

# Monitoring Relays

## True RMS 3-Phase, 3-Phase+N, Multifunction

### Types DPC01, PPC01

CARLO GAVAZZI



DPC01



PPC01

- TRMS 3-phase over and under voltage, phase sequence, phase loss, asymmetry and tolerance monitoring relay
- Detect when all 3 phases are present and have the correct sequence
- Detect if all the 3-phase-phase or phase-neutral voltages are within the set limits
- Detect if asymmetry and tolerance are within the set value
- Separately adjustable setpoints
- Separately adjustable delay functions (0.1 to 30 s)
- Output: 2 x 8 A relay SPDT NE
- For mounting on DIN-rail in accordance with DIN/EN 50 022 (DPC01) or plug-in module (PPC01)
- 45 mm Euronorm housing (DPC01) or 36 mm plug-in module (PPC01)
- LED indication for relays, alarm and power supply ON

## Product Description

3-phase or 3-phase+neutral line voltage monitoring relay for phase sequence, phase loss, asymmetry, tolerance, over and under voltage (separately adjustable set points)

with built-in time delay function.  
Supply ranges from 100 to 690 VAC covered by three multivoltage relays.

## Ordering key

**DPC 01 D M48**

Housing \_\_\_\_\_  
Function \_\_\_\_\_  
Type \_\_\_\_\_  
Item number \_\_\_\_\_  
Output \_\_\_\_\_  
Power Supply \_\_\_\_\_

## Type Selection

Mounting Output	Frequency	Supply: 100 to 115 VAC	Supply: 208 to 240 VAC	Supply: 380 to 415 VAC
DIN-rail 2 x SPDT	50 - 60 Hz	<b>DPC 01 D M11 400HZ</b>	<b>DPC 01 D M23</b>	<b>DPC 01 D M48 400HZ</b> <b>PPC 01 D M48</b>
DIN-rail 2 x SPDT	50 - 400 Hz		<b>DPC 01 D M23 400HZ</b>	
Plug-in 2 x SPDT	50 - 60 Hz		<b>PPC 01 D M23</b>	
Mounting Output	Frequency	Supply: 440 to 480 VAC	Supply: 380 to 480 VAC	Supply: 600 to 690 VAC
DIN-rail 2 x SPDT	50 - 60 Hz	<b>DPC 01 D M49 400HZ</b>	<b>DPC 01 D M48</b>	<b>DPC 01 D M69</b> <b>DPC 01 D M69 400HZ</b>
DIN-rail 2 x SPDT	50 - 400 Hz			

## Input Specifications

Input		Input	Input	Input
L1, L2, L3, N	DPC01: PPC01:	Terminals L1, L2, L3, N Terminals 5, 6, 7, 11 Measure their own supply	<b>Ranges</b> Upper level  Lower level  Asymmetry  Tolerance	+2 to +22% of the nominal voltage -22 to -2% of the nominal voltage 2 to 22% of the nominal voltage 2 to 22% of the nominal voltage
<b>Note:</b> Connect the neutral only if it is intrinsically at the star centre			<b>Note:</b> The input voltage must not exceed the maximum rated voltage or drop below the minimum rated voltage reported above.	
<b>Measuring ranges</b> M11 M23 M48		85 to 132 ΔVAC 177 to 275 ΔVAC 323 to 550 ΔVAC	<b>Hysteresis</b> Set points from 2 to 5% Set points from 5 to 22%	1% 2%
	DPC01	323 to 475 ΔVAC		
	PPC01	323 to 475 ΔVAC		
M49	DPC01	375 to 550 ΔVAC		
M69	DPC01	510 to 793 ΔVAC		

## Output Specifications

<b>Output</b>	2 x SPDT relays N.E.
Rated insulation voltage	250 VAC
<b>Contact ratings</b> (AgSnO <sub>2</sub> )	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
<b>Mechanical life</b>	≥ 30 x 10 <sup>6</sup> operations
<b>Electrical life</b>	≥ 10 <sup>5</sup> operations (at 8 A, 250 V, cos φ = 1)
<b>Operating frequency</b>	≤ 7200 operations/h
<b>Dielectric strength</b>	
Dielectric voltage	≥ 2 kVAC (rms)
Rated impulse withstand volt.	4 kV (1.2/50 μs)

