25 ... + 60°C
Altitude:	< 2,000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree:	4 kV / 2 IEC 60 664-1
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF-irradiation:	
80 MHz ... 1 GHz:	20 V / m IEC/EN 61 000-4-3
1.4 GHz ... 2 GHz:	20 V / m IEC/EN 61 000-4-3
2 GHz ... 2.5 GHz:	10 V / m IEC/EN 61 000-4-3
Fast transients:	4 kV IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class A*) *) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.
Degree of protection	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz IEC/EN 60 068-2-6 40 / 060 / 04 IEC/EN 60 068-1 EN 50 005
Climate resistance:	
Terminal designation:	
Wire connection:	
Cross section:	2 x 2.5 mm ² solid or 1 x 1.5 mm ² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
Stripping length:	10 mm

Technical Data	
Wire fixing:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1 0,8 Nm
Fixing torque:	
Mounting:	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory
Weight:	
IK 9065:	approx 65 g
SK 9065:	approx 84 g
SL 9065CT:	approx. 195 g
Dimensions	
Width x height x depth:	
IK 9065:	17.5 x 90 x 58 mm
SK 9065:	17.5 x 90 x 98 mm
SL 9065CT:	35 x 90 x 98 mm
Classification to DIN EN 50155 for IK 9065 and SK 9065	
Vibration and shock resistance:	Category 1, Class B IEC/EN 61 373
Ambient temperature:	T1, T2 compliant T3 and TX with operational limitations
Protective coating of the PCB:	No
Standard Types	
IK 9065.11 3 AC 400 V 0.4 ... 8 A 1 ... 100 s	
Article number:	0055534
• Output:	1 changeover contact
• De-energized on trip:	
• Nominal voltage U_N :	3 AC 400 V
• Current range:	0.4 ... 8 A
• Operate delay:	1 ... 100 s
• Width:	17.5 mm
SK 9065.11 3 AC 400 V 0.4 ... 8 A 1 ... 100 s	
Article number:	0055816
• Output:	1 changeover contact
• De-energized on trip:	
• Nominal voltage U_N :	3 AC 400 V
• Current range:	0.4 ... 8 A
• Operate delay:	1 ... 100 s
• Width:	17.5 mm
SL 9065.11CT/100 3 AC 400 V 5 ... 100 A 1 ... 100 s	
Article number:	0059410
• Output:	1 changeover contact
• Nominal voltage U_N :	3 AC 400 V
• Current range:	5 ... 100 A
• Operate delay:	1 ... 100 s
• programmable for: manual reset with built in or external push button, energized or de-energized on trip, selection via switch on the front	
• Width:	35 mm
Variants	
IK 9065.11/100, SK 9065.11/100:	programmable for: manual reset with built in or external push button, energized or de-energized on trip, selection via switch on the front
Ordering example for variants	
IK 9065 .11 / _ _ _ 3 AC 400 V 0.4 ... 8 A 1 ... 100 s	
	Operate delay
	Current range
	Nominal voltage
	Variant, if required
	Contacts
	Type
Accessories	
ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578

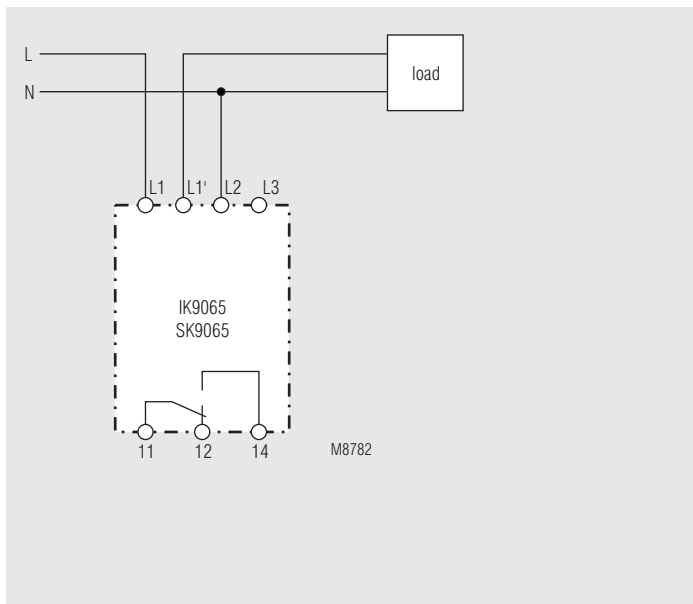
Connection Examples



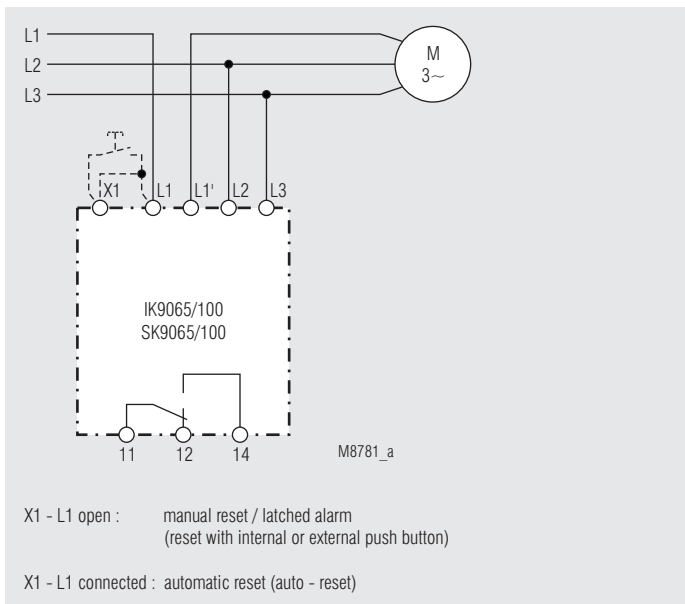
IK 9065.11 with 3-phase load



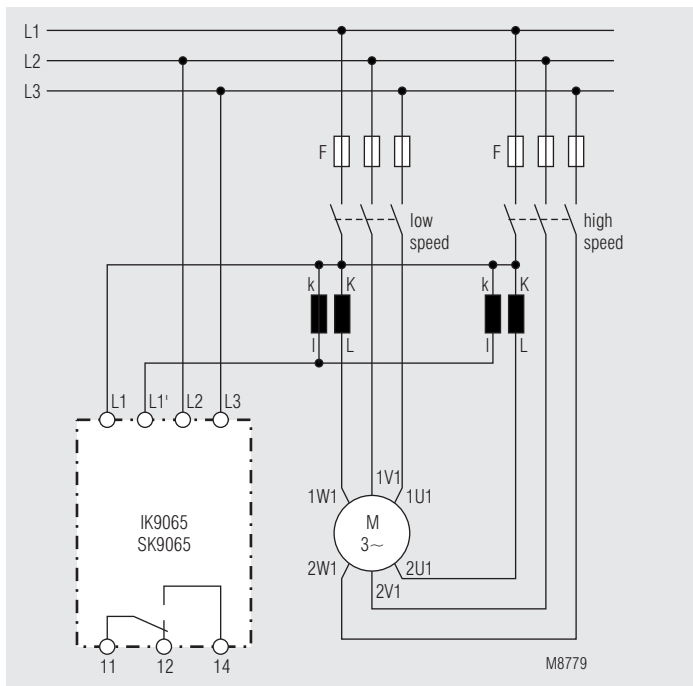
IK/SK 9065.11 with 3-phase load and external current transformer



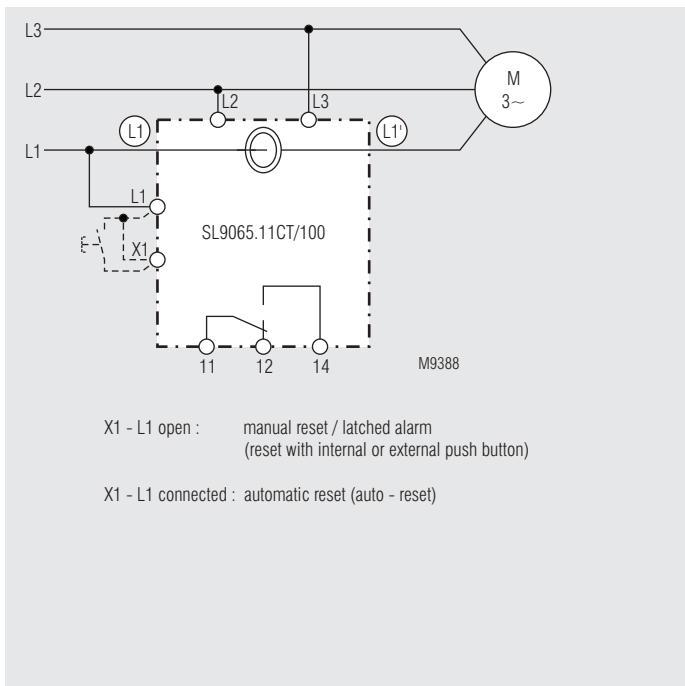
IK 9065.11 with single-phase load



IK/SK 9065.11/100 with 3-phase load



IK/SK 9065.11 for motors with separate windings



SL 9065.11CT/100

EMC-Testing of IK 9065 according to EN 50155 Rev. 25/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155 part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2 kV line to line 1.2/50µs source impedance 12 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155 part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155 part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
	EN50155 part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155 part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155 part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155 part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHZ	A	EN 61000-4-3	20 V/m 1GHz-2GHZ	A (1)	
	EN50155 part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 2GHZ-2,5GHZ	A (1)	
	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155 part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class A	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class A	
	EN50155 part 12.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class A	
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	230MHz to 1GHz	Limit value class A	

Voltage-Testing of IK 9065 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72Vor AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated Voltage 400V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated Voltage 400 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated Voltage 400V	No flashover allowed

VARIMETER

Over- and Undercurrent Relay

IL 9277, IP 9277, SL 9277, SP 9277



- According to IEC/EN 60 25-1
- IP 9277, SP 9277, SP 9277CT: 3-phase
IL 9277, SL 9277, SL 9277CT: single phase
- Detects over- and undercurrent
- Measuring ranges from 0.1 ... 15 A
- With built in current transformer for 0.5 ... 100 A
- IL 9277, SL 9277 with 4 programmable ranges
- Settable $0.1 \dots 1 I_N$
- Separate setting for over- and undercurrent
- Fixed hysteresis approx. 4 %
- Settable time delay
- IP 9277, SP 9277 with separate settable time delay for over- and undercurrent
- De-energized on trip
- LED indicators for over-, under- and normal current
- Auxiliary supply and measuring input galvanic separated
- IL 9277, SL 9277 with one output relay for over- and undercurrent
- IP 9277, SP 9277 with separate output relays for over- and undercurrent
- Optionally energized on trip
- Devices available in 2 enclosure versions:
 - I-model, e.g. IL _____, depth 61 mm
with terminals at the bottom for installations systems and industrial distribution systems according to DIN 43 880
 - S-model, e.g. SL _____, depth 100 mm
with terminals at the top for cabinets with mounting plate and cable duct
- DIN rail or screw mounting
- Width IL 9277, SL 9277, SL 9277CT: 35 mm
IP 9277, SP 9277, SP 9277CT: 70 mm

Approvals and Markings



*) only IL-devices

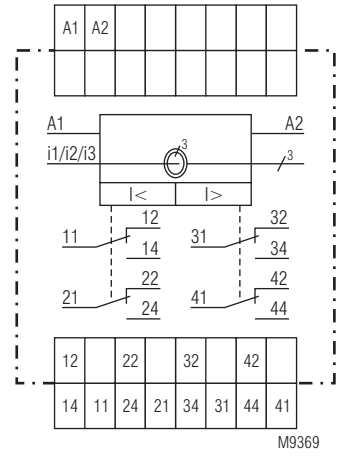
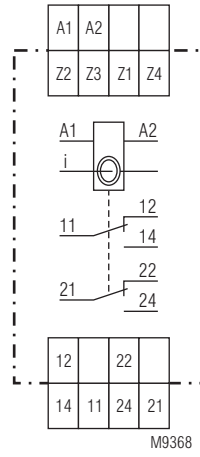
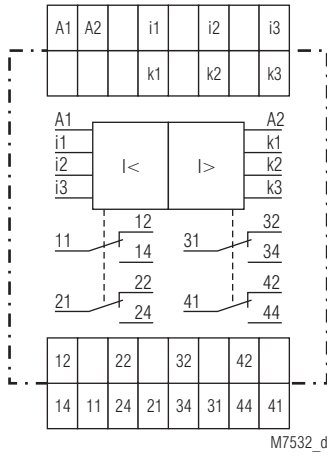
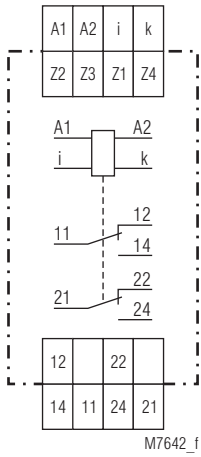
Applications

- Over- and undercurrent detection in single phase or 3-phase voltage systems
- For industrial and railway applications

Indicators

LED green:	current within limits
LED red I_{max} :	overcurrent
LED red I_{min} :	undercurrent

Circuit Diagram



IL 9277.12, SL 9277.12

IP 9277.39, SP 9277.39

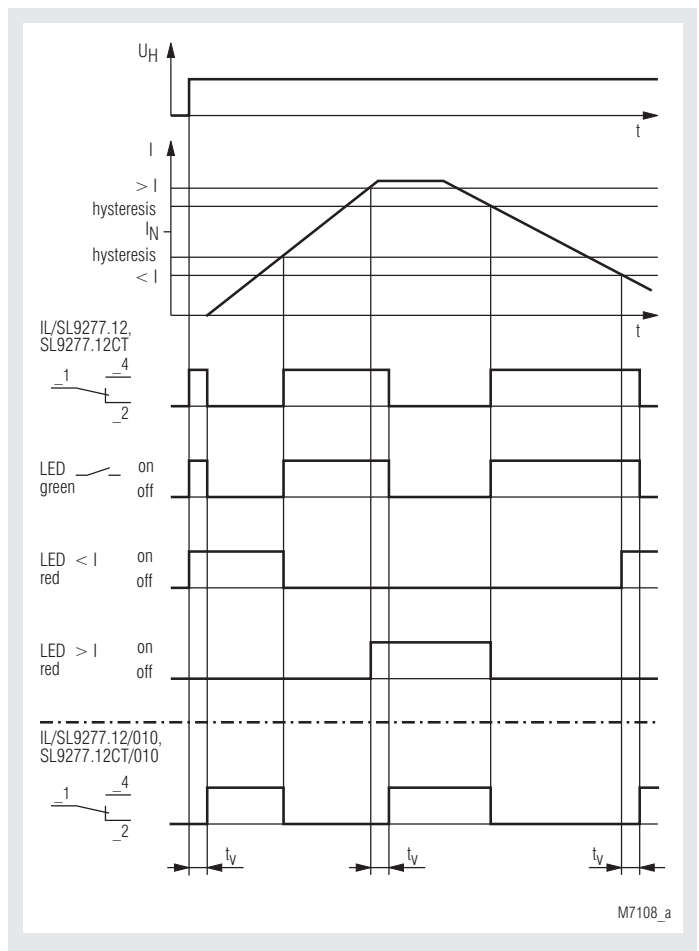
SL 9277.12CT

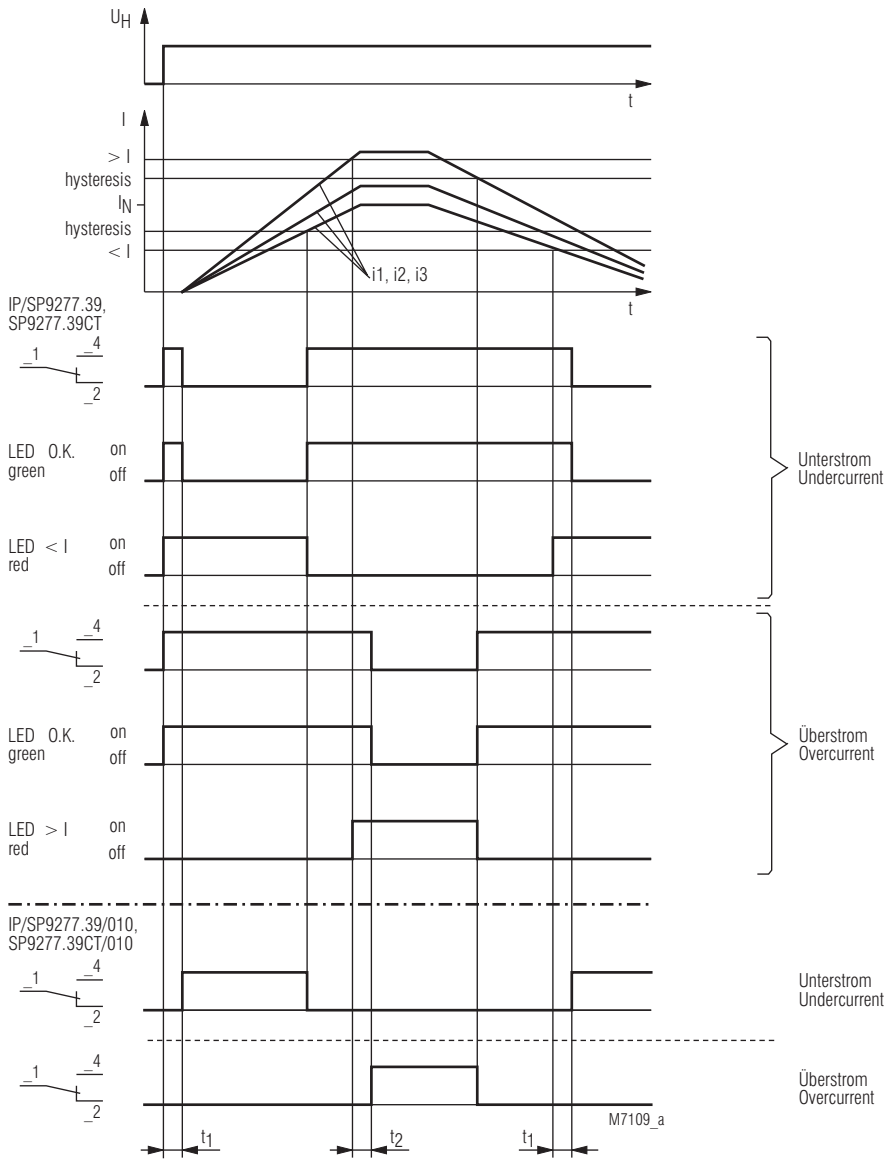
SP 9277.39CT

Connection Terminals





Terminal designation	Signal designation
A1, A2	Auxiliary voltage AC or DC
i, k	Current measuring circuit AC or DC
i1, k1; i2, k2; i3, k3	Current measuring circuit phase 1; 2; 3
Z1 / Z2, Z3, Z4	Measuring ranges with bridges via terminals
IL-device: 11, 12, 14	Contacts Rel. 1 over- / undercurrent signal
IL-device: 21, 22, 24	Contacts Rel. 2 over- / undercurrent signal
IP-device: 11, 12, 14	Contacts Rel. 1 underrcurrent signal
IP-device: 21, 22, 24	Contacts Rel. 2 underrcurrent signal
IP-device: 31, 32, 34	Contacts Rel. 3 overcurrent signal
IP-device: 41, 42, 44	Contacts Rel. 4 overcurrent signal

Function Diagram IL 9277, SL 9277, SL 9277CT





Technical Data

Type				
	IL 9277	SL 9277CT	IP 9277	SP 9277CT
Depth 61 mm	IL 9277.12		IP 9277.39	
Depth 100 mm	SL 9277.12	SL 9277.12CT	SP 9277.39	SP 9277.39CT
Width	35 mm	35 mm	70 mm	70 mm
Measuring input	single-phase	single-phase	3-phase	3-phase
Measuring range	0.1 ... 15 A settable with switch range / bridge	0.5 ... 100 A settable with bridges: range / bridge	1 Meas. range per unit	1 Meas. range per unit
Nominal frequency 50 ... 400 Hz	0.1 ... 1 A / Z1-Z2 0.5 ... 5 A / Z1-Z3 1 ... 10 A / Z1-Z4 1.5 ... 15 A / Z3-Z1-Z4 0.01 ... 1.5 A programmable with bridges: range / bridge 0.01 ... 0.1 A / Z1-Z3 0.05 ... 0.5 A / Z1-Z2 0.1 ... 1 A / Z1-Z4 0.15 ... 1.5 A / Z2-Z1-Z4	0.5 ... 5 A / Z1-/Z2 2.5 ... 25 A / Z1-Z3 7.5 ... 75 A / Z1-Z4 10 ... 100 A / Z3-Z1-Z4	0.1 ... 1 A 0.5 ... 5 A 1 ... 10 A 1.5 ... 15 A	0.5 ... 5 A 2.5 ... 25 A 5 ... 50 A 7.5 ... 75 A 10 ... 100 A
Continuous current/ Max. ambient temperature	20 A / 50 °C 15 A / 60 °C	limited only by diameter of cable 25 mm ²	3 x 15 A / 50 °C 3 x 20 A / 45 °C	limited only by diameter of cable 25 mm ²
Wire current path Solid Stranded ferrule	2 x 2.5 mm ² 2 x 1.5 mm ²	CT-diameter = 10 mm 25 mm ²	2 x 2.5 mm ² 2 x 1.5 mm ²	CT-diameter = 10 mm 25 mm ²
Contacts	2 C/O contacts	2 C/O contacts	2 x 2 C/O contacts *)	2 x 2 C/O contacts *)
Weight:	IL 9277: 125 g SL 9277: 150 g	approx. 230 g	IP 9277: 200 g SP 9277: 250 g	approx. 470 g

*) 2 changeover contacts for overcurrent, 2 changeover contacts for undercurrent

Technical Data

Max. overload: see table
Temperature influence: $\leq 0.05\%$ / K
Reaction time: see characteristic switching delay

Setting Ranges

Response value: infinite variable within measuring range
Hysteresis: approx. 4 % of setting value, fixed
Repeat accuracy: $\leq \pm 1\%$
Switching delay: 0.1 ... 20 sec settable

Auxiliary Circuit

Auxiliary voltage U_H

IL 9277, SL 9277, SL 9277CT: AC/DC 24 V
AC 115 ... 127 V, AC 220 ... 240 V,
AC 400 ... 440 V

IP 9277, SP 9277, SP 9277CT: AC/DC 24 V
AC 115, 127 V
AC 220 ... 240 V, AC 400 ... 440 V

Voltage range

at AC: 0.8 ... 1.1 U_H
at DC: 0.8 ... 1.25 U_H

Nominal consumption

IL 9277, SL 9277, SL 9277CT

at AC 230 V: 3.2 VA

at DC 24 V: 0.8 W

IP 9277, SP 9277, SP 9277CT

at AC 230 V: 7.2 VA

at DC 24 V: 1 W

Nominal frequency: 50 / 60 Hz

Frequency range: $\pm 5\%$

Output

Contacts

IL 9277.12, SL 9277.12,

SL 9277.12CT: 2 changeover contact

IP 9277.39, SP 9277.39,

SP 9277.39CT: 2 x 2 changeover contact

Thermal current I_{th} : 5 A

Switching capacity

to AC 15

NO contact: 5 A / AC 230 V IEC/EN 60 947-5-1

NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1

Electrical life

to AC 15 at 2 A, AC 230 V

NO contact: 2 x 10⁶ switch. cycles IEC/EN 60 947-5-1

Short-circuit strength

max. fuse rating: 6 A gL IEC/EN 60 947-5-1

Mechanical life: > 50 x 10⁶ switching cycles

Technical Data

General Data

Operating mode: Continuous operation

Temperature range

Operation: - 20 ... + 60°C

Storage: - 25 ... + 70°C

Altitude: < 2.000 m

Clearance and creepage distances

rated impulse voltage voltage/

pollution degree:

IEC 60 664-1

	IP/SP-devices	IL/SL-devices
Supply - Contacts	4 kV/2	4 kV/2
Supply - Measuring Circuit	6 kV/2	4 kV/2
Measuring circuit-Measuring circuit	6 kV/2	-
Measuring Circuit - contacts	6 kV/2	4 kV/2
Contact-Contact	4 kV/2	4 kV/2
Measuring Circuit, max. voltage:	3 AC 400/690 V	AC 230 V/400
The contacts are not designed for voltage systems with 400 / 690 V		
contacts, max. voltage:	AC 230/400 V	AC 230/400 V

EMC

Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2

HF irradiation

IL/SL 9277, IP/SP 9277

80 MHz ... 1 GHz: 20 V/m IEC/EN 61 000-4-3

1 GHz ... 2,7 GHz: 10 V/m IEC/EN 61 000-4-3

SL/SP 9277CT

80 MHz ... 1 GHz: 10 V/m IEC/EN 61 000-4-3

Fast transients: 4 kV IEC/EN 61 000-4-4

Surge voltages

between

wires for power supply: 1 kV IEC/EN 61 000-4-5

between wire and ground: 2 kV IEC/EN 61 000-4-5

HF-wire guided: 10 V IEC/EN 61 000-4-6

Interference suppression: Limit value class B EN 55 011

Degree of protection

Housing: IP 40 IEC/EN 60 529

Terminals: IP 20 IEC/EN 60 529

Housing:

Thermoplastic with V0 behaviour

according to UL subject 94

Amplitude 0.35 mm

frequency 10 ... 55 Hz IEC/EN 60 068-2-6

20 / 060 / 04 IEC/EN 60 068-1

EN 50 005

2 x 2.5 mm² solid or

2 x 1.5 mm² stranded ferruled

DIN 46 228-1/-2/-3/-4

0,6 mm²

Min. cross section:

Insulation of wires

or sleeve length: 10 mm

Wire fixing: Flat terminals with self-lifting

clamping piece IEC/EN 60 999-1

0.8 Nm

Fixing torque: DIN rail mounting (IEC/EN 60715) or

Mounting: screw mounting M4, 90 mm hole pattern,

with additional clip available as accessory

Dimensions

Width x height x depth

IL 9277: 35 x 90 x 61 mm

SL 9277, SL 9277CT: 35 x 90 x 100 mm

IP 9277: 70 x 90 x 61 mm

SP 9277, SP 9277CT: 70 x 90 x 100 mm

Classification to DIN EN 50155 for IL 9277

Vibration and shock resistance: Category 1, Class B IEC/EN 61 373

Ambient temperature: T1 compliant

T2, T3 und TX with operational limitations


Protective coating of the PCB: No

CCC-Data

Switching capacity

to AC 15: 5 A / AC 230 V IEC/EN 60 947-5-1

to DC 13: 2 A / DC 24 V IEC/EN 60 947-5-1

 Technical data that is not stated in the CCC-Data, can be found in the technical data section.

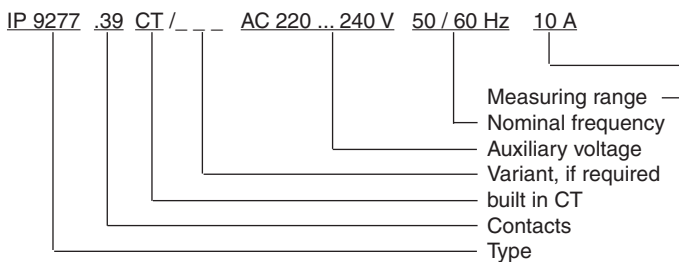
Standard Types

- IL 9277.12 AC 220 ... 240 V
 Article number: 0049306
 SL 9277.12 AC 220 ... 240 V
 Article number: 0054111
- Single phase
 - 4 programmable ranges up to 15 A
 - De-energized on trip
 - Auxiliary voltage U_H : AC 220 ... 240 V
 - 2 changeover contacts
 - Width: 35 mm
- IP 9277.39 0,5 ... 5 A AC 220 ... 240 V
 Article number: 0049308
 SP 9277.39 0,5 ... 5 A AC 220 ... 240 V
 Article number: 0056075
- 3-phase
 - Range 0.5 ... 5 A
 - De-energized on trip
 - Auxiliary voltage U_H : AC 220 ... 240 V
 - 2 changeover contacts each for over- and undercurrent
 - Width: 70 mm

Variants

- IL 9277.12/010, SL 9277.12/010: single phase current relay energized on trip
- IP 9277.39/010, SP 9277.39/010: 3-phase current relay energized on trip
- IP 9277.39/002, SP 9277.39/002: 3-phase current relay undercurrent de-energized on trip
 overcurrent energized on trip
- SL 9277.12CT single phase current relay with built in CT
- SP 9277.39CT 3-phase current relay with built in CT

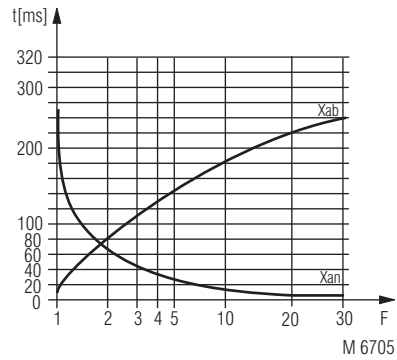
Ordering example for variants



Accessories

- ET 4086-0-2: Additional clip for screw mounting
 Article number: 0046578

Characteristics



Switching delay

The characteristic shows the switching delay depending on the values of X_{an} - X_{ab} when switching the current on or off. A slow current change reduces the delay.

$$F = \frac{I_{\text{applied}}}{I_{\text{setting}}}$$

EMC-Testing of IL 9277 according to EN 50155 Rev. 14/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1-EN50121-3-2 table 7	"1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm"	B	EN 61000-4-5	"1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm"	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2-EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Electrostatic discharge	EN50155part 12.2.7.3-EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
	EN50155part 12.2.8.1-EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHz	A	EN 61000-4-3	20 V/m 80MHz-1GHz	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHz	A	EN 61000-4-3	20 V/m 80MHz-1GHz	A (1)	
RF emission	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHz	A	EN 61000-4-3	10 V/m 1GHz-2,1GHz	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHz	A	EN 61000-4-3	10 V/m 2,1GHz-2,7GHz	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2-EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 99dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHz	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of IL 9277 according to EN 50155

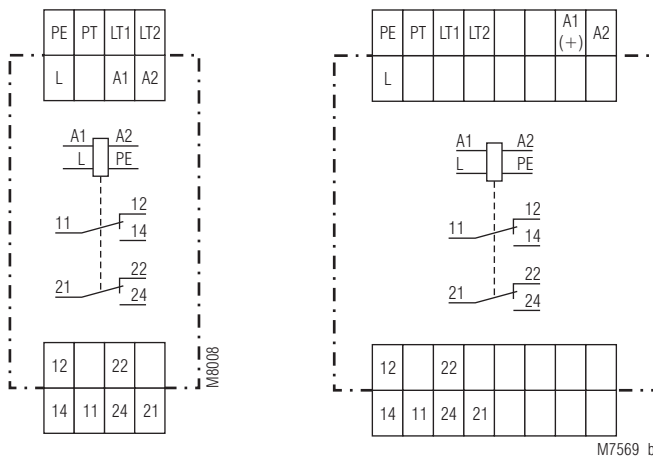
	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

VARIMETER IMD Insulation Monitor IL 5880, IP 5880, SL 5880, SP 5880



- According to IEC/EN 61 557-8
- For single and 3-phase AC-systems up to 0 ... 500 V and 10 ... 10000 Hz
- Adjustable tripping value R_{AL} of 5 ... 100 k Ω
- Monitors also disconnected voltage systems
- De-energized on trip
- Auxiliary voltage Measuring Circuit and output contacts are galvanically separated
- Manual and auto reset
- With test and reset button
- Connections of external test and reset buttons possible
- LED indicators for operation and alarm
- 2 changeover contacts
- IL/SL 5880/200 with additional prewarning
 - adjustable prewarning value 10 k Ω ... 5 M Ω
 - output function programmable
- Variant IL/SL 5880/300 according to DIN VDE 0100-551 for mobile generator sets available
- 4 models available:
 - IL 5880, IP 5880: 61 mm deep with terminals near to the bottom to be mounted in consumer units or industrial distribution systems according to DIN 43 880
 - SL 5880, SP 5880: 98 mm deep with terminals near to the top to be mounted in cabinets with mounting plate and cable ducts
- DIN rail or screw mounting
- 35 mm width

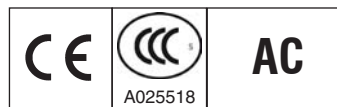
Circuit Diagram



IL 5880, SL 5880

IP 5880, SP 5880

Approvals and Markings



Applications

- Monitoring of insulation resistance of ungrounded voltage systems to earth.
- IL/SL 5880/200 can also be used to monitor standby devices for earth fault, e.g. motor windings of devices that have to function in the case of emergency.
- IL/SL 5880/300 according to DIN VDE 0100-551 to monitor mobile generator systems
- Other resistance monitoring applications.
- For industrial and railway applications

Function

The device is connected to the supply via terminals A1-A2. The unit can either be supplied from the monitored voltage system or from an separate auxiliary supply. Terminal L is connected to the monitored voltage and PE to earth. If the insulation resistance R_E drops below the adjusted alarm value R_{AL} the red LED goes on and the output relay switches off (de-energized on trip). If the unit is on auto reset (bridge between LT1-LT2) and the insulation resistance gets better (R_E rises), the insulation monitor switches on again with a certain hysteresis and the red LED goes off. Without the bridge between LT1-LT2 the Insulation monitor remains in faulty state even if the insulation resistance is back to normal. (In order to achieve failure storage, the voltage system showing a fault must not be switched off too fast after detection of the failure, see notes). The reset is done by pressing the internal or external reset button or by disconnecting the auxiliary supply. By activating the "Test" button an insulation failure can be simulated to test the function of the unit.

The variants IL/SL 5880.12/200 have a second setting range with a higher resistance up to 5 M Ω (Potentiometer R_{vw}). This setting value can be used for pre-warning with relay output, by positioning the lower setting switch to "AL 11-12-14; VW 21-22-24".

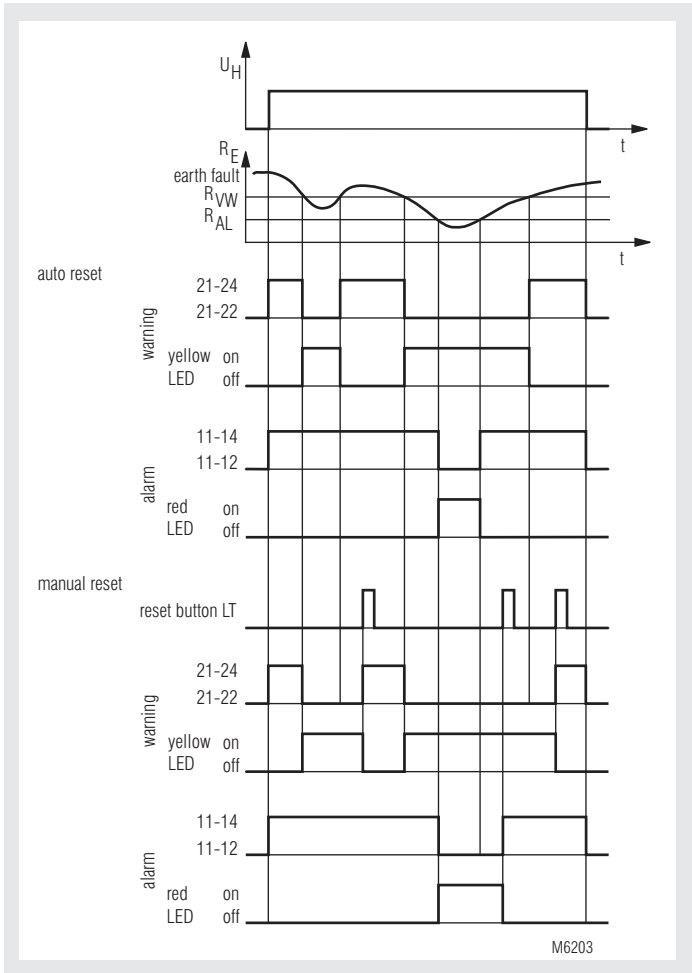
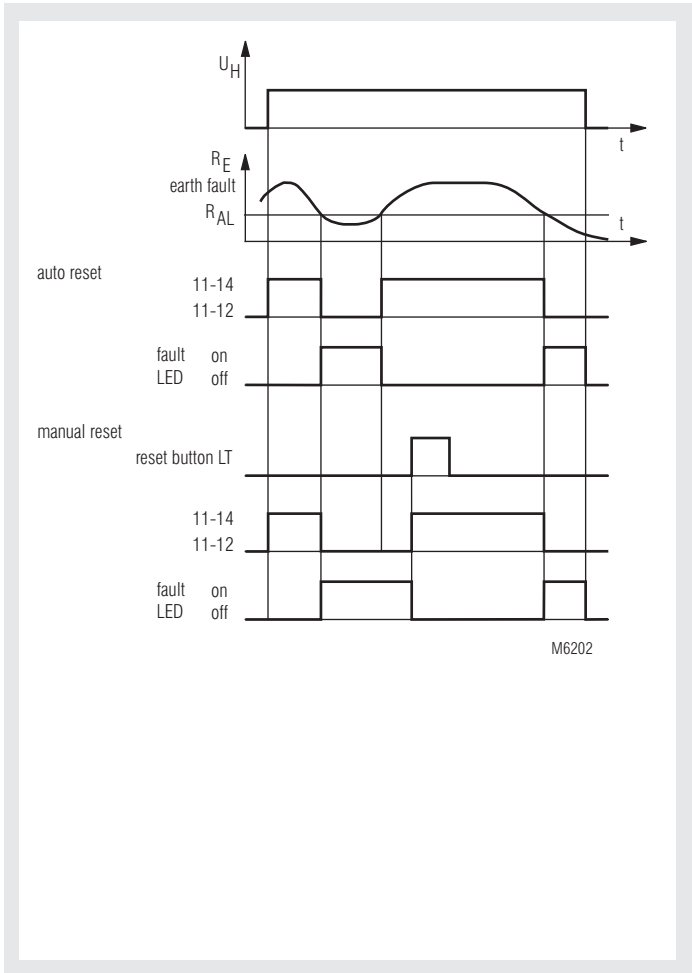
If the higher setting range should be used only, the setting switch is put in position "VW 2u" and both contacts react only to the higher setting. If the lower setting range should be used only, the setting switch is put in position "AL 2u" and both contacts react only to the lower setting.

When set to manual reset the latching is active on both settings R_{AL} and R_{vw} . Therefore it is possible in the case of a short insulation decrease (Switch position AL 11-12-14; VW 21-22-24), to pass the warning signal to a PLC while the main fault does not lead to a disconnection of the mains via the contacts 11-12-14.

Connection Terminals

Terminal designation	Signal designation
A1	L / +
A2	N / -
L	Connection for monitored IT-systems
PE	Connection for protective conductor
PT	Connection for external test button
LT1, LT2	Connections for external reset or manual and auto reset: LT1/LT2 bridged: hysteresis function LT1/LT2 not bridged: manual reset
11, 12, 14 21, 22, 24	Changeover contact (each for switch in position VW or AL)

Function Diagram



IL 5880, SL 5880, IP 5880, SP 5880

IL 5880/200, SL 5880/200, IP 5880/200, SP 5880/200

Indicators

- Green LED "ON": On, when supply voltage connected
- Red LED "AL": On, when insulation fault detected, ($R_E < R_{AL}$)
- Yellow LED "VW": On, when insulation resistance is under prewarningvalue, $R_E < R_{VW}$ (only with variant IL/SL 5880.12/2__ and /300)

Notes

Storing of insulation failures:
 The storing of an insulation failure is delayed slightly longer the reaction of the output relay because of interference immunity. In cases where the defective voltage system is switched off immediately by the output of the insulation monitor it can happen that the fault is not stored (e. g. mobile generator sets).

For these applications we recommend the variant IL/SL 5880/300, where the output relay reacts only after the fault ist stored. All other features of this variant are similar to IL/SL 5880/200.
 The Insulation monitors IL/SL 5880 are designed to monitor AC-voltage systems. Overlaid DC voltage does not damage the instrument but may change the conditions in the Measuring Circuit.

Notes

In one voltage system only one Insulation monitor must be connected. This has to be observed when coupling voltage system.
 Line capacitance C_E to ground does not influence the insulation measurement, as the measurement is made with DC-voltage. It is possible that the reaction time in the case of insulation time gets longer corresponding to the time constant $R_E * C_E$.

The model /200 can be used, because of it's higher setting value, to monitor single or 3-phase loads for ground fault. If the load is operated from a grounded system the insulation resistance of the load can only be monitored when disconnected from the mains. This is normally the fact with loads which are operated seldom or only in the case of emergency but then must be function (see connection example).

The auxiliary supply can be connected to a separate auxiliary supply or to the monitored voltage system. The range of the auxiliary supply input has to be observed.

When monitoring 3-phase IT systems it is sufficient to connect the insulation monitor only to one phase. The 3-phases have a low resistive connection (approx. 3 - 5 Ω) via the feeding transformer. So failures that occur in the non-connected phases will also be detected.

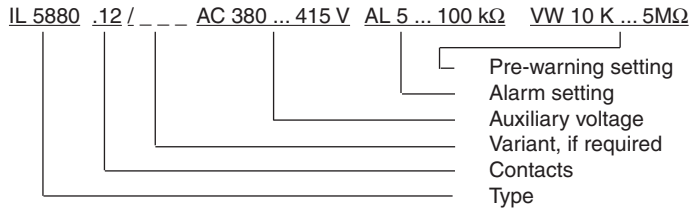
Technical Data	
Auxiliary Circuit	
Nominal voltage U_N IL 5880, SL 5880:	AC 220 ... 240 V, AC 380 ... 415 V 0.8 ... 1.1 U_N DC 12 V, DC 24 V
IP 5880, SP 5880:	AC / DC 110 ... 240 V 0.7 ... 1.25 U_N 45 ... 400 Hz
Frequency range (AC):	
Nominal consumption:	
AC:	approx. 2 VA
DC:	approx. 1 W
Measuring Circuit	
Nominal voltage U_N:	AC 0 ... 500 V
Voltage range:	0 ... 1.1 U_N
Frequency range:	10 ... 10000 Hz
Alarm value R_{AL}:	5 ... 100 k Ω
Prewarning value R_{VW} (only at IL/SL 5880/2__ and IL/SL 5880/300):	10 k Ω ... 5 M Ω
Setting R_{AL}, R_{VW}:	infinite variable
Internal test resistor:	equivalent to earth resistance of < 5 k Ω
Internal AC resistance:	> 250 k Ω
Internal DC resistance:	> 250 k Ω
Measuring voltage:	approx. DC 15 V, (internally generated)
Max. measuring current ($R_E = 0$):	< 0.1 mA
Max. permissible noise DC voltage:	DC 500 V
Operate delay at $R_{AL} = 50$ k Ω , CE = 1 μ F	
R_E from ∞ to 0.9 R_{AL} :	< 1.3 s
R_E from ∞ to 0 k Ω :	< 0.7 s
Response inaccuracy:	± 15 % + 1.5 k Ω IEC 61557-8
Hysteresis at $R_{AL} = 50$ k Ω :	approx. 15 %
Output	
Contacts:	
IL / SL 5880.12, IP / SP 5880.12:	2 changeover contacts
IL / SL 5880.12/2__, IL / SL 5880.12/300, IP / SP 5880.12/2__:	2 x 1 changeover contact, programmable
Thermal current I_{th}:	4 A
Switching capacity to AC 15	
NO:	5 A / AC 230 V IEC/EN 60 947-5-1
NC:	2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V IEC/EN 60 947-5-1
Electrical life to AC 15 at 1 A, AC 230 V:	$\geq 5 \times 10^5$ switching cycles IEC/EN 60 947-5-1
Short circuit strength max. fuse rating:	4 A gL IEC/EN 60 947-5-1
Mechanical life:	$\geq 30 \times 10^6$ switching cycles
General Data	
Operating mode:	Continuous operation
Temperature range	
Operation:	- 20 ... + 60°C
Storage:	- 20 ... + 70°C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree	
between auxiliary supply connections (A1- A2):	4 kV / 2 at AC-auxiliary voltage IEC 60 664-1
between measuring input connections (L - PE):	4 kV / 2 IEC 60 664-1
between auxiliary supply and measuring input connections:	4 kV / 2 IEC 60 664-1
auxiliary supply connections and measuring input to relay contacts:	6 kV / 2 IEC 60 664-1
relay contact 11-12-14 to relay contact 21-22-24:	4 kV / 2 IEC 60 664-1
Insulation test voltage	
Routine test:	AC 4 kV; 1 s AC 2,5 kV; 1 s

Technical Data	
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF irradiation	
80 MHz ... 1 GHz:	10 V / m IEC/EN 61 000-4-3
1 GHz ... 2.5 GHz:	3 V / m IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m IEC/EN 61 000-4-3
Fast transients:	2 kV IEC/EN 61 000-4-4
Surge voltages	
between A1 - A2:	1 kV IEC/EN 61 000-4-5
between L - PE:	2 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55 011
Degree of protection:	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL Subjekt 94
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz IEC/EN 60 068-2-6 20 / 060 / 04 IEC/EN 60 068-1
Climate resistance:	
Terminal designation:	EN 50 005
Wire connection:	DIN 46 228-1/-2/-3/-4
Cross section:	2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded wire
Stripping length:	10 mm
Fixing torque:	0.8 Nm
Wire fixing:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory
Weight:	
IL 5880:	160 g
SL 5880:	189 g
IP 5880:	250 g
SP 5880:	300 g
Dimensions	
Width x height x depth:	
IL 5880:	35 x 90 x 61 mm
SL 5880:	35 x 90 x 98 mm
IP 5880:	70 x 90 x 61 mm
SP 5880:	70 x 90 x 98 mm
Classification to DIN EN 50155 for IL 5880	
Vibration and shock resistance: Category 1, Class B IEC/EN 61 373	
Ambient temperature: T1 compliant	
T2, T3 and TX with operational limitations	
Protective coating of the PCB: No	
Standard Types	
IL 5880.12 AC 220 ... 240 V	
Article number:	0053378
• Auxiliary voltage U_H :	AC 220 ... 240 V
• adjustable alarm value R_{AL} :	5 ... 100 k Ω
• Width:	35 mm
SL 5880.12 AC 220 ... 240 V	
Article number:	0055396
• Auxiliary voltage U_H :	AC 220 ... 240 V
• adjustable alarm value R_{AL} :	5 ... 100 k Ω
• Width:	35 mm

Variants

IL / SL 5880.12/200:	with pre-warning and programmable outputs
IL / SL 5880.12/201:	as version IL / SL 5880.12/200, but both output relays with energized on Trip principle
IL / SL 5880.12/300:	according to DIN VDE 0100-551 as version IL / SL 5880.12/200, but for use with mobile generator sets

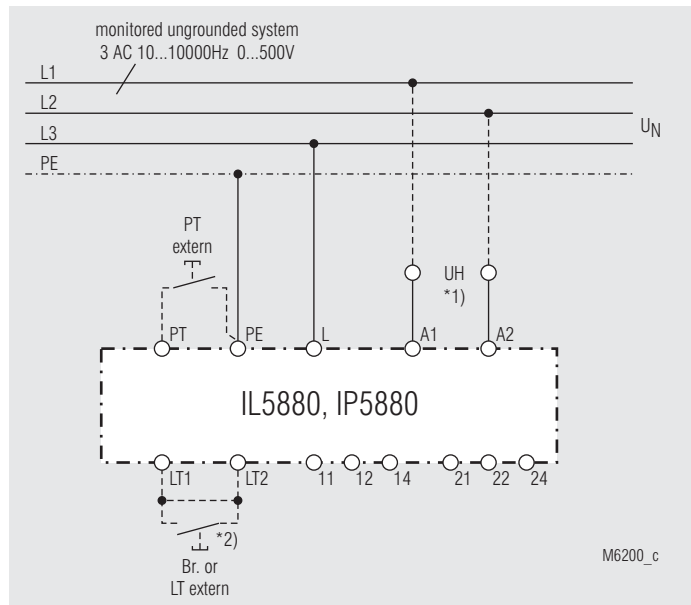
Ordering example for variants



Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578
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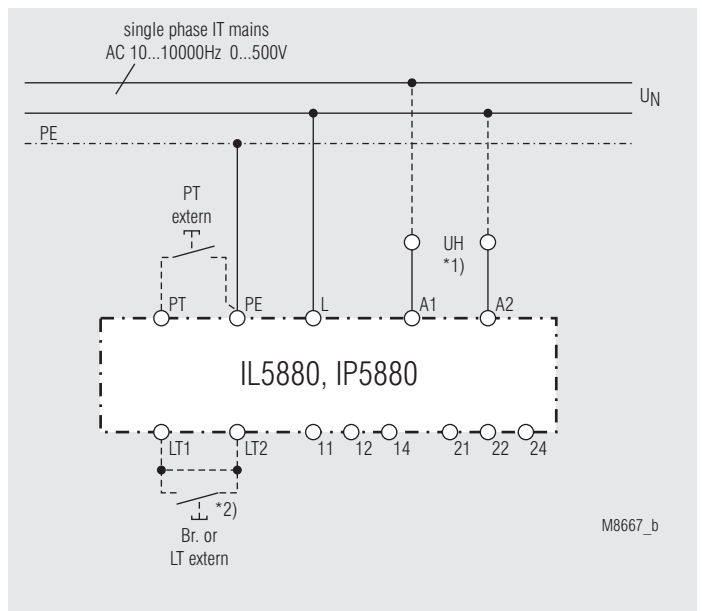
Connection Example



Monitoring of an ungrounded voltage system.

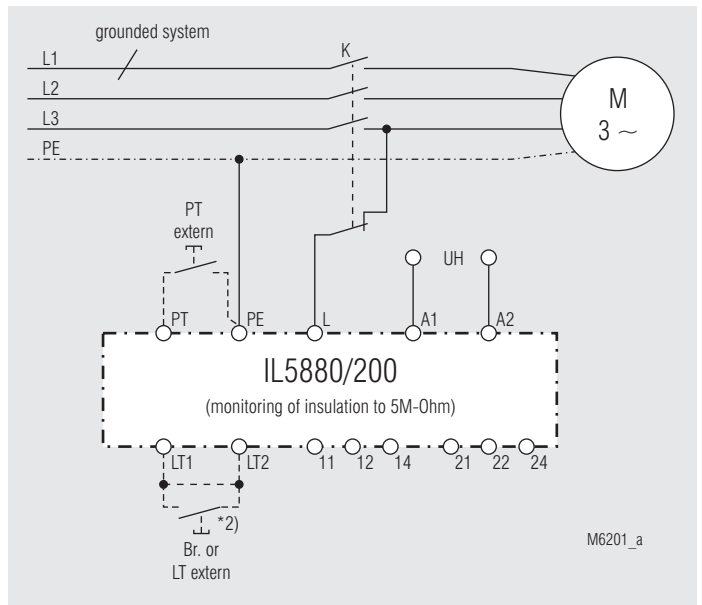
- *1) Auxiliary supply U_H (A1 - A2) can be taken from the monitored voltage system. The voltage- and frequency range of the auxiliary supply input must be observed.
- *2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT

Connection Example



Monitoring of an ungrounded voltage system.

