

# DPC02DM44



## True RMS 3-Phase voltage and frequency monitoring relay



### Benefits

- **Widest input voltage range and frequency.** Very wide input voltage range: from 208Vac to 690Vac  $\pm 15\%$  (177Vac to 793Vac), both 50Hz and 60Hz.
- **Adjustable voltage ranges.** 11 voltage ranges can be selected by front DIP Switches.
- **Under/over voltage or frequency tolerance.** Voltage and frequency are both monitored at the same time.
- **Switch mode power supply.** Very low consumption, heat and dissipation. Control circuit power supply is filtered and therefore immune to mains disturbances, noise and harmonics.
- **Output LED indication.** One LED each output provides output status information.
- **2 relay contact outputs.** Two relay outputs provide electrical (remote) indication of the alarms/output status.
- **2 delays on alarm.** Two independent alarms for under/over voltage and frequency tolerance.

### Description

DPC02DM44 relay is a multifunction threephase mains monitoring device. Power supply is provided by the monitored mains, is wide input range and switch mode. Consumption, dissipation and consequently heat are very limited.

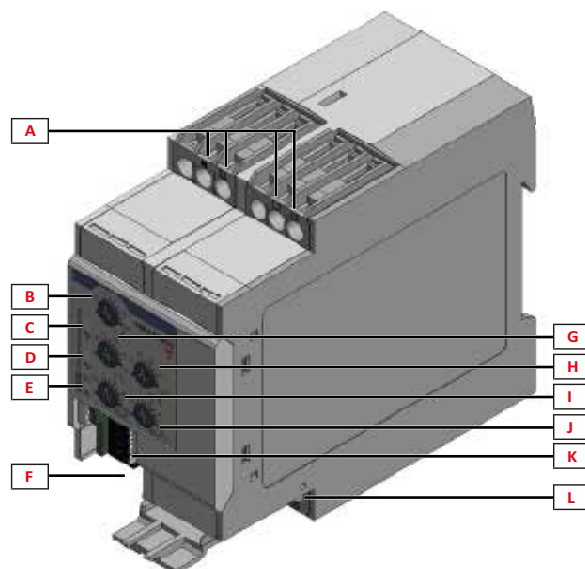
### Applications

DPC02DM44 is suitable for applications where it is necessary to monitor, besides the phase presence and correct phase sequence of threephase mains, also the correct supply voltage and frequency: it is particularly suited for generators, either fuel powered or renewable energy ones, and on CHP systems. It is also indicated to monitor supply voltage of loads sensitive to frequency fluctuations and correct voltage.

### Main functions

- 3Ph or 3Ph+N monitoring
- From 208V to 690V @ 50 or 60Hz, nominal voltage and frequency
- Over / under voltage and frequency tolerance
- Phase sequence and phase loss alarm
- 2 x 8A SPDT relay outputs

## Structure



Element	Component	Function
<b>A</b>	Input/supply terminals	L1, L2, L3 and N (when necessary), double cage clamp terminals
<b>B</b>	Alarm 1: Voltage	Overtoltage setting dial
<b>C</b>	Output status LED (2)	Yellow, ON when output 2 active (No Alarm)
<b>D</b>	Output status LED (1)	Yellow, ON when output 1 active (No Alarm)
<b>E</b>	Alarm "AL" and Power ON LED	Green in normally supplied conditions Red flashing or steady when an alarm condition is triggered
<b>F</b>	Output terminals (1)	Output 1 relay contacts terminals 15 COM, 16 NC*, 18 NO* * when power supply not applied.
<b>G</b>	Alarm 1: Voltage	Undervoltage setting dial
<b>H</b>	Alarm 2: Frequency	Frequency tolerance percentage setting dial
<b>I</b>	Delay on alarm 1	Delay on alarm 1 setting dial. Delay from 0.1s to 30s
<b>J</b>	Delay on alarm 2	Delay on alarm 2 setting dial. Delay from 0.1s to 30s
<b>K</b>	DIP switches	See fig. 1 (DIP switch settings table)
<b>L</b>	Output terminals (2)	Output 2 relay contacts terminals 25 COM, 26 NC*, 28 NO* * when power supply not applied.

