TY8690 Series Protection and control Equipment
(Volume 1)

Operation Manual

Tunanrz Electric Power Technology(Nanjing) Co,Ltd

Version number

Ver2.0

Version revision record of product manual

10				
9				
8				
7				
6				
5				
4				
3				
2	2.0	Operating circuit, DI all AC/DC universal	V2.0	2020/05/19
1	1.0	Initial Version	V1.0	2019/12/23
Ser.NO.	**Specification Version No.**	**Modification Abstract**	**Software Version No.**	**Modification Date**

* Technical support Tel: 13951851876

* This manual may be modified. Please check whether the actual product is consistent with the version of the manual

* The first printing of the 1st edition in December 2019

Table of Contents

Volume 1

Volume 2

Chapter 1 Device Overview

1 Overview

1.1 Main uses and programs

Measurement and Control Equipment TY8690 series of protection by the line protection, transformer protection, capacitor protection, reactor protection, standby power from the cast, composed of motor protection, can be used for 110kV and below voltage levels of various industrial and mining enterprises and power industry. By using a high-performance 32-bit CPU to integrate protection, measurement and control, and communication functions, it is suitable for substation integrated automatic systems or new energy power plant electrical automation systems. Devices can be installed Group centralized screen can also be directly installed in the switch cabinet to carry out decentralized control.

1.2 Technical Features

- ✧ Using the most popular high-speed processor, frequency up to 200 MHz, rich built-in resources, easy external circuit design, product manufacturing quality assurance and stability. Sufficient hardware resources, 8M bytes Flash Memory.
- ✧ Measuring three-phase current and zero-sequence current (Ia, Ib, Ic, I0), three-phase or line voltage (Uan, Ubn, Ucn, Uab, Ubc, Uca), active power P, reactive power Q, power factor cosφ, frequency f, meritorious electricity kWh, reactive power kVarh.
- ✧ The measured values of current, voltage, power, and electrical degrees not only reflect the fundamental wave, but also correctly reflect the 2~13th harmonic, and the frequency is 45~60HZ adaptive, so that the measurement results are consistent with the special measuring meter.
- ✧ Along with DC 4 ~ 20mA analog output (can be customized for the current, voltage or power) to replace capture transmitter communicate.
- ✧ Up to 15-channel DI, users can customize the name.
- ✧ Way to protect the export of components through the tripping matrix setting, the convenience of users to select the relay action. Contact may choose to export all the relays for tripping contact (automatic return) or signal contact (after reversion back).
- ✧ Independent operating circuit which can adapt to the 0.5A~5A switch tripping and closing current, and the operating circuit is universal for AC and DC.
- ✧ GPS time synchronization can adopt the network time synchronization method, and also supports the B code time synchronization method (RS485 interface) and the SNTP method.
- ✧ Differential protection to prevent equipment to start or outside the failure resulting in differential protection saturated TA maloperation criterion.
- ✧ Valid and reliable criterion disconnected TV effectively prevent low-voltage electrical components malfunction.

- ✧ Two 100M Ethernet communication interface, one RS485 communication interface, support the IEC60870-5-103, Modbus and other protocols.
- ✧ 16 recorders, the largest recorded wave volume contains the 13-channel analog (interval 1mS). Wave was recorded using standard Comtrade format.
- ✧ The full graphical programming technology, as well as stable and reliable protection relay library, improve reliability and correctness of the procedure.
- ✧ Machine static low power consumption (about 6W), LCD module using the new technology, life expectancy increased substantially.
- ✧ High anti-interference performance, by 10 Electromagnetic Compatibility Testing & Certification, fast transients, electrostatic discharge, surge anti-interference performance are the highest grade (IV grade) standard.
- ✧ Working ambient temperature range: -25 ℃ ~ +55 ℃ (liquid crystal non-fuzzy, slow phenomenon).

1.3 Protection device type and configuration

Device Type	Function Deployment	Scope
TYL8691 Line Protection And Control Equipment	3-zone composite voltage overcurrent protection / 3-zone directional zero-sequence overcurrent protection / Overload protection / Autoreclosing / Manual closing synchro-check / Closing Post-acceleration protection / Low frequency load shedding/Undervoltage load shedding / Lower current ground wire selection /Measurement	35kV and below the line voltage
TYT8691 Transformer Differential Protection Equipment	Differential Protection / Differential instantaneous protection / Differential current overcurrent alarm / TA wire break blocking	Differential Protection / Differential instantaneous protection / Differential current overcurrent alarm / TA wire break blocking
TYT8691F Transformer's Noumenon Protection Equipment	Transformer's noumenon protection / Independent Trip circuit	
TYT8692 Transformer Backup Protection Equipment	3-zone composite voltage overcurrent protection / Zero-sequence overcurrent protection / Gap zero-sequence overcurrent protection / Zero-sequence overvoltage protection / Overload protection/Starting ventilation / On-load voltage-regulated blocking / Measurement	
TYT8693 Transformer Protection And Control Equipment	3-zone composite voltage overcurrent protection / Overcurrent inverse time-limit protection /2-zone negative sequence overcurrent protection / HV side zero-sequence overcurrent protection / LV side zero-sequence overcurrent protection / LV side zero-sequence inverse time-limit overcurrent protection / Overload protection / Overvoltage protection / Undervoltage protection / Noumenon protection / FC blocking / 4-20mA output / Measurement	Plant transformers, used transformers and ground transformers below 2000kVA
TYT8694 Transformer Protection And Control Equipment	2-zone differential Protection / Differential instantaneous protection / Differential current overcurrent alarm / TA wire break / 3-zone composite voltage overcurrent protection / Inverse time overcurrent protection / 2-zone definite time-limit negative-sequence overcurrent protection / HV side definite time-limit zero-sequence overcurrent protection / LV side definite time-limit zero-sequence overcurrent protection / LV side inverse time-limit zero-sequence overcurrent protection / Overload protection / Overvoltage protection / Undervoltage protection / Noumenon protection / FC blocking / 4-20mA output / Measurement	Plant transformers, used transformers and ground transformers below 2000kVA
TYC8691 Capacitor Protection And Control Equipment	Instantaneous overcurrent protection / Overcurrent protection / Overvoltage protection / Undervoltage protection / Zero-sequence overcurrent protection / Neutral unbalance overcurrent protection / Neutral unbalance overvoltage protection / Measurement	Shunt Capacitor Bank
TYR8691 Reactor Differential Protection And Control Equipment	Differential Protection / Differential instantaneous protection / 3-zone composite voltage overcurrent protection / Zero-sequence overcurrent protection / Overload protection / Measurement	Series reactor, cable lines

