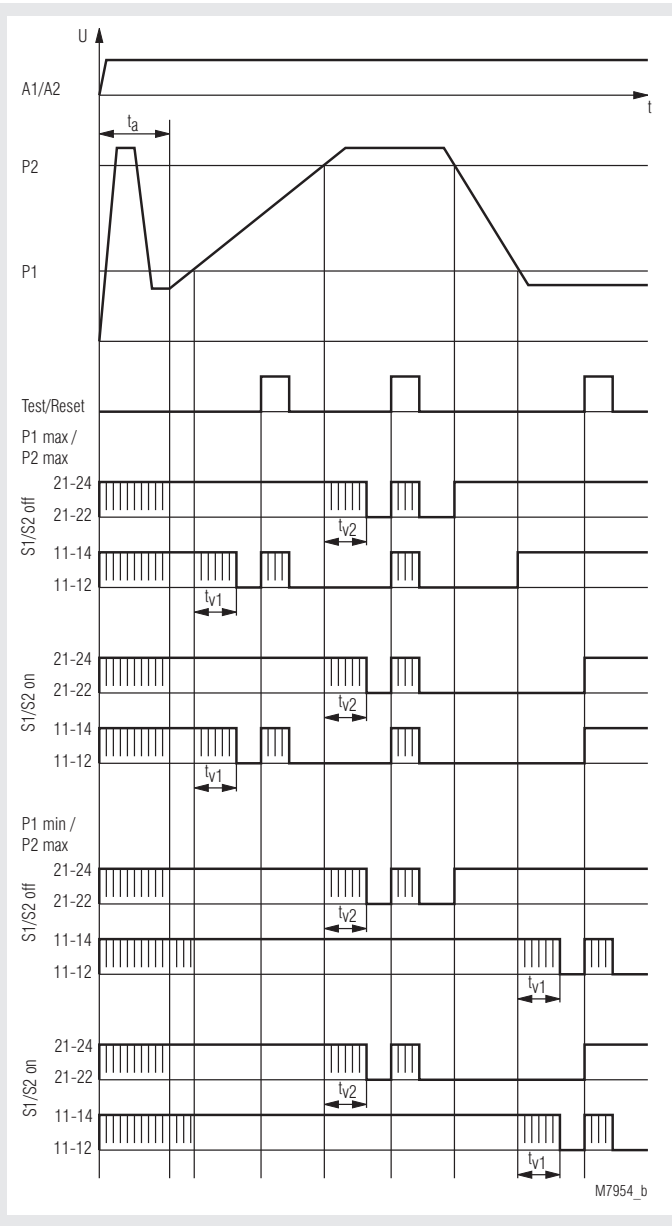




- According to IEC/EN 60255-1, IEC/EN 60255-26, DIN/VDE 0435-303
- Identification of
  - Underload  $P_1$  and Overload  $P_2$
  - Overload  $P_1$  (prewarning) and Overload  $P_2$  programmable
- Adjustment of  $P_1$  and  $P_2$  on absolute scale
- For motors up to 22 kW / 400 V; 37 kW / 600 V
- Measurement: effective power
- Large current range because of automatic range selection
- 1 changeover contact for  $P_1$  and 1 changeover contact for  $P_2$
- Adjustable start-up delay  $t_a$
- Adjustable switching delay  $t_v$
- With automatic or manual reset, programmable
- Test / Reset button for easy setup
- Up to 40 A without external current transformer
- De-energized or energized on fault, programmable
- Also for single-phase operation
- LED indicators
- Width 45 mm

### Function Diagram for Setting De-energized on Fault\*)



**P1max/P2max:** Overload monitoring with prewarning  
**P1min/P2max:** Under- and overload monitoring  
**S1/S2 ON:** manual reset  
**S1/S2 OFF:** automatic reset  
**IIIII:** corresponding LED is flashing

\*) when set to energized on fault the function of LEDs and output relays are inverted.

### Approvals and Marking



\* see variants

### Applications

The BH 9097 is used to monitor variable loads on industrial motors.

### Function

The motor load monitor BH 9097 checks the active power consumption of electrical consumers. As the measuring principle is only single phase correct measurement of 3-phase load is only possible when all three phases have the same load which is normal with motors. Using DIP-switches the unit can be set up to act as under- and overload relay  $P_{1min}/P_{2max}$ , or as overload relay with pre-warning  $P_{1max}/P_{2max}$ . The settings of  $P_1$  and  $P_2$  are absolute values and calibrated in Watts adjustable via rotational switches. 2 LEDs show the state of the corresponding output relays. The unit can be configured to energise or to de-energise on fault. Every output relay is fitted with it's own time delay  $t_v$ . A start-up delay  $t_a$  acts on both outputs.

