

# Monitoring Relays 3-Phase Load Guard Types DWB01, PWB01

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DWB01



PWB01

- TRMS load guard relays for three phase balanced applications
- Measuring if the power factor is within set limits
- Measure their own power supply
- Measuring ranges: 5A, 10A, MI current transformers
- Power ON delay 1 to 30 s knob adjustable
- Separately adjustable upper/lower level on absolute scale
- Programmable latching or inhibit at set level
- Automatic and manual start and stop of the system
- Output: 8 A SPDT relay N.D. or N.E. selectable
- For mounting on DIN-rail in accordance with DIN/EN 50 022 (DWB01) or plug-in module (PWB01)
- 45 mm Euronorm housing (DWB01) or 36 mm plug-in module (PWB01)
- LED indication for relay, alarm and power supply ON

## Product Description

DWB01 and PWB01 are precise TRMS power factor monitoring relays for 3-phase balanced systems. They can be used for monitoring the actual load of asynchronous motors and other symmetrical loads, where the power factor is almost proportional to the load.

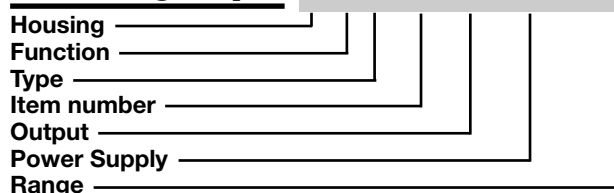
The relay measures the power factor ( $\cos \phi$ ), that is the ratio between the active and the apparent power of a motor.

Start/stop input allows to use a manual switch to start and stop the motor, without the need of an auxiliary device.

The advantage of using the latch function is that the relay can be kept energized even after the end of the alarm condition. Inhibit function can be used to avoid relay operation when not desired (maintenance, transients).

The LED's indicate the state of the alarm and the output relay.

## Ordering key **DWB 01 C M48 10A**



## Type Selection

Mounting	Output	Supply: 208 to 240 VAC	Supply: 380 to 415 VAC	Supply: 380 to 480 VAC	Supply: 600 to 690 VAC
DIN-rail	SPDT	<b>DWB 01 C M23 10A</b>	<b>PWB 01 C M48 10A</b>	<b>DWB 01 C M48 10A</b>	<b>DWB01 C M69 10A</b>
Plug-in	SPDT	<b>PWB 01 C M23 10A</b>			

## Input Specifications

Input	Measuring ranges	Upper level	Lower level
Voltage (Own power supply):	Power factor ( $\cos \phi$ )	0.1 to 0.99	0.1 to 0.99
3 - phase	Direct input:	<b>AACrms</b>	<b>Max. curr. (30 s)</b>
DWB01: L1, L2, L3	Standard CT (examples)	0.5 to 5A	30A
PWB01: 5, 6, 7	TADK2 50 A/5 A	1 to 10A	50A
M23: 208 to 240 VAC $\pm$ 15%	CTD1 150 A/5 A		
DWB01CM48: 380 to 480 VAC $\pm$ 15%	CTD4 400 A/5 A		
PWB01C 8: 380 to 415 VAC $\pm$ 15%	TAD12 1000 A/5 A		
DWB01CM69: 600 to 690 VAC $\pm$ 15%	TACO200 6000 A/5 A		
1- phase	MI CT ranges		
DWB01CM23: L1, L2 (connect pins L2, L3)	MI 100	5 to 50 A	60 A
PWB01CM23: 5, 6 (connect pins 6, 7)	MI 500	15 to 150 A	180 A
208 to 240 VAC $\pm$ 15%		40 to 400 A	480 A
Current:		100 to 1000 A	1200 A
DWB01: 5A, 10A: I1, I2		600 to 6000 A	7200 A
MI...: U1, U2			
PWB01: 5A, 10A: 11, 10			
MI...: 9, 8			

## Input Specifications (cont.)

<b>Note:</b> The input voltage cannot raise over 300 VAC with respect to ground (PWB01 only)	
<b>Contact input</b> DWB01 PWB01 Disabled Enabled Pulse width	Terminals Z1, U1 Terminals 2, 9 > 10 k $\Omega$ < 500 $\Omega$ > 500 ms
<b>Hysteresis</b>	PF approx 0.1

