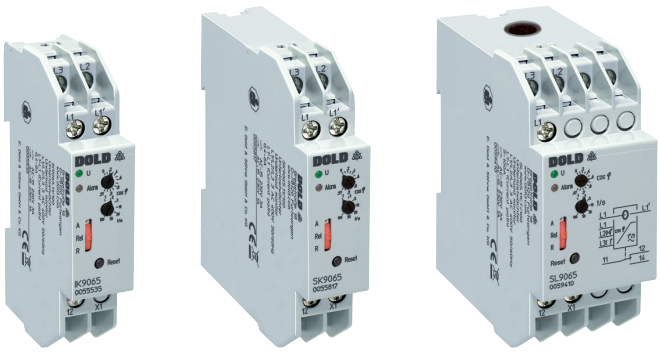
VARIMETER
Underload Monitor (cos φ Monitor)
IK 9065, SK 9065, SL 9065CT

Translation of the original instructions

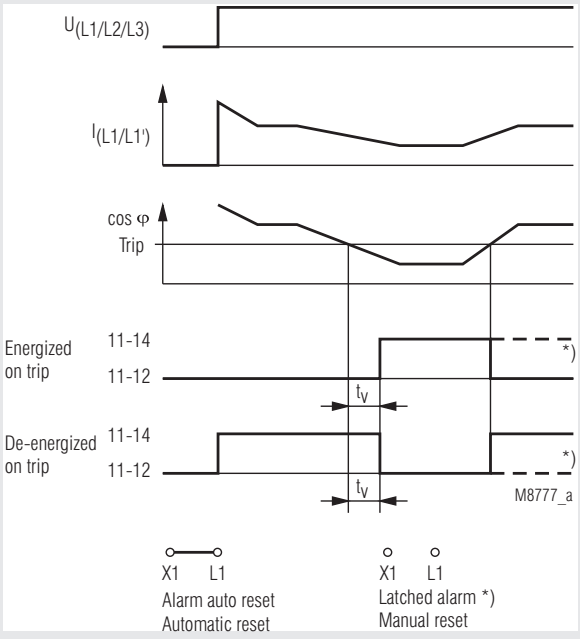
0246036



Product Description

The underload monitor IK / SK / SL 9065 of the VARIMETER series 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. The early detection of up-coming break downs and preventive maintenance avoid expensive damages. As user you profit from the reliability and availability of your plant.

Function Diagram



Your Advantages

- Without auxiliary supply
- IK 9065, SK 9065: Current up to 8 A
  Motors up to 5 A nominal current can be connected directly
- SL 9065CT: With integrated current transformer for currents up to 100 A
- Automatic reset (Alarm auto reset)
- Adjustable operate delay up to 100 s

Features

- According to EN 60255-1
- Detection of underload (cos φ)
- Higher currents via current transformer
- Adjustable response value
- 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 43880
  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

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

CE

Applications

Monitors underload and no load on squirrel cage motors e.g.

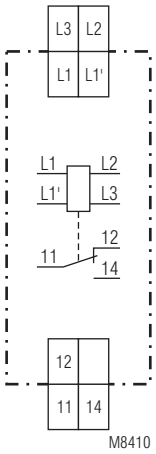
- Fan monitoring (broken belt)
- Filter monitoring (blocked filter)
- Pump monitoring (blocked valve, dry running)
- General cos phi monitoring
- For industrial and railway applications

Function

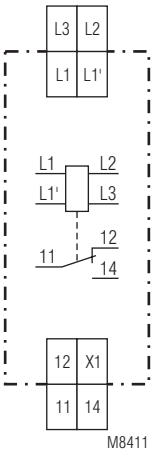
If a cos phi value lower then the adjusted value is detected the output relay changes into alarm state after the adjusted time delay t_v and the red LED “Alarm” lights up. If the underload monitor is in auto reset mode it changes back to normal state without delay when the cos phi rises above the adjusted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

All technical data in this list relate to the state at the moment of edition. We reserve the right for technical improvements and changes at any time.

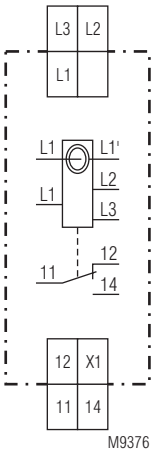
Circuit Diagrams



IK/SK 9065.11



IK/SK 9065.11/100



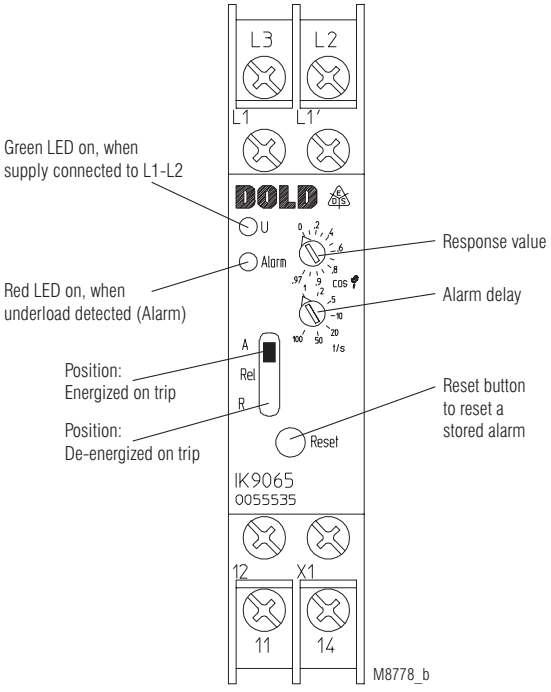
SL 9065.11CT/100

Connection Terminals

Terminal designation	Signal description
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



