

# Outdoor Intelligent High-voltage Permanent Magnet Circuit Breaker (ZW32-12/M630-20)

## Operation Instruction



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## 1. Brief Description

ZW32-12 Permanent Magnet Vacuum Circuit Breaker includes two parts: permanent structure with special design and high Reliable MGK FTU. The device mainly used in the middle-high voltage grid with the function of break-close load current, overload current, short circuit current. What's more , it can realize the 0-3 times auto reclosing function.

- High reliable;
- Free maintenance in the whole period;
- Have high mechanical life time and power life time;
- Little volume, lower weight, easy installation;
- Have standard relay protection and auto reclosing function.

### 1.1 Working environment

1. Working temperature : - 40°C-- 60°C;
2. Altitude : less than 2000m;
3. Relative humidity: daily average less than 95%, Monthly average less than 90%;
4. No fire, explosion, dirty, polluted and violent vibration;
5. Storage temperature: -40°C~+85°C;
6. The vibration from the switch and the control devices can be ignored.

### 1.2 Technical parameters:

No	Items	Unit	Number
1	Rated voltage	KV	12
2	Rated current	A	630 or 1250
3	Rated frequency	Hz	50
4	Power frequency resisting voltage(1min)	KV	42
5	Withstand current(peak) for thunder	KV	75
6	Rated short-circuit current for turning on or off	KA	16/20/25
7	Rated short-circuit current for opening or closing (peak number)	KA	50
8	Rated peak withstand current	KA	50
9	4s short-time withstand current	KA	20

10	Rated operation cycle		s-0.1s-ms-6s-ms-6sms-60s recovery
11	Number of times for rated short-circuit current on or off	times	30
12	Life	times	30000
13	Permanent-magnet device control voltage	V	DC 220

### 1.3 Mechanical parameters:

No	Parameter name	Unit	Data
01	Contacts opening distance	mm	9±1
02	Contacts over-travel	mm	2.5±0.5
03	Opening speed	m/s	1.2±0.2
04	Closing speed	m/s	0.6±0.2
05	Contacts closing bounce time	ms	≤2
06	Phase-to-phase center distance	mm	340±1.5
07	3-phase open/close non-synchronism	ms	≤2
08	Loop resistance each phase	μΩ	< 120 ( with isolation), < 80 without isolation)
09	Closing time	ms	25 -- 60
10	Opening time	ms	20 -- 45
11	Weight	kg	About 120

## 1.4 Technical Indicator of FTU

Electromagnet compatible characteristics	Insulation Resistance		$\geq 10M\Omega$	
	Insulating strength		2.5kV	
	Voltage dip and interrupt		100%、0.5s 1000-4-1 IEC	
	High-frequency interference	Series mode	1.5kVP 60870-2-2: 1996	IEC
		Common mode	2.5kVP 60870-2-2: 1996	IEC
	Transient pulse		4.0kVP, 1min 60870-2-2: 1996	IEC
	Surge interference		4.0kVP, 1min 60870-2-2: 1996	IEC
	ESD		8kV 60870-2-2: 1996	IEC
	PFMF		100A/m 1000-4-8	IEC
	Damped vibration		100A/m 1000-4-8	IEC
	Surge voltage		5kV, 1.2/50 $\mu$ s 60870-2-2: 1996	IEC
Power	Working power supply		AC220V	
	Power consumption		$\leq 10W$	
	Frequency		50Hz 或 60Hz	
Ratings	CT		5A, <1.0VA/phase	
	PT		220V, <0.5VA/phase	
	Frequency		50Hz 或 60Hz	
Protection performance parameters	Quick break protection scope		(20%~2000%) $\times$ In Continuously adjustable , Resolution 0.01A	
	Over current protection scope		(20%~2000%) $\times$ In Continuously adjustable , Resolution 0.01A	
	Over current delay		0s~99.99s Continuously adjustable , Resolution 0.01s	
	Reclosing times		0~3 次 Set the reclosing times freely	
	Reclosing interval		0s~999.9s Continuously adjustable, Resolution 0.1s	

