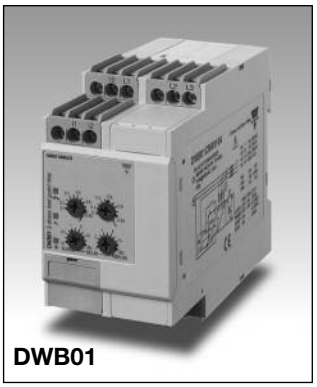
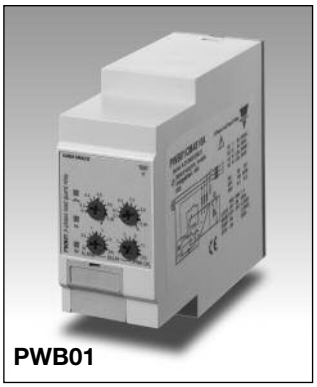
Monitoring Relays
3-Phase Load Guard
Types DWB01, PWB01


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 φ), 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

- **Housing**
- **Function**
- **Type**
- **Item number**
- **Output**
- **Power Supply**
- **Range**

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	**DWB 01 C M23 10A**		**DWB 01 C M48 10A**	**DWB01 C M69 10A**
Plug-in	SPDT	**PWB 01 C M23 10A**	**PWB 01 C M48 10A**		

Input Specifications

Input

Voltage (Own power supply):		
3 - phase	DWB01:	L1, L2, L3
	PWB01:	5, 6, 7
	M23:	208 to 240 VAC ± 15%
	DWB01CM48:	380 to 480 VAC ± 15%
	PWB01C 8:	380 to 415 VAC ± 15%
	DWB01CM69:	600 to 690 VAC ± 15%
1- phase	DWB01CM23:	L1, L2 (connect pins L2, L3)
	PWB01CM23:	5, 6 (connect pins 6, 7) 208 to 240 VAC ± 15%
Current:	DWB01:	5A, 10A: I1, I2
		MI...: U1, U2
	PWB01:	5A, 10A: 11, 10
		MI...: 9, 8

Measuring ranges	**Upper level**	**Lower level**
Power factor (cos φ)	0.1 to 0.99	0.1 to 0.99
	AACrms	**Max. curr. (30 s)**
Direct input:	0.5 to 5A	30A
	1 to 10A	50A
Standard CT (examples)		
TADK2 50 A/5 A	5 to 50 A	60 A
CTD1 150 A/5 A	15 to 150 A	180 A
CTD4 400 A/5 A	40 to 400 A	480 A
TAD12 1000 A/5 A	100 to 1000 A	1200 A
TACO200 6000 A/5 A	600 to 6000 A	7200 A
MI CT ranges		
MI 100	10 to 100 A	325 AAC
MI 500	50 to 500 A	1000 AAC

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Input Specifications (cont.)

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

Output Specifications

Output	SPDT relay
Rated insulation voltage	250 VAC
Contact ratings ($AgSnO_2$)	μ
Resistive loads AC 1	8 A @ 250 VAC
DC 12	5 A @ 24 VDC
Small inductive loads AC 15	2.5 A @ 250 VAC
DC 13	2.5 A @ 24 VDC
Mechanical life	≥ 30 x 10^6 operations
Electrical life	≥ 10^5 operations (at 8 A, 250 V, cos φ = 1)
Operating frequency	≤ 7200 operations/h
Dielectric strength	According to EN 60947-1
Dielectric voltage	≥ 2 kVAC (RMS)
Rated impulse withstand volt.	4 kV (1.2/50 μs)

General Specifications

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

Supply Specifications

Power supply	Overvoltage cat. III (IEC 60664, IEC 60038)
Rated operational voltage	
Through terminals:	
DWB01:	L1, L2, L3
PWB01:	5, 6, 7
M23	177 to 276 VAC 45 to 65 Hz
DWB01CM48	323 to 552 VAC45 to 65 Hz
PWB01CM48	323 to 477 VAC 45 to 65 Hz
DWB01CM69	510 to 793 VAC 45 to 65 Hz
Dielectric voltage	None
Dielectric voltage supply to output	4 kV
Rated operational power	
M23:	9 VA @ 230 VAC, 50 Hz
M48:	13 VA @ 400 VAC, 50 Hz
M69:	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 φ).
As cos φ 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 φ 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 φ 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

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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 φ. If cos φ 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 φ 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 φ is back within the two setpoints. When the measured cos φ exceeds the set upper level, the red LED starts flashing. The output relay releases after the set time period. When the measured cos φ 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 power 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 φ. If cos φ 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.