Indicators

Green LED:	On, when supply connected to L1-L2
Red LED:	On, when underload detected (Alarm)

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.

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

For these cases we recommend the use of our motor load monitor BH 9097.

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	0.4 ... 8 A*
Internal resistance:	Approx. 35 mΩ	Approx. 10 mΩ
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 φ:	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 60947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60947-5-1
To DC 13:	1 A / DC 24 V	IEC/EN 60947-5-1
Electrical life		
at 1 A, AC 230 V cos φ = 1:	1.5 x 10^5 switching cycles	
Short-circuit strength		
max. fuse rating:	4 A gG / gL	IEC/EN 60947-5-1
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:	≤ 2000 m	
Clearance and creepage distances		
Rated impulse voltage / pollution degree:	4 kV / 2	IEC 60664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61000-4-2
HF-irradiation:		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61000-4-3
1 GHz ... 6 GHz:	10 V / m	IEC/EN 61000-4-3
Fast transients:	4 kV	IEC/EN 61000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61000-4-5
Between wire and ground:	4 kV	IEC/EN 61000-4-5
HF-wire guided:	10 V	IEC/EN 61000-4-6
Damped oscillatory wave immunity test		
Differential mode voltage:	1 kV	IEC/EN 61000-4-18
Common mode voltage:	2,5 kV	IEC/EN 61000-4-18
Interference suppression:	Limit value class B	
Degree of protection		
Housing:	IP 40	IEC/EN 60529
Terminals:	IP 20	IEC/EN 60529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60068-2-6
Climate resistance:	25 / 060 / 04	IEC/EN 60068-1

Technical Data

Terminal designation:	EN 50005	
Wire connection:		
Cross section:	2 x 2.5 mm² solid or 1 x 1.5 mm² stranded wire with sleeve DIN 46228-1/-2/-3/-4	
Stripping length:	10 mm	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60999-1
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 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 61373
Service temperature classes:	OT1, OT2 compliant OT3 and OT4 with operational limitations	
Protective coating of the PCB:	No	

Standard Types

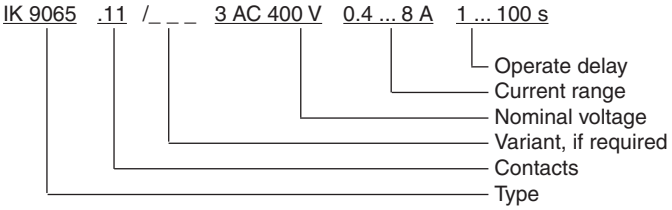
IK 9065.11 3 AC 400 V 0.4 ... 8 A 1 ... 100 s
Article number: 0055534
- Output: 1 changeover contact
- De-energized on trip:
- Nominal voltage U_N: 3 AC 400 V
- Current range: 0.4 ... 8 A
- Operate delay: 1 ... 100 s
- Width: 17.5 mm

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

Ordering example for 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

IK 9065.11/801: Same as IK 9065.11/100, but with fixed values

Article number:	0063445	0066887
Operating principle:	De-energized on trip	De-energized on trip
Nominal voltage U_N:	3 AC 400 V	3 AC 400 V
Current range:	0.4 ... 8 A	0.4 ... 8 A
cos φ:	0.4	0.4
Operate delay:	4 s	7 s

SK 9065.11/110: Same as SK 9065.11/100, but with a potted power supply capacitor

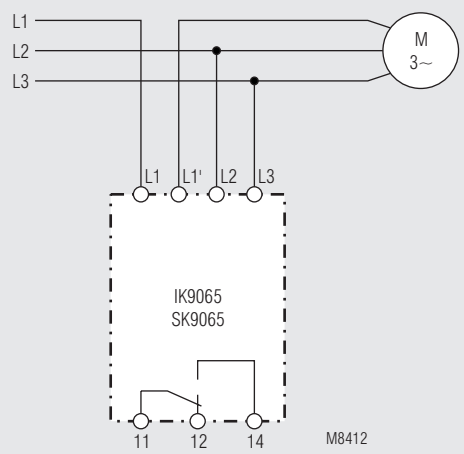
SK 9065.11/802: Same as SK 9065.11/100, but with fixed values and with a pottet power supply capacitor

