DPC02

True RMS 3-Phase voltage and frequency monitoring relay

Benefits

- **Wide voltages and frequency ranges**. Working in systems from 208 to 690 VAC.
- **Adjustable voltage levels, frequency and time delay**. To allow a correct response to real alarm conditions.
- **Output and status LED indication**. For quick troubleshooting.
- **Adjustable power ON delay**. To avoid nuisance tripping at start-up.
- **Ultra-high harmonic immunity**. For very noisy environments.

Description

DPC02 is a multifunction 3-phase mains monitoring relay.

It operates on 3P and 3P+N systems, monitoring phase loss and phase sequence, overvoltage and undervoltage, over and under frequency.

Power supply provided by the monitored mains.

Two independent delay functions, up to 30 s, for over / under voltage and frequency alarms.

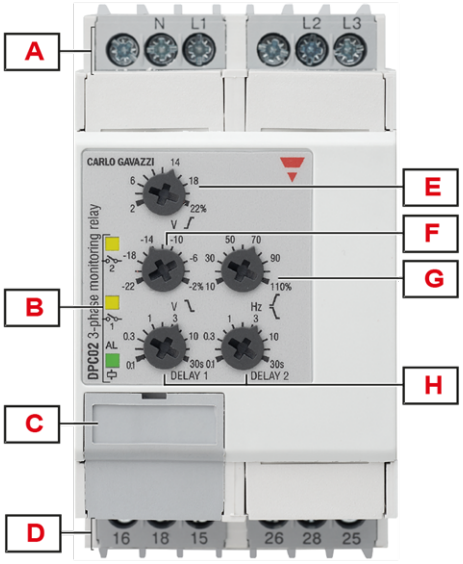
Main features

- Monitoring 3-phase mains with 3 wires (3P) or 4 wires (3P+N).
- Detection of the correct phase sequence, phase loss, correct voltage and frequency.
- Front dial adjustable overvoltage, undervoltage and frequency setpoints.
- Time delay.
- Two changeover relay outputs.

Order code

Mounting	Frequency	Power supply	Component name/part number
DIN-rail	50 - 60 Hz	208 to 240 VAC	**DPC02DM23**
	50 - 60 Hz	208 to 690 VAC	**DPC02DM44**
	50 - 60 Hz	380 to 415 VAC	**DPC02DM48**
	50 - 60 Hz	440 to 480 VAC	**DPC02DM49**
	50 - 60 Hz	600 to 690 VAC	**DPC02DM69**

Structure



Element	Component	Function
A	Input terminals	Connection of the line voltages (neutral when present)
B	Information LEDs	Yellow for relay output status Red for signal alarm status Green for device ON
C	DIP switches	Setting the nominal voltage, type of mains, system frequency
D	Output terminals	2 x SPDT relay outputs
E	Overvoltage dial (V ⎍)	Overvoltage setpoint adjustment
F	Undervoltage dial (V ⎏)	Undervoltage setpoint adjustment
G	Frequency tolerance dial (Hz ⎍)	Frequency tolerance setpoint adjustment
H	Delay time dials	Setting the alarm ON delay time

Features

Power supply

Power supply		Supplied by measured phases (L1, L2, L3)
Overvoltage category		III (IEC 60664)
Voltage range	**DPC02DM23**	208 to 240 V_{L-L} AC ± 15% (177 to 276 V)
	DPC02DM44	208 to 690 V_{L-L} AC ± 15% (177 to 793 V)
	DPC02DM48	380 to 415 V_{L-L} AC ± 15% (323 to 477 V)
	DPC02DM49	440 to 480 V_{L-L} AC ± 15% (374 to 552 V)
	DPC02DM69	600 to 690 V_{L-L} AC ± 15% (510 to 793 V)
Frequency range		50 to 60 Hz ± 10% sinusoidal waveform
Consumption	**DPC02DM23**	< 2.5 VA
	DPC01DM48 **DPC02DM49**	< 3.5 VA
	DPC02CM44 **DPC01DM69**	< 7 VA
Power ON delay		1 s ± 0.5 s or 6 s ± 0.5 s

