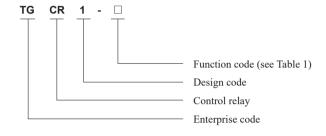


1 Overview

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°C)	-25°C ~ +55°C
Storage temperature	-40°C ~ +70°C
Permissible ambient environment	40°C/50% RH, 20°C/90% RH
Altitude	≤ 2,000 meters
Installation	Installed on TH35-7.5 rail
Location of installation	Installed in any position on the rail





4 Technical Parameters

4.1 Main technical parameters

Table 3

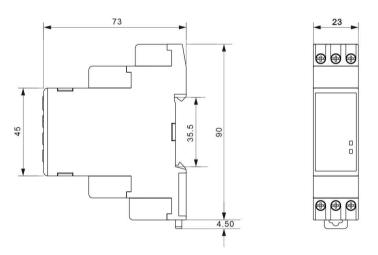
Input voltage circuit = measuring voltage Three-phase three-wire L1-L2-L2. AC380V × 30Hz AC380V-AC480V S0/60Hz Typical power Open phase Yes AC380V × 30Hz AC380V-AC480V S0/60Hz Typical power Open phase Sequence Yes Yes <th col<="" th=""><th colspan="2">Model</th><th>PH</th><th>PA</th><th>PM</th><th>PM2</th></th>	<th colspan="2">Model</th> <th>PH</th> <th>PA</th> <th>PM</th> <th>PM2</th>	Model		PH	PA	PM	PM2	
Number of contact control age tip the plane in the remail current Ith Sate disparsition of some states of partial sta	Input voltage circuit = measuring voltage		Three-phase three-wire L1-L2-L3					
Measurement function Open phase place place Yes	Rated input voltage Us, frequency		AC380V 50Hz AC380V~AC480V					
Measurement function Phase sequence vertically adjusted to the properties of the procession of th	Typical power							
Measurement function Measurement function Overvoltage		Open phase	Yes	Yes	Yes	Yes		
function Overvoltage [hose-it 3 adjustable hose		Phase sequence	Yes	Yes	Yes	Yes		
Three-phase unbalance S-15% adjustable 20% fixed		Overvoltage	-	1.2Us fixed	1.05~1.3 adjustable	1.05~1.3 adjustable		
Reset mode Open phase, Phase sequence Operation time Open phase, Phase sequence Three-phase unbalance Three-p		Undervoltage	-	0.8Us fixed	0.7~0.95 adjustable	0.7~0.95 adjustable		
Operation time Open phase, Phase sequence ≤ 1s Overvoltage, undervoltage, undervoltage under under under under under undervoltage un		Three-phase unbalance	-	5~15% adjustable	20%	fixed		
Sequence Covervoltage, undervoltage Covervoltage, undervoltage Covervoltage, undervoltage Covervoltage Covervolta	Reset mode				Auto reset			
undervoltage		1		≤ 1s				
Power-on delay 500ms fixed LED indicator Un: Green light; R: Red light Number of contacts IC 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 le 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 Electrical life \$\geq 10,000 \text{ times}\$ \$\geq 10,000	Operation time		-	2s fixed	0.1~10s	adjusted		
LED indicator Un: Green light; R: Red light		Three-phase unbalance	-	0.1~10s adjusted	2s f	ìxed		
Number of contacts 1C Contact control capacity 5A 250VAC, 5A 28VDC Resistive load Conventional free air thermal current Ith 8A 250VAC, 5A 28VDC Resistive load Conventional free air thermal current Ith 8A 250VAC, 5A 28VDC Resistive load AC380V Rated operating voltage Ue AC380V Rated operating current under the usage category le Rated insulation voltage Rated insulation voltage Rated impulse withstand voltage Uimp Protection grade Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life \$\gequiv \frac{1000,000 \times}{2000000000000000000000000000000000000	Power-on delay			5	00ms fixed			
Contact control capacity Conventional free air thermal current Ith Rated operating voltage Ue Rated operating current under the usage category le Rated insulation voltage Rated operating current under the usage category le AC-15 0.47A Rated insulation voltage Rated operating voltage Ump Akv Protection grade RT18-32(6A) RT18-32(6A) RT18-32(6A) RT18-32(6A) Rated insulation voltage Rated operating voltage Ump Rated operating voltage Ump Rated operating voltage Ump Rated insulation voltage AC-15 0.47A ARO-15 0.47A ARO-	LED indicator		Un: Green light; R: Red light					
