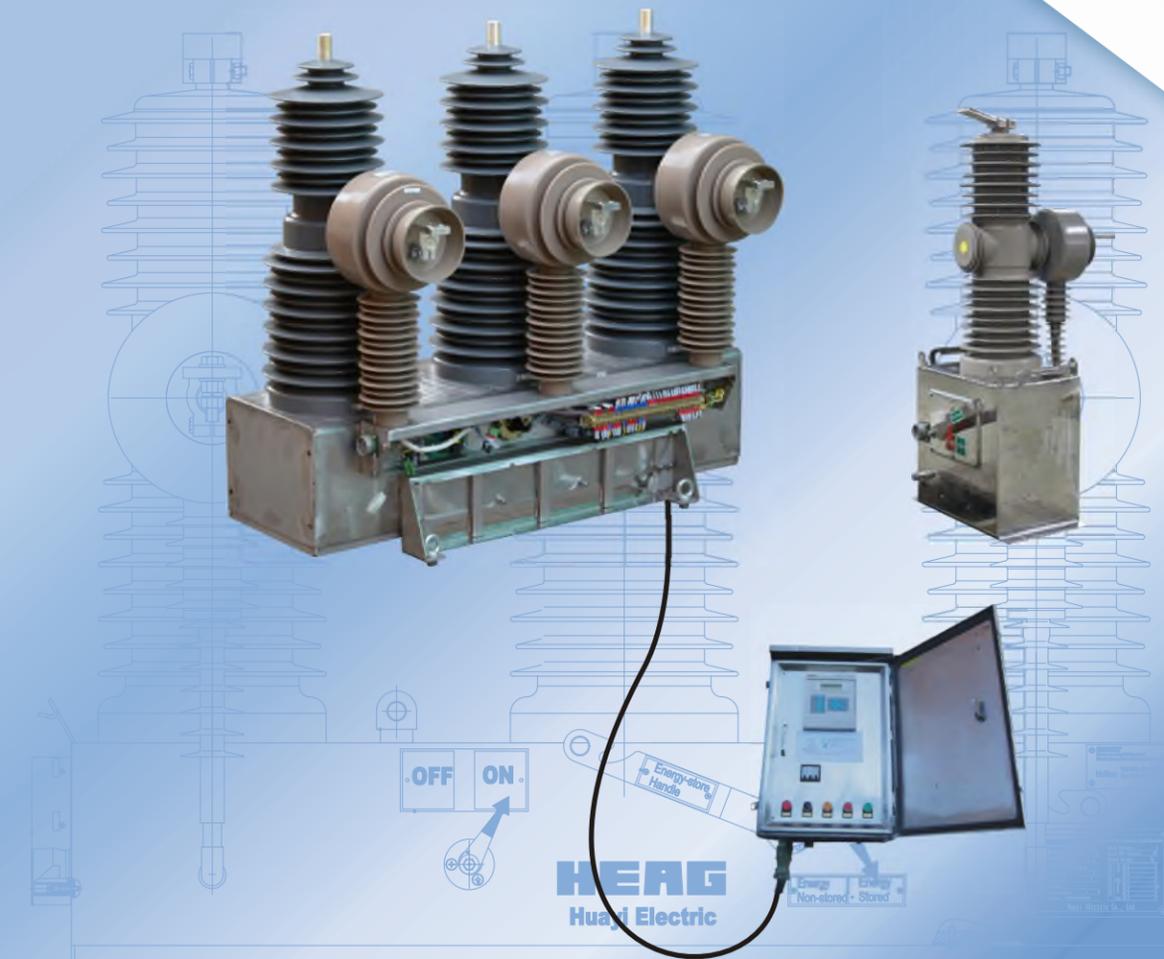


CHZ Series Pole-Mounted Automatic Circuit Recloser

ISO9001 International Quality System Certified Enterprise



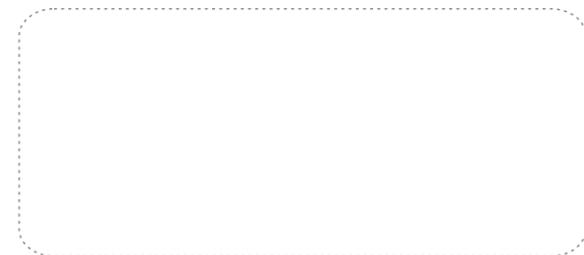
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This series product is only reference for product ordering, installation and use.
The specific technical requirements and configuration of the product is subject to the order contract.

1. GENERAL APPLICATION & STANDARDS

CHZ series Outdoor AC Automatic Circuit Recloser (hereinafter referred to as ACR) is outdoor distribution equipment with rated voltage 12/15/24/40.5kV, rated frequency 50Hz/60Hz, is applicable to the distribution system of substations and industrial & mining enterprises for protection and control, and the sites with frequent operation. It is composed of Solid Outdoor AC Vacuum Circuit Breaker and an automatic reclosing controller.

The Recloser works in conjunction with ACR, the sectionalizer or the fuse, to avoid the accidents of power outage due to the instantaneous faults, to remove the permanent fault circuit (or fault point) in time, so as to reduce the events of power outage at maximum limit, narrow down the range and time of power outage, and greatly improve the reliability of power supply in distribution system.

The circuit breaker of ACR adopts vacuum as the arcing medium, with simple structure, solid insulation, high breaking ability and long lifespan. The controller adopts current & voltage sampling mode, and is designed through synthesizing the features of the voltage type and current type controllers, integrates the functions of line protection, remote detect, remote control and remote adjustment, is a new type comprehensive controller. Consequently, the product can satisfy the requirements of distribution automation and is an ideal equipments for distribution automation system.

The operating mechanism can apply **spring type** or **permanent magnetic actuator** for different requirements of the customers.

The product mainly accords with the following standards:

IEC 62271-111 & IEEE C37.60	High voltage Switchgear and Controlgear - Part 111: Overhead, pad-mounted, dry vault and submersible automatic circuit reclosers and fault interrupters for alternating current systems;
IEC 62271-1, idt GB/T11022	High-voltage switchgear and controlgear - Part 1: Common specifications
IEC 62271-1 & GB/T 3309	Mechanical test at ambient temperature for high-voltage switchgear
IEC 62271-100 & GB 1984	HV alternating current circuit breaker
IEC 60071-1 & GB 311.1	Application guide for insulation co-ordination of high voltage transmission and transformation equipment.
IEC 60529 & GB/T 4208	Degrees of protection provided by enclosures

2. PRODUCT FEATURES

◆ **Unilateral voltage increase time delay**

The delay time is continuously adjustable. The circuit breaker will not close When the voltage increases at both sides, however it will automatically open when the voltage is loss.

◆ **Over current protection**

Inverse time over current protection, and the over current value can be randomly set through the keyboard.

◆ **Quick-breaking protection**

Inverse time quick-breaking protection, and the quick-breaking value can be randomly set through the keyboard.

◆ **Small current earthing protection**

Time-limited small current earthing protection, and the protective current value can be randomly set through the keyboard.

◆ **Reclosing function**

Multiple-reclosing function, the reclosing time and the reclosing interval can be randomly set through the keyboard.

◆ **Inverse time function**

20 fast & slow inverse time A-T curves will be provided, to realize the automatic cooperation between the higher and the lower.

◆ Closing lock

If the circuit breaker closes on the fault point, the controller will automatically open it and realize closing lock.

◆ Sequency cooperation

If the fault occurs on its front line, the upstream recloser will prevent the downstream recloser from acting, however, it will automatically isolate the fault zone without breaking if the fault occurs on the line of the downstream recloser.

◆ Four remote function

Standard RS-485 communication Interface can work

◆ Memory

The data will be automatically stored in the memory (Non volatile memory) for not less than 20 years

◆ Three-step protection

Power on password protection, only the authorized person can change the settings. The installation position of the meter is preserved in the box of the controller.

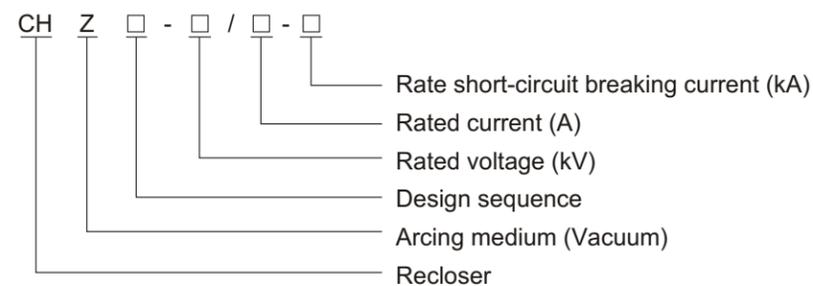
◆ Local remote control

The remote control distance is 50m.

3. NORMAL SERVICE CONDITIONS

- ◆ Altitude above sea level: not exceed 2000m;
- ◆ Ambient temperature: -40℃~+40℃, daily difference in temperature: 25℃;
- ◆ Air polluted degree: IV ;
- ◆ Earthquake intensity: not exceed 8 degree;
- ◆ Wind speed: less than 35m/s;
- ◆ Ice covering thickness: 10mm;
- ◆ Site without flammable, explosive and corrosive material, and frequent violent vibration.
- ※ Any special requirements for installation site, please consult with the manufacturer.

4. MODEL AND MEANING



5. MAIN TECHNICAL PARAMETERS

5.1 Rated technical parameters of circuit breaker for ACR

Item Description	Unit	12kV	15kV	24kV	40.5kV
VCB Model		ZW43(A)-12	ZW43(A)-15	ZW43(A)-24	ZW37(S)-40.5
Rated voltage	kV	10/11	13.8/15.5	20/24	35/38
Number of phases		1-ph /3-ph	1-ph /3-ph	1-ph /3-ph	3-ph
Nominal frequency	Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Max. Voltage of the equipment	kV	12	17.5	24/27.5	40.5

Item Description	Unit	12kV	15kV	24kV	40.5kV
Rated current	A	200/400 /630/800	200/400 /630/800 /1000	400/630 /800/1000 /1250	400/630 /800/1000 /1250/1600
Basic Insulation Level(BIL)					
P.F. withstand voltage, Dry , 60 seconds	kV	42	50	60	70
P.F. withstand voltage, Wet , 10 seconds	kV	34	45	50	60
Lightning impulse withstand voltage (P-P/P-G)	kV	75	95/110	125	150/170/185
Lightning impulse withstand voltage (Gap)	kV	85	105/125	145/150	170/185/215
Rated short-circuit breaking current	kA	12.5/16/20/25	12.5/16/20/25	12.5/16/20/25	12.5/16/20/25
Rated peak withstand current (peak)	kA	31/40/50/63	31/40/50/63	31/40/50/63	31/40/50/63
4s rated short-time withstand current	kA	12.5/16/20/25	12.5/16/20/25	12.5/16/20/25	12.5/16/20/25
Rated short-circuit making current (peak)	kA	31/40/50/63	31/40/50/63	31/40/50/63	31/40/50/63
Operation Characteristics	s	O-0.3s-CO-10-CO-10-CO-10-C / O-0.3s-CO-T1-CO-T2-CO-T3-C			
Cycles of reclosed at ruture capacity	No.s	3			
Max number of shots for open	No.s	4			
Number of electric operations	No.s	10000 / 30000			
Internal insulation		Solid			
Arc interrupting		Vacuum			
Insulation of the vacuum interrupter		Solid Dielectric			
Type of mechanism operation		Spring / Magnetic Actuator			
Control System		Microprocessor			

5.2 Mechanical parameters of VCB for ACR

Item Description	Unit	12kV	15kV	24kV	40.5kV
Open distance of contact	mm	9 ^{-0.5} ₊₁	10 ^{-0.5} ₊₁	8.5±1	17±1
Contacting travel of contact	mm	3 ^{-0.5} ₊₁	3 ^{-0.5} ₊₁	2.5~4	4.5±1
Average opening speed	m/s	1.2±0.2	1.3±0.2	1.4±0.3	1.6±0.3
Average closing speed	m/s	0.6±0.2	0.6±0.2	0.8±0.3	1.0±0.3
Bounce time of contact closing	ms	≤2	≤2	≤2	≤3
Three phase opening/closing asynchronism	ms	≤2	≤2	≤2	≤3
Closing time	ms	≤40	≤45	≤60	≤60
Opening time	ms	≤45	≤45	≤60	≤45
Circuit resistance of each phase	μ Ω	≤60	≤60	≤60	≤40
Centre distance between phases	mm	240	240/380	380	460
Allowable accumulated wear	mm	3	3	3	3
Contact self-closing pressure	N	2000±200	2000±200	2200±200	2500±200
Net weight	kg	85	85/158	158	260

5.3 Main technical parameters of Controller for ACR

No.	Item	Data
1	Transformation ratio of input CT	□/5A or 1A (□ selected by the user)
2	Rated voltage and frequency	AC 220V or AC100V, 50Hz(or 60Hz)
3	Opening/closing operating power supply	DC 24V or AC 220V
4	Output capacity	no less than 600W
5	Over-current settings	20% 300% continuous adjustable
6	Fast-breaking settings	20% 100% continuous adjustable
7	Reclosing time	0.1s 600s continuous adjustable
8	Delay time	0.1s 600s continuous adjustable
9	Zero phase sequence current	10% 100% continuous adjustable
10	Local remote control distance	no less than 30m
11	Remote control distance	no less than 1200m

5.4. Minimum start current: 20%~1000% continuous adjustable

Minimum start current is adjustable, the adjustment range can satisfy the technical requirement and the error is no more than 10%.