TYP8691 Standby Power Supply Automatic Throw-over Equipment	Bus coupler Automatic Throw-over / Incoming line Automatic Throw-over / Transformer Automatic Throw-over / Plant power supply Automatic Throw-over	Standby Power Supply Automatic Throw-over Equipment
TYV8691 TV Protection Equipment	2-zone undervoltage protection / Busbar insulation Check / Measurement	35kV and below TV cabinets
TYV8692 TV parallel equipment	TV parallel	Single busbar section system
TYV8693 TV parallel equipment	TV parallel / 2-zone undervoltage protection	Single busbar section system
TYM8691 Motor Differential And Integrated Protection	Differential protection + Integrated protection +Measurement	Asynchronous motors of 2000kW and above
TYM8692 Integrated Motor Protection And Control Equipment	Instantaneous overcurrent protection / Overcurrent protection / 2-zone negative-sequence overcurrent protection / Negative-sequence inverse time-limit overcurrent / Overheat protection / Rotor-locked protection / Single-phase ground fault protection / Undervoltage protection / Overload protection / Non-electric quantity protection / FC blocking / 4-20mA / Measurement	Asynchronous motors below 2000kW
TYM8693 Synchronous Motor Differential And Integrated Protection	Differential Protection + Integrated Protection + Measurement	Synchronous Motor
TYM8694 Synchronous Motor And Integrated Protection	Out of step protection / Reverse power protection / Current instantaneous protection / Definite time-limit overcurrent protection / Inverse time-limit negative-sequence protection / Overheat protection / Locked-rotor protection / Single-phase ground protection / Undervoltage protection / Overload protection / Non-electric quantity protection / Measurement	Synchronous Motor
TYM8695 Motor Differential Protection Equipment	Differential protection / Differential instantaneous protection / Differential current overcurrent alarm / TA wire break blocking	Asynchronous or Synchronous Motor
TYJ8691 Frequency and Voltage Emergent Equipment	Under-frequency load shedding / Over-frequency load shedding / Under-voltage load shedding / Over-voltage load shedding / Zero-sequence overvoltage protection	Power plant grid-connected system
TYJ8692 Anti-islanding Protection Equipment	Under-frequency load shedding / Over-frequency load shedding / Under-voltage load shedding / Over-voltage load shedding / Reverse power protection / Power loss protection / Zero-sequence overvoltage protection / External intertrip	Photovoltaic wind power grid-connected system

2 Technical performance and indicators

2.1 Rated electric parameters

✧ Power supply

Operating Voltage: AC/DC 86~264V

Ripple coefficient: not larger than 5%

✧ Rated current, voltage

AC current: 5A or 1A; (Specify when ordering)

AC Voltage: 100V or $100\sqrt{3}$V.

2.2 Principal technical indices

✧ Accurate operating range

Current: 0.04In ~ 20In (In =5A or In =1A);

Voltage: 1V ~ 150V;

Frequency: 45Hz~60Hz

✧ Measuring accuracy

Voltage, Current: Class 0.2; (Including harmonics)

Power: Class 0.5; (Including harmonics)

Frequency： ≤±0.01Hz;

4-20mA DC： Class 0.5. (Specify When Ordering)

✧ Setting error

Current components: ≤±2.5% setting value or $\pm 0.01I_N$;

Voltage components: ≤±2.5% setting value or $\pm 0.005U_N$;

Action time error: definite time protection, no more than (±1% setting value + 40)ms; inverse time limit protection, no more than ±5% setting value or ±40ms.

✧ Telesignalling resolution

Less than 2ms。

✧ GPS time-check

IRIG-B: DC Time Code, RS485 interface; NTP time-check: Ethernet interface.

✧ Contact capacity

Operation of circuit tripping current and closing current: 0.5A ~ 5A adaptive; AC/DC trip circuit self-adaptation.

Trip space contact: 5A (DC220V closure of capacity); signal space contact: 5A (DC220V closing capacity).

2.3 Environmental conditions

Ambient temperature: -25°C ~ +55°C

Relative humidity: 5% ~95% (No condensation or freezing inside the product)

Atmospheric pressure: 66Kpa ~ 106Kpa

2.4 Power consumption

AC current circuit: As I_N = 5A, not larger than 0.5VA each phase;
As I_N = 1A, not larger than 0.3VA each phase;

AC voltage circuit: At rated voltage, not larger 0.5VA each phase;

DC power supply circuit: For normal operation, not larger than 10W;
As the system operates, not larger than 20W.