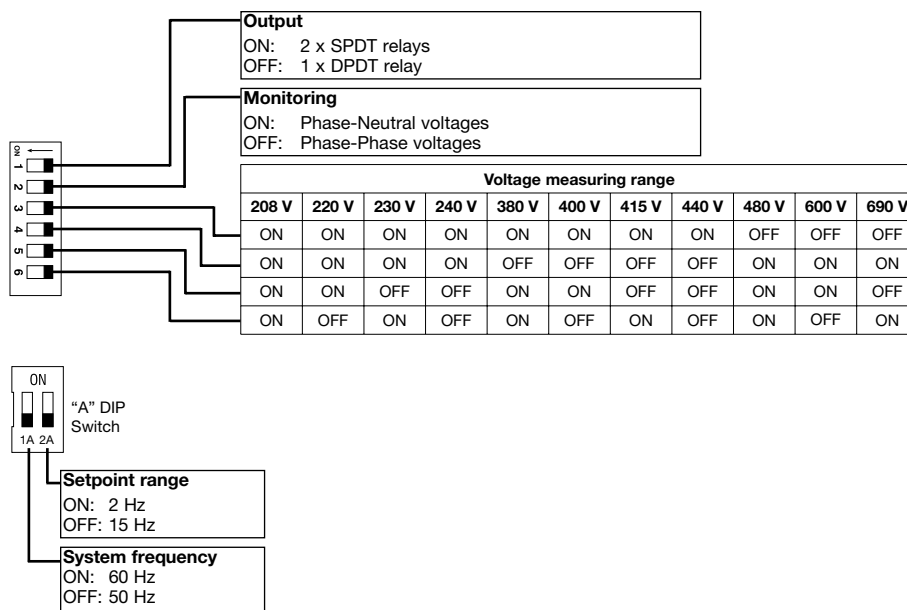
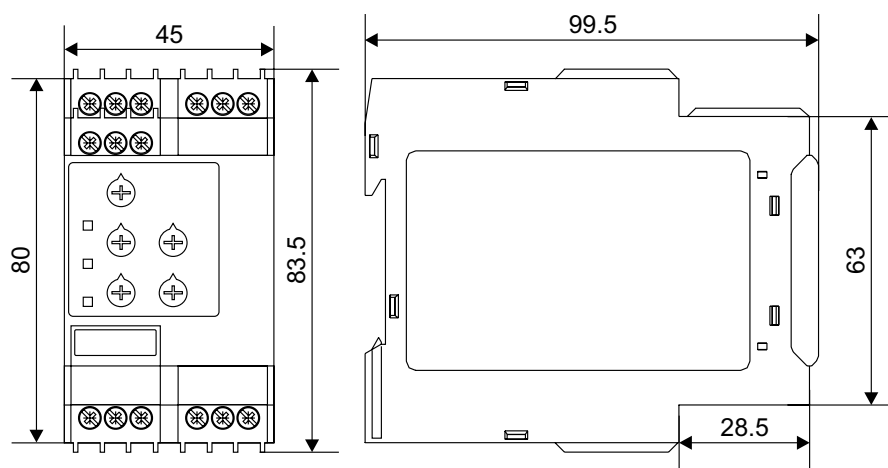


Fig. 1 DIP switch settings table

## Features

### General

<b>Material</b>	PA66 or Noryl
<b>Colour</b>	RAL7035 (light grey)
<b>Dimensions d x h x w</b>	99.5mm x 80mm x 45mm (3.92" x 3.15" x 1.77")
<b>Protection degree</b>	IP20
<b>Weight</b>	220 g (7.76oz)
<b>Terminals</b>	Cable size from 0.05mm <sup>2</sup> to 2.5mm <sup>2</sup> (AWG30 to AWG13), stranded or solid
<b>Tightening torque</b>	Max. 0.5Nm (4.425lb.in)
<b>Terminal type</b>	Double cage screw terminals



