

ANSI codes 27, 59, 78, 81

Type G59 package

## G59 protection relay package

uni-line

4921240217D

- **Combined vector shift and ROCOF (df/dt)**
- **Protection of over-/underfrequency**
- **3 phase protection of over-/undervoltage**
- **Digital data processing**
- **Fast decoupling of the generator**
- **Ensures no asynchronous reconnection**

**Note! Not in compliance with G59/2.**

### Application

The mains decoupling relay - type G59 package - forms part of a complete DEIF series of relays for the protection and control of generators.

This package is applied for the protection of synchronous generators, running in parallel with the mains. The package protects against over-/underfrequency, over-/undervoltage, vector shift and/or ROCOF (rate of change of frequency, df/dt).

In applications with only vector shift or ROCOF, the set point for the unwanted part is set at maximum and this part is hereby disabled.

A mains failure will be detected, provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency. An opening signal is then transmitted to the mains circuit breaker, and the generator will then be protected against damage caused by an automatic reconnection to the high-voltage network.

On the other hand, the vector shift/ROCOF will not detect the relatively slow and acceptable changes of the network frequency (the mains).

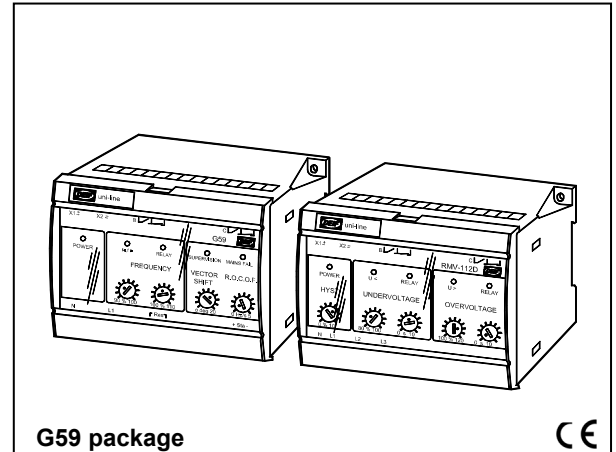
Frequency and voltage protection is needed to protect loads against unacceptable voltages and frequencies.

Furthermore, separating the generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains.

### Measuring principle

ROCOF, vector shift and frequency measure the voltage between 2 phases or between one phase and neutral. High measuring accuracy is achieved by digital data processing.

The ROCOF supervises the frequency change for every period. If the frequency change exceeds the set point for four periods in a row, the ROCOF has detected a failure.



The vector shift supervises the angular velocity of the mains by comparing the times for the latest two full cycles (1st, 2nd) with the times for the full cycles of the previous 4th and 5th period. If the vector shift or the ROCOF detects a failure, an opening signal is transmitted to the mains circuit breaker, and the LED marked "MAINS FAIL" is lit.

The over-/underfrequency supervise the frequency by supervising the latest 4 periods. If the under- or over-frequency set point is exceeded, the output is activated and the associated red LED is lit.

The over-/undervoltage part measures all 3 phase voltages. If the voltage drops below the set point or exceeds the upper set point, the associated output is activated and the associated red LED is lit.

The vector shift and the ROCOF are provided with 1 reset input connected to contacts to the generator circuit breaker and to the mains circuit breaker. These 2 contacts close when the respective circuit breaker is opened. When RESET (22-23) is activated, the vector shift and the ROCOF part will not detect a possible mains failure. This function ensures that the relay is only active when both circuit breakers are closed and the generator is thus running in parallel with the mains.

The vector shift and the ROCOF are provided with an initialising timer, which is activated when cancelling the reset signal (closing of circuit breakers). When this timer expires, the vector shift and the ROCOF are activated and the LED "SUPERVISION" is lit. The time delay is fixed at 5s.

### Relay outputs

The package is provided with 4 outputs either normally energised or normally de-energised. The contacts may be set to open or to close on activation.

### Power-up circuit

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

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### Technical specifications

**Meas. voltage ( $U_n$ ):** See supply voltage - AC ranges

**Overload:** 1.2 x  $U_n$ , continuously  
2 x  $U_n$  for 10 s

**Load:** 2k $\Omega$ /V  
UL/cUL listed: 57.7...450V AC

**Frequency range:** 40...45...65...70 Hz

**Nom. frequency ( $f_n$ ):** 50 Hz or 60 Hz

**“RESET” inputs:** Input voltage:  
18...250V AC/DC for “activated” condition

Input impedance: 100 k $\Omega$

**Output:** 4 change-over switches

**Contact type:** Relays B<sub>1</sub>+C<sub>1</sub>, B<sub>2</sub>+C<sub>2</sub>:  
Normally energised (“NE”), or normally de-energised (“ND”) with or without latch circuit (“I”)

**Contact ratings:** 250V AC/24V DC, 8 A  
(200 x 10<sup>3</sup> change-overs at resistive load)

**Contact voltage:** Max. 250V AC/150V DC

UL/cUL listed: Resistive load only

**Response time:** Vector shift <30 ms  
R.O.C.O.F. <100 ms  
Frequency <100 ms  
Voltage <100 ms

**Galvanic separation:** Between inputs and outputs:  
3250 V – 50 Hz - 1 min.

**Supply voltage ( $U_n$ ):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC  
 $\pm$ 20% (max. 4 VA)  
24-48-110-220V DC -25/+30% (max. 5.5 W)