Inputs

Terminals			L1, L2, L3, N
Measured variables			Phase sequence Phase loss Frequency 3P: voltages V_{L12}, V_{L23}, V_{L31} 3P+N: voltages V_{L1N}, V_{L2N}, V_{L3N}
Nominal line range			208 to 690 VAC ± 15% (177 to 793 VAC)
Nominal voltages (*)	**DPC02DM23**	**Delta voltage (3P)**	208 V, 220 V, 230 V, 240 V
		Star voltage (3P+N)	120 V, 127 V, 133 V, 140 V
	DPC02CM44	**Delta voltage (3P)**	208 V, 220 V, 230 V, 240 V, 380 V, 400 V, 415 V, 440 V, 480 V, 600 V, 690 V
		Star voltage (3P+N)	120 V, 127 V, 133 V, 140 V, 220 V, 230 V, 240 V, 254 V, 277 V, 347 V, 400 V
	DPC02CM48	**Delta voltage (3P)**	380 V, 400 V, 415 V
		Star voltage (3P+N)	220 V, 230 V, 240 V
	DPC02DM49	**Delta voltage (3P)**	440 V, 480 V
		Star voltage (3P+N)	254 V, 277 V
	DPC02DM69	**Delta voltage (3P)**	600 V, 690 V
		Star voltage (3P+N)	347 V, 400 V

(*) Note: connect the neutral only if it is intrinsically at the star centre.

Outputs

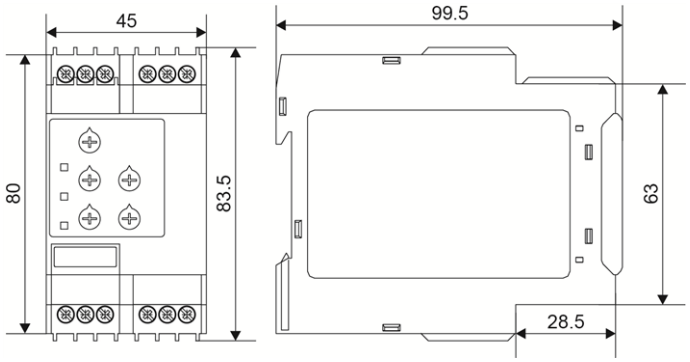
Terminals	15, 16, 18, 25, 26, 28
Number of outputs	2
Type	SPDT electromechanical relay with changeover contacts
Logic	Output de-energised on alarm
Contact rating	**Ith:** 8 A @ 250 VAC **AC15:** 2.5 A @ 250 VAC **DC12:** 5 A @ 24 VDC **DC13:** 2.5 A @ 24 VDC
Electrical lifetime	≥50 x 10^3 operations (at 8 A, 250 V, cos φ= 1)
Mechanical lifetime	>30 x 10^6 operations
Assignment	**2 x SPDT:** Output 1: overvoltage or undervoltage Output 2: frequency **1 x DPDT:** Output 1 and 2: any alarm

Insulation

Terminals	**Basic**
Inputs: L1, L2, L3, N **to** **outputs: 15, 16, 18, 25, 26, 28**	2.5 kVrms, 4 kV impulse 1.2/50 µs

General

Material	Polyamide (Nylon) (PA66/6) or Phenylene ether + Polystyrene (PPE-PS)
	Flammability rating: HB according to UL 94
Colour	RAL7035 (light grey)
Dimensions (W x H x D)	45 x 80 x 99.5 mm (1.77 x 3.15 x 3.92 in)
Weight	220 g (7.76 oz)
Terminals	Cable size from 0.05 to 2.5 mm^2 (AWG30 to AWG13), stranded or solid
Tightening torque	Max. 0.5 Nm (4.425 lbin)
Terminal type	Double cage screw terminals



Environmental

Operating temperature	-20 to 60 °C (-4 to 140 °F)
Storage temperature	-30 to 80 °C (-22 to 176 °F)
Relative humidity	5 - 95% non condensing
Protection degree	IP20
Pollution degree	2
Operating max altitude	2000 m amsl (6560 ft)
Salinity	Non saline environment
UV resistance	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

Marking	CE UKCA
Directives	2014/35/EU (LVD - Low voltage) 2014/30/EU (EMC - Electromagnetic compatibility)
Standards	Insulation coordination: EN 60664-1 Immunity: EN61000-6-2 Emission: EN61000-6-3
Approvals	c UL us LISTED (UL508, UL61010) RINA

Operating description

DIP switches		
Typology	**DPC02DM44**	6 + 2 switches (Fig.1)
	DPC02DM23 **DPC02DM48** **DPC02DM49** **DPC02DM69**	6 switches (Fig. 2, 3, 4 and 5)
Function		Mains type Mains voltage (M44: 11 ranges; M23, M48, M49 and M69: 4 ranges) Output configuration System frequency Frequency setpoint range