Conventional free air thermal current Ith Rated operating voltage Ue Rated operating current under the usage category Ie Rated insulation voltage Rated insulation voltage Rated impulse withstand voltage Uimp Protection grade Pollution degree Bodle of short-circuit protective device and maximum value Electrical life Electrical life Pightening torque of wiring terminal fastening screw Ma Tightening torque of wiring terminal fastening screw Hard wire without a wiring lug Wiring capacity Wiring capacity Hard wire without a wiring lug Soft wire with a wiring lug Soft wire wit	Number of contact	ts	1C			2C		
Rated operating voltage Ue Rated operating current under the usage category Ie Rated insulation voltage Rated insulation voltage Rated impulse withstand voltage Uimp Protection grade Pollution degree AC380V Rated impulse withstand voltage Uimp 4kV Protection grade Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life Electrical life Electrical life Electrical life AC380V AC-15 0.47A 4kV Protection grade IP20 Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life Electrical life Electrical life Electrical life AC380V AC-15 0.47A 4kV Protection grade IP20 Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life	Contact control ca	pacity	5A 250VAC, 5A 28VDC Resistive load					
Rated operating current under the usage category Ie Rated insulation voltage Rated impulse withstand voltage Uimp Protection grade Pollution degree Model of short-circuit protective device and maximum value Electrical life Mechanical life Wiring terminal fastening screw Ma Tightening torque of wiring terminal fastening screw Mard wiring lug Fard wire without a wiring lug Soft wire with a wiring lug Soft w	Conventional free	air thermal current Ith	5A					
category Ie Rated insulation voltage Rated impulse withstand voltage Uimp Protection grade Pollution degree AC-15 0.4/A 480V Rated impulse withstand voltage Uimp Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life Electrical life Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life Electrical life Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life E	Rated operating vo	oltage Ue	AC380V					
Rated impulse withstand voltage Uimp Protection grade Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life ≥ 100,000 times Mechanical life ≥ 1,000, 000 times Wiring terminal fastening screw M3 Tightening torque of wiring terminal fastening screw M3 Tightening torque of wiring terminal fastening screw M3 Hard wire without a wiring lug Soft wire with a wiring lug Soft wire without a wiring lug Soft wire without a wiring lug Soft wire with wire with wire with lug Soft wire with a wiring lug Soft wire w		arrent under the usage	AC-15 0.47A					
Protection grade Pollution degree 3 Model of short-circuit protective device and maximum value Electrical life \$\int \text{100,000 times}\$ Mechanical life \$\int \text{1000,000 times}\$ Wiring terminal fastening screw M3 Tightening torque of wiring terminal fastening screw And the provided of wiring terminal fastening screw Wiring terminal fastening screw And the provided of wiring termina	Rated insulation ve	oltage	480V					
Pollution degree 3 Model of short-circuit protective device and maximum value 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 Hard wire without a wiring lug Soft wire with a wiring lug 1 × 0.52 × 2.5mm² (AWG 20AWG 14) Hard wire without lug wiring lug 1 × 0.51 × 3.3mm² (AWG 20AWG 12) Hard wire without lug Soft wire with a wiring lug 1 × 0.21 × 2.5mm² (AWG 24AWG 14) Flexible wire with lug 1 × 0.21 × 2.5mm² (AWG 24AWG 14) Flexible wire with lug 1 × 0.21 × 2.5mm² (AWG 24AWG 14) Flexible wire with lug 1 × 0.21 × 2.5mm² (AWG 24AWG 14) Flexible wire with lug	Rated impulse with	hstand voltage Uimp	4kV					