### Power supply

<b>Power supply</b>	Voltage range: 208Vac to 690Vac $\pm 15\%$ (177V to 793V) Supplied from measured phases Frequency range: 50Hz or 60Hz $\pm 10\%$ sinusoidal waveform
<b>Consumption</b>	< 4.5 VA
<b>Supply technology</b>	Switch mode supply from all 3 phases

### Environmental

<b>Working temperature</b>	-20° C to 60° C (-4° F to 140° F)
<b>Storage temperature</b>	-30° C to 80° C (-22° F to 176° F)
<b>Relative humidity</b>	5-95% non condensing
<b>Pollution degree</b>	2
<b>Operating max altitude</b>	2000 m amsl ( 6560ft )
<b>Salinity</b>	No saline environment
<b>UV resistance</b>	No





### Vibration/Shock resistance

Test condition	Test	Level
Tests with unpacked device	Vibration response (IEC60255-21-1)	Class 1
	Vibration endurance (IEC 60255-21-1)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1
Tests with packed device	Vibration random (IEC60068-2-64)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1

Class 1: Monitoring devices for normal use in power plants, substations and industrial plants and for normal transportation conditions.

The packaging type is designed and implemented in such manner that the severity class parameters will not be exceeded during transportation.

### Compatibility and conformity

CE-marking	According to EN 60947-5-1. Complies to European LV directive 2014/35/EU and EMC directive 2014/30/EU: Immunity according to EN61000-6-2; Emissions according to EN61000-6-3
Approvals	 UL508, CSA Standard C22.2  , RINA

### Inputs

Measuring ranges	
Measured variables	Voltage and frequency PH-PH measurement on L1, L2 and L3 lines Phase sequence Phase loss

Voltage measurement	
Typology	PH-PH voltage measurement on L1, L2 and L3 lines
Nominal line range	From 208Vac to 690Vac $\pm 15\%$
Setting ranges (Un)	208V, 220V, 230V, 240V, 380V, 400V, 415V, 440V, 480V, 600V, 690V

Frequency measurement	
Typology	PH-PH or PH-N frequency measurement on L1, L2, L3 and N (when connected)
Nominal line range	50 to 60Hz $\pm 10\%$
Setting ranges	2Hz or 15Hz

Over / under voltage alarms	
<b>Input variables</b>	Voltage measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
<b>Reaction time</b>	≤ 200ms + set delay on Alarm
<b>Undervoltage setting range (U&lt;)</b>	From -2% to -22%
<b>Overvoltage setting range (U&gt;)</b>	From 2% to 22%
<b>Resolution</b>	1V + 2% notch
<b>Accuracy</b>	1V + 2%
<b>Repeatability</b>	0.5% reading
<b>Hysteresis</b>	Setpoint between 2% and 5% = Hys 1% Setpoint between 5% and 22% = Hys 2%
<b>Delay ON</b>	Adjustable from 0.1s to 30s Accuracy: absolute form ±50ms at 0.1s to ±5s at 30s Repeatability: absolute form ±10ms at 0.1s to ±1 at 30s
<b>Delay OFF</b>	None

Frequency tolerance alarm	
<b>Input variables</b>	Frequency measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
<b>Reaction time</b>	≤ 200ms + set delay on alarm
<b>Frequency tolerance setting range</b>	From 10% to 110%
<b>Hysteresis</b>	2Hz range: 0.05Hz 15Hz range: 0.025Hz
<b>Delay ON</b>	Adjustable from 0.1s to 30s Accuracy: absolute form ±50ms at 0.1s to ±5s at 30s Repeatability: absolute form ±10ms at 0.1s to ±1 at 30s
<b>Delay OFF</b>	None

Phase loss alarm	
<b>Input variables</b>	Voltage measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
<b>Alarm Threshold</b>	≤70% of the least one compared to rated value
<b>Restore threshold</b>	>70% of least phase compared to rated value + Hysteresis
<b>Reaction time</b>	≤ 200 ms
<b>Hysteresis</b>	2% fixed
<b>Delay ON</b>	None
<b>Delay OFF</b>	None

