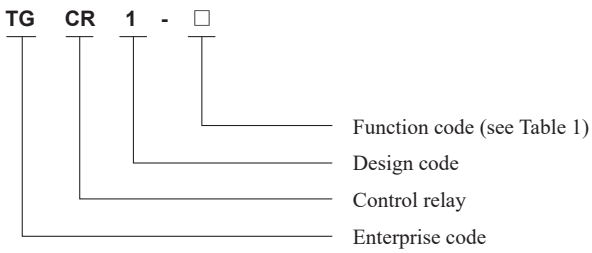
TGCR1 Series Control Relay

1 Overview

TGCR1 series control relay (hereinafter referred to as relay) is suitable for AC 50/60Hz control circuit with rated control power voltage up to AC480V (three-phase three-wire) for line protection control for faults such as open phase, phase sequence, three-phase voltage unbalance, overvoltage, and undervoltage.

2 Type Designation

2.1 Type meaning



2.2 Product Model and Function

Table 1

Model	Overvoltage protection	Undervoltage protection	Unbalance protection	Phase sequence protection	Open-phase protection	Rated voltage optional
TGCR1-PH	-	-	-	●	●	-
TGCR1-PA	●	●	●	●	●	-
TGCR1-PM	●	●	●	●	●	-
TGCR1-PM2	●	●	●	●	●	●

3 Operating, Installation and Transport, Storage Conditions

Table 2

Installation category	Class II, III
Pollution degree	3
Operating temperature	3P, 4P
(Daily mean temperature ≤+35℃)	-25℃ ~ +55℃
Storage temperature	-40℃ ~ +70℃
Permissible ambient environment	40℃/50% RH, 20℃/90% RH
Altitude	≤ 2,000 meters
Installation	Installed on TH35-7.5 rail
Location of installation	Installed in any position on the rail

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4 Technical Parameters

4.1 Main technical parameters

Table 3

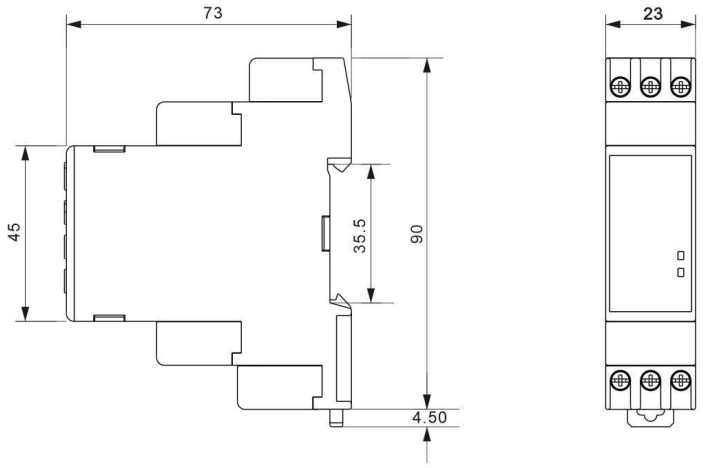
Model		PH	PA	PM	PM2
Input voltage circuit = measuring voltage		Three-phase three-wire L1-L2-L3			
Rated input voltage Us, frequency		AC380V 50Hz			AC380V~AC480V 50/60Hz
Typical power		Approx. 3W			
Measurement function	Open phase	Yes	Yes	Yes	Yes
	Phase sequence	Yes	Yes	Yes	Yes
	Overvoltage	-	1.2Us fixed	1.05~1.3 adjustable	1.05~1.3 adjustable
	Undervoltage	-	0.8Us fixed	0.7~0.95 adjustable	0.7~0.95 adjustable
	Three-phase unbalance	-	5~15% adjustable	20% fixed	
Reset mode		Auto reset			
Operation time	Open phase, Phase sequence	≤ 1s			
	Overvoltage, undervoltage	-	2s fixed	0.1~10s adjusted	
	Three-phase unbalance	-	0.1~10s adjusted	2s fixed	
Power-on delay		500ms fixed			
LED indicator		Un: Green light; R: Red light			
Number of contacts		1C			2C
Contact control capacity		5A 250VAC, 5A 28VDC Resistive load			
Conventional free air thermal current Ith		5A			
Rated operating voltage Ue		AC380V			
Rated operating current under the usage category Ie		AC-15 0.47A			
Rated insulation voltage		480V			
Rated impulse withstand voltage Uimp		4kV			
Protection grade		IP20			
Pollution degree		3			
Model of short-circuit protective device and maximum value		RT18-32(6A)			
Electrical life		≥ 100,000 times			
Mechanical life		≥ 1,000, 000 times			
Wiring terminal fastening screw		M3			
Tightening torque of wiring terminal fastening screw		0.6N.m			
Wiring capacity	Hard wire without a wiring lug	2 × 0.5…2 × 2.5mm^2 (AWG 20…AWG 14) Hard wire without lug			
	Soft wire with a wiring lug	2 × 0.2…2 × 1.5mm^2 (AWG 24…AWG 16) Flexible wire with lug			
	Hard wire without a wiring lug	1 × 0.5…1 × 3.3mm^2 (AWG 20…AWG 12) Hard wire without lug			
	Soft wire with a wiring lug	1 × 0.2…1 × 2.5mm^2 (AWG 24…AWG 14) Flexible wire with lug			
Weight		Approx. 90g			