2.5 Overload capability

AC current circuit: at 2 multiples of rated current, continuous operation; at 10 multiples of rated current, 10s is permitted; at 40 multiples of rated current, 1s is permitted.

AC voltage circuit: at 1.4 multiples of voltage, continuous operation

2.6 Insulation performance

✧ Insulation resistance

Under normal test atmospheric conditions, the insulation resistance of the system between the externally leading active circuits and the open non-active metal parts as well as the housings and between the electrically unconnected circuits is measured by a 500V megger to be not lower than 100MΩ.

✧ Media strength

Under normal test atmospheric conditions, the system can tolerate the 50Hz, 1min. power frequency withstand voltage test and no breakthrough flashover and element damages will occur. During the test, as the voltage apply at any tested circuit, the other circuits will interconnect and ground equipotentially.

✧ Impulse voltage

Under normal test atmospheric conditions, such circuits as DC input circuit, AC input circuit, output contacts, etc. to ground and between the electrically unconnected circuits can tolerate the short-duration impulse voltage test of 1.2/50μs standard lightning waves and its open-circuit test voltage is 5kV.

2.7 Humid-heat tolerant performance

The system can tolerate the constant humid-heat test stipulated in GB/T7261.20. The test temperature is +40°C ±2°C, relative humidity, (93±3)% and test duration, 48h. Within 2h before the end of the test, the insulation resistance between the external lead live circuit part and the exposed non-live metal part and the shell, as well as the circuit without electrical connection should not be less than 1.5Mω; The dielectric strength shall not be less than 75% of the specified dielectric strength test voltage value.

2.8 EMC

	Item	Request

1	RF radiated electromagnetic field immunity	The protection conforms to radiated, RF electromagnetic field immunity test class III stipulated in the standard GB/T 14598.9 — 2002(IEC 60255-22-3:2000，IDT).
2	Electric fast transient pulse group immunity	The protection conforms to electrical fast transient/burst immunity test class IV stipulated in the standard GB/T 14598.10—2007(idt IEC 60255-22-4:2002).
3	1MHz pulse group immunity	The protection conforms to 1MHz pulse group immunity test class III stipulated in the standard GB/T 14598.13—2008(eqv IEC 60255-22-1:2007).
4	Electrostatic discharge anti-interference	The protection conforms to the electrostatic discharge immunity test class 4 stipulated in the standard GB/T 14598.14—1998(idt IEC 60255-22-2:1996).
5	Radiated emission value limiting test	The protection conforms to radiated emission value limiting test class A stipulated in the standard GB/T 14598.16—2002(IEC 60255-25:2000，IDT).
6	Surge (impulse) immunity	The protection conforms to surge (impulse) immunity test class 4 stipulated in the standard GB/T 17626.5—2008(idt IEC 61000-4-5:2006).
7	RF induction conduction degree harassment	The protection conforms to immunity to conducted disturbances, induced by radio-frequency fields class 3 stipulated in the standard GB/T 17626.6—2008(idt IEC 61000-4-6:2006).
8	Power frequency magnetic field immunity	The protection conforms to power frequency magnetic field immunity test class 4 stipulated in the standard GB/T 17626.8—2006(idt IEC 61000-4-8:2001).
9	Pulsed magnetic field immunity	The protection conforms to pulse magnetic field immunity test class 4 stipulated in the standard GB/T 17626.9—1998(idt IEC 61000-4-9:1993).
10	DC power supply voltage dips and voltage interruptions influence	Allow GB/T8367-1987 (eqv IEC 60255-11:1979) called for 100ms voltage interruption, 30% voltage dips 0.5s

2.9 Mechanical performance

	Item	Request
1	Vibration	The system can tolerate the vibration response test of severity Class I stipulated in 3.2.1 of GB/T 11287-2000. The system can tolerate the vibration endurance test of severity Class I stipulated in 3.2.2 of GB/T 11287-2000.
2	Impulse	The system can tolerate the impulse response test of severity Class I stipulated in 4.2.1 of GB/T 14537-1993. The system can tolerate the impulse endurance test of severity Class I stipulated in 4.2.2 of GB/T14537-1993.
3	Collision	The system can tolerate the collision test of severity Class I stipulated in 4.3 of GB/T 14537-1993.

Chaper 2 Technical Manual

TYL8691 Line Protection And Control Equipment

1 Functions

- 3-zone composite voltage overcurrent protection
- 3-zone directional zero-sequence overcurrent protection
- Overload protection
- 3-phase Autoreclosing
- Manual closing synchro-check
- Closing Post-acceleration protection
- Low frequency load shedding
- Undervoltage load shedding
- Lower current ground wire selection
- I，U，P，Q，Cosφ，kWh，kVarh，15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 3-zone overcurrent protection

As any phase current is higher than the setting, the protection will trip after a time delay.

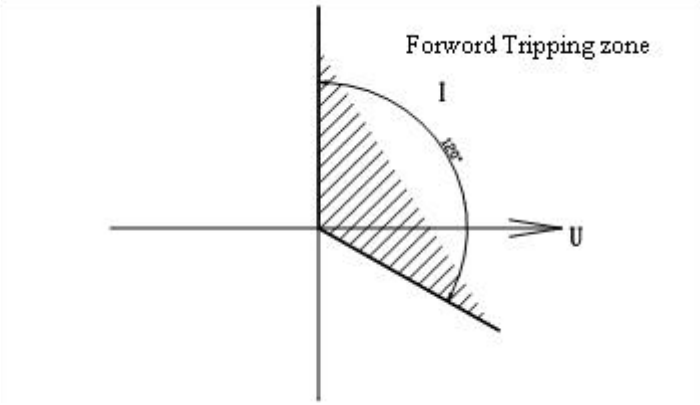
3-zone overcurrent protection control words may be represented by an independent selection inputs or exit, whether by the composite voltage required to start, whether the band direction.