5.5. Rated operating sequence of the controller:

O-t1-CO-t2-CO-t3-CO-lock there into, t1, t2, t3 are the reclosing intervals, will be not equal in one sequence. In rated operating sequence, t1, t2, t3 are min. values adjusted, and 2 times of fast-breaking operation.

5.6. About the detail adjustment method, please refer to the Instruction of Recloser

6. PRODUCTS STRUCTURE

6.1. Basic structure

This type of automatic circuit recloser consists of integrated solid sealed pole, CT, spring operating mechanism and base. The spring operating mechanism and pole are fixed on the base, and the sealed structure is suitable for outdoor condition. It is compact & simple in structure, beautiful in appearance and easy installation, and meets the requirements of travel and over travel of interrupter without adjustment. The automatic circuit recloser also reserves the auxiliary contacts to meet some different requirements of the users.

The VCB which is ZW43(A) type circuit breaker for system voltage maximum up to 27kV, 33/35kV level, maximum system voltage can reach 40.5kV as model ZW37S for VCB parts.

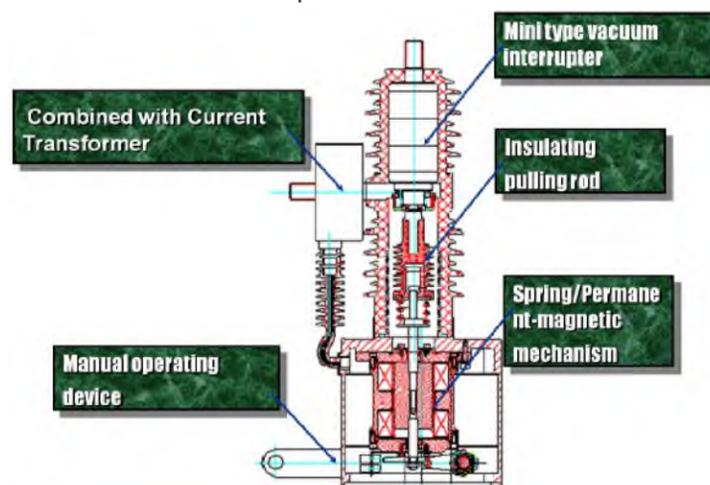


Fig. 1: Inner Structure

Inner Structure of Solid type VCB as main switch of ACR

◆ It can be combined with the disconnect switch or Zero sequence CT as below:



Fig.2: ZWSP-12/24 Single Phase ACR VCB



Fig.3: ZW43(A) VCB with Disconnect Switch

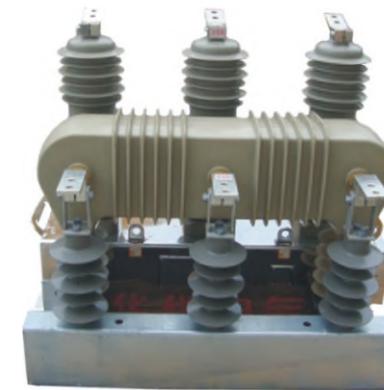


Fig.4: ZW43(32) VCB with Zero Sequence CT



Fig.5: ZW43(32)A VCB with Disconnect Switch And Zero sequence CT

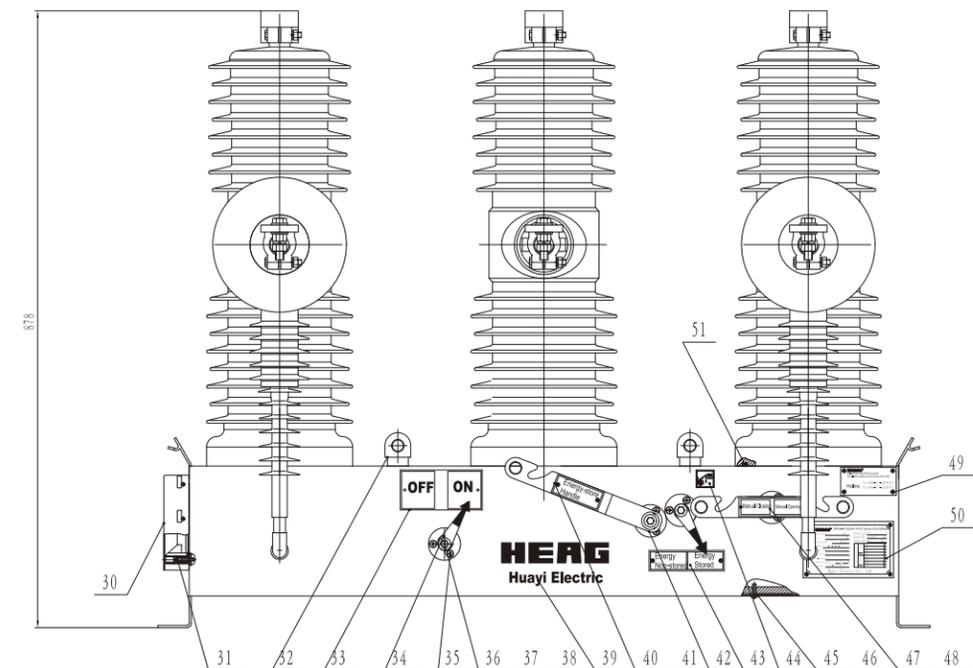


Fig.6, Outline Structure for 24kV VCB system(as example)

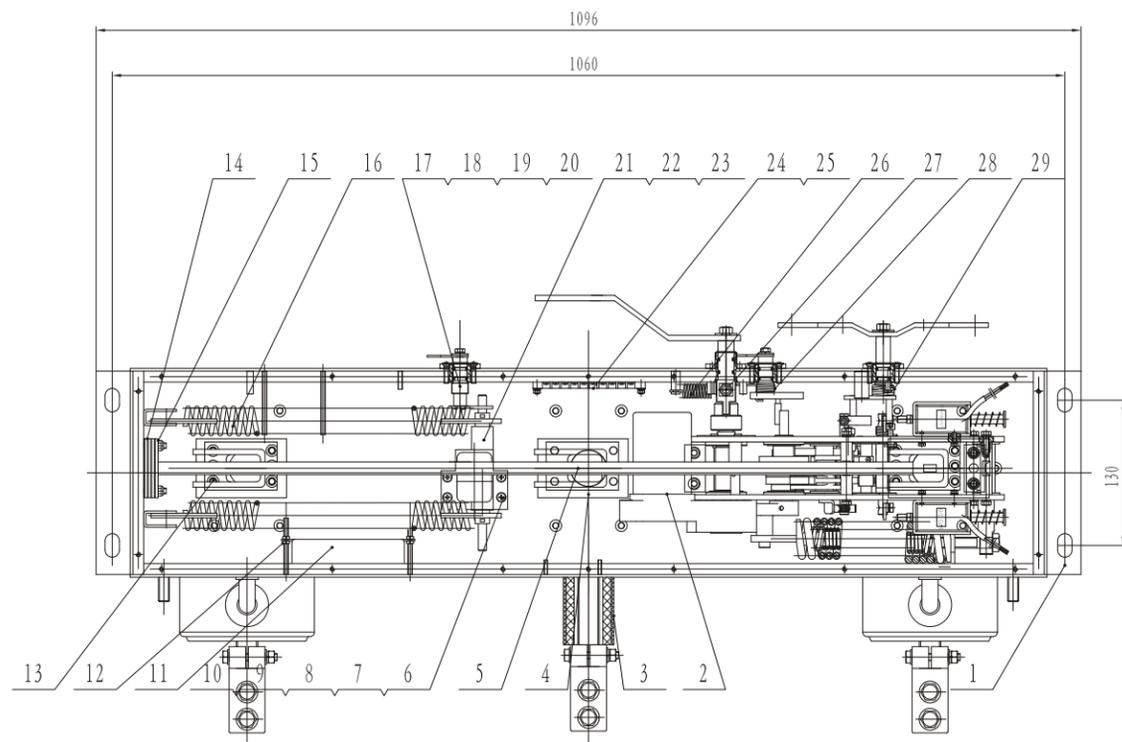
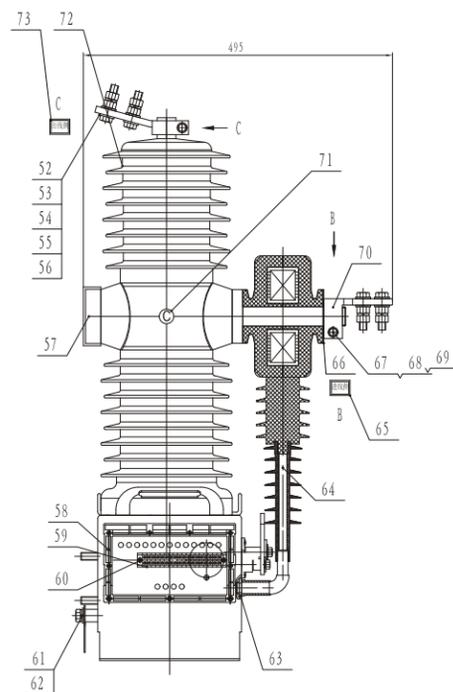


Fig.7 Spring Mechanism Structure for 24kV VCB of ACR(for example)



1. Shell 2. Spring 3. Sheath 4. Support 5. Cross-bar welding
6. Auxiliary switch insulating panel 7. Pan head screw 8. Flat gasket 9. Spring washer 10. Auxiliary switch 11. Delay 12. Nut M4
13. Hexagon socket head cap head screw 14. Bumper 15. Locknut
16. Spring group 17. Closing-opening indicating axle 18. Flange
19. O type seal ring 20. Rubber gasket 21. Pole 22. Cover 23. Cotter
24. Terminal 25. Nut M5 26. Tension spring 27. Pin 28. Torsional spring
29. Torsional spring 30. Cover 31. Pan head screw M4×20
32. Lifting hook cover 33. Closing-opening plate 34. Closing-opening indication
35. Sunk screw M6×16 36. Hexagon-headed bolt M6×20 37. Nut M5
38. Spring washer 39. HEAG sign 40. Charging hand shank plate
41. Copper bolt M3×6 42. Flange 43. Stored energy / unstored energy plate
44. Sling sign 45. Baseboard 46. Hexagon-headed bolt
47. Closing-opening hand shank 48. Manual closing-opening indication
49. Service plate 50. Switch plate 51. O type seal ring 52. Up jointing clamp
53. Hexagon-headed bolt M12×50 54. Spring washer 55. Flat gasket 56. type hexagon nut M12 57. Cover 58. Terminal box 59. Terminal
60. Cross recessed pan head screw M3×20 61. Earthing plate
62. Hexagon-headed bolt M12×10 63. Nut M20 64. Current transformer
65. Inlet and outlet 66. Gasket 67. Hexagon-headed bolt M8×50
68. Spring washer 69. Flat gasket 70. Down jointing clamp 71. ABC tags
72. Pole 73. Inlet and outlet