Model of short-circuit protective device and maximum value Electrical life ≥ 100,000 times Mechanical life ≥ 1,000, 000 times Wiring terminal fastening screw M3 Tightening torque of wiring terminal fastening screw M3 Hard wire without a wiring lug Soft wire with a wiring lug Soft wire without a wiring lug Soft wire with a	Protection grade		IP20					
maximum value Electrical life ≥ 100,000 times Mechanical life ≥ 1,000, 000 times Wiring terminal fastening screw M3 Tightening torque of wiring terminal fastening screw M3 Tightening screw Hard wire without a wiring lug Soft wire with a wiring lug Hard wire without a wiring lug Soft wire with wiring lug Soft wire wire wire wire wire wire wire wire	Pollution degree		3					
Mechanical life ≥ 1,000,000 times Wiring terminal fastening screw M3 Tightening torque of wiring terminal fastening screw 0.6N.m Wiring screw		cuit protective device and	RT18-32(6A)					
Wiring terminal fastening screw Tightening torque of wiring terminal fastening screw Hard wire without a wiring lug Soft wire with a wiring lug Wiring capacity Wiring capacity Wiring capacity Wiring capacity Wiring capacity Aware without a wiring lug Soft wire with a wiring lug Law 2 × 0.52 × 2.5mm² (AWG 20AWG 14) Hard wire without lug 2 × 0.22 × 1.5mm² (AWG 24AWG 16) Flexible wire with lug 1 × 0.51 × 3.3mm² (AWG 20AWG 12) Hard wire without lug Soft wire with a wiring lug Soft wire with a wiring lug Soft wire with a wiring lug N3 1 × 0.52 × 2.5mm² (AWG 24AWG 14) Flexible wire with lug 1 × 0.21 × 2.5mm² (AWG 24AWG 14) Flexible wire with lug	Electrical life	Electrical life		≥ 100,000 times				
Tightening torque of wiring terminal fastening screw Hard wire without a wiring lug Soft wire with a wiring lug Hard wire without a wiring lug Soft wire without a wiring lug Hard wire without a wiring lug Soft wire with a wiring lug 1 × 0.21 × 2.5mm² (AWG 24AWG 14) Flexible wire with lug	Mechanical life		≥ 1,000, 000 times					
Fastening screw Hard wire without a wiring lug Soft wire with a wiring lug Wiring capacity Wiring capacity Wiring capacity Hard wire without a wiring lug $2 \times 0.52 \times 2.5 \text{mm}^2 \text{ (AWG } 20AWG 14) \text{ Hard wire without lug}}$ $2 \times 0.22 \times 1.5 \text{mm}^2 \text{ (AWG } 24AWG 16) \text{ Flexible wire with lug}}$ Hard wire without a wiring lug Soft wire with a wiring lug $1 \times 0.51 \times 3.3 \text{mm}^2 \text{ (AWG } 24AWG 12) \text{ Hard wire without lug}}$ $1 \times 0.21 \times 2.5 \text{mm}^2 \text{ (AWG } 24AWG 14) \text{ Flexible wire with lug}}$	Wiring terminal fastening screw		M3					
Wiring capacity Wiring capacity Wiring capacity Wiring capacity Wiring capacity			0.6N.m					
Wiring capacity Soft wire with a wiring lug $1 \times 0.21 \times 3.3$ mm² (AWG 24AWG 16) Flexible wire with lug $1 \times 0.51 \times 3.3$ mm² (AWG 20AWG 12) Hard wire without lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 15) Flexible wire with lug $1 \times 0.21 \times 2.$	Wiring capacity	wiring lug	2 × 0.:	$2\times0.52\times2.5\text{mm}^2$ (AWG 20AWG 14) Hard wire without lug				
Hard wire without a wiring lug $1 \times 0.51 \times 3.3$ mm² (AWG 20AWG 12) Hard wire without lug Soft wire with a wiring lug $1 \times 0.21 \times 2.5$ mm² (AWG 24AWG 14) Flexible wire with lug		lug	2 × 0.22 × 1.5mm ² (AWG 24AWG 16) Flexible wire		ole wire with lug			
lug 1 × 0.21 × 2.5mm (AwG 24AwG 14) Flexible wire with lug		wiring lug	$1 \times 0.51 \times 3.3$ mm ² (AWG 20AWG 12) Hard wire without		wire without lug			
Weight Approx. 90g			$1 \times 0.21 \times 2.5$ mm ² (AWG 24AWG 14) Flexible wire with lug					
	Weight	Weight		Approx. 90g				