## Supply Specifications

<b>Power supply</b>	Overvoltage cat. III (IEC 60664, IEC 60038)
Rated operational voltage through terminals:	
L1, L2, L3, N (DPC01)	
5, 6, 7, 11 (PPC01)	
M11 - Delta Voltage:	100 to 115VAC ±15%; 45 to 65Hz
M23 - Delta Voltage:	208 to 240VAC ±15%; 45 to 65Hz
DPC01 M48 - Delta Voltage:	380 to 480VAC ±15%; 45 to 65Hz
DPC01 M48 - Star Voltage:	220 to 277VAC ±15%; 45 to 65Hz
PPC01 M48 - Delta Voltage:	380 to 415VAC ±15%; 45 to 65Hz
PPC01 M48 - Star Voltage:	220 to 240VAC ±15%; 45 to 65Hz
M48 400HZ - Delta Voltage:	380 to 415VAC ±15%; 45 to 440Hz
M48 400 HZ- Star Voltage:	220 to 240VAC ±15%; 45 to 440Hz
M49 400HZ - Delta Voltage:	440 to 480VAC ±15%; 45 to 440Hz
M49 400 HZ- Star Voltage:	254 to 277VAC ±15%; 45 to 440Hz
M69 - Delta Voltage:	600 to 690VAC ±15%; 45 to 65Hz
M69 - Star Voltage:	347 to 400VAC ±15%; 45 to 65Hz
M69 400HZ- Delta Voltage:	600 to 690VAC ±15%; 45 to 440Hz
M69 400HZ- Star Voltage:	347 to 400VAC ±15%; 45 to 440Hz
<b>Rated operational power</b>	
M11	8 VA @ Δ115 VAC, 50 Hz
M23	9 VA @ Δ230 VAC, 50 Hz
M48	13 VA @ Δ400 VAC, 50 Hz
M69	21 VA @ Δ600 VAC, 50 Hz
	Supplied by L2 and L3 for the DIN-rail versions and by L1 and L2 for the Plug-in versions

## General Specifications

<b>Power ON delay</b>	1 s ± 0.5 s or 6 s ± 0.5 s	<b>Housing</b>	
<b>Accuracy</b>	(15 min warm-up time)	Dimensions	DPC01 45 x 80 x 99.5 mm
Temperature drift	± 1000 ppm/°C	PPC01 36 x 80 x 94 mm	
Delay ON alarm	± 10% on set value ± 50 ms	Material	PA66 or Noryl
Repeatability	± 0.5% on full-scale	<b>Weight</b>	Approx. 220 g
<b>Reaction time</b>		<b>Screw terminals</b>	(DPC01)
Incorrect phase sequence or total phase loss	< 200 ms	Tightening torque	Max. 0.5 Nm acc. to IEC 60947
Voltage level	(input signal variation from -20% to +20% or from +20% to -20% of set value)	<b>Product standard</b>	EN 60255-6
Asymmetry level		<b>Approvals</b>	UL, CSA GL (DPC01 only, except 400Hz, M11)
Alarm ON delay:	< 200 ms (delay < 0.1 s)	<b>CE Marking</b>	L.V. Directive 2006/95/EC EMC Directive 2004/108/EC
Alarm OFF delay:	< 200 ms (delay < 0.1 s)		
<b>Indication for</b>		EMC	
Power supply ON	LED, green	Immunity	According to EN 60255-26
Alarm ON	LED, red (flashing 2 Hz during delay time)		According to EN 61000-6-2
Output relays ON	2 x LED, yellow	Emissions	According to EN 60255-26 According to EN 61000-6-3
<b>Environment</b>	(EN 60529)		
Degree of protection	IP 20		
Pollution degree	3 (DPC01), 2 (PPC01)		
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%		

## Mode of Operation

### Asymmetry definition.

Asymmetry is an indicator of the mains quality and it is defined as the absolute value of the maximum deviation among the mains voltages, divided by the nominal voltage of the 3-phase system. The definition changes according to the voltage reference:

- 1) in case of measuring phase-phase voltages:

$$\frac{\max |\Delta V_{PH-PH}|}{V_{\Delta NOM}} \times 100$$

- 2) in case of measuring phase-neutral voltages:

$$\frac{\max |\Delta V_{PH-N}|}{V_{\Delta NOM}} \times 100$$

### Tolerance definition.

Tolerance is another indicator of the mains quality and it is defined as the absolute value of the maximum deviation of the mains voltages from the nominal voltage, divided by the nominal voltage of the 3-phase system. The definition changes according to the voltage reference:

- 1) in case of measuring phase-phase voltages:

$$\frac{\max |V_{\Delta NOM} - V_{PH-PH}|}{V_{\Delta NOM}} \times 100$$

- 2) in case of measuring phase-neutral voltages:

$$\frac{\max |V_{\Delta NOM} - V_{PH-N}|}{V_{\Delta NOM}} \times 100$$

Connected to the 3 phases (and neutral) DPC01 and PPC01 operate when all 3 phases are present at the same time and the phase sequence is correct. It can be decided whether to monitor upper and lower voltage level of each phase or their asymmetry and tolerance.

### Voltage level monitoring:

if one or more phase-phase or phase-neutral voltage exceed the upper set level or drop below the lower set level, the red LED starts flashing 2 Hz and the respective output relay releases after the set time period.

### Asymmetry and tolerance monitoring:

if one or more phase-phase or phase-neutral voltage exceed the set levels the red LED starts flashing 2 Hz and the respective output relay releases after the set time period.

**Note:** For both functions, if the phase sequence is wrong or one phase is lost, both output relays release immediately. Only 200 ms delay occurs. The failure is indicated by the red LED flashing 5 Hz during the alarm condition.

### Example 1

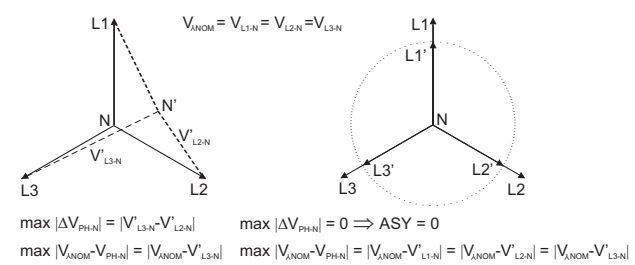
(Mains monitoring - over and under phase-phase voltage) The relay monitors over and under voltage, phase loss and correct phase sequence.

### Example 2

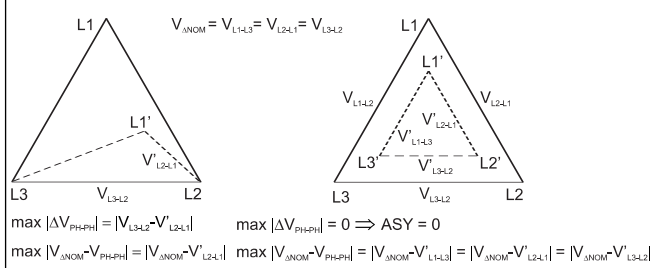
(Motor monitoring - starting and operating load - asymmetry and tolerance of phase-neutral voltage) DPC01 and PPC01 ensure correct starting and operating conditions. They monitor the voltage level, phase sequence (correct direction of the motor rotation) and asymmetry.

Frequent failures are fuse blowing and incorrect voltage level. In case of fuse blowing the motor regenerates a voltage in the interrupted phase. The relay detects the failure and reacts due to excessive imbalance among the phases.

#### Example: phase-neutral monitoring



#### Example: phase-phase monitoring



## Function/Range/Level/Time Setting

Adjust the input range setting the DIP-switches 3 and 4. Select the desired function setting the DIP-switches 5 and 6 as shown below. To

access the DIP-switches open the plastic cover using a screwdriver as shown below.

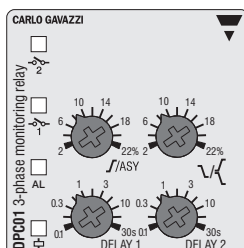
### Centre knobs:

Setting of upper ( $r$ ) and lower ( $\backslash$ ) level or setting of asymmetry (ASY) and tolerance ( $\wedge$ ) on relative scale.

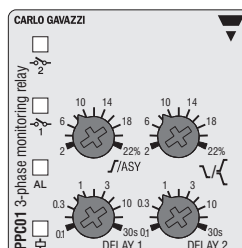
### Lower knobs:

Setting of delay on alarm times (DELAY 1, DELAY 2) on absolute scale: 0.1 to 30 s.