Fig.8-a Table list for main components of VCB

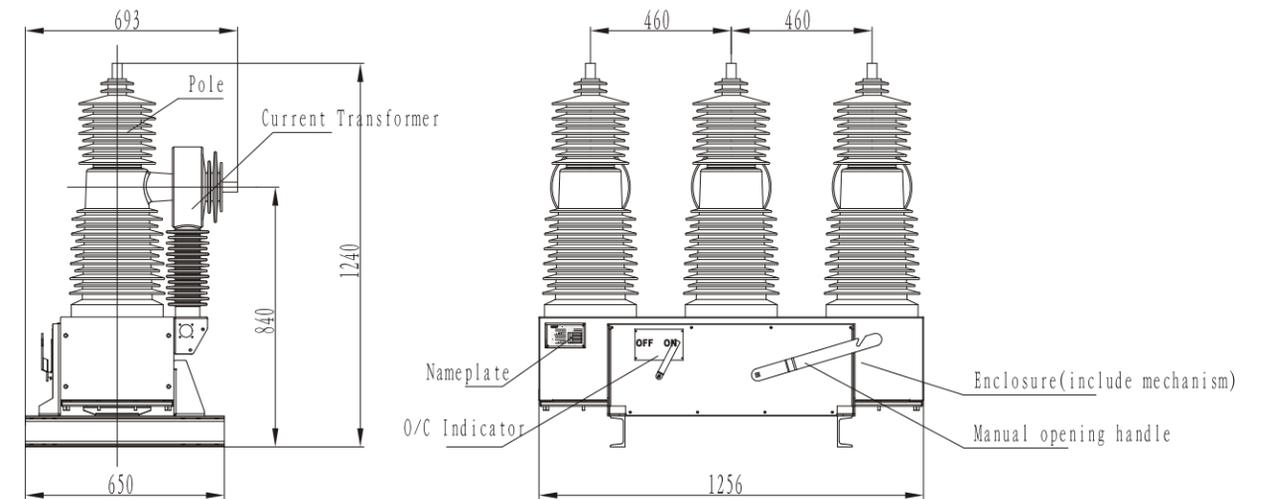


Fig.8-b Outline diagram of ZW37S-40.5 magnetic actuator VCB for ACR

6.2 Spring mechanism Energy storage and O/C device

The automatic circuit recloser not only has electrical energy storage device and O/C device for remote operation, but also has manual energy storage and O/C device, so that it will be sure to operate for energy storage and opening & closing if power is failed. There are clear indicators for energy storage, opening and closing on the base, which can reliably indicate if the energy of operating mechanism is stored and the automatic circuit recloser is in opening state or closing state.

6.3 Spring Operating mechanism (as per Fig. 9)

The operating mechanism consists of closing spring, energy storage system, over-current tripper, opening/closing coil, manual opening/closing system, energy storage status indicator and opening/closing status indicator, etc. It is small in size, reliable performance and the mechanical life is up to 10,000 times.

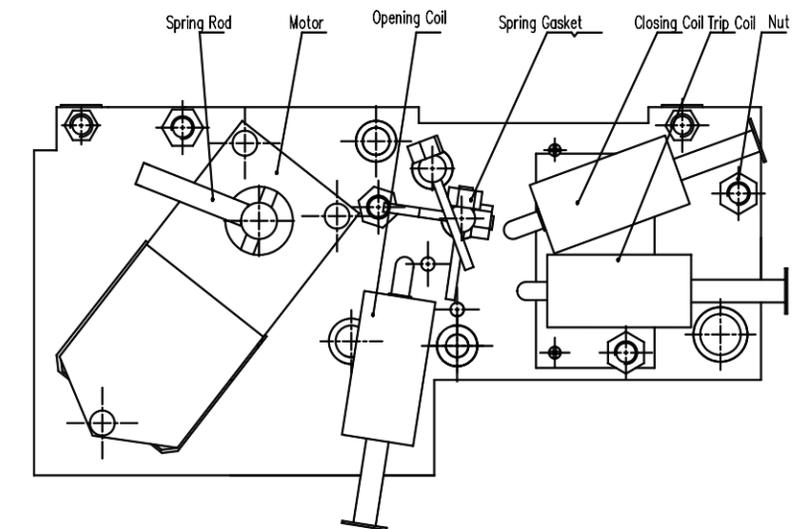


Fig.9 Structure of Spring Operating Mechanism

6.4. Additional protection function

If necessary, the automatic circuit recloser shall be equipped with a time delayer (surger current controller) for surge current protection, instantaneous trip protection, over-current protection, etc..

6.5 Grounding bolts: There is a M12 earthing bolt on the enclosure of automatic circuit recloser with obvious earthing symbol.

6.6 Disconnect Switch: Optionally, the disconnect switch can be linked to the automatic circuit recloser through mechanical inter-linkage device.

7. WORKING PRINCIPLE

7.1 Arcing principle

It adopts vacuum interrupter of outstanding arc-extinction ability. It will create vacuum arc between contacts when the movable contacts and fixed contacts electrically open under acting of operation mechanism, simultaneously, it will also create longitudinal magnetic field between contacts to keep the vacuum arc diffusing owing to the contacts, special structure, so that the vacuum arc will be evenly dispersed on the contact surface to keep low arc voltage. When the voltage is below zero, the residual ion, electron and metal steam will be compounded or coagulated on the contact surface and shield in a ms time, and the dielectric insulation strength will quickly recover, then the arc will be extinguished, so that the auto recloser has strong and stable short-circuit breaking ability.

7.2 Energy storage process of Spring mechanism(as per Fig. 10)

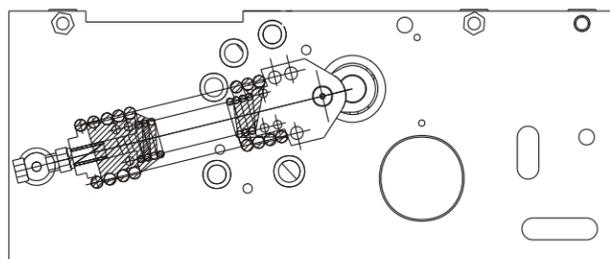


Fig. 10-a Energy non-storage state of closing spring

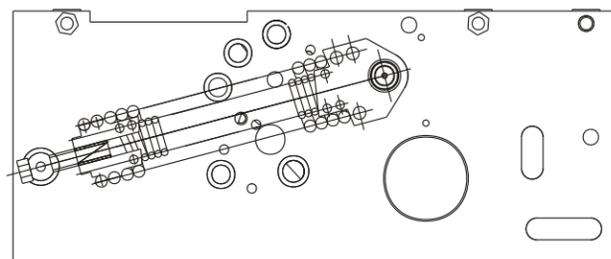


Fig.10-b Energy storage state of closing spring mechanism

Electrical energy storage: The motor applies output torque to the ratchet, so as to drive the cam and regulation crank rotating through the pawl, then closing spring starts storing energy. When the convex shoulder pushes the travel switch, cut off the power of motor, then spring energy storage is completed. Manual energy storage: Apply the force(80-100N) to the manual energy storage handle to drive the input shaft, then transmit torque to the big gear of output shaft through the small gear of input shaft, so as to drive the regulation crank rotating and the closing spring starts storing energy.

7.3 .Closing operation of Spring mechanism

Electrical closing operation: After the mechanism receives the closing signal, the movable iron core of closing electromagnet will move forward to drive the closing tripping rod, so as to make the closing half shaft anti-clockwise rotate and release the closing rocker. Simultaneously, the closing rocker will anti-clockwise rotate due to the pressure of roller and relieve energy storage maintenance. Due to the shrink of the closing spring, the cam on the main spindle will generate impact force and strike the wheel on the rocker-arm to make it anti-clockwise rotate, and the impact force will be conveyed to the switch through the transom, consequently, the closing operation is completed. Manual closing operation: Apply the force(40-50N) to the manual closing handle to drive the rod of the manual O/C shaft anticlockwise rotating, so as to make the closing half shaft anti-clockwise rotate. Consequently, the effect will be same to electrical closing operation.

Reclosing operation: After completing closing operation and the mechanism entirely releasing the energy of energy storage spring, the automatic circuit recloser is in the closing but energy non-storage state, then the mechanism will automatically proceed with energy storage operation up to energy storage completion, and the mechanism is in the closing energy storage state. Once tripping, the mechanism will realize the auto reclosing operation after receiving a reclose signal.

7.4. Opening operation of spring mechanism

Electrical Opening operation: After the mechanism receives the opening signal, the movable iron core of opening electromagnet will move forward to drive the opening tripping rod, so as to make the opening half shaft clockwise rotate and release the opening rocker. Simultaneously, the opening rocker will clockwise rotate due to the pressure of roller, and the rocker-arm will clockwise rotate due to the push of opening spring, consequently, the opening operation is completed.

Manual opening operation: Apply the force(40-50N) to the manual opening handle to drive the rod of the manual O/C shaft clockwise rotating, so as to make the opening half shaft clockwise rotate. Consequently, the effect will be same to electrical opening operation.

Over-current tripping operation: Once the current passing through the tripping coil of tripper reaches the stipulated tripping value, the electromagnet will act and the push rod will push the tripping rod, so as to make the opening half shaft clockwise rotate and release the opening rocker. Consequently, the effect will be same to electrical opening operation, and the auto recloser will trip due to over current.

7.5 Additional function: If necessary, the automatic circuit recloser can be equipped with a time delay for surge current protection, instantaneous trip protection, over-current protection, etc., or equipped with a FTU for Distribution Automation.

7.6 Electrical schematics of control circuit of Spring Mechanism

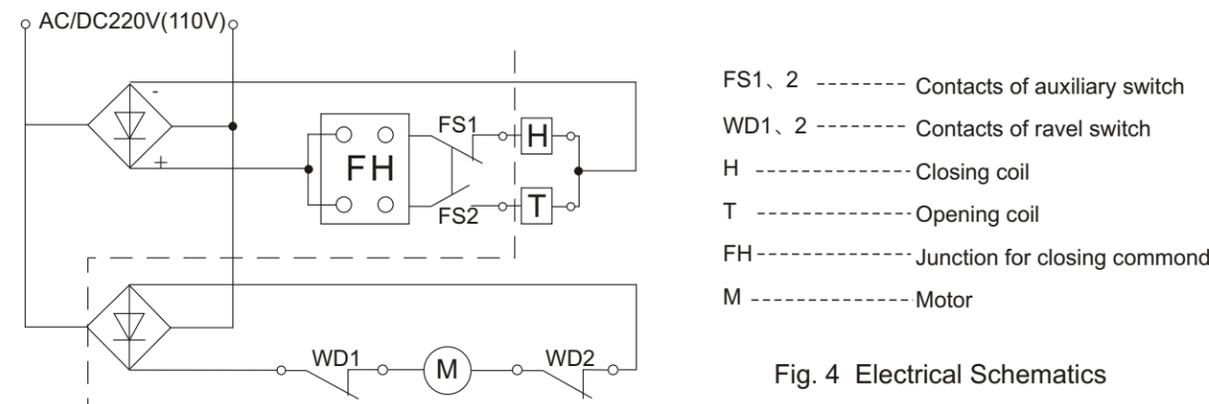


Fig. 4 Electrical Schematics

In energy non-storage state, NC contacts WD1, WD2 of travel switch are connected to the motor power, and motor M will drive the closing spring to start storing energy. Once energy storage is completed, NC contacts WD1, WD2 are disconnected, cut off power supply and the motor will stop rotating, consequently, the mechanism is in opening & energy storage state. After energy storage of the closing spring is completed, if the mechanism is open, NC contact FS1 of auxiliary switch is closed. As long as closing signal is given, the closing electromagnet H will be energized and the mechanism will start electrical closing operation. Once closing operation is completed, NC contact FS1 is disconnected and cut off the power of closing electromagnet. Whereafter, NC contacts WD1, WD2 are connected, as a result, the motor M will drive the closing spring to store energy. NC contacts WD1, WD2 will not be disconnected again until energy storage is completed, then cut off power supply and the mechanism is in closing & energy storage state.

NO contact FS2 is closed when the auto recloser is in closing state. As long as opening signal is given, the opening electromagnet coil T will be energized, and the mechanism starts opening operation. Once opening operation is completed, NO contacts FS2 of auxiliary switch will be disconnected and cut off the power of the opening electromagnet coil. The mechanism is in opening & energy storage state and NC contact FS1 is closed to prepare for the next closing/reclosing operation.

7.7 Working principle of magnetic actuator mechanism

ZW43/37s series outdoor pole mounted VCB of ACR equipped with a permanent magnetic operating mechanism for each pole or single magnetic actuator mechanism for three poles. The mechanism takes advantage of double stable magnetic circuit system to make two magnetizing coil driving iron core move to limited position, takes advantage of magnetic energy of high performance permanent body to keep in limited position. The driving force is more than confirming by excite anyone magnetizing coil, so make the iron core move.

The VCB can be open quickly by pulling open handle downwards when controlling system appear fault. It omits traditional device such as storage and foreshaft, reduce 70% components, so predigest assembly Process and improve reliable and life of mechanism. At the same time it adopt capacitor as power supply, avoid affect from auxiliary power wave.

