

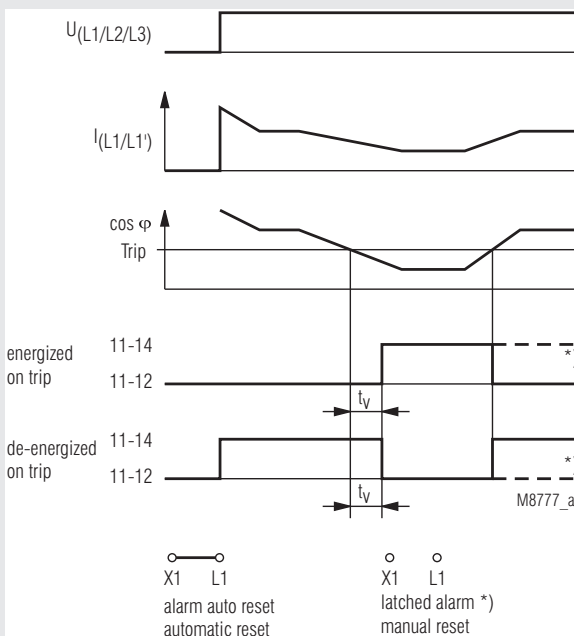
## VARIMETER

Underload Monitor (cos  $\varphi$  Monitor)

IK 9065, SK 9065, SL 9065CT



### Function Diagram



- According to EN 60 255-1
- Detection of underload (cos  $\varphi$ )
- 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

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

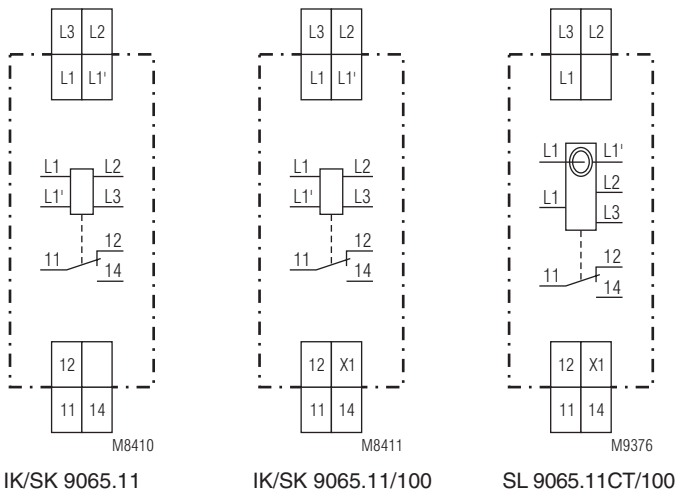


### Applications

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  $\varphi$  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  $\varphi$  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.

If a cos  $\varphi$  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  $\varphi$  rises above the adjusted cos  $\varphi$  value.