When start by compound-voltage is selected: phase current is started by low voltage or negative sequence voltage, low voltage means that any line voltage is less than the low voltage setting value.

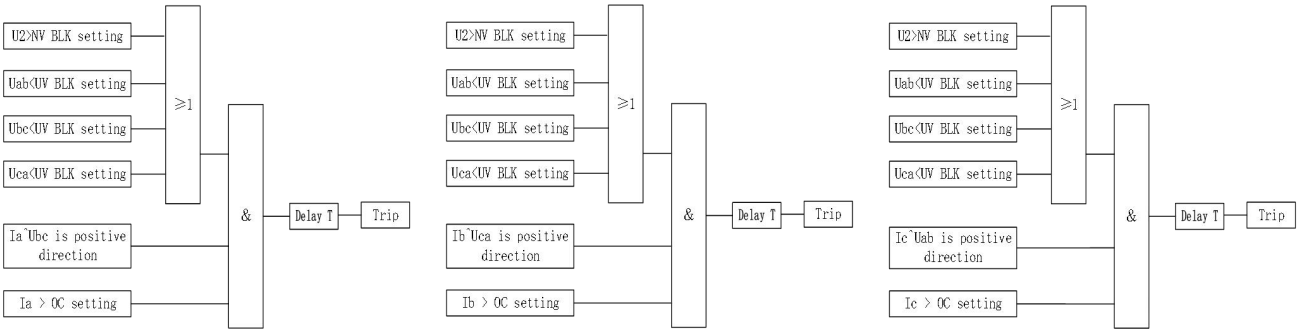
With the direction element: Ia and Ubc component A phase of the direction, Ib and Uca component B phase of the direction, Ic and Uab component C phase of the direction. When the relative current and voltage phase angle (-30 °~ +90 °), for the positive direction. Directional element with memory function to eliminate the direction of the proximal three-phase short-circuit component die area.

When the device detected Bus TV disconnected, the device automatically by repressing start or quit with the direction of the overcurrent protection, for there was no compound-voltage start-up and not with the direction of the net impact of over-current protection from the TV disconnected.

The 3-zone overcurrent alarm is a pure overcurrent alarm without re-pressure blocking.



Directional overcurrent protection action zone



2.2 3-zone directional zero-sequence overcurrent protection

When a system uses a low resistance grounded approach, such as greater than 3I0 value by delay, zero-sequence I and II above tripping, zero-sequence III zone selection control word may be tripping or alarm.

To consider such as with the direction of three has become the direction of zero-sequence overcurrent protection paragraph.

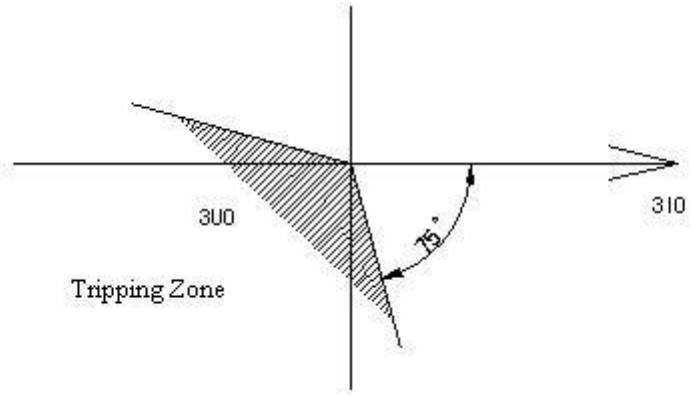
When 3U0 relative phase angle and 3I0 for (-75 °~ -195 °), the think are the positive direction.

The zero-sequence current 3I0 is collected by the external zero-sequence CT, and the zero-sequence voltage 3U0 is produced by the protection itself, that is, 3U0=Ua+Ub+Uc. When 3U0<2V, the zero-sequence direction overcurrent protection is automatically blocked.

Zero-sequence current 3I0 from protecting its own, taking three-phase currents and to protect, that is, 3I0 = Ia + Ib + Ic.

When the device detected Bus TV disconnected, the device automatically locking the direction of zero-sequence overcurrent protection. Who are not with the direction of flow of the zero-sequence protection from the impact of TV disconnected.

The zero-sequence 3-zone alarm is not affected by the zero-sequence voltage or TV disconnection, and is a pure overcurrent alarm.

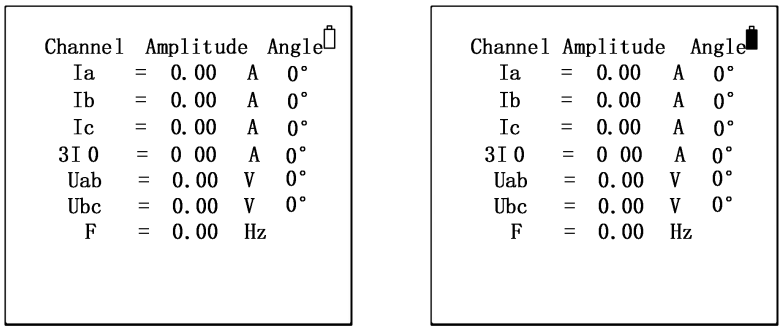


2.3 Overload protection

As any phase current is higher than the setting, the protection will alarm after a time delay.