## General Specifications

<b>Power ON delay</b>	1 to 30 s $\pm$ 0.5 s
<b>Reaction time</b>  Alarm ON delay Alarm OFF delay	(input signal variation from -20% to +20% or from +20% to -20% of set value) < 200 ms < 200 ms
<b>Accuracy</b> Temperature drift Delay ON alarm Repeatability	(15 min warm-up time) $\pm$ 1000 ppm/ $^{\circ}$ C $\pm$ 10% on set value $\pm$ 50 ms $\pm$ 0.5% on full-scale
<b>Indication for</b> Power supply ON Alarm ON  Output relay ON	LED, green LED, red (flashing 2 Hz during delay time) LED, yellow
<b>Environment</b> Degree of protection Pollution degree Operating temperature @ Max. voltage, 50 Hz @ Max. voltage, 60 Hz Storage temperature	IP 20 3 (DWB01), 2 (PWB01) -20 to 60 $^{\circ}$ C, R.H. < 95% -20 to 50 $^{\circ}$ C, R.H. < 95% -30 to 80 $^{\circ}$ C, R.H. < 95%
<b>Housing</b> Dimensions Material	DWB01 PWB01 45 x 80 x 99.5 mm 36 x 80 x 94 mm PA66 or Noryl
<b>Weight</b>	Approx. 250 g
<b>Screw terminals</b> Tightening torque	Max. 0.5 Nm acc. to IEC 60947
<b>Product standard</b>	EN 60255-6
<b>Approvals</b>	UL, CSA
<b>CE Marking</b>  EMC Immunity  Emissions	L.V. Directive 2006/95/EC EMC Directive 2004/108/EC  According to EN 60255-26 According to EN 61000-6-2 According to EN 60255-26 According to EN 61000-6-3

## Output Specifications

<b>Output</b>	SPDT relay
<b>Rated insulation voltage</b>	250 VAC
<b>Contact ratings (AgSnO<sub>2</sub>)</b> Resistive loads Small inductive loads	$\mu$ AC 1 DC 12 AC 15 DC 13 8 A @ 250 VAC 5 A @ 24 VDC 2.5 A @ 250 VAC 2.5 A @ 24 VDC
<b>Mechanical life</b>	$\geq$ 30 x 10 <sup>6</sup> operations
<b>Electrical life</b>	$\geq$ 10 <sup>5</sup> operations (at 8 A, 250 V, cos $\phi$ = 1)
<b>Operating frequency</b>	$\leq$ 7200 operations/h
<b>Dielectric strength</b> Dielectric voltage Rated impulse withstand volt.	According to EN 60947-1 $\geq$ 2 kVAC (RMS) 4 kV (1.2/50 $\mu$ s)

## Supply Specifications

<b>Power supply</b> Rated operational voltage Through terminals:	Overvoltage cat. III (IEC 60664, IEC 60038)  DWB01: PWB01: M23 DWB01CM48 PWB01CM48 DWB01CM69
Dielectric voltage Dielectric voltage supply to output	L1, L2, L3 5, 6, 7 177 to 276 VAC 45 to 65 Hz 323 to 552 VAC 45 to 65 Hz 323 to 477 VAC 45 to 65 Hz 510 to 793 VAC 45 to 65 Hz None 4 kV
<b>Rated operational power</b> M23: M48: M69:	9 VA @ 230 VAC, 50 Hz 13 VA @ 400 VAC, 50 Hz 21 VA @ 600 VAC, 50 Hz Supplied by L1 and L2

## Mode of Operation

DWB01 and PWB01 can be used for monitoring the actual load of asynchronous motors.

The relay measures the absolute value for the power factor of the system PF = Active Power/Apparent Power that is for balanced system with sinus waveforms the cosine of the angle between motor current and motor voltage (cos  $\phi$ ).

As cos  $\phi$  varies with the load of the motor, underload and overload can be indirectly detected by DWB01 and PWB01.