Basic operation principle

The microprocessor of CPU module is a core of controller basic controlling principle, Sample disposal of power circuit voltage current secondary signal, monitor power network firstly phase current and phase voltage. At the same time, CPU monitor remote control signal, switch open-closed position. The integral battery supply controller of power supply and operation voltage. The CPU hardware circuit complete floating and electricity management.

7.8 Internal electric wiring principle diagram of magnetic acuator

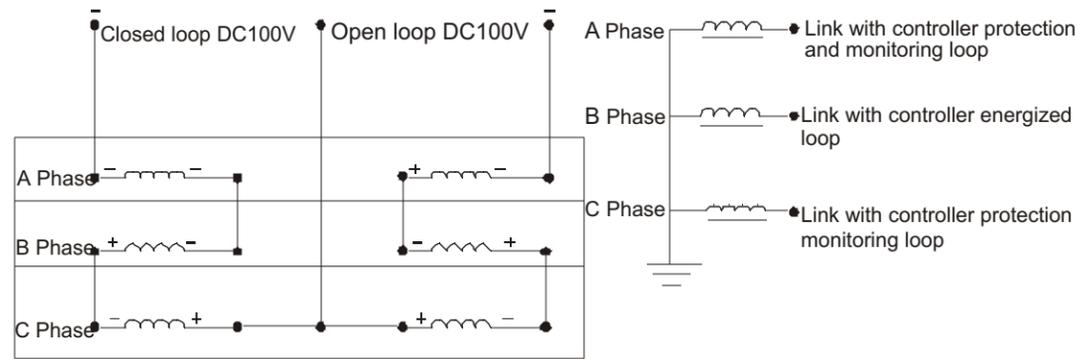


Fig.11, Internal electric principle diagram

7.9 Driving system of magnetic acuator mechansim

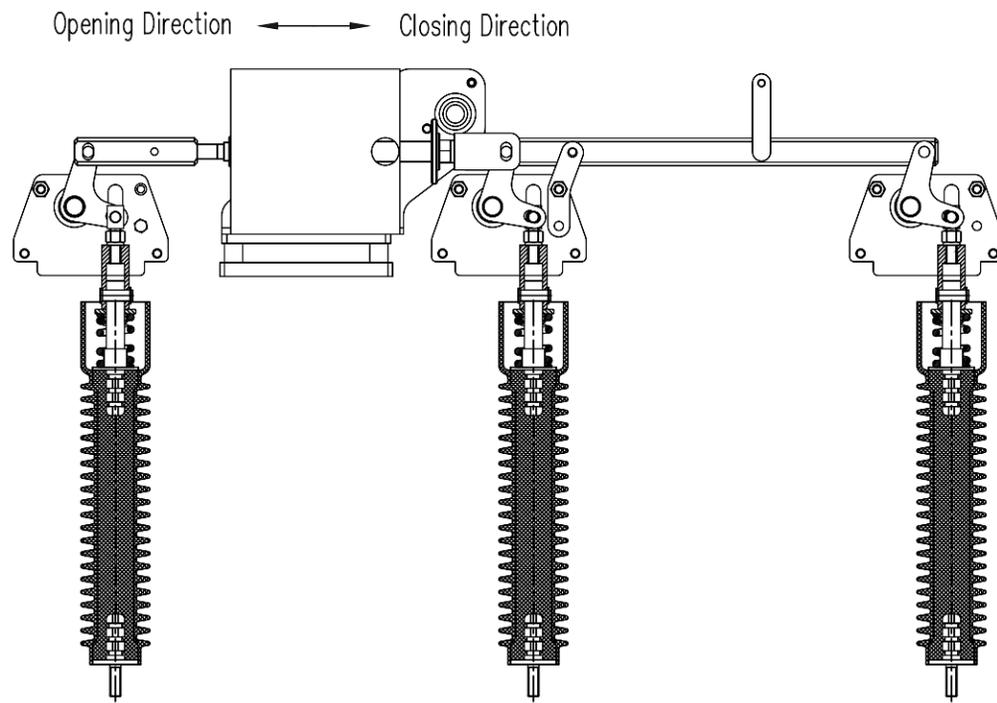


Fig.12 Internal driving system scheme

8. OPERATION MANUAL OF ACR CONTROLLER

About the Manual

This manual is designed to provide users with basic information of HYC2600-1 ACR controller, and focus on introducing the operation of the human-machine interface (HMI).

With regard to the technical characteristics of this controller, please read the "bound-volume edition of HYC2600-1 ACR controller technical manual."

Usage of the symbols

Electric warning icon: possibility of electric shock!

Warning icon: that is relative to the concepts of this article.

Information icon: recall the readers the relative facts and conditions.

Warning should be stated clearly for they are related to personal injury. Operation of damaged equipment may result in performance degradation of the device, thus to cause risks of accident or death. The warning labels should be strictly adhered to.

Safety information

All the maintenance, repair, installation and debugging personnel of HYC2600-1 ACR controller must be qualified and have read this manual.

Even dangerous voltage at the terminal of the rear panel would exist during the seconds when the secondary power supply is cut-off.

The chassis grounding bolt at the rear of HYC2600-1 must be connected properly.

HYC2600-1 can't be kept in the following environment: water vapor permeability, changeable temperature, vibration, dust, inflammable and explosive dangerous goods or corrosive gases.

HYC2600-1 has electrostatic sensitive devices, so that anti-static wristband should be put on when open the chassis for the sake of avoiding direct contact with the equipment.

It would have no claim on warranty if the equipment seals are damaged and no longer ensure the normal operation.

8.1 SUMMARY OF ACR CONTROLLER HYC2600-1

1.1 HYC2600-1 ACR controller is a new generation of digital relaying control terminal produced by Huayi Power Automation System. It can protect, control, measure and monitor the grid with voltage below 40.5kV. It is suitable for a variety of system operating modes, including isolated neutral system, resistance-grounded system and arc suppression coils grounding system.

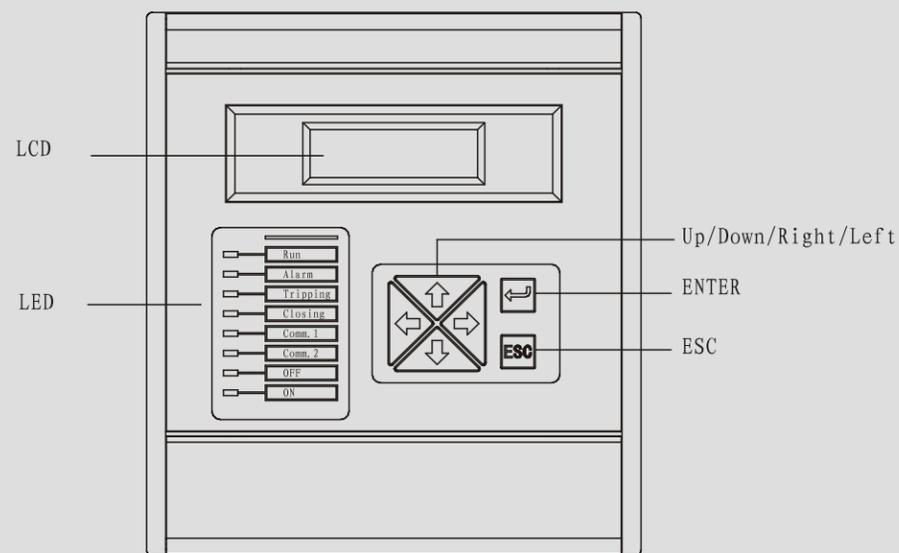


Fig.1: ACR Relay Layout Drawing

HYC2600-1 series device collect full power value and isolate the measurement current circuit from the protection current circuit, which not only improve the reliability of protection but also ensures the measurement accuracy. High-precision measurement function ensures the factor of voltage, current and power to grade 0.2, as well as the factor of grade 0.5 to four-quadrant power measuring and metering.

HYC2600-1 series supports function of GPS B code time setting. Two RS485 channels support for the double-net communication mode as well as the communication protocol of Modbus and IEC60870-5-103. It provides extremely reliable net communication for the users, for different protocols could be applied into different networks.

The controller is able to restore four groups of setting value, which greatly facilitates different operating mode.

1.2 Main characteristics

◇ **Rich interface resources**

The interface resources provided by HYC2600-1 are: the input passband of 7 channels AC current and 4 channel AC voltage. 10 channel switching value input passband (suitable for AC and DC), 7 channel switching value output; the communication interface has two RS485 and one RS232 maintenance ports.

◇ **Flexible and convenient connection method**

The four AC voltage inputs of HYC2600-1 can connect with the phase voltage, Line voltage or zero-sequence voltage or unbalanced voltage, which adapt to a variety of PT Connection.

◇ **Highly reliable design**

With the design principles of stable, reliable and durable, industrial components are adopted, all connections with the outside world are fully isolated as well as anti-lightning protection circuit and power filter are built in. Professional EMC

design provides a fundamental guarantee for the reliability of operation through real-time monitoring towards the device input power, analog and digital power supply, as well as perfect self-check program. To monitor the input power helps HYC2600-1 to save the important data in good time before the power is removed.

◇ **Events record in order**

HYC2600-1 will provider users 100 pieces of SOE for fault analysis (100 is a circle, namely, the next first SOE will cover the 101 SOE), the resolution of SOE is 1ms. SOE can not only record various protection actions but also filtered switching value deformation, as well as other information for fault analysis, which includes power-on, power-off, reset, self-test error of device and signal reversion, remote operation, modification of protection valuation.

◇ **High-precision measurement**

The measurement function of HYC2600-1 can measure IA、IB、IC、I0、Ua、Ub、Uc、Uab、Ubc、Uca、P、Q、F、fs、PF precisely and monitor the protection current Ia、Ib、Ic, as well as measurement towards forward kWh, reverse kWh, forward kVarh, reverse kVarh. The measurement accuracy of voltage, current and power factor reaches to grade 0.2, the accuracy of power and electric degree reaches to grade 0.5. The maximum frequency measurement bias is ±0.01Hz calculation error caused by fundamental frequency fluctuation can be eliminated completely through adopting the frequency tracking technique, and real-time monitoring the changes of system frequency, as well as adjusting the time interval of data sampling.

◇ **Accurate time setting**

HYC2600-1 has three types of time setting: time setting of artificial device panel, communication time setting and IRIG-B code time setting. Among them, artificial instrument panel is rough time setting, generally for debugging; and the precision of communication time setting is less than ±100ms; whereas the precision of IRIG-B code time setting reaches to ±1ms. Accurate time setting ensures the reliability of SOE information, and enhances their value in the fault analysis. Particularly, the clock accuracy will not be affected (the clock keeps on running) even when reset or short-term power-off occur.

1.3 Performance index

◇ **Rated data**

- Power: 110/220VDC or VAC , allowable deviation +15%, -20%;
24/48 VDC, allowable deviation +15%, -20%.
220VDC or VAC gap break (IEC 60255-11) 100 ms device without losing power
- AC voltage: 110V or 110/√3 V, linear measurement range is 0.2V~150V.
- AC current: 5A, 1A
Measuring linear range is 0.01A~6A(5A) or 0.002A~1.2A(1A);
Protecting linear range is 0.1A~120A(5A) or 0.02A~24A(1A);
I0 measuring linear range is 0.02A~20A or 0.004A~4A is optional.
- Frequency: 50Hz, the measurement range is 45.00 Hz~55.00 Hz.
- Phase sequence: ABC

◇ **Power consumption**

- Power: normal<7W; exit actuation <10W
- AC voltage: <0.3VA/circuit (when it is rated input)
- AC current: <0.2VA/phase (when it is rated input)

◇ **Output interface capability**

- Continuous power: 6A (DC)
- Switched current: 20A (DC)
- Breaking capacity (10,000times of operation, L/R=40ms):5A/48VDC or 1A/220VDC
---(trip). (Overload relay)
1A/48VDC, 0.15A/220VDC
---(signal). (Signal relay)

Actuation time: <5 ms

◇ **Switching value input**

Insulation voltage rating: 5kVDC.

Rated voltage value: 110/220VDC or VAC, allowable deviation $\pm 20\%$;
24/48 VDC, allowable deviation $\pm 20\%$.

Current consumption: <3m A/circuit.

Filtering time: 0ms~999ms can be set, Filtering time will not affect the accuracy of recording time.

◇ **Communication**

Insulation voltage rating: 2kV DC (except RS232)

RS485 port: baud rate 1200、2400、4800、9600、19200、38400 are optional

Communication protocol: IEC60870-5-103 protocol、Modbus, see appendix of communication part

RS232: baud rate is fixed at 19200, exclusive for PLPShell. Non-public communication protocol

Communication media: GSM or GPRS wireless communication can be used, specific operation requires consultation with the manufacturer.