Protection grade	Stainless Steel external shell	$\geq$ IP55
MTBF	MTBF	$\geq$ 80,000h

## 2.Circuit breaker structure and working principle

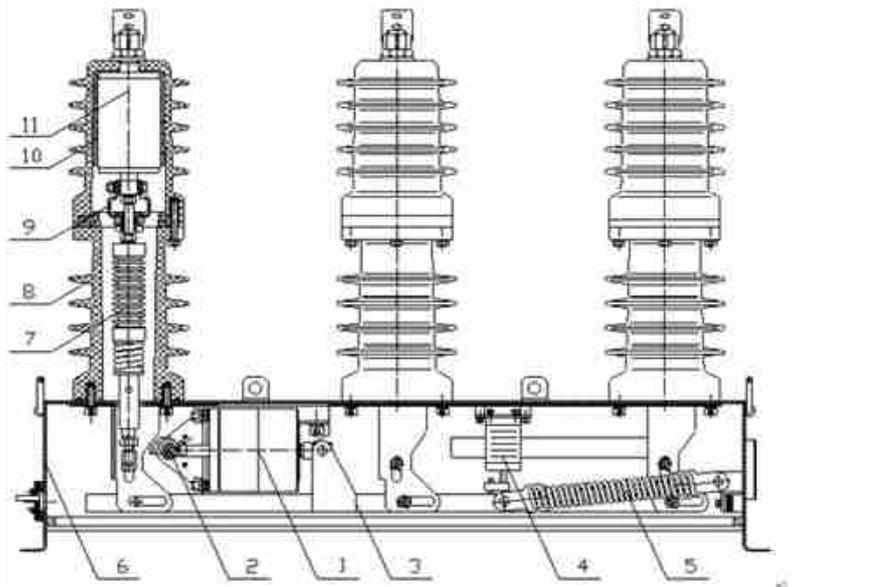
### 2.1 Structure of circuit breaker

ZW32-12 is mainly composed of integrated embedded pole, current transformer, permanent magnetic actuator, and cabinet. It was designed as miniature circuit breaker, the shell is made of high quality stainless steel. Meanwhile it was equipped with manual opening device for the emergency time. Isolating switches and current transformer can be selected according to the customers' needs.

The control of ZW32-12 permanent magnet circuit breaker can be finished by intelligent control unit. It can realize the switch opening-closing operation on site, or be operated by remote controlling system through communication port. The other information can be transmitted to the control center. The communication channel can choose cable, optical fiber, GPRS/CDMA, GSM, etc.

The intelligent control unit installed close to the circuit breaker, connects with breaker by controlling the cable. The power in the control unit includes main and spare supply, the main power is AC or DC 220V, be got through PT by high voltage line. The back up power be supplied by battery(Installed in the cabinet).In the normal work, the main power will charge the back-up power. When the main power is out, the back up power will supply power and control circuit breaker and finish its operation. The back up power can ensure the whole machine work not less than 48 hours.

There is opening switch handle in the circuit breaker as the controlling system or used to open switch in the emergency time when power failure occurs.



ZW32-12/D Circuit Breaker Principle Diagram (Internal Structure)

1. Permanent magnet mechanism   2. Manual brake wheel   3. Drive flat steel  
 4. Auxiliary switch   5. Break-brake spring   6. Shell   7. Isolation rod  
 8. Isolation tube(Down)   9. Flexible connection   10. Isolation tube(Upper)

## 2.2 Working principle and process of Circuit breaker

**Arcing principle:** ZW32-12 permanent magnet vacuum circuit breaker adopts vacuum arcing chamber, uses vacuum as the arcing and insulating medium, so it has a very high vacuum degree. When the dynamic and static contacts break switches in the working of operating mechanism, there will be vacuum arc between the contacts. Meanwhile because of contacts' special structure, in the contact gap, it will also have longitudinal magnetic field to keep the vacuum arc in the diffuse type and burn on the contact surface evenly, maintain a low arc voltage. When the current be zero, residual ions electrons and metal vapor can composite or condense on the contact surface and the shield in the millisecond time. Medium insulating strength of arcing chamber fracture will be restored quickly to put out and break arc. Because of its longitudinal magnetic field control vacuum arc, the vacuum circuit breaker has strong and stable open-close current capability.

