VARIMETER
Underload Monitor (cos φ)
BA 9065

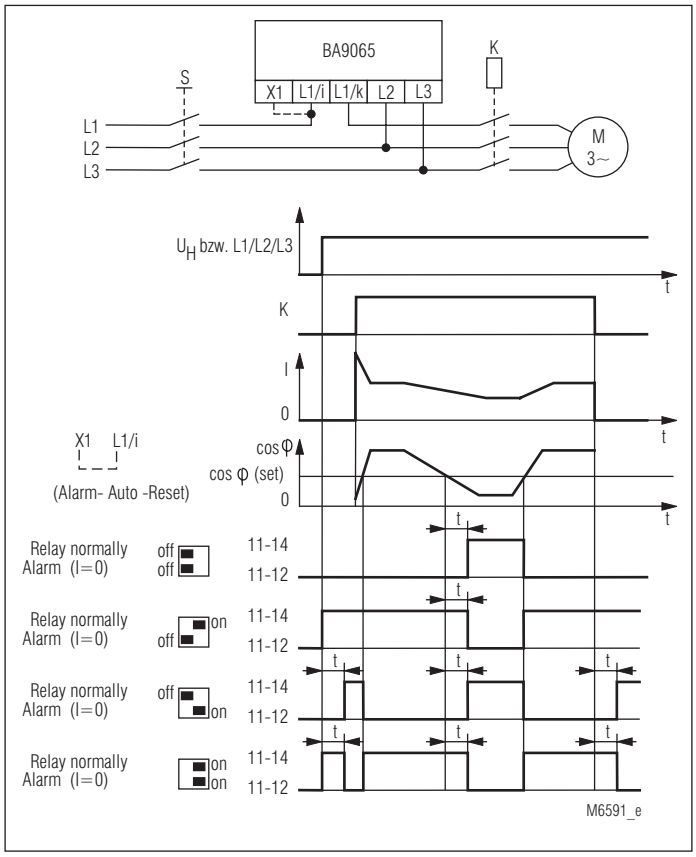
Translation of the original instructions

DOLD

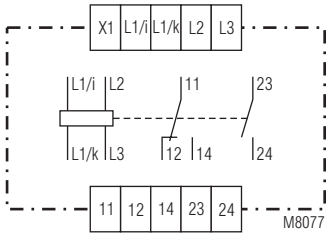
0225071

- According to IEC/EN 60255-1
- Detection of underload (cos φ)
- Current ranges up to 10 A, for higher values a CT must be used
- Adjustable response value
- Programmable functions:
  - Alarm when I = 0
  - Automatic or manual reset
  - Closed or open circuit operation
- Manual remote reset
- Adjustable operate delay
- Independent of phase sequence
- Also for 400 Hz systems
- Optionally for motors with frequency converters (10 ... 100 Hz) (see notes)
- Width 45 mm

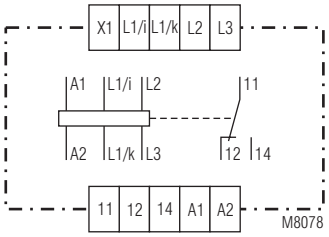
Function Diagram



Circuit Diagrams



BA 9065.20



BA 9065.11/001

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)

Function

The underload monitor BA 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. The change of cos φ has to be bigger then the hysteresis of the monitor (see diagram). 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 our motor load monitors e.g BH 9097.
The BA 9065 can also be used on systems with variable frequency because of it's frequency independent measuring principle.
The BA 9065.20 does not need a separate auxiliary supply as it takes the required energy from the monitored mains.
A yellow LED indicates operation. If the cos φ goes under the setting value the device reacts after a settable time delay. A green LED shows the state of the output relay.

Functions programmable with DIP-switches:

- Open circuit operation (relay normally off)
- Alarm when no current is flowing (Alarm at I = 0 on)
- Closed circuit operation (relay normally on)
- No alarm when no current is flowing (Alarm at I = 0 off)

Function programmable with bridge X1-L1/i:

bridge
X1-L1/i

- Manual reset, reset with built-in reset button or remote reset with button connected to X1-L1/i
- Automatic reset when system returns to correct load (cos φ)

Connection Terminals

Terminal designation	Signal description
L1/i, L2, L3	Connection for 3-phase systems
L1/i, L	Current measuring circuit, connection for external current transformer possible
X1, L1/i	Control input (manual reset / auto-Reset) X1/L1 not bridged: manual reset X1/L1 bridged: auto-reset
11, 12, 14	1. Changeover contact
21, 22, 24	2. Changeover contact