The relation between the load and cos  $\phi$  depends on the type of motor. As a

guideline to ensure correct working conditions for a motor, the upper level could be set above the cos  $\phi$  marking on the motor, and the lower level under this value. It is anyway recommended to make the adjustment in connection with a practical test. The relay has an adjustable power ON delay in order to avoid overload detection during motor start.

### Example 1

Latching mode, relay NE  
In this application DWB01 or PWB01 are connected to an external current metering transformer, type MI..., (connected between U1 & U2) as

## Mode of Operation (cont.)

well as to a 3-phase asynchronous motor. The relay energizes as soon as the power supply is applied. After the power ON delay, the unit starts measuring  $\cos \varphi$ . If  $\cos \varphi$  is within the setpoints the relay is energized. As soon as the power factor drops below the lower setpoint or exceeds the upper setpoint the output relay releases and the red LED turns on after the set time has expired. To restart the  $\cos \varphi$  measurement, connect Z1 and U1 (2 and 9) or interrupt the power supply for at least 1 s.

### Example 2

Non-latching mode, relay NE DWB01 and PWB01 react as described in the previous example 1 except for the

automatic reactivation of the relay as soon as  $\cos \varphi$  is back within the two setpoints. When the measured  $\cos \varphi$  exceeds the set upper level, the red LED starts flashing. The output relay releases after the set time period. When the measured  $\cos \varphi$  drops below the set lower level, the red LED starts flashing, and the output relay releases after the set time period. When the output relay releases there will be no LED indication.

### Example 3

**1-Phase load monitoring**  
DWB01CM2310A and PWB01CM2310A can be used for monitoring the power factor of a 1-Phase load with 208 to 240 V AC mains voltage. In this case the pow-

er supply has to be connected between L1, L2 (or 5, 6), L2 and L3 (or 6 and 7) have to be connected.

### Example 4

Start/stop mode, relay NE In this application DWB01 or PWB01 are directly connected to a 3-phase asynchronous motor. The relay energizes as soon as the power supply is applied and the start/stop contact is closed. After the power ON delay, the unit starts measuring  $\cos \varphi$ . If  $\cos \varphi$  is within the setpoints the relay energizes. As soon as the power factor drops below the lower setpoint or exceeds the upper setpoint the output relay releases and the red LED turns ON after the set time has expired. When the

start/stop contact is opened the relay de-energizes immediately. To restart the system just connect the start/stop contact.

**Note 1:** to use the start/stop function the output relay has to command a contactor connected in series to the load (see last two wiring diagrams).

**Note 2:** in case of current below the minimum level the alarm is conventionally ON.

**Note 3:** (3-phase voltage): connect the 3-phase power supply to the terminals L1, L2 and L3 (DWB01) - 5, 6 and 7 (PWB01) taking care of the sequence.

## Function/Range/Level/Time Setting

Select the desired function setting the DIP-switches 1 to 4 as shown on the right. To access the DIP-switches open the plastic cover using a screwdriver as shown on the right.

If DIP switch 3 is set to ON (start/stop) the position of DIP-switch 4 does not affect the products working mode.

### Centre knobs:

Setting of upper and lower level of  $\cos \varphi$  0.1 to 0.99.

### Lower left knob:

Setting of delay on absolute scale: 0.1 to 30 s.

### Lower right knob:

Setting of power ON delay on absolute scale: 1 to 30 s.



### Input current range (terminals I1, I2 or 10, 11)

ON: 10A  
OFF: 5A/MI input

### Relay status

ON: Relay de-energized in normal condition  
OFF: Relay energized in normal condition

### Working mode

ON: Contact input for start/stop functions  
OFF: Contact input for latch/inhibit functions