2.4 Auto-reclosing

When reclosing function input and switches at close status and 15 seconds, not energy storage spring contact disconnect when three conditions are met, reclosing Charging completed (is reclosing ready, could be coincidence). After the reclosing charging is completed, the battery in the upper right corner of the device is marked as solid, otherwise it is hollow. At the same time, the reclosing charging remote signaling is enabled.



Before charging Charging completed

Reclosing charging is completed, once the protection of tripping or switch steal jump, after reclosing delay, Reclosing start.

Reclosing after, according to cast back seized without selection pressure, seized or not seized in the same period.

a) Seized over the same period reclosing conditions: | ∠ Ux - ∠ Uab - ∠ φ | ≤ seized close angle over the same period .

Note: ∠ Ux is angle for the line voltage;

∠Uab is angle for the bus voltage Uab;

∠φ is the angle at which Ux leads Uab due to different phases or system wiring under normal circumstances.

b) Non-pressure seizure Reclosing conditions: Ux ≤ seized without pressure value.

If Ux seized more than non-pressure setting, then automatically be converted to the same

period Reclosing seized.

c) Do not seized Reclosing: Ux not determine the amplitude or phase angle, direct reclosure.

After reclosing If it can not be completed within 10S Reclosing, then automatically the end of the reclosing.

When CB not ready, manually tripping, remote tripping, overload, low-cycle or low-voltage load shedding load shedding actions, the automatic reclosing feature atresia.

2.5 Manual closing synchro-check

When the relationship between Ux and Uab Satisfied Reclosing conditions over the same period and seized the hands together in the same period, the device 4X19, 4X21 contact closure, the user can be 4X19, 4X21 series access point manually switch loop, you can achieve manually Reclosing seized over the same period.

2.6 Closing Post-acceleration overcurrent protection

When the manual switch, remote control switch or reclosing action, if encountered failure, for fast removal of a fault protection device has accelerated. The protection monitoring switch from trip status into close status together after 3 seconds of current, such as greater than any one phase current value, after a short delay, the device tripping. 3 seconds after the exit post-accelerated protection automatically.

2.7 Low frequency load shedding

When the system is lower than the frequency value by delay, the device tripping.

Low-frequency load shedding function with under-voltage blocking, or slip locking function to prevent low-cycle load shedding maloperation.

Criterion for low-voltage latch-up: Uab, Ubc, Uca were lower than the low-voltage lock closure value, low-cycle load shedding atresia.

Criterion for slip atresia: Δf/Δt is greater than slip lock closure value, low-cycle load shedding atresia.

2.8 Undervoltage load shedding

When the switch is in the closed position, and the three line voltages are all lower than the fixed value, and the current of any phase is greater than the no-current fixed value, the device trips after a delay.

Any of the following conditions for the establishment of low-voltage load shedding will latch functions:

a) Any line voltage <30V

b) ΔU / Δt> closed lock voltage rate of change value, ΔU / Δt for the second term changes in the value of line voltage. When the line voltage below the set value, the voltage change rate. When the line voltage is greater than set value, the voltage rate of change of real-time updates.

c) The three-phase current is less than the no-current setting.

d) Switching at jump-bit

e) TV disconnected

f) Negative sequence voltage greater than 5V

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

2.9 Lower current ground wire selection

When a system neutral grounding or Petersen-coil grounded by the device and the main station together small current grounding line selection function.

When the system single-phase ground fault occurred, the devices determine the circuit breaker in the combined digital and 3U0 greater than 10V, the more limited 3U0 generate alarms. Master station detects 3U0 more limited after the alarm, access to the device records 3U0, 3I0 sampling, calculate strategy to give access locations.

2.10 TV disconnection alarm

The device has TV disconnection check function, when the device detects the TV disconnection, it will send alarm siginal.

1) The difference between any two-phase line voltage>30V;
2) Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

3 Setting

Setting Value Table

Ser.No.	Abbreviation	Name of setting	Unit	Range
1	OC-I current	Overcurrent zone I current	A	0.05~99.99
2	OC-I time	Overcurrent zone I time	S	0~60
3	OC-II current	Overcurrent zone II current	A	0.05~99.99
4	OC-II time	Overcurrent zone II time	S	0~60
5	OC-III current	Overcurrent zone III current	A	0.05~99.99
6	OC-III time	Overcurrent zone III time	S	0~60
7	CV UV-I setting	Complex-voltage Undervoltage zone I setting	V	10~90
8	CV UV-II SET	Complex-voltage Undervoltage zone II setting	V	10~90
9	CV UV-III SET	Complex-voltage Undervoltage zone III setting	V	10~90
10	CV NV setting	Complex-voltage negative-sequence voltage setting	V	1~99.99
11	ZOC-I current	Zero-sequence zone I current	A	0.05~30
12	ZOC-I time	Zero-sequence zone I time	S	0~60
13	ZOC-II current	Zero-sequence zone II current	A	0.05~30
14	ZOC-II time	Zero-sequence zone II time	S	0~60
15	ZOC-III current	Zero-sequence zone III current	A	0.05~30
16	ZOC-III time	Zero-sequence zone III time	S	0~60
17	OVLD current	Overload current	A	0.1~99.99
18	OVLD time	Overload time	S	0~60
19	Reclosing time	Reclosing time	S	0.2~10
20	Ux LD UabAngle	Ux leading Uab angle	°	0~359.9
21	RCLS SYNC-CHK	Reclosing synchro-check closing angle	°	0~60
22	RCLS No-V	Reclosing no-voltage check setting	V	1~30