Notes

To terminal X1 only the potential of L1/i must be connected.
When setting the response value on BA 9065 with frequency converters please note that the cos φ of the motor changes with the frequency.
The measurement of the cos φ is made by detecting the phase angle between current and voltage by monitoring the shift of the zero passage of current and voltage. Therefore the measurement is independent of frequency and voltage amplitude.
When using the model BA 9065.11/001 with separate auxiliary supply, the measuring circuit (L1/i-L1/k; L2-L3) can also monitor variable frequencies and voltages on the output of a frequency converter. As the cos φ of squirrel cage motors varies with the frequency and with the load, it must be checked for each application if the BA 9065 is suitable. When a current transformer is used with variable frequency, this must also be a special one, that can transmit also low frequencies.

Please note when using a current transformer:
- The phase position must be correct (see Connection Examples), if not there will be no or permanent alarm
- There must be a connection from L1 to the secondary side of the CT (see Connection Examples)

Technical Data

Input Circuit

Nominal voltage U_N: AC / 3 AC 220 ... 254 V, 380 ... 440 V, 480 ... 550 V, 600 ... 690 V
Voltage range: 0.8 ... 1.1 U_N
Nominal frequency of U_N: 45 ... 400 Hz
Nominal consumption: 2.5 VA (terminals L1/i-L2, A1-A2)
Current range (L1/i-L1/k): 0.1 ... 2 A 0.5 ... 10 A *
Internal resistance L1/i-L1/k: Approx. 30 mΩ approx. 10 mΩ
Consumption L1/i-L1/k: Max. 0.12 VA max. 1.1 VA
* (higher currents using external current transformers, see connection examples)
Short time overload: see diagram short time overload
Usable current transformers: 1 A or 5 A type
Class 3 or better with necessary power
Setting range cos φ: 0 ... 0.9 ; infinite variable
Operate delay t_v: 1 ... 40 s; infinite variable

Output

Contacts
BA 9065.20: 1 changeover contact, 1 NO contact
BA 9065.11/001: 1 changeover contact
Thermal current I_{th}: 6 A (up to 25°C, see also derating curve)

Switching capacity
To AC 15
NC contact: 1 A / AC 230 V IEC/EN 60947-5-1
NO contact: 3 A / AC 230 V IEC/EN 60947-5-1
Electrical life IEC/EN 60947-5-1
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

Technical Data

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 20 ... + 60°C
Storage: - 20 ... + 60°C
Altitude: < 2000 m
Clearance and creepage distances
Rated impulse voltage / pollution degree: 4 kV / 2 IEC 60664-1
Overvoltage category: III *)
*) up to 3 AC 480 V

EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61000-4-2
HF irradiation
80 MHz ... 6 GHz: 10 V / m IEC/EN 61000-4-3
Fast transients: 2 kV IEC/EN 61000-4-4
Surge voltages
Between
wires for power supply: 1 kV IEC/EN 61000-4-5
Between wire and ground: 2 kV IEC/EN 61000-4-5
Interference suppression: Limit value class B EN 55011
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: 20 / 060 / 04 IEC/EN 60068-1
Terminal designation: EN 50005
Wire connection: 2 x 2.5 mm^2 solid or
2 x 1.5 mm^2 stranded wire with sleeve DIN 46228-1/-2/-3/-4
Insulation of wires or sleeve length: 8 mm
Wire fixing: Flat terminals with self-lifting clamping piece IEC/EN 60999-1
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60715
Weight: 270 g

Dimensions

Width x height x depth: 45 x 74 x 124 mm

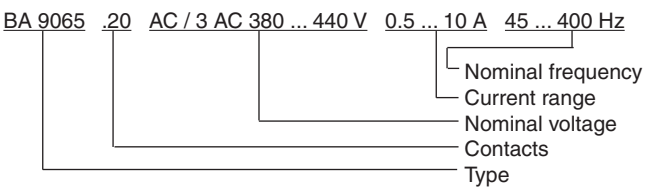
Standard Type

BA 9065.20 3 AC 380 ... 440 V 0.5 ... 10 A
Article number: 0039727
- Output: 1 changeover contact, 1 NO contact
- Nominal voltage U_N: 3 AC 380 ... 440 V
- Current range: 0.5 ... 10 A
- Width: 45 mm