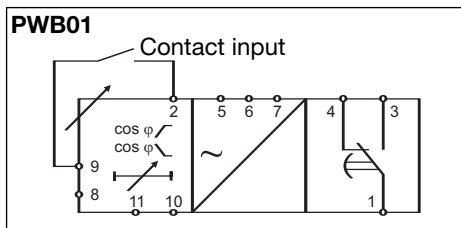
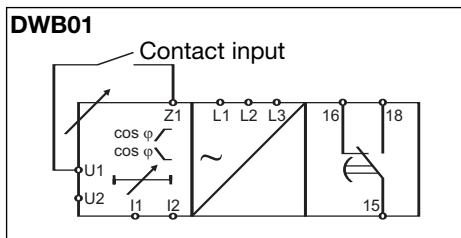
### Contact input (SW4 does not affect the working mode if SW3 is ON)

ON: Latch function enable  
OFF: Inhibit function enable

### Notes

- DIP-switch 3 set ON enables the start/stop function that is managed by the closing-opening of the contact input.
- DIP-switch 3 set OFF enables the input contact for the latch/inhibit functions: the selection between these is allowed by the DIP switch 4.

The following table shows how the input contact manages the mode of operation:

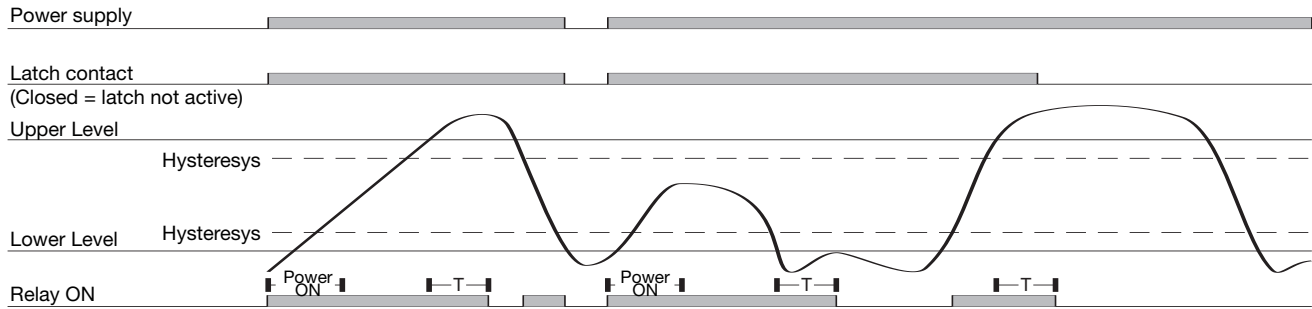


### Contact input working mode

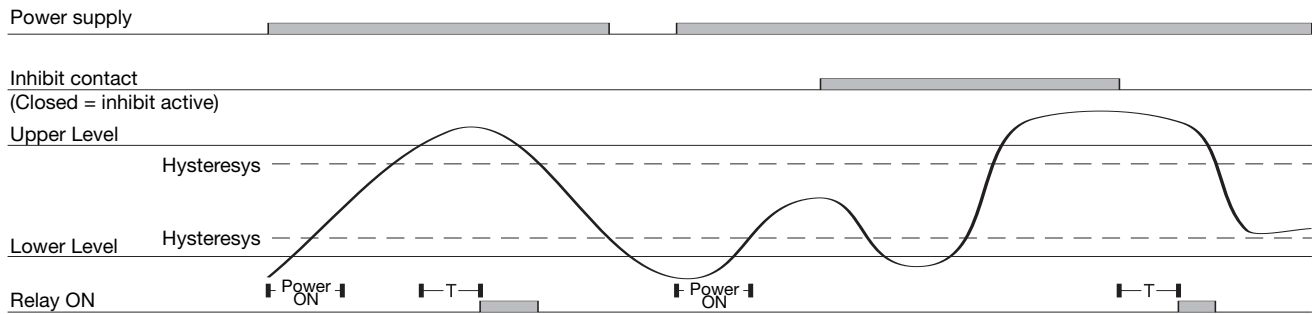
	CLOSED	OPEN
LATCH	NOT ACTIVE	ACTIVE
INHIBIT	ACTIVE	NOT ACTIVE
START/STOP	START	STOP