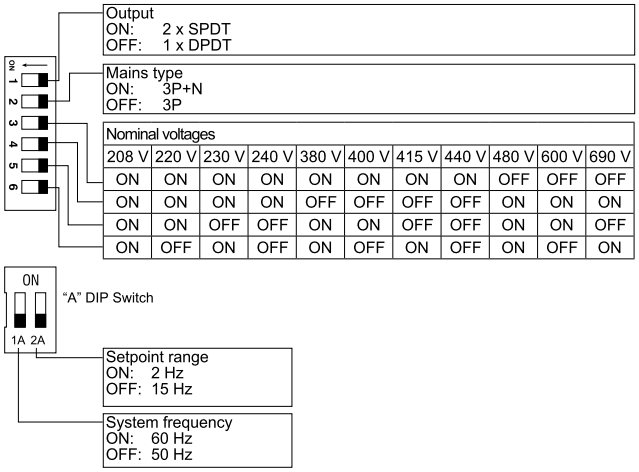


Fig. 1 *DIP switch settings M44*

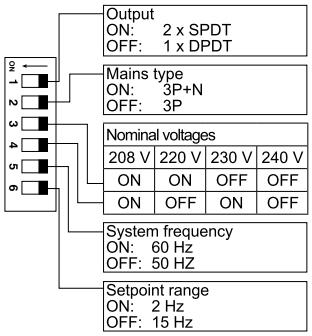


Fig. 2 *DIP switch settings M23*

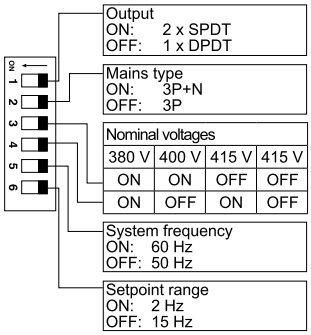


Fig. 3 *DIP switch settings M48*

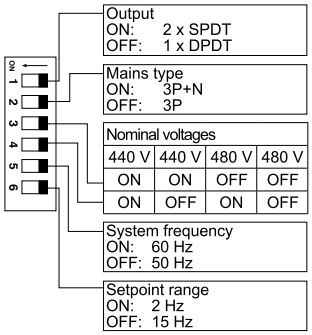


Fig. 4 *DIP switch settings M49*

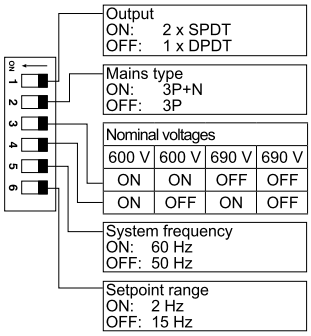


Fig. 5 *DIP switch settings M69*

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 (undervoltage / overvoltage or frequency) can be set with individual delay.

Overvoltage adjustment dial	
Typology	Linear selection from 2 to 22%
Resolution	2% setpoint increase per notch
Function	Relative overvoltage setpoint

Undervoltage adjustment dial	
Typology	Linear selection from -22 to -2%
Resolution	2% setpoint increase per notch
Function	Relative undervoltage setpoint

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

Delay 1 setting dial	
Typology	Logarithmic adjustment from 0.1 to 30 s
Resolution	From 100 ms/notch at 0.1 s to 10 s/notch at 30 s
Function	Alarm ON delay setting for voltage

Delay 2 setting dial	
Typology	Logarithmic adjustment from 0.1 to 30 s
Resolution	From 100 ms/notch at 0.1 s to 10 s/notch at 30 s
Function	Alarm ON delay setting for frequency

Alarms

DPC02 operates in 3 different modes depending upon the alarm type:

- Phase loss and incorrect phase sequence cause immediate output relays 1 and 2 de-energisation.
- Overvoltage or undervoltage triggering cause output 1 relay to turn OFF at the end of the set delay on alarm 1.
- Out of frequency tolerance triggering causes output 2 relay to turn OFF at the end of the set delay on alarm 2.