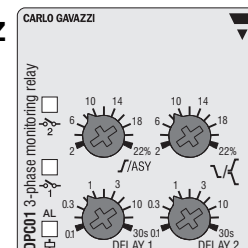
#### DPC01



#### PPC01

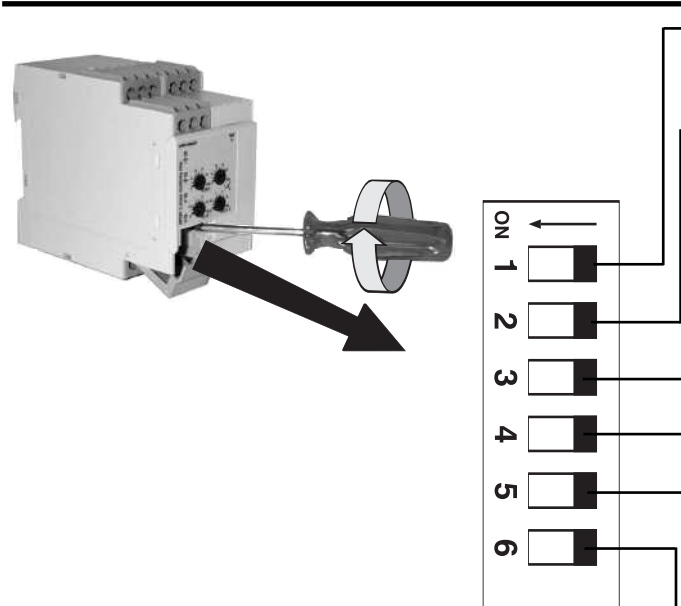


#### DPC01 400 HZ





Function/Range/Level/Time Setting (cont.)



**Power-ON delay**  
ON: 6 s ± 0.5 s  
OFF: 1 s ± 0.5 s

**Monitoring**  
ON: Phase-Neutral voltages  
OFF: Phase-Phase voltages

**Measuring range**

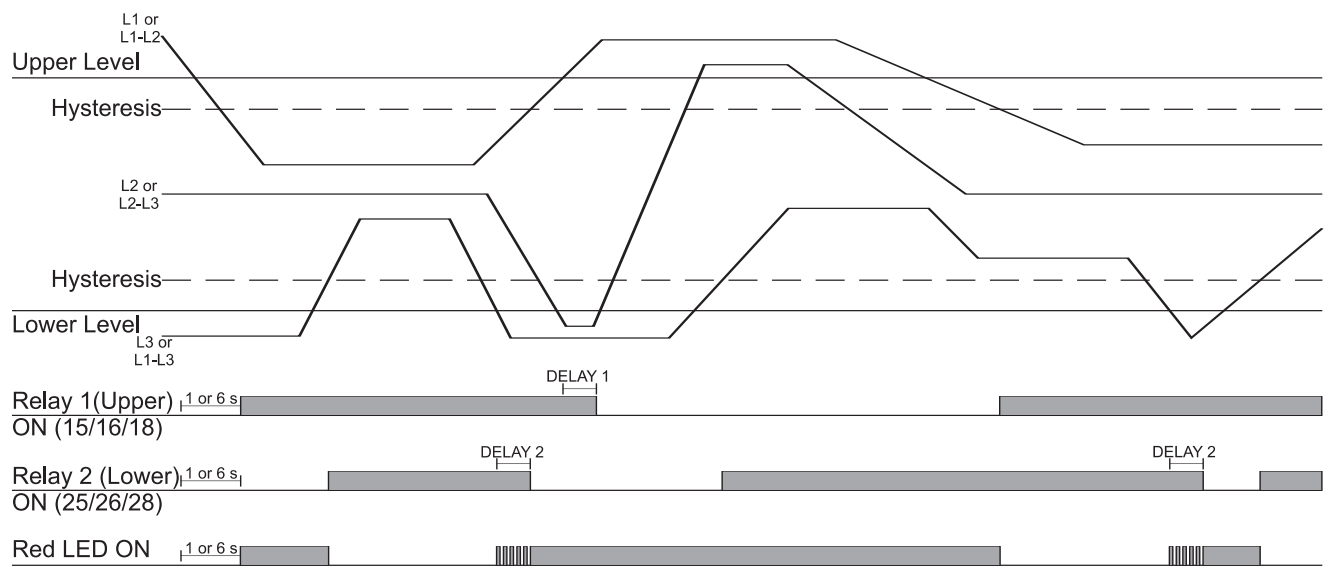
SW3	ON	ON	OFF	OFF
SW4	ON	OFF	ON	OFF
M11 Ph-Ph Voltage	100 VAC	100 VAC	115 VAC	115 VAC
M23 Ph-Ph Voltage	208 VAC	220 VAC	230 VAC	240 VAC
M48 Ph-Ph Voltage	380 VAC	400 VAC	415 VAC	480 VAC DPC01 only
M48 Ph-N Voltage	220 VAC	230 VAC	240 VAC	277 VAC DPC01 only
M49 Ph-Ph Voltage	440 VAC	440 VAC	480 VAC	480 VAC
M49 Ph-N Voltage	254 VAC	254 VAC	277 VAC	277 VAC
DPC01DM69 Ph-Ph Volt.	600 VAC	600 VAC	690 VAC	690 VAC
DPC01DM69 Ph-N Volt.	347 VAC	347 VAC	400 VAC	400 VAC