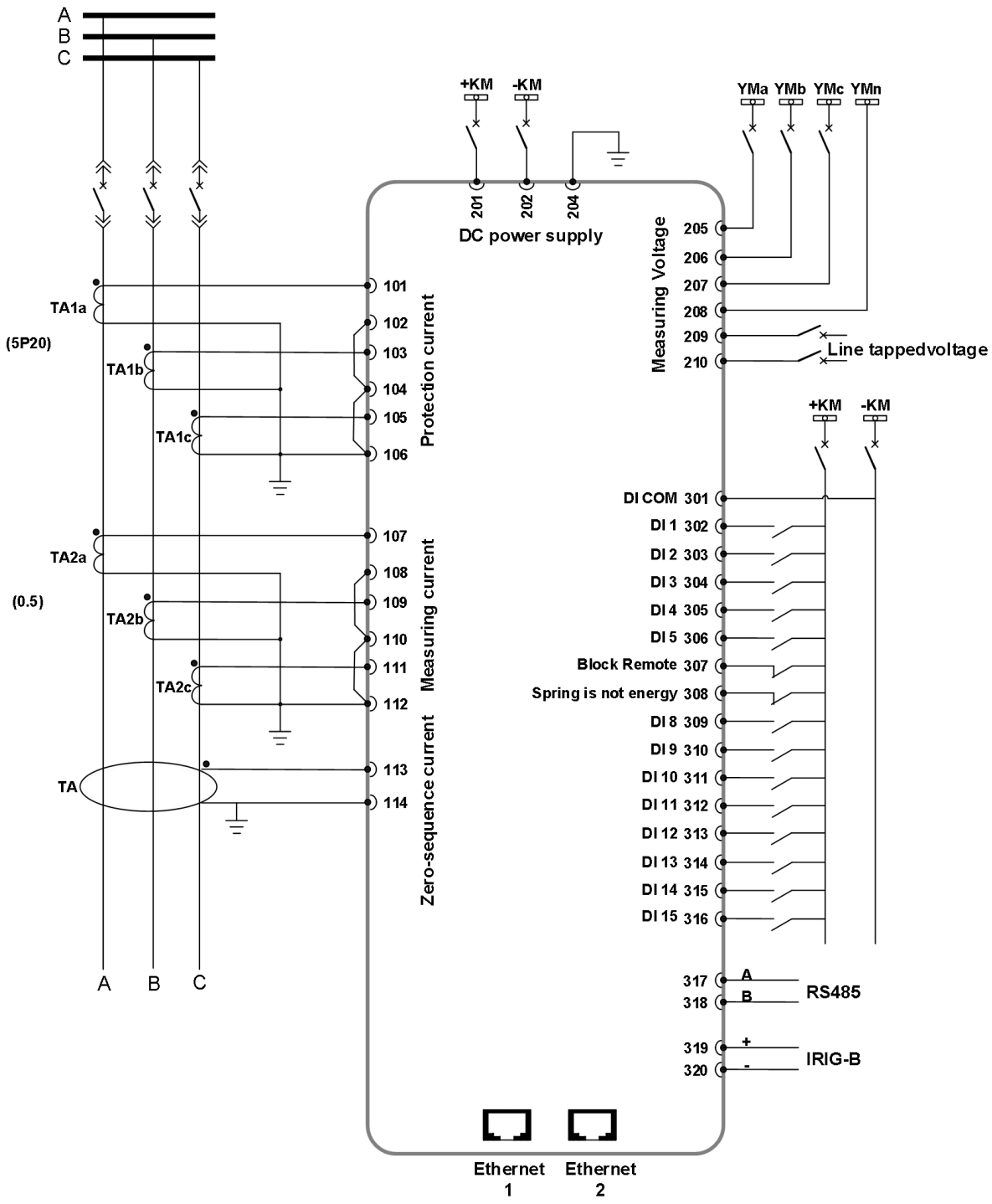
	CHK			
23	Post-Acc current	Closing Post-acceleration overcurrent current	A	0.05~99.99
24	Post-Acc time	Closing Post-acceleration overcurrent time	S	0~3
25	UFreq setting	Under-frequency load shedding setting	Hz	45~50
26	UFreq time	Under-frequency load shedding time	S	0.1~20
27	UV BLK UFreq SET	Undervoltage blocking under-frequency setting	V	10~90
28	Slip BLK UF SET	Slip blocking under-frequency setting	Hz/S	0.3~10
29	UV LS setting	Undervoltage load shedding setting	V	30~99.99
30	UV LS time	Undervoltage load shedding time	S	0.1~99.99
31	dv/dt BLK UV	dv/dt blocking undervolage	V/S	1~99.99