**Storage:** Divide-shut switching of ZW32-12 permanent magnet vacuum circuit breaker is stored in the capacitor with high performance which was installed in the intelligent controlling unit. When need, the divide-shut switching can discharge and supply energy instant.

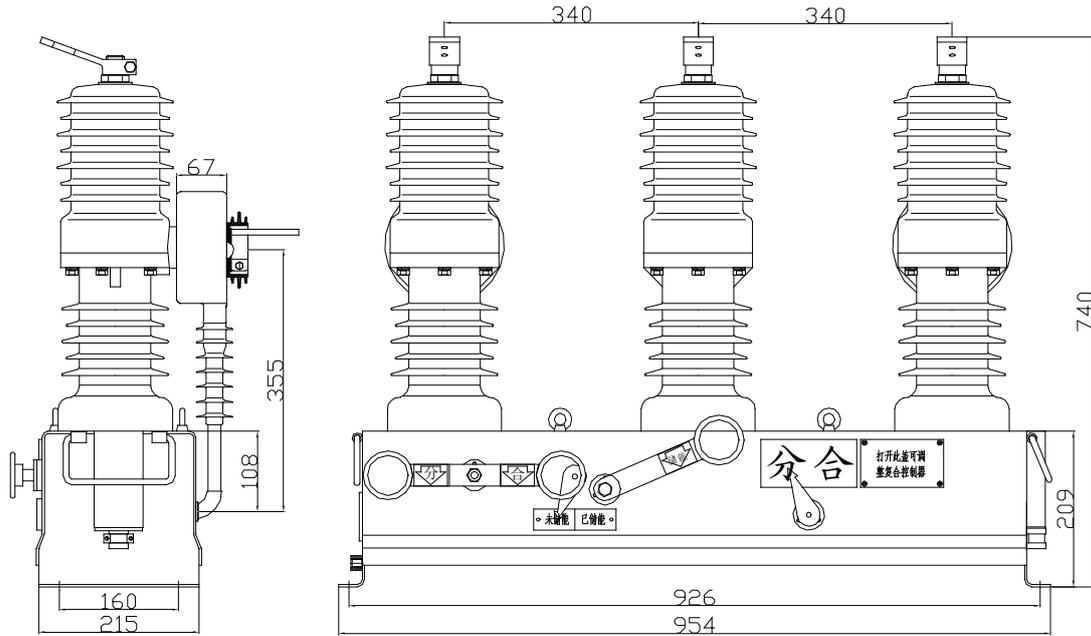
Capacitor's charging energy provided by the main power or back-up power of the control unit. The charging time less than 10s, capacitor voltage error  $\leq 1V$ .

**Closing operation:** Push switching knob in the intelligent control unit on site or finish the operation by remote control, incentive operating mechanism of the closing coil, and make the iron core drive dynamic contact to close switch according to the specified speed. When it realizes that the circuit breaker is already in the closing position, the control loop will disconnect the closing coil power automatically. At that time, the iron core is in the closing site due to the role of permanent magnet. When the closing coil without electricity, it not only can overcome the circuit breaker contact's spring reaction, but also has the retention and keep the circuit breaker in the closing position reliably.