◇ **IRIG-B input**

To adopt RS422 apparatus standard or TTL reception level IRIG-B. Non-modulation signal (optional)

Insulation voltage rating: 2kVDC

TTL receiving load: <2 mA (steady state)

RS422 receiving load: <0.2 mA (steady state)

Time setting accuracy: ± 1 ms

◇ **AC sampling and processing**

Filtering circuit: second-order low-pass filtering, cut-off frequency is 700 Hz, quality factor is 0.707.

Software filtering: full-cycle cos frequency

Sampling frequency: 32 point/cycle

Actuation interval of protection and control algorithm: 1/4cycle

Actuation interval of measuring algorithm: 1cycle

◇ **Actuation precision of steady-state protection and control**

Phase current element: $\pm 3\%$

Voltage element: $\pm 3\%$

Phase angle: $\pm 2^\circ$

Frequency element: ± 0.01 Hz

Slip: ± 0.1 Hz/s

Time element: ± 15 ms (1.2 times setting value, includes export time)

Fixed actuation time <35 ms

Curve timing of inverse time limitation: $\pm 5\%$ or ± 40 ms

Coefficient of over-value return: 0.98

Coefficient of under-value return: 1.02

◇ **Precision of measurement and metrology**

Phase current: $\pm 0.2\%$

Voltage: $\pm 0.2\%$

Phase angle: $\pm 0.5^\circ$

Rate factor: $\pm 0.5\%$

Frequency: ± 0.01 Hz

Power: $\pm 0.5\%$

KWh: $\pm 0.5\%$

Temperature coefficient: $\pm 2\text{ppm}/(^{\circ}\text{C})^2$

◇ **Ambient conditions**

Temperature range of operation: $-20^{\circ}\text{C} \sim +65^{\circ}\text{C}$

Temperature range of transportation and storage $-35^{\circ}\text{C} \sim +70^{\circ}\text{C}$

Humidity: 15%~95% non-condensing

IEC60068-2-2 dry heat testing

IEC60068-2-1 dry cold testing

Cyclic damp heat test: IEC60068-2-30, relative humidity >93%, T=20~65 $^{\circ}\text{C}$

Storage temperature testing: IEC60068-2-48

◇ **Insulation performance(IEC 60255-5)**

Dielectric strength (between the loop and ground, between the independent circuits): 2kV, 50 Hz/1minute

Impulse withstands voltage: $\pm 5\text{kV}$ (1.2/50us, 0.5J)

Insulation resistance: >100M Ω , 500VDC

◇ **Mechanical testing**

IEC60255-21-1: 1 stage

Impact testing: IEC60255-21-2: 1 stage

Earthquake testing: IEC60255-21-3: 2 stage

◇ **Electromagnetic compatibility**

Anti-interference towards high-frequency: IEC 60255-22-1: 3 stage (1MHz, 2.5kV common-mode and 1.0kV differential-mode)

Anti-static discharge: IEC 60255-22-2: 4 stage ($\pm 8\text{kV}$ contact discharge)

Anti-frequency magnetic interference IEC 1000-4-8: 5 stage (100A/m)

Anti-radiated electromagnetic field interference IEC 60255-22-3: 3 stage (10V/m, f=80~1000M Hz)

Anti-fast transient disturbance interference: IEC 60255-22-4: 4 stage (2.5kHz & 5kHz, $\pm 4\text{kV}$)

Anti-surge interference: IEC 1000-4-5: 4 stage ($\pm 5\text{kV}$ common-mode, $\pm 2\text{kV}$ differential-mode)

8.2 DEVICE PANEL INTRODUCTION**2.1 LED screen**

The LED of the device is 128*32 lattices, which displays both English letters and Chinese characters with back lightening.

The LCD screen on human machine interface (HMI) can display 4 lines of English or 2 lines of Chinese characters. The device can be operated locally. It is convenient for users to search and set through supporting software PLP-Shell®.

2.2 Indicators (LED)

There are 8 indicators on the relay; the meaning of each indicator is stated as below:

Run: green, flashes when the unit operates normally

Alarm: yellow, it lights up to show there is alarm output

Tripping: red, it lights up when there is tripping output

Closing: red, it lights up to show the closing output

Comm. 1: green, flashes during the operation of communication1.

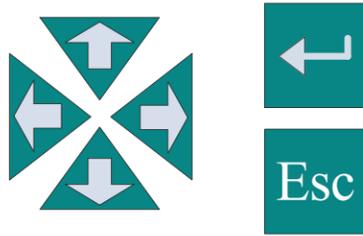
Comm. 2: green, flashes during the operation of communication2.

OFF: green, it lights up when the state of the switch is OFF

ON: red, it lights up when the state of the switch is ON

2.3 Key-presses and key combination

The panel has 6 key-presses like figure2 has showed, and their functions are shown in the following figure (fig. 2).



(Fig. 2)

Figure 2

Up/Down		move the cursor up/down or numerical additional setting
Left/Right		move the cursor left/right or switching between the main screens
Enter		confirm the content displays on the main screen
Back/Delete		back to the upper menu/ without saving the modifications made

Key combination:

- (1) Signal reset key: appears beneath the main screen, the operating relay and the indicators on the panel are reset in 3 seconds after having pressed the “down” and “back” keys simultaneously.
- (2) SOE (event record) delete key: press “enter” and “back” keys simultaneously beneath the interface of event record, all the event records are deleted.

8.3 MAIN SCREEN INTRODUCTION

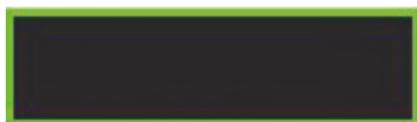


figure 3



figure 4



figure 5

Start Screen

The following graphics (figure3-5) will be showed in order once the device is turn on.

The quality of the LED can be checked through whether there has missing images or not.



figure 6

The ideal boot image is defined as the 8 indicators light up orderly and correctly. Then, the event record image of “device power on” appears, and switch to the “main image” automatically in seconds (figure 6); or, when there is the event record image, press “back” key twice, the main screen appears.



figure 7

Main screen

The main screen has a total number of 6 pages (figure7-12). The monitoring images are displayed in order when press the “left” “right” keys. They are respectively: Secondary current protection value, primary circuit current measurement value, secondary line voltage, primary line voltage, primary actual power and power factor, secondary four-quadrant metrology kWh. The current screen page is showed on the right scroll bar.

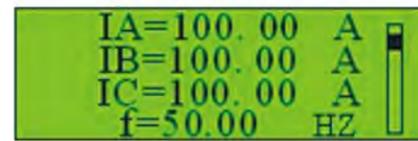


figure 8

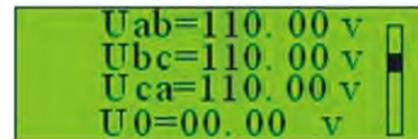


figure 9

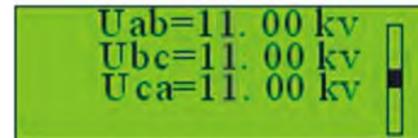


figure 10

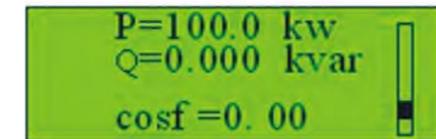


figure 11

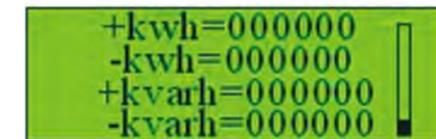


figure 12

8.4 MENU INTRODUCTION



figure 13

No matter which main image is, press “enter” to the main menu, just like figure13 shows. The main menu includes 5 articles: fixed protection value, unit parameters, unit record, unit testing and unit information. The main menu options can roll and cycle by pressing the “up” ,” down” keys respectively. The selected one is displayed with black surround, then press “enter” to the submenu of the next level and back to the main screen by pressing the “back” key.

HYP2600-1 is shown in figure 14, Users can choose the correct channel in accordance with the actual needs.

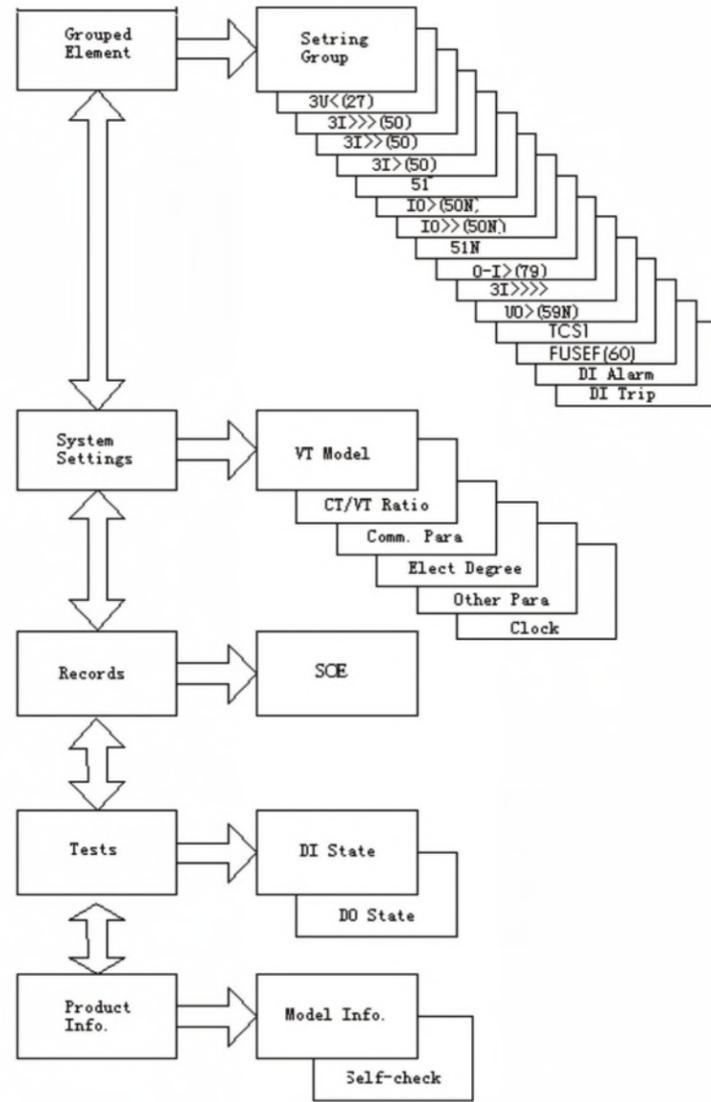


Figure 14

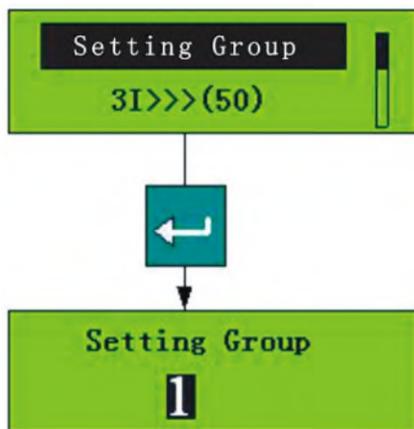


Figure 15

4.1 Fixed protection value setting

The protection functions of each protection device are different; however, they have the same setting method. Firstly, groups of fixed value are set, and then each function needs to throw/withdraw the control word, as well as the fixed current or voltage value and fixed time value are set. The fixed values of the control word and current of each function are in the same menu. All the fixed values are set through "left", "right" keys. This manual takes instantaneous protection for example. It requires password to change the original setting. Part 5, user password is the password description.

Groups of fixed value setting

The default of the groups is 1, namely, the first group. The password is showed by pressing the "enter" key (if the operation doesn't carry out in 1minute, the password is no more in effect). Press "up", "down" to make a choice between

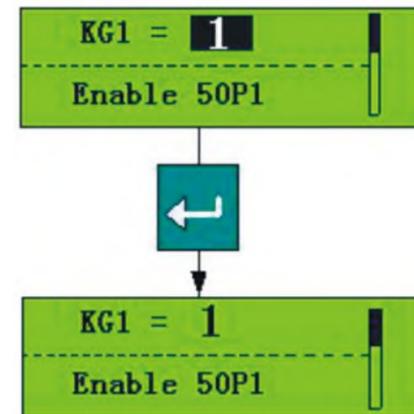


figure 16

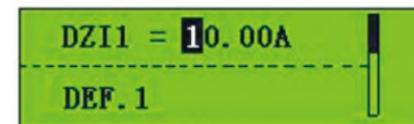


figure 17



figure 18



figure 19

the groups. Press "enter" when the setting is finished, then press "back" twice, there will appear the menu of "save settings on exit", "exit without saving". "Enter" represents "save settings on exit", whereas "back" represent "exit without saving".