- *1) Auxiliary supply U_H (A1 - A2) can be taken from the monitored voltage system. The voltage- and frequency range of the auxiliary supply input must be observed.
- *2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT



Monitoring of motorwindings against ground.

- The insulation of the motor to ground is monitored as long as contactor K does not activate the load.
- *2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT

EMC-Testing of IL5880 according to EN 50155 Rev. 14/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: „A“ to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHz	A	EN 61000-4-3	10 V/m 80MHz-1GHz	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHz	A	EN 61000-4-3	10 V/m 80MHz-1GHz	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHz	A	EN 61000-4-3	3 V/m 1GHz-2,5GHz	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHz	A	EN 61000-4-3	3 V/m 1GHz-2,5GHz	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHz	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of IL 5880 according to EN 50155

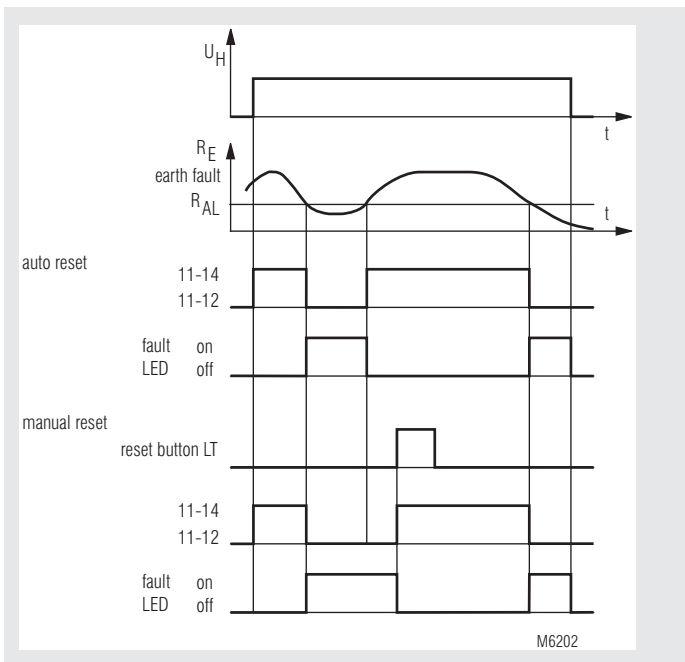
	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated Voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated Voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated Voltage 300V	No flashover allowed

VARIMETER IMD Insulation Monitor IL 5881, SL 5881



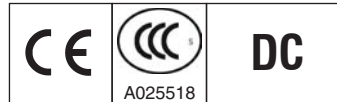
- According to IEC/EN 61 557-8
- For DC voltage systems up to 12 ... 280 V
- Wide voltage range of measuring input U_N DC 12 ... 280 V (on request DC 24 ... 500 V with separate auxiliary supply, Measuring range 20 ... 500 k Ω)
- Adjustable tripping value R_{AL} of 5 ... 200 k Ω
- Selective ground fault indication for L+ and L- allows fast fault finding
- Without auxiliary supply
- De-energized on trip
- 2 changeover contacts
- Automatic or manual reset, programmable
- With test and reset buttons
- Connection for external test and reset button possible
- galvanic separated AC or DC auxiliary supply available as option
- adjustable time delay as option
- 2 models available:
 - IL 5881: 61 mm deep with terminals near to the bottom to be mounted in consumer units or industrial distribution systems according to DIN 43 880
 - SL 5881: 98 mm deep with terminals near to the top to be mounted in cabinets with mounting plate and cable ducts
- DIN rail or screw mounting
- 35 mm width

Function Diagram



IL 5881/100, SL 5881/100; IL 5881, SL 5881

Approvals and Markings



Application

- Monitoring of insulation resistance of ungrounded DC-voltage systems to earth.
- For industrial and railway applications

Function

If the insulation resistance R_E between L+ or L- to ground drops below the adjusted alarm value R_{AL} (insulation failure) the corresponding red LED goes on and the output relay switches off (de-energized on trip). If the unit is on auto reset (bridge between LT-X1) and the insulation resistance gets better (R_E rises), the insulation monitor switches on again with a certain hysteresis and the red LED goes off.

Without the bridge between LT-X1 the insulation monitor remains in faulty state even if the insulation resistance is back to normal. The location of the fault on L+ or L- is indicated on the corresponding LED (selective fault indication).

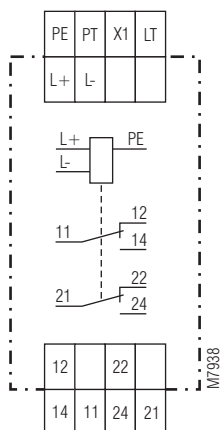
The reset is done by pressing the internal or external reset button or by disconnecting the auxiliary supply.

By activating the "Test" button internal or external an insulation failure can be simulated to test the function of the unit.

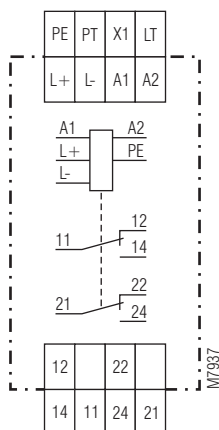
Indicators

- Green LED "ON": On, when supply voltage connected
- Red LED "RE+": On, when insulation fault detected ($R_{E+} < R_{AL}$) on L+
- Red LED "RE-": On, when insulation fault detected ($R_{E-} < R_{AL}$) on L-

Circuit Diagrams



IL 5881.12/100



IL 5881.12

Notes

On models with separate auxiliary supply the alarm state is not defined when the voltage drops below 3 V. To avoid false alarm an additional auxiliary relay should be used which is connected to the monitored voltage or the variant IL 5881.12/010 is used.

On the models with galvanic separation between DC auxiliary supply and measuring input, the supply (A1/A2) can be connected to the monitored voltage system (L+/L-). The voltage range of the auxiliary input must be noticed which is only 1.25 of U_H while the measuring input always goes up to 280 V.

If no auxiliary supply is available the model IL/SL 5881/100 (without auxiliary supply) can be used which takes the auxiliary supply from the monitored system ($U_H = U_N = DC 12 \dots 280 V$).

In one isolated voltage system only one insulation monitor must be connected, because several units would influence each other (half response value if 2 devices are connected).

Connection Terminals

Terminal designation	Signal designation
A1	L / +
A2	N / -
L+, L-	Connection for monitored IT-systems
PE	Connection for protective conductor
PT, X1	Connection for external test button
LT, X1	Connections for external reset or manual and auto reset: LT/X1 bridged: hysteresis function LT/X1 not bridged: manual reset
11, 12, 14 21, 22, 24	Changeover contact (insulation failure)

Technical Data

Auxiliary Circuit
(only at IL/SL 5881)

Auxiliary voltage U_H : AC 220 ... 240 V, 380 ... 415 V
DC 12 V, 24 V
DC 24 ... 60 V

Voltage range:

AC: 0.8 ... 1.1 U_H
DC: 0.9 ... 1.25 U_H

Frequency range (AC): 45 ... 400 Hz

Nominal consumption

AC: approx. 2 VA
DC: approx. 1 W

Measuring Circuit

	Standard	extended, on request
Nominal voltage U_N at		
≤ 5 % residual ripple:	DC 12 ... 280 V	DC 24 ... 500 V
≤ 48 % residual ripple:	DC 12 ... 220 V	
Voltage range:	0,9 ... 1,1 U_N	0,9 ... 1,1 U_N
Alarm value R_{AL}:	5 ... 200 kΩ	20 ... 500 kΩ
Setting R_{AL}:	infinite setting	infinite setting
Internal AC resistance	each approx. 75 kΩ	each approx. 190 kΩ
Max. Messstrom an PE ($R_E = 0$):	$U_N / 75 \text{ k}\Omega$	$U_N / 190 \text{ k}\Omega$

Operate delay

at $R_{AL} = 50 \text{ k}\Omega$, $C_E = 1 \mu\text{F}$

R_E from ∞ to $0.9 R_{AL}$:

R_E from ∞ to $0 \text{ k}\Omega$:

Response inaccuracy:

Hysteresis

at $R_{AL} = 50 \text{ k}\Omega$:

Time delay:

approx. 0.8 s

approx. 0.4 s

± 15 % + 1.5 kΩ

IEC 61557-8

approx. 10 ... 15 %

0.5 ... 20 s (variant)

Output

Contacts:

IL / SL 5881.12: 2 changeover contacts

Thermal current I_{th} : 4 A

Switching capacity

to AC 15: 3 A / AC 230 V IEC/EN 60 947-5-1

Switching capacity

to DC 13: 2 A / DC 24 V
0.2 A / DC 250 V IEC/EN 60 947-5-1

Electrical life

to AC 15 at 1 A, AC 230 V: ≥ 2 x 10⁵ switching cycles IEC/EN 60 947-5-1

Short circuit strength

max. fuse rating: 4 A gL

IEC/EN 60 947-5-1

Mechanical life:

≥ 10 x 10⁶ switching cycles

Notes

The IL/SL 5881 can be used in systems with high leakage capacity to ground. When the unit is adjusted to high alarm values a leakage capacity can create a pulse when switching the system on (short alarm pulse). This happens at the following values:

IL / SL 5881: $R_{AL} = 200 \text{ k}\Omega$; $C_E > 1 \mu\text{F}$

IL / SL 5881: $R_{AL} = 50 \text{ k}\Omega$; $C_E > 6 \mu\text{F}$

IL / SL 5881: $R_{AL} = 20 \text{ k}\Omega$; $C_E > 16 \mu\text{F}$

IL / SL 5881/100: $R_{AL} = 500 \text{ k}\Omega$; $C_E > 0.8 \mu\text{F}$

IL / SL 5881/100: $R_{AL} = 200 \text{ k}\Omega$; $C_E > 0.8 \mu\text{F}$

IL / SL 5881/100: $R_{AL} = 50 \text{ k}\Omega$; $C_E > 2.0 \mu\text{F}$

IL / SL 5881/100: $R_{AL} = 20 \text{ k}\Omega$; $C_E > 4.5 \mu\text{F}$

An optional time delay (on request) could suppress this pulse.

Because of the measuring principle with a resistor bridge (asymmetry principle) the insulation monitor IL/SL 5881 will not detect symmetric ground faults of L+ and L-. Also a voltagefree (disconnected $U_N = 0V$) system cannot be monitored.

Technical Data	
General Data	
Operating mode:	Continuous operation
Temperature range	
Operation:	- 20 ... + 60°C
Storage:	- 20 ... + 60°C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree	
between auxiliary supply connections(A1 / A2):	4 kV / 2 at AC-auxiliary voltage IEC 60 664-1
between measuring input connections (L+ / L- / PE):	4 kV / 2 IEC 60 664-1
between auxiliary supply and measuring input connections:	4 kV / 2 IEC 60 664-1
Input to output(contacts):	6 kV / 2 IEC 60 664-1
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF irradiation:	
80 MHz ... 1 GHz:	12 V / m IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V / m IEC/EN 61 000-4-3
Fast transients:	2 kV IEC/EN 61 000-4-4
Surge voltages	
between A1 - A2 and L+ - L-:	1 kV IEC/EN 61 000-4-5
between A1, A2 - PE and L+, L- - PE:	2 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55011
Degree of protection	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL Subjekt 94
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz IEC/EN 60 068-2-6 20 / 060 / 04 IEC/EN 60 068-1
Climate resistance:	
Terminal designation:	EN 50 005
Wire connection:	DIN 46 228-1/-2/-3/-4
Cross section:	2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded wire
Stripping length:	10 mm
Fixing torque:	0.8 Nm
Wire fixing:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory
Weight	
IL 5881:	approx. 170 g
SL 5881:	approx. 200 g
Dimensions	
Width x height x depth:	
IL 5881:	35 x 90 x 61 mm
SL 5881:	35 x 90 x 98 mm

Classification to DIN EN 50155 for IL 5881

Vibration and shock resistance:	Category 1, Class B IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations
Protective coating of the PCB:	No

Standard Types

IL 5881.12/100 DC 12 ... 280 V	5 ... 200 kΩ
Article number:	0053805
• Without auxiliary supply U _H :	
• Nominal voltage U _N :	DC 12 ... 280 V
• adjustable alarm value R _{AL} :	5 ... 200 kΩ
• Width:	35 mm

SL 5881.12/100 DC 12 ... 280 V	5 ... 200 kΩ
Article number:	0055168
• Without auxiliary supply U _H :	
• Nominal voltage U _N :	DC 12 ... 280 V
• adjustable alarm value R _{AL} :	5 ... 200 kΩ
• Width:	35 mm

Variants

IL / SL 5881.12:	with auxiliary supply
IL / SL 5881.12/010	with auxiliary supply no alarm at U _N < 3 V
IL / SL 5881.12/300	without auxiliary supply Nominal voltage U _N DC 12 ... 280 V closed circuit operation Time delay 0.5 ... 20 s

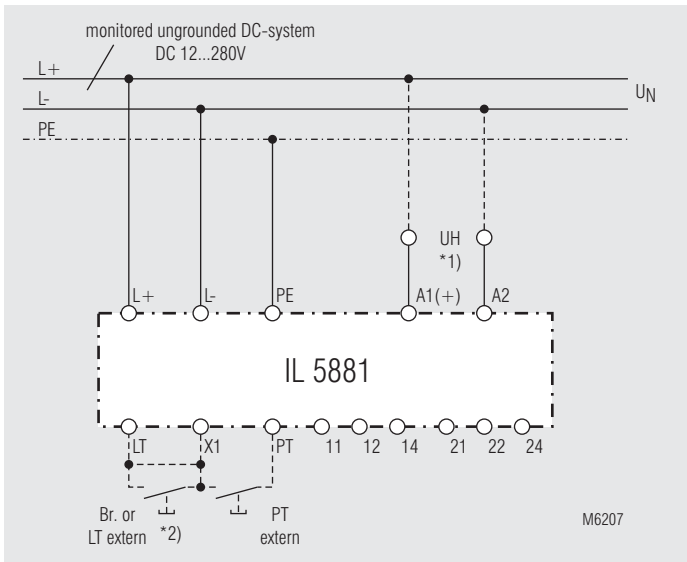
Ordering example for variants

IL 5881	.12	AC 220 ... 240 V	5 ... 200 kΩ	
				Response value
				Auxiliary voltage
				Contacts
				Type

Accessories

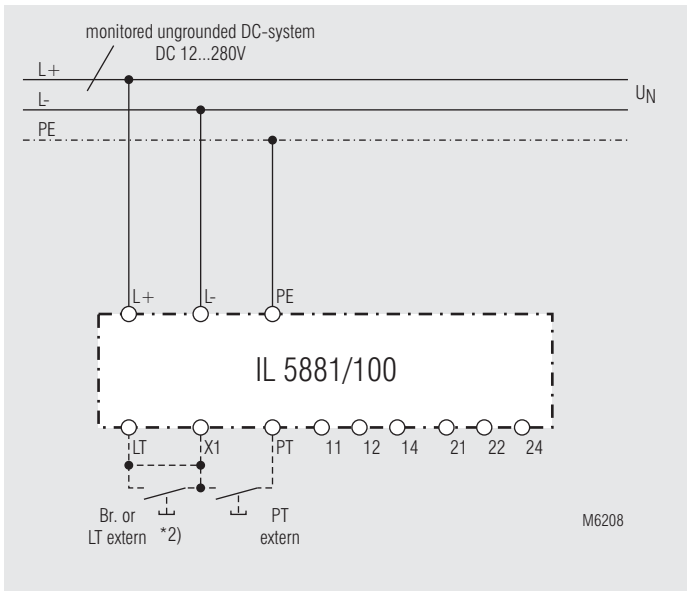
ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578
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Connections Examples



Monitoring of an ungrounded system.

- *1) Auxiliary supply U_H (A1-A2) can be taken from monitored voltage system. The range of the auxiliary supply input must be observed.
- *2) with bridge LT - X1: automatic reset
without bridge LT - X1: manual reset, reset with button LT



Monitoring of an ungrounded system without auxiliary supply.

- *2) with bridge LT - X1: automatic reset
without bridge LT - X1: manual reset, reset with button LT

EMC-Testing of IL5881 according to EN 50155 Rev. 14/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 80MHz-1GHZ	A	EN 61000-4-3	12 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHz	A	EN 61000-4-3	12 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHz	A	EN 61000-4-3	10 V/m 1GHz-2,7GHz	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHz	A	EN 61000-4-3	10 V/m 1GHz-2,7GHz	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi- peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi- peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHz	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of IL 5881 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC 125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

VARIMETER RCM

Residual Current Monitor, Type B for AC and DC Systems
IP 5883



IP 5883

ND 5018/035

ND 5018/030

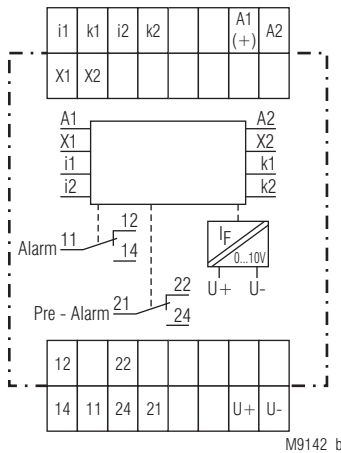
Product Description

The AC/DC sensitive residual current monitor IP 5883 allows an early detection of insulation faults and detects differential currents with AC as well as DC components in grounded voltage systems (type B). The measurement takes place via an external current transformer.

Contrary to an RCD the residual current monitor IP 5883 does not disconnect the mains when detecting a fault but only indicates it. Besides the easy to read LED chain indicating the actual current several LEDs display operation, pre-alarm and alarm. The 4 measuring ranges cover 10 to 3 A. Additional features are broken wire detection, test function and adjustable pre-alarm.

The residual current monitor IP 5883 provides early information for precise and cost effective maintenance before the plant stops.

Circuit Diagrams



M9142_b

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage U_H
i1, k1, i2, k2	Connection of an external residual current transformer
X1, X2	Parameterization input energized or de-energized on trip ¹⁾
11, 12, 14	Contacts alarm signal
21, 22, 24	Contacts pre-alarm signal
U+, U-	Analogue output (option)

¹⁾ de-energized on trip via bridge

Your Advantage

- Preventive fire and system protection
- Increasing the availability of plants by early fault detection
- Universal usage at AC/DC mains

Features

- According to IEC/EN 62 020, VDE 0663
- For AC and DC systems Type B, according to IEC/TR 60755
- To detect earth faults in grounded voltage systems
- 4 Setting Ranges from 10 mA to 3 A
- Manual reset, with pre-warning
- As option pre warning without auto reset
- With adjustable pre-warning
- With adjustable switching delay
- Energized or de-energized on trip
- LED indicator for operation, prewarning and alarm
- LED-chain indicates fault current
- Analogue output
- With test function
- Broken wire detection
- Removable cover
- DIN rail or screw mounting
- 70 mm width

Approvals and Markings



Application

- Monitoring of DC systems and AC systems up to 250 Hz
- For industrial and railway applications

Indicators

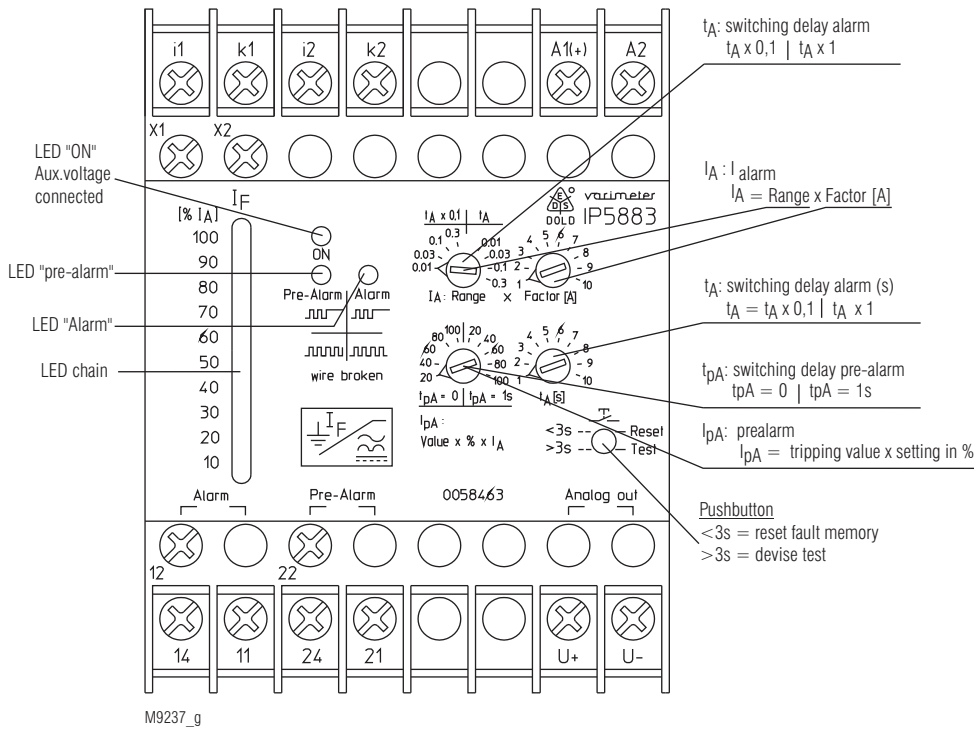
- Green LED "ON": On, when auxiliary supply connected
- Red LED "pre alarm": flashes during time delay, on, when pre-alarm active
- Red LED "alarm": flashes during time delay, on, when alarm active
- Both red LEDs: flashing on broken wire or extremely high input signal
- Yellow LEDs: LED chain indicates fault current in % of adjusted alarm value

Notes

The devices measure AC and DC current (AC/DC sensitive). Due to the measuring principle they are also influenced by magnetic fields next to current transformer.

When planning equipment with AC/DC sensitive residual current monitors, components that create magnetic fields as contactors, transformers etc., should not be placed near to the current transformer. If an influence cannot be avoided, turning the transformer 90° could reduce the influence.

Set-up and Adjustment Facilities



It is of advantage to keep the range small and the Factor high.

Example: Setting 300 mA: Range 0,1 x Factor 3 = 300 mA

Function

The Measuring circuit includes an external residual current transformer. All conductors of a voltage system are fed through the transformer except the ground wire. In a healthy system the sum of all flowing currents is zero, so that no voltage is induced in the CT. If an earth fault occurs, sourcing a current flowing to ground, the current difference induces a current in the CT that is detected by the IP 5883. If an earth fault occurs, sourcing a current flowing to ground, the current difference induces a current in the CT that is detected by the IP 5883.

On broken sensor wires and broken CT coils the unit goes into alarm state and the both red LEDs for pre-alarm and alarm flashes.

The unit has 2 changeover output contacts. One for alarm 11, 12, 14 and 21, 22, 24 and one for pre-alarm.

4 Setting Ranges can be selected from 10 mA to 3 A. The fine adjustment is made via potentiometer „Factor“

Measuring range = Range x Factor.

The alarm level switches at 100 % of the adjusted response value.

The pre-alarm can be set between 20, 40, 60, 80 and 100 % of the alarm value.

Via rotary switch „ t_A “ the time delay of the alarm relay can be adjusted in 2 ranges. Within the chosen range the value is adjusted on rotary switch „Range“.

$t_A \times 0,1$; $t_A = 0,1 \dots 1\text{s}$; $t_A \times 1$; $t_A = 1 \dots 10\text{s}$

For the time delay of the pre-alarm 2 settings are available.

$t_{pa} = 0$ and $t_{pa} = 1\text{s}$

The different CT sizes require a correct adaption of the residual current monitor. 3 models are available:

Type	Frequency range	Suitable residual current transformer
IP 5883	DC + AC up to 250 Hz	ND 5018/030 ND 5018/035
IP 5883/070	DC + AC up to 180 Hz	ND 5018/070
IP 5883/140	DC + AC up to 60 Hz	ND 5018/105 ND 5018/140 ND 5018/210

An external link on X1-X2 allows the change between energized and de-energized on trip. A change of the function will only be valid after interruption of the supply voltage.

Terminal X1 / X2: external link = De-energized on trip,
open = Energized on trip

De-energized on trip: In the case of groundfault or missing auxiliary supply the relays are de-energized, the NC contacts 11/12; 21/22 are closed

In fault free state the relays are energized, the NO contacts 11/14; 21/24 are closed

Energized on trip: In the case of groundfault the relays are energized, the NO contacts 11/14; 21/24 are closed

in fault free state the relays are de-energized, the NC contacts 11/12; 21/22 are closed

If an adjusted value is reached on the measuring input (alarm or pre-warning) at the standard type IP 5883 the signal is stored. Reset is made by pressing the button „Test/Reset“ for < 3 s or by disconnecting the auxiliary supply (approx. 30 s).

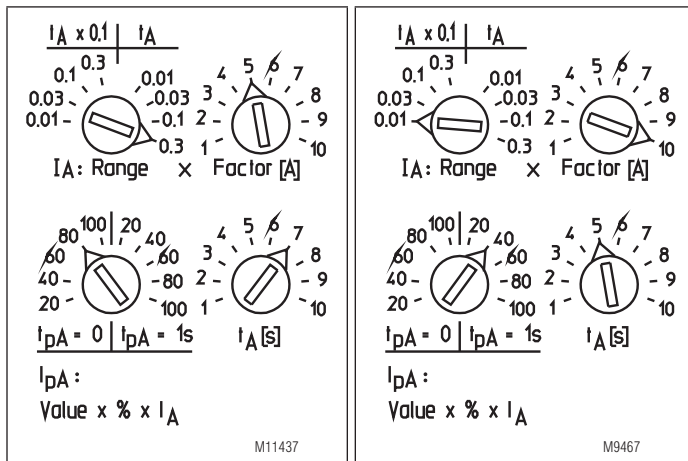
If the „Test/Reset“ button is pressed for > 3 s, a test of the unit is made. The time delays run, the pre-warning and alarm is activated.

An LED chain shows the fault current between 10 and 100 % of the adjusted alarm value.

An analogue output 0 ... 10 V indicates also the fault current. 10 V corresponds to 100 % of the adjusted alarm value.

Settings

Front detail with potentiometers



Example 1

Alarm at 1.5 A (0.3 A x 5)
 Time delay alarm:
 $t_A = 1 \times 7 \text{ s}$
 Pre-warning at
 80 % of alarm value, 1.2 A
 Time delay pre-warning:
 $t_{pa} = 0 \text{ s}$

Example 2

Alarm at 100 mA (0.01 A x 10)
 Time delay alarm:
 $t_A = 0.1 \times 5 \text{ s}$
 Pre-warning at
 40 % of alarm value, 40 mA
 Time delay pre-warning:
 $t_{pa} = 1 \text{ s}$

Technical Data

Input

Auxiliary voltage U_H:	AC/DC 24 ... 80 V, AC/DC 80 ... 230 V
Voltage range:	DC 19 ... 110 V, AC 19 ... 90 V, DC 64 ... 300 V, AC 64 ... 265 V
Nominal frequency U_H:	AC 50 / 60 Hz
Nominal consumption	
at AC:	5 VA
at DC:	2.5 W
Measuring range:	10 ... 100 mA, 30 ... 300 mA, 100 ... 1000 mA, 300 ... 3000 mA
Measuring range fine adjustment:	1 ... 10
Max. overload:	with overload protection
Pre-warning:	20, 40, 60, 80, 100 %
Frequency range:	DC und AC to 250 Hz
Repeat accuracy:	$\leq \pm 3 \%$
Temperature drift:	$\leq \pm 0.1 \%$ / K
Reaction time:	< 50 ms
Switching delay pre-warning:	without delay or 1 s adjustable
Switching delay alarm:	x 0.1, x 1, fine adjustment 1 ... 10

Output

Contacts:	1 changeover contact for pre-warning, 1 changeover contact for alarm
Thermal current I_{th}:	5 A
Switching capacity	
at AC 15:	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life	
to AC 15 at 1 A, AC 230 V:	3 x 10 ⁵ switch. cycl. IEC/EN 60 947-5-1
Short circuit strength	
max. fuse rating:	4 A gL IEC/EN 60 947-5-1
Mechanical life:	$\geq 10^8$ switching cycles

Technical Data

Analogue Output

Terminal U_+ / U_- : 0 ... 10 V; 5 mA

If using the analogue output "U+ / U-" you have to use a shielded cable. The shield has to be grounded one end to PE at the device.

General Data

Operating mode:	Continuous
Temperature range	
Operation:	- 40 ... + 60 °C
Storage:	- 40 ... + 70 °C
Altitude:	< 2,000 m
Insulation coordination according to IEC 60664-1:	
RN 5883 connected with current transformer ND 5018	
Rated voltage:	800 V
Rated impuls voltage / pollution degree:	
Auxiliary voltage / Meas. circuit:	6 kV / 2
Auxiliary voltage / Contacts:	4 kV / 2
Auxiliary voltage / Analogue output:	6 kV / 2
Contacts / Analogue output:	4 kV / 2
Meas. circuit / Analogue output:	6 kV / 2
Contacts 11,12,14 / 21, 22, 24:	4 kV / 2

EMC

Surge voltages:	Class 3 (5 kV / 0,5 J) DIN VDE 0435-303
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF-irradiation	IEC/EN 61 000-4-3, DIN EN 50 121-3-2
80 MHz ... 1 GHz:	20 V / m
1 GHz ... 2.7 GHz:	10 V / m
HF-wire guided:	10 V (class 3) IEC/EN 61 000-4-6
Fast transients:	2 kV (class 3) IEC/EN 61 000-4-4
Surge voltages:	2 kV (class 4) IEC/EN 61 000-4-5
Interference suppression:	Limit value class B EN 55 011

Degree of protection

Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529

Housing:

Vibration resistance:

	Thermoplastic with V0-behaviour according UL subject 94
	Amplitude 0.35 mm
	frequency 10 ... 55 Hz IEC/EN 60 068-2-6
	40 / 60 / 03 IEC/EN 60 068-1
	EN 50 005

Climate resistance:

Terminal designation:

Wire connection

Cross section:	2 x 2.5 mm ² solid or 2 x 1.5 mm ² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
Stripping length:	10 mm
Wire fixing:	Flat terminals with self-lifting clamping piece

Fixing torque:

Mounting:

	0.8 Nm
	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory
Weight:	220 g

Dimensions

Width x height x depth:	70 x 90 x 63 mm
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Classification to DIN EN 50155 for IP 5883

Vibration and shock resistance:	Category 1, Class B IEC/EN 61 373
Ambient temperature:	T1, T2 compliant T3 and TX with operational limitations
Protective coating of the PCB:	No

Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578
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Standard Type

- IP 5883 AC/DC 80 ... 230 V 50 / 60 Hz
 Article number: 0058463
- for residual current transformer ND 5018/030 and ND 5018/035
 - with pre warning and manual reset
 - Energized or de-energized on trip
 - Auxiliary voltage U_H : AC/DC 80 ... 230 V
 - Width: 70 mm

Variants

For residual current transformer ND5018/030, ND5018/035:

- IP 5883/001: manual reset,
pre warning with auto reset

For residual current transformer ND5018/070:

- IP 5883/070: pre warning and manual reset

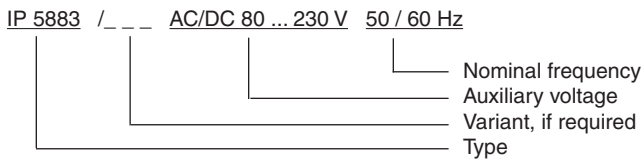
- IP 5883/071: manual reset,
pre warning with auto reset

For residual current transformer ND5018/105, ND5018/140, ND5018/210:

- IP 5883/140: pre warning and manual reset

- IP 5883/141: manual reset,
pre warning with auto reset

Ordering example for variants



Technical Data Residual Current Monitor ND 5018

- Ambient temperature:** - 40 ... + 60°C / 253 K ... 333 K
Inflammability class: V0 according to UL94

Insulation coordination according to IEC 61869-1

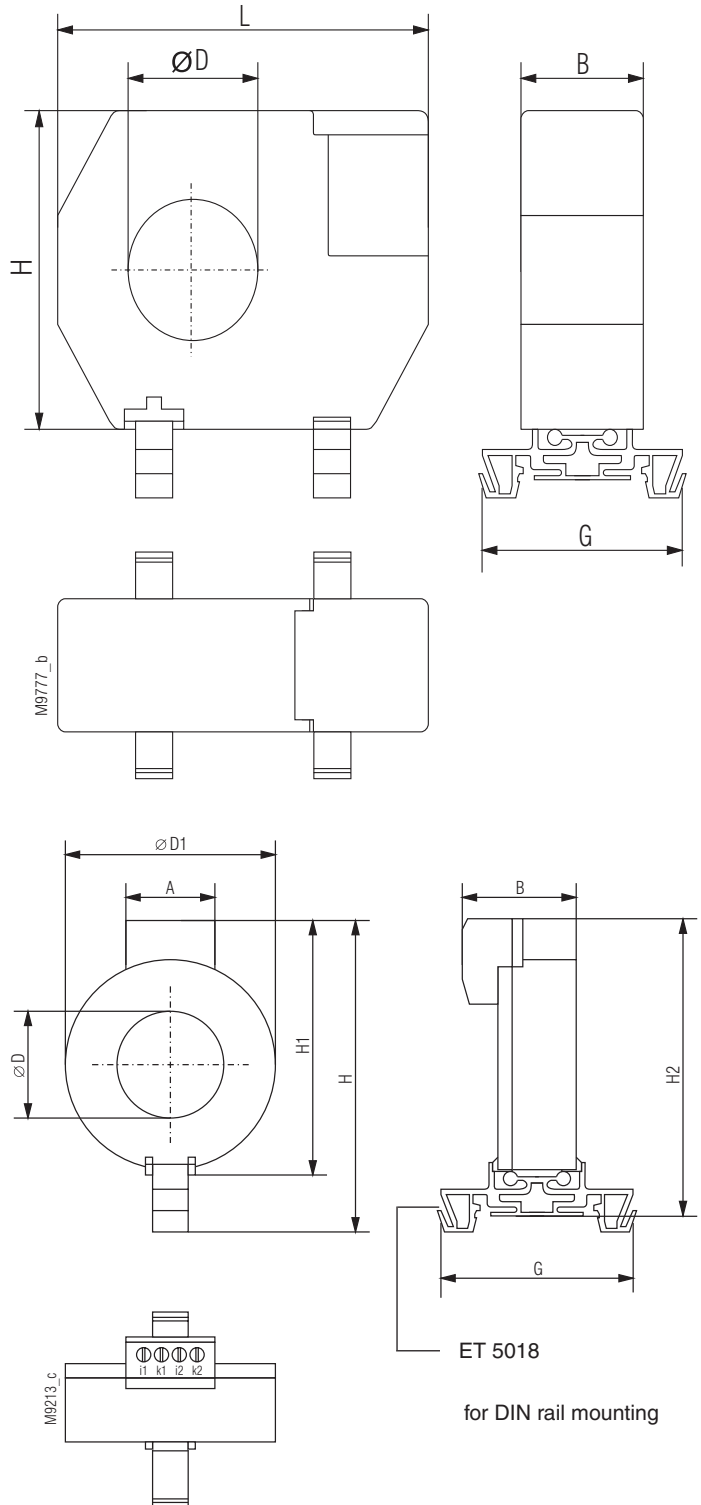
- Highest rated operating voltage U_m : AC 720 V
 Rated impulse voltage: 3 kV

- Length of connection wires
 Type of wire to CT, e.g.
 Single wire: up to 1 m
 Single wire twisted pair: up to 10 m
 (pair 1: i1 - k1; pair 2: i2 - k2): up to 25 m
 Screened wire; screen one end grounded to PE at the device: up to 25 m
 Wire cross section: 0,2 ... 1,5 mm²
 Stripping length: 8 mm

- ND 5018:**
 Wire fixing: Flat terminals with self-lifting clamping piece
 Screw fastening: (only at ND 5018/035, ND 5018/070,
 ND 5018/105, ND 5018/140, ND 5018/210) M 5
 DIN rail mounting: using mounting adapter ET 5018

Accessories

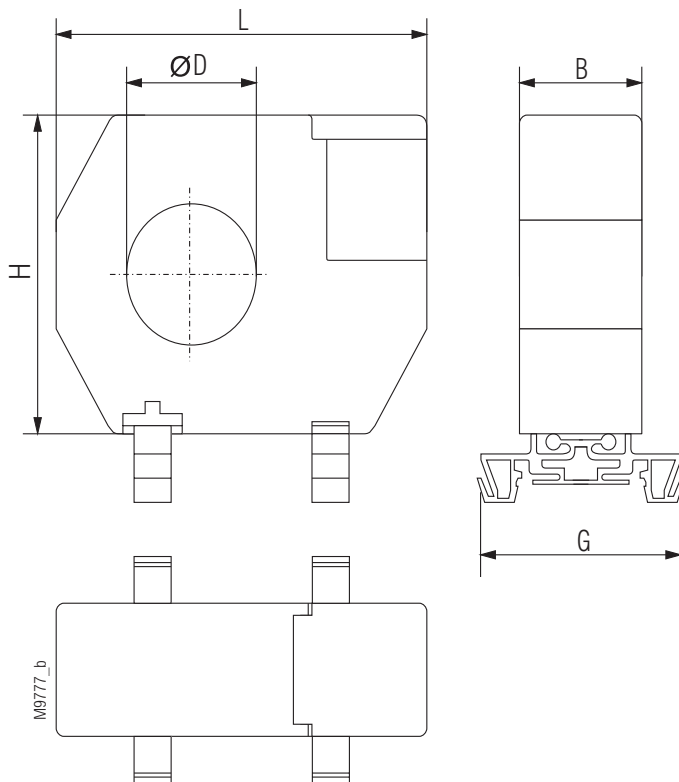
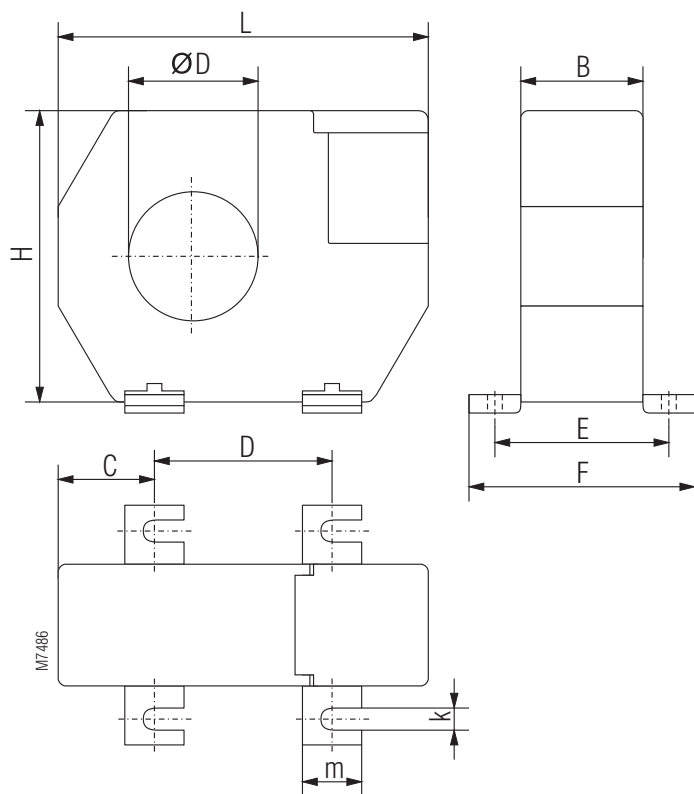
ND 5018/030 Residual Current Transformer



ND 5018/030	øD	øD1	L	B	A	H	H1
Dimensions/mm	30	59	55	32	25	87	70
Weight / g	90						

Residual Current Monitor ND 5018/035, ND 5018/070, ND 5018/105, ND 5018/140, ND 5018/210,

Residual Current Monitor ND 5018/035, ND 5018/070, ND 5018/105



for screw mounting

for DIN rail mounting

ND 5018/035	øD	L	B	H	C	D	E	F	k	m
Dimensions / mm	35	100	33	79	26	48.5	46	61	6.5	16
Weight / g	170									

ND 5018/035	øD	L	B	H	G
Dimensions / mm	35	100	33	79	55
Weight / g	170				

ND 5018/070	øD	L	B	H	C	D	E	F	k	m
Dimensions / mm	70	130	33	110	32	66	46	61	6.5	16
Weight / g	300									

ND 5018/070	øD	L	B	H	G
Dimensions / mm	70	130	33	110	55
Weight / g	300				

ND 5018/105	øD	L	B	H	C	D	E	F	k	m
Dimensions/mm	105	170	33	146	38	94	46	61	6.5	16
Weight / g	530									

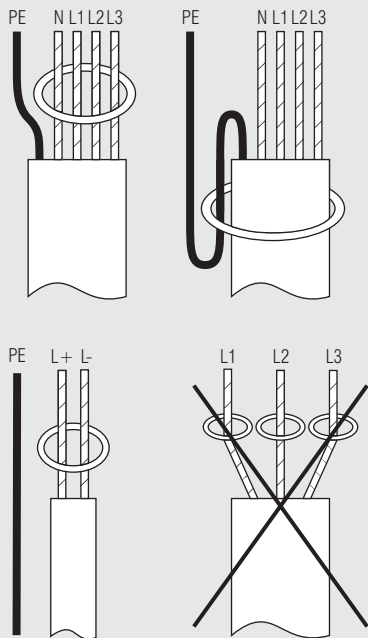
ND 5018/105	øD	L	B	H	G
Dimensions / mm	105	170	33	146	55
Weight / g	530				

ND 5018/140	øD	L	B	H	C	D	E	F	k	m
Dimensions/mm	140	220	33	196	48,5	123	46	61	6.5	16
Weight / g	1250									

ND 5018/210	øD	L	B	H	C	D	E	F	k	m
Dimensions/mm	210	299	33	284	69	161	46	61	6.5	16
Weight / g	2100									

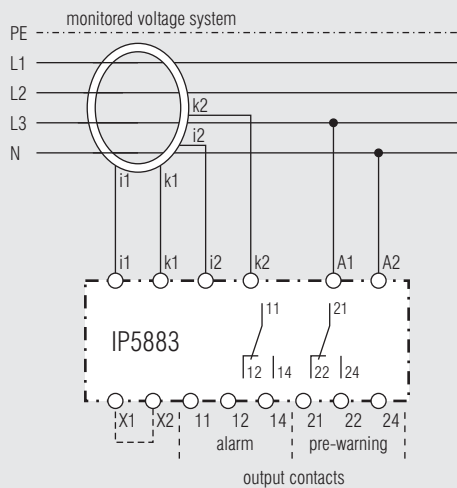
The residual current transformers ND 5018/035, ND 5018/070, ND 5018/105 can also be mounted on DIN-rail. To do this the metal screw fixings have to be removed and have to be replaced by 2 mounting clips (ET5018: art.no. 0058754; set with 2 pcs)

Installation of Wires



M8362_a

Connection Examples



X1-X2 without bridge : energized on trip
 X1-X2 with bridge : de-energized on trip

M9238_a

EMC-Testing of IP5883 according to EN 50155 Rev. 25/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHz-2,1GHZ	A	EN 61000-4-3	10 V/m 1GHz-2,1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHz	A	EN 61000-4-3	10 V/m 2,1GHz- 2,7GHz	A (1)	
	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	Limit value class B	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B	
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	230MHz to 1GHz	Limit value class B	

Voltage-Testing of IP5883 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

VARIMETER

Temperature Monitoring Relay

IK 9094, IL 9094, SK 9094, SL 9094

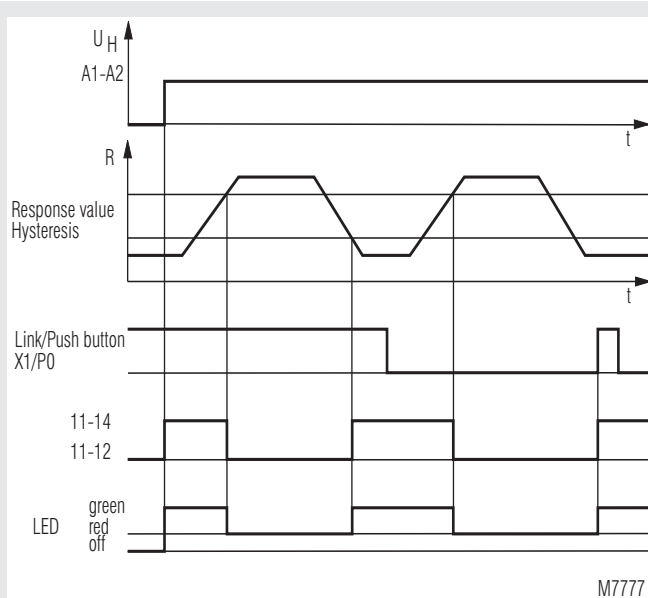


- According to IEC/EN 60 255-1
- 1 PT100 input, 2-wire connection
- 3 temperature ranges
- Adjustable response value
- Adjustable Hysteresis with wide range 3 ... 30 °C or 1 ... 15°C
- Broken wire detection in sensor circuit
- Programmable hysteresis or latching function via terminal X1
- IK 9094 no galvanic separation between measuring and Auxiliary Circuit
- Closed circuit operation
- LED indicator for operation and state of output relay
- 1 changeover contact
- As option with response value up to - 50°C, e.g. for refrigeration plants
- As option with galvanic separation between measuring and Auxiliary Circuit
- Devices available in 2 enclosure versions:
 - I-model: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
 - S-model: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- DIN rail or screw mounting
- IK 9094, SK 9094: 17.5 mm width
- IL 9094, SL 9094: 35 mm width

Approvals and Markings



Function Diagram



Applications

- Monitoring of temperature e.g. Motors, ball bearings, rooms, refrigeration plants, etc.
- Temperature control
- Monitoring of humidity, see relay workshop no. 19
- For industrial and railway applications

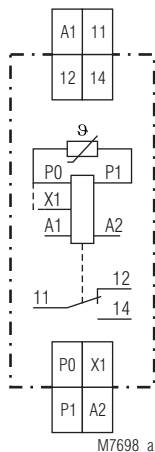
Function

On terminals P0 - P1 the resistance of the PT 100 is measured. On overtemperature and broken wire the output relay deenergises

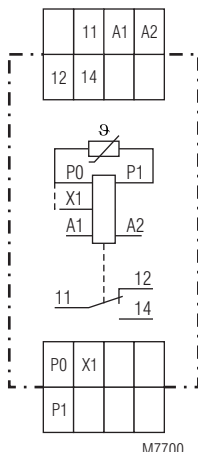
Indicators

LED: green, when auxiliary supply connected
 LED: red, when overtemperature

Circuit Diagrams



IK 9094.11, SK 9094.11



IL 9094.11, SL 9094.11

Connection Terminal

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
P0, P1	Connection for resistance thermometer PT100
X1, P0	Control input (manual reset / hysteresis function) X1/P0 nicht gebrückt: manual reset X1/P0 gebrückt: Hysteresis function
11, 12, 14	Changeover contact

Notes

Setting

Easy to set the temperature in °C:

Response value: Upper switch sets range (3 positions)
+ Middle potentiometer sets response value in °C

Release value: Lower potentiometer sets Hysteresis in °C

To operate the unit as temperature controller it has to be set to hysteresis function and to a small hysteresis (e.g. 3 °C).

With link X1-P0: Hysteresis function
Without link X1-P0: Latching function (the relay stays in off position even if the temperature is correct again.

The latching can be reset by bridging X1-P0 for a short time (Push button) or by disconnecting the auxiliary supply.

The IK/SK 9094 is designed to operate 2 wire PT 100 sensors. Therefore the setting must be corrected when using longer wires with about 2.6 °C per Ω of the connection wires (e.g. 2 pole cable 2 x 1.5 mm² of 40 m length has about 1Ω).

A temperature sensor with insulation must be used (AC 300 V).