Phase loss alarm	
Input variables	L1-L2, L2-L3 and L3-L1
Alarm setpoint	One phase ≤ 85% of the rated value (regenerated voltage detection)
Restore setpoint	All phases > 85% of the rated value + Hysteresis
Reaction time	≤ 200 ms
Hysteresis	2% fixed
Delay ON	None
Delay OFF	None

Phase sequence alarm	
Input variables	Connection L1, L2, L3
Reaction time	≤ 200 ms
Delay ON	None
Delay OFF	None

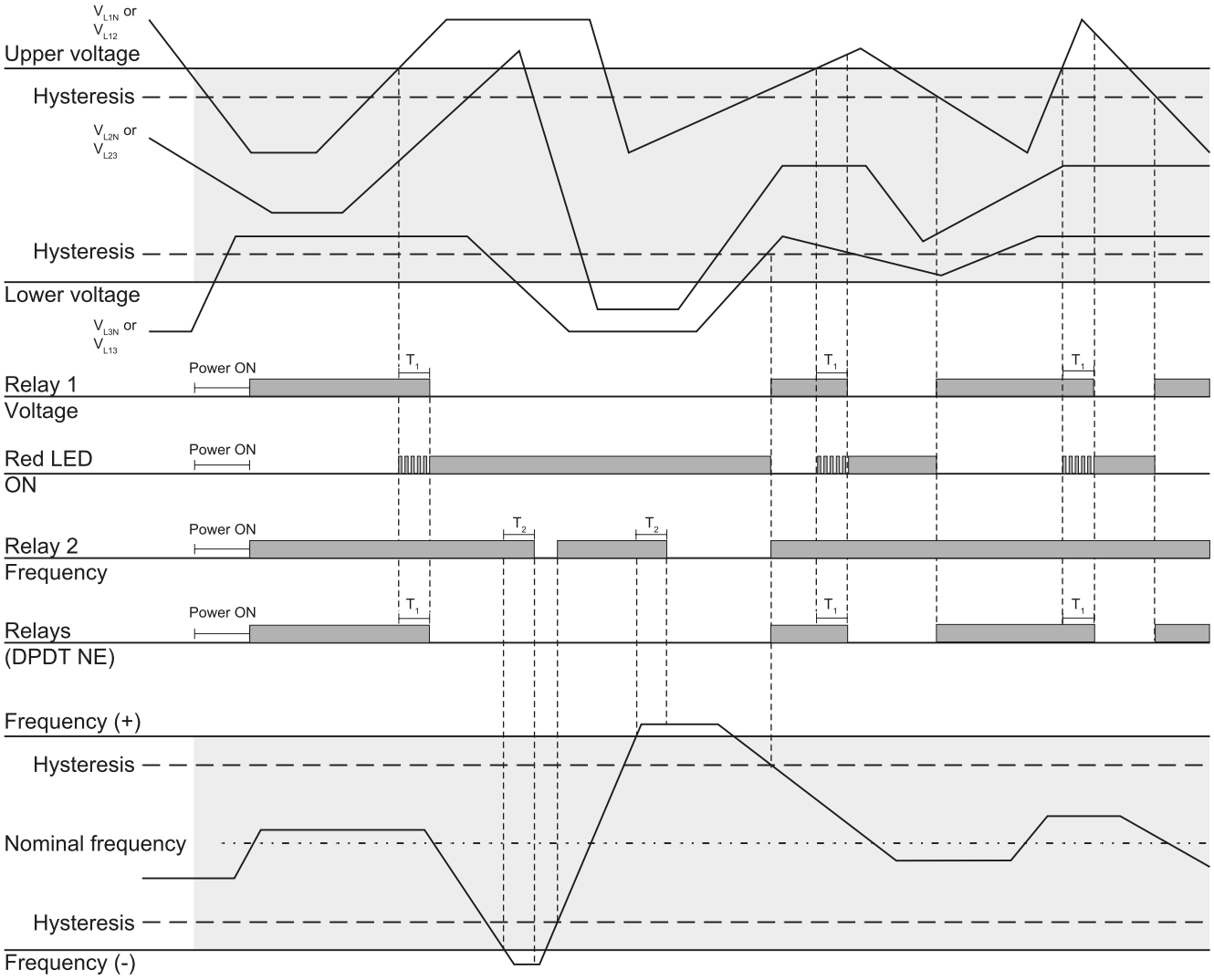
Over / under voltage alarms	
Input variables	3P: voltages V_{L12}, V_{L23}, V_{L31} 3P+N: voltages V_{L1N}, V_{L2N}, V_{L3N}
Reaction time	≤ 200 ms + set delay ON alarm
Undervoltage setting range	From -2 to -22%
Overvoltage setting range	From 2 to 22%
Repeatability	1% reading + 1 V
Hysteresis	Setpoint between 2% and 5% → Hys 1% Setpoint between 5% and 22% → Hys 2%
Delay ON	Adjustable: from 0.1 to 30 s Accuracy: from ± 50 ms at 0.1 s to ± 5 s at 30 s Repeatability: from ± 10 ms at 0.1 s to ± 1 s at 30 s
Delay OFF	None