Take fixed instantaneous value for example

The fixed instantaneous value includes the throwing and withdrawing of control word, fixed instantaneous current value. When the throwing and withdrawing of control word is ready, turn the pages by pressing the "left", "right" keys to set the fixed current value.

- 1) Throwing and withdrawing of the protection control word. After having pressed the "enter" key, a choice between throw or withdraw is made by pressing "up" or "down", 1 represents throwing, and 0 represent withdrawing. The fixed current value is chosen through "left", "right" key after having pressed the "enter" key.
- 2) Setting of current fixed value. Firstly, press the "enter" key to the edit page, then press the "left", "right" keys to move the cursor, finally, press the "up", "down" keys to adjust the values.
- 3) Firstly, press the "enter" key to exit the edit page, secondly, press "back" to the top-level menu, and then press "back" again, finally press "enter" to save the modification, whereas press "back" key means no saving.

4.2 Unit Parameter

The setting of the unit parameter includes the following 6 articles:

- 1) VT wire connection mode
- 2) CT/VT ratio (two rated values are displayed together)
- 3) Communication parameter
- 4) kWh value
- 5) Other parameters (protection element, minimal pulse of tripping and closing, password)
- 6) Clock

The graphics are shown as below after having entered into the unit menu. The "up", "down" keys are used to make a free choice among the 6 articles, and then press "enter" to the next-level menu.

4.2.1 VT Wire connection mode

Press "enter" to choose the method, the switching of graphics is shown as below: Choose the connection mode by pressing the "up", "down" keys. There are two kinds of wire connection modes:

- Mode 1: Ua、Ub、Uc、U0/UL
- Mode 2: Uab、Ubc、U0

Mode 1 is three-phase voltage with zero-sequence voltage input, namely, voltage wire connection belongs to the connection mode of star topology.

Mode 2 is line voltage with zero-sequence voltage input, namely, the connection mode is angle topology.

4.2.2 CT/VT Ratio

Name	Range	Step Length	Unit
CT ratio	1-9999	1	No
VT ratio	1-9999	1	No

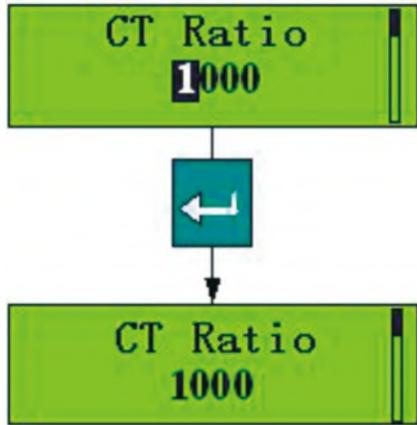


figure 20

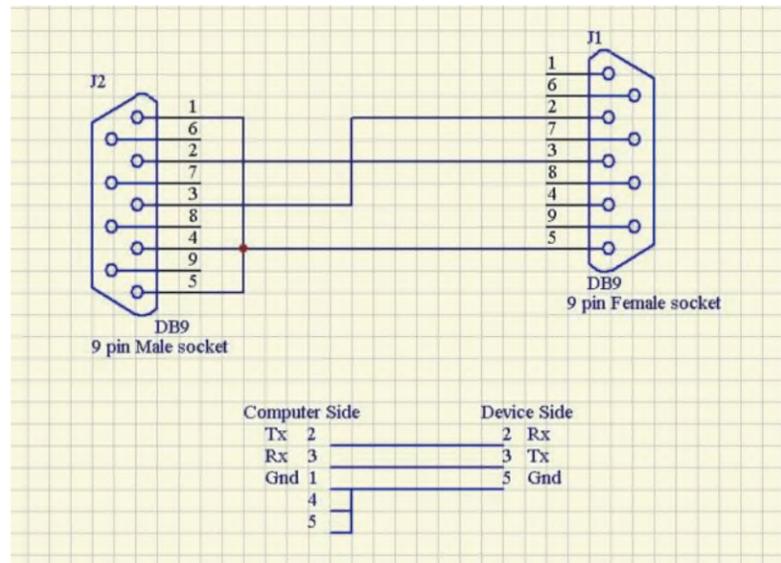
- 1) The setting of CT ratio
The graphics of CT ratio setting is shown as below: the bits of number is decided by pressing the "left", "right" keys, and the numerical value can be changed by pressing the "up", "down" keys, then press "enter" to save it.
- 2) Press "left", "right" to make a choice between CT setting and VT setting, as well as VT ratio setting and CT ratio setting.

4.2.3 Communication parameter

The communication parameters which need to be set include communication address, communication speed, and communication protocol.

The communication terminal DB9 at the lower left of the HYC2600-1 panel is used to connect with the interface RS232 (DB9) of PC machine which is installed with the PLPShell software package. The connection cable is with the machine (see the following figure). (2-pin, receiving; 3-pin, sending; 1, 4, 5 are grounding)

Tip: well-grounded is necessary when the maintenance port RS232 is connected with the desktop computer. When it is connected with the luggable computer, built-in battery is recommended to supply power instead of using power cord.



The operation mode of the maintenance port RS232 and the 485 port 2 on the rear panel of the relay is either-or mode. Once the connecting cable is plug into the terminal DB9 on the HYC2600-1 panel, the 485 port 2 stops working soon, and it starts to work again once remove the communication cable from the relay.

The communication parameter of this maintenance port RS232 is fixed: the speed rate is 19200bit/s, parity check, 1 initiation bit, 1 stop bit, no handling control signal, the communication address is 254.

The communication parameters need to be set include communication address, communication speed rate and communication protocol.

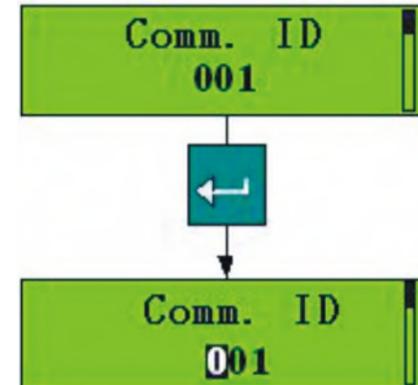


figure 21

- 1) Communication address
The rang of communication address: 1-255
The setting graphics are stated as below:
Press "left", "right" keys to move the cursor, whereas the numerical value is adjusted by pressing the "up", "down" keys.

- 2) Communication speed rate
The baud rate which is able to be set by the communication speed rate are 1200, 2400, 4800, 9600, 19200, 38400.(unit: bit/s)
Different baud rates are chosen by pressing the "up", "down" keys at this moment.

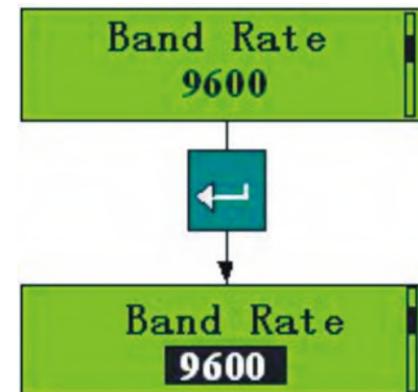


figure 22

- 3) Communication protocol
Press "enter" when the communication speed rate is set, and then choose the communication protocol by pressing "left", "right" keys. This protection device series has two communication protocols: 60870-5-103 and MODBUS -RTU.
Press "up", "down" keys to choose communication protocols at this moment.

4.2.4 kWh value

kWh value includes: forward active kWh, reverse active kWh, forward reactive kWh, reverse reactive kWh. The setting graphics are shown as below: Press "left", "right" keys to move the cursor, and the numerical value is adjusted by pressing the "up", "down" keys. The other three values are set similarly. The unit is kWh.

Notice: the KWh values here are quadric, the actual KWh value needs to be multiplied by the ratio of CT and VT.

4.2.5 Other parameters

A total of three other parameters, see the table below:

	Name	Range	Step Length	Unit	
1	Protection component	two-phase / three-phase	no	no	three-phase
2	Minimum pulse-width of tripping and closing	0~9.99	0.01	S	0.5
3	user password	0~99999	1	no	000000

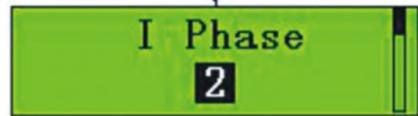
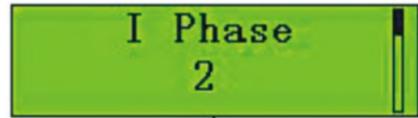


figure 25



figure 26



Enter

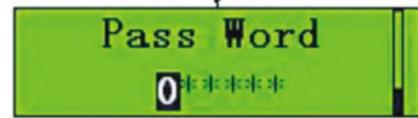


figure 27



figure 28

1) Protection component

There are two kinds of protection components, namely, two-phase and three-phase. The setting method is shown as below:

Press "up", "down" keys to make a choice between two-phase and three-phase at this moment.

2) Minimum pulse-width of tripping and closing:

The setting method is shown as below:

Press "up", "down" keys to adjust the numerical value.

3) User password

The resetting of the parameters and fixed value of the device needs a password to access. The setting steps of the password are shown as below:

At this moment, move the cursor through the "left", "right" keys, whereas the numerical value are adjusted by pressing the "up", "down" keys.

The initial password is: 000000

4.2.6 Clock

Time settings include the setting of year, month, day, hour, minute, seconds; the screen graphic is shown as the Figure below:

Press the "left", "right" keys to move the cursor, while the numerical value is adjusted by pressing the "up", "down" keys.

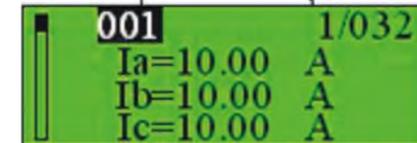


figure 29



figure 30

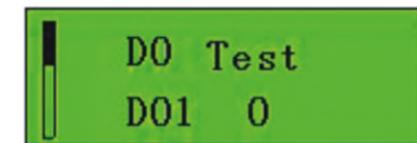


figure 31



figure 32



figure 33

4.3 Event record

The event record mainly refers to SOE. The latest event is always No.1. The device restores 100 pieces of SOE and each piece can be browsed by pressing the "up", "down" keys. Every piece of information has two graphics, in which the first one shows the SOE serial number, time (year, month, day, hour, minute, second), the name of the event. Take instantaneous fast-break for example, the specific time of the actuation in graphic is at 999 ms 12:21:16 on May 5, 2006; the second graphic includes two situations: if it is protection Actuation, then it records the component value of the Actuation has happened, the state after deformation and the serial number of SOE (figure 29); otherwise, it only shows the SOE serial number. The example indicates the three fault-current A, B, C phase are 10A.

The switching of the two graphics is by pressing the "up", "down" keys directly, it shows in the figure.

4.4 Unit testing

The unit testing mainly tests the switching input value (DI) and switching output value (DO) of the device.

There are two testing graphics; they are respectively the switching input test and the switching output test. Press the "left", "right" keys to make a choice between the two graphics.

The graphic of switching input testing is shown as below:

There are 10 numbers from the left to the right, which respectively represent the state of the ten switching input values.

The graphic of the switching output testing is shown as below:

There are 7 channels in the graphic of switching output, namely, DO1-DO7. Press "up", "down" keys to check the state of all switching output channels. It requires a valid password to enter into the testing menu for Actuation testing. (The password should be valid), then press "up", "down" keys to choose the channel, and next press "enter" to test the switching output.

Tip: the seventh channel is always closing, the others are always opening.

4.5 Unit information

The unit information has two pages of submenu, press "left", "right" keys to turn the pages. Page1: check the module, version, serial number, see figure32.

- ◆ The serial number of HYP2600-1 consists of 11 numbers • AA CC DD EEEEE • AA: Represents the module (the serial number of the device is 04, if the module is HYP461)
- ◆ CC: Represents the year (06)
- ◆ DD: Represents (weeks)
- ◆ EEEEE: Represents serial number

1) Correct self-checking is shown in the following graphic:
Means the self-checking has passed, the internal chip and logic are correct.



figure 34

2) Self- checking error

There are 8 situations of self- checking error, The eight squares from left to right represent their own situations. "X" in square refers to errors exist. Their meanings are respectively stated in the following table:

1	Control word error
2	Fixed value error
3	Logical data error
4	RAM error
5	Fixed value setting error
6	FRAM error
7	Clock error
8	Blank

8.5 USER PASSWORD

The password consists of 6 numbers. The password dialog box pops and require valid password input before resetting or setting actuation take place.