### Indication

green LED, $U_N$ :	flashing:	during Start-up delay $t_a$
	continuous:	supply connected
yellow LED, $P_1$ :	flashing:	during time delay $t_{v1}$ and for set up assistance
	continuous:	when relay $P_1$ active (contact 11-14)
yellow LED, $P_2$ :	flashing:	during time delay $t_{v2}$ and for set up assistance
	continuous:	when relay $P_2$ active (contact 21-24)

### Fault indication

2 different faults are displayed with the LEDs.

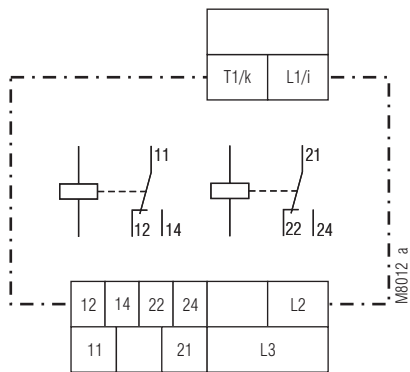
#### 1.) No measurement:

Without measuring voltage measurement is not possible  
 - All 3 LEDs flash in sequence one after the other.  
 The output contacts are in failure state.

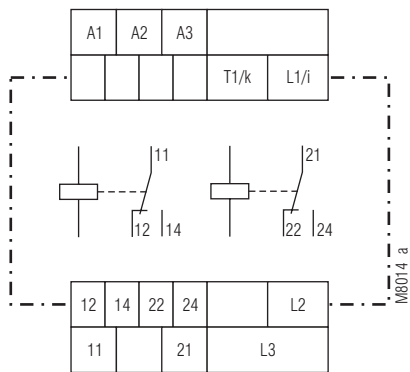
#### 2.) The BH 9097 measures negative load:

Possible reason: The unit measures reverse power or the current connections are connected wrong.  
 - All 3 LEDs flash simultaneously.

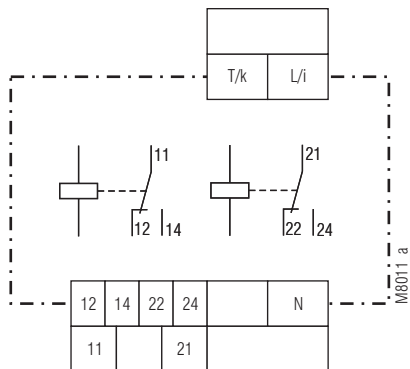
## Connection Diagrams



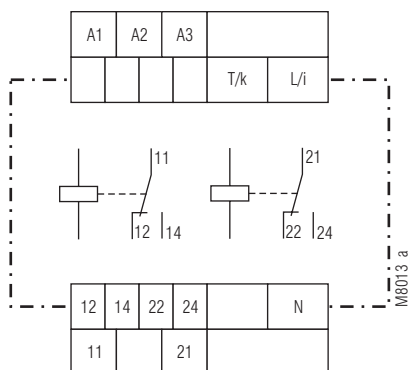
BH 9097.38/001



BH 9097.38/011



BH 9097.38



BH 9097.38/010

## Technical Data

### Input

#### Measuring voltage

Voltage range: without auxiliary voltage  $0.8 \dots 1.1 \times U_N$   
with auxiliary voltage, see setting ranges  
300 k $\Omega$  ... 500 k $\Omega$

#### Input resistance:

#### Measuring current

Measuring range: see setting ranges

Nominal current [A]	40	24	8	2.4	0.8	0.24
Permissible current range (overload) [A]						
continuously:	0 ... 40	0 ... 40	0 ... 16	0 ... 8	0 ... 2.4	0 ... 1
1 min. (10 min. break):	150	150	20	16	3	1.5
20 s (10 min. break):	200	200	25	20	4	2
Input res. of current on i-k [m $\Omega$ ]:	$\leq 1$	$\leq 1$	7	14	830	830

#### Frequency range:

10 ... 400 Hz  
(please see characteristics M7953)

### Setting Ranges

#### P<sub>1</sub> und P<sub>2</sub> on absolute scale

Switch

load range

for P1 and P2:

lower range

upper range

Measuring accuracy (in % of setting value):

