

DPC02



True RMS 3-Phase voltage and frequency monitoring relay



Benefits

- **Wide voltages 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 30s, for over/under voltage and frequency alarms.

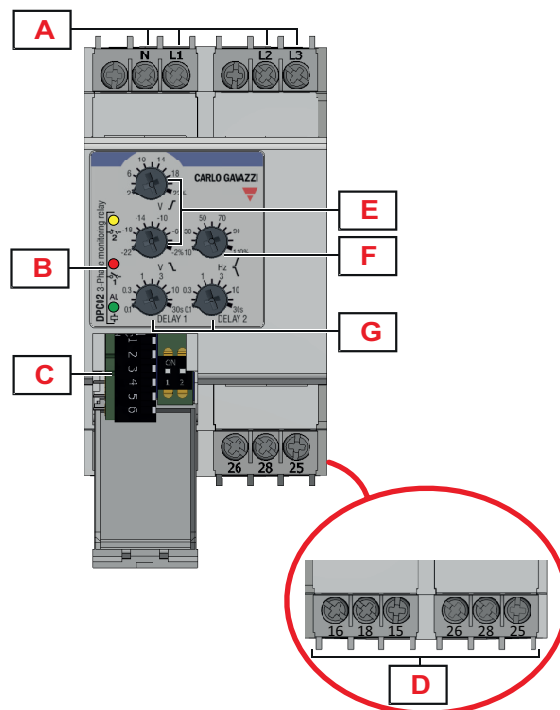
Applications

DPC02 are particularly suited for generators, either fuel powered or renewable energy ones and on Combined Heat and Power systems. It is also indicated to monitor loads sensitive to voltage and frequency fluctuations.

Main functions

- 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.

Structure

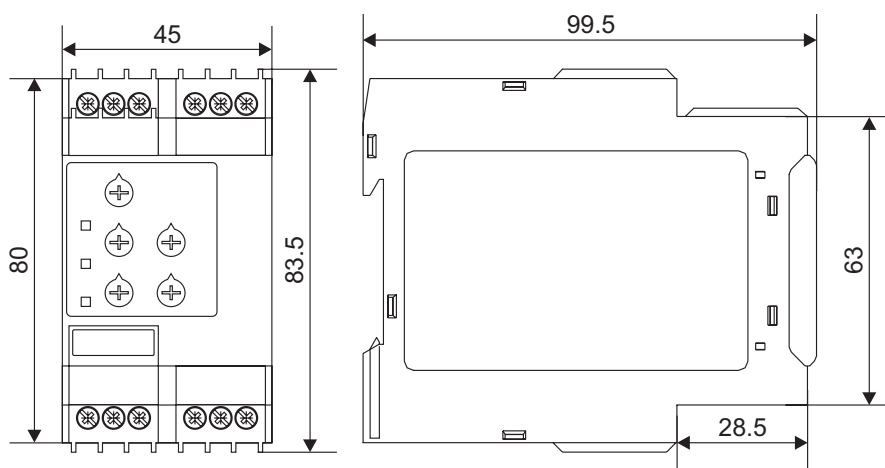


Element	Component	Function
A	Input terminals	Connection of the line voltages (neutral when present)
B	Information LED	Yellow for relay output status Red to signal alarm status Green for device ON
C	DIP-switches	Setting the nominal voltage, type of mains, system frequency
D	Output terminals	2 x SPDT relay outputs
E	Voltage setpoints dials	Overvoltage and undervoltage setpoints adjustment
F	Frequency setpoint dial	Frequency tolerance setpoint adjustment
G	Delay time dials	Setting the alarm ON delay times for voltage and frequency

Features

General

Material	Polyamide (Nylon) or Phenylene ether + Polystyrene
Colour	RAL7035 (light grey)
Dimensions (W x H x D)	45mm x 80mm x 99.5mm
Protection degree	IP20
Weight	220 g (7.76oz)
Terminals	Cable size from 0.05mm ² to 2.5mm ² (AWG30 to AWG13), stranded or solid
Tightening torque	Max. 0.5Nm (4.425lb.in)
Terminal type	Double cage screw terminals