Variant

BA 9065.11/001:
For motors with frequency converters, separate auxiliary supply is necessary
Auxiliary voltage U_H: AC 220 ... 254 V
AC 380 ... 440 V
Nominal frequency of U_H: 45 ... 400 Hz
Motorvoltage U_N: 3 AC 40 ... 660 V without neutral
Nominal frequnecy of U_N: 10 ... 100 Hz
Contacts: 1 changeover contact

Ordering example for variants



Accessories

ET 4762-5: Adapter for screw fixing
Article number: 0023119

Characteristic

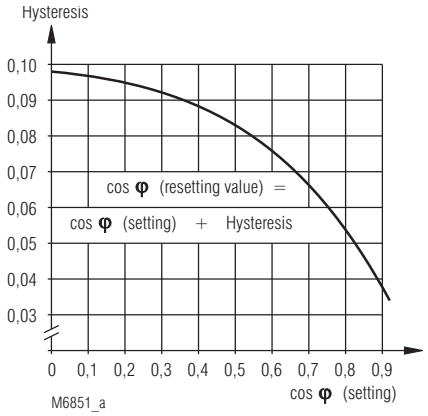


Diagram for hysteresis

Hysteresis depending on adjusted cos φ setpoint. The hysteresis is the switching difference between alarm on (cos φ setting) and alarm off (cos φ reset value).

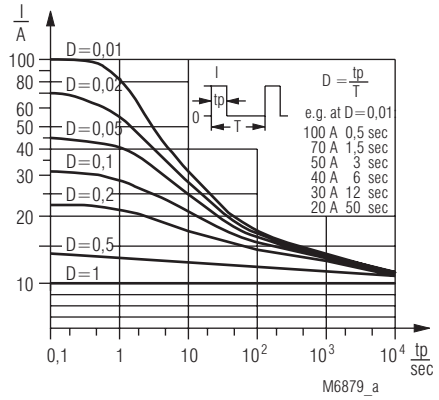
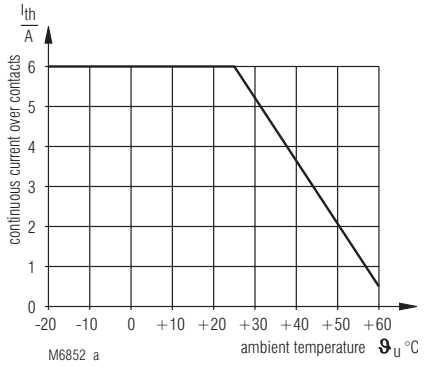


Diagram for short-time overload of the current input L1/i-L1/k (0.5 ... 10 A)



Continuous current limit curve for contacts

Operating Instructions

The example of a frequency controlled fan motor shows how to set up the unit.

1) Setting on BA 9065
   - Set BA 9065 to automatic restart (bridge X1-L/i; or while doing below mentioned tests press the reset button continuously)
   - Adjust time delay to minimum (left position)
   - Adjust cos φ potentiometer to 0 (left position)

2) Setting on Motor:
   - Simulate broken belt (motor runs without load)
   - Run motor on lowest frequency

   When the motor runs without load and lowest possible frequency, this is the worst case to detect broken belt.

3) Keep the conditions of 2) and turn the cos φ potentiometer slowly(because of time delay) to the right (to higher value) until the contac switches. Please note this setting and keep it.

4) - Remount the belt (normal working condition)
   - At the lowest frequency and automatic reset or pressed reset button the monitor should show "good" condition, because the cos φ rises.

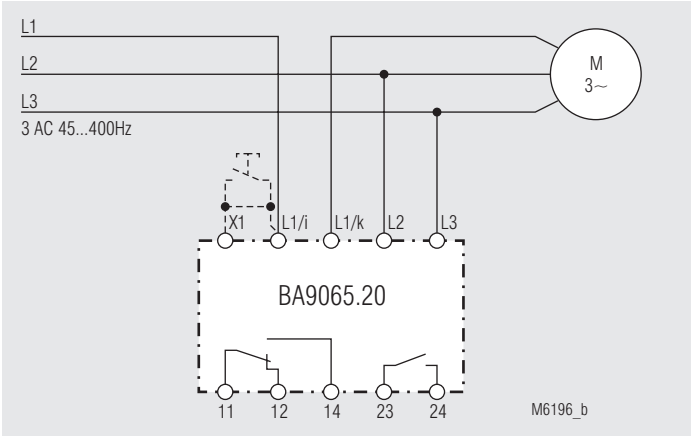
     If the Monitor does not show "good" condition the change of cos φ is obviously smaller then the hysteresis.