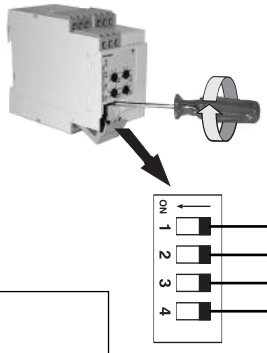
Function/Range/Level/Time Setting

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 φ 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

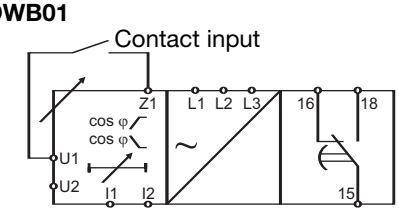
Working mode
ON: Contact input for start/stop functions
OFF: Contact input for latch/inhibit functions

Contact input (SW4 does not affect the working mode if SW3 is ON)
ON: Latch function enable
OFF: Inhibit function enable

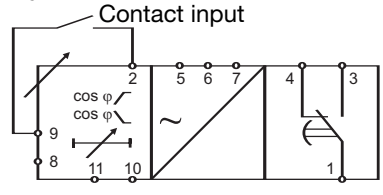
Notes
1. DIP-switch 3 set ON enables the start/stop function that is managed by the closing-opening of the contact input.
2. DIP-switch 3 set OFF enables the input contact for the latch/inhibit functions: the selection between these is allows by the DIP switch 4.

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

DWB01



PWB01

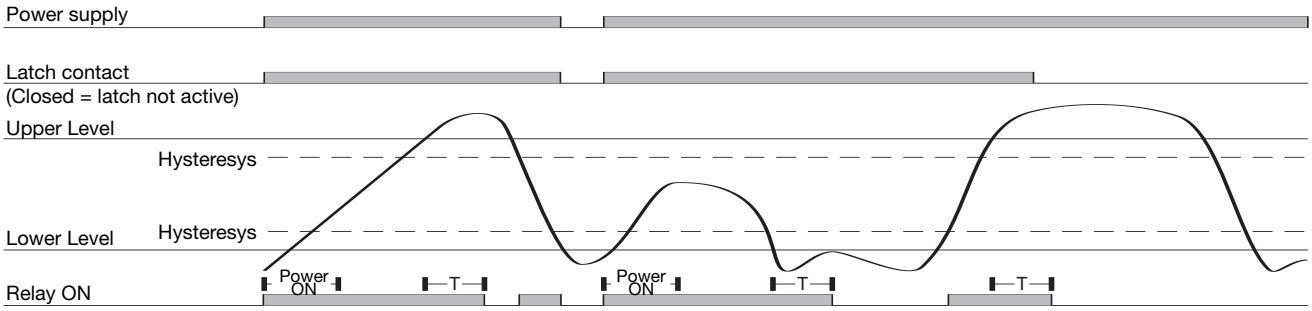


Contact input working mode

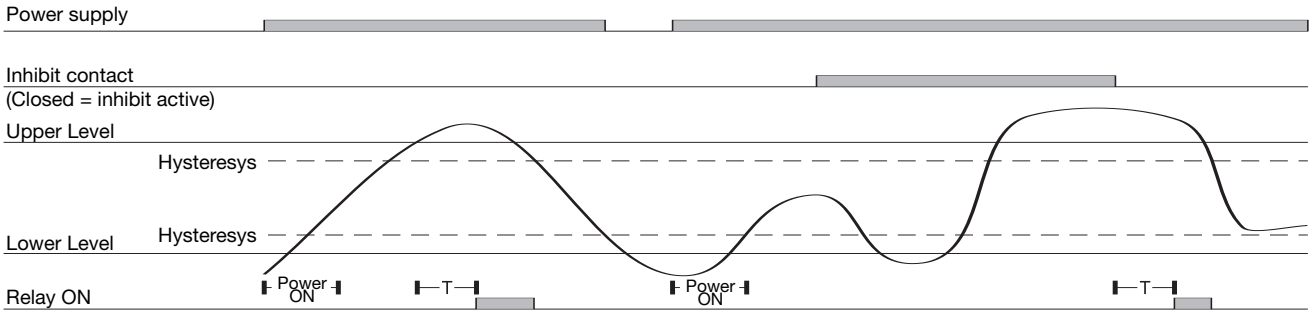
	CLOSED	OPEN
LATCH	NOT ACTIVE	ACTIVE
INHIBIT	ACTIVE	NOT ACTIVE
START/STOP	START	STOP