Technical Data

Input

Inputs : P0 and P1 for PT100 sensors according to DIN 43 760 / DIN IEC 751
X1 to set hysteresis or latching function:
hysteresis function
latching function (Fault signal remains stored when temperature goes over set point)

Setting range of response value: 0 ... 150°C in 3 ranges
(0 ... 50°C, 50 ... 100°C, 100 ... 150°C)
(on request 100 ... 250°C in 3 ranges of 50°C)

IL/SL 9094.11/010: - 50 ... +25°C in 3 ranges
(- 50 ... -25°C, -25 ... 0°C, 0 ... +25°C)

Release value: Adjustable hysteresis on absolute scale 3 ... 30°C,
Hysteresis 1 ... 15°C adjustable
(Release value = response value minus hysteresis)

Voltage and temperature influence:

< 1 % of setting value

Measuring current:

approx. 2.5 mA

Dissipation of PT 100:

approx 0.6 mW

Voltage on open terminals

P0-P1:

approx. 6 V

Broken wire detection:

A broken wire in the PT 100 sensor wires is detected as fault (over-temperatur)

Auxiliary Circuit (A1-A2)

Auxiliary voltage U_H

IK/SK 9094:

AC/DC 24 V

IL/SL 9094:

AC 230 V (galvanic separation to measuring circuit)

Voltage range

at AC:

0.8 ... 1.1 U_N

at DC:

0.9 ... 1.25 U_N

Nominal consumption

IK/SK 9094.11

at AC:

approx. 1 VA

at DC:

approx. 0.6 W

IL/SK 9094.11/001

at AC:

approx. 1.2 VA

at DC:

approx. 0.7 W

IL/SL 9094.11:

approx. 2 VA

Nominal frequency (AC):

50/60 Hz

Galvanic isolation between measuring and auxiliary inputs

IK/SK 9094.11/001

DC 1000 V

IL/SL 9094.11:

4 kV / 2

Output

Contacts

IK/SK 9094.11, IL/SL 9094.11: 1 changeover contact

Thermal current I_{th} :

4 A

Switching capacity

to AC 15

NO contact:

3 A, AC 230 V

IEC/EN 60 947-5-1

NC contact:

1 A, AC 230 V

IEC/EN 60 947-5-1

to DC 13 at 0.1 Hz:

1 A / DC 24 V

IEC/EN 60 947-5-1

Electrical life

IEC/EN 60 947-5-1

to AC 15 at 1 A, AC 230 V:

≥ 3 x 10⁵ Switching cycles

Short circuit strength

max. fuse rating:

4 A gL

IEC/EN 60 947-5-1

Mechanical life:

≥ 30 x 10⁶ Switching cycles

Technical Data**General Data**

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	max. 95 %	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
IK/SK 9094.11:		
Between A1-A2 auxiliary supply:	0.5 kV / 2	IEC 60 664-1
IK/SK 9094.11/001:		
Between measuring input P0-P1 (-X1) and auxiliary supply:	1 kV / 2	IEC 60 664-1
IL/SL 9094.11:	4 kV / 2	IEC 60 664-1
Between input and output contacts:	4 kV / 2 (basis insulation)	IEC 60 664-1
Airgap:	≥ 3 mm	
Creepage distance on PCB:	≥ 3 mm,	
Inside enclosure:	≥ 5.5 mm	
Outside enclosure:	≥ 5.5 mm	
Overvoltage category:	III	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	10 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply		
IK/SK 9094:	0.5 kV	IEC/EN 61 000-4-5
IL/SL 9094:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04 IEC/EN 60 068-1	
Terminal designation:	EN 50 005	
Wire connection:		
Cross section:	2 x 2.5 mm ² solid 2 x 1.5 mm ² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Stripping length:	10 mm	
Wire connection:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight		
IK 9094:	65 g	
SK 9094:	83 g	
IL 9094:	137 g	
SL 9094:	164 g	

Dimensions**Width x height x depth**

IK 9094:	17.5 x 90 x 59 mm
SK 9094:	17.5 x 90 x 98 mm
IL 9094:	35 x 90 x 59 mm
SL 9094:	35 x 90 x 98 mm

Classification to DIN EN 50155 for IK 9094**Vibration and**

shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant	
	T2, T3 and TX with operational limitations	

Protective coating of the PCB: No**Standard Types**

IK 9094.11 AC/DC 24 V 0 ... 150°C	
Article number:	0051642
SK 9094.11 AC/DC 24 V 0 ... 150°C	
Article number:	0054753
• Output:	1 changeover contact
• Auxiliary voltage U _H :	AC/DC 24 V
• Response value:	0 ... 150°C
• Width:	17.5 mm
IL 9094.11 AC 230 V 0 ... 150°C	
Article number:	0056024
SL 9094.11 AC 230 V 0 ... 150°C	
Article number:	0056100
• Output:	1 changeover contact
• Auxiliary voltage U _H :	AC 230 V
• Response value:	0 ... 150°C
• Width:	35 mm

Variants

IK 9094.11 /001:	with galvanic isolation between measuring and Auxiliary Circuit
IL 9094.11/010:	for refrigeration plants Art.-no.: 0056080

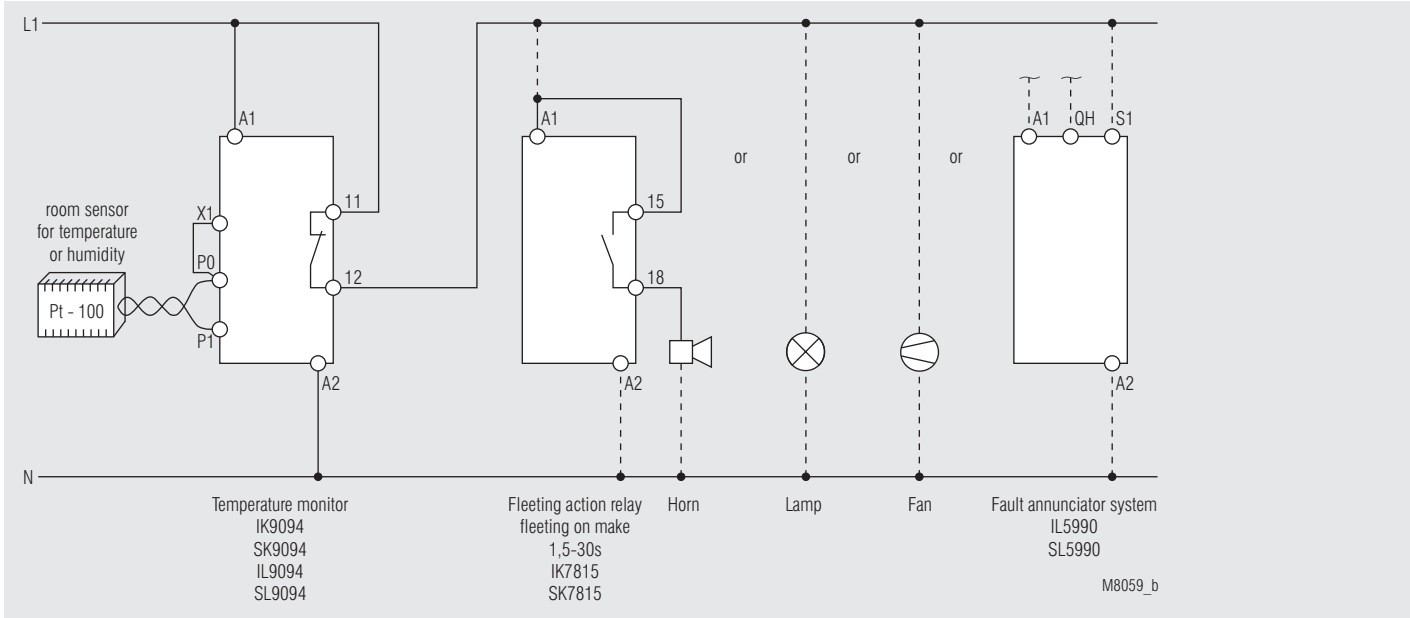
Ordering example for variants

IK 9094 .11 / _ _ _ AC/DC 24 V 0 ... 150°C	
	Response value
	Auxiliary voltage
	Variant, if required
	Contacts
	Type

Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578
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Application Examples

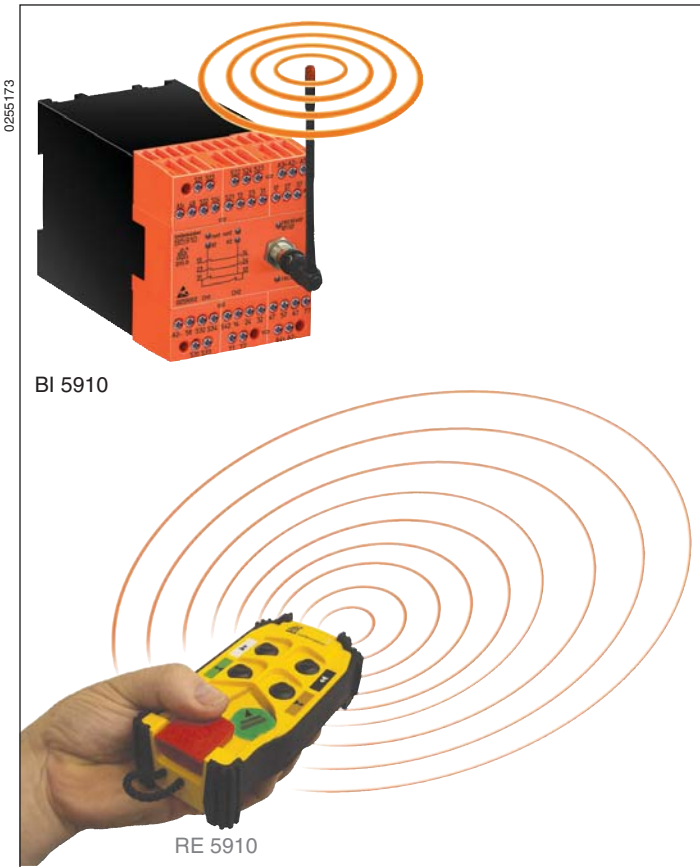


EMC-Testing of IK 9094 according to EN 50155 Rev. 14/10/2016

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	0,5 kV line to line 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: „A“ to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ		
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ		
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	10 V/m GHz-2GHZ		
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 2GHZ- 2,7GHZ		
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 10.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi- peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi- peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
	EN50155part 10.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	to be tested externally
		230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	to be tested externally	
		230MHz to 1GHz		EN 55011	230MHz to 1GHz	to be tested externally	

Voltage-Testing of IK 9094 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 10.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed



- According to
 - Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008
 - Safety Integrity Level (SIL 3) to IEC/EN 61508
 - Category 4 to EN 954-1
- Safety radio transmission
- Radio receiver for:
 - E-stop
 - Control signals for 6 non-safety semiconductor outputs
- Multifunction safety modul with additional control input to connect:
 - E-stop pushbutton (2-channel), safety gate or LC type 4 according to EN 61496
 - 1 Start button
 - 1 or 2 monitoring contacts to signal the use of radio
- Adjustable functions with step switch for:
 - Manual start or automatic start
 - when removing the remote control from the charger (open control contact) manual start is possible by remote control
 - possibility of disabling the access protection (gate) with active remote control
- Broken wire and short circuit monitoring with error indication
- 2 semiconductor outputs for status indication
- Feedback circuit Y1/Y2 for monitoring of external contactors
- LEDs for status indication
- Easy connection
- DIN rail mounting
- Removable terminal blocks allow fast exchange of module
- Also as input modul for multifunction, modular safety system SAFEMASTER M available
- Compact unit, only 67.5 mm width

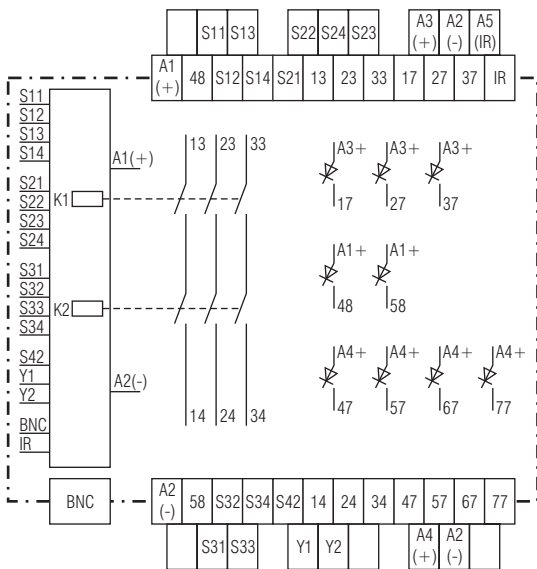
Additional Information About This Topic

- Informations about the additional remote control see datasheet RE 5910

Approvals and Markings

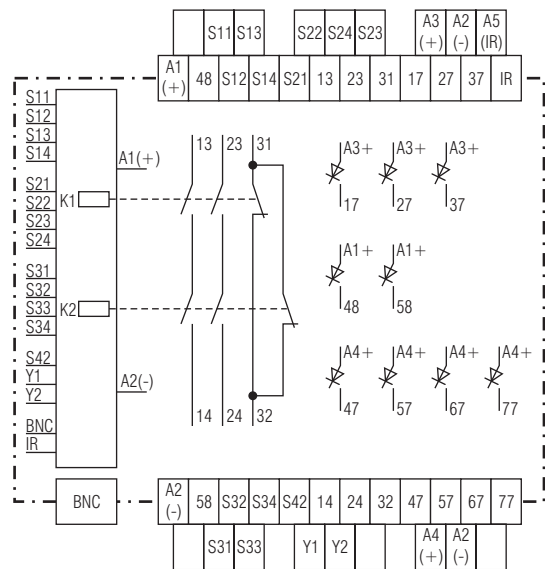


Circuit Diagrams



M9374_a

BI 5910.03/00MF9



M9375_a

BI 5910.22/00MF9

Indication for Remote Control

The device is equipped with a safety radio receiver to operate the signals from a remote control with remote e-stop. It has 1 or 2 inputs depending on the operation mode (S31-S32 and S33-S34) to connect the indication contacts of a battery charger for the remote control.

Aerial Connection

The radio connection of the radio controlled safety module to the remote control is made via an aerial that is mounted directly on the front of the BI 5910. If the unit is built into a metal cabinet the aerial has to be mounted outside. The connection is made via DOLD coax cable (e.g. RE 5910/042; Article number: 0059653). Special functions like activity monitoring and selection of radio frequency can be adjusted on the remote control.

Indications

green LEDs K1 and K2:	on when safety relay activated
green LED reception:	on at radio receive
yellow LEDs run 1, run 2 and outputs 48 and 58:	indicate the actual status of the modul
red LED receiver error:	indicate errors on radio-receiver

Notes

A machine must only be started from a location from which one can see that no person is present in the dangerous area.

To solve this there are 2 variants of the BI 5910:

BI 5910.__/00MF9

This unit is used in applications where start is only possible from a hard-wired start button.

BI 5910.__/01MF9

This unit has in addition to the radio control also an infrared function. The reset of the remotecontrol is only accepted if the reset signal is received via radio and via infrared. This means that the remote control must be pointed at the infrared receiver for reset.

Technical Data

Radio	
Conformity:	ETS 300 220
Aerial:	1/4 aerial, plug in as accessory
Frequency:	64 programmable frequencies 433.1 ... 434.675 MHz
Sensitivity:	< -100 dBm
Nominal voltage U_N:	DC 24 V
Voltage range:	0.85... 1.15 U_N at max. 5% residual ripple
Nominal consumption:	max. 120 mA (Semiconductor outputs not connected)
Control voltage on S11, S13, S21, S23, S31, S33, 48, 58:	DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42:	each 4.5 mA at U_N
Max. voltage for active signals on: S12, S14, S22, S24, S32, S34, S42:	DC 16 V
Max. Voltage for inactive signals on: S12, S14, S22, S24, S32, S34, S42:	DC 9 V
Max. input voltage on S12, S14, S22, S24, S32, S34, S42:	DC 30 V
Fusing:	Internal with PTC
Max. time difference between input signals of one function	
E-stop, Light curtains:	250 ms
Gates:	3 s

Technical Data

Safety output

Contacts

BI 5910.03:	3 NO contacts
BI 5910.22:	2 NO contacts, 1 NC contact
	The NC contact can only be used as indicator contact!!
	Relais, forcibly guided

Contact type:

Operating time typ. at U_N

automatic start: max. 800 ms	
manual start:	max. 110 ms
automatic restart:	max. 70 ms

Switching off time (reaction time)

S12-S14, S22-S24, S32-S34:	max. 25 ms
E-stop (Radio):	max. 170 ms

Passive disconnection because of interrupted radio signal: max. 500ms

Disconnection with active radio signal and closed charge control contact: max. 1 s

Nominal output voltage:

AC 250 V	
DC: see limit curve for arc-free operation	
> 100 mV	
5 A	

Switching of low loads:

Thermal current I_{th} :

Switching capacity

to AC 15	
NO contacts:	AC 3 A /230 V IEC/EN 60 947-5-1
NC contacts:	AC 2 A /230 V IEC/EN 60 947-5-1
to DC 13:	DC 8 A / 24V at 0.1Hz IEC/EN 60 947-5-1

Electrical life

to AC 15 at 2 A, AC 230 V: 100000 switching cycles IEC/EN 60 947-5-1

Permissible switching frequency: max. 1200 switching cycles / h

Short circuit strength

Max. fuse rating:	6 A gL IEC/EN 60 947-5-1
Line circuit breaker:	C 8 A
Mechanical life:	10 x 10 ⁶ switching cycles

Semiconductor outputs

Outputs

(terminals 48, 58, 17, 27, 37,

47, 57, 67, 77): transistor outputs, switching +

Nominal output voltage

(A3+, A4+): DC 24 V

Nom. output voltage at U_N : min. DC 23 V, max. 100 mA cont. current
max. 400 mA für 0.5 s internal short circuit, over temperature and overload protection

Min. operating current: min. 0.5 mA

Residual current: min. 0.1 mA

General Data

Operating mode: Continuous operation

Temperature range

operation: 0 ... 50°C

storage: - 25 ... + 85 °C

altitude: < 2.000 m

Clearance and creepage distance

rated impulse voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1

EMC

HF-irradiation: 10 V / m IEC/EN 61 000-4-3

Fast transients

on wires for power supply A1-A2: 2 kV IEC/EN 61 000-4-4

on signal and control wires: 2 kV IEC/EN 61 000-4-4

Surge voltages

between wires for power supply 1 kV IEC/EN 61 000-4-5

between wire and ground: 2 kV IEC/EN 61 000-4-5

HF- wire guided: 10 V IEC/EN 61 000-4-6

Interference suppression: Limit value class B EN 55 011

Degree of protection: acc. to EN 61 496-1 (1997) the unit has to be mounted in a control cabinet with protection class 54

Housing: IP 40 IEC/EN 60 529

Terminals: IP 20 IEC/EN 60 529

Enclosure: Thermoplastic with V0 behaviour according to UL subject 94

Technical Data

Vibration resistance: according to EN 61496-1 (1997)
Amplitude 0.35 mm IEC/EN 60 068-2-6
Frequency 10 ... 55 Hz

Shock proof

Acceleration: 10 g
Impulse length: 16 ms
Number of shocks: 1000 per ax is on all 3 axes

Climate resistance: 0 / 050 / 04 IEC/EN 60068-1

Terminal designation: EN 50 005

Wire connection: 1 x 2.5 mm² strand. wire with sleeve or
1 x 4 mm² solid or
2 x 1.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4

Wire fixing: Plus- minus- terminal screws M 3.5

box terminals with wire protection
DIN-rail IEC/EN 60 715
Weight: 495g

Dimensions

Width x height x depth: 67.5 x 84 x 129 mm

Safety Related Data for E-STOP via wired e-stop button

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
MTTF _d :	> 100	a
DC _{avg} :	98.4	%
d _{op} :	365	d/a (days/year)
h _{op} :	24	h/d (hours/day)
t _{Zyklus} :	3.60E+03	s/Zyklus
	≅ 1	/h (hour)

Values according to IEC/EN 61508:

SIL	3	IEC/EN 61508
HFT ¹⁾ :	1	
DC _{avg} :	98.4	%
SFF	99.5	%
PFH _D :	1.20E-9	h ⁻¹

Safety Related Data for E-STOP via radio control

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
MTTF _d :	> 100	a
DC _{avg} :	98.0	%
d _{op} :	365	d/a (days/year)
h _{op} :	24	h/d (hours/day)
t _{Zyklus} :	2	h (hours)

Values according to IEC/EN 61508:

SIL	3	IEC/EN 61508
HFT ¹⁾ :	1	
DC _{avg} :	98.4	%
SFF	99.5	%
PFH _D :	2E-9	h ⁻¹

¹⁾ HFT = Hardware-Failure Tolerance



The values stated above are valid for the standard type.

Safety data for other variants are available on request.

The safety relevant data of the complete system has to be determined by the manufacturer of the system.

Standard Types

BI 5910.22/00MF9 DC 24 V

Article number: 0059002

Safety outputs: 2 NO contacts, 1 NC contact^{*)}

BI 5910.03/00MF9 DC 24 V

Article number: 0059003

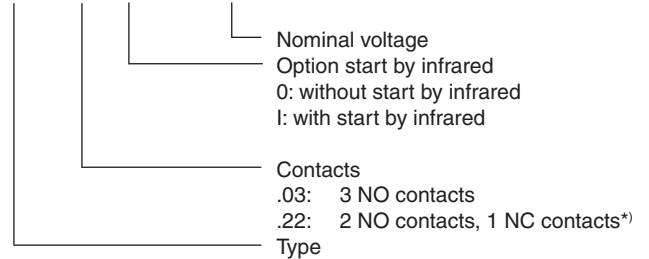
Safety outputs: 3 NO contacts

- Function with rotational switches adjustable
- Nominal voltage U_N: DC 24 V
- Width: 62.5 mm

^{*)} The NC contact can only be used as indicator contact!

Ordering Example

BI 5910 _ _ _ /0_MF9 _ _ DC 24 V



^{*)} The NC contact is not a safety contact

Accessories

RE 5910/040: 1/4 λ aerial 433 - 434 MHz - BNC
Article number: 0059573

RE 5910/041: 1/2 λ aerial 433 - 434 MHz - BNC
Article number: 0059652

RE 5910/042: 2 m extension for aerial + trough hole
connector - BNC fixing angle
Article number: 0059653

RE 5910/043: 5 m extension for aerial + trough hole
connector - BNC fixing angle
Article number: 0059654

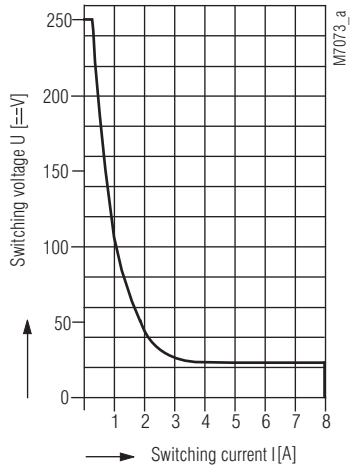
RE 5910/045: Extension 50 cm
Article number: 0059656

RE 5910/046: 90° adapter for aerial
Article number: 0059685

RE 5910/060: 1 infra red receiver with 10 m wire
Article number: 0059665

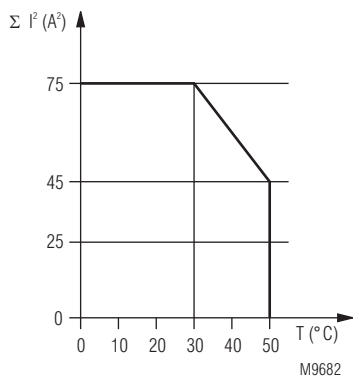
RE 5910/061: 10 m extension wire for infra red module
Article number: 0059666

Characteristics



safe breaking, no continuous arcing
under the curve, max. 1 switching cycle/s

Limit curve for arc-free operation

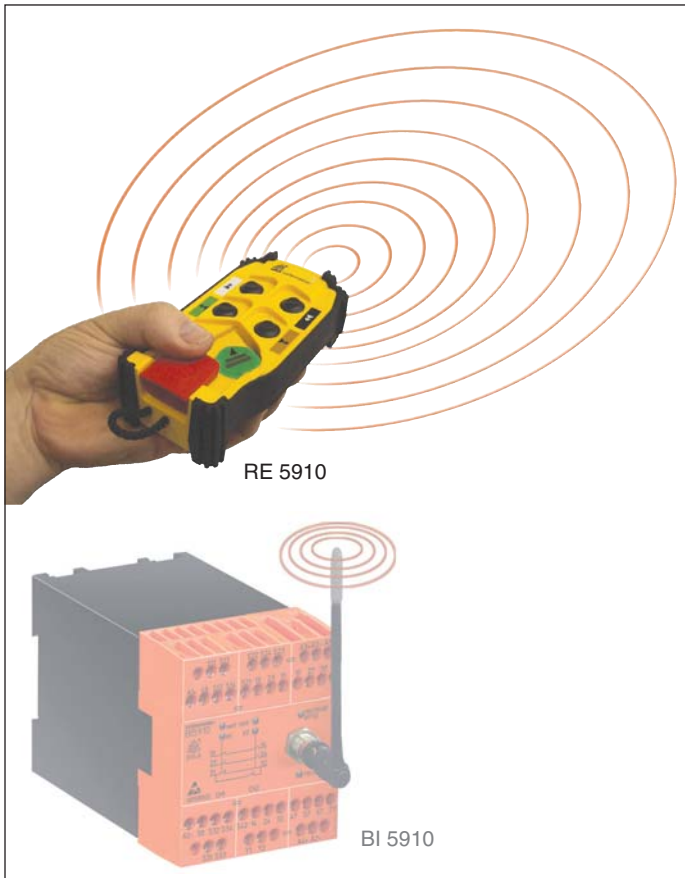


Quadratic total current

$$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2$$

I_1, I_2, I_3 - current in contact paths

Quadratic total current limit curve



RE 5910

BI 5910

- with DOLD Wireless Safety System
 - Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008
 - Safety Integrity Level (SIL 3) to IEC/EN 61508
 - Category 4 to EN 954-1
 - DIN EN ISO 13850
- Safety radio transmission
- User friendly, compact transmitter
 - for radio controlled safety modul BI 5910
 - for multifunction, modular safety system SAFEMASTER® M
- Comfortable single hand operation
- Options with 4 configurable push buttons or rotational switches for control functions
- With perceptible 2 step push buttons
- With marking space besides the push buttons
- Protection against unintentional activation
- Speed charging and high battery capacity
- Fast change of frequency
- Pocket for remote control as option

Additional Information

- Information about the receiver unit you find in the data sheet BI 5910

Approvals and Markings



Notes

A visible e-stop button must be active all the time.

This means that the e-stop button of the remote control must not be visible when it is inactive. Therefore the charger must be mounted in a way that the remote control is not visible while charging.

Technical Data

Radio

Conformity:	ETS 300 220
Carrier frequency:	UHF, frequency modulated (FM)
Frequency:	64 programmable frequencies
Frequency range:	433.1 ... 434.675 MHz
HF-power:	< 10 mW (without licence), integrated aerial
Distance:	approx. 150- 200 m under industrial ambient conditions *) approx. 600 m in open area

*) The distance can vary with the ambient conditions of the remote control and the receiver aerial (roof construction, metal walls etc.)

Battery

Type:	Lithium-ion
Service life:	min. 500 cycles (charge/discharge cycles)
Charging time:	2 h, bei +20°C (80%) (for completely discharged battery)
Full charging time:	2 h 30 min (100%)

Charge capacity

- Normal operation of push buttons:	20 h, at 50% operation and + 20°C
- after 10 minutes charging of discharged battery:	approx. 1 h
Storage temperature:	-20°C ... +50°C
Charging temperature:	0°C ... +40°C

Attention! Slow charging outside temperature range may damage the battery

Technical Data

Enclosure

Material:	ABS
Degree of protection:	IP 65
Ambient temperature:	-20°C ... +50°C
Holder for non-operation:	Charger unit
Weight (with battery):	240 g

Dimensions

Width x height x depth: 46 x 78 x 143 mm

Standard Type

RE 5910/001

Article number: 0060610

- with 4 2 step push buttons
- without infrared
- with electronic key

Ordering Example

RE 5910/00_

Variant

- 1: with 4 2 step push buttons, without IR
- 2: with 4 2 step push buttons, with IR
- 3: with 4 1 step push buttons, without IR
- 4: with 4 1 step push buttons, with IR
- 5: B1-B3: step push button (BPSV),
B4: rotational switch with auto return (COM3R)
- 6: B1-2: 1 step pushbutton (BPSV),
B3-B4: rotational switch (COM3), with IR
- 7: B1-B2: 1 step pushbutton (BPSV)
B3-B4: rotational switch (COM3),
without IR, with electronic key
- 8: B1-B2: 2 step pushbutton (BPDV)
B3-B4: rotational switch (COM2),
without IR, without electronic key

9114: B1-B3: 1 step pushbutton (BPSV),
B4: rotational switch (COM3R), with IR

others on request

Accessories

RE 5910/010:	Industrial charger unit Article number: 0060616
RE 5910/011:	Power supply for charger AC 230 V (Euro connector) Article number: 0060617
RE 5910/012:	Power supply for charger DC 24 V Article number: 0060618
RE 5910/013:	Power supply for charger AC 230 V (U.K. connector) Article number: 0061323
RE 5910/030:	Set with 6 colour stickers "movements" for 2-step push buttons Article number: 0059660
RE 5910/031:	Set with 90 black and white stickers Article number: on request
RE 5910/033:	Set with 48 white stickers + 48 transparent protection stickers for individual marking Article number: 0059663
RE 5910/051:	Replacement rechargeable battery Article number: 0060621
RE5910/070:	Remote control holster for RE5910; Material: leather, - metal clip to fix it on belt. - with rings to clip in the personal mounting harness RE 5910/071 Article number: 0060490
RE 5910/071:	Personal mounting harness with elastic straps to carry the remote control in the holster RE5910/070 on the body of the operator. Article number: 0060491

Electrical replacement key

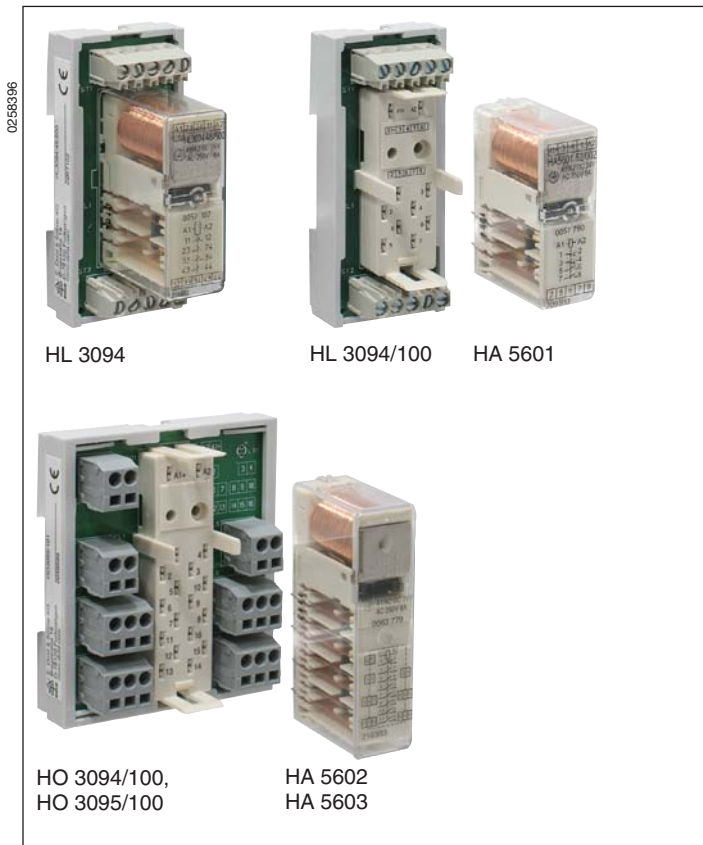
RE 5910/020:	Green electronic key with program Article number: 0060619
RE 5910/021:	Orange electronic key with program Article number: 0060620

Important:

Please state the following details on order:

- Number of electronic key (6 figure number, noted on page 2 of this manual)
- Frequency channel, if it should be programmed by manufacturer
- Time delay for activity control (01-99 sec or 01-98 min)

SAFEMASTER
Interface Module
HL 3094, HO 3094, HO 3095

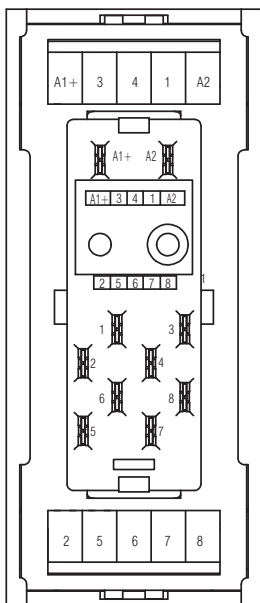


- According to IEC/EN 60255-1, IEC/EN 61810-1
- With forcibly guided contacts according to IEC 61810-3
- Low nominal consumption: 0.75 W / 1 W / 1.25 W
- Max. 8 output contacts
- Contact material AgNi + 0.2 µm Au
- High thermal current $I_{th} = 8$ A
- Large temperature range: -25 ... +55°C
- Safety relay soldered on PCB
- Optional AgNi + 5 µm Au or AgSnO + 0.2 µm Au
- Optional with free-wheeling diode across A1/A2
- Plug in relay option
HA 5601 on socket HL 3094/10_
HA 5602 on socket HO 3094/10_
HA 5603 on socket HO 3095/10_
- DIN rail or screw mounting
- HL: 38 mm width
HO: 73.3 mm width

Approvals and Markings

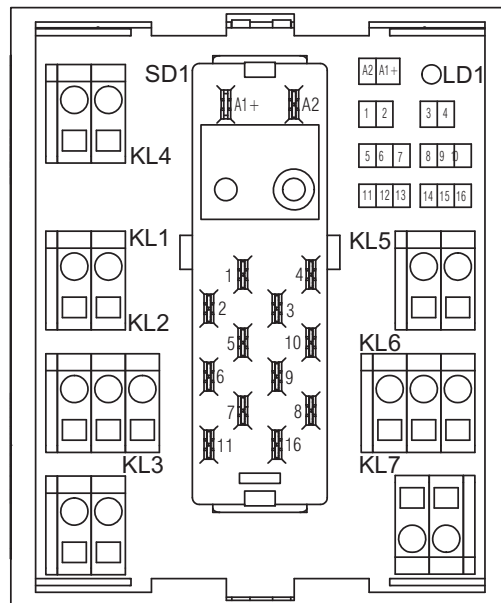


Socket Labeling



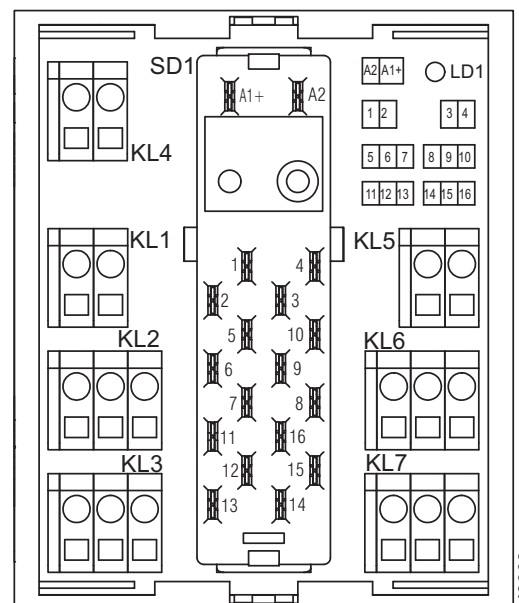
HL 3094/100, HL 3094/101

M2404_c



HO 3094/100, HO 3094/101
HO 3094/102, HO 3094/103

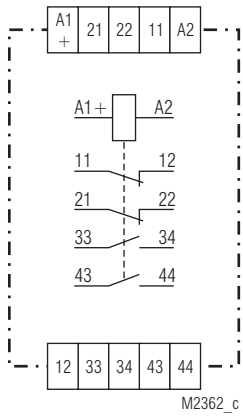
M3993_a



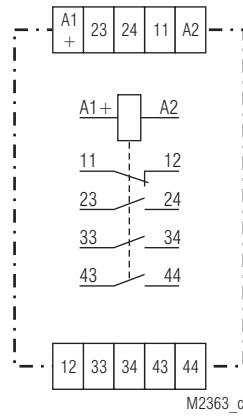
HO 3095/100, HO 3095/101
HO 3095/102, HO 3095/103

M3992_a

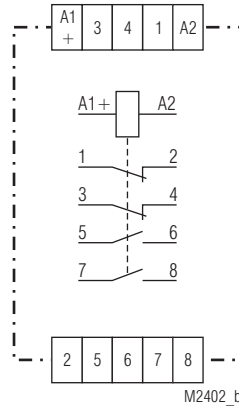
Circuit Diagrams



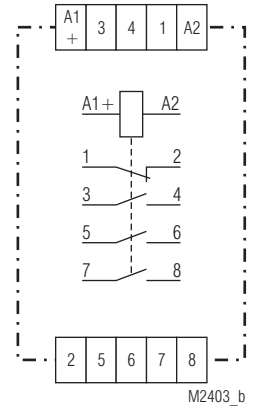
HL 3094.52



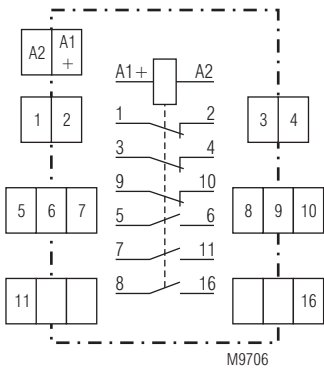
HL 3094.48



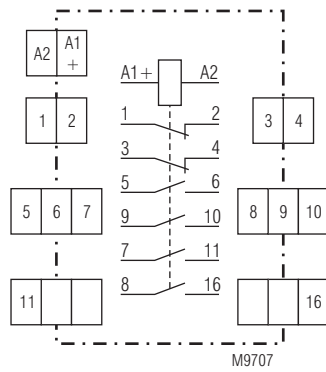
HA 5601.52



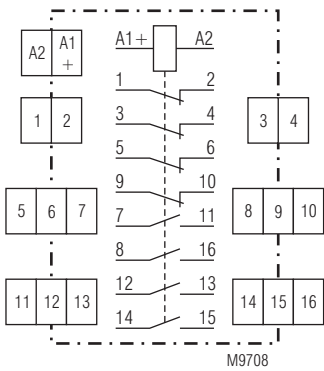
HA 5601.48



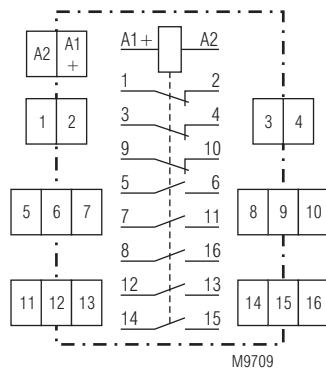
HA 5602.18



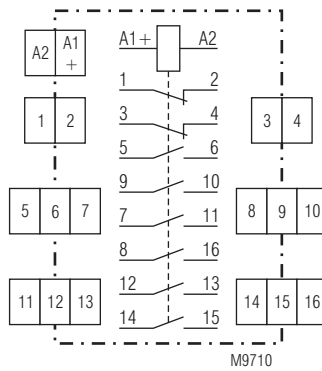
HA 5602.54



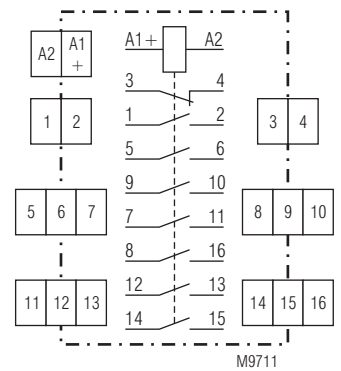
HA 5603.57



HA 5603.58



HA 5603.59



HA 5603.63

Connection Terminals

Terminal designation	Signal designation
A1+	L / +
A2	N / -
11, 12 / 1, 2	NC contact
All other contacts see relevant circuit diagram	NC contacts / or NO contacts

Technical Data	
Input	
Nominal voltage U_N:	DC 6, 12, 24, 48, 60, 110 V other voltages on request
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption:	
HL 3094:	0.75 W
HO 3094:	1 W
HO 3095:	1.25 W
Output	
Contacts	
HL 3094.52, HA 5601.52:	2 NO, 2 NC contacts
HL 3094.48, HA 5601.48:	3 NO, 1 NC contacts
HO 3094.18, HA 5602.18:	3 NO, 3 NC contacts
HO 3094.54, HA 5602.54:	4 NO, 2 NC contacts
HO 3095.57, HA 5603.57:	4 NO, 4 NC contacts
HO 3095.58, HA 5603.58:	5 NO, 3 NC contacts
HO 3095.59, HA 5603.59:	6 NO, 2 NC contacts
HO 3095.63, HA 5603.63:	7 NO, 1 NC contacts
Contact material:	AgNi + 0.2 μ m Au
Measured nominal voltage:	AC 250 V
Contact type:	spring contact
Operate time:	\leq 40; typical 27 ms
Release time:	\leq 10; typical 5 ms
Thermal current I_{th}:	3 x 8 A
Switching capacity	
to AC 15	
NO contact:	5 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V IEC/EN 60 947-5-1
Electrical life	IEC/EN 60 947-5-1
at 1 s x On, 1 s Off	
at AC 230 V 5 A $\cos \varphi = 1$:	$> 7 \times 10^5$ switching cycles / AgSnO $> 5 \times 10^5$ switching cycles / AgNi
at AC 230 V 8 A $\cos \varphi = 1$:	$> 3 \times 10^5$ switching cycles / AgSnO $> 2 \times 10^5$ switching cycles / AgNi
to AC 15 at 1 A, AC 230 V:	1.5×10^6 switching cycles
Permissible switching frequency:	10 switching cycles / s
Switching voltage min./max.:	AC/DC 10 V / DC 250 V, AC 400 V (100 mV / AC/DC 60 V for AgNi-contacts + 5 μ m Au)
Switching current min./max.:	10 mA / 8 A (2 mA / 0.3 A for AgNi-contacts + 5 μ m Au)
Switching power min./max.:	0.1 VA / 2000 VA (10 mVA / 7 VA for AgNi-contacts + 5 μ m Au) 0,1 W / 240 W (10 mW / 7 W for AgNi-contacts + 5 μ m Au)
Short circuit strength	
max. fuse rating:	6 A gL / gG IEC/EN 60 947-5-1
Mechanical life:	$> 30 \times 10^6$ switching cycles
General Data	
Operating mode:	Continuous operation
Temperature range:	
Operation:	- 25 ... + 55 °C
Storage:	- 25 ... + 70 °C
Relative air humidity:	93 % at 40 °C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree:	
Input / Output:	4 kV / 2 (basis insulation) IEC 60 664-1
Output / Output:	4 kV / 2 (basis insulation) IEC 60 664-1
Overvoltage category:	III
Insulation test voltage, type test:	2.5 kV; 1 min

Technical Data	
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
HF-irradiation	
80 MHz ... 1 GHz:	10 V / m IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz:	10 V / m IEC/EN 61 000-4-3
Fast transients:	4 kV IEC/EN 61 000-4-4
Surge voltages	
between	
wires for power supply:	2 kV IEC/EN 61 000-4-5
between wire and ground:	4 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55 011
Degree of protection	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Housing:	Thermoplastic
Vibration resistance:	Amplitude 0.35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz
Climate resistance:	Humid heat IEC/EN 60 068-2-30
Terminal designation:	EN 50 005
Wire connection:	0.14 ... 4 mm ² solide 0.14 ... 2.5 mm ² flexible
Wire fixing	
HL 3094:	box terminals
HO 3094, HO 3095:	cage clamp terminals
Fixing torque:	0.4 Nm
Mounting:	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory
Weight:	
HL 3094 (incl. relay):	approx. 120 g
HL 3094/100:	approx. 58 g
HO 3094 (incl. relay):	approx. 173 g
HO 3095 (incl. relay):	approx. 183 g
HO 3094/100, HO 3095/100:	approx. 93 g
HA 5601:	approx. 78 g
HA 5602:	approx. 85 g
HA 5603:	approx. 95 g
Dimensions	
Width x height x depth	
Interface module HL 3094:	37.8 x 88 x 55.2 mm
Interface module HO 3094:	73.8 x 88 x 51.9 mm
Interface module HO 3095:	73.8 x 88 x 51.9 mm
Socket HL 3094 with safety relay HA 5601:	
	37.8 x 88 x 65.5 mm
Socket HO 3094 with safety relay HA 5602:	
	73.8 x 88 x 59.9 mm
Socket HO 3095 with safety relay HA 5603:	
	73.8 x 88 x 59.9 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations
Voltage range:	0.7 ... 1.25 U_N with operational limitations
Protective coating of the PCB:	No

Standard Type

HL 3094.52 DC 24 V

Article number: 0047426

• 2 NO, 2 NC contacts

• Contact material: AgNi + 0.2 µm Au

• Nominal voltage U_N : DC 24 V

• Width: 38 mm

Variants

Interface module:

H_309_/100: Socket

H_309_/101: Socket with free-wheeling diode

H_309_/102: Socket with free-wheeling diode + LED

H_309_/103: Socket with LED

Safety relay

HA 5601._._, HA 5602._._,

HA 5603._._: Contact material AgNi + 0.2 µm Au

HA 5601._._/001,

HA 5602._._/001

HA 5603._._/001: Contact material AgNi + 5 µm Au

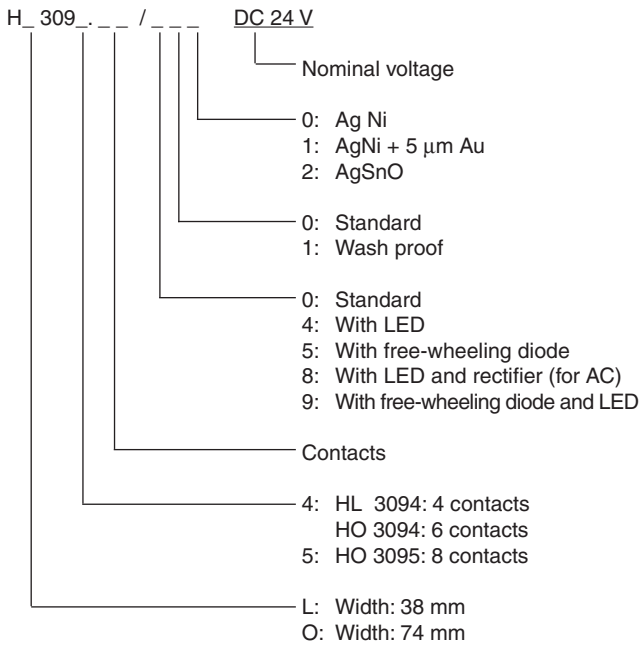
HA 5601._._/002,

HA 5602._._/002,

HA 5603._._/002: Contact material AgSnO + 0.2 µm Au

other variants on request

Ordering example for variants



Accessories

ET 4086-0-2: Additional clip for screw mounting
Article number: 0046578

EMC-Testing of HL/HO 3094/95 according to EN 50155 Rev 14/10/2016

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	2 kV line to line 4 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
RF emission	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	10 V/m 1GHZ-2,5GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 1GHZ-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	Limit value class B	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B	
		230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B	
				EN 55011	230MHz to 1GHZ	Limit value class B	

Voltage-Testing of HL/HO 3094/95 according to EN 50155

	Test Standard	Severity	Performance	DoId Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		DIN VDE 0435 part 2021	for 1 min	
		500V at < DC72Vor AC 50V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed

SAFEMASTER Interface Module HL 3094N



Your Advantages

- Simple contact extension and re-inforcement also of safety modules
- Cost and space saving alternative compared to contactors
- Simple contact monitoring via forcibly guided NC contact
- Large wire cross section 0.5 - 2.5mm² (12-24 AWG) reduces thermal load on wires

Features

- Acc. to DIN EN 61810-1, IEC 60664-1, IEC/EN 60 947-5-1, EN 50 155
- With forcibly guided contacts according to IEC 61810-3
- **Models with soldered in or pluggable PCB safety relay**, consisting of
 - plug in socket HL 3094N and safety relay OA 5601
- With polarity protected diode
- With free-wheeling diode between A1+ and A2
- Optionally AgNi + 0.2 µm Au or AgNi + 5 µm Au
- For DIN rail mounting according DIN EN 60715
- Width: 36 mm

Product Description

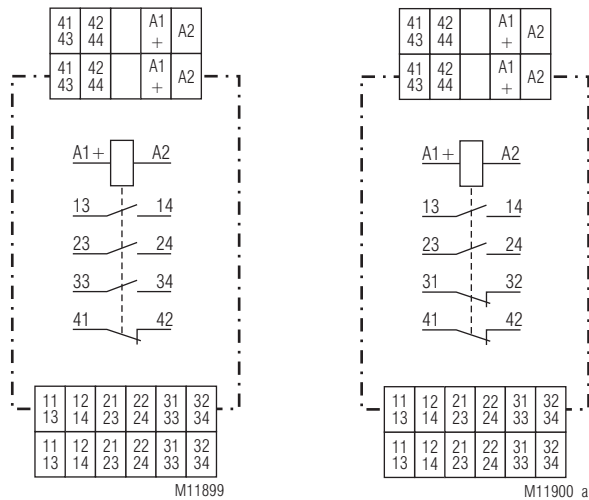
The interface module HL 3094N has forcibly guided contacts. Therefore it can be used to safely separate control and load circuits.

Double terminals für easy looping of the signals. Spring clamp terminal blocks ensures constant contact forces and vibration-proof connection technology.