### Indicators

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

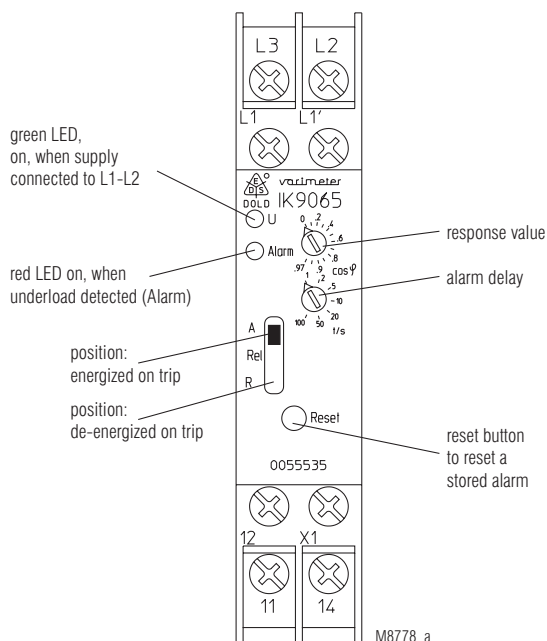
## Connection Terminals

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

<sup>1)</sup> Only at IK/SK 9065

<sup>2)</sup> 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

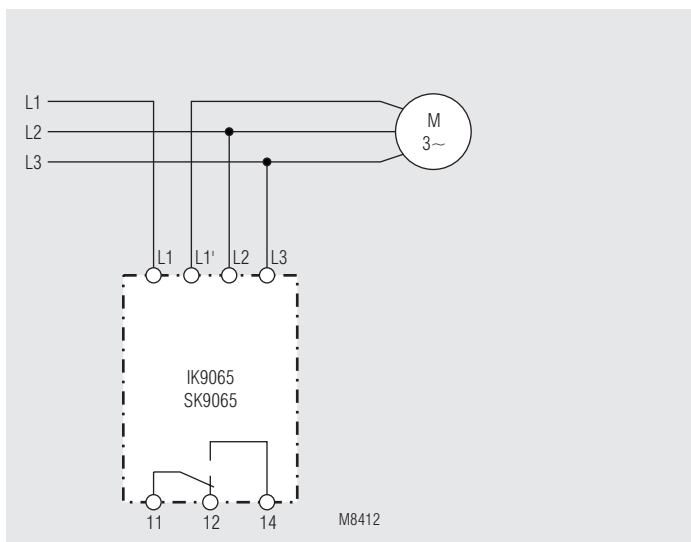
- Automatic restart (Alarm auto reset)
- Manual restart (Latched Alarm), reset with built in push button, external push button on X1-L1 or by disconnecting the supply voltage.

Switch "REL" on front side

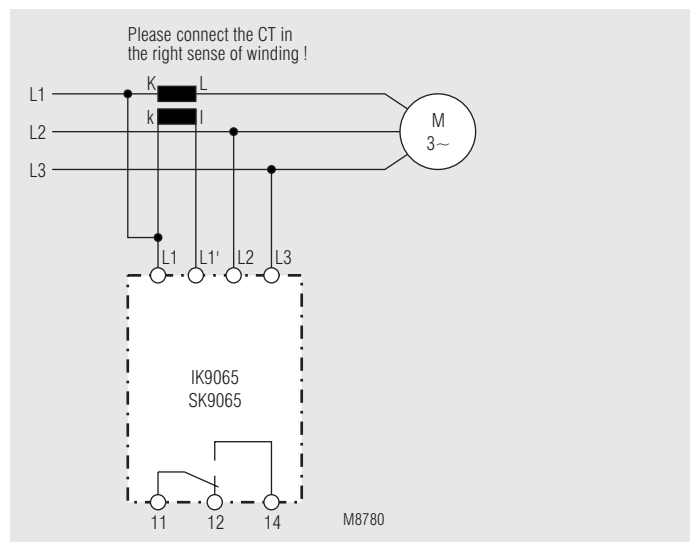
- Position "A": energized on trip (relay energizes on underload-alarm)
- Position "R": de-energized on trip (relay de-energizes on underload-alarm)