Operation Diagrams

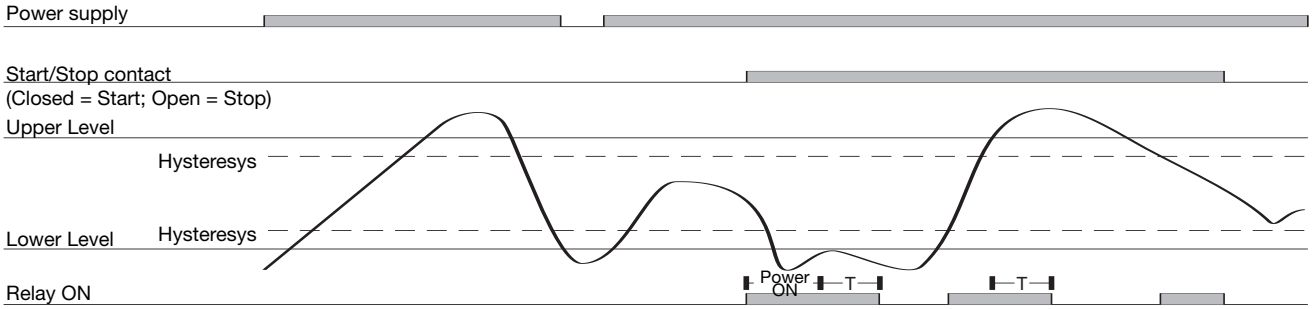
Latch function - NE relay



Inhibit function - ND relay

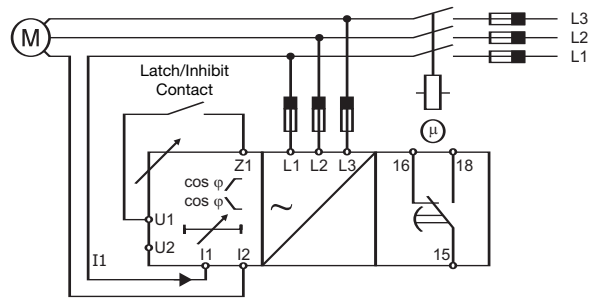


Start and stop function - NE relay

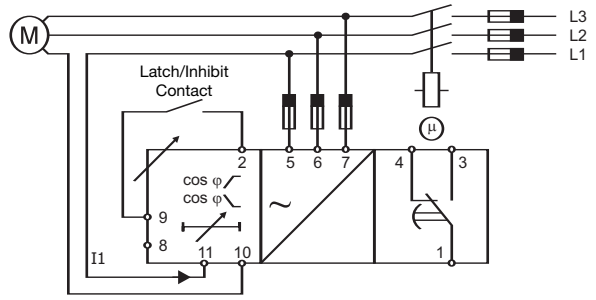


Wiring Diagrams

DWB01 - Direct connection



PWB01 - Direct connection



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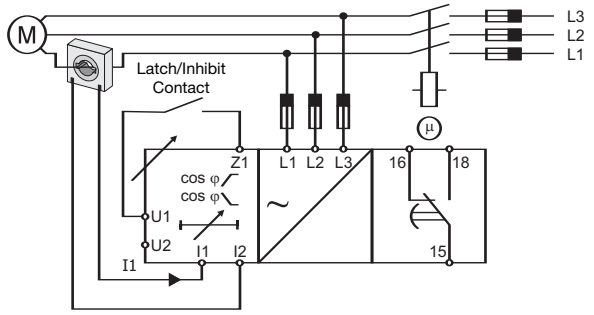
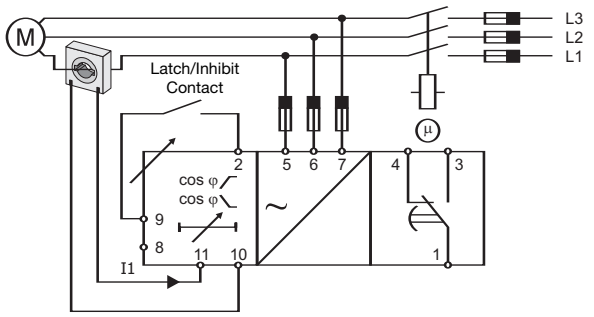
Wiring Diagrams (cont.)