$\pm 4 \%$  (2 % on request)

#### Hysteresis

(in % of setting value):

< 5 %

#### Harmonic distortion

< 40 %

#### Reaction time:

< 50 ms

#### Switching delay $t_{v1}/t_{v2}$ :

0 ... 10 s (infinite variable)

#### Start-up delay $t_a$ :

0 ... 30 s (infinite variable)

### Setting Ranges

Available variants	Measuring voltage $U_N$	Measuring current $I_N$ [A]	selection of load range
<b>1-phase</b>			
without auxiliary voltage			
BH 9097.38/000	AC 230 V	0.0024 ... 0.24	0.1 ... 60 W
	AC 230 V	0.024 ... 2.4	1 ... 600 W
	AC 230 V	0.24 ... 24	10 ... 6000 W
with auxiliary voltage			
BH 9097.38/010	AC 35...250 V	0.0024 ... 0,24	0.1 ... 60 W
	AC 35...250 V	0.024 ... 2,4	1 ... 600 W
	AC 35...250 V	0.24 ... 24	10 ... 6000 W
<b>3-phase</b>			
without auxiliary voltage			
BH 9097.38/001	3 AC 400 V	0.008 ... 0,8	0.1 ... 60 W
	3 AC 400 V	0.08 ... 8	10 ... 6000 W
	3 AC 400 V	0.4 ... 40	0.1 ... 30 kW
with auxiliary voltage			
BH 9097.38/011	3 AC 60 ... 440 V	0.008 ... 0,8	1 ... 600 W
	3 AC 60 ... 440 V	0.08 ... 8	10 ... 6000 W
	3 AC 100 ... 760 V	0.4 ... 40	0.1 ... 52 kW

### Auxiliary Circuit

#### Auxiliary voltage $U_H$

only for BH 9097.38/010,

BH 9097.38/011:

AC 110 V (Klemmen A 1 - A 2),

AC 230 V (Klemmen A 1 - A 3),

DC 24 V

#### Voltage range:

0.8 ... 1.1  $U_H$

#### Frequency range of $U_H$ :

45 ... 400 Hz

#### Input current

AC 110 V:

approx. 30 mA

AC 230 V:

approx. 15 mA

DC 24 V:

approx.. 50 mA

## Technical Data

### Output

<b>Contacts:</b>	1 changeover contact for P1 1 changeover contact for P2	
<b>Thermal current <math>I_{th}</math>:</b>	2 x 5 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:	1 A / DC 24 V	IEC/EN 60 947-5-1
<b>Electrical life</b> to AC 15 at 3 A, AC 230 V:	2 x 10 <sup>5</sup> switching cycles	IEC/EN 60 947-5-1
<b>Permissible switching frequency:</b>	1800 switching cycles / h	
<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	

### General Data

<b>Operating mode:</b>	continuous	
<b>Temperature range:</b>	- 20 ... + 55°C	
<b>Clearance and creepage distances</b> rated impuls 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:	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:	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
<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 frequency 10 ... 55 Hz IEC/EN 60 068-2-6	
<b>Climate resistance:</b>	20 / 055 / 04 IEC/EN 60 068-1	
<b>Terminal designation:</b>	EN 50 005	
<b>Wire connection</b> Load terminals:	1 x 10 mm <sup>2</sup> solid or 1 x 6 mm <sup>2</sup> stranded wire with sleeve 1 x 4 mm <sup>2</sup> solid or 2 x 1.5 mm <sup>2</sup> stranded wire with sleeve or 1 x 2,5 mm <sup>2</sup> stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
<b>Wire fixing:</b>	Box terminals with self-lifting wire protection and Plus-minus terminal screws M3.5	
<b>Mounting:</b>	DIN rail	IEC/EN 60 715
<b>Weight:</b>	430 g	

### Dimensions

Width x height x depth: 45 x 84 x 121 mm

### CCC-Data

<b>Thermal current <math>I_{th}</math>:</b>	4 A	
<b>Switching capacity</b> to AC 15:	3 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