Power supply

Power supply	Supplied by measured phases	
Overvoltage category	III (IEC 60664)	
Voltage range	M23	208 to 240 V _{L-L} AC ±15% (177V to 276V)
	M44	208 to 690 V _{L-L} AC ±15% (177V to 793V)
	M48	380 to 415 V _{L-L} AC ±15% (323V to 477V)
	M49	440 to 480 V _{L-L} AC ±15% (374V to 552V)
	M69	600 to 690 V _{L-L} AC ±15% (510V to 793V)
Frequency range	50Hz to 60Hz ±10% sinusoidal waveform	
Consumption	M23	< 2.5 VA
	M44	< 7 VA
	M48	< 3.5 VA
	M49	< 3.5 VA
	M69	< 7 VA
Power ON delay	1 s ± 0.5 s or 6 s ± 0.5 s	

Environmental

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

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	

Inputs

Measuring ranges	
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 VAC to 690 VAC $\pm 15\%$ (85 VAC to 793 VAC)
Nominal voltages (*)	M23 3P: 208V, 220V, 230V, 240V (delta voltage) 3P+N: 120V, 127V, 133V, 140V (star voltage)
	M44 3P: 208V, 220V, 230V, 240V, 380V, 400V, 415V, 440V, 480V, 600V, 690V (delta voltage) 3P+N: 120V, 127V, 133V, 140V, 220V, 230V, 240V, 254V, 277V, 347V, 400V (star voltage)
	M48 3P: 380V, 400V, 415V (delta voltage) 3P+N: 220V, 230V, 240V (star voltage)
	M49 3P: 440V, 480V (delta voltage) 3P+N: 254V, 277V (star voltage)
	M69 3P: 600V, 690V (delta voltage) 3P+N: 347V, 400V (star voltage)

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

Outputs

Number of outputs	2
Type	SPDT electromechanical relay with change-over contacts
Logic	Output de-energized on alarm
Contact rating	AC1: 8 A @ 250 VAC AC15: 2.5 A @ 250 VAC DC12: 5 A @ 24 VDC DC13: 2.5 A @ 24 VDC
Electrical lifetime	$\geq 50 \times 10^3$ operations (at 8 A, 250 V, $\cos \varphi = 1$)
Mechanical lifetime	$> 30 \times 10^6$ operations
Assignment	2 x SPDT: Output 1: overvoltage or undervoltage Output 2: frequency 1 x DPDT: Output 1&2: any alarm

Insulation

Terminals	Basic insulation
Inputs: L1, L2, L3, N to Output: 15, 16, 18, 25, 26, 28	2.5kVrms, 4kV impulse 1.2/50 μ s (basic)

Operating description

► 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 voltage or frequency) can be set with individual delay.

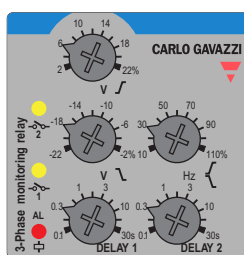
Overvoltage adjustment dial	
Typology	Linear selection from 2% to 22%
Resolution	2% setpoint increase per notch
Function	Relative overvoltage setpoint

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: $\pm 0.2\text{Hz}$ to $\pm 2.2\text{Hz}$ with DIP 2A OFF: $\pm 1.5\text{Hz}$ to $\pm 16.5\text{Hz}$

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

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



DIP-switches		
Typology	M44	6 + 2 switches
	M23, M48, M49, M69	6 switches
Function		<ul style="list-style-type: none"> · Output configuration · Mains type · Mains voltage (M44: 11 ranges; M23, M48, M49 and M69: 4 ranges) · System frequency · Frequency setpoint range