| Technical Data                                  |                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Input</b>                                    |                                                                                                                                                                                                                                                                                   |
| <b>Nominal voltage <math>U_N</math>:</b>        | (= Motor voltage)<br>3 AC (or AC) 110, 230, 400 V                                                                                                                                                                                                                                 |
| <b>Voltage range:</b>                           | 0.8 ... 1.1 $U_N$                                                                                                                                                                                                                                                                 |
| <b>Nominal frequency of <math>U_N</math>:</b>   | 45 ... 65 Hz                                                                                                                                                                                                                                                                      |
| <b>Nominal consumption (L1-L2):</b>             | max. approx. 11 VA                                                                                                                                                                                                                                                                |
| <b>Current Path</b>                             |                                                                                                                                                                                                                                                                                   |
| <b>Current range</b>                            |                                                                                                                                                                                                                                                                                   |
| <b>IK 9065, SK 9065:</b>                        | 0.1 ... 2 A      0.5 ... 8 A*                                                                                                                                                                                                                                                     |
| Internal resistance:                            | approx. 30 m $\Omega$ approx. 10 m $\Omega$                                                                                                                                                                                                                                       |
| 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                                                                                                                                                                                                                           |
| <b>Current range SL 9065CT:</b>                 | 5 ... 100 A via integrated current transformer in the base (max. wire-diameter: 10 mm)                                                                                                                                                                                            |
| <b>Setting range <math>\cos \varphi</math>:</b> | 0 ... 0.97 infinite variable                                                                                                                                                                                                                                                      |
| <b>Operate delay <math>t_v</math>:</b>          | 1 ... 100 s infinite variable                                                                                                                                                                                                                                                     |
| <b>Output</b>                                   |                                                                                                                                                                                                                                                                                   |
| <b>Contacts:</b>                                | 1 changeover contact                                                                                                                                                                                                                                                              |
| <b>Thermal current <math>I_{th}</math>:</b>     | 4 A                                                                                                                                                                                                                                                                               |
| <b>Switching capacity</b>                       |                                                                                                                                                                                                                                                                                   |
| 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                                                                                                                                                                                                                                              |
| <b>Electrical life</b>                          |                                                                                                                                                                                                                                                                                   |
| to AC 15 at 1 A, AC 230 V:                      | 1.5 x 10 <sup>5</sup> switching cycles<br>IEC/EC 60 947-5-1                                                                                                                                                                                                                       |
| <b>Short-circuit strength</b>                   |                                                                                                                                                                                                                                                                                   |
| <b>max. fuse rating:</b>                        | 4 A gL      IEC/EN 60 947-5-1                                                                                                                                                                                                                                                     |
| <b>Mechanical life:</b>                         | 30 x 10 <sup>6</sup> switching cycles                                                                                                                                                                                                                                             |
| <b>General Data</b>                             |                                                                                                                                                                                                                                                                                   |
| <b>Operating mode:</b>                          | Continuous operation                                                                                                                                                                                                                                                              |
| <b>Temperature range</b>                        |                                                                                                                                                                                                                                                                                   |
| Operation                                       | - 25 ... + 60°C                                                                                                                                                                                                                                                                   |
| Storage:                                        | - 25 ... + 60°C                                                                                                                                                                                                                                                                   |
| <b>Altitude:</b>                                | < 2,000 m                                                                                                                                                                                                                                                                         |
| <b>Clearance and creepage distances</b>         |                                                                                                                                                                                                                                                                                   |
| rated impulse voltage / pollution degree:       | 4 kV / 2      IEC 60 664-1                                                                                                                                                                                                                                                        |
| <b>EMC</b>                                      |                                                                                                                                                                                                                                                                                   |
| 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*)<br>*) The device is designed for the usage under industrial conditions (Class A, EN 55011).<br>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. |
| <b>Degree of protection</b>                     |                                                                                                                                                                                                                                                                                   |
| Housing:                                        | IP 40      IEC/EN 60 529                                                                                                                                                                                                                                                          |
| Terminals:                                      | IP 20      IEC/EN 60 529                                                                                                                                                                                                                                                          |
| <b>Housing:</b>                                 | Thermoplastic with V0 behaviour according to UL subject 94                                                                                                                                                                                                                        |
| <b>Vibration resistance:</b>                    | Amplitude 0.35 mm<br>frequency 10 ... 55 Hz    IEC/EN 60 068-2-6                                                                                                                                                                                                                  |
| <b>Climate resistance:</b>                      | 40 / 060 / 04      IEC/EN 60 068-1                                                                                                                                                                                                                                                |
| <b>Terminal designation:</b>                    | EN 50 005                                                                                                                                                                                                                                                                         |
| <b>Wire connection:</b>                         |                                                                                                                                                                                                                                                                                   |
| Cross section:                                  | 2 x 2.5 mm <sup>2</sup> solid or<br>1 x 1.5 mm <sup>2</sup> stranded wire with sleeve<br>DIN 46 228-1/-2/-3/-4                                                                                                                                                                    |
| Stripping length:                               | 10 mm                                                                                                                                                                                                                                                                             |