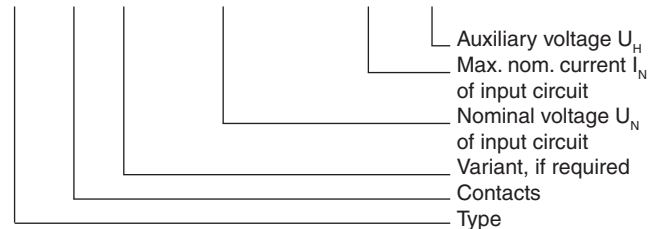
BH 9097.38/001	3 AC 400 V	50 / 60 Hz	$t_a$ 30 s	$t_v$ 10 s
Article number:	0053944			
• 3-phase, without auxiliary supply				
• Output:	1 changeover contact for P1 and 1 changeover contact for P2			
• Nominal voltage $U_N$ :	3 AC 400 V			
• Width:	45 mm			

## Variants

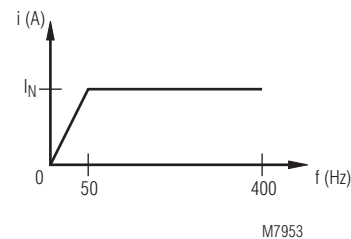
BH 9097:	with CCC-approval on request
BH 9097.38/001:	3-phase without auxiliary supply
BH 9097.38/011:	3-phase with auxiliary supply
BH 9097.38/000:	1-phase without auxiliary supply
BH 9097.38/010:	1-phase with auxiliary supply
BH 9097.38/1_ _:	With galvanically separated current path. For applications with current transformers grounded on the secondary side, current range limited to 25 A same as BH 9097.38/001, but with start up delay $t_a = 0 \dots 10$ s
BH 9097.38/801:	

## Ordering example for variants

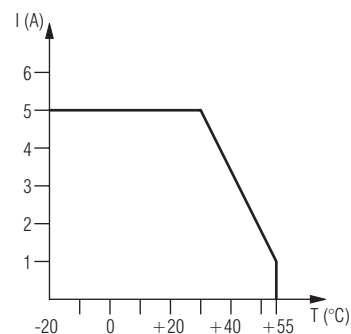
BH 9097\_38 / \_ \_ 3 AC 100...760 V AC 40 A AC 230/110 V



## Characteristics



Max. input current curve in relation to input frequency



continuous current limit curve  
(current over 2 contacts)

## Settings

2 rotational switches for P <sub>1</sub> :	Value P <sub>1</sub> (2 decades)
2 rotational switches for P <sub>2</sub> :	Value P <sub>2</sub> (2 decades)
Potentiometer t <sub>v1</sub> :	time delay for value P <sub>1</sub>
Potentiometer t <sub>v2</sub> :	time delay for value P <sub>2</sub>
Potentiometer t <sub>a</sub> :	start-up delay after connection voltage
Test/Reset-Taste:	Test function as setting assistance Reset function when manual reset is selected

Dip-switches:



x10 | x1  
A | R

selection of upper / lower load range  
selection of closed or open circuit operation for output relays

P<sub>2</sub> max. | P<sub>2</sub> max.  
P<sub>1</sub> max. | P<sub>1</sub> min.

2 MAX switching values (Overload with Pre-warning) or MAX and MIN switching value (Overload / Underload monitoring)  
manual / automatic reset for P<sub>1</sub>  
manual / automatic reset for P<sub>2</sub>

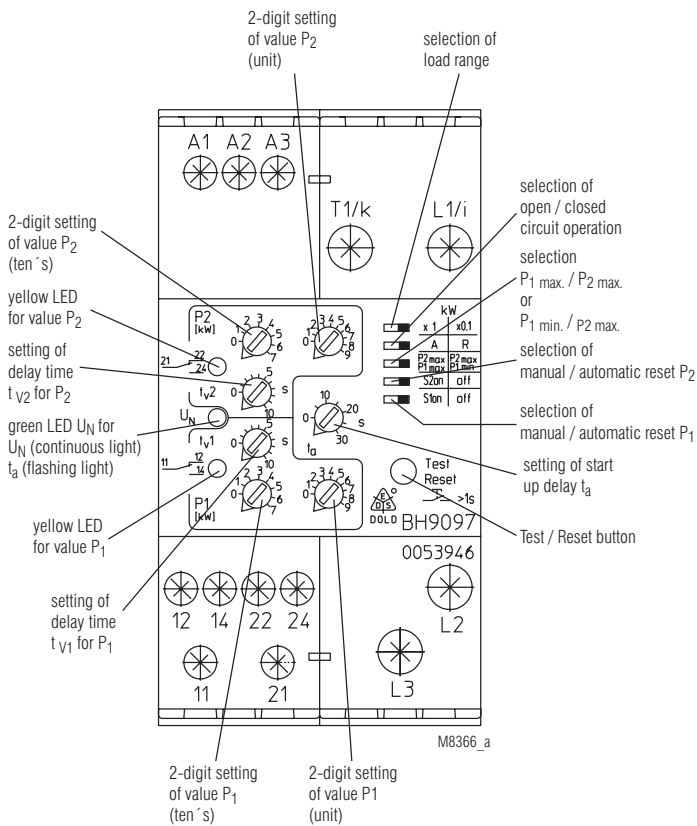
S1 ON | OFF:

S2 ON | OFF:

## Connection

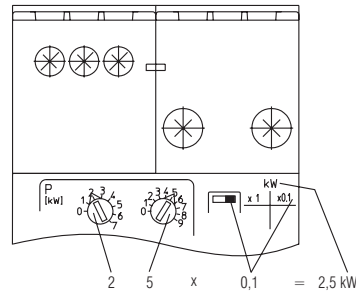
The device has to be connected according to the connection diagrams. The motor is connected to terminals L/i and T/k or L1/i and T1/k. The flow direction of the current has to be observed. On reverse power the unit gives a fault signal. The max continuous motor current is 40 A limited by the terminals. With higher currents a current transformer with 2,5 VA has to be used.

## Set-up Procedure and Setting Instructions



## Adjustment example: response value: 2,5 kW

M9950



Response value = 25 x 0,1 = 2,5 kW

The adjustment of the unit can be made without additional measuring equipment and calculations. Please make sure that the load values are in the permitted operating range of the unit. Based on the max permitted values the BH 9097 can be used for 48 kW 3-phase motors at 3 AC 690 V and 5.8 kW single phase motors at AC 230 V.

There are three methods to set up the unit:

### Method 1:

If the absolute values of the actual required tripping points P<sub>1</sub> and P<sub>2</sub> are known, they can be set directly on the unit (2-digit setting of P<sub>1</sub> and P<sub>2</sub>).

### Method 2:

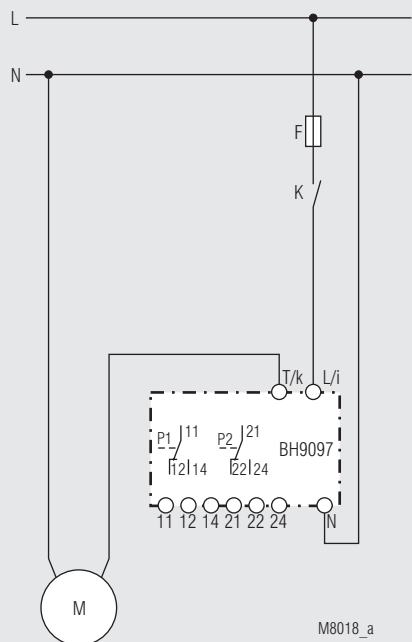
This method is recommended when it is possible to simulate the different load situations during set-up. In this case nothing has to be calculated. Turn the delay time for P<sub>1</sub> and P<sub>2</sub> to min. The motor runs in underload while the Pot 1 is turned until the output relay switches. The same has to be done for overload. Now the unit is set accurately. Now adjust the operate delay and the start-up delay to the required values.

Pressing the test / reset button during setup disables the switching of the output relays. The LEDs of P<sub>1</sub> and P<sub>2</sub> flash.

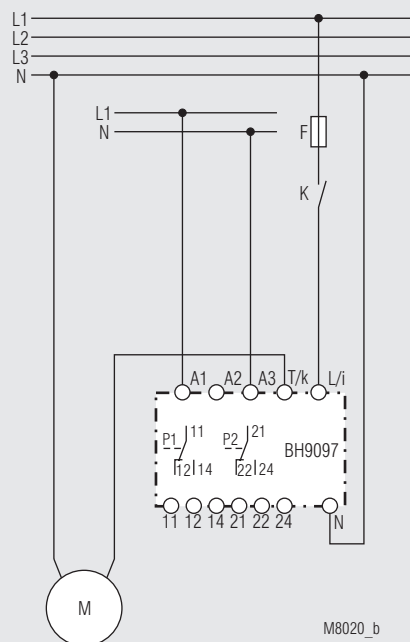
### Method 3:

This method is the most simple one but not the most accurate. The operate delay is set to min. The motor is switched on and runs on nominal load. With both potentiometers the set points are searched by slowly turning the max. Pot from high to low value and the min. Pot from low to high value until the corresponding output relays switch. After that turn the Pot P<sub>2</sub> to the right (e.g. + 10 %) side and the Pot P<sub>1</sub> to the left (e.g. - 10 %) until the output relays reset. The unit is now set and responds if the load differs from the nominal value. Finally set the operate delay and start-up delay to the required values. The DIP switch should be set to P<sub>1</sub> min / P<sub>2</sub> max.

single phase

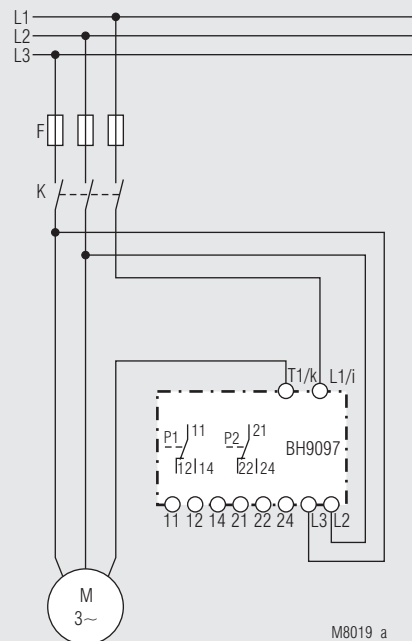


BH 9097.38

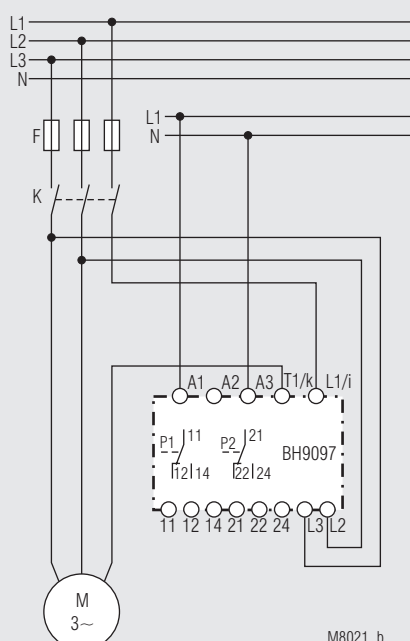


BH 9097.38/010

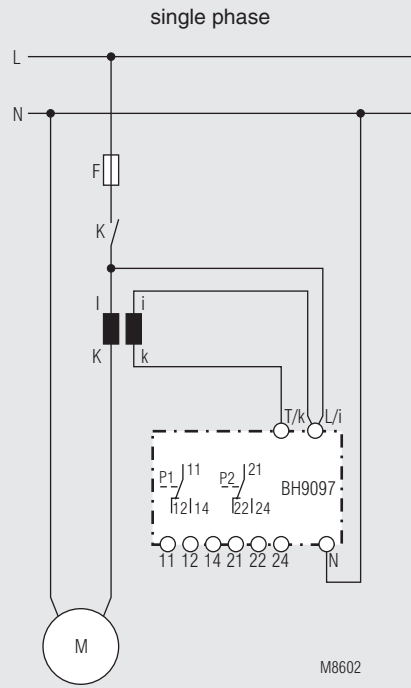
3-phase



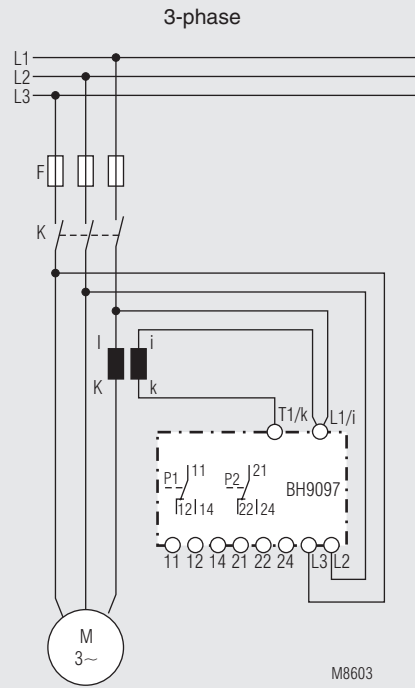
BH 9097.38/001



BH 9097.38/011



BH 9097.38



BH 9097.38/001

**Note:** When using external CTs the adjusted value has to be multiplied with the transmission ratio ( $\ddot{u}$ ) of the CT.  
**Example:** Switching value = Setting value (P1/P2)  $\times$   $\ddot{u}$