Article number:	0069076	0069077
Operating principle:	De-energized on trip	De-energized on trip
Nominal voltage U_N:	3 AC 400 V	3 AC 400 V
Current range:	0.4 ... 8 A	0.4 ... 8 A
cos φ:	0.4	0.4
Operate delay:	4 s	7 s

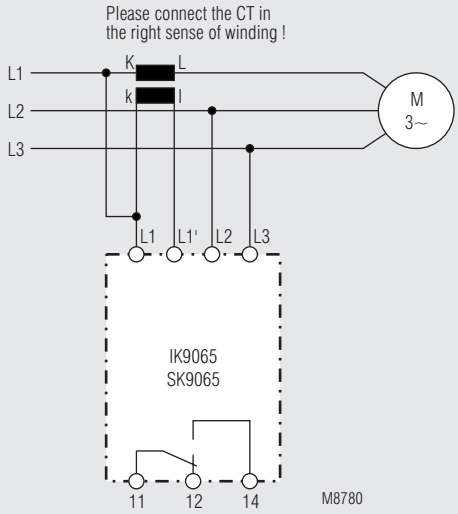
Accessories

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

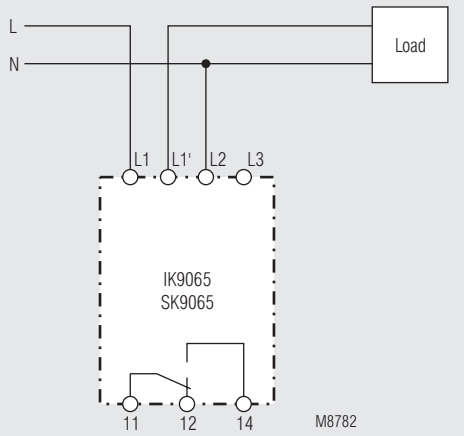
Connection Examples



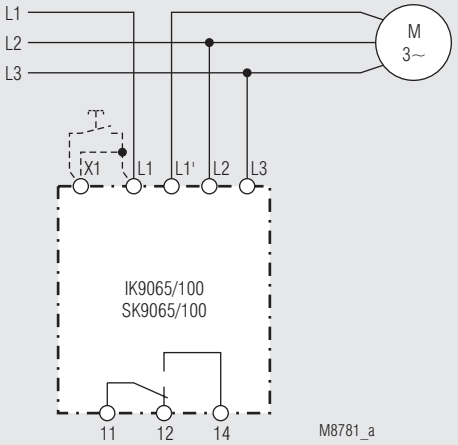
IK 9065.11 with 3-phase load



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



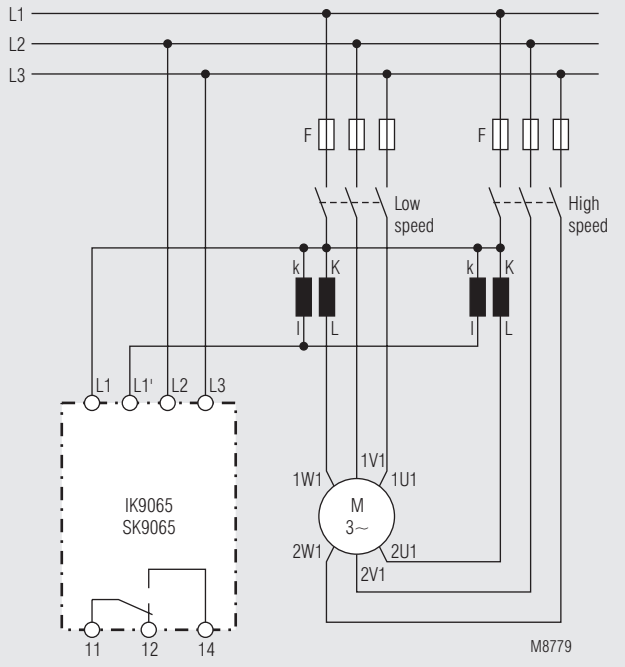
IK 9065.11 with single-phase load



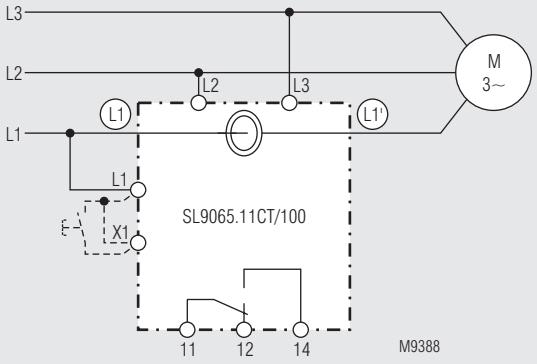
X1 - L1 open : Manual reset / Latched alarm
(Reset with internal or external push button)

X1 - L1 connected : Automatic reset (Auto - Reset)

IK/SK 9065.11/100 with 3-phase load



IK/SK 9065.11 for motors with separate windings



X1 - L1 open : Manual reset / Latched alarm
(Reset with internal or external push button)

X1 - L1 connected : Automatic reset (Auto - Reset)

SL 9065.11CT/100