**Output**  
ON: 2 x SPDT relays  
OFF: 1 x DPDT relay

**Function**  
ON: Asymmetry and tolerance monitoring  
OFF: Over and undervoltage monitoring

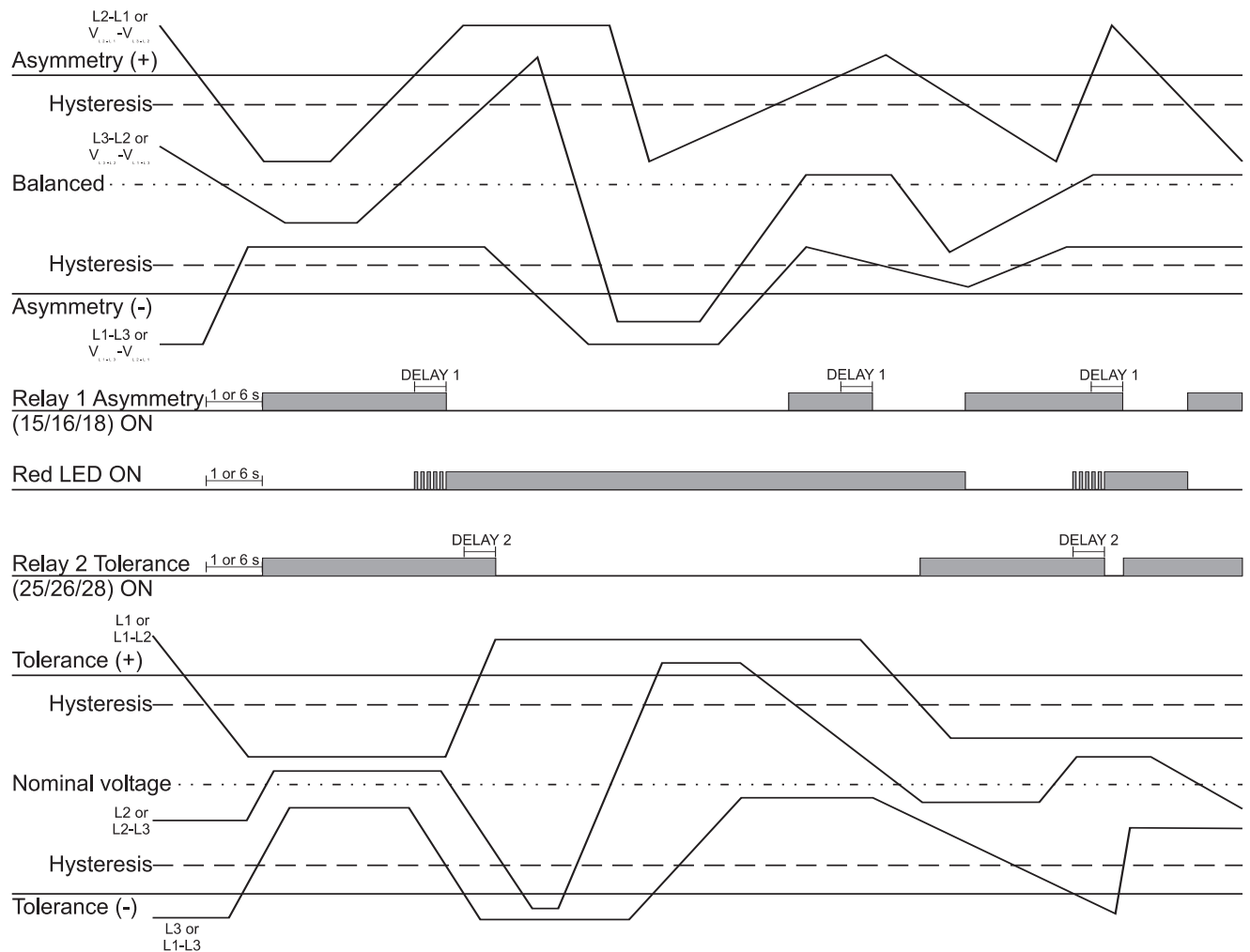
Operation Diagrams

Over and undervoltage monitoring (2 x SPDT relays)