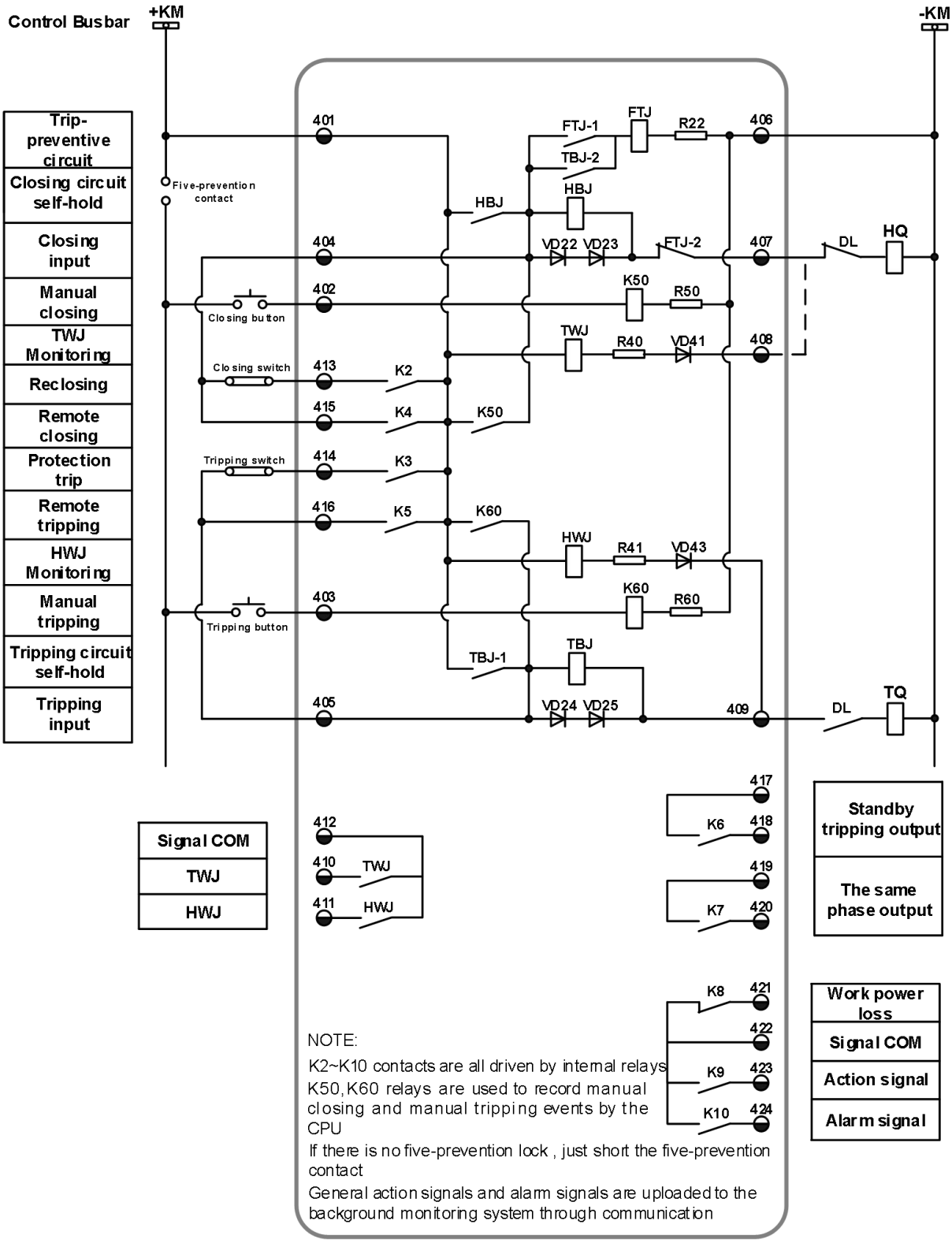
List of control characters

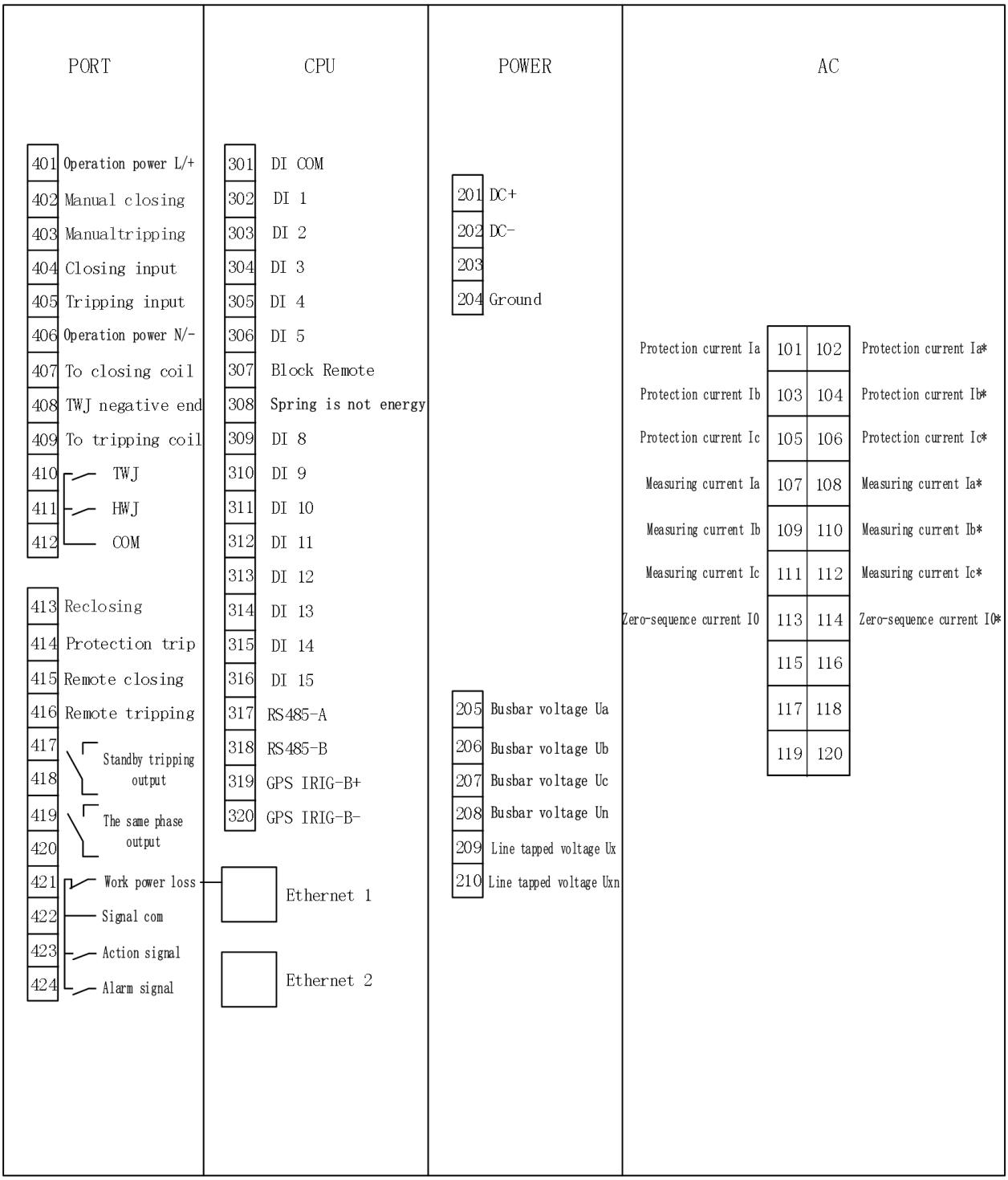
Ser.No.	Abbreviation	Name of control characters	Options
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON
3	Two to three	2 phase – 3 relay (measure Ia, Ic) calculate Ib= - (ia+ic)	□OFF □ON
4	OC-I switch	Overcurrent zone I switching on/off	□OFF □ON
5	OC-I DRCT	Overcurrent zone I direction	□OFF □ON
6	OC-I CV ST	Overcurrent zone I Complex-voltage starting	□OFF □ON
7	OC-II switch	Overcurrent zone II switching on/off	□OFF □ON
8	OC-II DRCT	Overcurrent zone II direction	□OFF □ON
9	OC-II CV ST	Overcurrent zone II Complex-voltage starting	□OFF □ON
10	OC-III switch	Overcurrent zone III switching on/off	□OFF □ON
11	OC-III DRCT	Overcurrent zone III direction	□OFF □ON
12	OC-III CV ST	Overcurrent zone III Complex-voltage starting	□OFF □ON
13	OC-III trip	Overcurrent zone III trip	□OFF □ON
14	OC-III alarm	Overcurrent zone III alarm	□OFF □ON
15	ZOC-I switch	Zero-sequence overcurrent zone I switching on/off	□OFF □ON
16	ZOC-I DRCT	Zero-sequence overcurrent zone I direction	□OFF □ON
17	ZOC-II switch	Zero-sequence overcurrent zone II switching on/off	□OFF □ON
18	ZOC-II DRCT	Zero-sequence overcurrent zone II direction	□OFF □ON
19	ZOC-III switch	Zero-sequence overcurrent zone III switching on/off	□OFF □ON
20	ZOC-III DRCT	Zero-sequence overcurrent zone III direction	□OFF □ON
21	ZOC-III trip	Zero-sequence overcurrent zone III trip	□OFF □ON
22	ZOC-III alarm	Zero-sequence overcurrent zone III alarm	□OFF □ON
23	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
24	Reclosing switch	Reclosing switching on/off	□OFF □ON
25	RCLS No-V CHK	Reclosing no-voltage check	□OFF □ON
26	RCLS SYNC-CHK	Reclosing synchro-check	□OFF □ON
27	MCLS SYNC-CHK SW	Manual closing synchro-check switching on/off	□OFF □ON