Phase sequence alarm	
<b>Input variables</b>	Connection L1, L2, L3
<b>Reaction time</b>	≤ 200 ms
<b>Adjustable range</b>	Not applicable, always active
<b>Delay ON</b>	None
<b>Delay OFF</b>	None

## Outputs

<b>Number of outputs</b>	2
<b>Type</b>	SPDT electromechanical relay with change-over contacts
<b>Logic</b>	Output de-energized on alarm
<b>Contact rating</b>	<b>AC1:</b> 8 A @ 250 VAC <b>AC15:</b> 2.5 A @ 250 VAC <b>DC12:</b> 5 A @ 24 VDC <b>DC13:</b> 2.5 A @ 24 VDC
<b>Electrical lifetime</b>	10 <sup>5</sup> operations
<b>Mechanical lifetime</b>	>30 x 10 <sup>6</sup> operations
<b>Assignment</b>	According to DIP 2A setting: Output 1: over / under voltage Output 2: frequency tolerance

## Insulation

Terminals	Basic insulation
Inputs: L1,L2,L3,N to Output : 11,12,14	≥ 2kVac (rms), 4KV impulse 1.2/50us (basic)

## Operating Description

- Suitability**

DPC02DM44 can be used for supply quality monitoring of three phase loads and generators, with or without neutral, supply voltage from 208VAC to 690VAC and frequency 50 or 60Hz.

It can be configured to monitor, together with voltage, also mains frequency stability with a precision, depending upon setting, from ± 0.2Hz to ± 2.2Hz or from ± 1.5Hz to ± 16.5Hz.

- Device configuration**

The relay operates when all the phases are present, the phase sequence is correct and the input voltage and frequency levels are within set limits.

Delay on alarm is configurable by front dials, each one of the two alarms (under/over or frequency) can be set with individual delay.

### Overvoltage adjustment dial

<b>Typology</b>	Linear selection from 2% to 22%
<b>Resolution</b>	2% / notch
<b>Function</b>	Overvoltage percentage alarm setting

### Undervoltage adjustment dial

<b>Typology</b>	Linear selection from -2% to -22%
<b>Resolution</b>	2% / notch
<b>Function</b>	Undervoltage percentage alarm setting

### Frequency tolerance adjustment dial

<b>Typology</b>	Linear selection from 10% to 110% of tolerance
<b>Resolution</b>	10% / notch
<b>Function</b>	Fine adjustment of frequency tolerance on the range selected by DIP Switches
<b>Adjustable tolerance range</b>	with DIP 2A ON: ± 0.2Hz to ± 2.2Hz with DIP 2A OFF: ± 1.5Hz to ± 16.5Hz

Alarm 1 delay setting dial	
<b>Typology</b>	Logarithmic adjustment from 0.1s to 30s
<b>Resolution</b>	From 100ms/notch at 0.1s to 10s/notch at 30s
<b>Function</b>	Delay on alarm 1, for voltage

Alarm 2 delay setting dial	
<b>Typology</b>	Logarithmic adjustment from 0.1s to 30s
<b>Resolution</b>	From 100ms/notch at 0.1s to 10s/notch at 30s
<b>Function</b>	Delay on alarm 2, for frequency

DIP switches	
<b>Typology</b>	6 + 2 DIP Switches
<b>Function</b>	<ul style="list-style-type: none"> <li>- Output configuration</li> <li>- Grid type</li> <li>- Grid voltage (11 ranges)</li> <li>- System frequency</li> <li>- Tolerance range selection</li> </ul>

#### • Alarms

The relays release immediately (<200ms), when an alarm goes off, in case of phase loss detection or wrong phase sequence.

Else it releases after the set "delay on alarm", in case of other, DPC02 possible configurable, events detection:

- Overvoltage
- Undervoltage
- Frequency out of tolerance

Overvoltage or undervoltage detection cause output 1 relay and LED 1 to turn OFF at the end of the set delay on alarm 1. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.

Frequency or out of tolerance detection cause output 2 relay and LED 2 to turn OFF at the end of the set delay on alarm 2. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.

#### • Visual information

DPC02DM44 feature 3 front LEDs which provide operation status information.