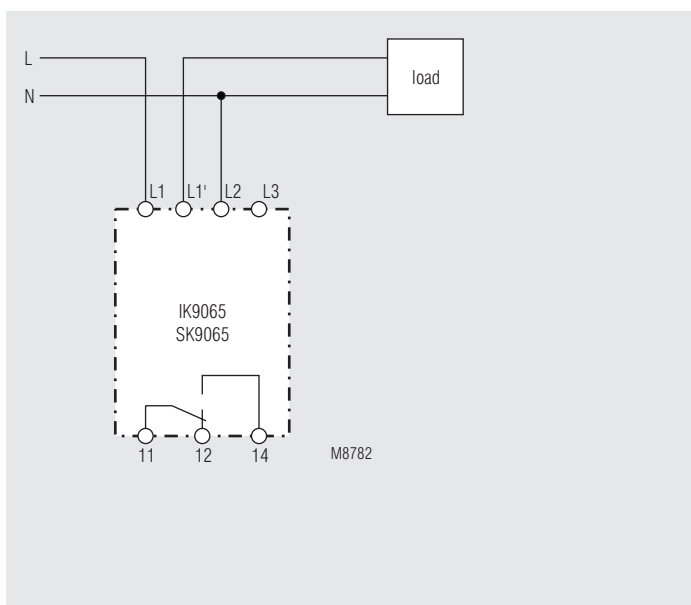
| Technical Data                                                                                                                               |                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Wire fixing:</b>                                                                                                                          | Flat terminals with self-lifting clamping piece IEC/EN 60 999-1                                                                            |
| <b>Fixing torque:</b>                                                                                                                        | 0,8 Nm                                                                                                                                     |
| <b>Mounting:</b>                                                                                                                             | DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory                     |
| <b>Weight:</b>                                                                                                                               |                                                                                                                                            |
| IK 9065:                                                                                                                                     | approx 65 g                                                                                                                                |
| SK 9065:                                                                                                                                     | approx 84 g                                                                                                                                |
| SL 9065CT:                                                                                                                                   | approx. 195 g                                                                                                                              |
| Dimensions                                                                                                                                   |                                                                                                                                            |
| <b>Width x height x depth:</b>                                                                                                               |                                                                                                                                            |
| 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                                                                                       |                                                                                                                                            |
| <b>Vibration and shock resistance:</b>                                                                                                       | Category 1, Class B IEC/EN 61 373                                                                                                          |
| <b>Ambient temperature:</b>                                                                                                                  | T1, T2 compliant<br>T3 and TX with operational limitations                                                                                 |
| <b>Protective coating of the PCB:</b>                                                                                                        | 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,<br>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 |
| <b>Ordering example for variants</b>                                                                                                         |                                                                                                                                            |
| IK 9065 .11 / 3 AC 400 V 0.4 ... 8 A 1 ... 100 s                                                                                             |                                                                                                                                            |
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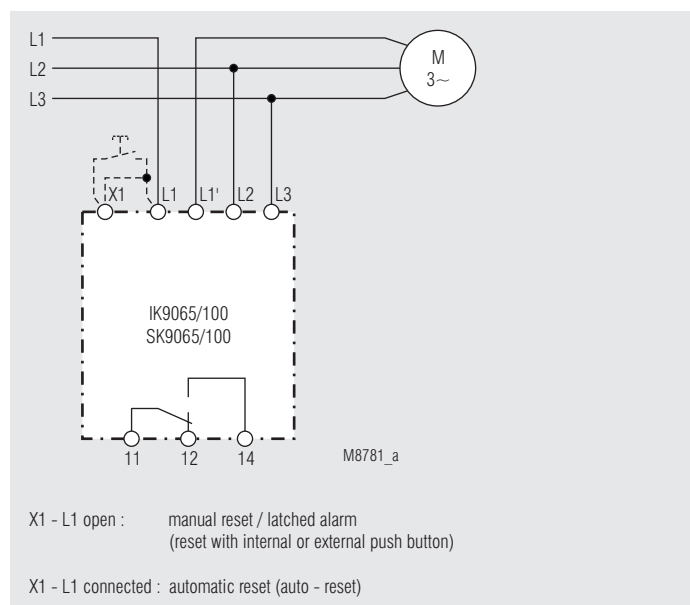
IK 9065.11 with 3-phase load