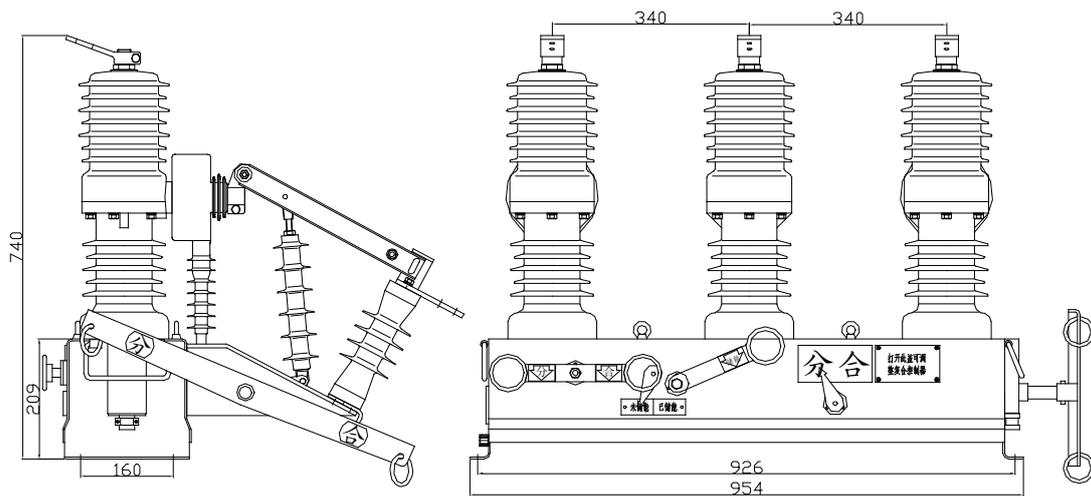
**Opening operation:** Push switching knob in the intelligent control unit on site, or finish the operation by remote control, incentive operation mechanism of the opening coil, overcome permanent magnetic's retention ability in the opening side. Meanwhile make the opening spring to pull the iron core and drive circuit breaker dynamic contact to disconnect with the specified speed. When it realizes that the circuit breaker is already in the opening position, the control loop will disconnect the opening coil power automatically. At that time, the iron core is in the opening site due to the role of permanent magnet and keep the circuit breaker in the closing position reliably.

**Manual emergency opening operation:** When the circuit breaker in the closing position, users can hook the pull tab using insulation operating rod, and pull down, the circuit breaker will brake. meanwhile it also has certain opening speed to ensure the circuit breaker can break rated overload current reliably.

### 2.3 Shape and installation size of Circuit breaker



**Include CT size**



**Include CT, Insulation size**

**Special attention:** Operate when the closing-opening switch in the right position.

### 3. Intelligent control unit(FTU)

MGK intelligent control unit as outdoor controlling system special designed for the medium permanent magnet switch can cooperate pole-mounted permanent magnet switch to realize the opening-closing management, line protection and automatic reclosing function. Control unit installed near the circuit breaker as the switches' electronic operation and intelligent protector.

- Permanent magnetic closing-opening operation
- Line protection
- Reclose function
- Communication function with control center
- Power supply
- Switch test
- Power measurement
- Remote control
- Wireless data transmission(choose)
- Historical operating inventory

#### 3.1 Circuit breaker closing-opening management

- Control switch on site
- Remote control switch
- Remote control unit by hand ( $\leq 30$  meters)
- GSM mobile phone message control switch

#### 3.2 Line protection

- Interruption protection
- Protective scope:  $0.2I_n \sim 20I_n$  step length 0.01A
- Time range:  $0s \sim 600.00s$  step length 0.01s
- $I_n$  is the secondary circuit rated current, usually choose 1A or 5A.
- Current protection
- Protective scope:  $0.2I_n \sim 20I_n$  step length 0.01A
- Time range:  $0s \sim 600.00s$  step length 0.01s

##### **Inverse time over-current protection**

Inverse time over-current curve should satisfy the following 4 IEC curve, and get back after protection at the specified time.

The general inverse time characteristics:

$$t = \frac{0.14}{(I/I_p)^{0.02} - 1} t_p \quad (1)$$

Inverse time characteristics:

$$t = \frac{13.5}{(I/I_p) - 1} t_p \quad (2)$$

Inverse time characteristics:

$$t = \frac{80}{(I/I_p)^2 - 1} t_p \quad (3)$$

Long inverse time characteristics:

$$t = \frac{120}{(I/I_p) - 1} t_p \quad (4)$$

Note: t-action time (S)

$t_p$ -multiple curve

$I_p$ —Starting current ,  $\frac{I}{I_p}$  Value scope < 20

### Reclosing protection

Times: 1-3 times (can choose)

Operation cycle: open—0.1s—close open—3s—close open-6s close open-60s restore

Overlapping intervals: one overlapping intervals 0~600.00s step length 0.01s

Secondary overlapping intervals: 0~600.00s step length 0.01s

Third overlapping intervals: 0~600.00s step length 0.01s

Accelerating protection

Closed circuit breaker in the failure point by hand, the breaker trip with high speed and protection range and time continuously adjustable.