- LED 1, yellow, is ON when the output 1 relay is energised.
- LED 2, yellow, is ON when the output 2 relay is energised.
- LED "AL" provides POWER and ALARM status information: Green when powered on at least two phases and no alarms are present. When an over/under voltage or frequency alarm is triggered, but there is a delay on alarm elapsing, the LED blinks red at 2Hz during the delay then, if alarm situation still present at the end of delay, it turns steady ON.

If a phase is lost or the phase sequence is wrong and the LED flashes fast at 5Hz.

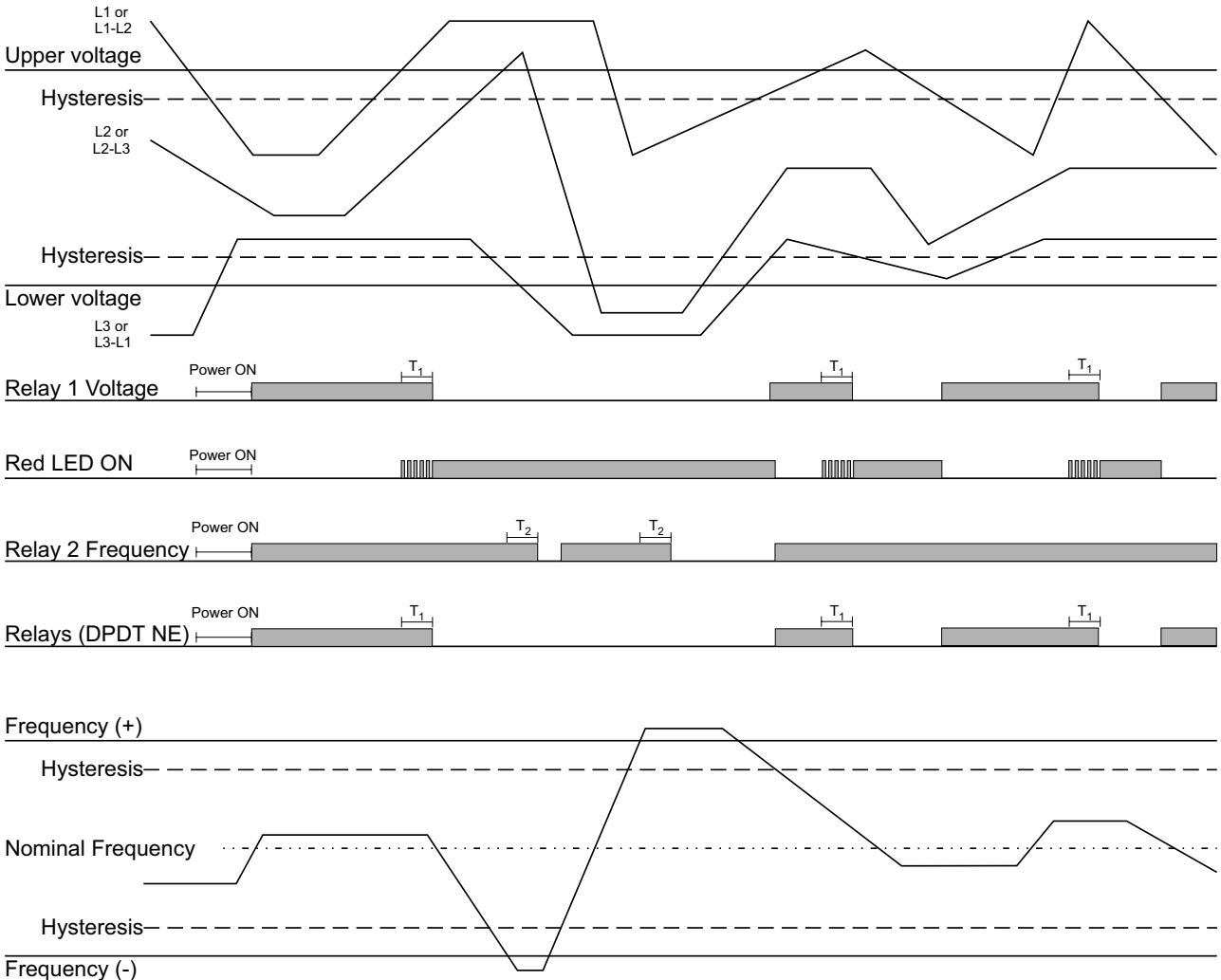
#### • Phase loss

Phase loss measurement is performed by comparing the 3 phases voltages (L1-L2, L2-L3, L3-L1) or phase to neutral (L1-N, L2-N, L3-N) on star grid type. If the voltage of one phase falls below 70% compared to the other 2 phases, the alarm goes off. DPC02DM44 detects loads regenerated voltage, for instance on motor or transformer loads.

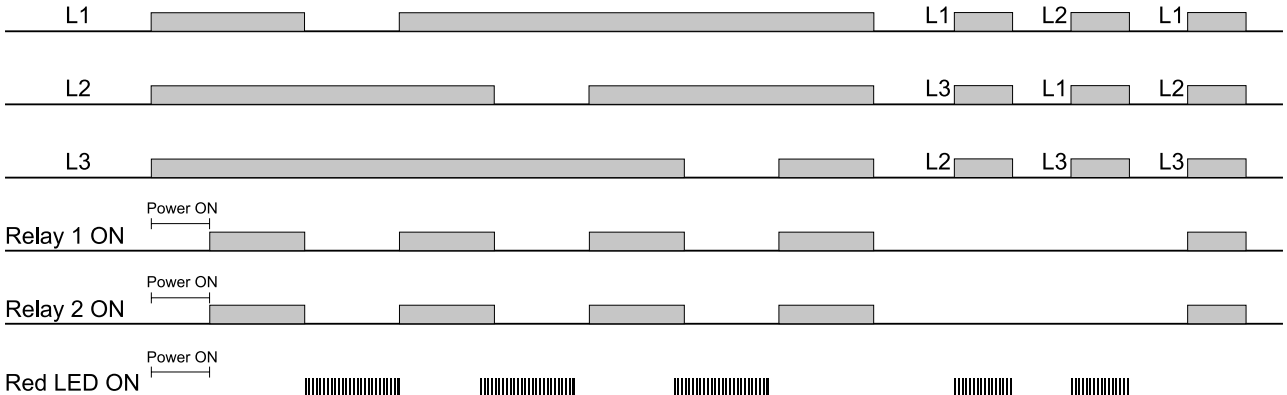




**Operating diagram**



**Fig. 2 Over/under voltage and over/under frequency monitoring (2 x SPDT relays)**



**Fig. 3 Phase sequence, total phase loss**

## Connection Diagrams

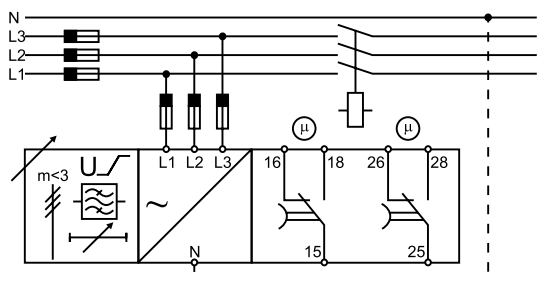


Fig. 4 DPC02 - Example 1

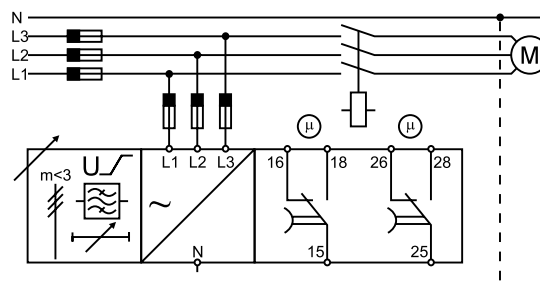


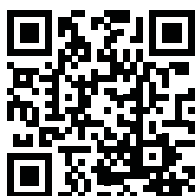
Fig. 5 DPC02 - Example 2

## References

Order code



DPC02DM44



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