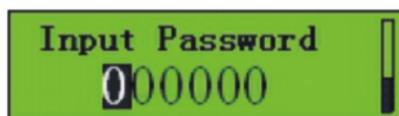


figure 35

Press "left", "right" keys to change the position of the cursor, press "up", "down" keys to change the position of the cursor, and then press "up", "down" to adjust the numerical value. After having input the password, press "enter" to the resetting page.

The original password of the unit is 000000.

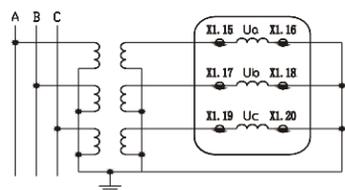
8.6 ELECTRICAL WIRE CONNECTION

6.1 Wire connection of AC value

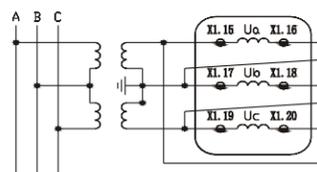
HYC2600-1 is double CT design of measurement and protection. It provides accurate measuring function under the premise of ensuring the reliability.

X1.1 and X1.2, 1.3 and X1.4,X1.5 and X1.6 of the backpanel of HYC2600-1 is respectively correspond to the A, B, C phase of the protecting CT; X1.7 and X1.8 of the backpanel are zero-sequence CT, which can provide reliable grounding protection; 1.9 and X1.10、 X1.11 and X1.12、 X1.13 and X1.14 are respectively correspond to A, B, C phase of the measuring CT, which can adopt two-phase or three-phase connection mode.

X1.15 and X1.16、 X1.17 and X1.18、 X1.19 and X1.20 are respectively the voltage A, B, C phase, which can adopt either the Y topology connection or Δ topology connection in accordance with the wire connection mode of VT. Just like the following figure shows, X1.21 and X1.22 are correspond to the input of opening voltage, to achieve the input of full power value with the above AC wire connection.



Y topology connection



Δ topology connection

6.2 Input/output wire connection

HYC2600-1 provides the switching value input of ten channels, all the switching value inputs are non-polar, which can connect with AC/DC voltage. The switching value inputs must have the same polarity, because they have one termination connected with the public termination.

The 7th channel electromagnetic relay in HYC2600-1 is non-polar contact. In addition to the OUT7 is always closing contact output, the other 6 channels are always opening contacts.

6.3 Communication wire connection

HYC2600-1 provides double RS485 communication interface. X2.3、 X2.4 and X2.5 on the back panel constitute RS485(1) communication terminals, which are respectively called RS485-(1)、 RS485+(1) and SHIELD(1) (communication area1). X2.6、 X2.7 and X2.8 constitute RS485(2) communication terminal, which are respectively called RS485-(2)、 RS485+(2) and SHIELD(2) (communication area2). In order to avoid circuit caused by grounding current, the connected shielding layer and SHIELD must and only be grounded at one end, which is usually grounded in the master end of the station. Each communication node must ensure perfect connection of the shielding layer.

8.7 ACR CONTROLLER & RELAY OUTLINE & INSTALLATION DIMENSION

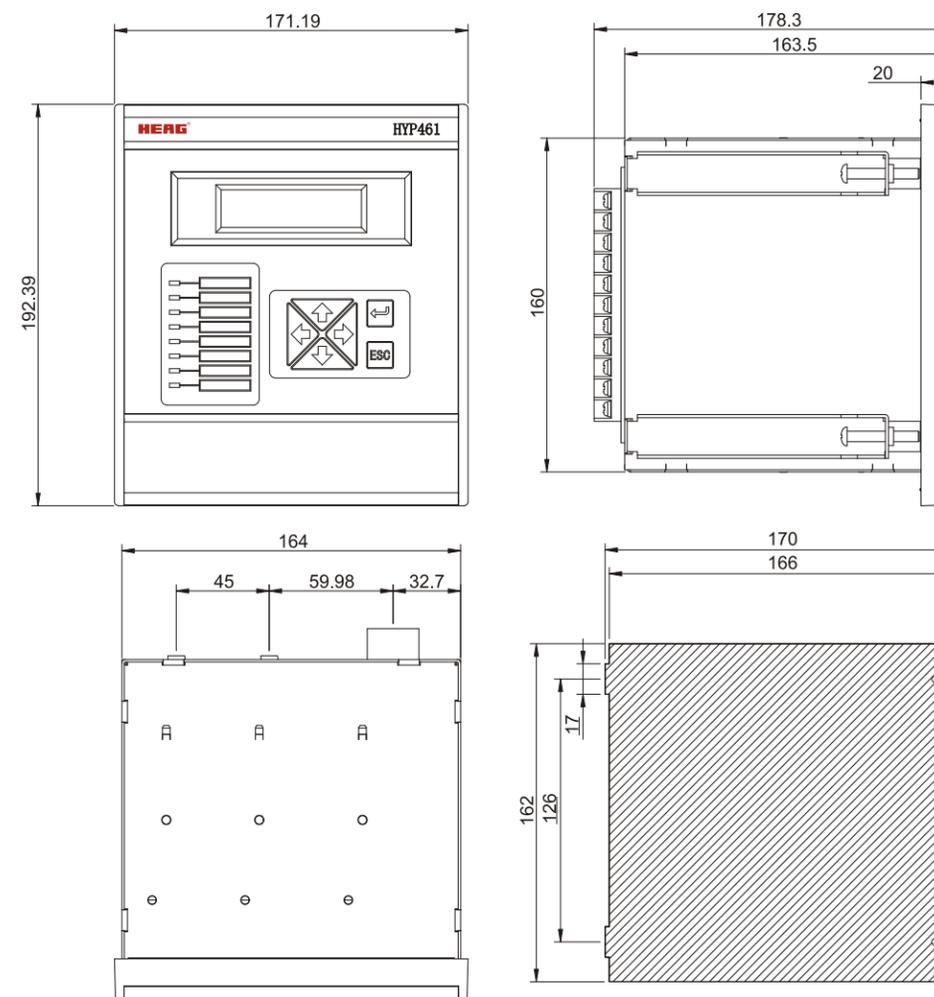


Fig.36. Outline & Installation Dimension of ACR Relay(unit: mm)

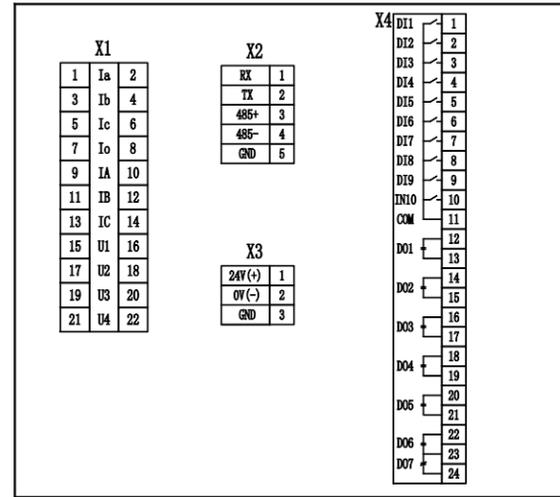


Fig.37 Rear Terminal Layout of Relay

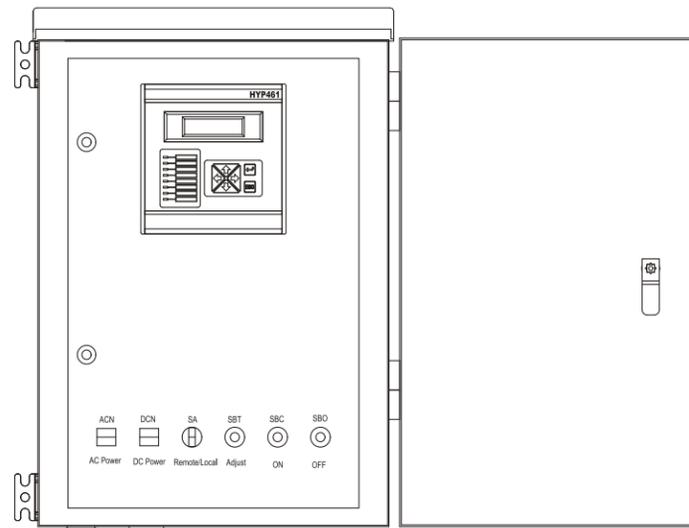


Fig. 38 ACR Controller Surface Layout Drawing

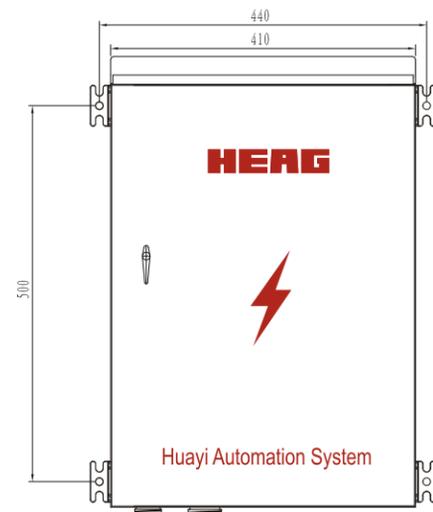


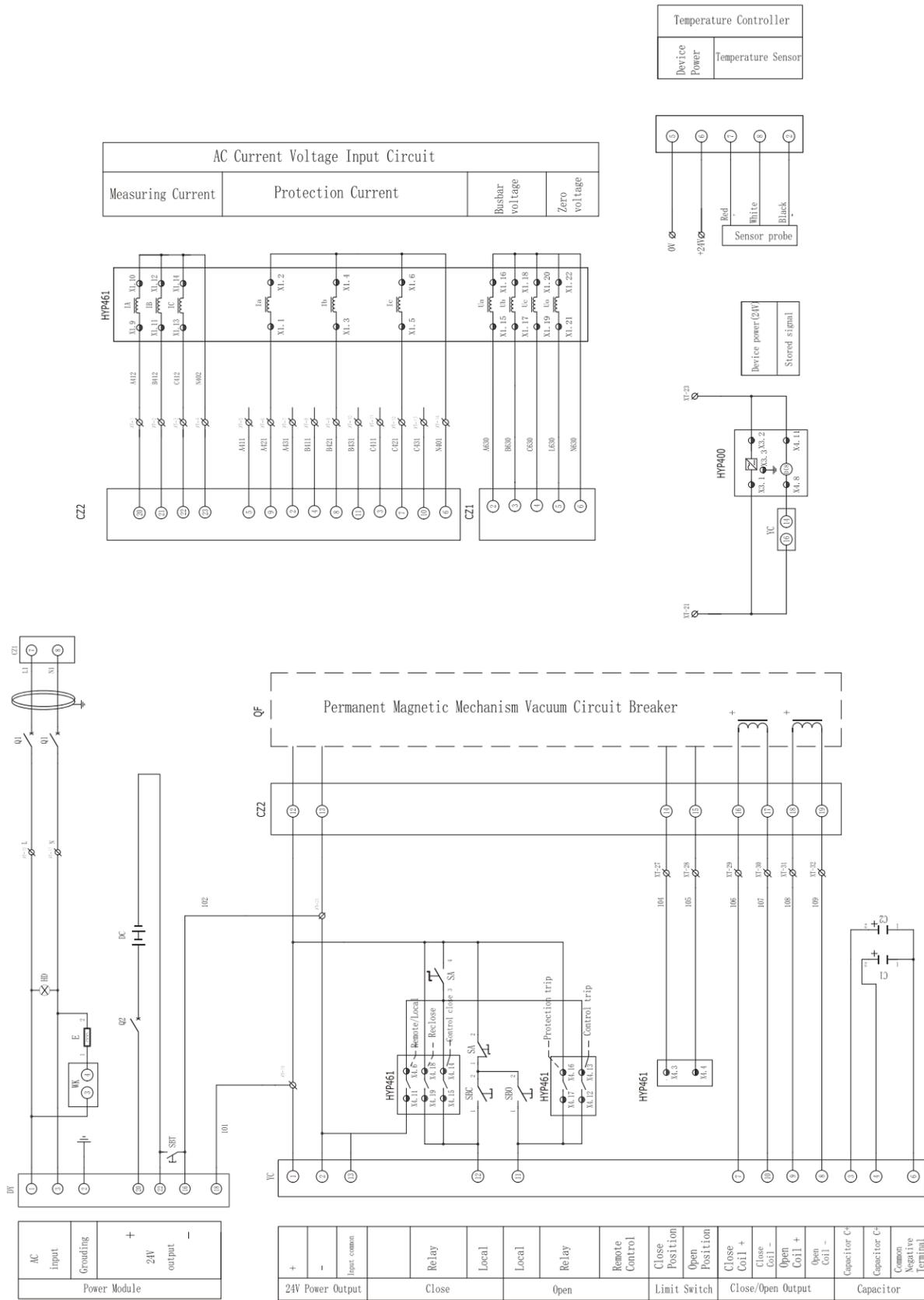
Fig.39 ACR Controller HYC2600-1 Outline Dimension