     Now set potentiometer back to 0 again and turn is slowly to higher values to check the alarm value.

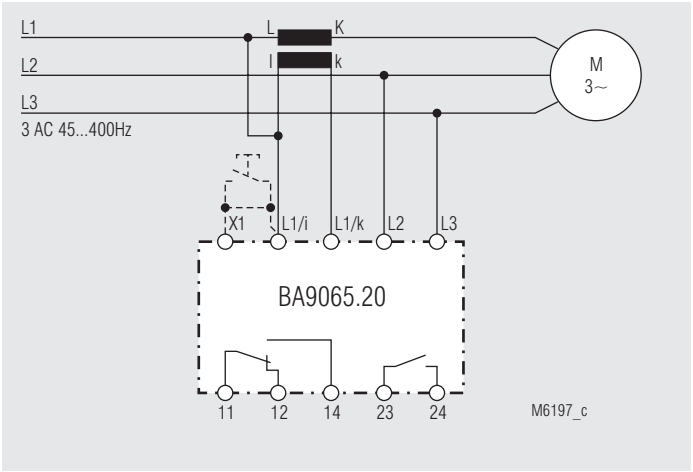
     Finally turn the potentiometer again to 0 and then set it to the value found under 3) as this is the optimum setting.

5) Rise the frequency under normal conditions to maximum. The Alarm state should reset. Lower the frequency to minimum, no alarm should occur. At last set the time delay to a higher value, because the motor runs as generator for a short time when the frequency is lowered and the BA 9065 would react immediately.

Connection Examples

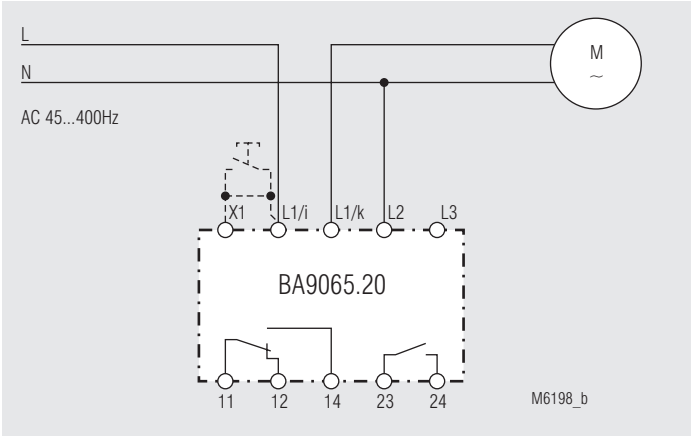


Without current transformer (I_{Mot} = 0.5 ... 10 A)
Please note:
The nominal voltage is the phase to phase voltage

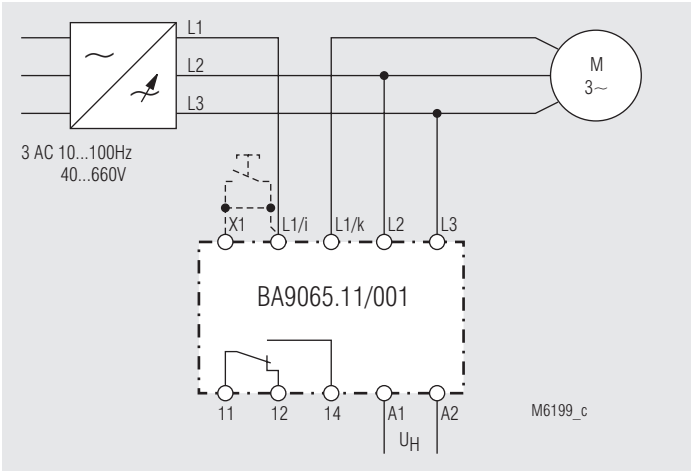


With current transformer (I_{Mot} > 10 A)
Please note:
The nominal voltage is the phase to phase voltage.
The sens of winding of the CT is of impartance!

Connection Examples



Single phase connection
Please note:
The nominal voltage is the phase to neutral voltage



Connection with CT or single phase see BA 9065.20