Approvals and Markings



Circuit Diagrams



HL 3094N.48C

HL 3094N.52C

HL 3094NC/10_
+ OA5601.48

HL 3094NC/10_
+ OA5601.52

Connection Terminals

Terminal designation	Signal designation
A1+	L / +
A2	N / -
41, 42	NO contact
All other contacts seerelevant circuit diagram	NC contacts / or NO contacts

Technical Data

Input

Nominal voltage U_N:	DC 24, 110 V other voltages on request
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption:	1.0 W

Output

Contacts:	HL 3094N.52, OA 5601.52: 2 NO and 2 contacts	
	HL 3094N.48, OA 5601.48: 3 NO and 1 contacts	
Contact material:	AgNi + 0.2 μ m Au, AgNi + 5 μ m Au other on request	
Contact type:	spring contact	
Operate time:	typical 27 ms	
Release time:	typical 30 ms	
Measured nominal voltage:	AC 250 V	
Thermal current I_{th}:	3 x 8 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact: nach DC 13	2 A / AC 230 V	IEC/EN 60 947-5-1
NO contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
NC contact: according to DC 13	2 A / DC 24 V	IEC/EN 60 947-5-1
NO contact:	6 A / 24 V at 0.1 Hz	
NC contact:	6 A / 24 V at 0.1 Hz	
Electrical life to AC 230 V / 6 A $\cos\phi = 1$: at DC 24 V / 5 A ohmic:	$\geq 5 \times 10^5$ switching cycles $\geq 6 \times 10^6$ switching cycles	
Permissible switching frequency:	10 switching cycles / s	
Short circuit strength max. fuse rating:	8 A gG / gL	IEC/EN 60 947-5-1
Mechanical life:	$\geq 30 \times 10^6$ switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 40 ... + 55 °C	
Storage:	- 40 ... + 70 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances rated impulse voltage / pollution degree		
Input / output:	6 kV / 2	IEC 60 664-1
Output / output:	4 kV / 2	IEC 60 664-1
Overvoltage category:	III	
Insulation test voltage, type test:	2.5 kV; 1 min	
EMC		
Statische Entladung (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF-Einstrahlung:		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply: between wire and ground:	1 kV	IEC/EN 61 000-4-5
HF-wire guided:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	10 V	IEC/EN 61 000-4-6
	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	Humid heat IEC/EN 60 068-2-30	
Terminal designation:	EN 60 947-1	
Fire behaviour		
DIN rail socket:	V0	UL 94
PCB:	V0	UL 94
Connection terminals:	V0	UL 94

Technical Data

Wire connection:	0,5 ... 2,5 mm ² solid 0,5 ... 2,5 mm ² flexible	
Wire fixing:	Cage clamp terminals	
Schnellbefestigung:	DIN rail	IEC/EN 60 715
Nettogewicht:	approx. 140 g	

Weight

Width x height x depth	
HL 3094N._ _C:	36 x 106 x 68 mm
HL 3094NC mit OA 5601:	36 x 106 x 79 mm

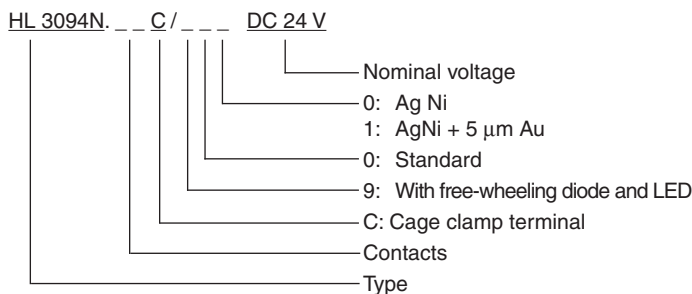
Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2, T3 and TX compliant	
Voltage range:	0.7 ... 1.25 U_N with operational limitations	
Protective coating of the PCB:	No	

Standard Types with soldered relay

HL 3094N.48C/900 DC 24 V	
Article number:	0067990
• 3 NO contacts, 1 NC contact	
• Contact material AgNi + 0.2 μ m Au	
• Width:	36 mm

Ordering Example

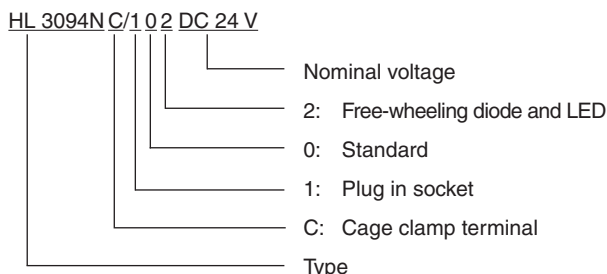


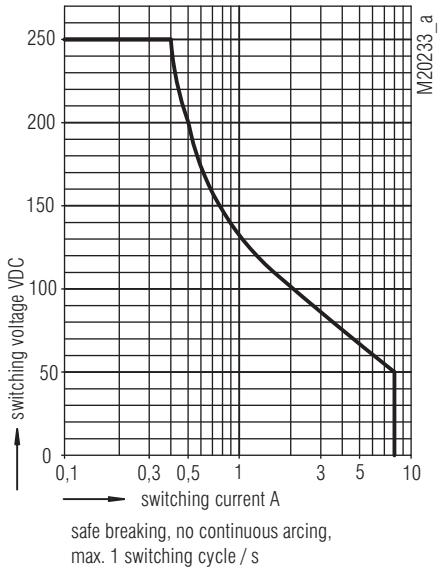
Standard Types for plug in relay

Plug in socket	
HL 3094NC/102 DC 24 V:	With free-wheeling diode and LED Article number: 0067991
Suitable relay:	OA 5601.48/2133L1 DC 24 V 3 NO, 1 NC Contact material: AgNi + 0,2 μ m Au Article number: 0046563

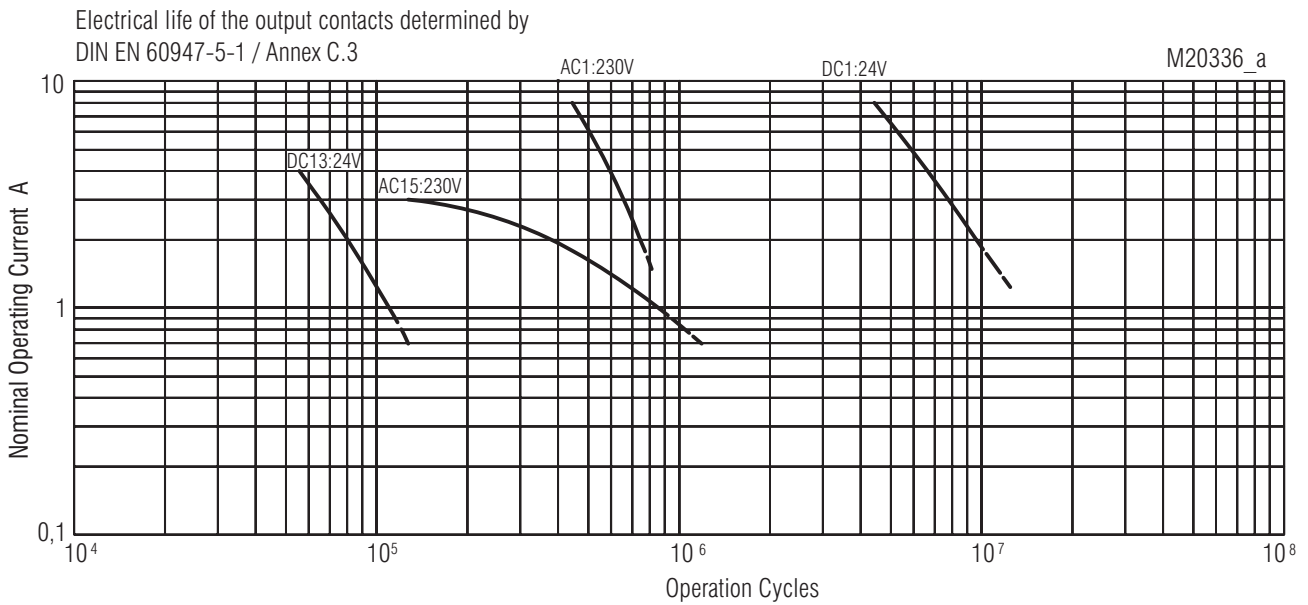
further variantes on request

Ordering Example





Arc limit curve under resistive load



Electrical contact service life


Connection Example for HL 3094NC/10_

Relay: OA 5601.48 \cong 3 NO and 1 NC contact (standard)


A1, A2	Contact	Contact-type	Connection								
<table border="0"> <tr><td>11</td><td>21</td></tr> <tr><td>13</td><td>23</td></tr> <tr><td>12</td><td>22</td></tr> <tr><td>14</td><td>24</td></tr> </table>	11	21	13	23	12	22	14	24	1	NO contact	13, 14
11	21										
13	23										
12	22										
14	24										
<table border="0"> <tr><td>41</td><td>31</td></tr> <tr><td>43</td><td>33</td></tr> <tr><td>42</td><td>32</td></tr> <tr><td>44</td><td>34</td></tr> </table>	41	31	43	33	42	32	44	34	2	NO contact	23, 24
41	31										
43	33										
42	32										
44	34										
	3	NO contact	33, 34								
	4	NC contact	41, 42								

The terminal assignment is according to the diagram on the installed relay

Safety Notes

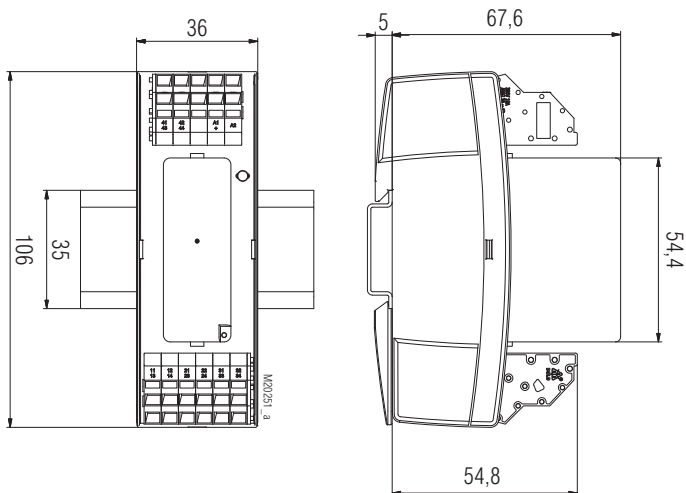
 **Dangerous voltage.**
Electric shock will result in death or serious injury.

 Disconnect all power supplies before servicing equipment.

 The installation must only be done by a qualified electrician!

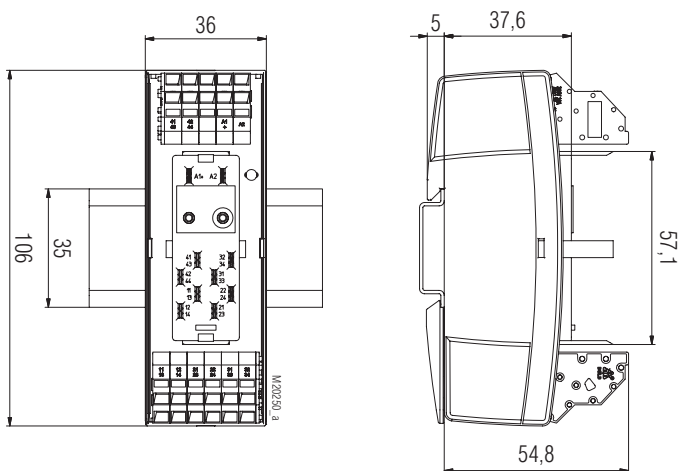
- Faults must only be removed when the relay is disconnected.
- The user has to make sure that the device and corresponding components are installed and wired according to the local rules and law (TUEV, VDE, Health and safety)
- Installation work must only be done when power is disconnected.

Dimensions with safety relay



HL 3094N.__C

Dimensions with plug in socket



HL 3094NC

EMC-Testing of HL 3094N according to EN 50155 Rev 19/01/28

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	"1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm"	B	EN 61000-4-5	"1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm"	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	"B" effect on unit allowed during test but unit must not be affected thereafter
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 2,1Hz-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	
				EN 55011	230MHz to 1GHZ	Limit value class B, 37dBµV quasi-peak at 10m distance	

Voltage-Testing of HL 3094 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		DIN VDE 0435 part 2021	for 1 min	
		500V at < DC72Vor AC 50V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300 V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed

SAFEMASTER
Interface Module
HC 3096N, HL 3096N



0270831



Your Advantages

- Simple contact extension and re-inforcement also of safety modules
- Cost and space saving alternative compared to contactors
- Simple contact monitoring via forcibly guided NC contact
- large wire cross section 0.5 - 2.5 mm² (12-24 AWG) reduces thermal load on wires

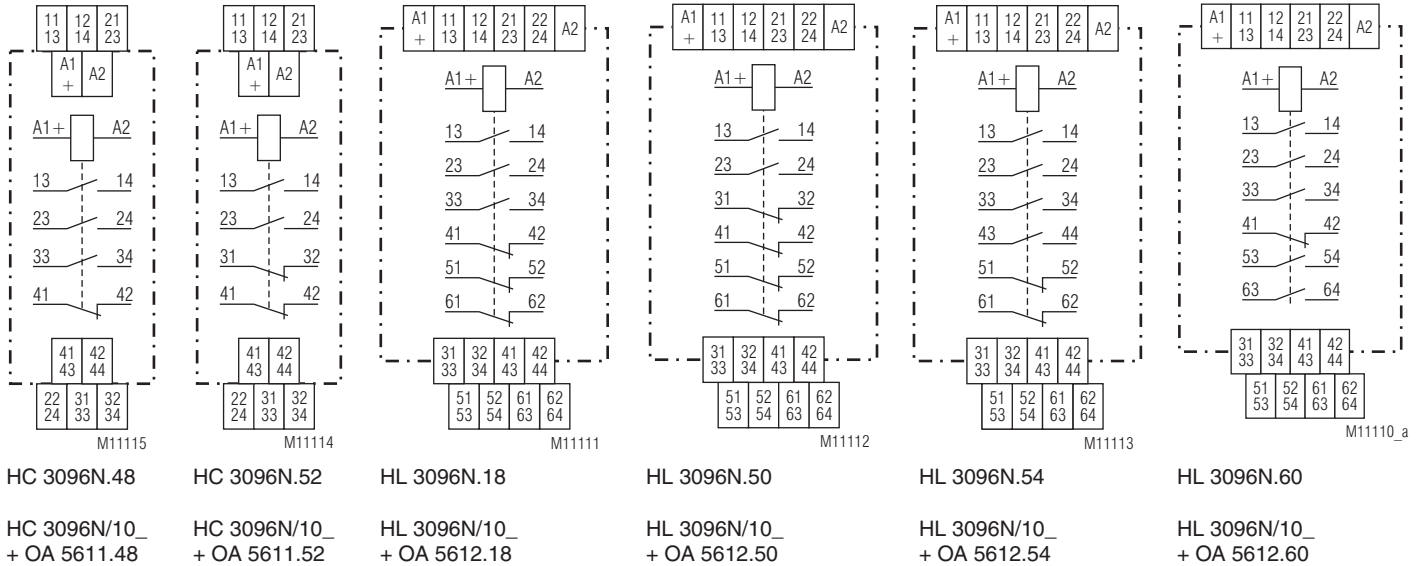
Features

- According to DIN EN 61810-1, IEC 60664-1, IEC/EN 60 947-5-1
- With forcibly guided contacts according to IEC 61810-3
- Models with soldered in or plug-in PCB safety relay consisting of:
 - plug in socket HC 3096N and safety relay OA 5611
 - plug in socket HL 3096N and safety relay OA 5612
- With polarity protected diode
- Optionally with free-wheeling diode across A1+ and A2
- Optionally AgNi + 0,2 µm Au or AgNi + 5 µm Au
- For DIN rail mounting according IEC/EN 60715
- HC 3096N:width 18 mm
- HL 3096N: width 36 mm

Approvals and Markings



Circuit Diagrams



Connection Terminals

Terminal designation	Signal designation
A1+	L / +
A2	N / -
41, 42 / 61, 62	NC contact
All other contacts see relevant circuit diagram	NC contacts / or NO contacts

Technical Data

Input

Nominal voltage U_N:	DC 24, 60, 110 V other voltages on request
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption	
HC 3096N:	0.6 W
HL 3096N:	0.8 W
HL 3096N.50:	1.0 W

Output

Contacts:	
HC 3096N.52, OA 5611.52:	2 NO and 2 NC contacts
HC 3096N.48, OA 5611.48:	3 NO and 1 NC contacts
HL 3096N.18, OA 5612.18:	3 NO and 3 NC contacts
HL 3096N.50, OA 5612.50:	2 NO and 4 NC contacts
HL 3096N.54, OA 5612.54:	4 NO and 2 NC contacts
HL 3096N.60, OA 5612.60:	5 NO and 1 NC contacts
Contact material:	AgNi + 0,2 μ m Au, AgNi + 5 μ m Au other on request

Contact type:	spring contact
Operate time:	typical 20 ms
Release time:	typical 6 ms
Measured nominal voltage:	AC 250 V

Thermal current I_{th}

HC 3096N:	3 x 5 A
HL 3096N:	4 x 5 A

Switching capacity

to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
according to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	
NC contact:	4 A / 24 V at 0.1 Hz	

Electrical life

HC 3096N	
to AC 230 V / 5 A $\cos\phi = 1$:	$\geq 2 \times 10^5$ switching cycles
HL 3096N	
at DC 24 V / 5 A ohmic:	$\geq 2 \times 10^5$ switching cycles

Permissible switching

frequency:	10 switching cycles / s
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Short circuit strength

max. fuse rating:	6 A gG / gL	IEC/EN 60 947-5-1
--------------------------	-------------	-------------------

Mechanical life:	$\geq 50 \times 10^5$ switching cycles
-------------------------	--

General Data

Operating mode:	Continuous operation
------------------------	----------------------

Temperature range:

Operation:	- 40 ... + 55 °C
Storage:	- 25 ... + 70 °C

Relative air humidity:	93 % at 40 °C
-------------------------------	---------------

Altitude:	< 2.000 m
------------------	-----------

Clearance and creepage distances

rated impulse voltage /
pollution degree

Input / output		
HC devices:	6 kV / 2	IEC 60 664-1
HL devices:	4 kV / 2	IEC 60 664-1

output / output:	4 kV / 2	IEC 60 664-1
------------------	----------	--------------

Overvoltage category:	III
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Insulation test voltage, type test:	2,5 kV; 1 min
--	---------------

EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2

HF-irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz:	10 V / m	IEC/EN 61 000-4-3

Fast transient:	4 kV	IEC/EN 61 000-4-4
-----------------	------	-------------------

Surge voltages		
between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6

Interference suppression:	Limit value class B	EN 55 011
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Technical Data

Degree of protection

Housing:	IP 40	IEC/EN 60 529
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Terminals:	IP 20	IEC/EN 60 529
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Housing:	Thermoplastic
-----------------	---------------

Vibration resistance:	Amplitude 0.35 mm
------------------------------	-------------------

	Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
--	---

	Humid heat IEC/EN 60 068-2-30
--	-------------------------------

Climate resistance:	
----------------------------	--

Terminal designation:	EN 50 005
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Wire connection:	0.5 ... 2,5 mm ² solid
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	0.5 ... 2,5 mm ² flexible
--	--------------------------------------

	Captive slotted screw
--	-----------------------

Wire fixing:	
---------------------	--

Fixing torque:	0,5 Nm
-----------------------	--------

Mounting:	DIN rail	IEC/EN 60 715
------------------	----------	---------------

Weight	
---------------	--

HC 3096N:	approx. 71 g
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HL 3096N:	approx. 90 g
-----------	--------------

Dimensions

Width x height x depth

HC 3096N:	18 x 106 x 65 mm
-----------	------------------

HL 3096N:	36 x 106 x 65 mm
-----------	------------------

UL Data

Nominal voltage U_N:	DC 6 ... 110 V
--	----------------

Switching capacity:

Ambient temperature 60 °C:	Pilot duty B300
	5 A 250Vac G. P.
	5 A 24Vdc
	0.4 A 250Vac resistive

Wire connection:	60°C / 75°C copper conductors only AWG 24 - 12 torque value 4.4 lb-in
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Technical data that is not stated in the UL-Data, can be found in the technical data section.

Classification to DIN EN 50155

Vibration and

shock resistance:	Category 1, Class B	IEC/EN 61 373
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Ambient temperature:	T1, T2, T3 and TX compliant
-----------------------------	-----------------------------

Voltage range:	0.7 ... 1.25 U_N with operational limitations
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Protective coating of the PCB:	No
---------------------------------------	----

Standard Types

HC 3096N.48/400 DC 24 V	
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Article number:	0066000
-----------------	---------

- 3 NO, 1 NC contact
- AgNi + 0.2 μ m Au
- Width: 18 mm

HL 3096N.54/400 DC 24 V	
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Artikelnummer:	0066040
----------------	---------

- 4 NO, 2 NC contact
- AgNi + 0.2 μ m Au
- Width: 36 mm

Ordering Example

H_3096N. / /61 DC 24 V	
	Nominal voltage
	with UL approval
	0: Ag Ni
	1: AgNi + 5 μ m Au
	0: Standard
	4: with LED
	9: with free-wheeling diode and LED
	Contacts
	C: 4 Contacts; width: 18 mm
	L: 6 Contacts; width: 36 mm

Variants

Plug in socket
H_ 3096N /102: Plug in socket with free-wheeling diode and LED
H_ 3096N /103: Plug in socket with LED

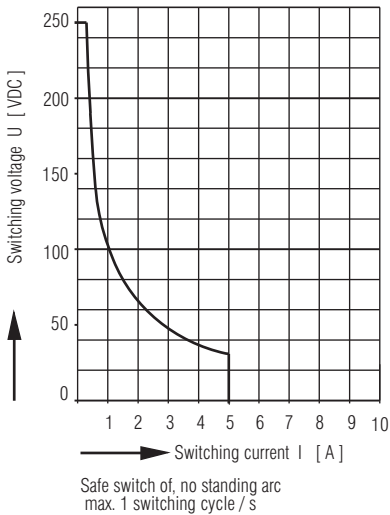
further variants on request

Ordering example for variants

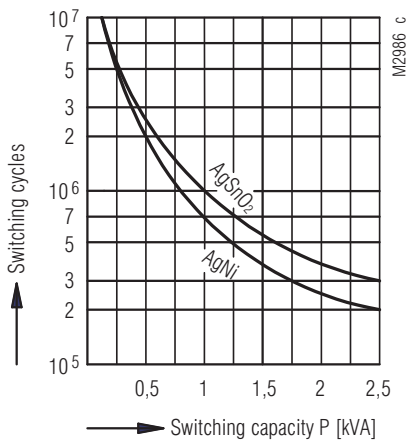
H_ 3096N / 10 _ /61 DC 24 V

Nominal voltage
with UL-approval
2: Plug in socket with free-wheeling diode and LED
3: Plug in socket with LED
0: Standard
1: Plug in socket
C: 4 Contacts; width: 18 mm
L: 6 Contacts; width: 36 mm

Characteristic



Arc limit curve under resistive load



Contact service life

Connection example for HC 3096N/10_/61

Relay: OA 5611.52 ≅ 2 NO contacts and 2 NC contacts (Standard)

Terminal	Contact	Contact-type	Connection
11, 13, 12, 14	1	NO contact	13, 14
21, 23, 22, 24	2	NO contact	23, 24
41, 43, 42, 44	3	NC contact	31, 32
31, 33, 32, 34	4	NC contact	41, 42

The terminal assignment is according to the diagram on the installed relay

Connection example for HC 3096N/10_/61

Relay: OA 5612.18 ≅ 3 NO contacts and 3 NC contacts (Standard)

Terminal	Contact	Contact-type	Connection
11, 13, 12, 14	1	NO contact	13, 14
41, 43, 42, 44	2	NO contact	23, 24
31, 33, 32, 34	3	NO contact	33, 34
51, 53, 52, 54	4	NC contact	41, 42
61, 63, 62, 64	5	NC contact	51, 52
	6	NC contact	61, 62

The terminal assignment is according to the diagram on the installed relay

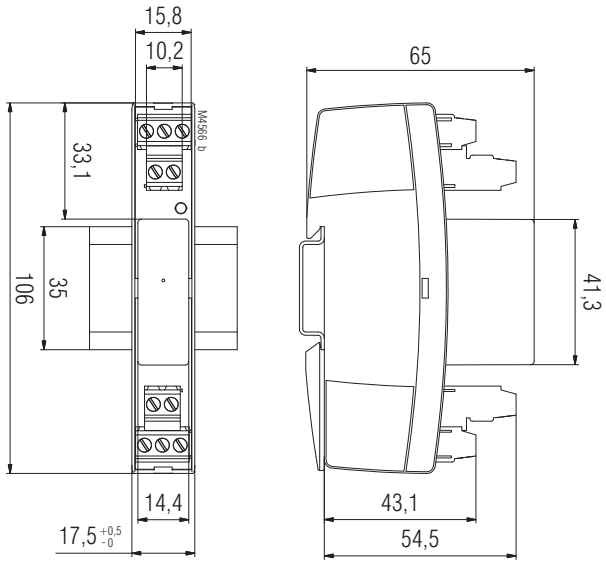
Safety Notes

Dangerous voltage.
Electric shock will result in death or serious injury.

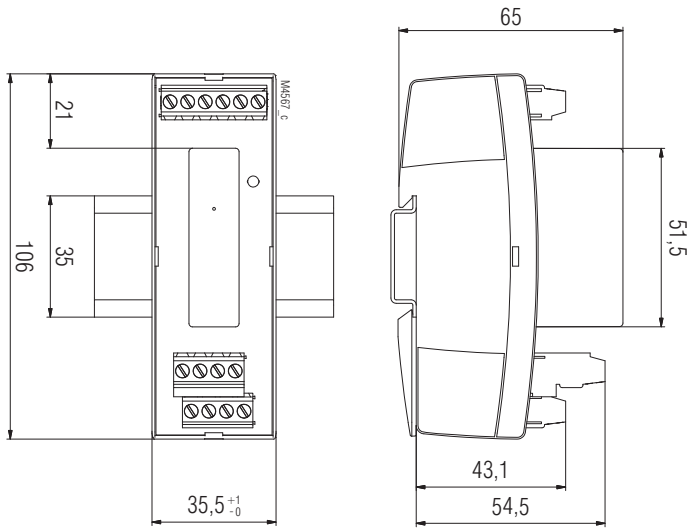
Disconnect all power supplies before servicing equipment.

- Faults must only be removed when the relay is disconnected
- The user has to make sure that the device and corresponding components are installed and wired according to the local rules and law (TUEV, VDE, Health and safety).
- Installation work must only be done when power is disconnected.

Dimensions with safety relay

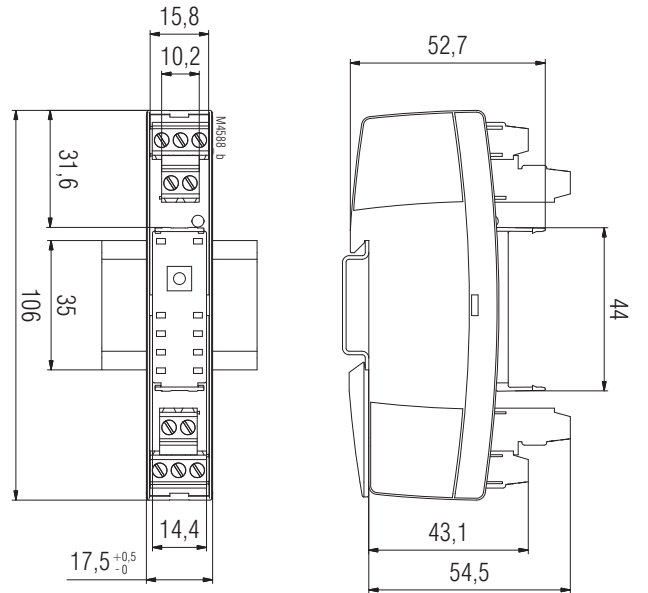


HC 3096N

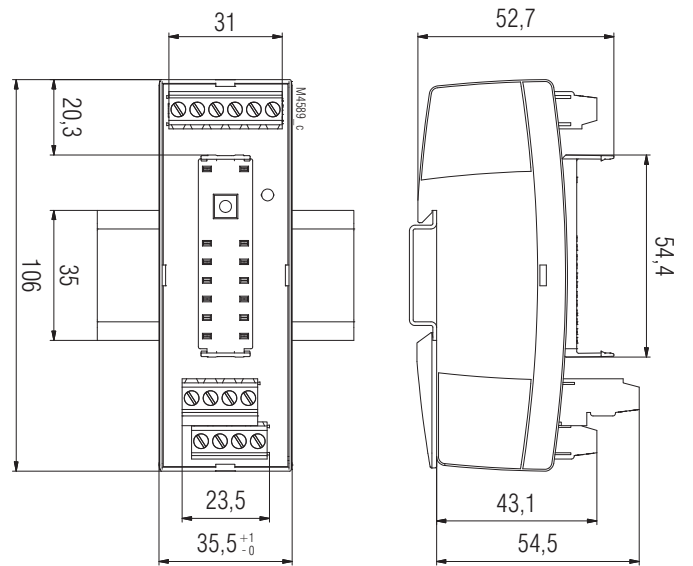


HL 3096N

Dimensions with plug in socket



HC 3096N



HL 3096N

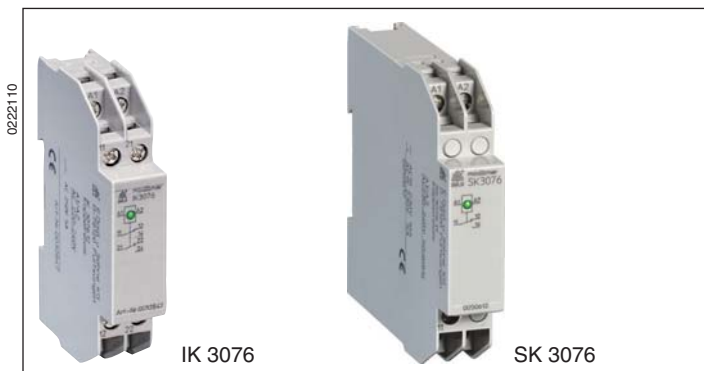
EMC-Testing of HC/HL 3096N according to EN 50155 Rev 14/10/2016

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	4kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	20 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	10 V/m 1GHZ-2,7GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	10 V/m 1GHZ-2,7GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	Limit value class B	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B	
	EN50155part 12.2.8.2- EN50121-3-2 table 6 EN 55011	230MHz to 1GHZ	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B	
				EN 55011	230MHz to 1GHZ	Limit value class B	

Voltage-Testing of HC 3096 according to EN 50155

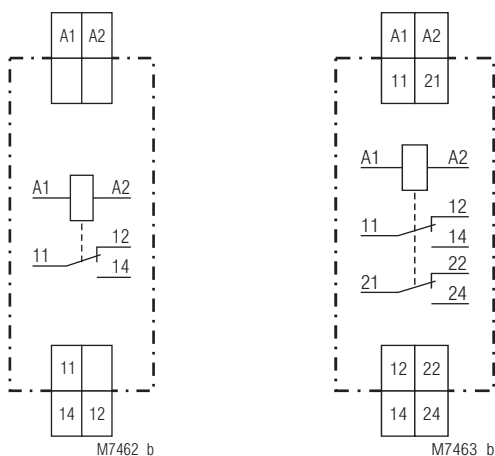
	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		DIN VDE 0435 part 2021	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed

Interface Relay Input Interface Relay - Output Interface Relay IK 3076, SK 3076



- According to IEC/EN 60 255, IEC/EN 61 810-1
- Protective separation according to IEC/EN 61 140, IEC/EN 60 947-1 in configuration with 1 changeover contact
- With input wiring protection against voltage surges
- High permanent current I_{th}
- LED indicator
- As option with 1 or 2 changeover contacts
- As option for switching low loads
- Devices available in 2 enclosure versions:
 - IK 3076: depth 59 mm with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
 - SK 3076: depth 98 mm with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Circuit Diagrams



IK 3076.11
SK 3076.11

IK 3076.12
SK 3076.12

Connection Terminals

Terminal designation	Signal designation
A1	L / +
A2	N / -
11, 12, 14 21, 22, 24	Changeover contacts

Approvals and Markings



Applications

- Link between the control and power levels
- For separating potentials
- For industrial and railway applications

Indicator

LED: on when the relay is supplied with current

Technical Data

Input

Nominal voltage U_N : AC/DC 8, 12, 24, 48 V
AC 110 ... 130, 230 ... 240 V

Voltage range: 0.8 ... 1.1 U_N
0.9 ... 1.25 U_N in battery operating mode

Nominal consumption: DC 24 V AC 230 V
0.5 W 0.8 VA

Nominal frequency: 50 / 60 Hz

Frequency range: $\pm 5\%$

Output

Contacts
IK 3076.11, SK 3076.11: 1 changeover contact
IK 3076.12, SK 3076.12: 2 changeover contacts

Operate/release time: < 10 ms / < 20 ms

Thermal current I_{th}
IK 3076.11, SK 3076.11: 10 A
IK 3076.12, SK 3076.12: 5 A

Switching capacity
to AC 15:
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
to DC 13:
NC contact: 1 A / DC 24 V IEC/EN 60 947-5-1
NO contact: 1 A / DC 24 V IEC/EN 60 947-5-1

Electrical life
AC 15 at 3 A, AC 230 V IEC/EN 60 947-5-1
IK 3076.11, SK 3076.11: 1 x 10⁵ switching cycles
IK 3076.12, SK 3076.12: 1 x 10⁵ switching cycles

Permissible switching frequency: 6 000 switching cycles/h

Short circuit strength max. fuse rating
IK 3076.11, SK 3076.11: 10 A gL IEC/EN 60 947-5-1
IK 3076.12, SK 3076.12: 4 A gL IEC/EN 60 947-5-1

Mechanical life: > 30 x 10⁶ switching cycles

Technical Data

General Data

Operating mode: Continuous operation

Temperature range

Operation: - 20 ... + 60 °C

Storage: - 40 ... + 80 °C

Altitude: < 2.000 m

Clearance and creepage distances

rated impulse voltage/

pollution degree:

IK 3076.11, SK 3076.11:

Input/output: 6 kV / 2 IEC 60 664-1

IK 3076.12, SK 3076.12:

Input/output: 4 kV / 2 IEC 60 664-1

Contacts: 2.5 kV / 2 IEC 60 664-1

only for 1-phase systems
(same phase)

EMC

Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2

HF irradiation

80 MHz ... 1 GHz: 10 V/m IEC/EN 61 000-4-3

1 GHz ... 2.5 GHz: 3 V/m IEC/EN 61 000-4-3

2.5 GHz ... 2.7 GHz: 1 V/m IEC/EN 61 000-4-3

Fast transients: 2 kV IEC/EN 61 000-4-4

Surge voltages

between

wires for power supply: 1 kV IEC/EN 61 000-4-5

between wire and ground: 2 kV IEC/EN 61 000-4-5

HF-wire guided: 10 V IEC/EN 61 000-5-6

Interference suppression: Limit value class B EN 55011

Degree of protection

Housing: IP 40 IEC/EN 60 529

Terminals: IP 20 IEC/EN 60 529

Housing:

Thermoplastic with V0 behaviour
according to UL Subject 94

Vibration resistance:

Amplitude 0.35 mm
frequency 10 ... 55 Hz IEC/EN 60 068-2-6

Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1

Terminal designation: EN 50 005

Wire connection

Cross section:

2 x 2.5 mm² solid or
2 x 1.5 mm² stranded ferruled
DIN 46 228-1/-2/-3/-4

Stripping length:

10 mm

Wire fixing:

Flat terminals with self-lifting
clamping piece IEC/EN 60 999-1

Fixing torque:

0.8 Nm

Mounting:

DIN rail mounting (IEC/EN 60715) or
screw mounting M4, 90 mm hole pattern,
with additional clip available as accessory

Weight

IK 3076: 72 g

SK 3076: 91 g

Dimensions

Width x height x depth

IK 3076: 17.5 x 89 x 59 mm

SK 3076: 17.5 x 90 x 98 mm

Standard Types

IK 3076.12 AC/DC 24 V 50/60 Hz

Article number: 0033445

SK 3076.12 AC/DC 24 V 50/60 Hz

Article-number: 0054988

• Output: 2 changeover contacts

• Nominal voltage U_N : AC/DC 24 V

• Width: 17.5 mm

Accessories

ET 4086-0-2: Additional clip for screw mounting
Article number: 0046578

Variants

IK 3076._./004,
SK 3076._./004: for low loads of 0.1 ... 60 V,
1 mA ... 300 mA

IK 3076._./007,
SK 3076._./007: safe release voltage
approx. 27 % of U_N

Ordering example for variants

IK 3076 .12 / - AC/DC 48 V 50 / 60 Hz

— Nominal frequency
— Nominal voltage
— Variant, if required
— Contacts
— Type

Classification to DIN EN 50155 for IK 3076

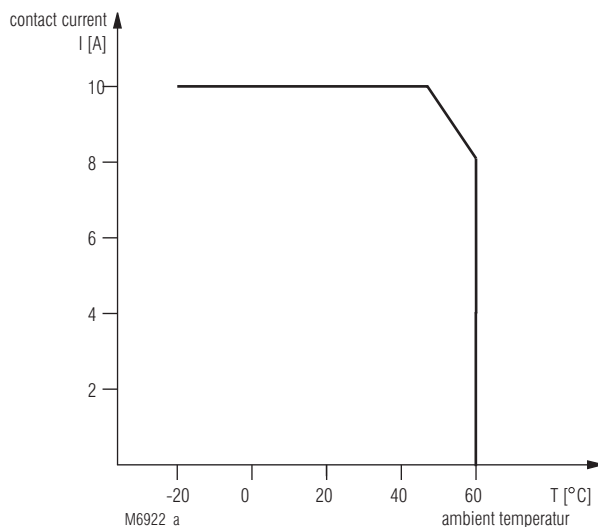
Vibration and

shock resistance: Category 1, Class B IEC/EN 61 373

Ambient temperature: T1 compliant
T2, T3, TX with operational limitations

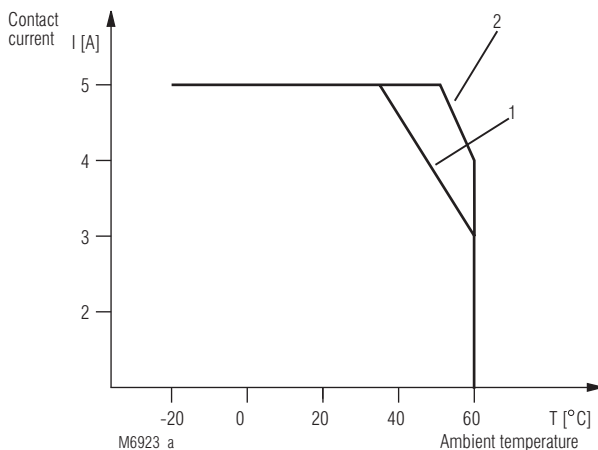
Protective coating of the PCB: No

Characteristics



Permanent current limit curve:

Permissible contact current of IK 3076.11, SK 3076.11 in relation to the ambient temperature



Permanent current limit curve:

Permissible contact current of IK 3076.12, SK 3076.12 in relation to the ambient temperature

- 1 Nominal voltage, mounted without distance, current supplied to both contacts
- 2 Nominal voltage, mounted without distance, current only supplied to one contact

EMC-Testing of IK 3076 according to EN 50155 Rev 14/10/2016

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A , (2) = B	Remarks
Surge	EN50155part 12.2.7.1-EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
	EN50155part 12.2.7.2-EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Electrostatic discharge	EN50155part 12.2.7.3-EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
	EN50155part 12.2.8.1-EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz-80MHz Source impedance 150 Ohm	A (1)	"B" effect on unit allowed during test but unit must not be affected thereafter
RF immunity	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
RF emission	EN50155part 12.2.8.1-EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	3 V/m 1GHZ-2,5GHZ	A (1)	
	EN50155part 12.2.8.2-EN50121-3-2 table 4+5 EN 55011	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	3 V/m 1GHZ-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 12.2.8.2-EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
		30MHz to 230MHz	< 40 dBµV/m quasi-peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
	EN50155part 12.2.8.2-EN50121-3-2 table 6 EN 55011	230MHz to 1GHz	< 47 dBµV/m quasi-peak at 10m distance	EN 55011	30MHz to 230MHz	Limit value class B, 30dBµV quasi-peak at 10m distance	

Voltage-Testing of IK 3076 according to EN 50155

	Test Standard	Severity	Performance	DoId Type test	Severity	Performance
High Voltage test	EN 50155 part 12.2.9.2	for 1 min		DIN VDE 0435 part 2021	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	DIN VDE 0435 part 2021	2.5 kV at rated voltage 300V	No flashover allowed



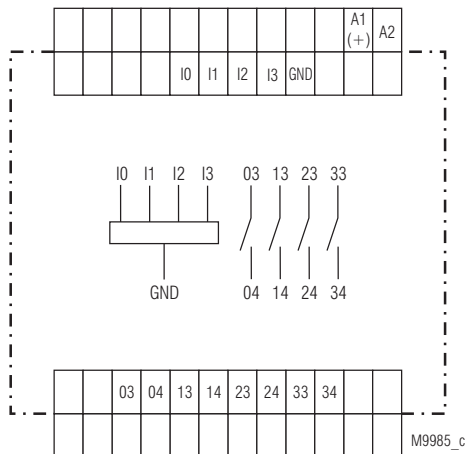
Your Advantage

- Easy remote control of unit via mobile phone
- Easy configuration of unit via mobile phone
- SMS-status request of all i/p's - and o/p's via configurable shortcuts
- SMS text messages via customers SIM card
- Cyclic SMS message with configurable time interval (watchdog function)

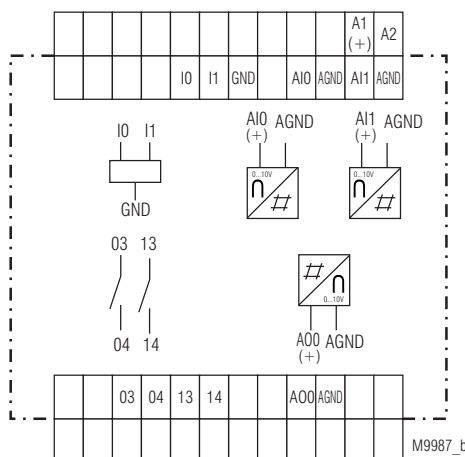
Features

- According to directive 1999/5/EC (RTTE) for radio equipment and telecommunications terminal equipment
- 4 digital inputs and 4 relay outputs
- Variant RP 5812/001 with 2 digital and 2 analogue inputs and 1 analogue - and 2 relay outputs
- Auxiliary voltage DC 24 V
- DC 24 V digital inputs
- Automatic SMS messages for status changes
- Quad-Band GSM-Module for 850, 900, 1800 and 1900 MHz (GSM = Global System for Mobile)
- Pin protection of SIM card
- Caller password protection against unauthorised access
- User Dialogue language for: German, English or French
- Configurable authorization levels for up to 16 users
- Assignment of different I/O's to different users
- Automatic sending of SMS when digital inputs change state i.e. come on or go off or both (on rising edge or falling edge)
- Automatic sending of SMS when analogue inputs
 - exceed preset lower and upper limits or
 - when signal is within the preset window
 - and when the signal returns to good state
- Adjustable
 - Hysteresis for analogue inputs
 - Time delay for each input
 - Repeat time for SMS-transmitting
 - Time delay for output status after starting the unit
 - Time delay for activation of the output
- SMS for device status to the system administrators
- SMS-counter to monitor the remaining account
- No interruption of operation after Voltage failure due to integrated Li-Ion battery backup 24Hours
- Compact width: 70 mm

Circuit Diagrams



RP 5812S, RP 5812PS, RP 5812PC



RP 5812S/001, RP 5812PS/001, RP 5812PC/001

Approvals and Markings



Application

- Remote monitoring control and operation of
 - Machinery and installations for industry and building automation.
 - Small power plants
 - Remote buildings
 - Unmanned production plants
 - Air-conditioning and refrigeration systems
 - Heating systems
 - Elevators and escalators
 - Alarm systems, burglar alarms
 - Smoke, fire and gas warning systems
 - Doors, gates and windows
 - Flood warning systems
- Level alarm in pumping stations
- Remote shut down of rental equipment when payment overdue
- Level monitoring in silos, tanks, etc.

Indication

green LED „U _H “:	on when supply connected
yellow LED „GSM“ off:	SMS-Telecontrol module is off
flashes 600ms on / 600 ms off:	SMS-Telecontrol module searches for available network and logs on
flashes 75ms on / 3s off:	SMS-Telecontrol module is registered on GSM network.
on:	Data transmission in GSM network is taking place
yellow LED „Status“ off:	Configuration correct, SMS-Telecontrol module is working correctly
flashes:	Indication of failure code, see table “Fault indication by flashing code”
on:	SMS transmission take place

Settings



Safety remarks

- The SMS-Telecontrol module must not be used for safety relevant control functions due to signal availability.
- The use of the SMS-Telecontrol module in medical rooms must be evaluated thoroughly as medical equipment such as pacemakers etc may react to the radiofrequency of the SMS-Telecontrol module. Also be aware that the radio frequency of the SMS-Telecontrol module may disturb the function of insufficiently protected PCs, monitors and other electronic equipment.
- Delays in the transmission of I/O status may take place due to network problems.

General settings

- If the SMS-Telecontrol module is disconnected for a long period, (e.g. as when delivered) the battery must be charged. To do this the SMS-Telecontrol module needs to be connected to the supply Voltage for up to 6 h. Only after this time is correct operation is possible.



Attention

On delivery the battery is disconnected. Before the batteries can be charged the connection has to be made by changing the slide switch at the bottom edge of the unit to the ON position.

- On first activation a SIM card with a pin code of 1234 has to be inserted. This pin can then be changed by an SMS command. After pin change only the SIM card with the changed pin can to be used. If the pin number on the SIM card is different to the one in the configuration the SIM card may be locked when connecting to the GSM network. A locked SIM card can be unlocked by placing it in a mobile Phone and entering the PUK or Master pin.
- If the Reset/Default Konf. button on the front of the unit is pressed for 3-4 seconds while the unit is powered up, the SMS-Telecontrol module is reset. This means, that the any connection to an SMS network is disconnected and reconnected. If the reset button is pressed for more than 5 sec the configuration is reset to default and the unit makes a factory reset.
- Due to the internal battery back up, the function of the SMS-Telecontrol module is still available even if the power supply is disconnected for up to 24 hours.



Attention

It is your responsibility as an end user to dispose old batteries correctly. Of course, you may return replaced batteries to us.

Settings

Set up procedure of SMS-Telecontrol module

- Wire the i/p's- o/p's and the auxiliary supply connections
- Press the SIM eject button (use pen tip), insert the SIM-card with the Preconfigured pin 1234 into the SMS-Telecontrol module
- Power up the SMS-Telecontrol module
- Send the necessary configuration commands via text to the SMS-Telecontrol module (see manual)

Examples for configuration and communication of the SMS module via SMS:

Demand:

The SMS module located in the pump station, should be named “Pump station” and then answer with this name.

The following SMS is created and sent:

CFGDN\$Pump station#

Demand:

Input I0 shall send an SMS on the negative edge (turning off) of the input signal

The following SMS is created and sent:

DISEND\$0\$FE#

Demand:

Input I0 shall be named „ Pump“

The following SMS is created and sent:

DISYMB\$0\$Pump#

Demand:

The status „0“ of input I0 shall be named „ Pump stopped“

The following SMS is created and sent:

DITXTLO\$0\$Pump stopped#

An SMS is generated and sent by the SMS module caused by a defective Pump, it appears as follows:

Answer: „Pump station:Pump stopped“

Demand:

The current status of the (2 or 4) digital inputs can be called up.

The following SMS is created and sent:

?DIALL#

Answer: „Pump station:Pump stopped; Level to high“

and for the 2 analogue inputs:

and to call up the 2 analogue inputs if previously configured for level and motor temperature

?AIALL#

Answer: „Pump station: Level:180cm; pump temp: 85°C“

Safety notes

- It is important, that the connected voltage of the analogue inputs and the analogue outputs of the variant /001 are no larger than are specified in the Technical Data.



- The Li-Ion battery can not be changed by the user. Is there a need to replace the battery please send the device back to the manufacturer.
- Please note, before using, the other safety instructions of the manual INFOMASTER SMS-Telecontrol module RP 5812.

Technical Data

Input

Auxiliary Voltage A1-A2 (U_H): DC 24 V,

Nominal consumption A1-A2: max. 4.5 W at DC 24V

Inputs (digital)

RP 5812:

4 x i/p; I0 ... I3

DC 24 V with galvanic separation

RP 5812/001:

2 x i/p; I0 ... I1

DC 24 V with galvanic separation

Inputs (analogue)

RP 5812/001:

2 x i/p; AI0 ... AI1

DC 0 .. 10 V resolution 100 mV

Technical Data

Outputs

Contacts:

RP 5812: 4 N/O contacts
RP 5812/001: 2 N/O contacts

Thermal current I_{th} : 2A

Switching capacity to AC 15: IEC/EN 60947-5-1
3 A / AC 230 V (secondary voltage)

Electrical life

to AC15 at 1A / 230V: $\geq 1,5 \times 10^6$ switch. cycl. IEC/EN 60 947-5-1

Max. fuse rating: 4A gL IEC/EN 60947-5-1

Mechanical life: $\geq 30 \times 10^6$ switching cycles

Output (analogue)

RP 5812/001: AOO
DC 0..10V resolution 100 mV

GSM

Frequency band: 850 / 900 / 1800 / 1900 MHz
Power class: GSM 850 / 900 MHz: 4 (2 W)
GSM 1800 / 1900 MHz: 1 (1 W)
SIM-card: 1.8V and 3 V SIM cards are supported
Aerial jack: SMA (male)

General Data

Nominal operating mode: continuous operation

Temperature range: 0 ... + 40°C

Clearance and creepage distance:

Rated impulse Voltage /
pollution degree: 4 kV / 2 IEC 60 664-1

EMC

Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2

HF irradiation: 10 V / m IEC/EN 61 000-4-3

Fast transients: 2 kV IEC/EN 61 000-4-4

Surge

between
wires for power supply: 1 kV IEC/EN 61 000-4-5

wire and ground: 2 kV IEC/EN 61 000-4-5

Interference suppression: Limit value class B EN 55011

Degree of protection:

Housing, Cover IP 30 IEC/EN 60 529

Terminals IP 20 IEC/EN 60 529

Housing: thermoplastic with VO behaviour acc. to
UL subject 94

Vibration resistance: Amplitude 0,35 mm

Frequency 10 ... 55 Hz IEC/EN 60 068-2-6

00 / 040 / 04 IEC/EN 60 068-1

Terminal designation: EN 50 005

Wire connection: DIN 46 228/-1/-2/-3/-4

fixed screw terminal (S): 0,2 ... 4 mm² solid or

0,2 ... 1,5 mm² stranded wire with sleeve

plug in screw terminal (PS): 0,1 .. 2,5 mm² solid or

0,1 .. 1,5 mm² stranded wire with sleeve

plug in cage clamp terminals (PC): 0,2 .. 2,5 mm² solid or

0,2 .. 1,5 mm² stranded wire with sleeve

Wire fixing:

fixed screw terminal (S),

plug in screw terminal (PS): Captive plus-minus-terminal screws M2,5
with self raising terminal box

plug in cage clamp terminals (PC): spring terminal for direct

plug in of wires,

screw driver 0,6 x 3,5 for

spring releasing

Mounting: DIN rail IEC/EN 60175

Weight: 216 g

Dimensions

Width x height x depth: 70 x 95 x 80 mm

Standard Types

RP 5812S DC 24 V

Article number: 0065147

• Auxiliary Voltage U_H : DC 24 V

• Inputs: 4 digital inputs DC 24 V

• Outputs: 4 relay outputs N/O contacts

• Width: 70 mm

RP 5812S/001 DC 24 V

Article number: 0065148

• Auxiliary voltage U_H : DC 24 V

• Inputs: 2 digital inputs DC 24 V

2 analogue inputs 0 ... 10 V

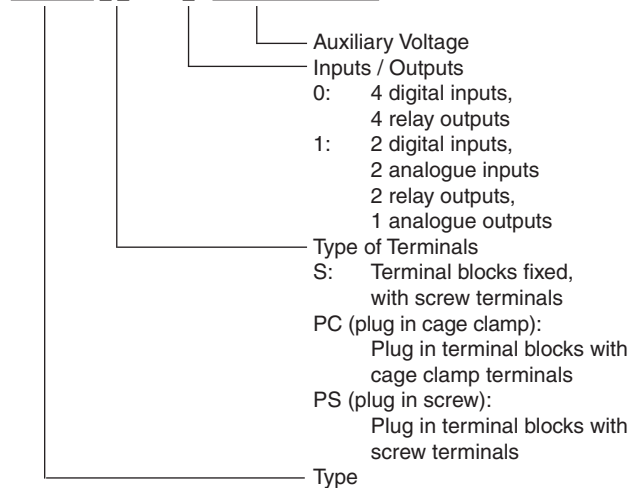
• Outputs: 2 relay outputs N/O contacts

1 analogue output 0 ... 10 V

• Width: 70 mm

Ordering Example

RP 5812 - - / 0 0 - AC/DC 19 ... 30 V



Accessories

OA 5810/900:	GSM-aerial, 90° angle Article number: 0062212
OA 5810/901:	GSM magnetic foot areal with 2,5 m connecting lead Article number: 0062213

Fault indicated by Flashing Code

The current state of the SMS-Telecontrol module is indicated by the flashing code on the status LED. The number of flashing pulses followed by a longer space relates to the failure code in the following table. After the longer space the flashing cycle is repeated until the state on the unit changes.