## Operation Diagrams

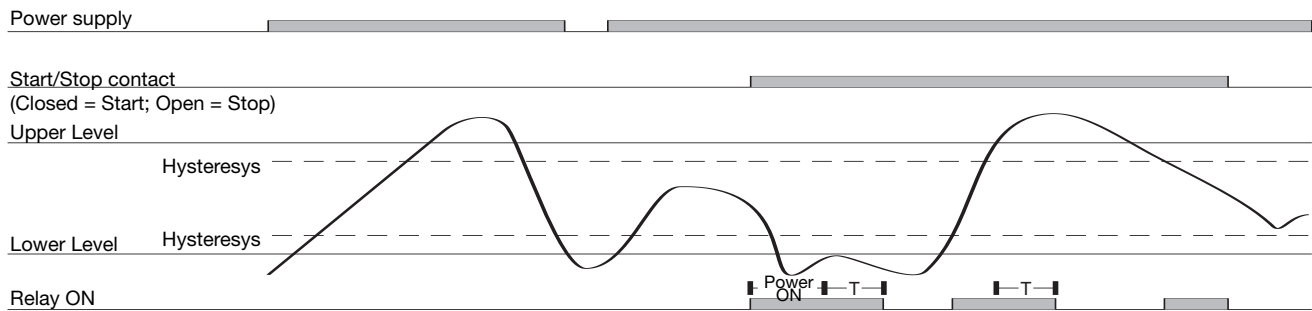
### Latch function - NE relay



### Inhibit function - ND relay

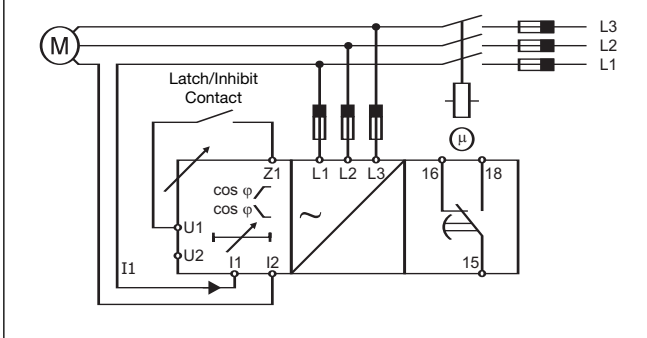


### Start and stop function - NE relay

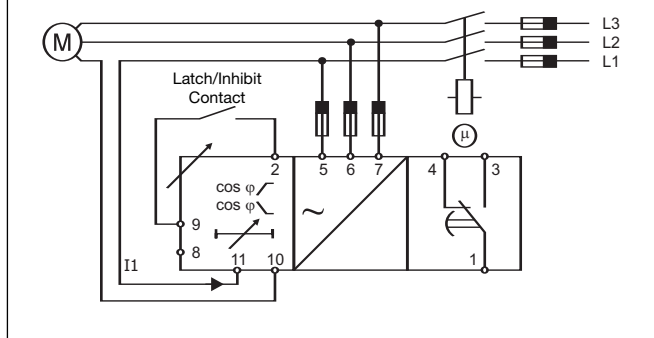