UL/cUL listed: Only 24V DC and 110V AC

DC supply must be from a class 2 power source

**Climate:** HSE, to DIN 40040

**EMC:** To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4.0 mm<sup>2</sup> (single-stranded)  
Max. 2.5 mm<sup>2</sup> (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

### UL markings:

Wiring:

Use 60/75°C (140/167°F) copper conductors only

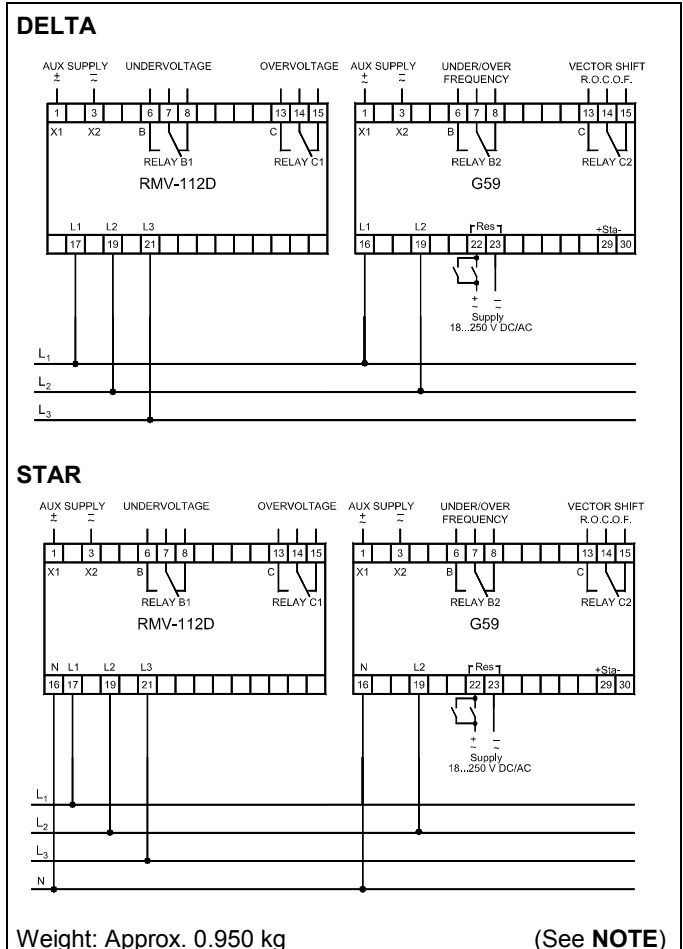
Wire size:

AWG 12-16 or equivalent

Installation:

To be installed in accordance with the NEC (US) or the CEC (Canada)

### Connections



### NOTE:

See the installation instructions for information about status output (29-30).

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**Settings and indications**

Setting of	LED/relay
<b>Vector shift set point:</b> (2...20 elect. degr.) <b>Initialising delay:</b> Fixed at 5s	Red LED "MAINS FAIL" is lit during fault condition
<b>R.O.C.O.F. set point:</b> (0.3...5) Hz/s <b>Initialising delay:</b> Fixed at 5s	Red LED "MAINS FAIL" is lit during fault condition
<b>Underfrequency set point:</b> (90...100%) of $f_n$	"f>, f<" yellow LED is lit when the frequency has dropped below the set point, but the relay is not yet activated
<b>Overfrequency set point:</b> (100...110%) of $f_n$	"f>, f<" yellow LED is lit when the set point is exceeded, but the relay is not yet activated
<b>Undervoltage limit:</b> (80...100%) of $U_n$	"U<" yellow LED is lit when the input voltage is lower than the preset limit, but the relay is not yet activated
<b>Overvoltage limit:</b> (100...120%) of $U_n$	"U<" yellow LED is lit when the input voltage is lower than the preset limit, but the relay is not yet activated
<b>Hysteresis:</b> (1...10%) of $U_n$	Relay contact is reset when fault voltage equals or is less than the preset hysteresis

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

**Order specifications**

<b>Relay B<sub>1</sub>:</b>	Undervoltage
<b>Relay C<sub>1</sub>:</b>	Overvoltage
<b>Relay B<sub>2</sub>:</b>	Over-/underfrequency
<b>Relay C<sub>2</sub>:</b>	Vector shift/ROCOF
<b>Star coupling:</b>	Specify phase-neutral voltage
<b>Delta coupling:</b>	Specify phase-phase voltage
<b>Type – Coupling – Meas. voltage – Nom. frequency – Relay B<sub>1</sub> – Relay C<sub>1</sub> – Relay B<sub>2</sub> – Relay C<sub>2</sub> – Supply voltage</b>	
<i>Examples:</i>	
G59 package – delta – 400V AC – 50 Hz – NDL – NDL – NDL – ND – 24V DC	
G59 package – star – 230V AC – 50 Hz – NDL – NDL – NDL – ND – 230V AC	

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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