Protection range: 0.2In~20In Step length 0.01A

Time range: 0.2In~20In Step length 0.01A

Open-close signal acquisition and non-electricity protection function with special requirements. Alarm in light gas, trip protection in heavy gas.

Adjust/change each protection data and time through operation panel.

### 3.3 Signal supervise

- Test circuit breaker working state(opening/closing position)
- Control circuit voltage, give warning, opening, closing in low voltage.
- Give warning when battery in low voltage.
- Insulate photo-electricity, strong interference resistance.
- Have 8 way switch signal input.

### 3.4 Measurement

Item	Rated data(Secondary input values)	Precision	The max overload ratio
Voltage	220V	0.5%	1.5 倍
3 phase protection current Ia、Ib、Ic	5A/1A	1.0%	20 倍
Frequency	50Hz	±0.02Hz	
Switch operation times			

Operation LCD panel can display all the measurement data.

### 3.5 Historical operating inventory

- Write down and save all the important information and users' operation information, with time scale, the min resolution ratio is 2ms.Can store 64 groups of SOE events.
- Can write down current volume in line protection with time scale.
- Check the SOE events on the LCD panel or check through remote communication.

### 3.6 Self diagnosis and protection

Self-checking : RAM, FLASH,RART, A/D, control circuit voltage and self check regularly. If something wrong, it will give warning through panel and close corresponding operation.

Receive the time tick order from the master station or sub station .  
Synchronized with the system clock, and enhance the comparability of time records.

### **3.7 High protection grade**

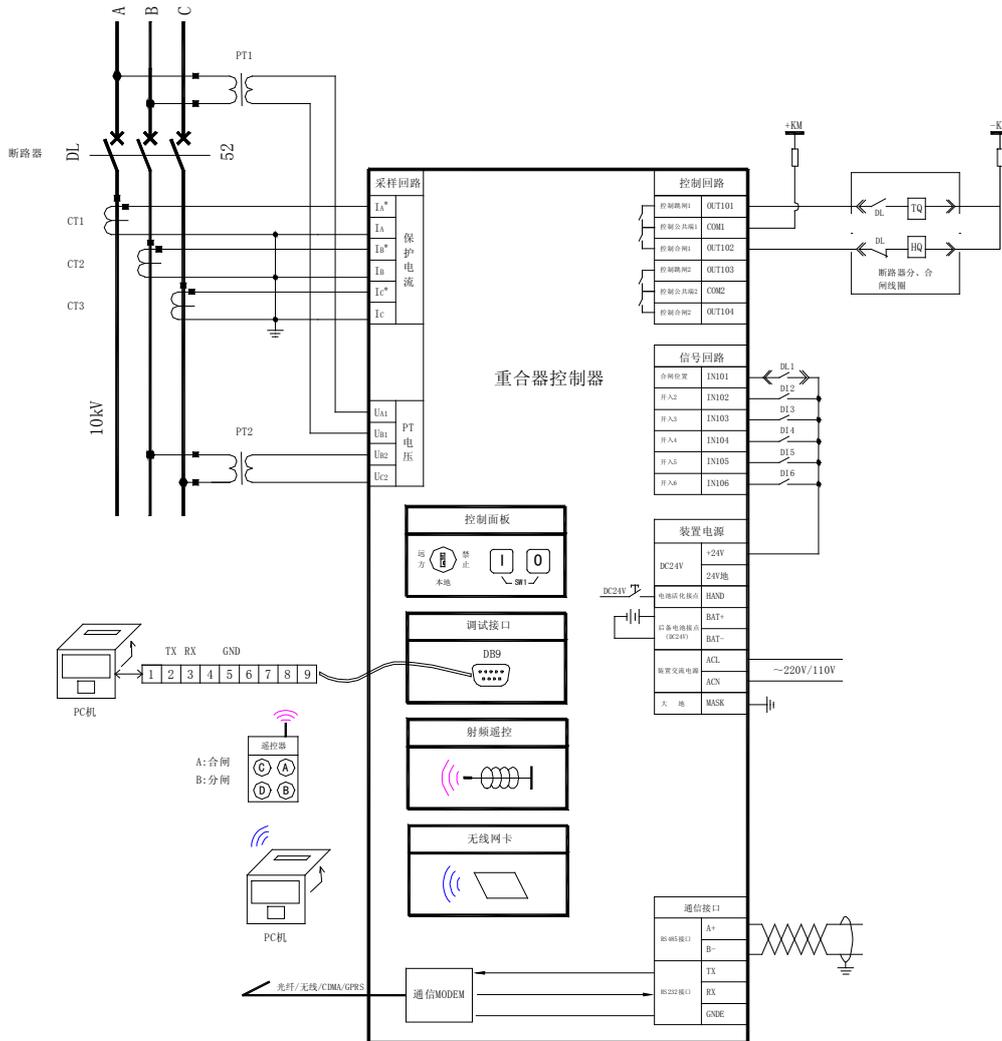
The high protection grade ;  
The FTU cabinet adopts the stainless steel material, brushed surface, can prevent corrosion, accident injury, UV and high-frequency actuation. Wall mounted outdoor has great protection capability. The protection grade  $\geq$  IP54;