4.2 Immunity capacity

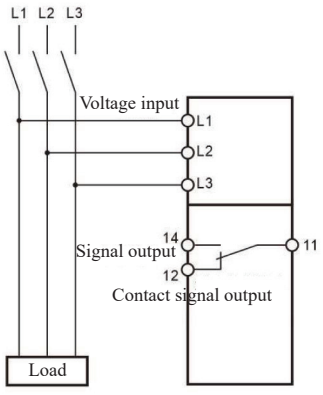
Table 4

Immunity test item	Test grade
Electrostatic discharge	8kV (air discharge) / 4kV (contact discharge)
Radiofrequency electromagnetic field radiation	10V/m 80MHz ~1000MHz
Electrical fast transient burst	2kV 5kHz Power end
Surge	1kV line-to-line

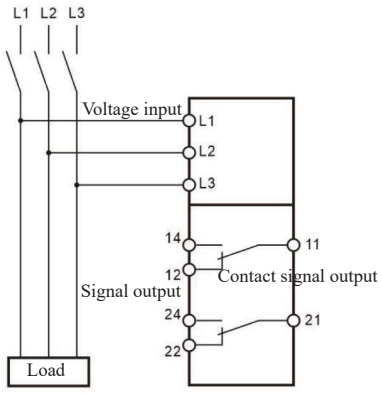
5 Outline and Installation Dimensions



6 Installation and Operation



TGCR1-PH PA PM



TGCR1-PM2

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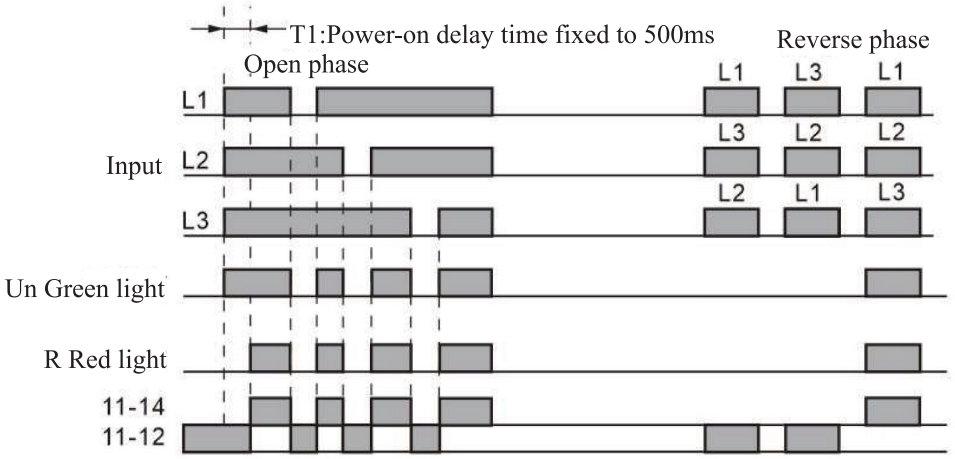
6.1 Reverse phase and open phase protection sequence chart