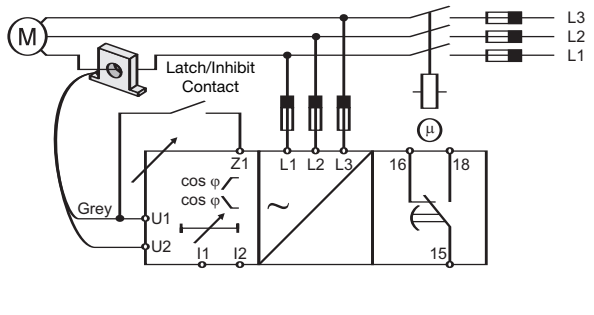
DWB01 - Standard CT



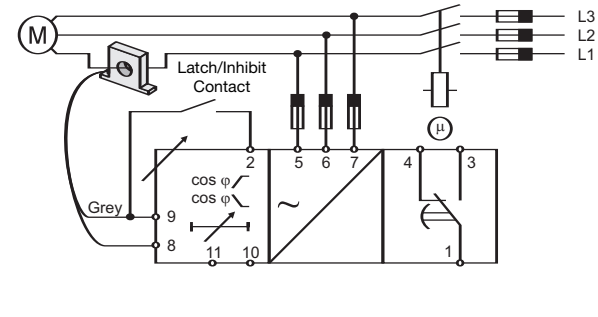
PWB01 - Standard CT



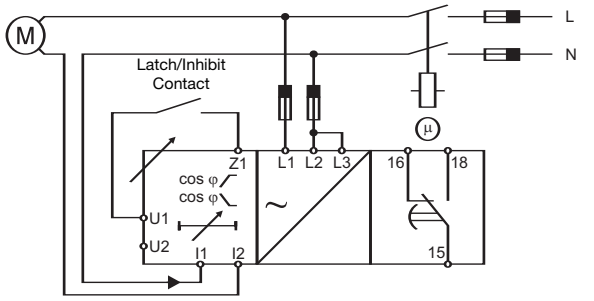
DWB01 - MI CT



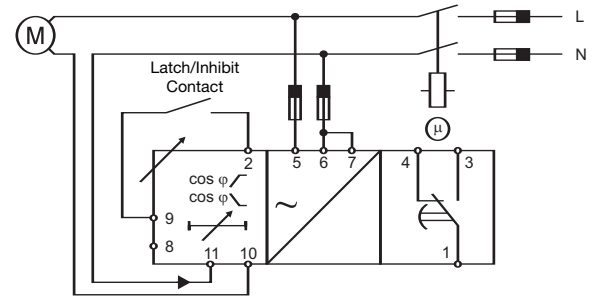
PWB01 - MI CT



DWB01CM2310A - Direct connection - 1-Phase Load

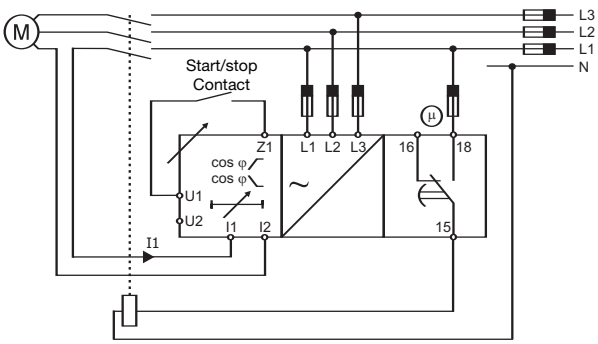


PWB01CM2310A - Direct connection - 1-Phase Load



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.

DWB01 - Direct connection - Manual start and stop (NE relay)



PWB01 - Direct connection - Manual start and stop (NE relay)