## Wiring Diagrams

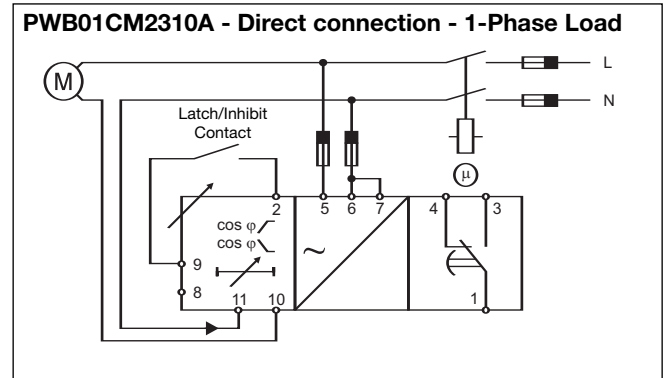
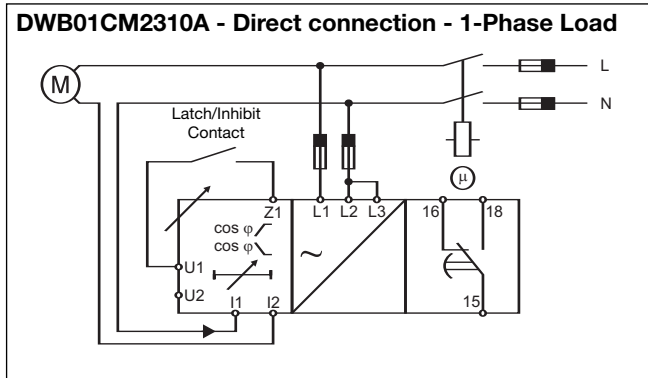
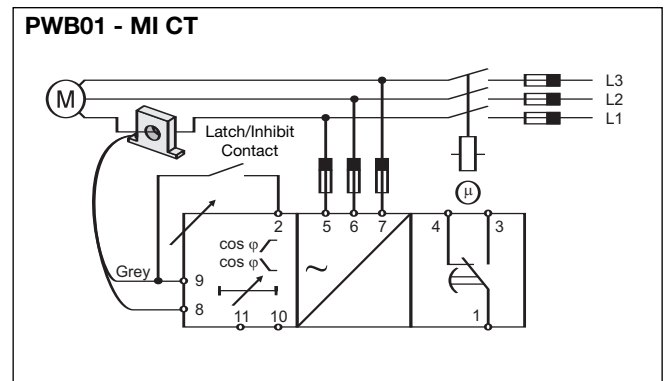
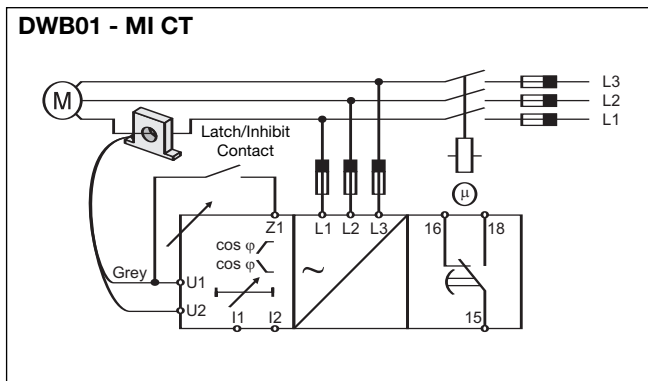
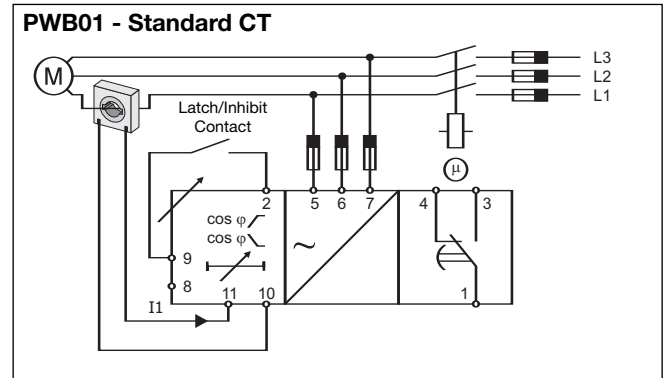
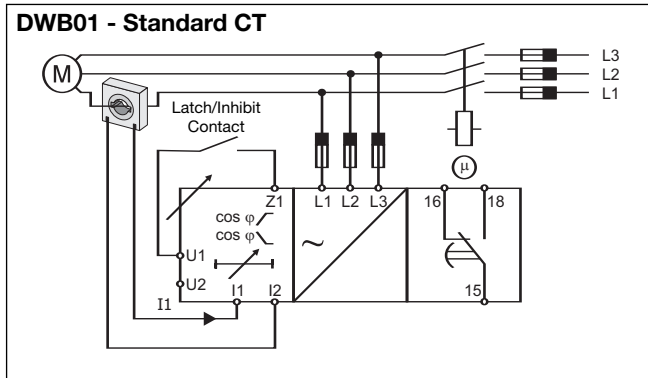
### DWB01 - Direct connection