State LED	Description
OFF	No status for indication, normal operation
ON	SMS transmission
2 * flashes	Internal system failure, please contact the manufacturer
3 * flashes	Invalid configuration. When this failure occurs, the unit tries to reset the configuration to factory settings followed by a device test. If the failure remains, please contact manufacturer.
4 * flashes	No access on SIM-card Cause: no SIM-card inserted or invalid PIN for inserted SIM card
5 * flashes	No GSM network available Cause: insufficient radio signal, aerial placed in a poor location.
6 * flashes	In the configuration, the service centre for SMS transmission is not yet defined. Cause: The CFGINT command sequence SMS has not been sent to the module
7 * flashes	No administrator for using are defined. No user administrator is defined Cause: The CFGINT command sequence SMS has not been sent to the module

LEDs for each I/O on the front of the unit indicate the status of the in- and outputs.

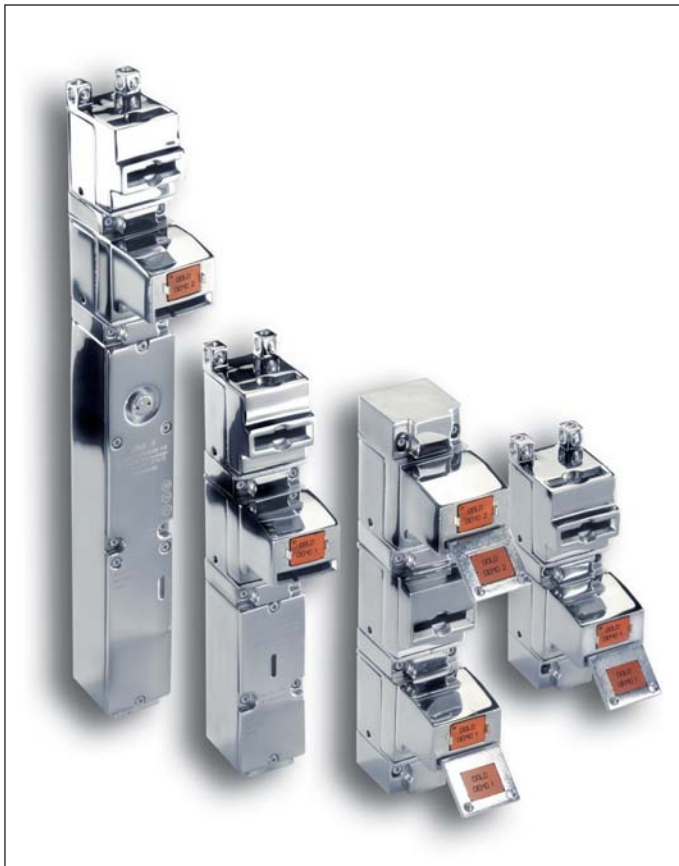
EMC-Testing of RP 5812 according to EN 50155 Rev. 14/10/16

EN 50155 Required tests	Test Standard	Severity	Performance	Dold Type test Test Standard	Severity	Performance () Dold criteria (1) = A, (2) = B	Remarks
Surge	EN50155part 12.2.7.1- EN50121-3-2 table 7	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 42 Ohm	B	EN 61000-4-5	1 kV line to line 2 kV line to ground 1.2/50µs source impedance 2 Ohm	A (1)	Dold test is more severe due to lower source impedance
Electrostatic discharge	EN50155part 12.2.7.2- EN50121-3-2 table 9 EN 61000-4-2	6kV contact discharge 8kV air discharge	B	EN 61000-4-2	8kV air discharge	A (1)	6kV contact discharge N/A due to plastic enclosure
Fast Transients	EN50155part 12.2.7.3- EN50121-3-2 table 7+8 EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A	EN 61000-4-4	2kV 5/50ns Tr/Th 5kHz rep frequency	A (1)	Note: "A" to have no effect unit during or after test
RF immunity	EN50155part 12.2.8.1- EN50121-3-2 table 7+8 EN 61000-4-6	3Vrms 150kHz-80MHz Source impedance 150 Ohm	A	EN 61000-4-6	10Vrms 150kHz- 80MHz Source impedance 150 Ohm	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20/10 V/m 80MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	20 V/m 800MHz-1GHZ	A	EN 61000-4-3	10 V/m 80MHz-1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	10 V/m 1,4GHZ-2,1GHZ	A	EN 61000-4-3	3 V/m 1,4GHZ- 2,1GHZ	A (1)	
	EN50155part 12.2.8.1- EN50121-3-2 table 9 EN 61000-4-3	5 V/m 2,1Hz-2,5GHZ	A	EN 61000-4-3	3 V/m 2,1Hz-2,5GHZ	A (1)	
RF emission	Test Standard	Frequency range	Limits	Dold Type test Test Standard	Frequency range	Limits	Remarks
	EN50155part 10.2.8.2- EN50121-3-2 table 4+5 EN 55011	9kHz to 150kHz	No limits	EN 55011	9kHz to 150kHz	No limits	
		150kHz to 500kHz	< 99dBµV quasi-peak	EN 55011	150kHz to 500kHz	Limit value class B, 65-56dBµV quasi-peak	
		500kHz to 30MHz	< 93dBµV quasi-peak	EN 55011	500kHz to 5MHz	Limit value class B, 56dBµV quasi-peak	
	EN50155part 10.2.8.2- EN50121-3-2 table 6 EN 55011	30MHz to 230MHz	< 40 dBµV/m quasi- peak at 10m distance	EN 55011	5MHz to 30MHz	Limit value class B, 60dBµV quasi-peak	
		230MHz to 1GHz	< 47 dBµV/m quasi- peak at 10m distance	EN 55011	30MHz to 230MHz	to be tested externally	
				EN 55011	230MHz to 1GHz	to be tested externally	

Voltage-Testing of RP 5812 according to EN 50155

	Test Standard	Severity	Performance	Dold Type test	Severity	Performance
High Voltage test	EN 50155 part 10.2.9.2	for 1 min		IEC 60-1	for 1 min	
		500V at < DC72V or AC 50V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1000V at DC72 to 125V or AC 50 to 90V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed
		1500V at DC125 to 315V or AC 90 to 225V	No flashover allowed	IEC 60-1	2.5 kV at rated voltage 300V	No flashover allowed

SAFEMASTER STS Safety switch- and key interlock system System overview



Your advantages

Cost Saving:

- Reduced wiring
- Cost saving simple installation
- Mechanical (part) solutions save wiring cost in ATEX areas

Robust Design:

- Stainless steel
- All modules of one unit can be mounted separate
- For harsh ambient conditions, e. g. vibration, extreme temperature, dust, moisture, dirt

Optimised Ergonomics:

- Key and actuator modules can be mounted in 4 directions
- Plug-in keys for fast and easy operation

High Flexibility:

- Very flexible in concept, optimum adaptation to your process
- Easy to redesign when expanding systems
- Can be used for many applications, e. g. valves, gates, covers

Functionality and Safety:

- Protects against being locked in
- Over 46000 key codes

Approvals and marking



Additional information about this topic

- Datasheets, short description and system description about SAFEMASTER STS products on request, you will find also information on Dold-Portal on www.dold.com or at PRODUCTS & SERVICES → Safety switch and trappedkey interlock system

Applications

Safety should not be difficult. The SAFEMASTER STS has been developed to offer efficient operation and optimum protection for dangerous areas protected by fences with gates access to the operator. In addition it protects against being locked inside the dangerous area during repair and maintenance.

The Idea

The safety concept adapts to specific customer demands with respect to the individual processes and not vice versa. Therefore it can be used in nearly all applications using safety fences and covers that are operated in rugged ambient conditions.

The Solution

SAFEMASTER STS is a modular, most flexible system solution of safety switches, interlocks and trapped key system combining the advantages of all 3 systems: the mechanical units can be integrated without wiring into the machine and plant concept and provide a cost effective protection solution for large applications to secure maintenance gates. It is also suitable for ATEX and high temperature applications. Electromechanical units are used to enable mechanical units and to protect frequently used entry points. In conjunction with safety controllers (e.g. SAFEMASTER series) dangerous movements are stopped when the gate to a dangerous area is opened, or the gate access is only enabled after the dangerous movement is stopped. The 46000 different key codes allow a forced or partly forced access sequence.

The Components

The modular design of SAFEMASTER STS allows individual adaptation to the actual application. Using only few different basic modules a great number of functional units can be built by joining them via bayonet junctions. The function of a unit is dependant on the type of module and the mounting position. The combinations of the different units define the function of the complete safety system.



Coded Key



Actuator module
B, D, K, E



Actuator module A



Key module
10, 10 S



Key module
01, 01S R1



Pad-lock module
V, W



Bayonet ring



End module M



Standard actuator



C-actuator



CS-actuator



J-actuator



Locking module
Z, Y



Switch module
S, R

The System

The SAFEMASTER STS system offers far more than just the combination of safety switches and a key interlock system. It adds the advantages of both systems by the interconnection of wireless mechanical components and electrical protection. It is very flexible and can be easily adapted to the requirements of the user.

The system offers maximum safety and respects the requirements of the user concerning robustness, long life and user ergonomics. Special features are stainless steel units with ergonomic linear keys. It is flexible, can be easily extended and guarantees a safe and interruption free process, offering an intelligent and cost saving solution for industrial applications of all kinds.

With only a few single components, a number of individual interlock units can be assembled. The stainless steel units guarantee good stability. Extensive equipment allows a simple mounting.

- 1 End module M
- 2 Actuator module B
- 3 Padlock module
- 4 Actuator module A
- 5 Bayonet ring
- 6 Key module
- 7 Switch modul
- 8 Solenoid locking module



Example: SX01A:

Accessories (without picture):

- Mounting plate to install an STS-unit
- Mounting plate to install an STS-CS-actuator
- Mounting frame to install an STS unit into an operating panel

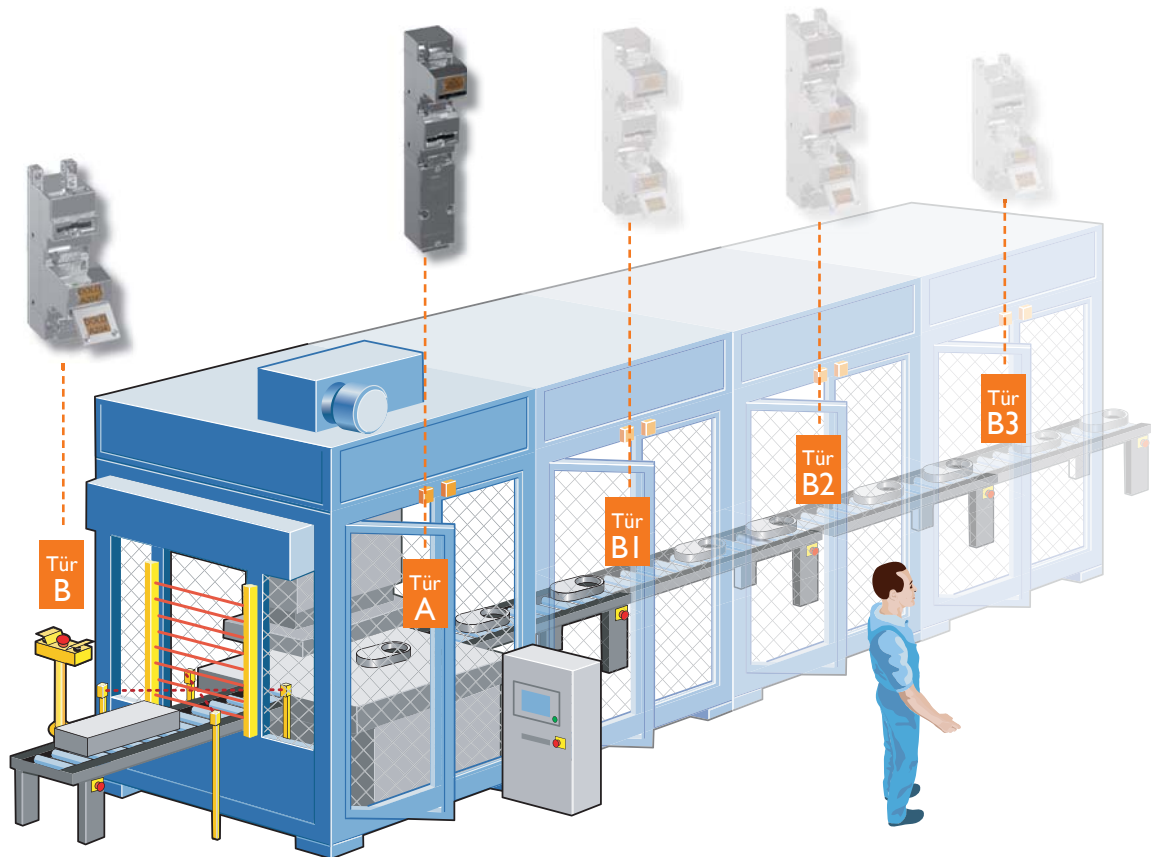
Example

The SAFEMASTER STS Program consists of modules that can be individually combined and adapted to your application. They combine the advantages of safety switches, interlocks and key transfer in one system.

The modular design allows systems to be assembled out of several units, or to modify and expand existing systems as required. All mechanical interlocks can be utilised in machine and plant concepts without wiring. They provide an economic and reliable protection in wide applications.

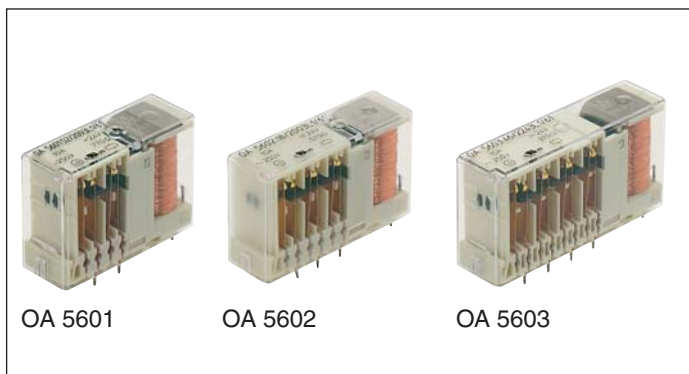
The picture shows a press with several access gates. When opening the main entry gate A during operation, the machine stops immediately. To open the maintenance gates B the following sequence has to be followed: Open gate A, take out coded key, insert key in gate B, open gate B. After reversing the procedure the production may be started again.

Advantage: The maintenance gates are made safe without wiring.



Safety relays

OA 5601, OA 5602, OA 5603



- According to DIN EN 61810-1, DIN EN 61810-3
- With forcibly guided contacts
- High switching reliability due to crown contacts
- Clearance and creepage distances:
contact - coil ≥ 8 mm
contact - contact ≥ 5.5 mm
- **Double and reinforced insulation with pollution degree 2**
- Overvoltage category: III
- High voltage resistance ≥ 4 kV
- High mechanical service life
- High temperature range
at OA 5601 and OA 5602: $-40 \dots +85^\circ\text{C}$
at OA 5603: $-40 \dots +75^\circ\text{C}$
- High continuous thermal current $I_{th} = 10$ A
- High voltage range $0.7 \dots 1.6 U_N$
- As option wash proof RT III

Application

- To be used in circuits for safety applications
- Escalators and walkways
- Elevators for men and load
- Railway technology
- Medical technology

Approvals and Markings



Technical Data

Relay type		OA 5601	OA 5602	OA 5603
1.0 Coil				
1.1 Nominal voltage	DC V	6, 12, 24, 48, 60, 110 (others on request)		
1.2 Nominal consumption	W	0.75	1	1.25 ¹⁾
1.11 Voltage range	U_N	0.7 ... 1.6	0.7 ... 1.6	0.7 ... 1.6
1.3 Holding power (at $0.5 \times U_N$)		0.19	0.25	0.32
2.0 Contacts				
2.1 Contact arrangement		2 NO / 2 NC 3 NO / 1 NC	2 NO / 4 NC 3 NO / 3 NC 4 NO / 2 NC	7 NO / 1 NC : 2 NO / 6 NC
2.2 Contact material		AgSnO ₂ + 0.2 μm Au; AgNi + 0.2 μm Au, AgNi + 5 μm Au		
2.3 Rated insulation voltage	AC V	250		
Switching voltage min./max.	V	AC/DC 10 / DC 250, AC 400 (AC/DC 2 V / AC/DC 60 V) ²⁾		
2.4 Limiting continuous current I_{th} max.	A	6 x 10 (see operating voltage limit curve)		
Switching current min./max.	A	10 mA ⁴⁾ / 10 A (2 mA / 0.3 A) ²⁾		
2.5 Switching power min./max.	VA	0.1 / 2500 (10 mVA / 12 VA) ²⁾		
Switching power min./max.	W	0.1 ⁴⁾ ... 240 (10 mW / 12 W) ²⁾ (see limit curve for arc-free operation)		
2.6 Switching capacity to IEC/EN 60947-5-1				
AC 15 ⁵⁾			NO: 250 / 3 NC: 250 / 2	
AC 15 ⁶⁾	AC V/A		NO: 250 / 5 NC: 250 / 2	
DC 13 ⁵⁾	DC V/A		NO: 24 / 2 NC: 24 / 2	
DC 13 ⁵⁾ at 0.1 Hz	DC V/A		NO: 24 / 6 NC: 24 / 6	
to UL 508			A300	
2.7 Electrical life		at 1 s ON, 1 s OFF (see contacts service life)		
at AC 230 V, 6 A, $\cos\phi = 1$	switching cycles	$> 7 \times 10^5$, AgSnO ₂ / $> 5 \times 10^5$, AgNi10		
at AC 230 V, 10 A, $\cos\phi = 1$	switching cycles	$> 5 \times 10^5$, AgSnO ₂ / $> 4 \times 10^5$, AgNi10		
2.8 Switching frequency max.	switching cycles/s	10		
2.9 Response time / Release time	ms	typically 27 / typically 5		
2.10 Contact force	cN	≥ 14		
2.14 Contact gap	mm	> 1 (normal operation) / $> 0.5^3)$		
3.0 Other				
3.1 Mechanical life	switching cycles	$> 30 \times 10^6$		
3.2 Temperature range	$^\circ\text{C}$	- 40 ... + 85	- 40 ... + 85	- 40 ... + 75
3.3 Degree of protection		Solder line proof RT II as option wash proof RT III		
3.5 Vibration resistance		10 ... 55 Hz, 0.35 mm Ampl.; 5 g max. IEC/EN 60068-2-6		
3.4 Test procedure		A (group mounting)		
3.6 Climate resistance		40 / 085 / 04; A / B / D IEC/EN 60068-1		
3.7 Short circuit strength 1 kA / AC 250 V	AgSnO ₂ AgNi	NO: 10 A gL / NC: 10 A gL IEC/EN 60947-5-1 NO: 10 A gL / NC: 6 A gL IEC/EN 60947-5-1		

¹⁾ For OA 5603.46 (2 NO / 6 NC) and OA 5603.56 (3 NO / 5 NC) nominal consumption is 1.65 W

²⁾ Values for AgNi10-Contacts + 5 μm Au

³⁾ over entire service life, even when under fault and at $1.6 U_N$

⁴⁾ Typical values for AgSnO₂ and AgNi

⁵⁾ Values for AgNi-Contacts

⁶⁾ Values for AgSnO₂-Contacts

Technical Data

3.8	Insulation acc. to IEC 60664-1, EN 50178			
	Rated insulation voltage	AC V		250
	Pollution degree			3 / 2 (double and reinforced insulation)
	Overvoltage category			III
	Test voltage			
	Contact- Coil (1 min)	AC kV eff.		≥ 4
	Contact-Contact (1min)	AC kV eff.		≥ 4
	Open contact acc. to DIN EN 61810-1	AC kV eff.		1.5
	Transient voltage			
	Contact- Coil (1,2 - 50 μs)	kV		≥ 6
	Clearance and creepage distances			
	Contact- Coil	mm		≥ 8
	Contact-Contact	mm		≥ 5.5
3.9	Weight	g	approx. 78	approx. 85 approx. 95
4.0 Packing				
4.1	on cardboard in slipcase	piece	20	15 15
4.2	in case package	piece	100	75 75
5.0 Solder method				
5.1	Solder method /-temperature /-duration	°C / s	Wafer soldering / 260 / 5	

Design versions

U _N (DCV)	Voltage range (DC V)	OA 5601			OA 5602				OA 5603							
		R _{Coil} Ω±10%	.52 2 NO, 2 NC	.48 3 NO, 1 NC	R _{Coil} Ω±10%	.18 3 NO, 3 NC	.50 2 NO, 4 NC	.54 4 NO, 2 NC	R _{Coil} Ω±10%	.63 7 NO, 1 NC	.59 6 NO, 2 NC	.58 5 NO, 3 NC	.57 4 NO, 4 NC	R _{Coil} Ω±10%	.56 3 NO, 5 NC	.46 2 NO, 6 NC

AgSnO₂-Contacts + 0.2 μm Au

6	4,2 ... 9,6	48	2091	2121	35	2001	2031	2061	29	2151	2181	2271	2211	21	2301	2241
12	8,4 ... 19,2	192	2092	2122	140	2002	2032	2062	112	2152	2182	2272	2212	88	2302	2242
24	16,8 ... 38,4	770	2093	2123	570	2003	2033	2063	460	2153	2183	2273	2213	370	2303	2243
48	33,6 ... 76,8	2880	2094	2124	2300	2004	2034	2064	1800	2154	2184	2274	2214	1400	2304	2244
60	42,0 ... 96,0	4800	2095	2125	3600	2005	2035	2065	2880	2155	2185	2275	2215	2230	2305	2245
110	77,0 ... 176,0	16000	2096	2126	12100	2006	2036	2066	9500	2156	2186	2276	2216	7150	2306	2246

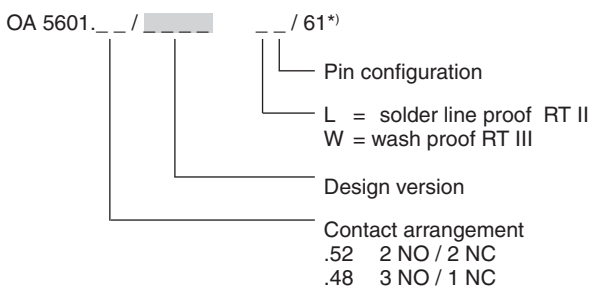
AgNi 10-Contacts + 0.2 μm Au

6	4,2 ... 9,6	48	2101	2131	35	2011	2041	2071	29	2161	2191	2281	2221	21	2311	2251
12	8,4 ... 19,2	192	2102	2132	140	2012	2042	2072	112	2162	2192	2282	2222	88	2312	2252
24	16,8 ... 38,4	770	2103	2133	570	2013	2043	2073	460	2163	2193	2283	2223	370	2313	2253
48	33,6 ... 76,8	2880	2104	2134	2300	2014	2044	2074	1800	2164	2194	2284	2224	1400	2314	2254
60	42,0 ... 96,0	4800	2105	2135	3600	2015	2045	2075	2880	2165	2195	2285	2225	2230	2315	2255
110	77,0 ... 176,0	16000	2106	2136	12100	2016	2046	2076	9500	2166	2196	2286	2226	7150	2316	2256

AgNi 10-Contacts + 5 μm Au

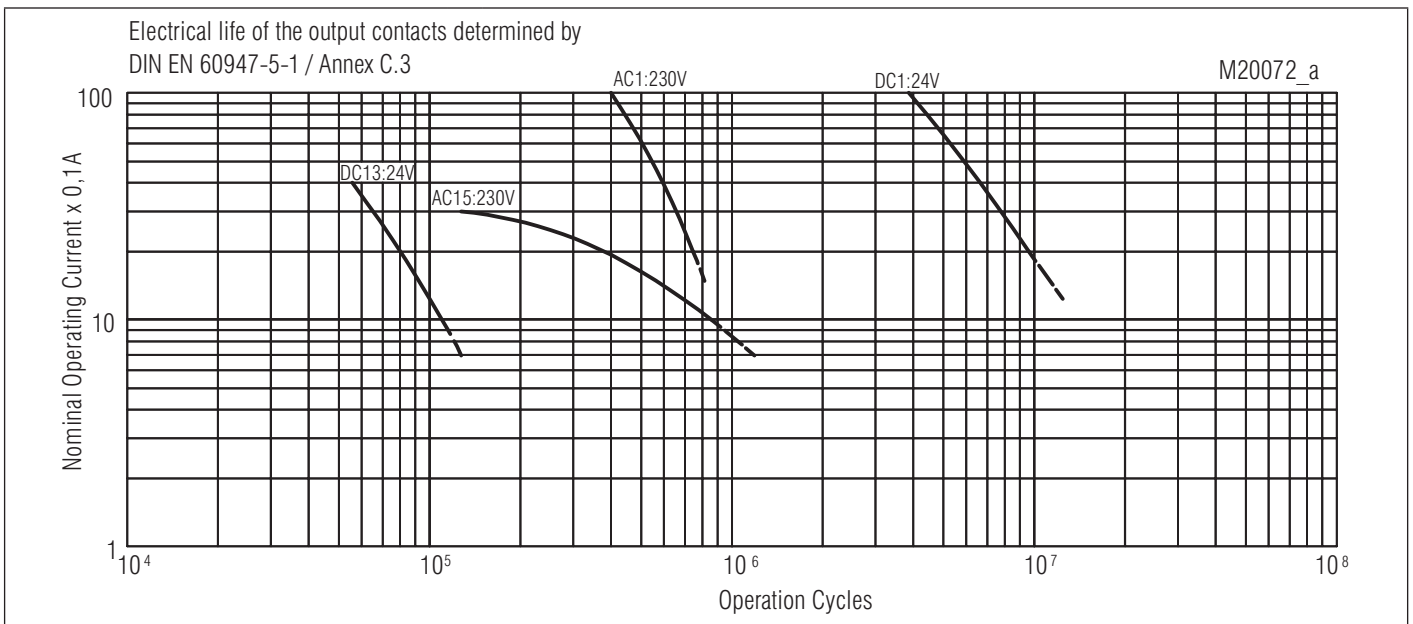
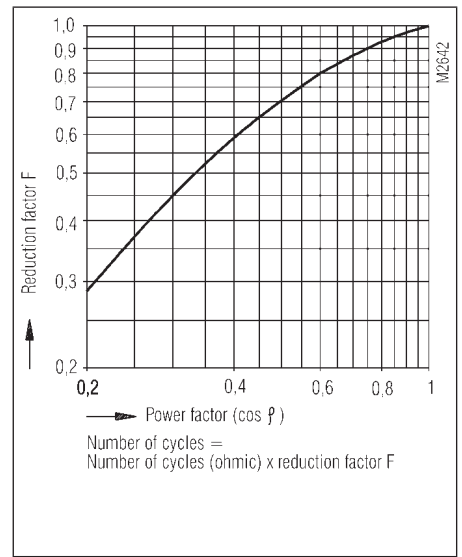
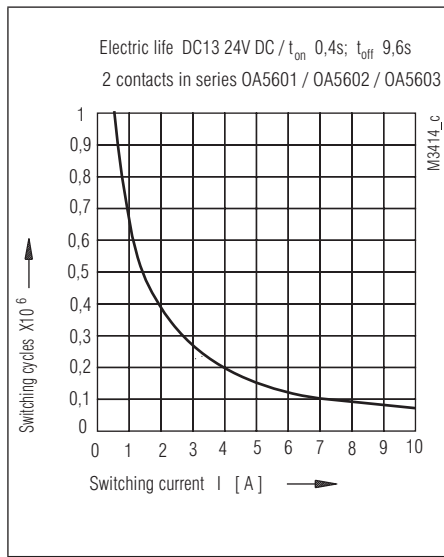
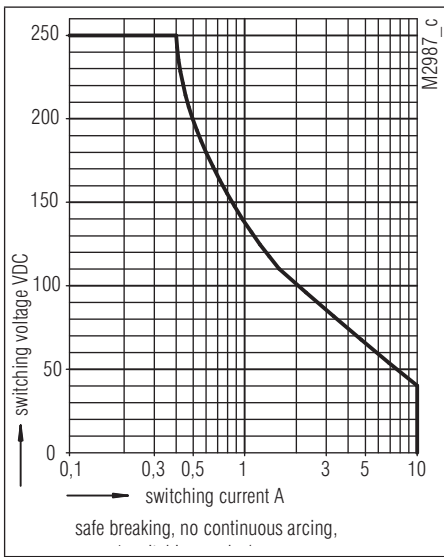
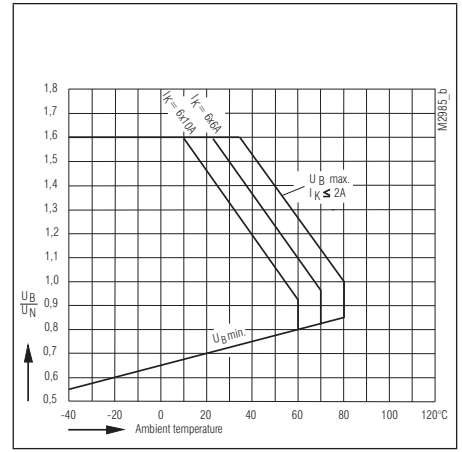
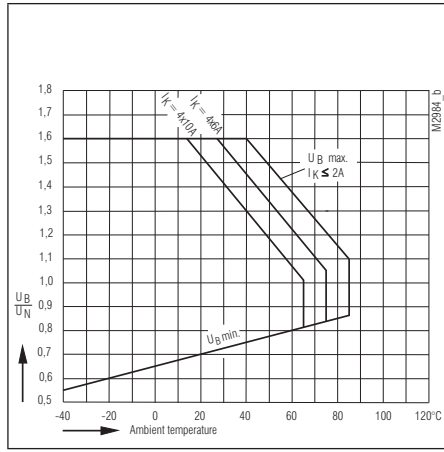
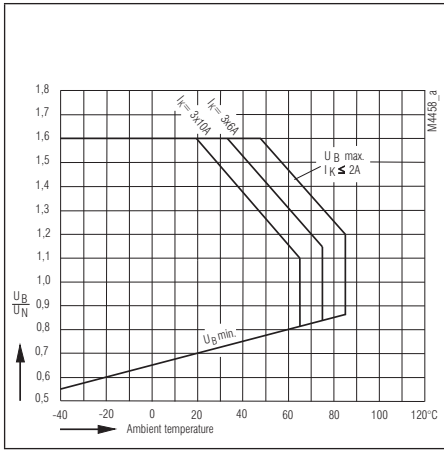
6	4,2 ... 9,6	48	2111	2141	35	2021	2051	2081	29	2171	2201	2291	2231	21	2321	2261
12	8,4 ... 19,2	192	2112	2142	140	2022	2052	2082	112	2172	2202	2292	2232	88	2322	2262
24	16,8 ... 38,4	770	2113	2143	570	2023	2053	2083	460	2173	2203	2293	2233	370	2323	2263
48	33,6 ... 76,8	2880	2114	2144	2300	2024	2054	2084	1800	2174	2204	2294	2234	1400	2324	2264
60	42,0 ... 96,0	4800	2115	2145	3600	2025	2055	2085	2880	2175	2205	2295	2235	2230	2325	2265
110	77,0 ... 176,0	16000	2116	2146	12100	2026	2056	2086	9500	2176	2206	2296	2236	7150	2326	2266

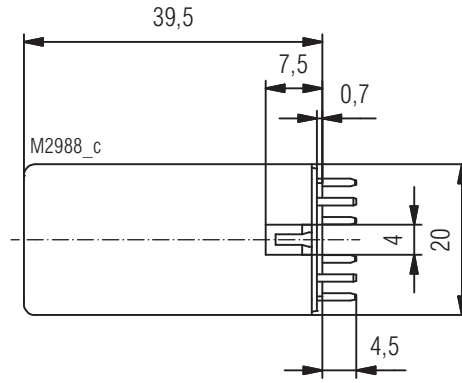
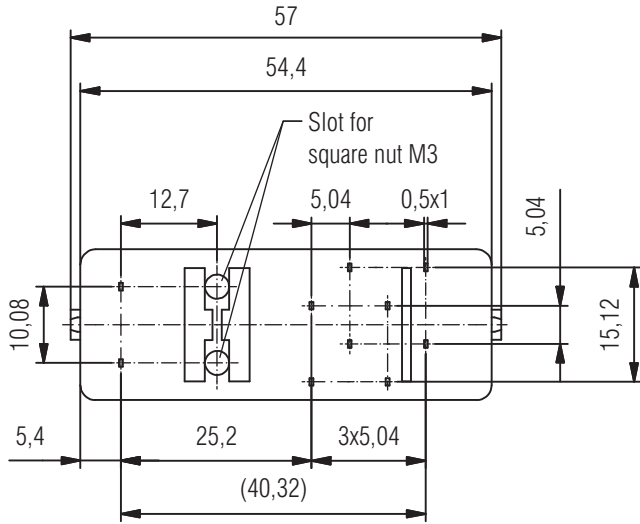
Ordering example



*) / 61 cURus approval

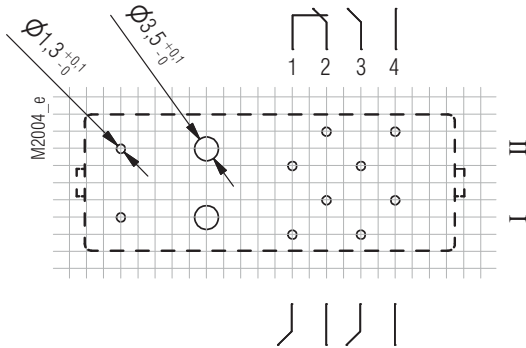
Characteristics



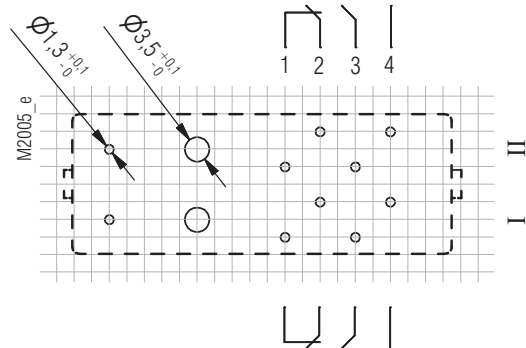


Drilling plan (solder side)

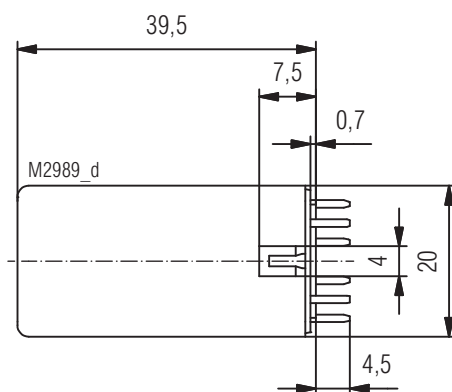
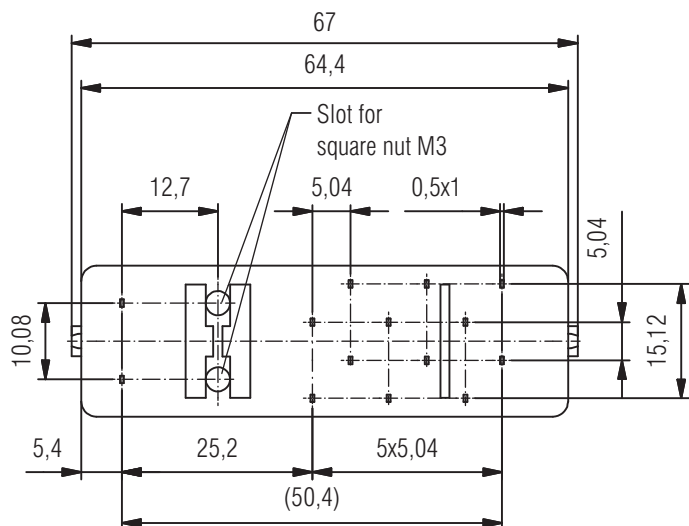
Pin arrangement OA5601.48 3NO/1NC



Pin arrangement OA5601.52 2NO/2NC

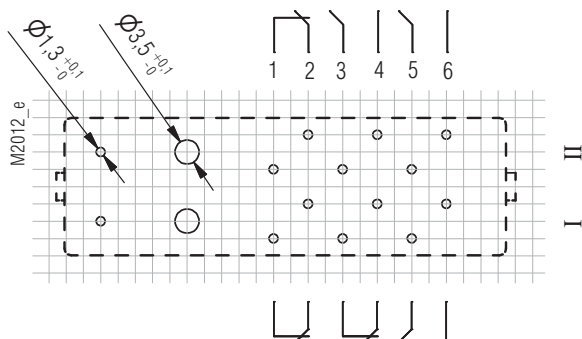


Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

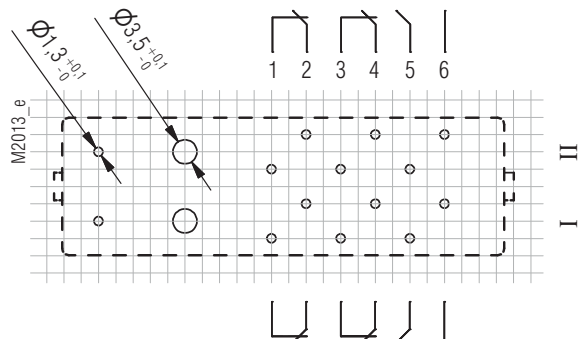


Drilling plan (solder side)

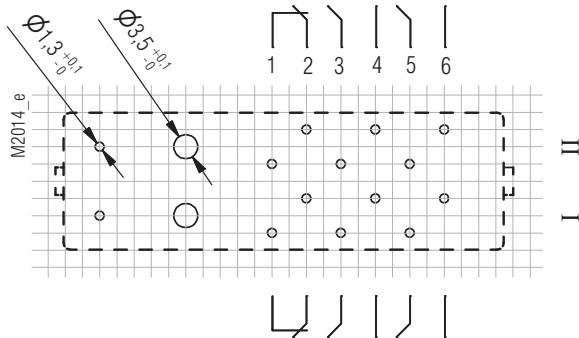
Pin arrangement OA5602.18 3NO/3NC



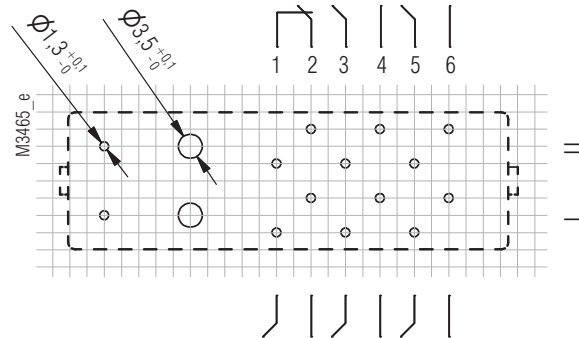
Pin arrangement OA5602.50 2NO/4NC



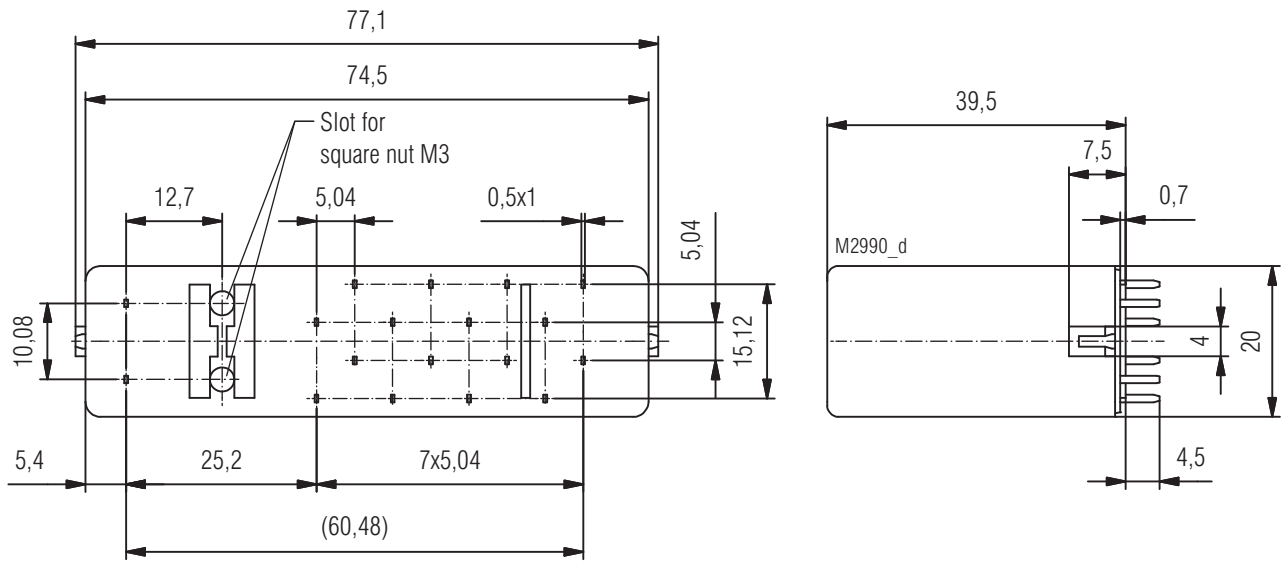
Pin arrangement OA5602.54 4NO/2NC



Pin arrangement OA5602.60 5NO/1NC

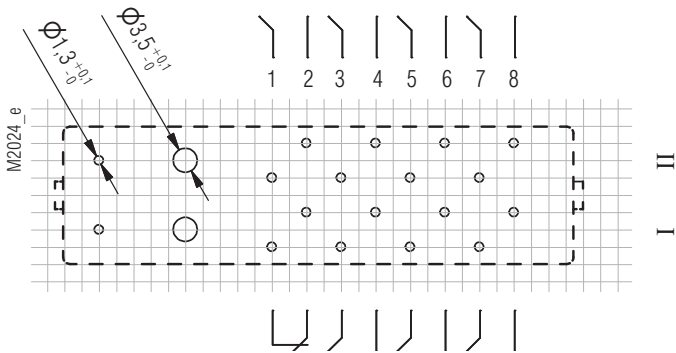


Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

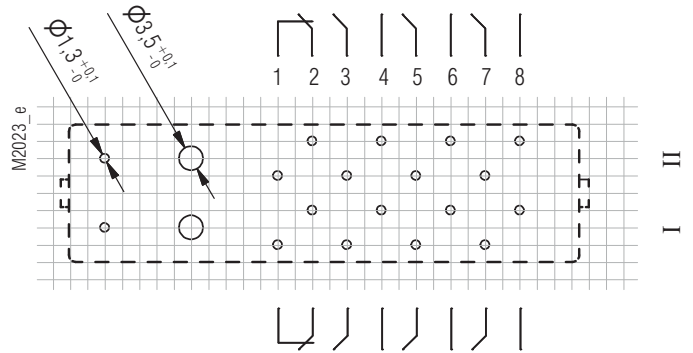


Drilling plan (solder side)

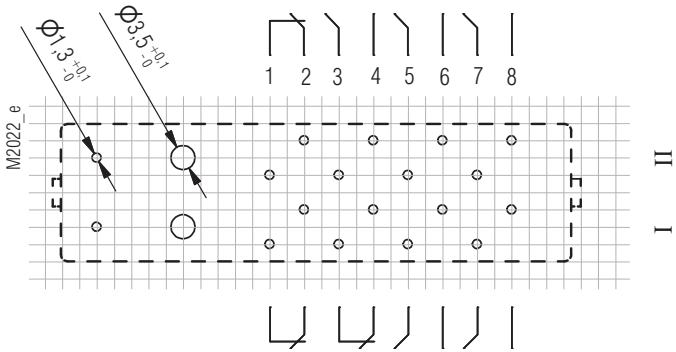
Pin arrangement OA5603.63 7NO/1NC



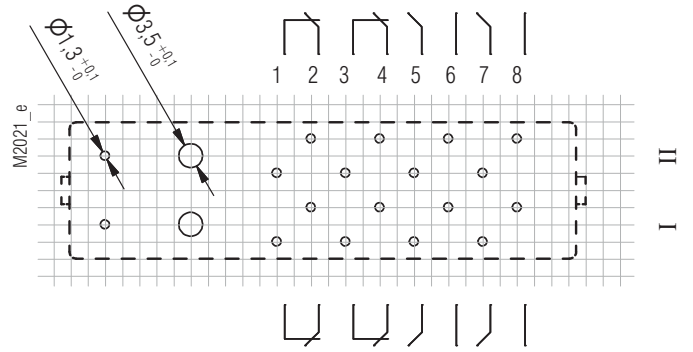
Pin arrangement OA5603.59 6NO/2NC



Pin arrangement OA5603.58 5NO/3NC



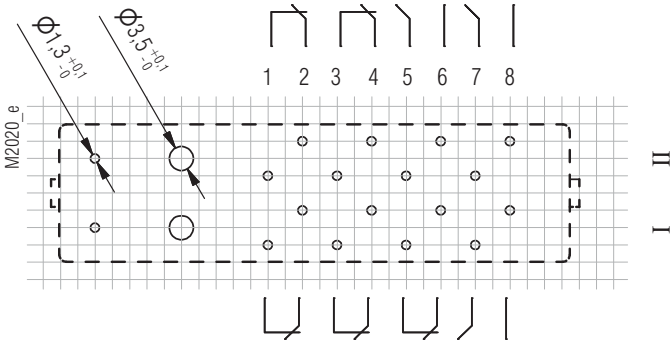
Pin arrangement OA5603.57 4NO/4NC



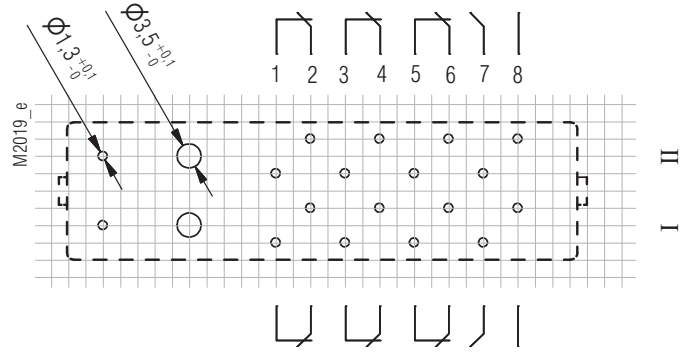
Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

Drilling plan (solder side)

Pin arrangement OA5603.56 3NO/5NC

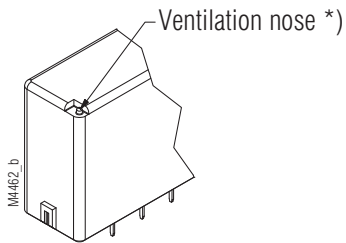


Pin arrangement OA5603.46 2NO/6NC



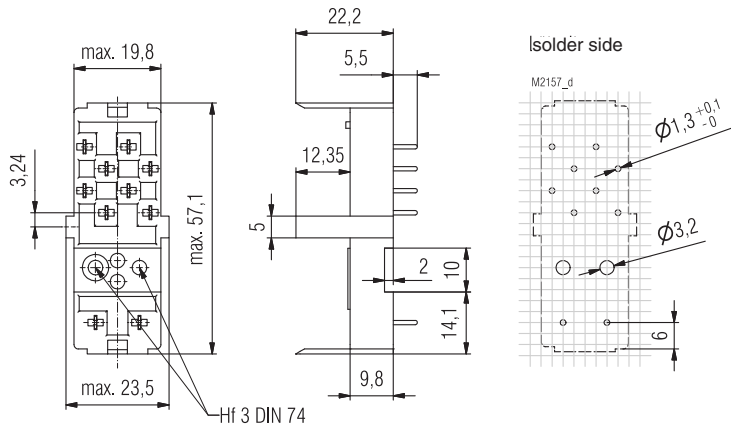
Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

Notes



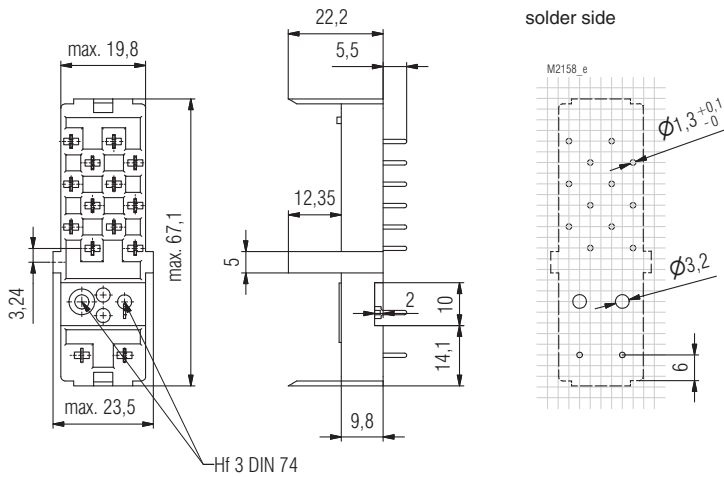
*) When using the maximum switching capacity it is recommended to open the wash proof relay at the indicated position.