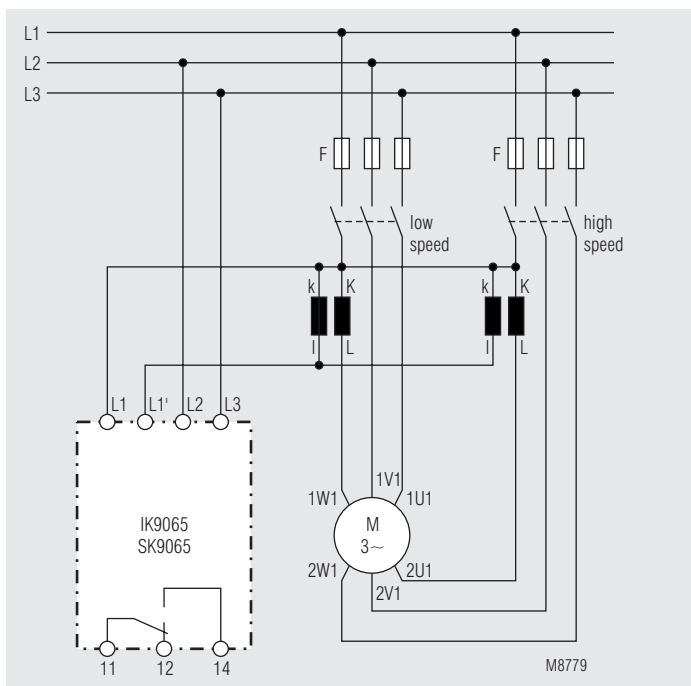
IK/SK 9065.11 with 3-phase load and external current transformer



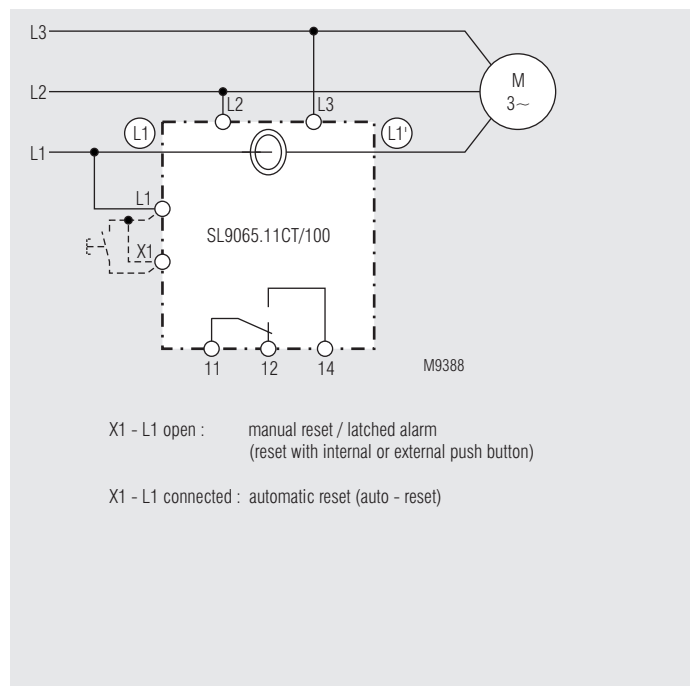
IK 9065.11 with single-phase load



IK/SK 9065.11/100 with 3-phase load



IK/SK 9065.11 for motors with separate windings



SL 9065.11CT/100