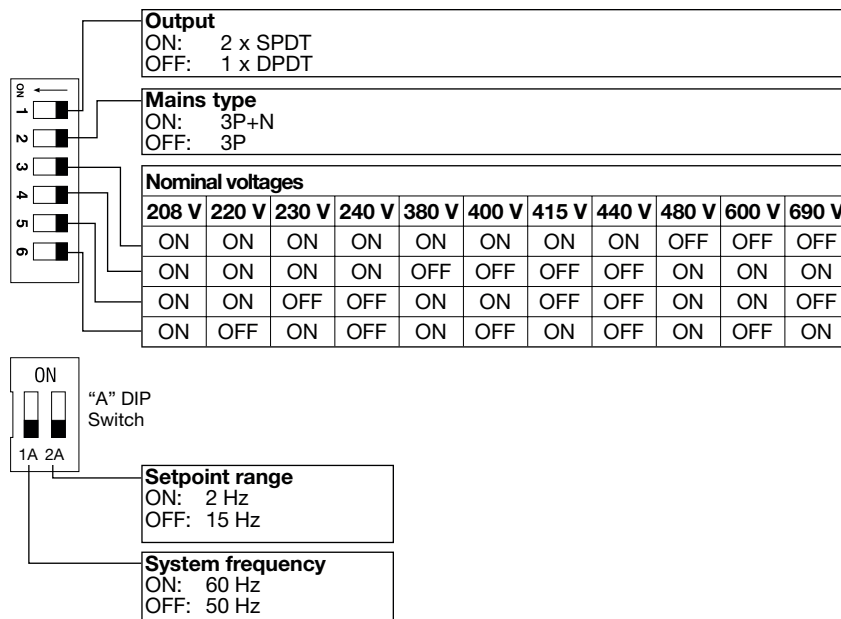


Fig. 1 DIP switch settings table M44

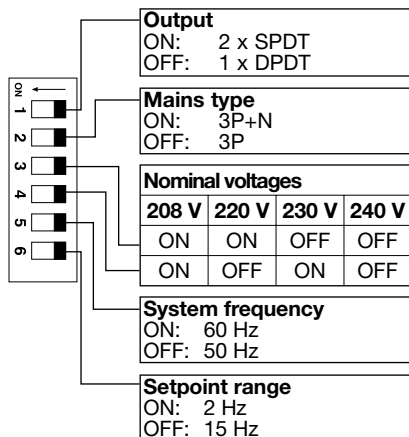


Fig. 2 DIP switch settings table M23

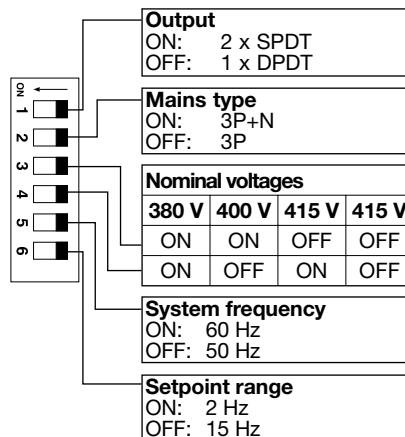


Fig. 3 DIP switch settings table M48

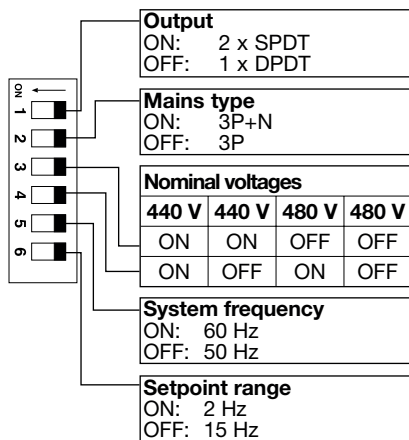


Fig. 4 DIP switch settings table M49

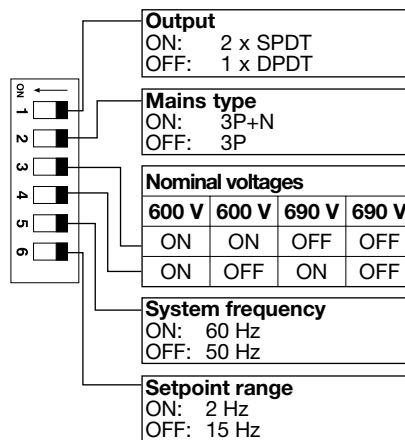


Fig. 5 DIP switch settings table M69

► 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 cause output 2 relay to turn OFF at the end of the set delay on alarm 2.