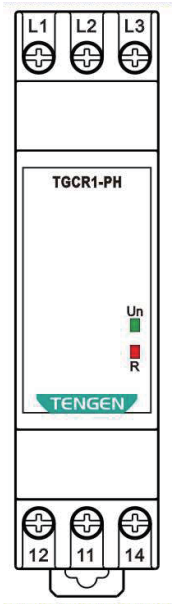


Note 1: The contact is at the operation state under normal input voltage (normally-open ON, normally-closed OFF).

Note 2: As power supply, L1 and L2 will not work if the voltage is less than 70% the minimum input voltage.

Note 3: Open-phase detection is conducted through voltage, and the open phase at the load end cannot be detected.

6.2 TGCR1-PH panel diagram



Indicator state

Item	Description
Input voltage indicator Un green light	Always ON under normal voltage; OFF in case of open phase or reverse phase
Contact action indicator R red light	ON when the contact is closed; OFF when the contact opens

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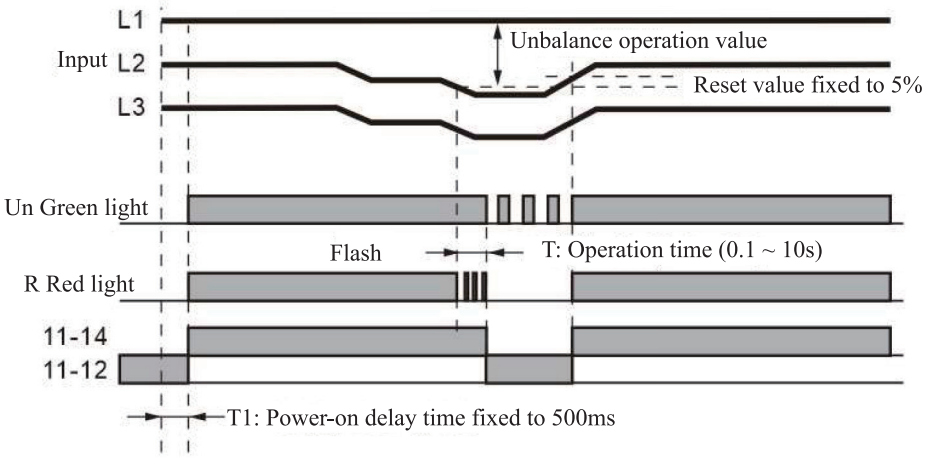
6.3 Three-phase unbalance protection sequence chart



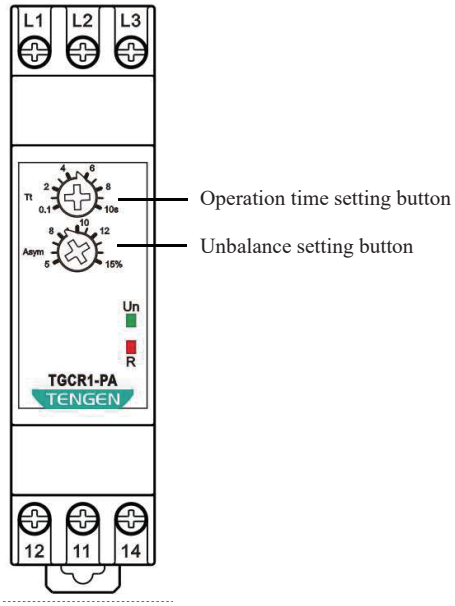
Note 1: The contact is at the operation state under normal input voltage (normally-open ON, normally-closed OFF).