Socket ET 1415.011



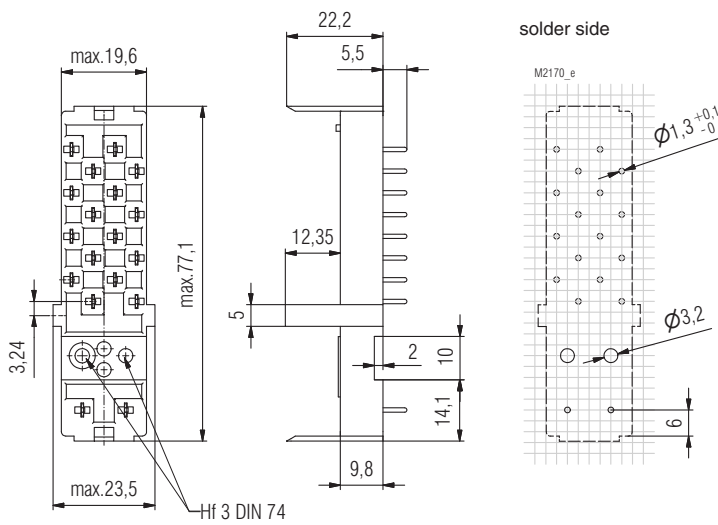
Article number: 0041069

Socket ET 1415.012

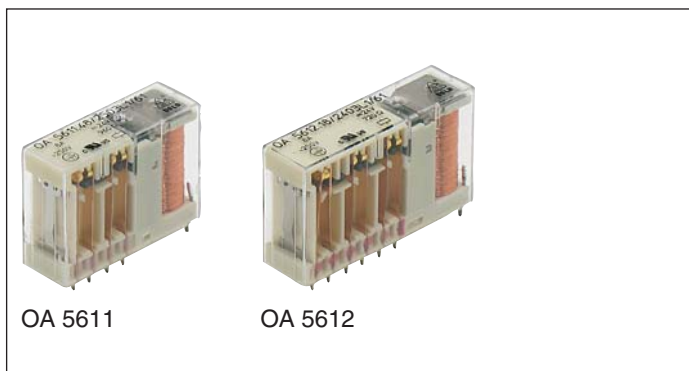


Article number: 0041065

Socket ET 1415.013



Article number: 0041070

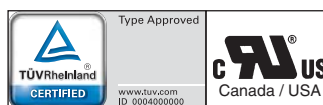


- According to DIN EN 61810-1, DIN EN 61810-3
- With forcibly guided contacts
- High switching reliability due to crown contacts
- Low rated power consumption
- High mechanical service life
- Compact size
- Optionally wash proof

Applications

- To be used in circuits for safety applications
- Escalators and walkways
- Elevators for men and load
- Railway technology

Approvals and Markings



Technical Data

Relay type		OA 5611	OA 5612
1.0 Relay coil			
1.1 Nominal voltage	DC V	6, 12, 24, 48, 60, 110 (others on request)	
1.2 Nominal consumption	W	0.6	0.8 / 1.0 ³⁾
1.11 Voltage range	U _N	0.7 ... 1.4	
1.13 Holding power (at 0.5 x U _N)	W	0.15	0.20 / 0.24 ³⁾
2.0 Contacts			
2.1 Contact arrangement		2 NO / 2 NC 3 NO / 1 NC	2 NO / 4 NC 3 NO / 3 NC 4 NO / 2 NC 5 NO / 1 NC
2.2 Contact material		AgSnO ₂ + 0.2 μm Au; AgNi + 0.2 μm Au, AgNi + 5 μm Au	
2.3 Rated insulation voltage	AC V	250	
Switching voltage min./max	V	AC/DC 10 / DC 250, AC 400 (AC/DC 2 V / 60 V) ¹⁾	
2.4 Limit. contin. current I _N max.	A	3 e.g. 5 x 8 (see operating voltage limit curve)	
Switching current min./max	A	> 10 mA ⁴⁾ / 8 (2 mA / 0.3 A) ¹⁾	
2.5 Switching power min./max.	VA	0.1 / 2000 (10 mVA / 12 VA) ¹⁾	
Switching power min./max	W	0.1 ⁴⁾ / 200 (10 mW / 12 W) ¹⁾ (see limit curve for arc-free operation)	
2.6 Switching capacity IEC/EN 60947-5-1		B300	
AC 15 ⁵⁾	AC V/A	NO: 250 / 2	NC: 250 / 1
AC 15 ⁶⁾	AC V/A	NO: 250 / 3	NC: 250 / 2
DC 13 ⁵⁾	DC V/A	NO: 24 / 1	NC: 24 / 1
DC 13 ⁵⁾ at 0.1 Hz to UL 508	DC V/A	NO: 24 / 4	NC: 24 / 4
2.7 Electrical life		at 1 s ON, 1 s OFF (see contacts service life)	
at AC 230 V, 5 A, cosφ = 1	switching cycles	> 3 x 10 ⁵ AgSnO ₂	> 2 x 10 ⁵ AgNi 10
at AC 230 V, 8 A, cosφ = 1	switching cycles	> 1.5 x 10 ⁵ AgSnO ₂	> 10 ⁵ AgNi 10
2.8 Switching frequency max.	switching cycles / s	10	
2.9 Response time / Release time	ms	typically 20 / typically 6	
2.10 Contact force	cN	≥ 10	
2.14 Contact gap	mm	> 1 (normal operation) / > 0.5 ²⁾ (under fault)	
3.0 Other			
3.1 Mechanical life	switching cycles	≥ 50 x 10 ⁶	
3.2 Temperature range	°C	- 40 ... + 85	- 40 ... + 85
3.3 Degree of protection		Solder line proof RT II as option wash proof RT III	
3.4 Test procedure		A (group mounting)	
3.5 Vibration resistance		10 ... 200 Hz; 0.35 mm amplitude; 3 g max. IEC/EN 60068-2-6	
3.6 Climate resistance		40 / 085 / 04; A / B / D IEC/EN 60068-1	
3.7 Short circuit strength 1 kA / AC 250 V	AgSnO ₂ AgNi	NO: 10 A gL / NC: 10 A gL NO: 10 A gL / NC: 6 A gL	IEC/EN 60947-5-1 IEC/EN 60947-5-1

¹⁾ Values for AgNi 10-Contacts + 5 μm Au

³⁾ OA 5612.50 (2 NO / 4 NC)

⁵⁾ Values for AgNi-Contacts

²⁾ over entire service life, even when under fault and at 1.4 x U_N

⁴⁾ Typical values for AgSnO₂ and AgNi

⁶⁾ Values for AgSnO₂-Contacts

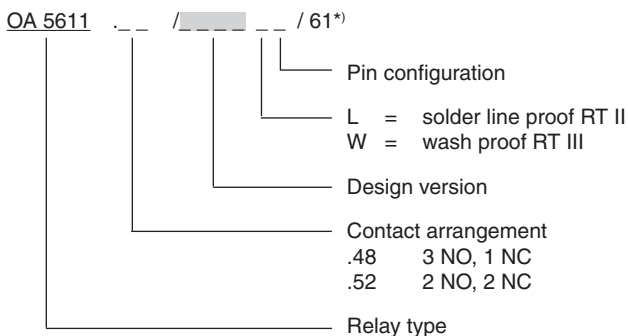
Technical Data

3.8	Insulation acc. to IEC 60664-1, EN 50178		
	Rated insulation voltage	AC V	250
	Pollution degree		3
	Overvoltage category		III
	Test voltage		
	Contact - Coil (1 min)	AC kV eff.	≥ 4
	Contact - Contact (1min)	AC kV eff.	≥ 2.5
	Open contact acc. to DIN EN 61810-1	AC kV eff.	1.5
	Transient voltage		
	Contact - Coil (1,2 - 50 μs)	kV	≥ 6
	Clearance and creepage distances		
	Contact - Coil	mm	≥ 8
	Contact side-Contact side	mm	≥ 4.5
	Contact - Contact	mm	≥ 4.5
3.9	Weight	g	approx. 35 approx. 38
4.0 Packing			
4.1	on cardboard	piece	30 20
4.2	in case package	piece	150 100
5.0 Solder method			
5.1	Solder method /-temperature /-duration	°C / s	Wafer soldering / 260 / 5

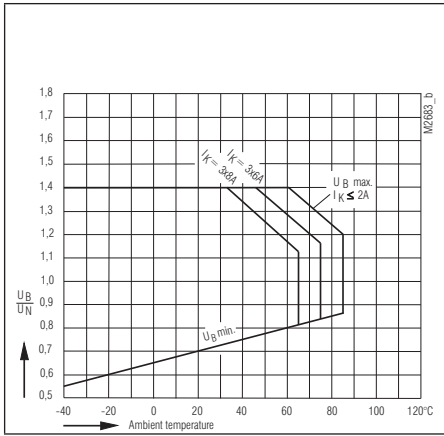
Design versions

U _N (DC V)	Voltage range (DC V)	OA 5611			OA 5612					
		R _{Coil} Ω ± 10%	.48 3NO, 1NC	.52 2NO, 2NC	R _{Coil} Ω ± 10%	.18 3NO, 3NC	.54 4NO, 2NC	.60 5NO, 1NC	R _{Coil} Ω ± 10%	.50 2NO, 4NC
AgSnO-contacts + 0,2 μm Au										
6	4,2 ... 8,4	56	2491	2521	45	2401	2461	2571	36	2431
12	8,4 ... 16,8	240	2492	2522	180	2402	2462	2572	145	2432
24	16,8 ... 33,6	960	2493	2523	720	2403	2463	2573	600	2433
48	33,6 ... 67,2	3840	2494	2524	2880	2404	2464	2574	2300	2434
60	42,0 ... 84,0	6000	2495	2525	4500	2405	2465	2575	3600	2435
110	77,0 ... 154,0	20150	2496	2526	15125	2406	2466	2576	12100	2436
AgNi-contacts + 0,2 μm Au										
6	4,2 ... 8,4	56	2501	2531	45	2411	2471	2581	36	2441
12	8,4 ... 16,8	240	2502	2532	180	2412	2472	2582	145	2442
24	16,8 ... 33,6	960	2503	2533	720	2413	2473	2583	600	2443
48	33,6 ... 67,2	3840	2504	2534	2880	2414	2474	2584	2300	2444
60	42,0 ... 84,0	6000	2505	2535	4500	2415	2475	2585	3600	2445
110	77,0 ... 154,0	20150	2506	2536	15125	2416	2476	2586	12100	2446
AgNi-contacts + 5 μm Au										
6	4,2 ... 8,4	56	2511	2541	45	2421	2481	2591	36	2451
12	8,4 ... 16,8	240	2512	2542	180	2422	2482	2592	145	2452
24	16,8 ... 33,6	960	2513	2543	720	2423	2483	2593	600	2453
48	33,6 ... 67,2	3840	2514	2544	2880	2424	2484	2594	2300	2454
60	42,0 ... 84,0	6000	2515	2545	4500	2425	2485	2595	3600	2455
110	77,0 ... 154,0	20150	2516	2546	15125	2426	2486	2596	12100	2456

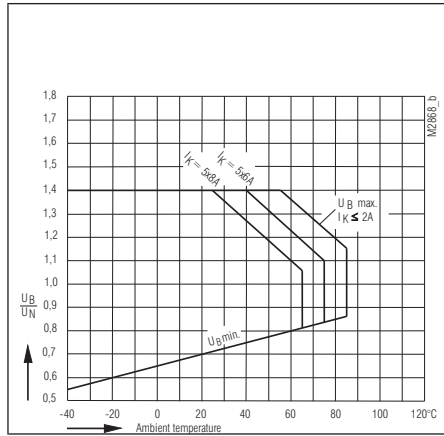
Ordering example



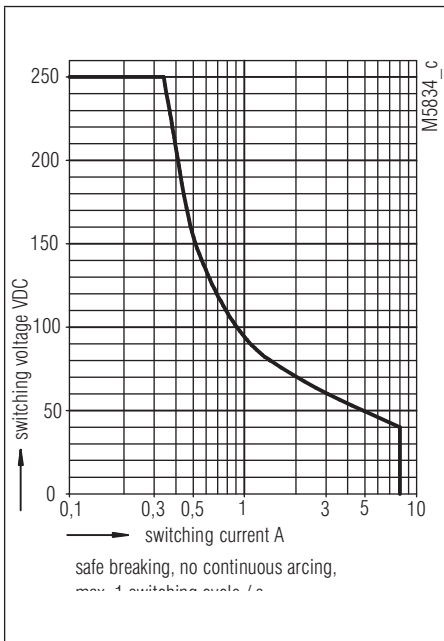
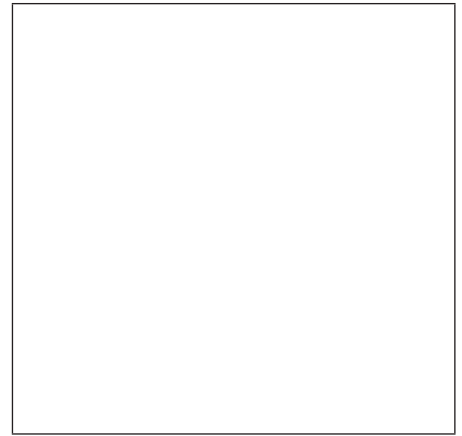
*) / 61 cURus approval



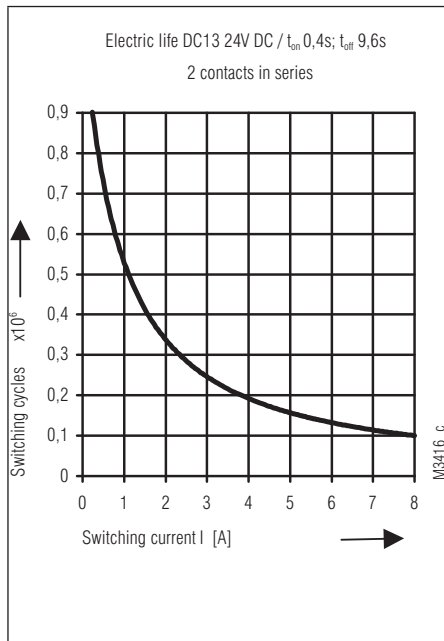
Operating voltage limit curve OA 5611



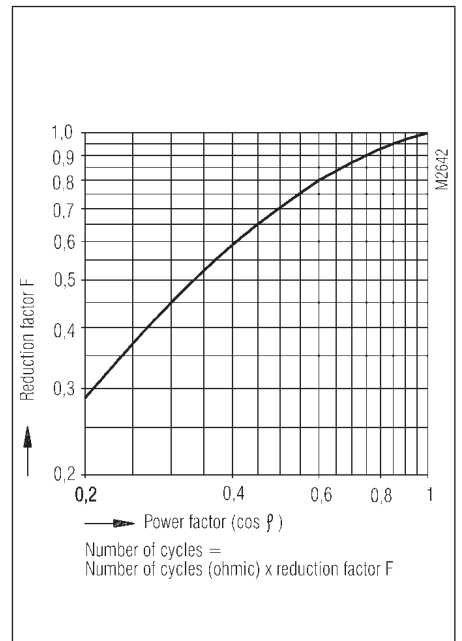
Operating voltage limit curve OA 5612



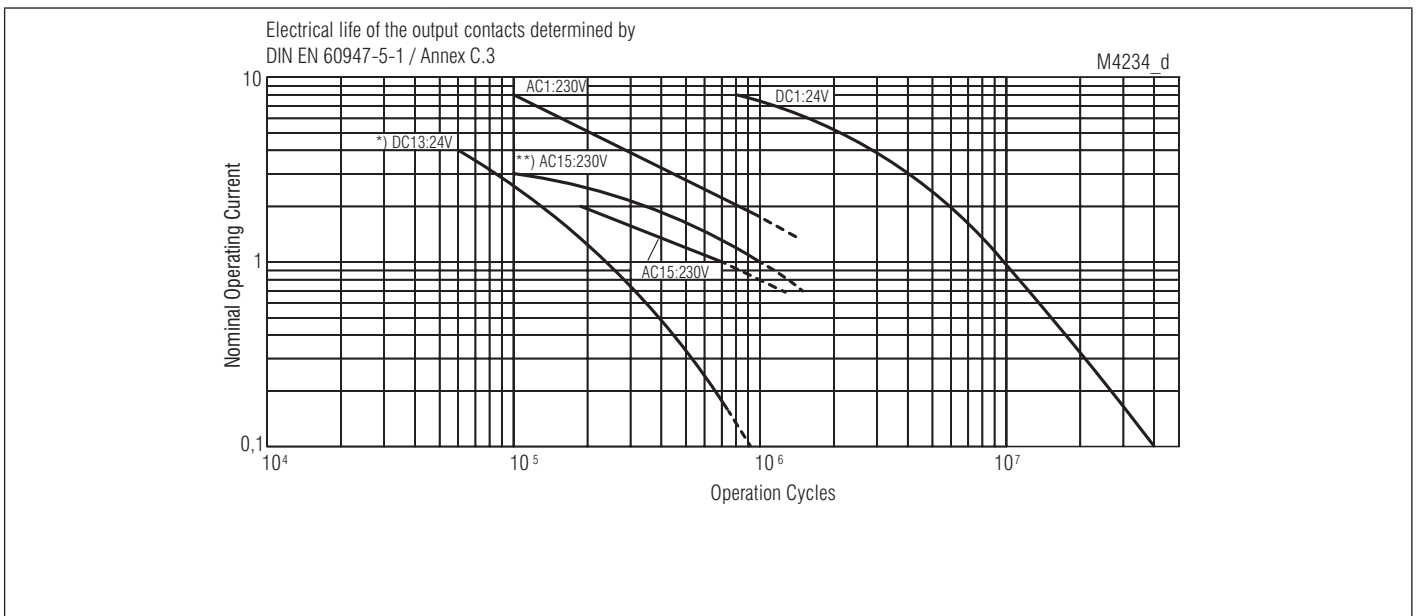
Limit curve for arc-free operation (load limit curve)



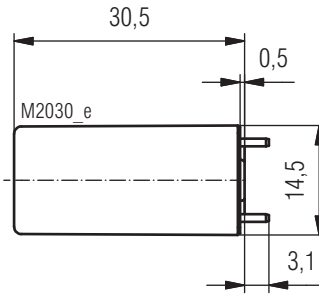
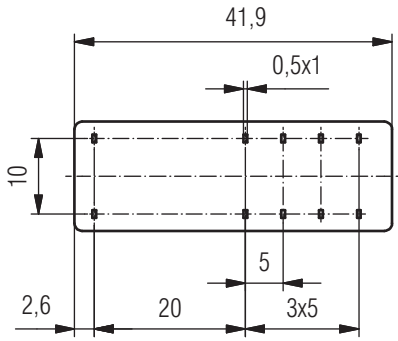
Electric life



Reduction factor for inductive loads

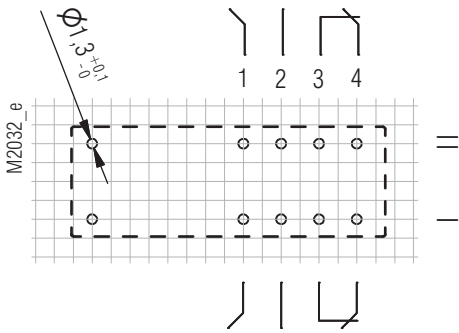


Electrical life for contact material AgNi

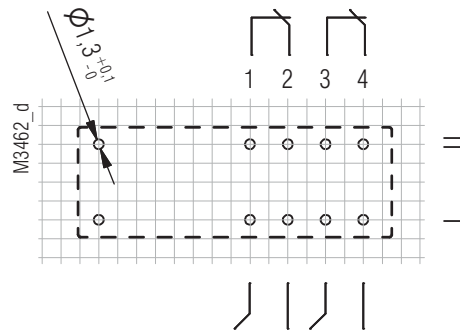


Drilling plan (solder side)

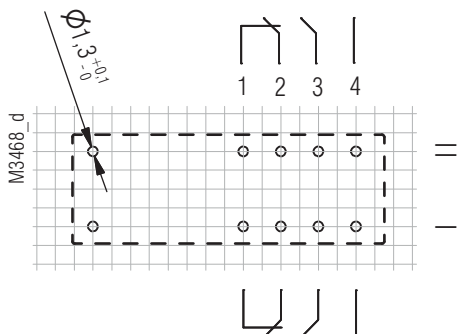
Pin arrangements OA 5611.52/...L1 2NO / 2NC



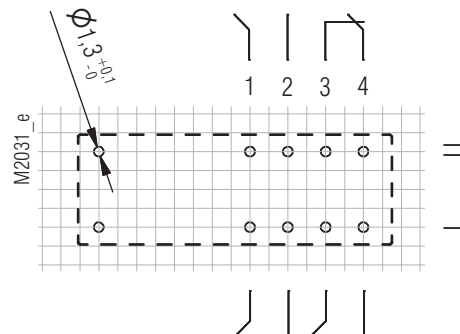
Pin arrangements OA 5611.52/...L4 2NO / 2NC



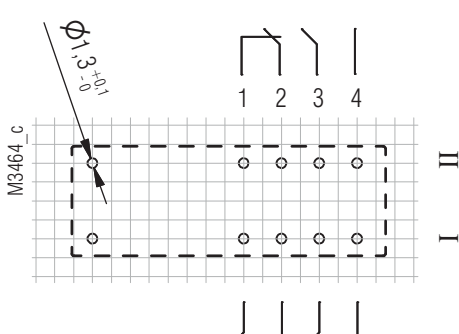
Pin arrangements OA 5611.52/...L5 2NO / 2NC



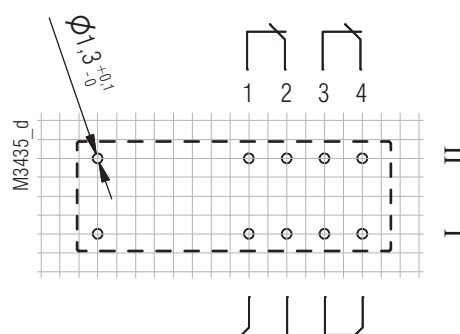
Pin arrangements OA 5611.48/...L1 3NO / 1NC



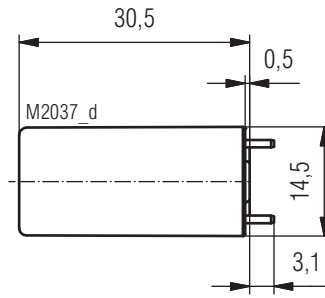
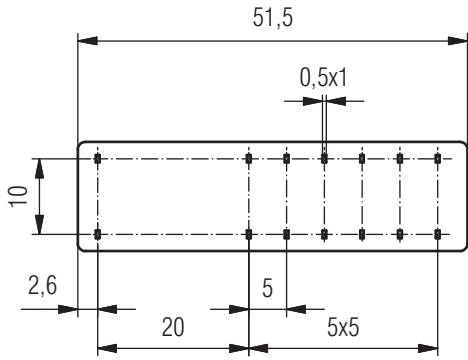
Pin arrangements OA 5611.48/...L4 3NO / 1NC



Pin arrangements OA 5611.28 1NO / 3NC

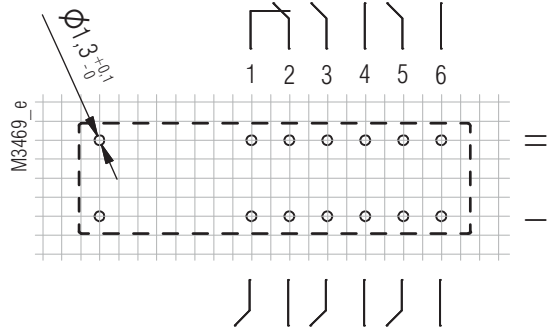


Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average



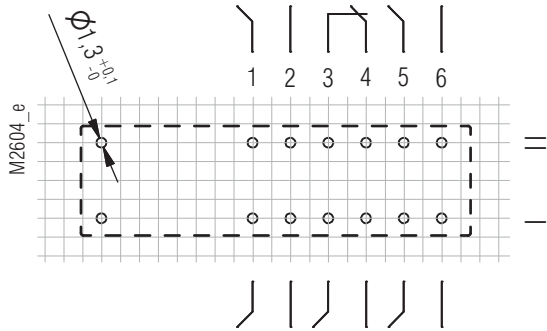
Drilling plan (solder side)

Pin arrangements OA 5612.60/...L4 5NO / 1NC

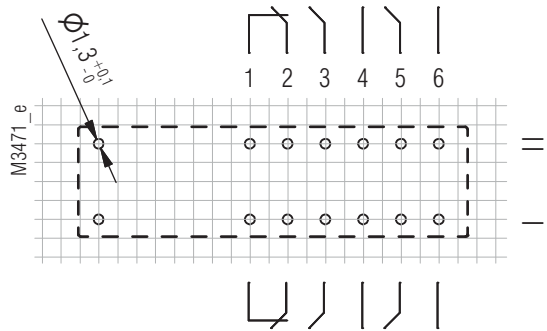


Drilling plan (solder side)

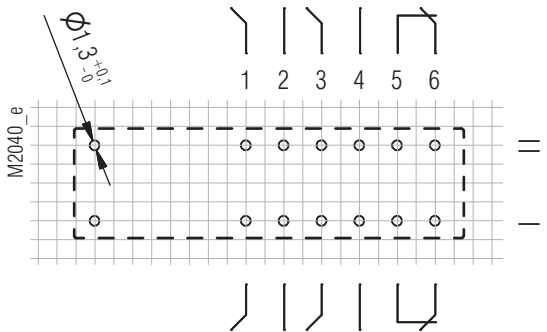
Pin arrangements OA 5612.60/...L1 5NO / 1NC



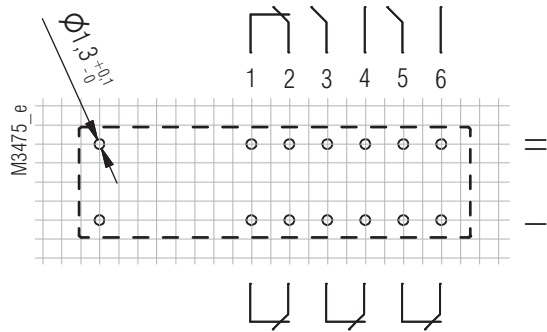
Pin arrangements OA 5612.54/...L4 4NO / 2NC



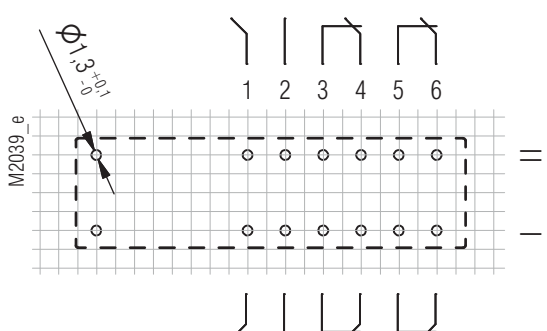
Pin arrangements OA 5612.54/...L1 4NO / 2NC



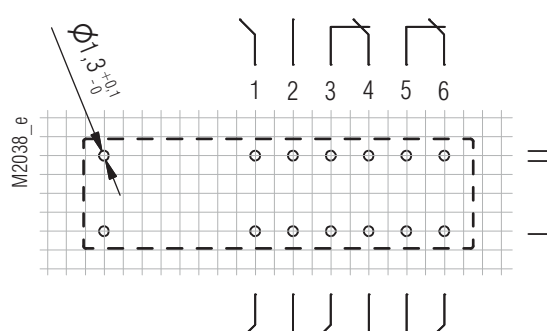
Pin arrangements OA 5612.50/...L4 2NO / 4NC



Pin arrangements OA 5612.50/...L1 2NO / 4NC

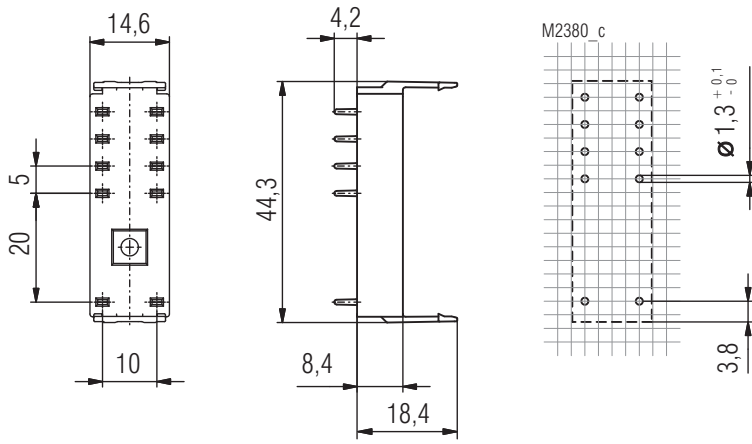


Pin arrangements OA 5612.18/...L1 3NO / 3NC



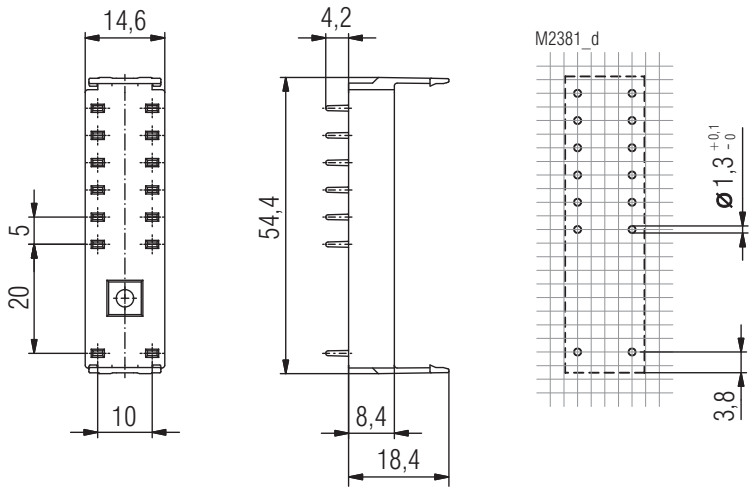
Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

Socket ET 1415.031



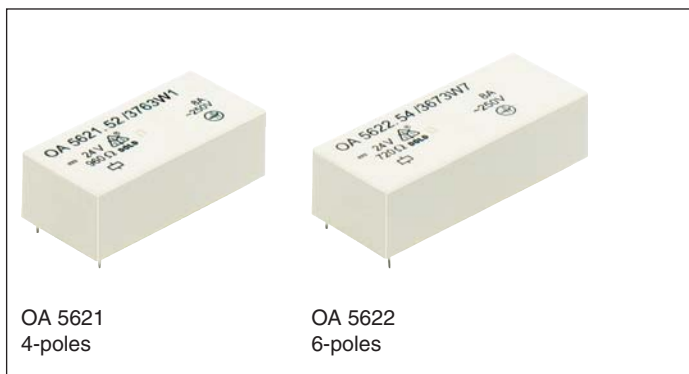
Article number: 0049512

Socket ET 1415.032



Article number: 0049513

Gold plated double contacts
see separate datasheet

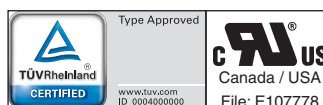


- According to DIN EN 61810-1, IEC 61810-3
- With forcibly guided contacts
- Clearance and creepage distances:
contact - contact $\geq 5,5$ mm
- Low rated power consumption and holding power
- High mechanical service life
- High temperature range
- High thermal continuous current
- 15,5 mm height
- Version with double contacts possible, AgNi 0.15 + 5 μ m Au-contacts

Applications

- To be used in electrical circuits for safety applications
- Escalators and walkways
- Elevators for men and load
- Press controls
- Railway technology
- Medical technology

Approvals and Markings



Technical Data

Relay type	OA 5621	OA 5622	OA 5622.50
1.0 Coil			
1.1 Nominal voltage	DC V	6, 12, 24, 48, 60, 110 (others on request)	
1.2 Nominal consumption	W	0.6	0.8
1.11 Voltage range	U_N	0.75 ... 1.4	
1.12 Thermal resistance	K/W	55 (mounting distance between relays ≥ 5 mm)	
1.13 Holding Power (at $0.5 \times U_N$)	W	0.15	0.2
			0.225
2.0 Contacts			
2.1 Contact arrangement	2 NO / 2 NC 3 NO / 1 NC	3 NO / 3 NC 4 NO / 2 NC 5 NO / 1 NC	2 NO / 4 NC
2.2 Contact material	AgSnO ₂ + 0.2 μ m Au; AgNi + 0.2 μ m Au, AgNi + 5 μ m Au		
2.3 Rated insulation voltage	AC V	250	
Switching voltage min./max	V	AC/DC 10 / DC 250, AC 400 (AC/DC 2 V / 60 V) ¹⁾	
2.4 Limiting continuous current I_{th}	A	3 x 8	5 x 8 (s. operating voltage limit curve.)
Switching current min./max	A	10 mA ⁴⁾ / 8 (2 mA / 0.3 A) ¹⁾	
2.5 Switching power min./max.	VA	0.1 ⁴⁾ / 2000 (10 mVA / 12 VA) ¹⁾	
Switching power min./max.	W	0.1 ⁴⁾ / 200 (10 mW / 12 W) ¹⁾ (see limit curve for arc-free operation)	
2.6 Switching capacity to IEC/EN 60947-5-1			
AC 15 ⁷⁾	AC V/A	NO: 250 / 3	NC: 250 / 2
AC 15 ⁶⁾	AC V/A	NO: 250 / 5	NC: 250 / 2
DC 13 ⁷⁾	DC V/A	NO: 24 / 2	NC: 24 / 2
DC 13 ⁷⁾ at 0.1 Hz	DC V/A	NO: 24 / 4	NC: 24 / 4
to UL 508		B300 / Q 300	
2.7 Electrical life		at 1 s On, 1 s Off (see contacts service life)	
at AC 230 V, 5 A, $\cos\phi = 1$	switching cycles	$> 3 \times 10^5$ AgSnO ₂	$> 2.2 \times 10^5$ AgNi
at AC 230 V, 8 A, $\cos\phi = 1$	switching cycles	$> 1.5 \times 10^5$ AgSnO ₂	$> 10^5$ AgNi
at DC 24 V, 5 A ohmic	switching cycles	$> 2 \times 10^5$ AgSnO ₂	$> 1.5 \times 10^5$ AgNi
at DC 24 V, 8 A ohmic	switching cycles	$> 10^5$ AgSnO ₂	$> 0.75 \times 10^5$ AgNi
2.8 Switching frequency max	switching cycles/s	10	
2.9 Response time / Release time	ms	typically 12 / typically 8	
2.10 Contact force	cN	≥ 8	
2.14 Contact gap	mm	> 0.5 ⁵⁾	
3.0 Other			
3.1 Mechanical life	switching cycles	$> 20 \times 10^6$	
3.2 Temperature range	$^{\circ}$ C	- 40 ... + 80	
3.3 Degree of protection, housing		Wash proof RT III	
3.4 Test procedure		A (group mounting)	
3.5 Vibration resistance		10 ... 200 Hz; 0,35 mm amplitude; 5 g max. IEC/EN 60068-2-6	
3.6 Climate resistance		40 / 080 / 04; A / B / D IEC/EN 60068-1	
3.7 Short circuit strength 1 kA / AC 250 V	AgSnO ₂ AgNi	NO: 10 AgL / NC: 10 AgL NO: 10 AgL / NC: 6 AgL	IEC/EN 60947-5-1 IEC/EN 60947-5-1

¹⁾ Values for AgNi-contacts + 5 μ m Au ²⁾ at $T_u = 60^{\circ}$ C $> 10^5$
⁵⁾ over entire service life, even when under fault and at $1.4 \times U_N$

³⁾ at $T_u = 60^{\circ}$ C $> 0,75 \times 10^5$
⁶⁾ Values for AgSnO₂-contacts

⁴⁾ Typical values
⁷⁾ Values for AgNi-contacts

Technical Data

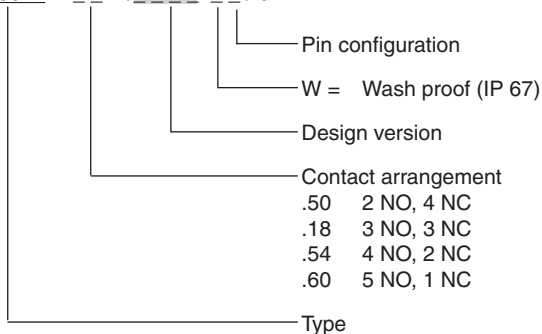
3.8	Insulation acc. to IEC 60664-1, EN 50178			
	Rated insulation voltage	AC V		250
	Pollution degree			2
	Overvoltage category			III
	Test voltage			
	Contact-coil (1 min)	AC kV eff.		≥ 4
	Contact-contact (1min)	AC kV eff.		≥ 4
	Open contact acc. to DIN EN 61810-1	AC kV eff.		1.5
	Transient voltage			
	Contact-coil (1,2 - 50 μs)	kV		≥ 6
	Clearance and creepage distance	mm		≥ 5.5
3.9	Weight	g	approx. 35	approx. 38
				approx. 38
4.0 Packing unit				
4.1	on cardboard in slipcase	piece	25	20
4.2	in case package	piece	250	200
				200
5.0 Solder method				
5.1	Solder method /-temperature /-duration	°C / s	Wafer soldering / 260 / 5	

Design Versions

U _N (DC V)	Voltage range (DC V)	OA 5621				OA 5622					
		R _{Coil} Ω ± 10%	.48 3NO, 1NC	.52 2NO, 2NC	R _{Coil} Ω ± 10%	.18 3NO, 3NC	.54 4NO, 2NC	.60 5NO, 1NC	R _{Coil} Ω ± 10%	.50 2NO, 4NC	
AgSnO ₂ -contacts + 0,2 μm Au											
6	4,5 ... 8,4	60	3721	3751	45	3601	3661	3691	38	3631	
12	9,0 ... 16,8	240	3722	3752	180	3602	3662	3692	150	3632	
24	18,0 ... 33,6	960	3723	3753	720	3603	3663	3693	600	3633	
48	36,0 ... 67,2	3840	3724	3754	2880	3604	3664	3694	2425	3634	
60	45,0 ... 84,0	6000	3725	3755	4500	3605	3665	3695	3790	3635	
110	82,5 ... 154,0	20000	3726	3756	15125	3606	3666	3696	12735	3636	
AgNi-contacts + 0,2 μm Au											
6	4,5 ... 8,4	60	3731	3761	45	3611	3671	3701	38	3641	
12	9,0 ... 16,8	240	3732	3762	180	3612	3672	3702	150	3642	
24	18,0 ... 33,6	960	3733	3763	720	3613	3673	3703	600	3643	
48	36,0 ... 67,2	3840	3734	3764	2880	3614	3674	3704	2425	3644	
60	45,0 ... 84,0	6000	3735	3765	4500	3615	3675	3705	3790	3645	
110	82,5 ... 154,0	20000	3736	3766	15125	3616	3676	3706	12735	3646	
AgNi-contacts + 5 μm Au											
6	4,5 ... 8,4	60	3741	3771	45	3621	3681	3711	38	3651	
12	9,0 ... 16,8	240	3742	3772	180	3622	3682	3712	150	3652	
24	18,0 ... 33,6	960	3743	3773	720	3623	3683	3713	600	3653	
48	36,0 ... 67,2	3840	3744	3774	2880	3624	3684	3714	2425	3654	
60	45,0 ... 84,0	6000	3745	3775	4500	3625	3685	3715	3790	3655	
110	82,5 ... 154,0	20000	3746	3776	15125	3626	3686	3716	12735	3656	

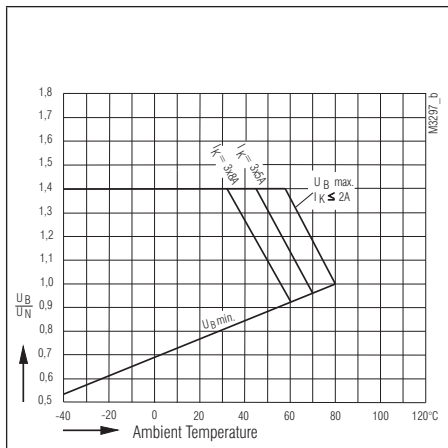
Ordering example

OA 5622 . . . / . . . / 61*)

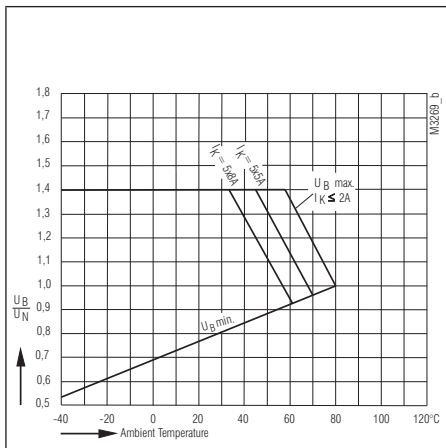


On request
version with double contacts

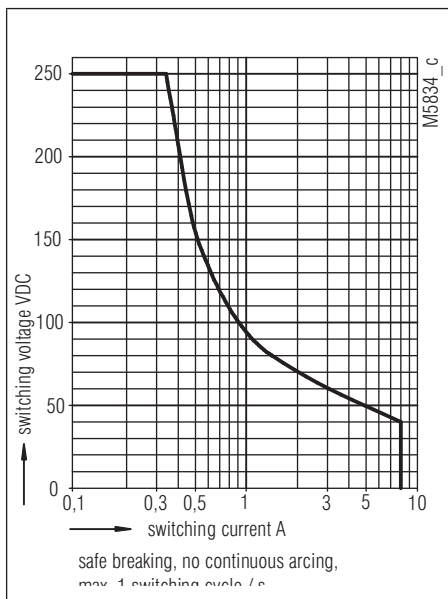
*) / 61 cURus approval



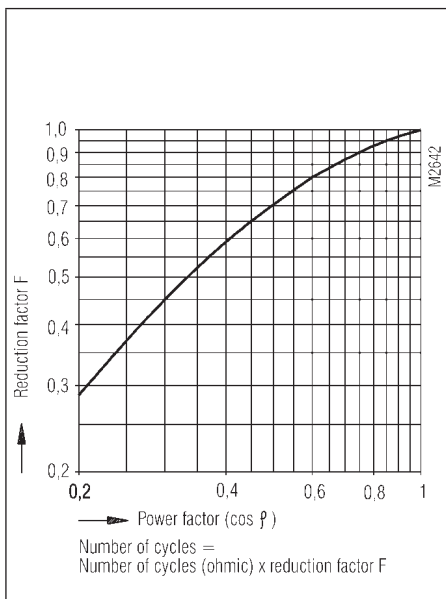
Operating voltage limit curve OA 5621



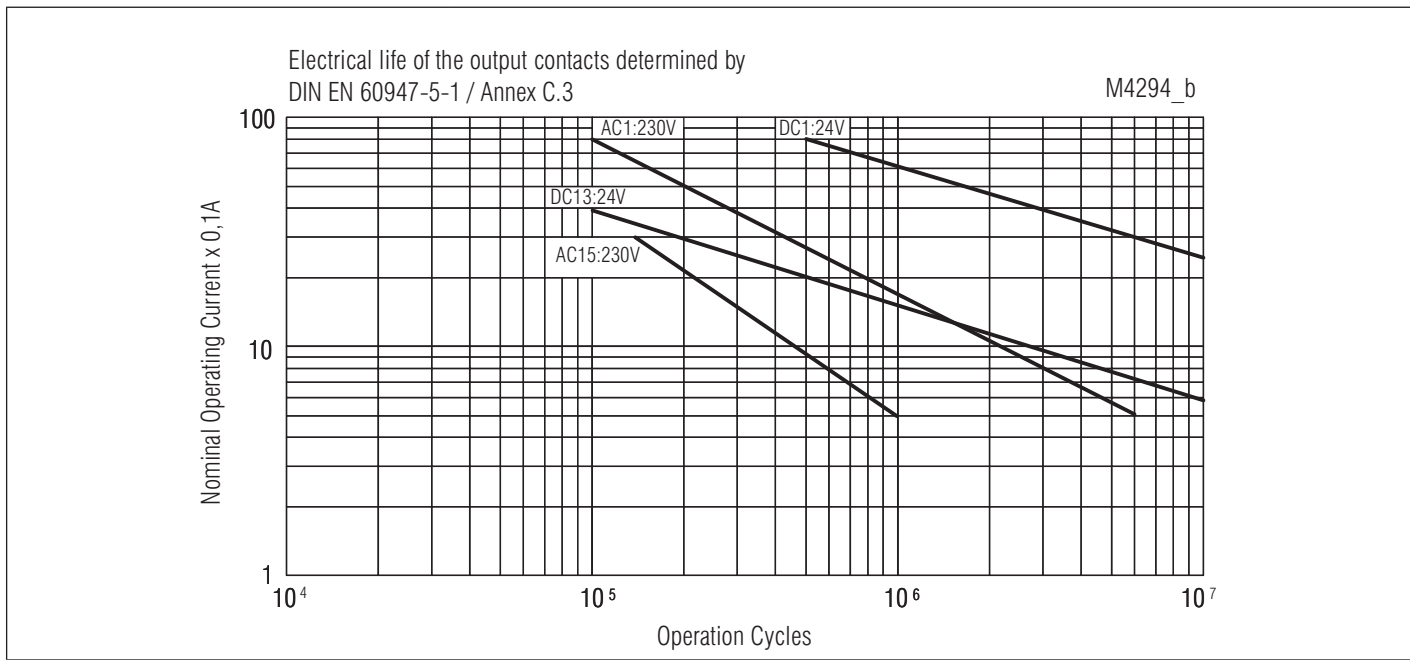
Operating voltage limit curve OA 5622



Limit curve for arc-free operation (load limit curve)

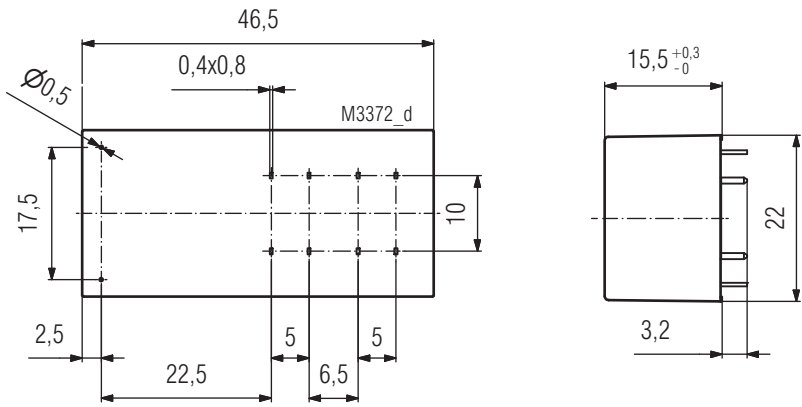


Reduction factor for inductive loads

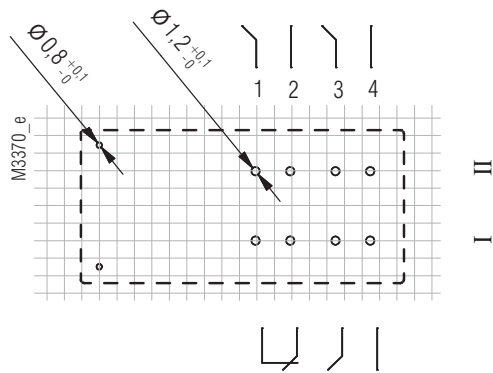


Electrical life

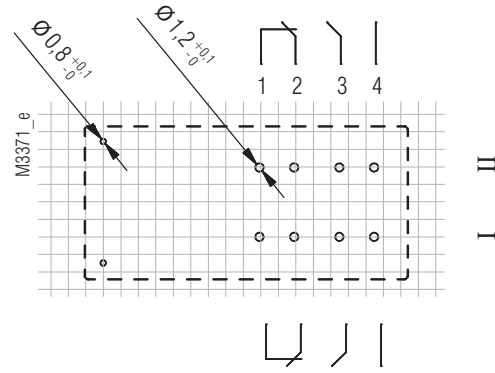
Pin Configuration W1 / W5



Pin Configuration sW1
Drilling plan (solder side)

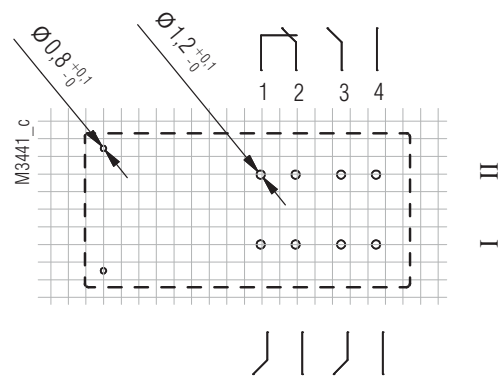


OA5621.48/___W1 3NO / 1NC



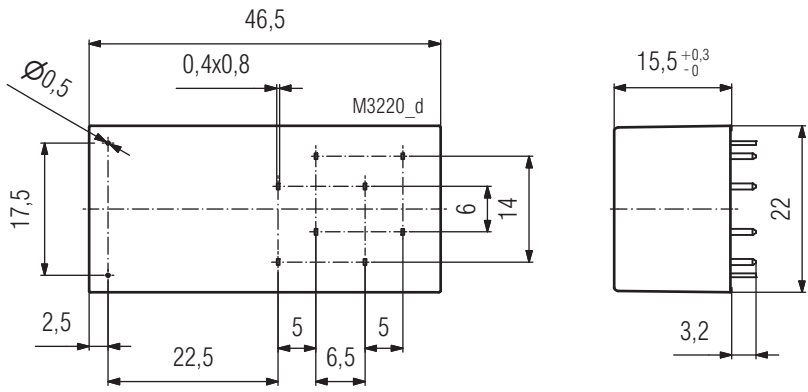
OA5621.52/___W1 2NO / 2NC

Pin Configuration D5
Drilling plan (solder side)

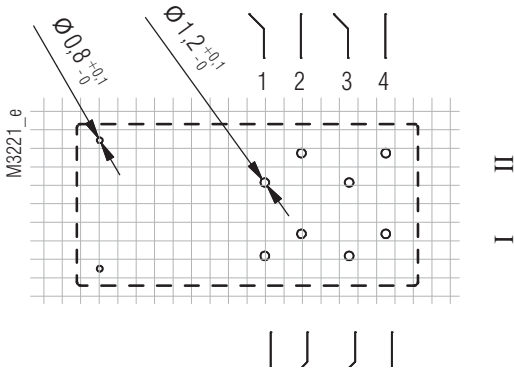


OA5621.48/___W5 3NO / 1NC

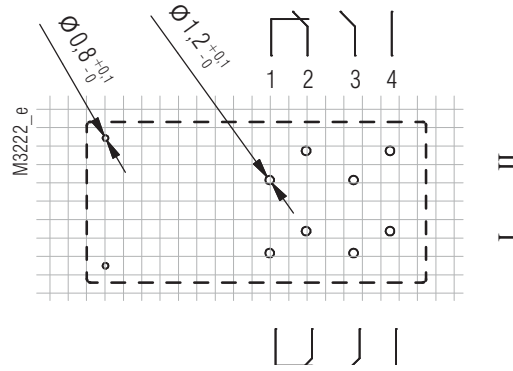
Pin Configuration W7



Pin Configurations W7
Drilling plan (solder side)