4.2 Immunity capacity

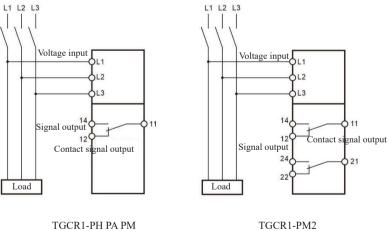
Table 4

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

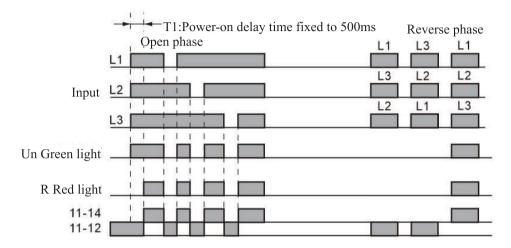


TGCR1-PH PA PM

Control Devices

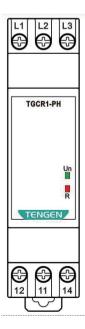
TGCR1 Series Control Relay

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.

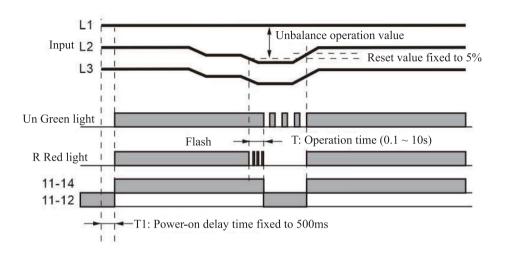
6.2 TGCR1-PH panel diagram



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	

6.3 Three-phase unbalance protection sequence chart

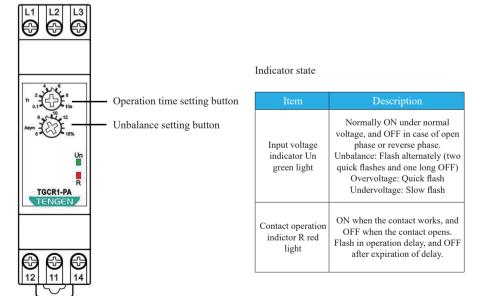


Note 1: The contact is at the operation state under normal input voltage (normally-open ON, normally-closed OFF).

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 (%)

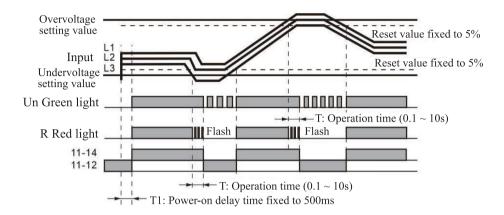
6.4 TGCR1-PA Panel Diagram



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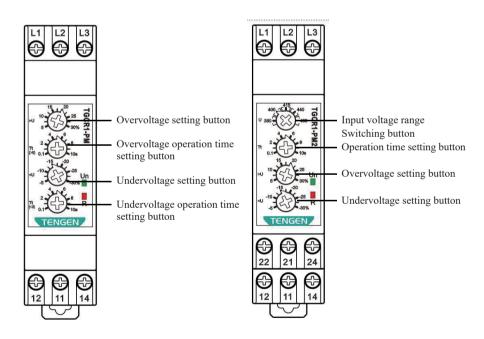
TGCR1 Series Control Relay

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.		

7 Troubleshooting and Solutions

General fault analysis and corresponding solution

Fault	Cause	Solution	
	L1 L2 L3 open phase	Check input voltage	
Un indicator is not lit	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;	
	L1 L2 L3 three-phase unbalance (flash alternately)	Check for normal input voltage; 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.	
Un light flashes, and contact does not work	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 $+5 \sim +30\%$ 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 $399 \sim 494$ V.
 - 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 \sim -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
 - 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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TGCR1 Series Control Relay

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 $5\% \sim 15\%$ of rated input

For example: For TGCR1-PA, the rated input voltage is 380V, and the setting range is $19 \sim 57V$ 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