### **3.8 Communication method**

Standard RS232 communication port. Communicate through port on site or remote. Communication protocol support IEC870-5-101.

WIFI: Within 500 meters from the circuit breaker, it is convenient to carry out microcomputer query and configuration data. You can get all the information without lever operation. It is used in close communication transmission network.

## 4. Typical application solutions



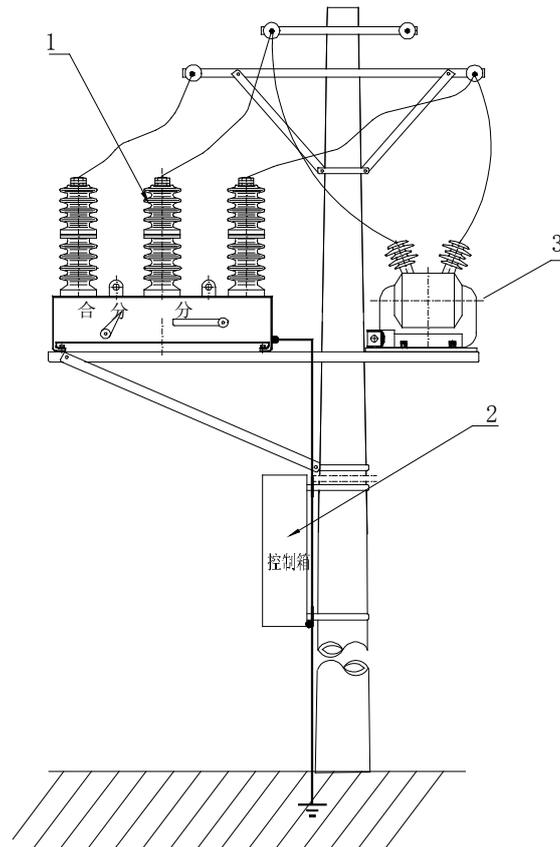
Operation panel: located in the upper of the cabinet, operate switch and observe its station

LCD interface: FTU with 128\*64dot matrix LCD, convenient to check and modify.

Remote control: Use hand-held remote-control unit to operate the switch in the scope of 50meters near the circuit breaker.

WIFI: Within 500 meters from the circuit breaker, it is convenient to carry out microcomputer query and configuration data. You can get all the information without lever operation. It is used in close communication transmission network.

## 5. Installation Instruction



- 1: Permanent magnet outdoor circuit breaker
- 2: The reclosing controller
- 3: Voltage transformer

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