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	$\leq 200\text{ms} + \text{set delay ON alarm}$
Undervoltage setting range	From -2% to -22%
Overvoltage setting range	From 2% to 22%
Repeatability	0.5% reading
Hysteresis	Setpoint between 2% and 5% \rightarrow Hys 1% Setpoint between 5% and 22% \rightarrow Hys 2%
Delay ON	Adjustable from 0.1s to 30s Accuracy: from $\pm 50\text{ms}$ at 0.1s to $\pm 5\text{s}$ at 30s Repeatability: from $\pm 10\text{ms}$ at 0.1s to ± 1 at 30s
Delay OFF	None

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

Phase loss alarm	
Input variables	Voltage measurements L1-L2, L2-L3 and L3-L1
Alarm setpoint	One phase $\leq 85\%$ of the rated value (regeneration voltage detection)
Restore setpoint	All phases $> 85\%$ of the rated value + Hysteresis
Reaction time	$\leq 200 \text{ ms}$
Hysteresis	2% fixed
Delay ON	None
Delay OFF	None

Phase sequence alarm	
Input variables	Connection L1, L2, L3
Reaction time	$\leq 200 \text{ ms}$
Delay ON	None
Delay OFF	None

► Visual information

DPC02 features 3 front LEDs (Power ON and alarm in the same LED) which provide operation status information.

- Green LED is ON when the power supply is present.
- Red "AL" LED provides alarm status information: when an over/under voltage or frequency alarm is triggered, and there is a delay on alarm elapsing, the LED flashes at 2Hz during the delay. If the alarm situation is still present at the end of delay, the LED turns steady ON.

If a phase is lost or the phase sequence is incorrect, the LED flashes fast at 5Hz.

- Yellow LED 1 is ON when the output 1 relay is energised.
- Yellow LED 2 is ON when the output 2 relay is energised.