Information LEDs

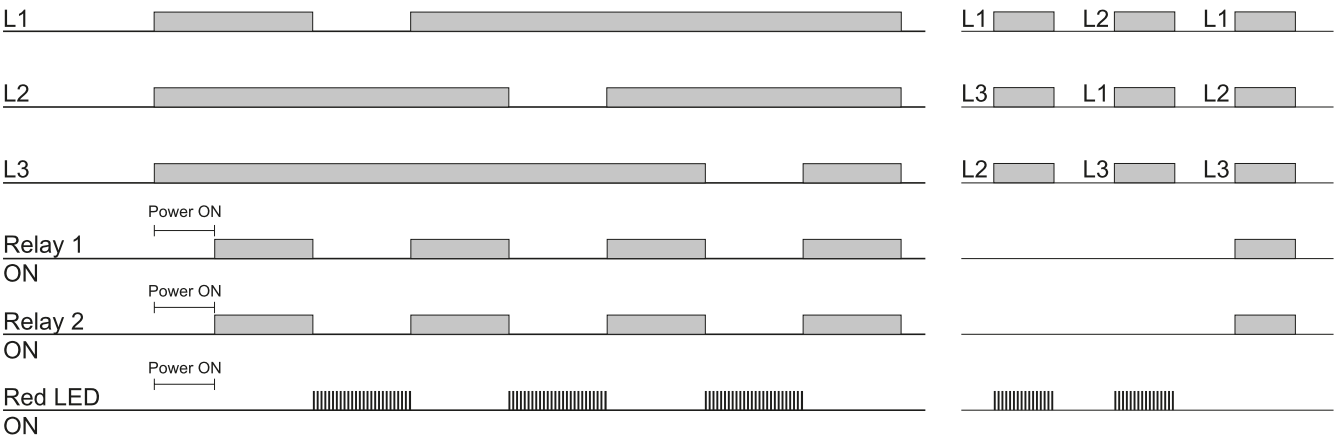
Colour	Status		Description
Green (⏚) (*)	Power supply	ON	Power supply ON
		OFF	Power supply OFF
Red (AL) (*)	Alarm	ON (steady)	Alarm situation is still present at the end of delay
		OFF	Alarm OFF
		Flashing 2 Hz	Under / overvoltage or frequency alarm triggered with a delay on alarm elapsing
		Flashing 5 Hz	Phase loss or incorrect phase sequence alarm
Yellow ($\multimap_1$)	Relay output	ON	Energised
		OFF	De-energised
Yellow ($\multimap_2$)	Relay output	ON	Energised
		OFF	De-energised

NOTE: power supply ⏚ and AL alarm in the same LED.

Operating diagram



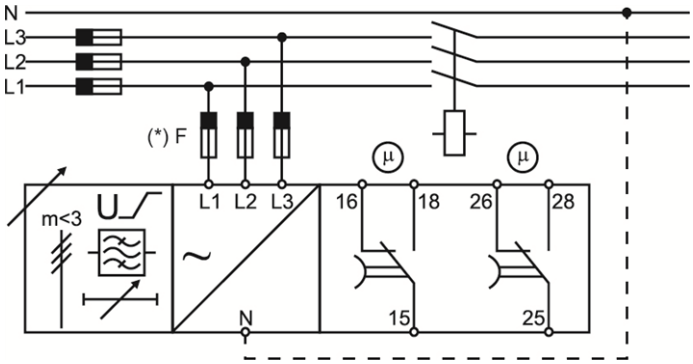
Over/under voltage and over/under frequency monitoring (2 x SPDT relays)



Total phase loss, phase sequence

Connection diagrams

(*) NOTE: fuses F of 315 mA delayed, if required by local law.



References

Further reading

Information	Document	Where to find it
Installation manual	DPC02DMxx_IM.pdf	https://gavazziautomation.com/images/PIM/MANUALS/ENG/DPC02DMxx%20IM.pdf
	DPC02CM44_IM.pdf	https://gavazziautomation.com/images/PIM/MANUALS/ENG/DPC02DM44_IM.pdf