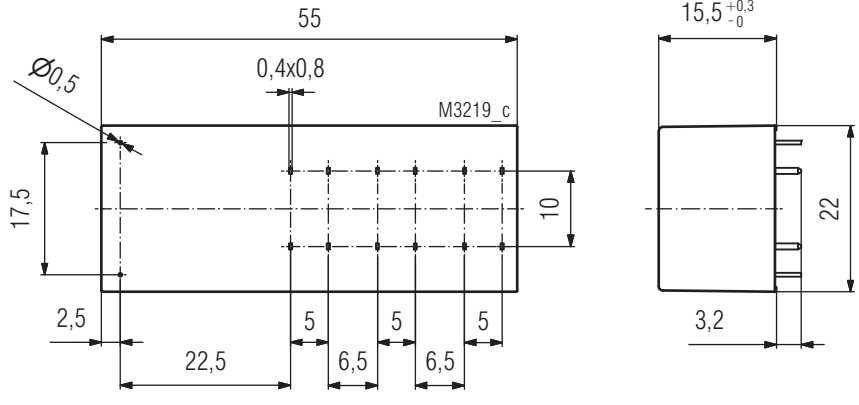
OA5621.48/___W7 3NO / 1NC



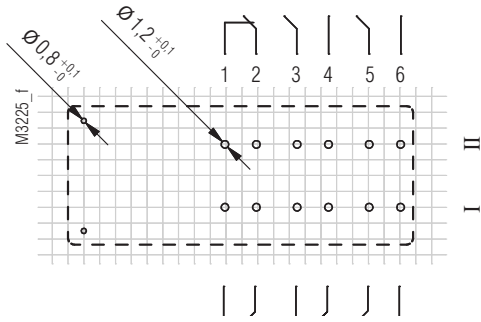
OA5621.52/___W7 2NO / 2NC

Connection for basic grid dimensions 2.50 mm as well as 2.54 mm according to IEC/EN 60 097, IEC 60 326

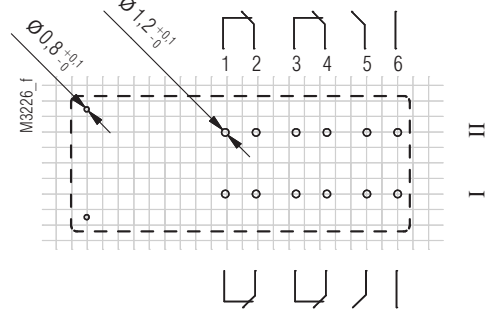
Pin Configuration W1



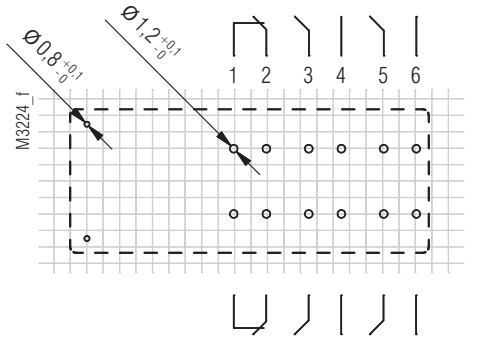
Pin Configurations W1
Drilling plan (solder side)



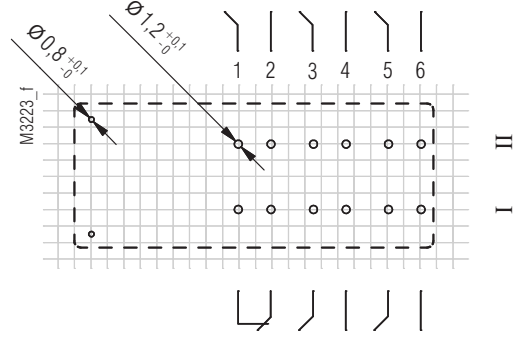
OA 5622.18/___W1 3NO / 3NC



OA 5622.50/___W1 2NO / 4NC

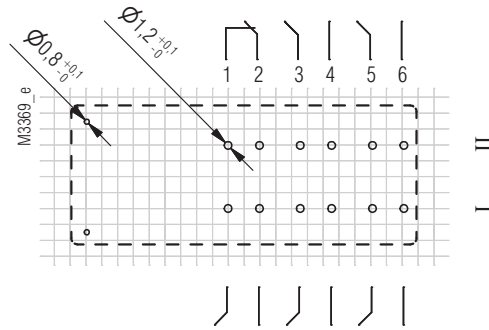


OA 5622.54/___W1 4NO / 2NC



OA 5622.60/___W1 5NO / 1NC

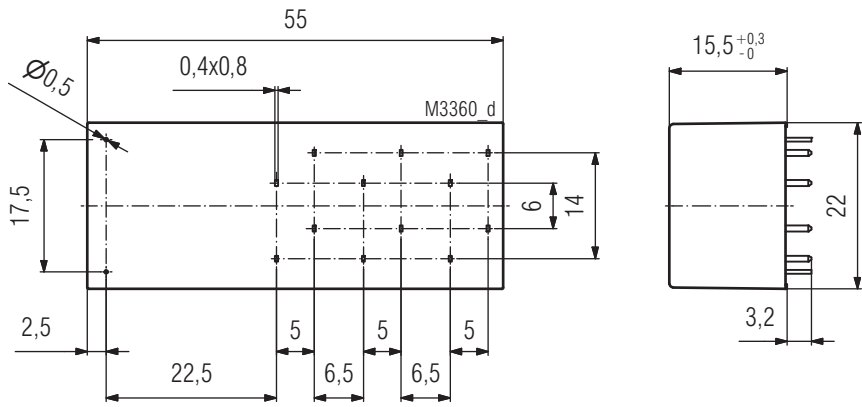
Pin Configuration W5
Drilling plan (solder side)



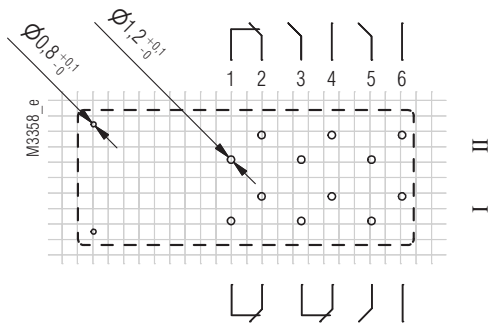
OA 5622.60/___W5 5NO / 1NC

Connection for basic grid dimensions 2.50 mm as well as 2.54 mm according to IEC/EN 60 097, IEC 60 326

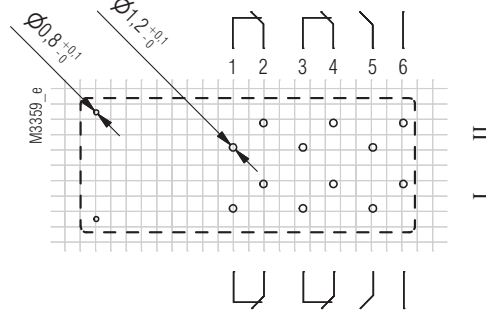
Pin Configuration W7



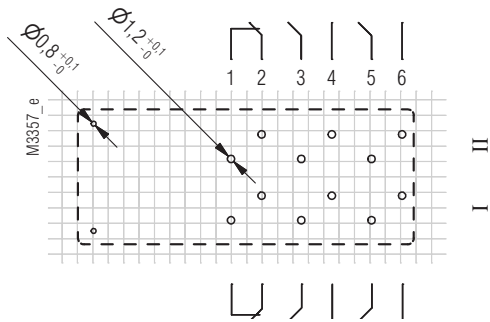
Pin Configurations W7
Drilling plan (solder side)



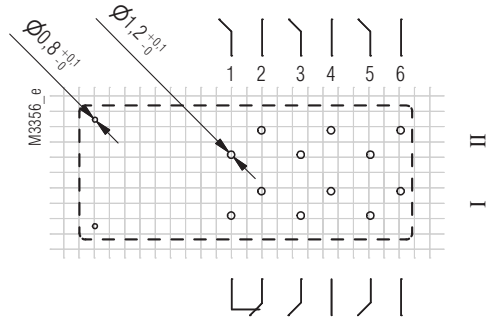
OA 5622.18/___W7 3NO / 3NC



OA 5622.50/___W7 2NO / 4NC

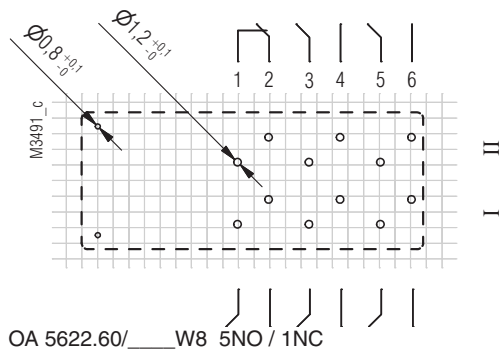


OA 5622.54/___W7 4NO / 2NC



OA 5622.60/___W7 5NO / 1NC

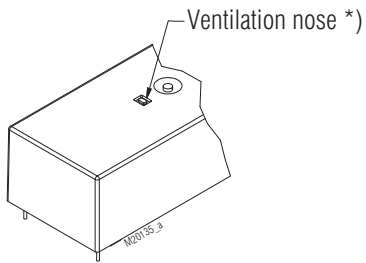
Pin Configurations W8
Drilling plan (solder side)



OA 5622.60/___W8 5NO / 1NC

Connection for basic grid dimensions 2.50 mm as well as 2.54 mm according to IEC/EN 60 097, IEC 60 326

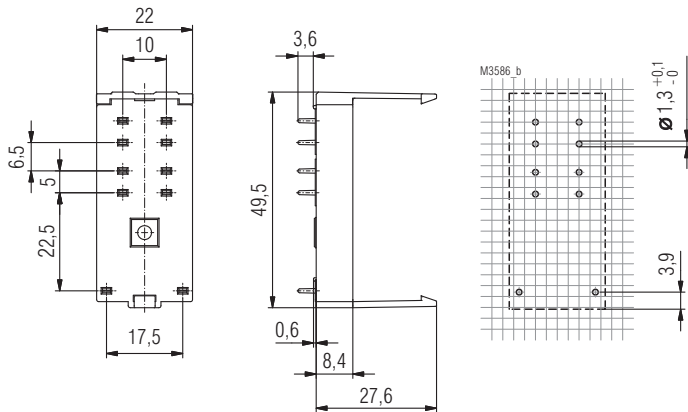
Notes



*) When using the maximum switching capacity it is recommended to open the relay at the indicated position.

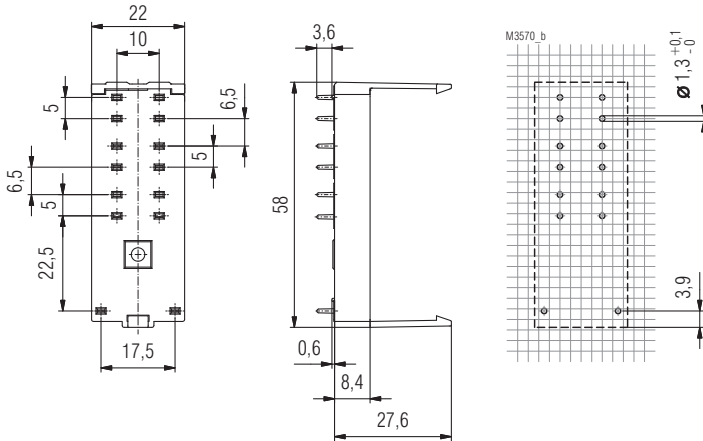
Accessories

Socket ET 1415.035



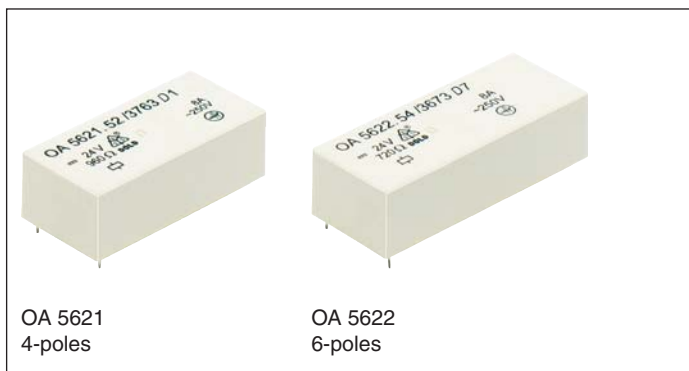
Article number: 0059509

Socket ET 1415.037



Article number: 0059275

Safety Relay with double contacts OA 5621, OA 5622

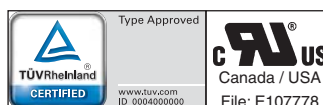


- According to DIN EN 61810-1, IEC 61810-3
- With forcibly guided contacts
- High switching safety because of gold plated double contacts
- Clearance and creepage distances:
contact - contact $\geq 5,5$ mm
- Low rated power consumption and holding power
- High mechanical service life
- High temperature range
- High thermal continuous current
- Voltage range $0.75 \dots 1.2 U_N$
- 15.5 mm height

Applications

- To be used in electrical circuits for safety applications
- Escalators and walkways
- Elevators for men and load
- Railway technology

Approvals and Markings



Technical Data

Relay type		OA 5621	OA 5622	OA 5622.50
1.0 Coil				
1.1 Nominal voltage	DC V	6, 12, 24, 48, 60, 110 or others on request		
1.2 Nominal consumption	W	0.6	0.8	0.9
1.11 Voltage range	U_N	0.75 ... 1.2		
1.12 Thermal resistance	K/W	55 (mounting distance between relays ≥ 5 mm)		
1.13 Holding capacity	mW	≥ 150	≥ 200	≥ 225
2.0 Contacts				
2.1 Contact arrangement		2 NO / 2 NC 3 NO / 1 NC	3 NO / 3 NC 4 NO / 2 NC 5 NO / 1 NC	2 NO / 4 NC
2.2 Contact material		AgNi + 5 μ m Au		
2.3 Rated insulation voltage	AC V	250		
Switching voltage min./max	V	AC/DC 2 V / AC/DC 60 V (AC 250 V, DC 220 V) ¹⁾		
2.4 Limiting continuous current I_{th}	A	3 x 5	5 x 5 (s. operating voltage limit curve)	
Switching current min./max	A	AC/DC 1 mA / 0.3 A (AC 5 A, DC 3 A) ¹⁾		
2.5 Switching power min./max.	VA	1 mVA / 7 VA (1250 VA) ¹⁾		
Switching power min./max.	W	1 mW / 7 W (120 W) ¹⁾		
2.6 Switching capacity to IEC/EN 60947-5-1				
AC 15	AC V/A		NO: 250 / 3	NC: 250 / 1
DC 13	DC V/A		NO: 24 / 2	NC: 24 / 2
at 0.1 Hz	DC V/A		NO: 24 / 4	NC: 24 / 4
to UL 508			B300 / Q 300	
2.7 Electrical life		at 1 s On, 1 s Off (see contacts service life)		
at AC 230 V, 5 A, $\cos\phi = 1$	switching cycles	$> 2 \times 10^5$ AgNi 0.15		
at DC 24 V, 3 A ohmic	switching cycles	$> 1.5 \times 10^5$ AgNi 0.15		
2.8 Switching frequency max	switching cycles / s	10		
2.9 Response time / Release time	ms	typically 12 / typically 8		
2.10 Contact force	cN	≥ 8		
2.13 Contact resistance	m Ω	≤ 100 (DC 2 V, 100 mA)		
2.14 Contact gap	mm	> 0.5 ²⁾		
3.0 Other				
3.1 Mechanical life	switching cycles	$> 20 \times 10^6$		
3.2 Temperature range	$^{\circ}$ C	- 40 ... + 80		
3.3 Degree of protection, housing		Wash proof RT III		
3.4 Test procedure		A (group mounting)		
3.5 Vibration resistance		NO: 10 ... 200 Hz; 10 g; NC: 10 ... 140 Hz ≤ 5 g; IEC/EN 60068-2-6		
3.6 Climate resistance		40 / 080 / 04; A / B / D IEC/EN 60068-1		
3.7 Short circuit strength 1 kA / AC 250 V	AgNi	NO: 10 AgL / NC: 6 AgL IEC/EN 60947-5-1		

¹⁾ these higher values are possible but the gold plate will be destroyed

²⁾ over entire service life, even when under fault and at $1.2 \times U_N$

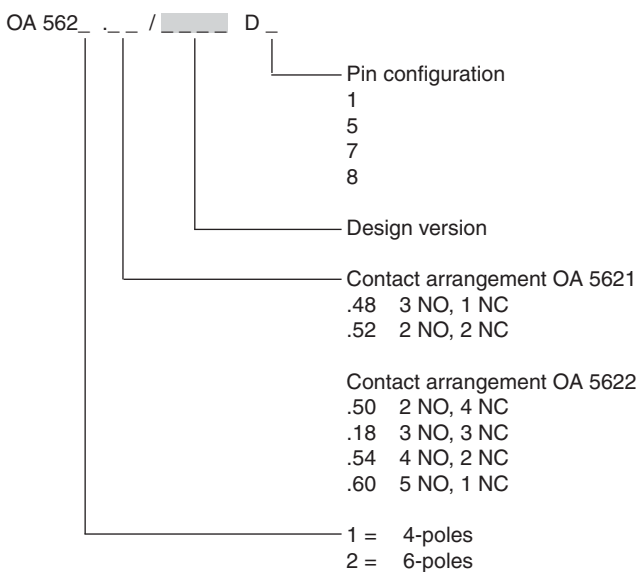
Technical Data

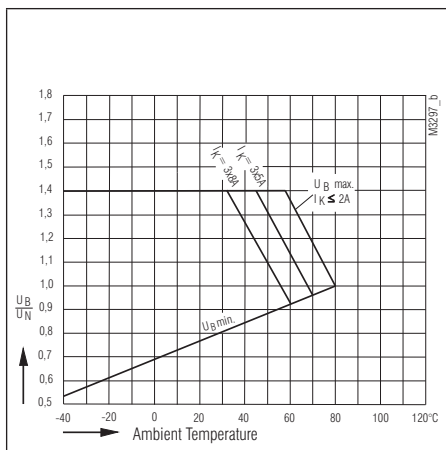
3.8	Insulation acc. to IEC 60664-1, EN 50178		
	Rated insulation voltage	AC V	250
	Pollution degree		2
	Overvoltage category		III
	Test voltage		
	Contact-coil (1 min)	AC kV eff.	≥ 4
	Contact-contact (1min)	AC kV eff.	≥ 4
	Open contact acc. to DIN EN 61810-1	AC kV eff.	1.5
	Transient voltage		
	Contact-coil (1,2 - 50 μs)	kV	≥ 6
	Clearance and creepage distance	mm	≥ 5,5
3.9	Weight	g	approx. 35 approx. 38 approx. 38
4.0 Packing unit			
4.1	on cardboard in slipcase	piece	25 20 20
4.2	in case package	piece	250 200 200
5.0 Solder method			
5.1	Solder method /-temperature /-duration	°C / s	Wafer soldering / 260 / 5

Design Versions

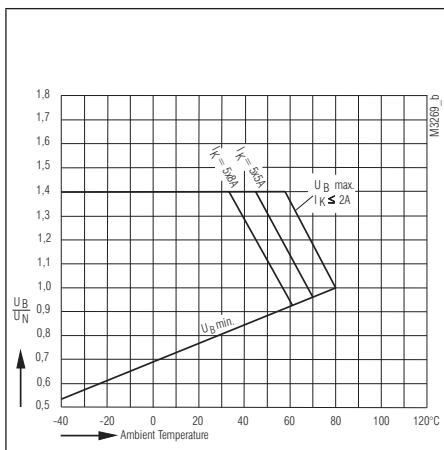
U _N (DC V)	Voltage range (DC V)	OA 5621			OA 5622					
		R _{Coil} Ω ± 10%	.48 3NO, 1NC	.52 2NO, 2NC	R _{Spule} Ω ± 10%	.18 3NO, 3NC	.54 4NO, 2NC	.60 5NO, 1NC	R _{Coil} Ω ± 10%	.50 2NO, 4NC
AgNi 0,15-contacts + 5 μm Au										
6	4,5 ... 8,4	60	3791	3801	45	3821	3831	3841	38	3851
12	9,0 ... 16,8	240	3792	3802	180	3822	3832	3842	150	3852
24	18,08 ... 33,6	960	3793	3803	720	3823	3833	3843	600	3853
48	36,0 ... 67,2	3840	3794	3804	2880	3824	3834	3844	2425	3854
60	45,0 ... 84,0	6000	3795	3805	4500	3825	3835	3845	3790	3855
110	82,5 ... 154,0	20000	3796	3806	15125	3826	3836	3846	12735	3856

Ordering Example

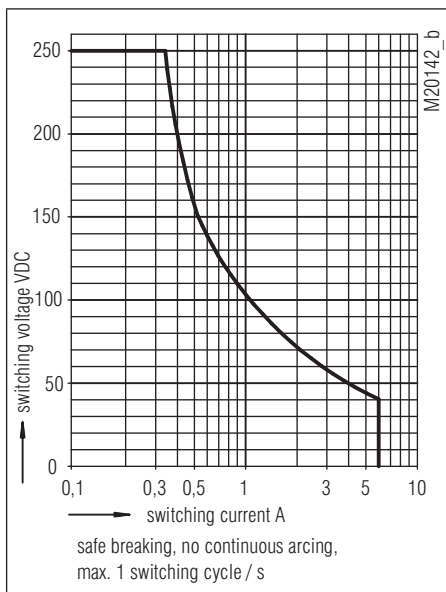




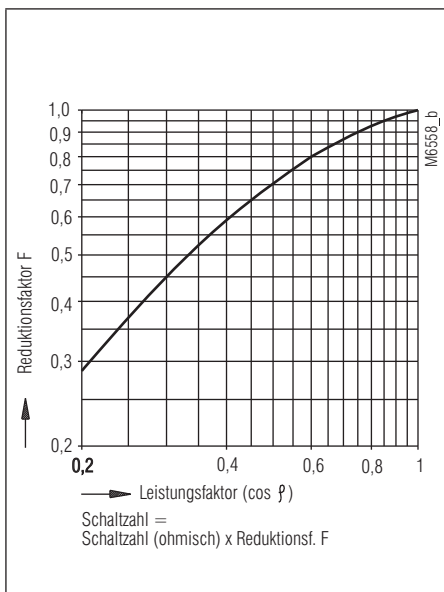
Operating voltage limit curve OA 5621



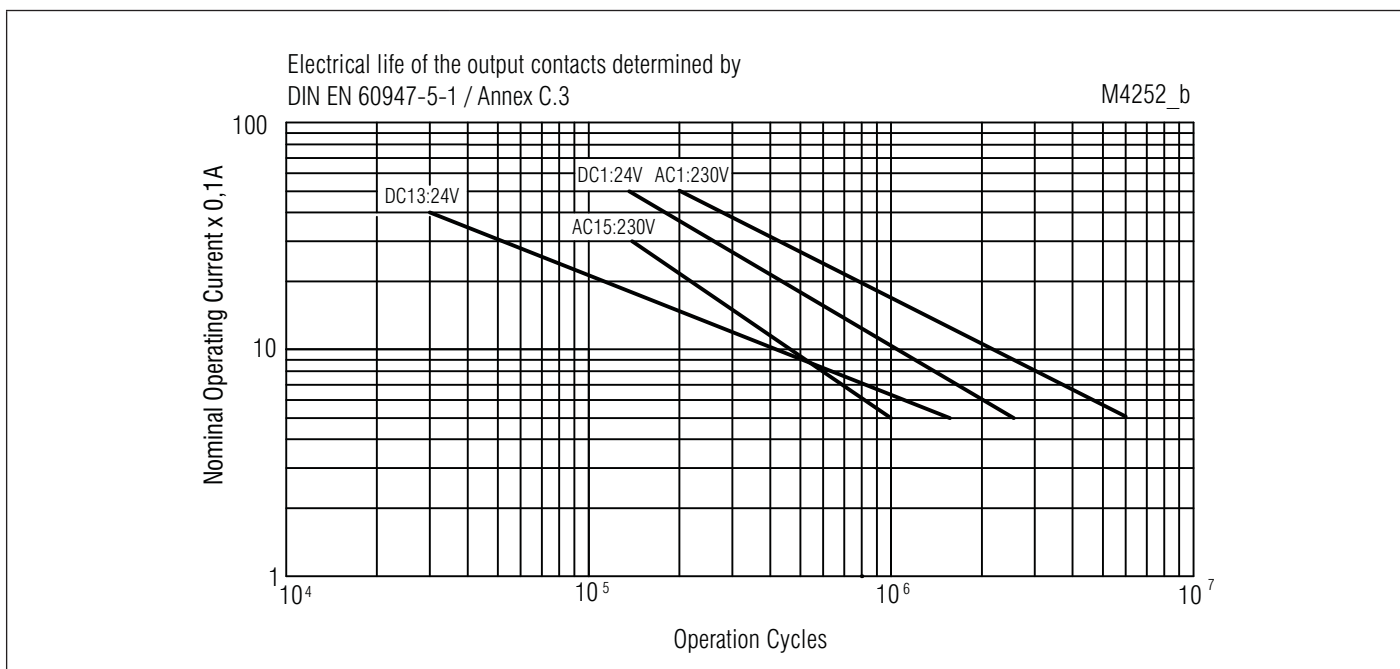
Operating voltage limit curve OA 5622



Limit curve for arc-free operation (load limit curve)

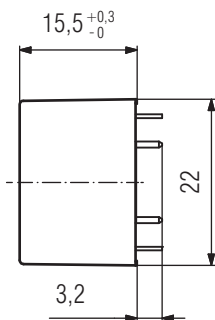
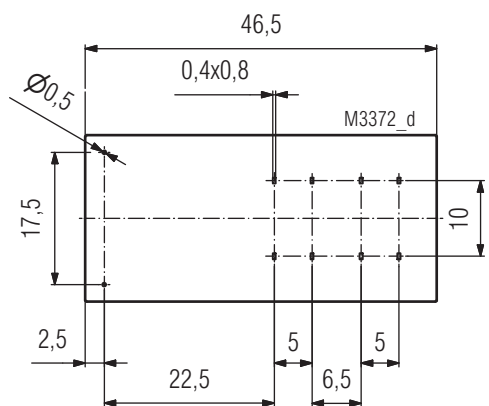


Reduction factor for inductive loads

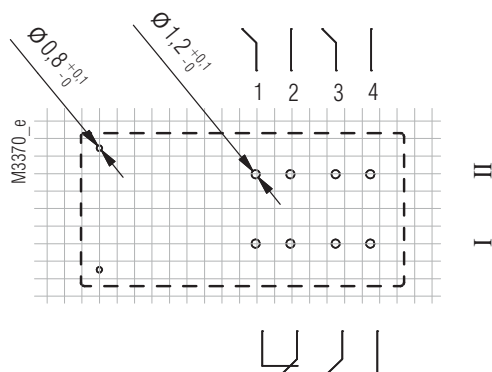


Electrical life

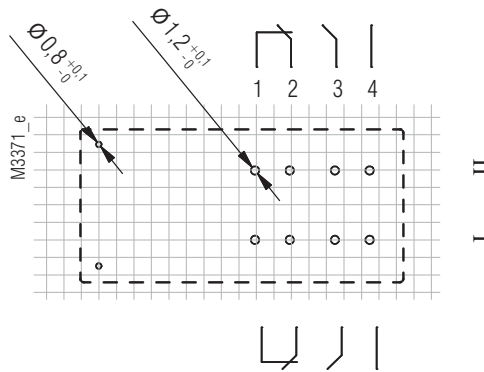
Pin Configurations D1 / D5



Pin Configuration D1
Drilling plan (solder side)

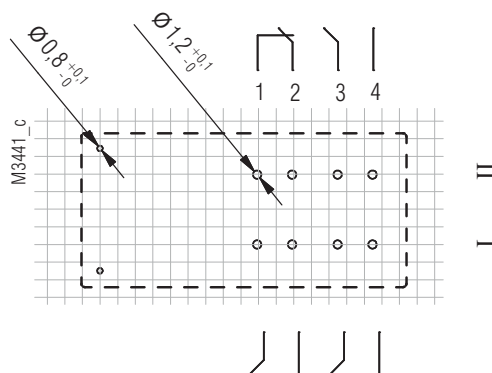


OA5621.48/___D1 3NO / 1NC



OA5621.52/___D1 2NO / 2NC

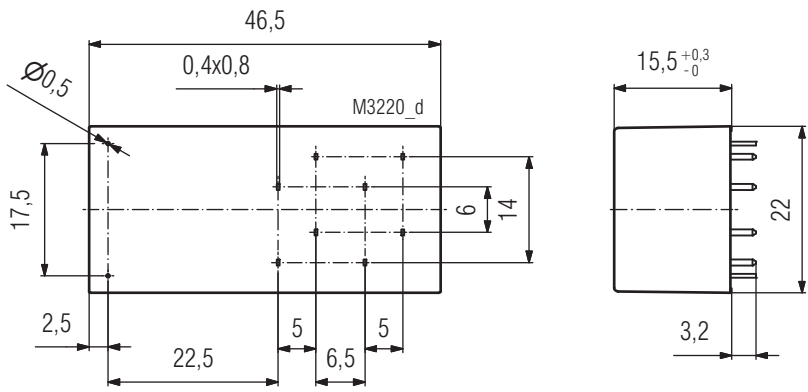
Pin Configuration D5
Drilling plan (solder side)



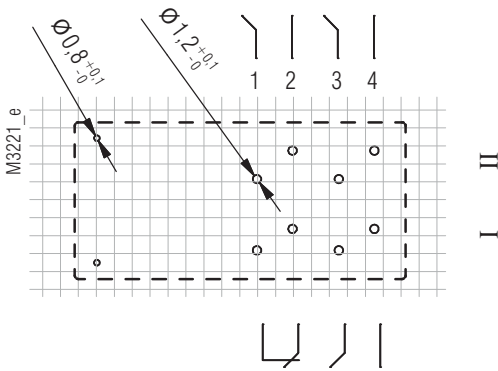
OA5621.48/___D5 3NO / 1 NC

Connection for basic grid dimensions 2,50 mm as well as 2,54 mm according to DIN EN 60097, DIN EN 60326

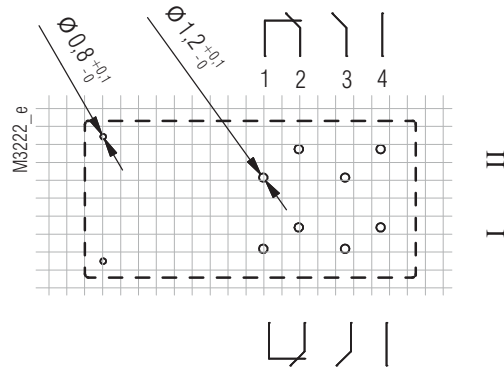
Pin Configurations D7 / D8



Pin Configuration D7
Drilling plan (solder side)

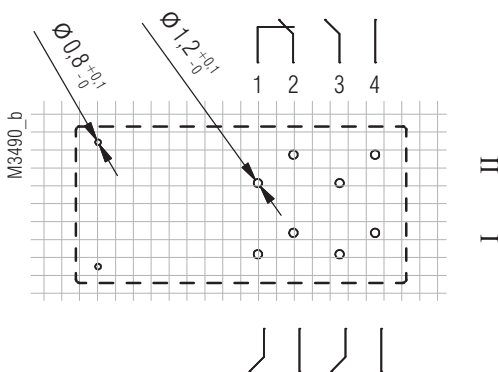


OA5621.48/___D7 3NO / 1NC



OA5621.52/___D7 2NO / 2NC

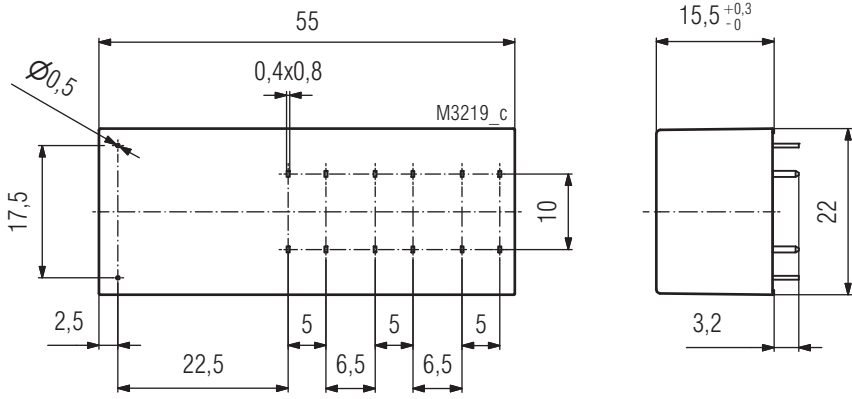
Pin Configuration D8
Drilling plan (solder side)



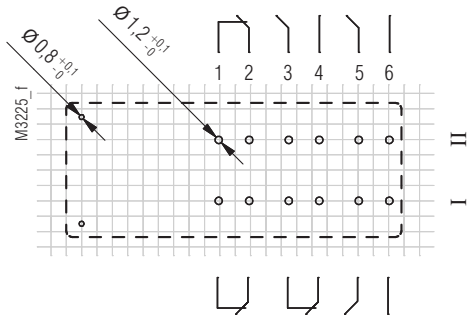
OA5621.48/___D8 3NO / 1NC

Connection for basic grid dimensions 2,50 mm as well as 2,54 mm according to DIN EN 60097, DIN EN 60326

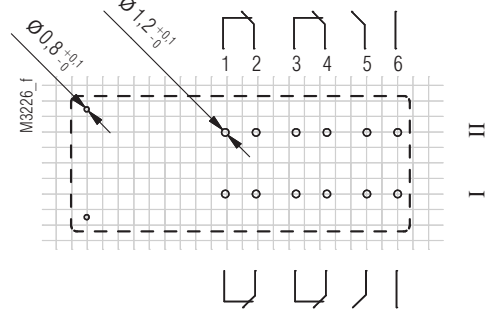
Pin Configurations D1 / D5



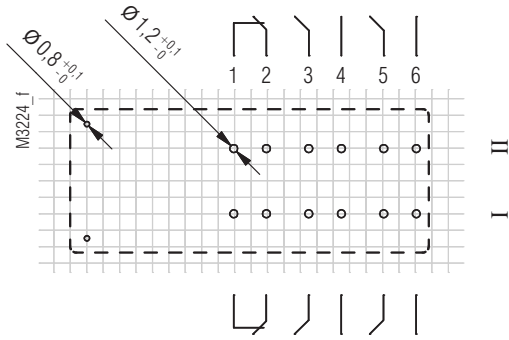
Pin Configuration D1
Drilling plan (solder side)



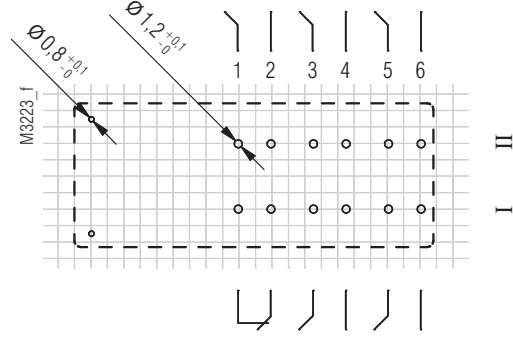
OA 5622.18/___D1 3NO / 3NC



OA 5622.50/___D1 2NO / 4NC

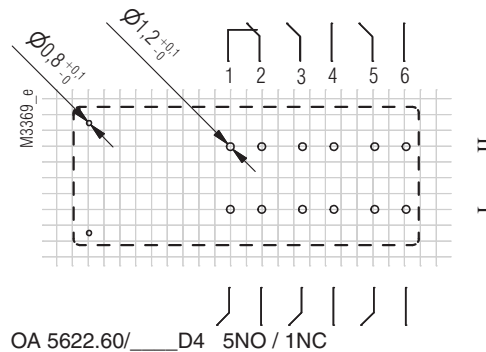


OA 5622.54/___D1 4NO / 2NC



OA 5622.60/___D1 5NO / 1NC

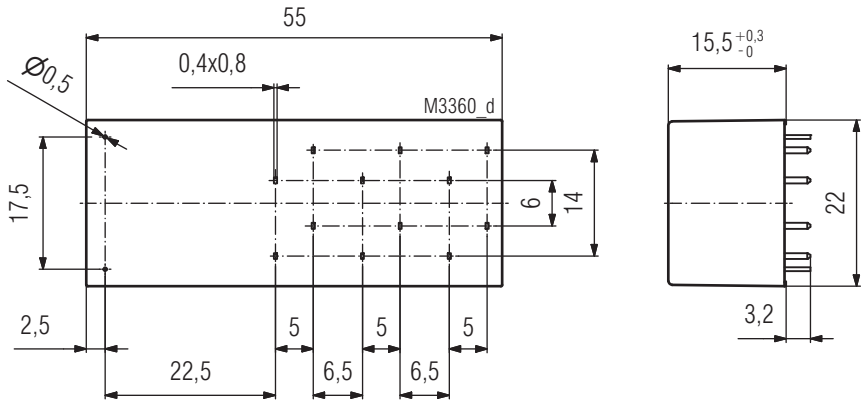
Pin Configuration D4
Drilling plan (solder side)



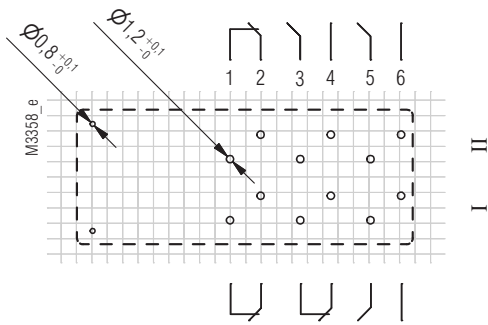
OA 5622.60/___D4 5NO / 1NC

Connection for basic grid divisions 2,50 mm as well as 2,54 mm according to DIN EN 60097, DIN EN 60326

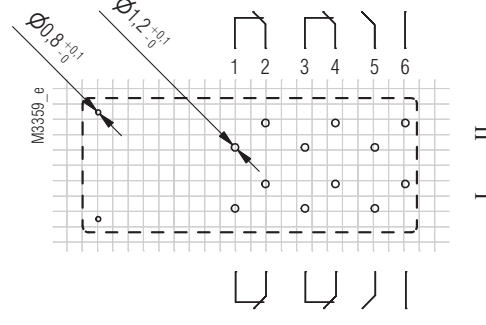
Pin Configuration D7



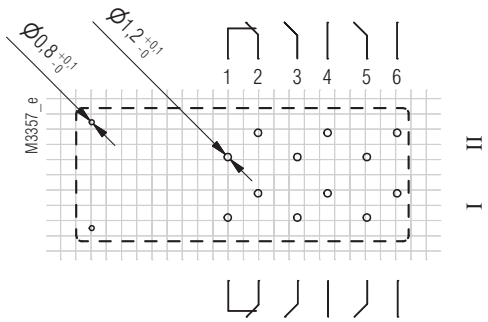
Pin Configuration D7
Drilling plan (solder side)



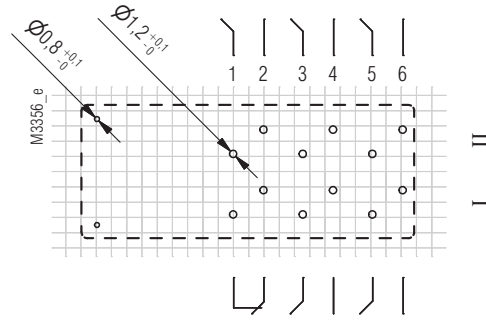
OA 5622.18/___D7 3NO / 3NC



OA 5622.50/___D7 2NO / 4NC

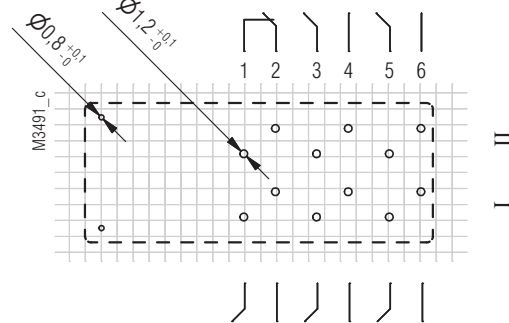


OA 5622.54/___D7 4NO / 2NC



OA 5622.60/___D7 5NO / 1NC

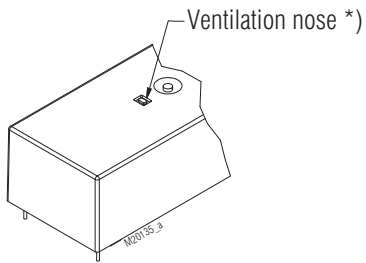
Pin Configuration D8
Drilling plan (solder side)



OA 5622.60/___D8 5NO / 1NC

Connection for basic grid dimensions 2,50 mm as well as 2,54 mm according to DIN EN 60097, DIN EN 60326

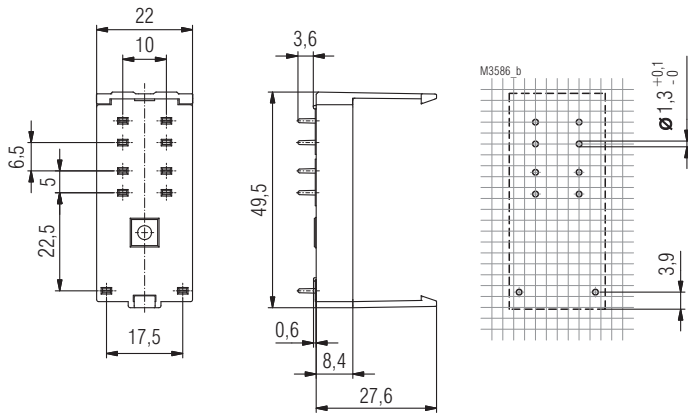
Notes



*) When using the maximum switching capacity it is recommended to open the relay at the indicated position.

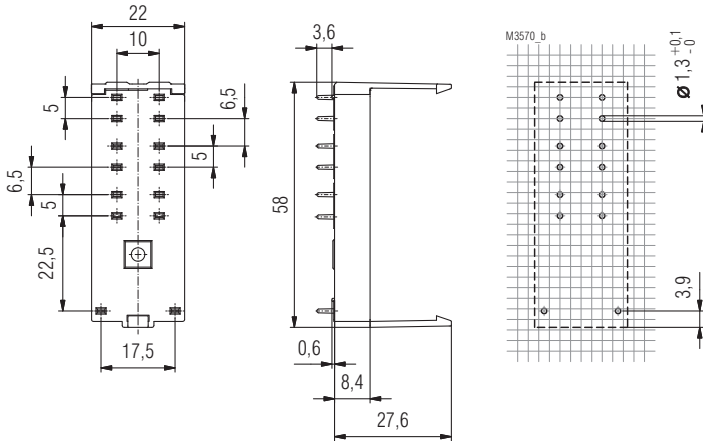
Accessories

Socket ET 1415.035



Article number: 0059509

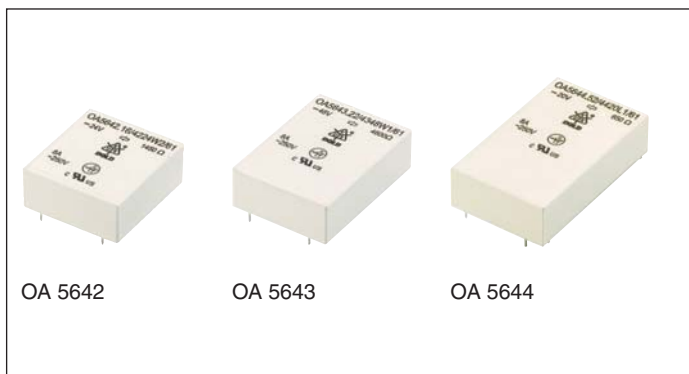
Socket ET 1415.037



Article number: 0059275

Safety Relays

OA 5642, OA 5643, OA 5644

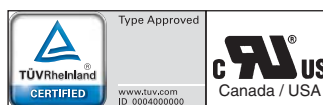


- According to DIN EN 61810-1, IEC 61810-3 resp. DIN EN 50205, DIN EN 45545 (fire protection on railway vehicles)
- With forcibly guided contacts
- Safe separation between coil/contact and contact/contact for applications at pollution degree 2 with rated insulation voltage 250 V
- Clearance and creepage distances
contact - coil ≥ 5.5 mm
contact - contact ≥ 5.5 mm
- Low nominal and holding power
- High mechanical service life
- **Extremely smallest height only 10.3 mm and minimum area**
- RoHS compliance
- Placing SMD components between PCB and relay is possible

Applications

- Switchgear for safety technology
- Press controls
- Escalators and walkways EN 115
- Elevators EN 81-1
- Railway technique

Approvals and Markings



Technical Data

Relay type		OA 5642	OA 5643	OA 5644
1.0 Relay coil				
1.1 Nominal voltage	DC V	6; 12; 21; 24; 48; 60; 110; others on request		
1.2 Nominal consumption	W	0.40	0.50	0.65
1.11 Voltage range	U_N	0.7 ... 1.6	0.7 ... 1.6	0.7 ... 1.6
1.12 Thermal resistance	K/W	65 \pm 10		
1.13 Holding power (at 0.5 x U_N)	W	0.1	0.125	0.160
2.0 Contacts				
2.1 Contact arrangement		1 NO / 1 NC	2 NO / 1 NC	2 NO / 2 NC 3 NO / 1 NC
2.2 Contact material		AgSnO ₂ + 0.2 μ m Au; AgNi + 0.2 μ m Au, AgNi + 5 μ m Au		
2.3 Rated insulation voltage	AC V	250		
Switching voltage min./max	V	AC 10; DC 10 / DC 250, AC 400 (AC/DC 2 V / AC/DC 60 V) ¹⁾		
2.4 Limit. contin. current I_{th} max. (each contact)	A	8		
Switching current min./max	A	10 mA ²⁾ / 8 A (2 mA / 0.3 A) ¹⁾		
2.5 Switching power min./max.	VA	0,1 ²⁾ / 2000 (10 mVA / 12 VA) ¹⁾		
Switching power min./max	W	0,1 ²⁾ ... 200 (10 mW / 12 W) ¹⁾ (see arc limit curve under resistive load)		
2.6 Switching capacity to IEC/EN 60947-5-1				
AC 15 ³⁾	V/A	NO 250 / 3	NC 250 / 1	
AC 15 ⁴⁾	V/A	NO 250 / 5	NC 250 / 2	
DC 13 ³⁾	V/A	NO 24 / 2	NC 24 / 2	
DC 13 ³⁾ at 0,1 Hz	V/A	NO 24 / 4	NC 24 / 4	
to UL 508		B300 / Q300		
2.7 Electrical life		$> 10^5$		
at AC 230 V, 8 A, $\cos\phi = 1$	switching cycles	at 1 s On, 1 s Off (see diagram)		
2.8 Switching frequency max.	switching cycles/s	20		
2.9 Response time / Release time	ms	typ. 10 / typ. 5		
2.14 Contact gap	mm	1.0 ... 1.2 (> 0.5 ⁵⁾) $\hat{=}$ micro contact gab		
3.0 Other				
3.1 Mechanical life	switching cycles	$> 40 \times 10^6$		
3.2 Temperature range	$^{\circ}$ C	- 40 ... + 85		
3.3 Degree of protection		Wash proof RT III		
3.5 Vibration resistance		10 ... < 60 Hz, a = 0,35 mm IEC/EN 60068-2-6		
Criteria: contact opening ≥ 10 μ s		60 ... 200 Hz, 5g (all contacts) IEC/EN 60068-2-6		
3.6 Climate resistance		040 / 085 / 21 IEC/EN 60068		
3.7 Short circuit strength		1 kA / AC 250 V IEC/EN 60947-5-1 ^{3) 4)}		
SCPD / Fuse		NO contacts: 10 A gG/gL / NC contacts: 6 A gG/gL IEC/EN 60269 ^{3) 4)}		

¹⁾ Values for AgNi-contacts + 5 μ m Au

²⁾ Typical values for AgNi and AgSnO₂

³⁾ Values for AgNi

⁴⁾ Values for AgSnO₂

⁵⁾ over entire service life, even when under fault and at 1.6 x U_N

Technical Data

3.8	Insulation according to IEC 60664-1				
	Rated insulation voltage	AC V		250	
	Pollution degree			2	
	Overvoltage category			III	
	Test voltage				
	Contact- Coil (1 min)	AC kV eff.		≥ 4	
	Contact - Contact (1min)	AC kV eff.		≥ 4	
	between open contacts	AC kV eff.		≥ 1,5	
	Transient voltage				
	Contact- Coil (1,2 - 50 μs)	kV		≥ 6	
	Contact - Contact (1,2 - 50 μs)	kV		≥ 6	
	Clearance and creepage distances				
	Contact- Coil	mm		≥ 5.5	
	Contact - Contact	mm		≥ 5.5	
3.9	Weight	g	approx. 14	approx. 15	approx. 16
4.0 Packing					
4.1	on cardboard in slipcase	piece	32	28	20
4.2	in case package	piece	320	280	200
5.0 Solder method					
5.1	Solder method /-temperature /-duration	°C / s		Wafer soldering / 260 / 5	