► Operating diagrams

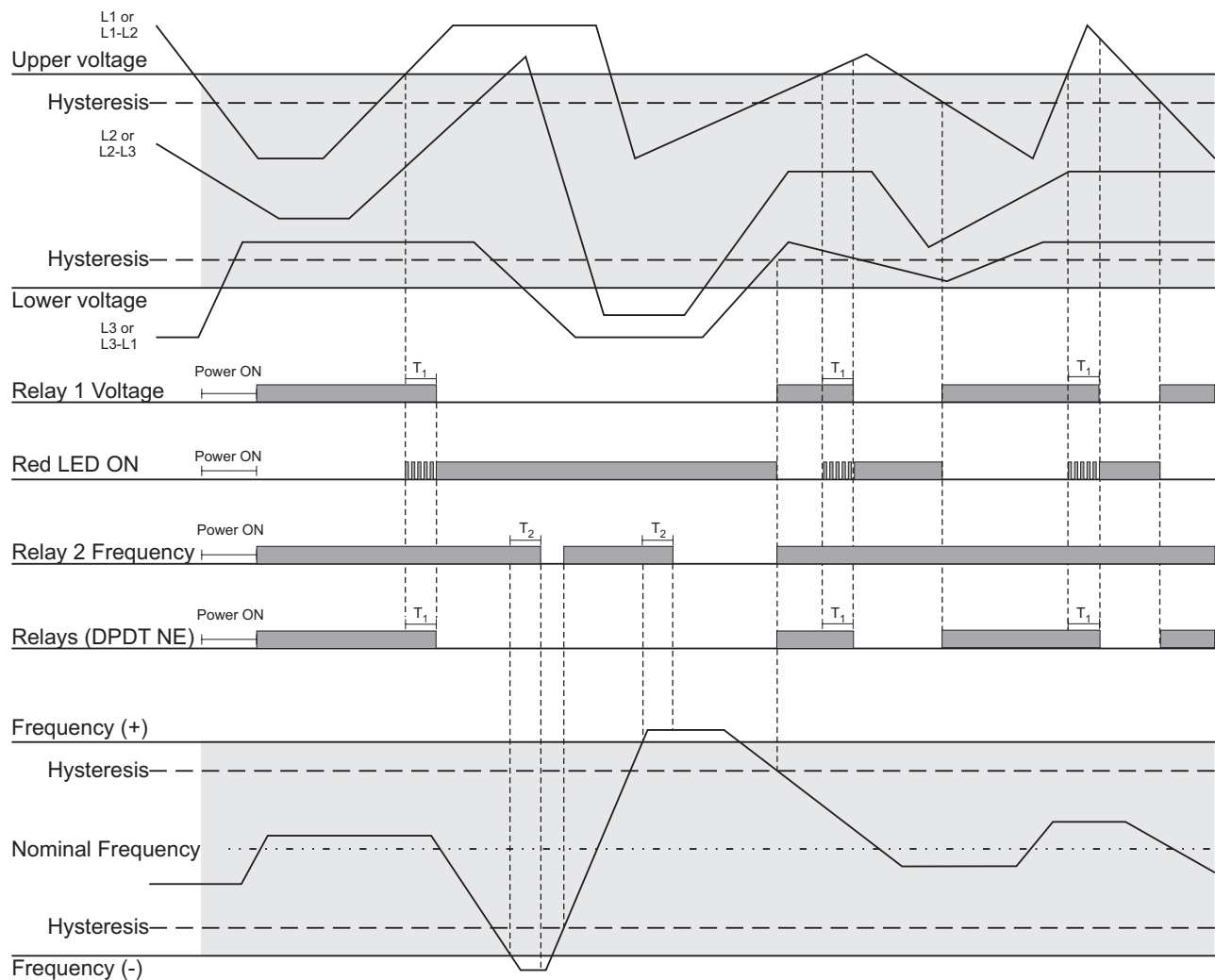


Fig. 6 Over/under voltage and over/under frequency monitoring (2 x SPDT relays)

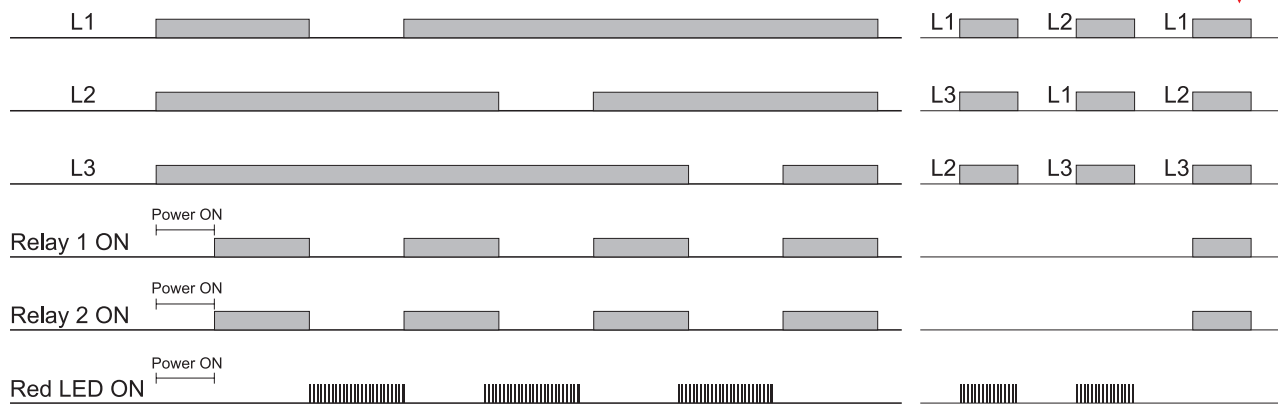
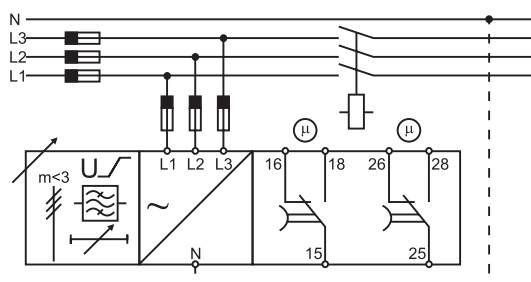


Fig. 7 Total phase loss, phase sequence

Connection Diagram





References

Order code

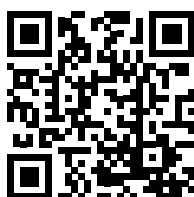


DPC02D

Complete the code entering the corresponding option instead of

Code	Option	Description
D	-	DIN rail housing
P	-	3-phase voltage
C	-	Full functions
02	-	Item number
D	-	2 x SPDT relay outputs
<input type="checkbox"/>	M23	Power supply
	M44	
	M48	
	M49	
	M69	

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



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