Note 2: Calculation method of unbalance operation value

Unbalance operation condition = (Max. voltage – Min. voltage) > Unbalance operation value

Unbalance operation value = Rated input voltage (V) x Unbalance setting value (%)

6.4 TGCR1-PA Panel Diagram



Indicator state

Item	Description
Input voltage indicator Un green light	Normally ON under normal voltage, and OFF in case of open phase or reverse phase. Unbalance: Flash alternately (two quick flashes and one long OFF) Overvoltage: Quick flash Undervoltage: Slow flash
Contact operation indictor R red light	ON when the contact works, and OFF when the contact opens. Flash in operation delay, and OFF after expiration of delay.

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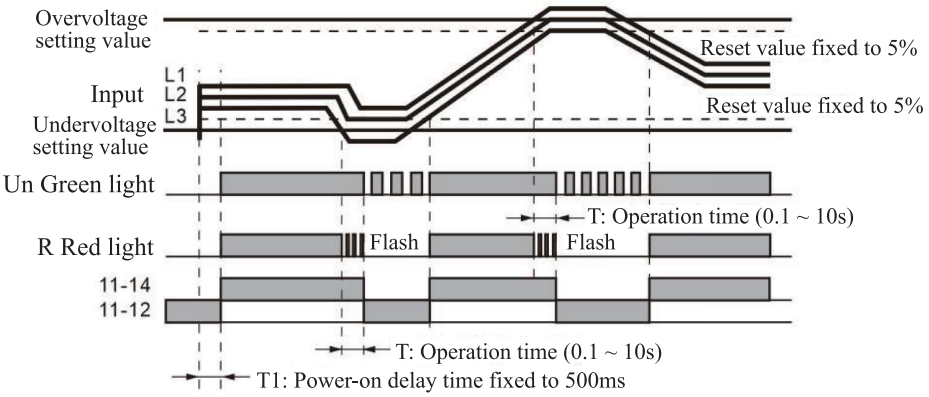
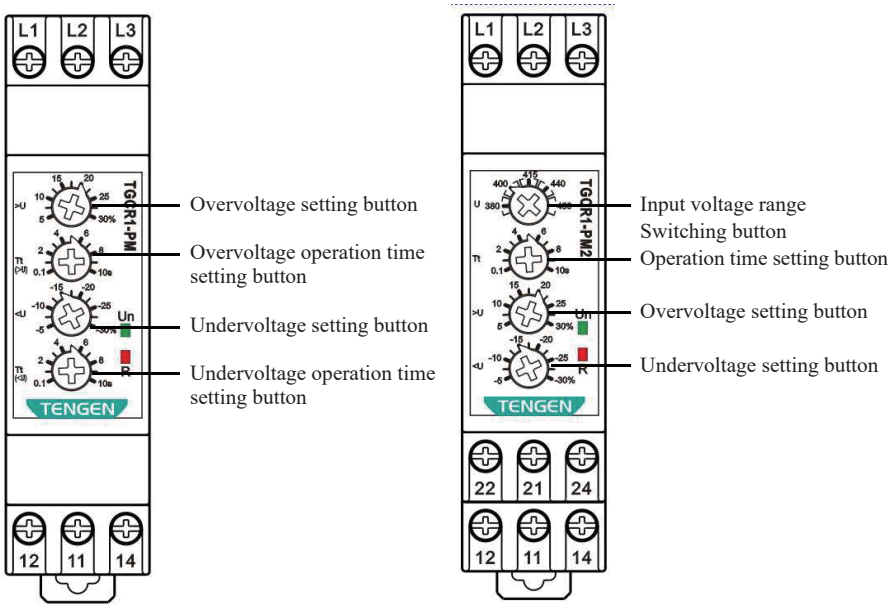
6.5 Overvoltage and undervoltage protection sequence chart



Note 1: The contact is at the operation state under normal input voltage (normally-open ON, normally-closed OFF)

6.6 TGCR1-PM PM2 panel diagram



Indicator state

Item	Description
Input voltage indicator Un green light	Normally ON under normal voltage, and OFF in case of open phase or reverse phase. Overvoltage: Quick flash Undervoltage: Slow flash Unbalance: Flash alternately (two quick flashes and one long off)
Contact action indicator R red light	ON when the contact works, and OFF when the contact opens. Flash in operation delay, and off after expiration of delay.