Design Versions

U _N (DC V)	Voltage range (DC V)	OA 5642		OA 5643		OA 5644		
		R _{Coil} Ω±10%	.16	R _{Coil} Ω±10%	.22	R _{Coil} Ω±10%	.48	.52
			1NO, 1NC		2NO, 1NC		3NO, 1NC	2NO, 2NC
AgSnO ₂ -contacts + 0,2 μm Au								
6	4.2 ... 9.6	90	4231	70	4331	55	4431	4531
12	8.4 ... 19.2	370	4232	290	4332	230	4432	4532
21	15.0 ... 33.6	1050	4233	840	4333	680	4433	4533
24	16.8 ... 38.4	1450	4234	1150	4334	900	4434	4534
48	33.6 ... 76.8	6000	4235	4600	4335	3600	4435	4535
60	42.0 ... 96.0	9250	4236	7100	4336	5600	4436	4536
110	77.0 ... 176.0	31000	4237	24000	4337	18500	4437	4537
AgNi-contacts + 0.2 μm Au								
6	4.2 ... 9.6	90	4201	70	4301	55	4401	4501
12	8.4 ... 19.2	370	4202	290	4302	230	4402	4502
21	15.0 ... 33.6	1050	4203	840	4303	680	4403	4503
24	16.8 ... 38.4	1450	4204	1150	4304	900	4404	4504
48	33.6 ... 76.8	6000	4205	4600	4305	3600	4405	4505
60	42.0 ... 96.0	9250	4206	7100	4306	5600	4406	4506
110	77.0 ... 176.0	31000	4207	24000	4307	18500	4407	4507
AgNi-contacts + 5 μm Au								
6	4.2 ... 9.6	90	4221	70	4321	55	4421	4521
12	8.4 ... 19.2	370	4222	290	4322	230	4422	4522
21	15.0 ... 33.6	1050	4223	840	4323	680	4423	4523
24	16.8 ... 38.4	1450	4224	1150	4324	900	4424	4524
48	33.6 ... 76.8	6000	4225	4600	4325	3600	4425	4525
60	42.0 ... 96.0	9250	4226	7100	4326	5600	4426	4526
110	77.0 ... 176.0	31000	4227	24000	4327	18500	4427	4527

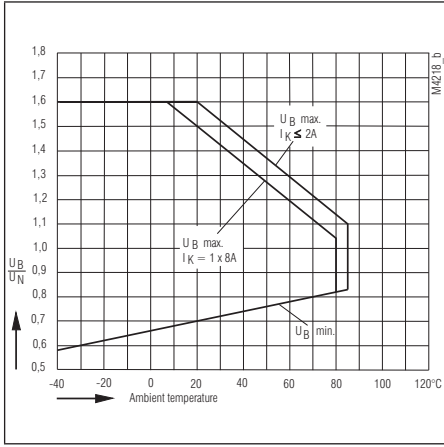
Ordering Example

OA 5642. _ _ / W 1 / 61*)

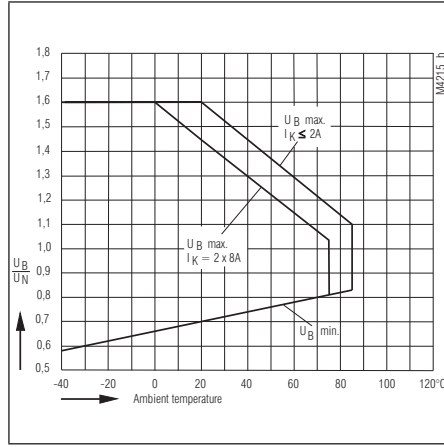
└─ Pin configuration
└─ W = wash proof RT III
└─ Design version
└─ Contact arrangement
.16 1 NO / 1 NC

*) / 61 cURus approval

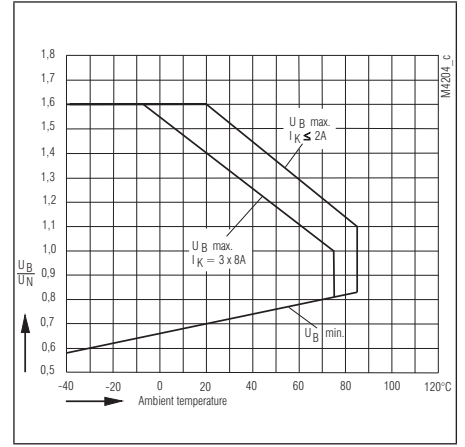
Characteristics



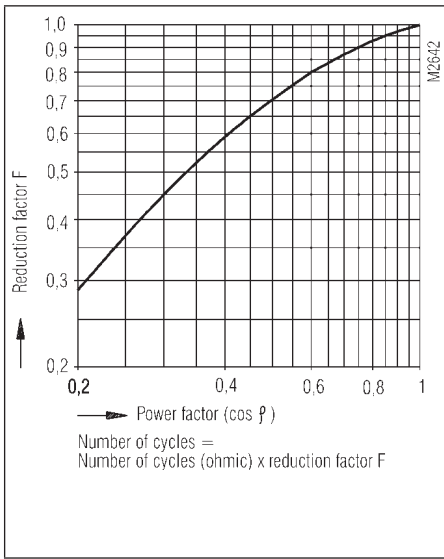
Operating voltage limit curve
OA 5642.16



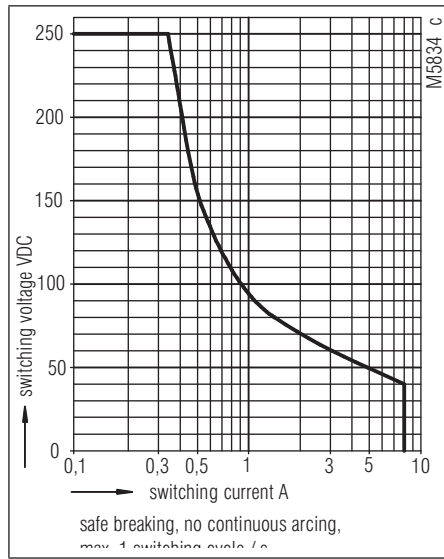
Operating voltage limit curve
OA 5644.52 und OA 5643.22



Operating voltage limit curve
OA 5644.48

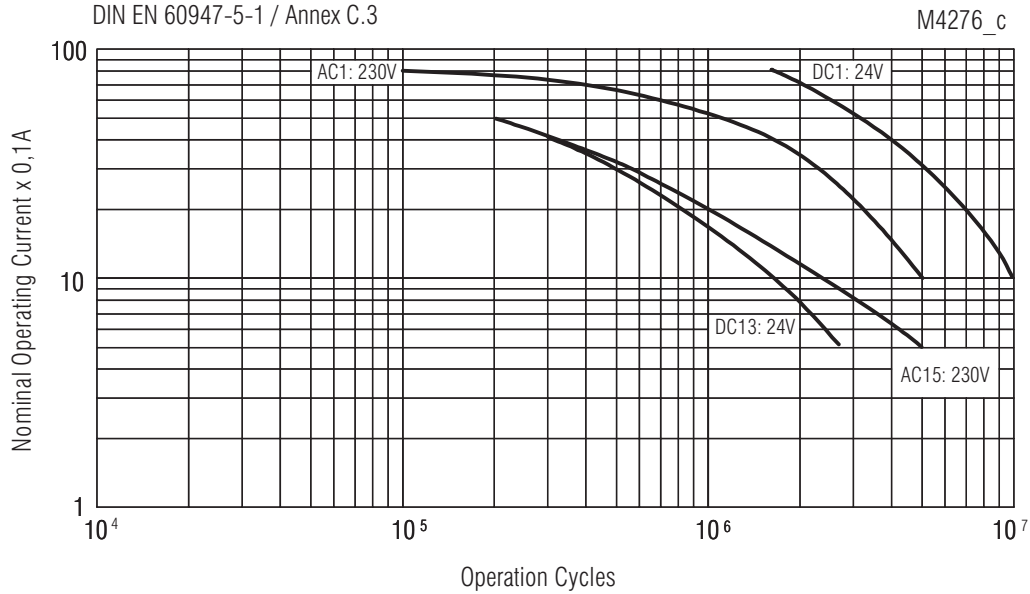


Reduction factor for inductive loads



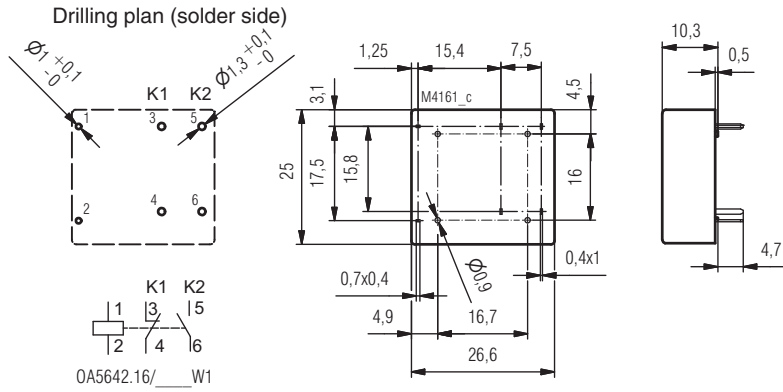
Limit curve for arc-free operat. (load limit curve)

Electrical life of the output contacts determined by
DIN EN 60947-5-1 / Annex C.3

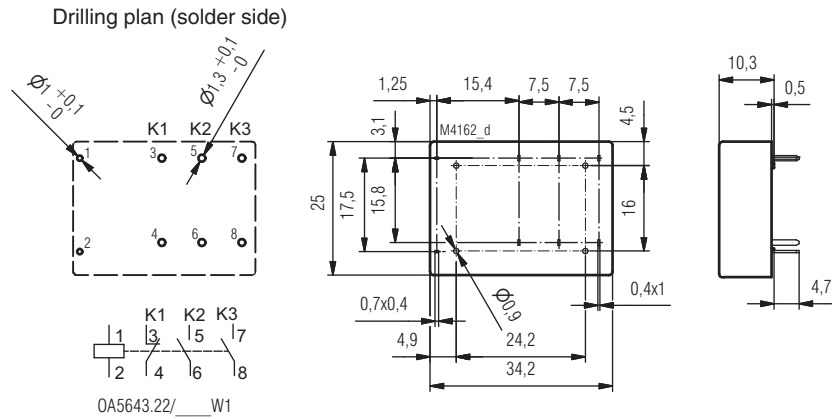


Electrical life

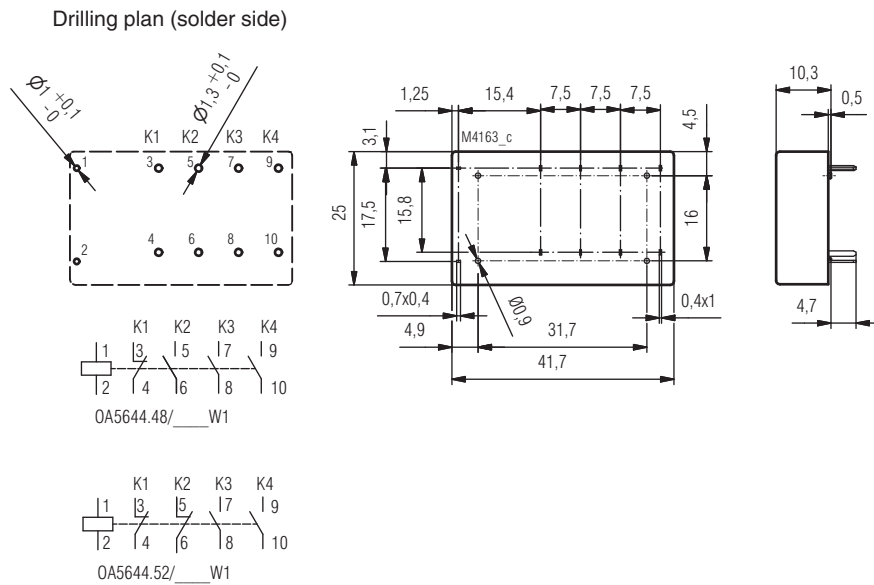
OA 5642 Dimensions, Pin Configuration, Connection Diagrams



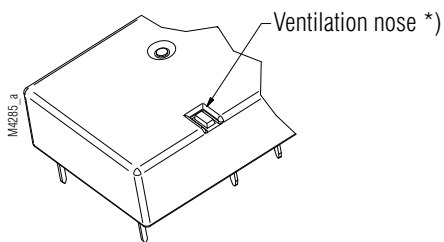
OA 5643 Dimensions, Pin Configuration, Connection Diagrams



OA 5644 Dimensions, Pin Configuration, Connection Diagrams



Notes



*) When using the maximum switching capacity it is recommended to open the relay at the indicated position.

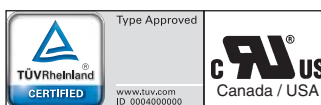


- According to DIN EN 61810-1, DIN EN 61810-3
- With forcibly guided contacts
- Clearance and creepage distances
contact-coil ≥ 8 mm,
contact - contact ≥ 5.5 mm
- **Double and reinforced insulation between contact sets**
- Low rated power consumption
- High mechanical service life
- Compact size, small height
- Wash proof model as option

Application

- Switchgear for safety technology
- Escalators and walkways
- Elevators for men and load
- Press controls
- Railway technology

Approvals and Markings



Technical Data

Relay type		OA/OW 5669	
1.0 Relay coil			
1.1 Nominal voltage	DC V	6, 12, 20, 24, 48, 60, 110 (other on request)	
1.2 Nominal consumption	W	0.7	
1.11 Voltage range	U_N	0.8 ... 1.6	
1.3 Holding power (at $0.5 \times U_N$)	W	0.18	
2.0 Contacts			
2.1 Contact arrangement		1 NC / 1NO 2 changeover contacts	
2.2 Contact material		AgSnO ₂ + 0.2 μ m Au; AgNi + 0.2 μ m Au, AgNi + 5 μ m Au	
2.3 Rated insulation voltage	AC V	250	
Switching voltage min./max.	V	AC/DC 10 / DC 250, AC 400 (AC/DC 2 V / 60 V) ¹⁾	
2.4 Limiting continuous current I_{th}	A	2 x 5 (see operating voltage limit curve)	
Switching current min./max.	A	10 mA ³⁾ / 8 (2 mA / 0.3 A) ¹⁾	
2.5 Switching power min./max.	VA	0,1 / 2000 (10 mVA / 12 VA) ¹⁾	
Switching power min./max.	W	0,1 ³⁾ / 200 (10 mW / 12 W) ¹⁾ (see limit curve for arc-free operation)	
2.6 Switching capacity to IEC/EN 60947-5-1		R300	
AC 15 ⁴⁾	AC V/A	NO: 250 / 2	NC: 250 / 1
AC 15 ⁵⁾	AC V/A	NO: 250 / 3	NC: 250 / 2
DC 13 ⁴⁾	DC V/A	NO: 24 / 2	NC: 24 / 1
DC 13 ⁴⁾ at 0.1 Hz	DC V/A	NO: 24 / 4	NC: 24 / 4
to UL 508			
2.7 Electrical life ²⁾		at 1 s On, 1 s Off (see contacts service life)	
AC 230 V 6 A $\cos \varphi = 1$	switching cycles	$> 2 \times 10^5$ AgSnO ₂	$> 2 \times 10^5$ AgNi
2.8 Switching frequency max.	switching cycles / s	10	
2.9 Response time / Release time	ms	≤ 15 / ≤ 12	
2.10 Contact force	cN	≥ 10 / ≥ 8	
3.0 Other			
3.1 Mechanical life	switching cycles	$\geq 50 \times 10^6$	
3.2 Temperature range	$^{\circ}$ C	- 40 ... + 70 mounted without distance ($I_{th} = 2 \times 5$ A)	
3.3 Degree of protection		Solder line proof RT II as option wash proof RT III	
3.4 Test procedure		A (group mounting)	
3.5 Vibration resistance		10 ... 200 Hz; NC 2 g; NO 10 g; IEC/EN 60068-2-6	
3.6 Climate resistance		40 / 070 / 04; A / B / D IEC/EN 60068-1	
3.7 Short circuit strength 1 kA / AC 250 V	AgSnO ₂ AgNi	10 A gL IEC/EN 60947-5-1 6 A gL IEC/EN 60947-5-1	

¹⁾ Values for AgNi-contacts + 5 μ m Au

²⁾ 10 A total current at $t = 20^{\circ}$ C and coil voltage U_N

³⁾ Typical values for AgSnO₂ and AgNi

⁴⁾ Values for AgNi-contacts

⁵⁾ Values for AgSnO₂-contacts

Technical Data

3.8	Insulation acc. to IEC 60664-1, EN 50178		double and reinforced insulation
	Rated insulation voltage	AC V	250
	Pollution degree		2
	Overvoltage category		III
	Test voltage		
	Contact-coil (1 min)	AC kV eff.	≥ 4
	Contact-contact (1min)	AC kV eff.	≥ 4
	Open contact acc. to DIN EN 61810-1	AC kV eff.	1.5
	Transient voltage		
	Contact-coil (1.2 - 50 μs)	kV	≥ 6
	Clearance and creepage distances		
	Contact-coil	mm	≥ 8
	Contact-contact	mm	≥ 5.5
3.9	Weight	g	approx. 19
4.0 Packing			
4.1	on cardboard in slipcase	piece	56
4.2	in case package	piece	280
5.0 Solder method			
5.1	Solder method /-temperature /-duration	°C / s	Wafer soldering / 260 / 5

Design versions

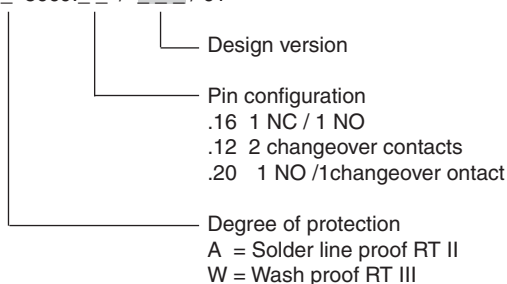
U _N DC V	Voltage range V	Resistance Ω (± 10%)	AgNi - contacts + 0.2 μm Au			AgNi - contacts + 5 μm Au		AgSnO ₂ - contacts + 0.2 μm Au	
			OA5669.12	OA5669.16		OA5669.12	OA5669.16	OA5669.12	OA5669.16
6	4.8 ... 9.6	50	981	992	462	691	771	581	
12	9.6 ... 19.2	210	982	993	463	692	772	582	553
20	16.0 ... 32.0	580	987	998	468	697	777	587	558
24	19.2 ... 38.4	820	983	994	464	693	773	583	554
48	38.4 ... 76.8	3200	984	995	465	694	774	584	555
60	48.0 ... 96.0	5200	985	996	466	695	775	585	556
110	88.0 ... 176.0	18000	986	997	467	696	776	586	557
				1)	2)		1)		1)

1) = Pin configuration standard

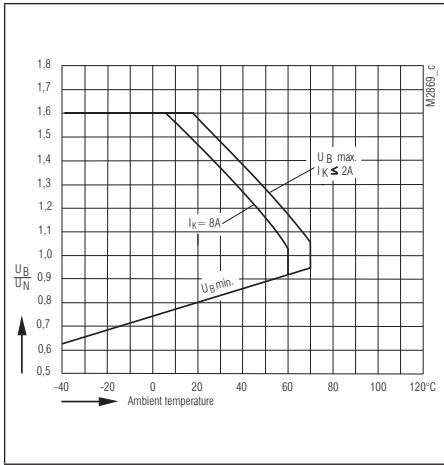
2) = Pin configuration reverse

Ordering example

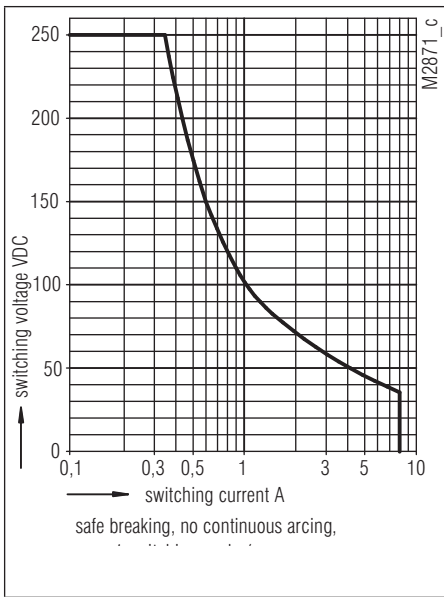
O_ 5669._._ / _._ / 61*)



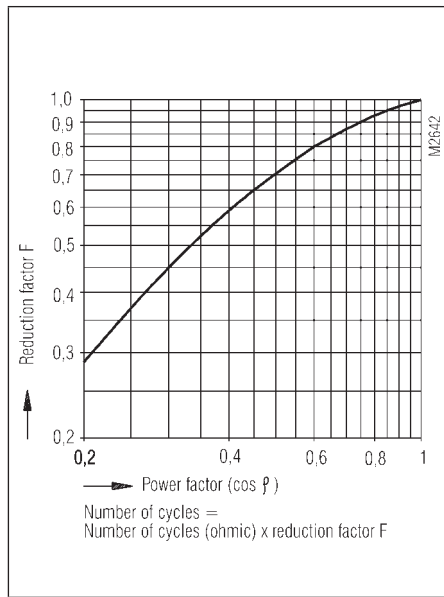
*) /61 cURus approval



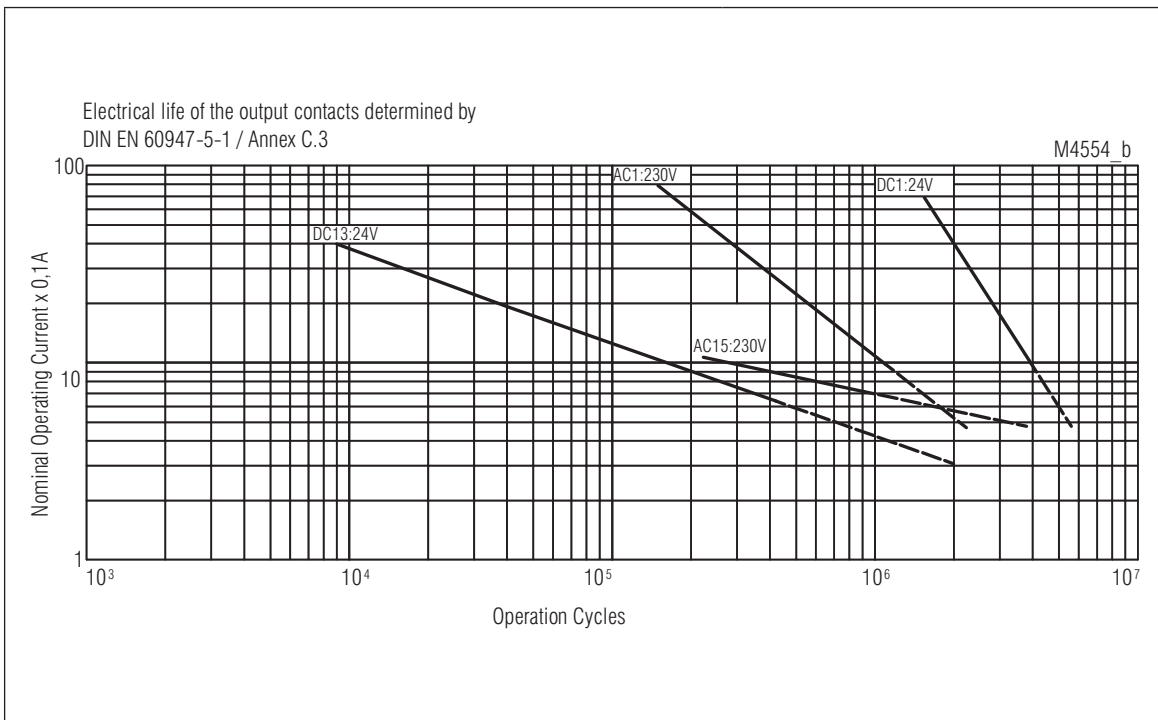
Operating voltage limit curve



Limit curve for arc-free operation (at $t_u = 20^\circ\text{C}$)
Contact material AgNi

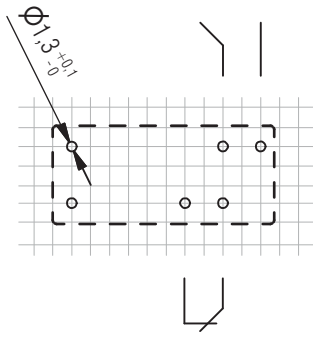


Reduction factor for reactive loads

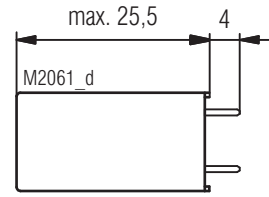
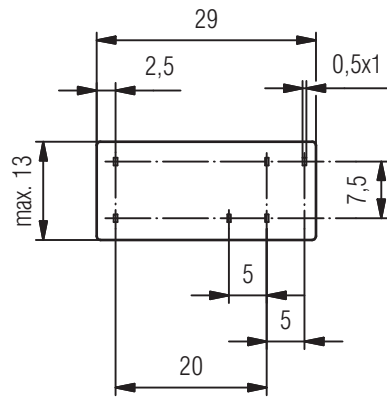


Electrical life for contact material AgNi

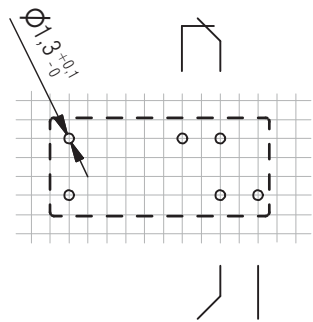
Drilling plan (solder side)



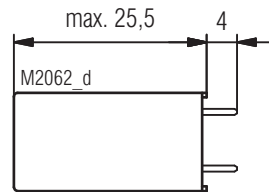
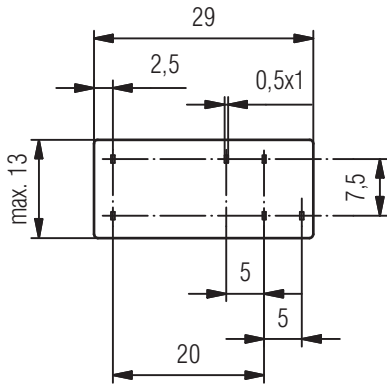
Pin configuration standard



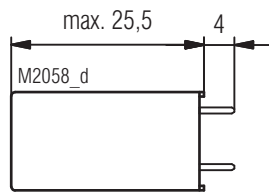
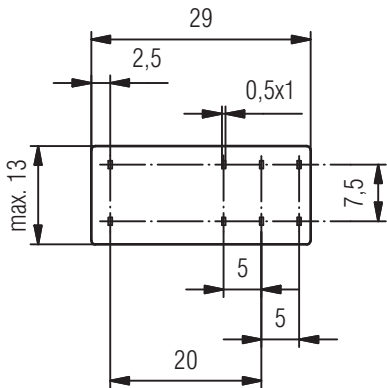
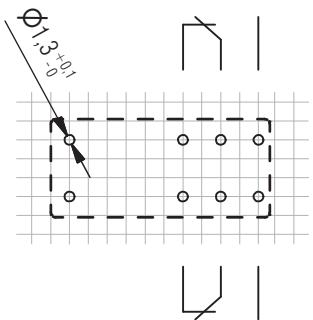
M2061_d
OA5669.16
OW5669.16



Pin configuration reverse

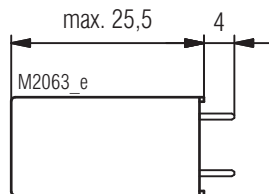
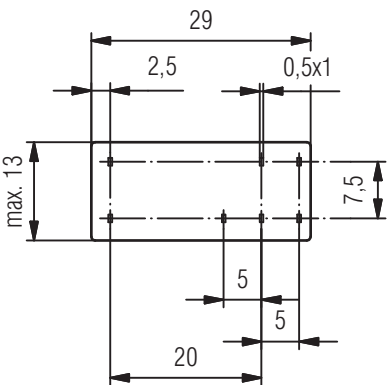
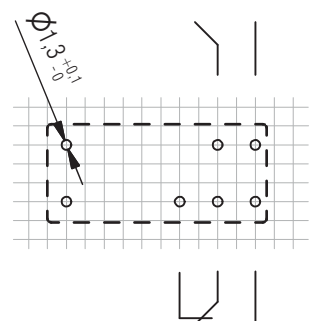


M2062_d
OA5669.16
OW5669.16



M2058_d
OA5668.12
OW5668.12

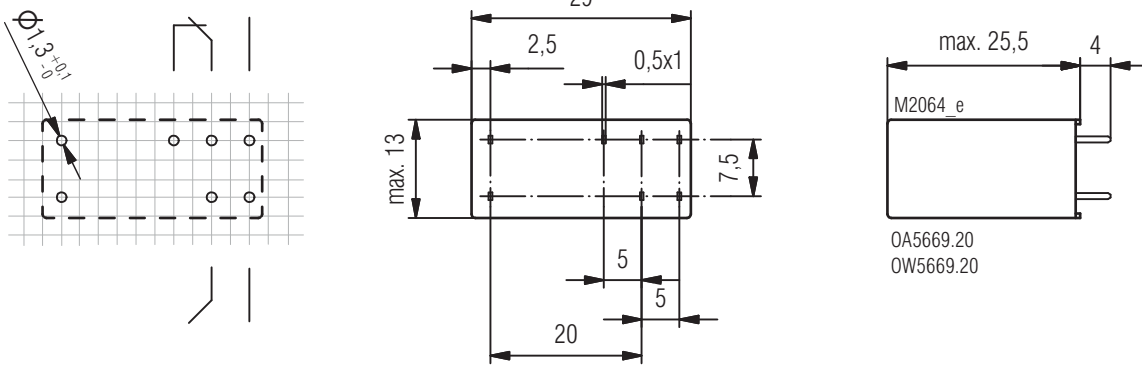
OA5669.12
OW5669.12



M2063_e
OA5669.20
OW5669.20

Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

Drilling plan (solder side)



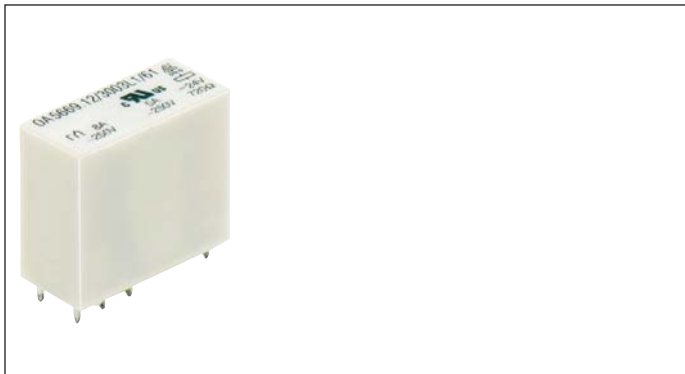
Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

Accessories

Socket ET 1415.021 Fixing clip ET 1415.025	Socket ET 1415.041	Socket ET 1415.044	Socket ET 1415.047
	<ul style="list-style-type: none"> • Socket for DIN-rail • incl. fixing clip 	<ul style="list-style-type: none"> • Socket for DIN-rail • incl. fixing clip 	<ul style="list-style-type: none"> • incl. safe separation between coil and contacts according to DIN EN 60947-1, DIN EN 61140, DIN EN 60204
<p>Article number: 0034769</p>	<p>Article number: 0055571</p>	<p>Article number: 0059274</p>	<p>Article number: 0059270</p>
	<p>wire connection solid / stranded: 0.14 ... 2.5 mm² (14 - 20 AWG) wire connection with sleeved end: 0.14 ... 1.5 mm² (14 - 25 AWG)</p>	<p>wire connection solid / stranded: 0.14 ... 2.5 mm² (14 - 20 AWG) wire connection with sleeved end: 0.14 ... 1.5 mm² (14 - 25 AWG)</p>	<p>wire connection solid / stranded / sleeved end: 2 x (0.2 ... 1.5) mm² (16 - 25 AWG)</p>
<p>Fixing clip (wire): 0034770 Fixing clip (plastic): 0047726</p>	<p>Function modules ET1415.913: DC 24 V, with free-wheel diode and green LED Article number: 0056828 ET1415.911: DC 24 V, with free-wheel diode and red LED Article number: 0055909 ET1415.924: DC 60 V, with free-wheel diode and red LED Article number: 0062552 ET1415.912: AC/DC 24 V, with varistor and green LED Article number: 0055910</p>		

Safety relay

OA 5669. _ _ /3 _ _ _

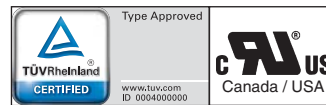


- According to DIN EN 61810-1, DIN EN 61810-3
- Clearance and creepage distances:
contact - coil ≥ 8 mm,
contact - contact ≥ 5.5 mm
double and reinforced insulation between contact sets
- Low rated power consumption
- High mechanical service life
- For high ambient temperature up to $+ 85^{\circ}\text{C}$
- Compact size, small height
- As option wash proof RT III

Applications

- Switchgear for safety technology
- Press controls

Approvals and Markings



Technical Data

Relaistyp		OA 5669
1.0 Relay coil		
1.1 Nominal voltage	DC V	6; 12; 24; 48; 60; 110 (others on request)
1.2 Nominal consumption	W	0.8
1.11 Voltage range	U_N	0.75 ... 1.4
1.13 Holding Power (at $0.5 \times U_N$)	W	0.2
2.0 Contacts		
2.1 Contact arrangements		2 changeover contacts, 1 NC and 1 NO
2.2 Contact material		AgSnO ₂ + 0.2 μm Au; AgNi + 0.2 μm Au, AgNi + 5 μm Au
2.3 Rated insulation voltage	AC V	250
Switching voltage min./max.	V	AC/DC 10 / DC 250, AC 400 (AC/DC 2 V / 60 V) ¹⁾
2.4 Limiting continuous current I_{th}	A	2 x 5 (see operating voltage limit curve)
Switching current min./max.	A	10 mA ³⁾ / 8 (2 mA / 0.3 A) ¹⁾
2.5 Switching power min./max.	VA	0.1 / 2000 (10 mVA / 12 VA) ¹⁾
Switching power min./max.	W	0.1 ³⁾ / 200 (10 mW / 12 W) ¹⁾ (s. limit curve for arc-free operation)
2.6 Switching capacity to IEC/EN 60947-5-1		
AC 15 ⁴⁾	AC V/A	NO: 250 / 2 NC: 250 / 1
AC 15 ⁵⁾	AC V/A	NO: 250 / 3 NC: 250 / 2
DC 13 ⁴⁾	DC V/A	NO: 24 / 1 NC: 24 / 1
DC 13 ⁴⁾ at 0.1 Hz	DC V/A	NO: 24 / 4 NC: 24 / 4
to UL 508		R300
2.7 Electrical life	switching cycles	at 1 s On, 1 s Off (see contacts service life)
at AC 230 V, 6 A, $\cos\phi = 1$	switching cycles	$> 2 \times 10^5$ AgNi $> 2 \times 10^5$ AgSnO ₂
2.8 max. switching frequency	switching cycles/s	10
2.9 Response time / Release time	ms	≤ 15 / ≤ 12
2.10 Contact force NO / NC	cN	≥ 13 / ≥ 10
3.0 Other		
3.1 Mechanical life	switching cycles	$\geq 50 \times 10^6$
3.2 Temperature range	$^{\circ}\text{C}$	- 40 ... + 85 mounted without distance ($I_{th} = 2 \times 5$ A)
3.3 Degree of protection		Solder line proof RT II as option wash proof RT III
3.4 Test procedure		A (group mounting)
3.5 Vibration resistance		10 ... 200 Hz; NC 2 g; NO 10 g; IEC/EN 60068-2-6
3.6 Climate resistance		40 / 085 / 04; A/B/D IEC/EN 60068-1
3.7 Short circuit strength 1 kA / AC 250 V	AgSnO ₂	10 A gL IEC/EN 60947-5-1
	AgNi	6 A gL IEC/EN 60947-5-1

¹⁾ Values for AgNi-contacts + 5 μm Au

²⁾ 10 A total current at $t = 20^{\circ}\text{C}$ and coil voltage = U_N

³⁾ Typical values for AgSnO₂ and AgNi

⁴⁾ Values for AgNi-contacts

⁵⁾ Values for AgSnO₂-contacts

Technical Data

3.8	Insulation acc. to IEC 60664-1, EN 50178		double and reinforced insulation
	Rated insulation voltage	AC V	250
	Pollution degree		2
	Overtoltage category		III
	Test voltage		
	Contact-coil (1 min)	AC kV eff.	≥ 4
	Contact-contact (1min)	AC kV eff.	≥ 4
	Open contact acc. to DIN EN 61810-1	AC kV eff.	1.5
	Transient voltage		
	Contact-coil (1.2 - 50 µs)	kV	≥ 6
	Clearance and creepage distances		
	Contact-coil	mm	≥ 8
	Contact-contact	mm	≥ 5.5
3.9	Weight	g	approx. 19
4.0 Packing			
4.1	on cardboard	piece	56
4.2	in case package	piece	280
5.0 Solder method			
5.1	Solder method /-temperature /-duration	°C / s	Wave soldering / 260 / 5

Design Versions

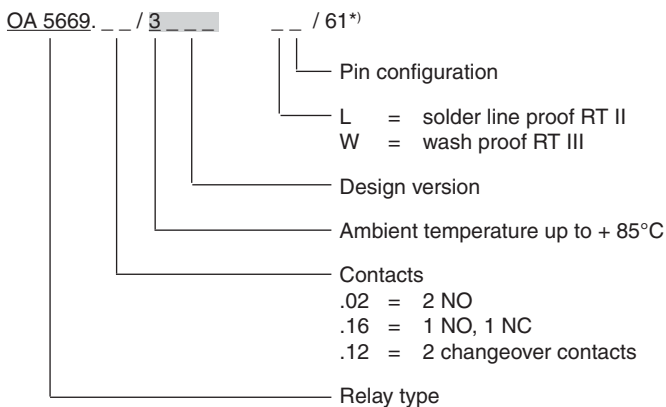
U _N (DC V)	Voltage range (DC V)	Resistance at 20°C	AgNi-contacts + 0,2 µm Au		
			OA 5669.12	OA 5669.16	
6	4,5 ... 7,8	44	3001	3011	3501
12	9,0 ... 16,8	175	3002	3012	3502
24	18,0 ... 33,6	720	3003	3013	3503
48	36,0 ... 67,0	2880	3004	3014	3504
60	45,0 ... 84,0	4500	3005	3015	3505
110	82,0 ... 154	15000	3006	3016	3506
				1)	2)

U _N (DC V)	AgNi - contacts + 5 µm Au			AgSnO ₂ - contacts + 0,2 µm Au		
	OA 5669.12	OA 5669.16		OA 5669.12	OA 5669.16	
6	3031	3041	3511	3061	3071	3521
12	3032	3042	3512	3062	3072	3522
24	3033	3043	3513	3063	3073	3523
48	3034	3044	3514	3064	3074	3524
60	3035	3045	3515	3065	3075	3525
110	3036	3046	3516	3066	3076	3526
		1)	2)		1)	2)

1) = Pin configuration standard

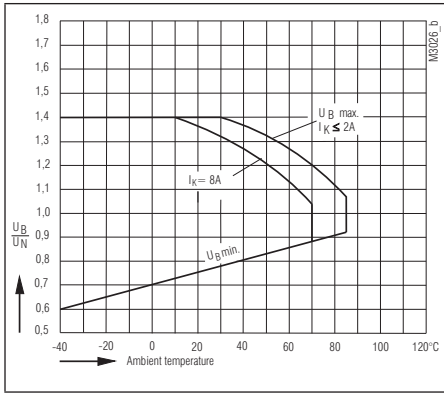
2) = Pin configuration reverse

Ordering Example

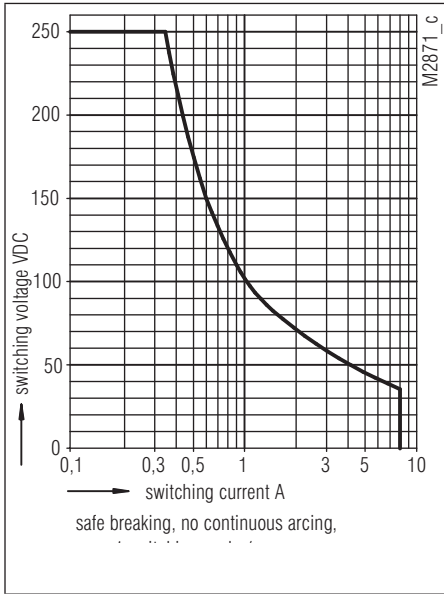


*) /61 cURus approval

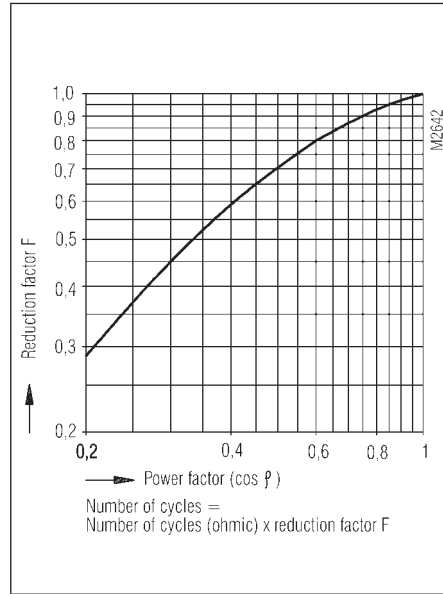
Characteristics



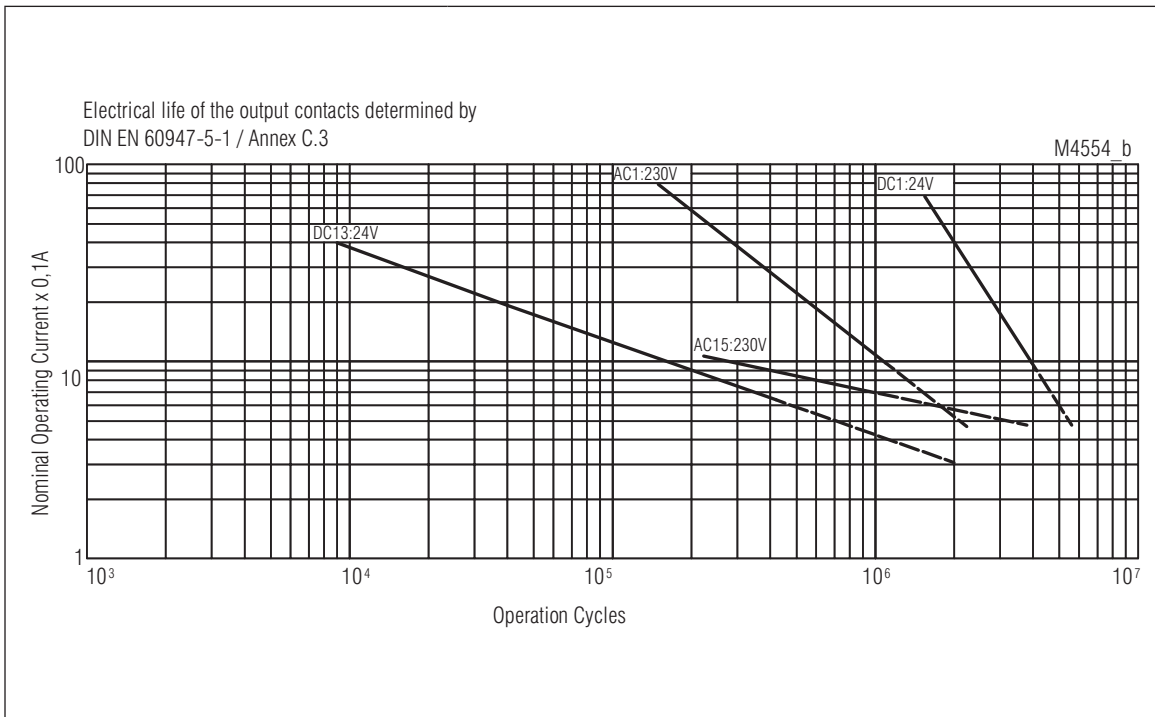
Operating voltage limit curve



Limit curve for arc-free operation



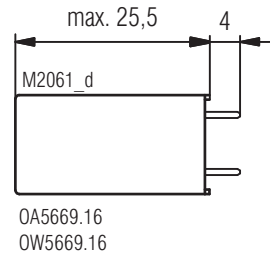
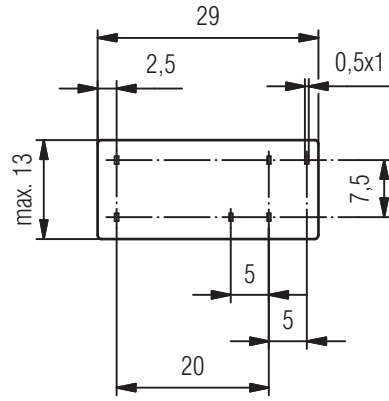
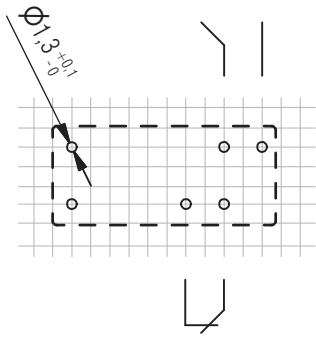
Reduction factor for reactive loads



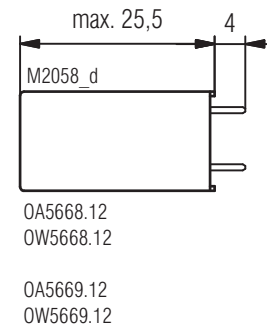
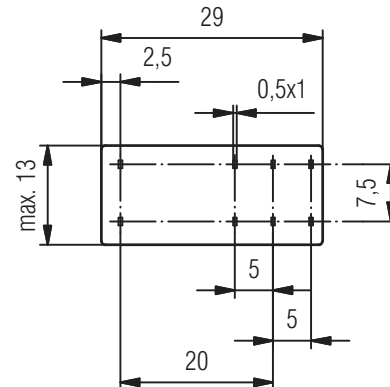
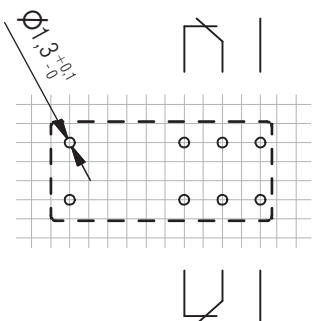
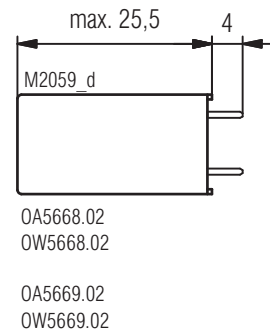
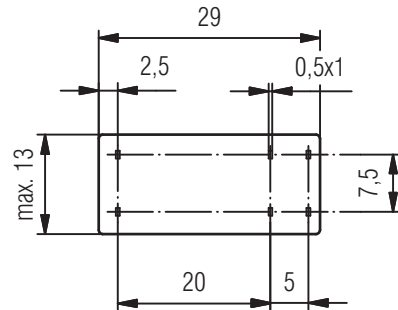
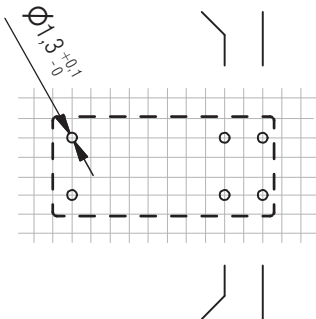
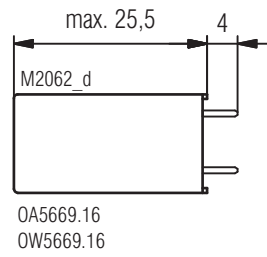
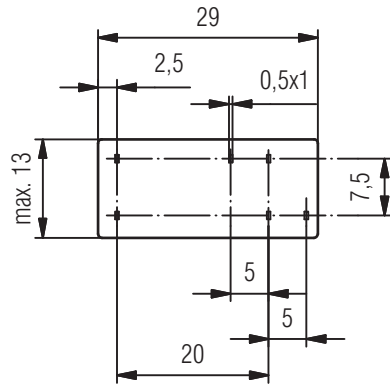
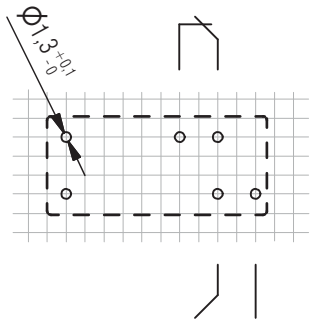
Electrical life for contact material AgNi

Bohrbild (Lötseite)

Pin configuration standard



Pin configuration reverse



Connection for basic grid dimensions 2.5 mm as well as 2.54 mm according to IEC/EN 60097 and IEC 60326 average

Accessories

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	<p>Fixing clip</p>	<p>Fixing clip</p>	<p>Fixing clip</p>								
Article number: 0034769	Article number: 0055571	Article number: 0059274	Article number: 0059270								
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ET1415.912: AC/DC 24 V, with varistor and green LED	Article number: 0055910										

IK 7817N.81/200

Electrical life: DC 110 V, 300 mA , L/R 35 ms > 2 x 10⁵ switching cycles
 DC 110 V, 200 mA , L/R 50 ms > 1 x 10⁶ switching cycles

BA 9054

Switching capacity:

BA9054/034

NO contact DC 13: 4 A / DC 24 V

NC contact DC 13: 1 A / DC 24 V

HL / HO 3094, HO 3095

Switching capacity:

switching cycle 0.1 Hz

single NO contact: 10 A / DC 24 V

single NO contact: 0.8 A / DC 110 V

2 NO contacts in series: 3 A / DC 110 V

3 NO contacts in series: 5 A / DC 110 V

BA 9053

Switching capacity:

BA9053/034

BA 9034/045:

NO contact DC 13: 4 A / DC 24 V

NC contact DC 13: 1 A / DC 24 V

MK 7850N

Switching capacity:

DC 110 V, 300 mA, L/R 30 ms: 2 x 10⁵ switching cycles

DC 110 V, 200 mA, L/R 50 ms: 1 x 10⁶ switching cycles

HC / HL 3096

Switching capacity:

To DC 13 IEC/EN 60947-5-1

Switching cycle 0.1 Hz

2 NO contacts in series: 8 A DC 24 V

2 NO contacts in series: 1 A DC 110 V

IK 9065

Electrical life: DC 110 V, 300 mA , L/R 35 ms > 2 x 10⁵ switching cycles
 DC 110 V, 200 mA , L/R 50 ms > 1 x 10⁶ switching cycles

IK 9094

Electrical life: DC 110 V, 300 mA , L/R 35 ms > 2 x 10⁵ switching cycles
 DC 110 V, 200 mA , L/R 50 ms > 1 x 10⁶ switching cycles