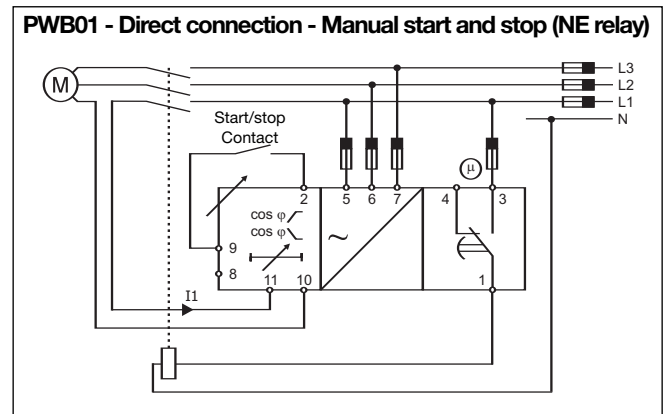
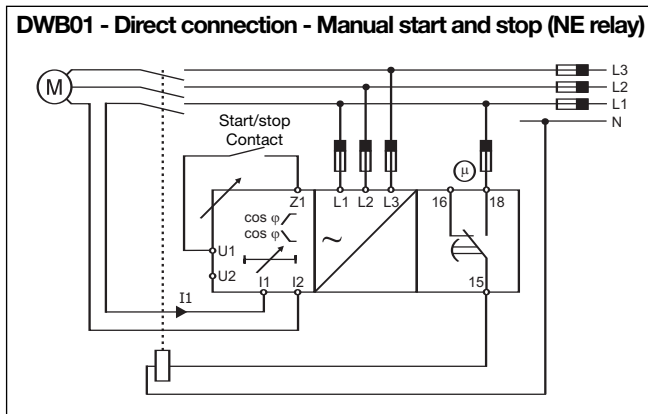
### PWB01 - Direct connection



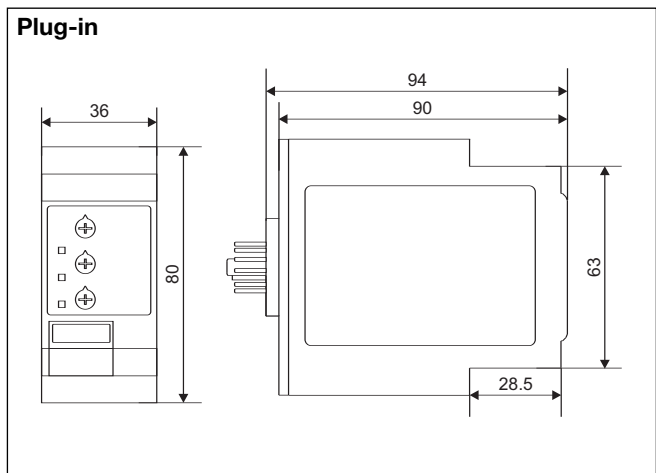
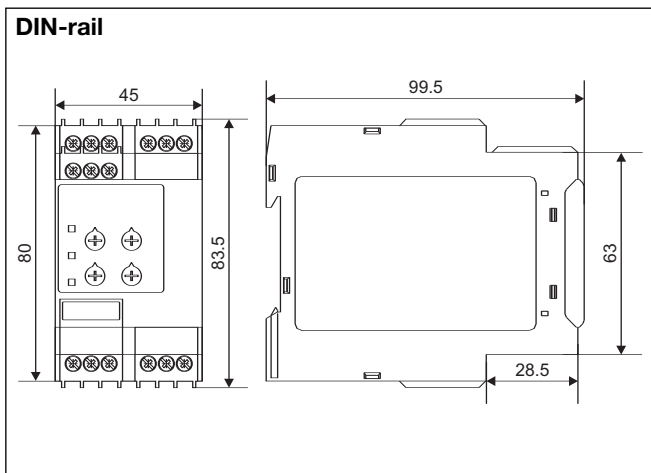
## Wiring Diagrams (cont.)



With the start/stop function enabled, it's necessary to use the following wiring diagrams (which are two examples among many others). It is possible for both 3-phase loads and 1-phase loads, either through direct connection or external current metering transformer.



## Dimensions



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