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7 Troubleshooting and Solutions

General fault analysis and corresponding solution

Fault	Cause	Solution
Un indicator is not lit	L1 L2 L3 open phase	Check input voltage
	L1 L2 L3 reverse phase	Check for normal input voltage and for normal phase sequence; try to exchange any two phase wires at input ends L1 L2 L3;
Un light flashes, and contact does not work	L1 L2 L3 three-phase unbalance (flash alternately)	1. Check for normal input voltage; 2. Overvoltage, undervoltage or unbalance fault occurs, or the current voltage does not reach the return value due to occurred fault, so it is at the fault protection state. Please check all operation value settings meet the requirements according to the specific working conditions, and adjust it to the appropriate setting value if necessary.
	L1 L2 L3 overvoltage (quick flash)	
	L1 L2 L3 overvoltage (flash flash)	
Un light works normally, contact works, R light flashes	R light flashes irregularly	Input voltage at the protection operation threshold

7.1 Turn the button with a screwdriver. When turning to left or to right to the limit position, it will stop rotation by a stop block; at this time, do not apply too large force onto it for rotation.

7.2 Not used at the secondary side of control and inverter of semiconductor switching element.

7.3 To reduce setting error, turn the setting button to the maximum value side from the minimum value side for setting.

7.4 Used to detect the open phase when power-on of motor but unable to detect the open phase during the motor operation.

7.5 Open-phase detection is only used for input connection point at the power side rather than at the load side.

8 Function Confirmation and Setting Method

8.1 Reverse phase sequence: Exchange any two wires of input L1 L2 L3 to change phase sequence, and confirm whether the product works.

8.2 Open phase: Open any phase of input L1 L2 L3, and confirm whether the product works.

8.3 Overvoltage: The overvoltage value is set through the overvoltage setting button (>U)
Setting range: For +5 ~ +30% of rated voltage. At the normal input voltage and product operation state, turn the setting button. When the setting value is below the input value, R light will flash; when the delay expires, the contact will open for reset. For example: For TGCR1-PM, the rated input voltage is 380V, and the setting range is 399 ~ 494V.
Increase the input voltage slowly from the 80% rated voltage, and R light starts to flash when greater than the setting value; at this time, the input value is an overvoltage operation value. When the operation delay expires, the contact will open.

8.4 Undervoltage: The undervoltage setting is adjusted through the undervoltage setting button (<U).
Setting range: For -5 ~ -30% of rated voltage. At the normal input voltage and product operation state, turn the setting button. When the setting value is greater than the input value, R light will flash, and the contact will open for reset. For example: For TGCR1-PM, the rated input voltage is 380V, and the setting range is 361 ~ 266V.
Slowly decrease the input voltage from 120% rated voltage; when below the setting value, R light starts to flash; at this time, the input value is a undervoltage operation value. When the operation delay expires, the contact will open.

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Confirmation of overvoltage and undervoltage operation time: Set the overvoltage to +5% to make the input voltage increase to +20% instantly from 80%, and measure the operation time.
Set the undervoltage to -5% to make the input voltage reduce to -20% from 120% instantly, and measure the operation time.

8.5 Unbalance: set the setting range through the unbalance operation value setting button (Asym): for 5% ~ 15% of rated input
For example: For TGCR1-PA, the rated input voltage is 380V, and the setting range is 19 ~ 57V
If set to 10%, the unbalance operation voltage is 38V, and when the difference between the maximum and minimum voltages of three-phase line voltage exceeds 38V, the contact will open. Confirm the operation time to make the difference between the maximum and minimum values of three-phase voltage exceeds the setting value instantly, and measure the operation time.

9 Function Confirmation and Setting Method

Please specify the product model and order quantity when ordering.

For example: To order TGCR1-PM relay, voltage AC380V, 100 pcs;
Please specify: TGCR1-PM AC380V 100 pcs