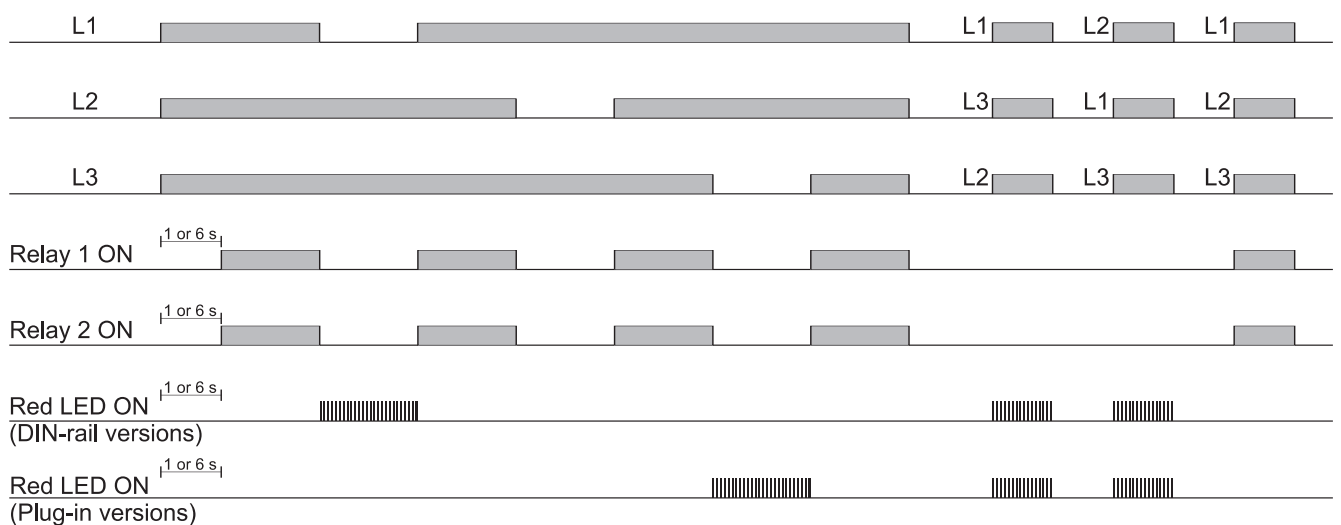


## Operation Diagrams (cont.)

### Asymmetry and tolerance monitoring (2 x SPDT relays)

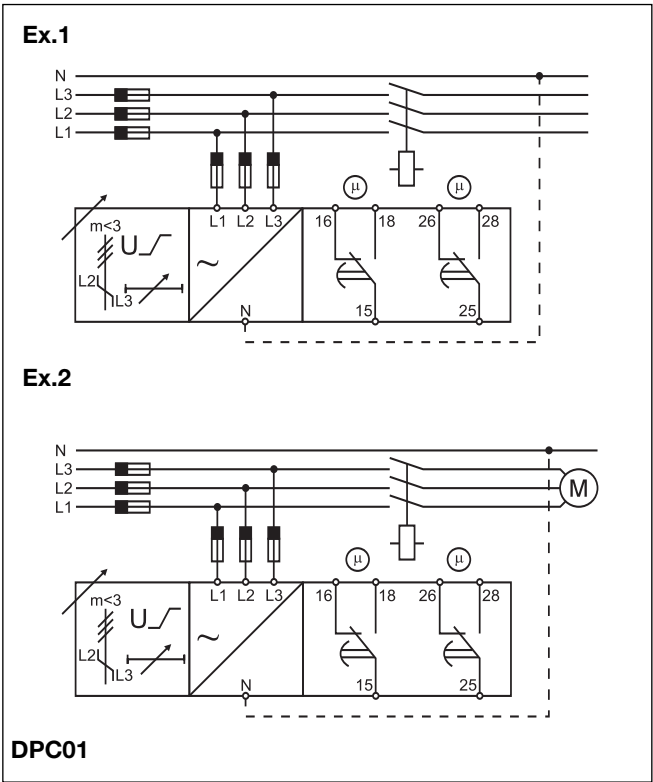


### Phase sequence, total phase loss