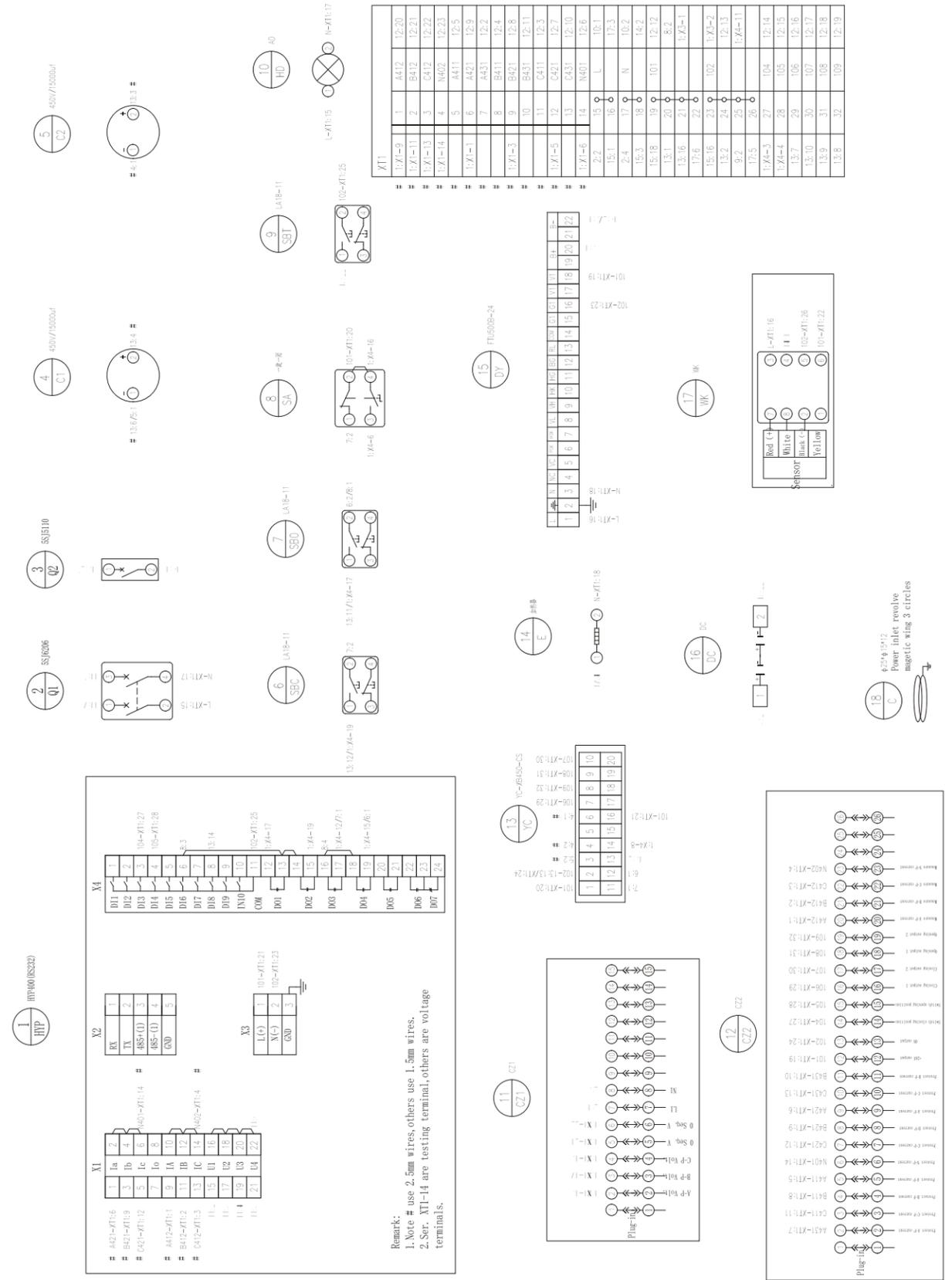
Fig.40 Rear side view of controller



Fig.41 Internal layout of main devices



2-a) Principle control diagrams of ACR controller(Permanent Magnetic) as ref.



2-b) Typical secondary wiring diagrams of ACR controller(Permanent Magnetic) as ref.

8.8 MAINTANENCE AND FAQ

Categories	Issues	Causes	Solutions
Protection	The relay does not trip	The function is prohibited Out-of-service Blocking under conditions	To check whether the self-testing information is correct or not Throw the corresponding protective control words on To check whether the conditions of blocking is satisfied or not
Common	The indicators on the panel fail to light on when HYC2600-1 is power on	Lack of power voltage Protective fuse melted Protective fuse is not installed Wiring error	To check the power voltage To use new T 3A protective fuse To install T 3A Protective fuse To check the auxiliary power terminal No.
Common	The clock is extremely inconsistent with the actual time, when HYC2600-1 is power on	The button battery ceases to be in effect inside the device	Replacement of new 3V button battery
Communication	The RS232 port of HYC2600-1 panel is enable to communicate with the Shell	Wrong communication cable Damage of the communication cable Ungrounded of HYC2600-1 or PC	To use special cable offered by the manufacturer To use a new communication cable To ensure reliable grounding of them two (grounding is unnecessary for portable PC and is powered by battery)
Communication	Enable to communicate with the RS485 port of the HYC2600-1 back panel	Communication parameter error of PC Damage of RS 232 port of PC polarity error of wiring Ungrounded of ACR Controller or the main station Communication parameters or protocols are inconsistent	To check the communication parameter setting of PC. To check whether the RS232 port of PC is well operating. To exchange the +/- wire To ensure correct grounding of them. To check the setting of communication parameters and protocols



The devices on each PCB inside the HYC2600-1 chassis are almost electrostatic sensitive, so well-grounded anti-static wristband must be worn when open the chassis.

9. ACCESSORIES CAN BE CHOSEN

No.	Item	Specification	Photos
1	Connecting Terminals	For ACSR Cable or Copper XLPE Insulation Cable	
2	Lightning Arrester	Rated Voltage MCOV 5kA/10kA Basic Insulation Level	
3	Voltage Transformer Single Phase or 3-ph combined	Outdoor Cast Resin Dry Type Ratio Accuracy & Burden	
4	Distribution Transformer	Single Phase or 3-Ph combined	
5	Mouting Accessories	Brackets, Hooks, Steel Channel	As request

10. TRANSPORTATION, ACCEPTANCE AND STORAGE

- 1). The automatic circuit recloser shall be completely packed and fixed in the sealed packing box for transportation. During transportation, roll-over and leaning is prohibited and the shockproof measure shall be provided. During portage, the pole, wiring terminals and current transformer shall not be shocked.
- 2). After receiving the equipment, the user shall check if the package is good, and the solid sealed insulator is broken or not after opening the package, check if the documents, accessories and spare parts are complete and good according to the packing list, check if the technical data on the nameplate and the eligible certificate accord with the ordering requirements.
- 3). The automatic circuit recloser shall be stored indoor or in the warehouse, which is dry, ventilated, dampproof, shockproof and will not be eroded by harmful gas. Packing, unpacking and storage shall be indoor.

11. INSTALLATION, OPERATION AND MAINTENANCE

- 1). The operator shall have a preliminary understanding of the performance, installation, debugging and maintenance of the equipment, and shall record the problems occurring during operation and inform the manufacturer if necessary.
- 2). The user shall not loosen the bolts and nuts of the auto recloser and try to open it. Before delivering operation, please carefully check if rated voltage and current of each operating component accord with the practical situation, and non-electrically debug the mechanism to check each action.
- 3). Connect earth line well according to the earthing symbols. Installation bolts shall be 4 pieces of M12 40 and details as per table.
- 4). The installation of the automatic circuit recloser, controller and power transformer refers to Fig.5-6.

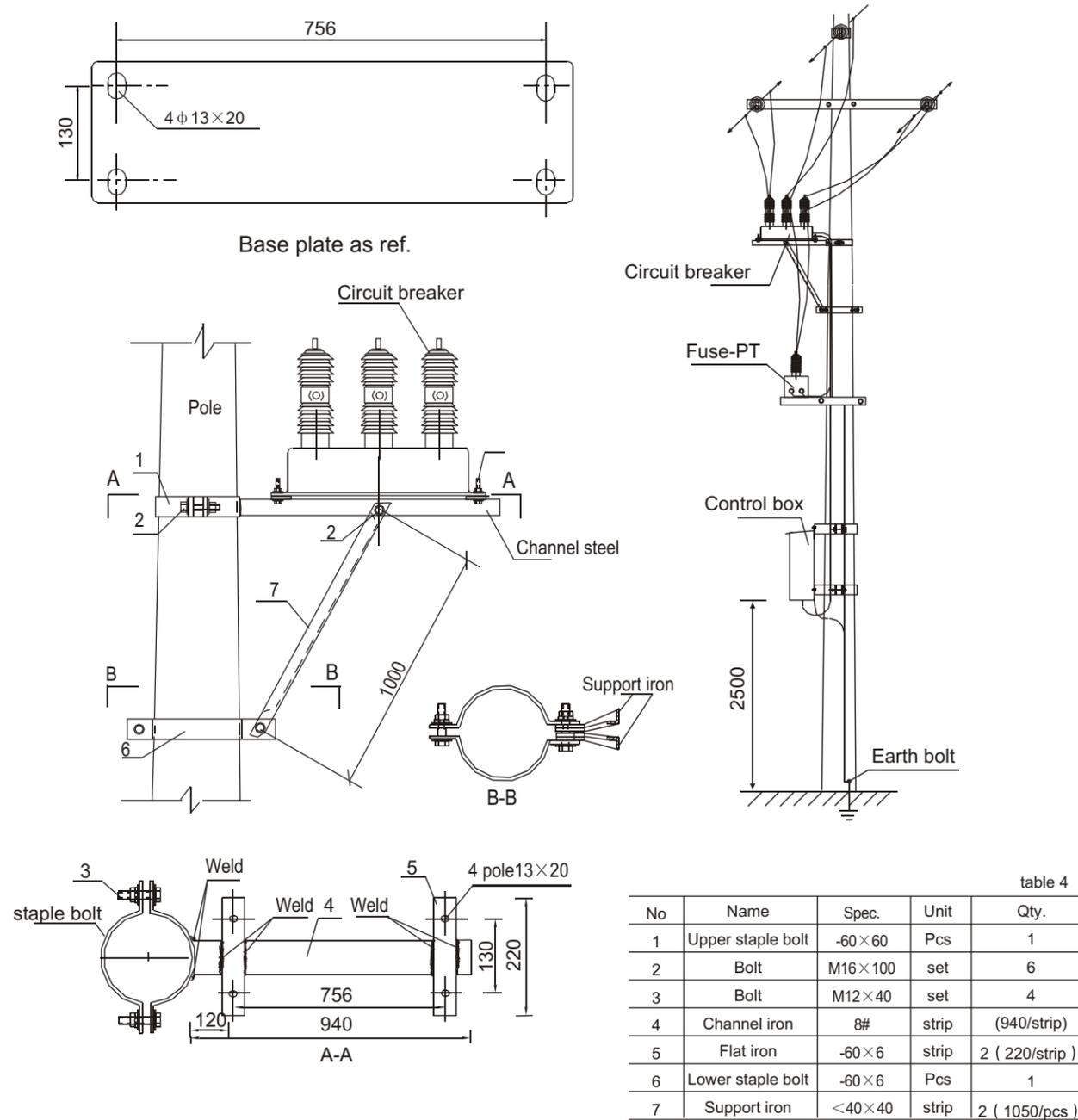


Fig.42 Single pole installation of ACR(CHZ-12) as ref.

12. AUTOMATIC CIRCUIT RECLOSER INSTALLATION SITES



12kV ACR in Belarus



24kV ACR in Viet Nam



40.5kV ACR in Viet Nam



24kV ACR in Peru

Fig.43 Site Installation Photos as ref.