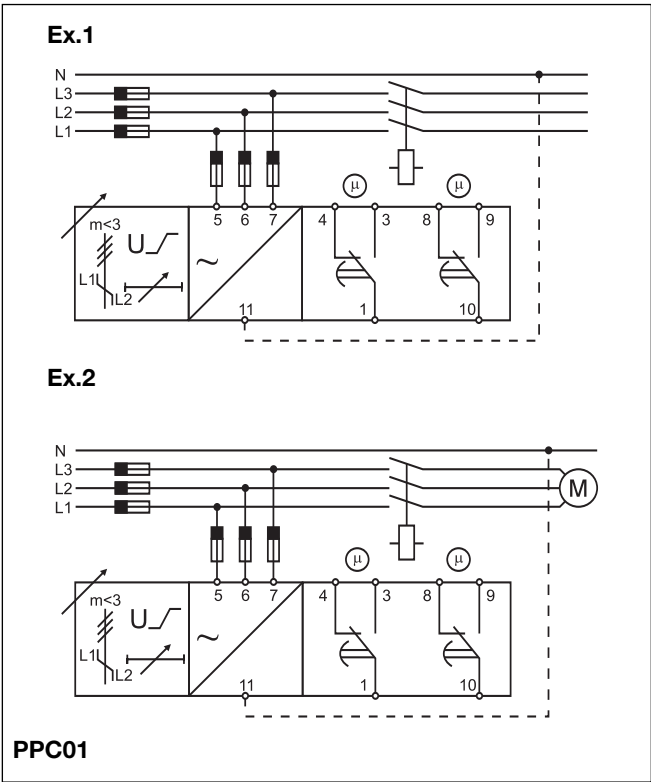




Wiring Diagrams

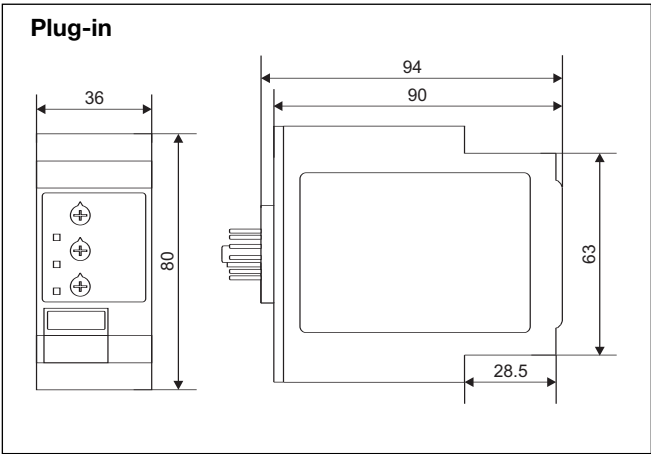
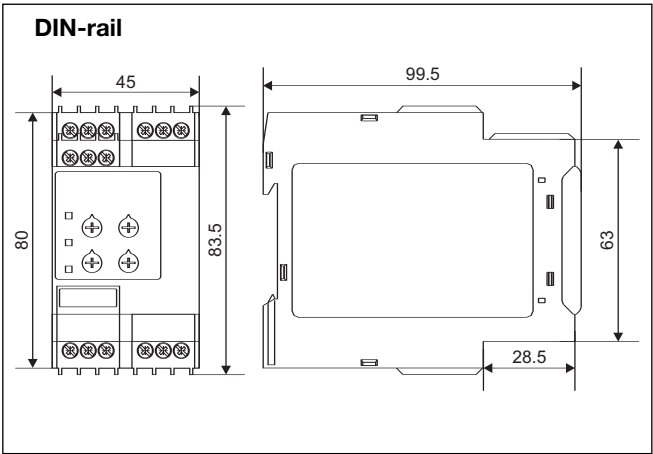


DPC01



PPC01

Dimensions



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