28	Post-Acc OC SW	Closing post-Acceleration overcurrent switching on/off	□OFF □ON
29	UFreq switch	Under-frequency switching on/off	□OFF □ON
30	UV BLK UFreq	Undervoltoage blocking Under-frequency switching on/off	□OFF □ON

31	Slip BLK UFreq	Slip blocking Under-frequency switching on/off	□OFF □ON
32	UV LS switch	Undervoltage load shedding switching on/off	□OFF □ON
33	dv/dt BLK UV	dv/dt blocking undervoltoage	□OFF □ON
34	3U0 alarm swtich	3U0 alarm switching on/off	□OFF □ON
35	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
36	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
37	2 wattmeter PWR	2 wattmeters measure way(power) (If select off, 3 wattmeters measure way auto on)	□OFF □ON

4 Device secondary wiring schematic diagram




Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Reclosing
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Closing switch
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
FTJ
FTJ-1
TBJ-2
R22
406
HBJ
VD22 VD23
FTJ-2
407
DL
HQ
K50
R50
TWJ
R40
VD41
408
K2
K4
K3
K5
K60
HWJ
R41
VD43
TBJ-1
TBJ
VD24 VD25
409
TQ
412
410
411
Signal COM
TWJ
HWJ
417
K6
418
419
K7
420
Standby tripping output
The same phase output
K8
421
422
K9
423
K10
424
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Reclosing
414 Protection trip
415 Remote closing
416 Remote tripping
417
418
Standby tripping output
419
420
The same phase output
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 DI 1
303 DI 2
304 DI 3
305 DI 4
306 DI 5
307 Block Remote
308 Spring is not energy
309 DI 8
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 DI 13
315 DI 14
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209 Line tapped voltage Ux
210 Line tapped voltage Uxn
AC
Protection current Ia 101 102 Protection current Ia*
Protection current Ib 103 104 Protection current Ib*
Protection current Ic 105 106 Protection current Ic*
Measuring current Ia 107 108 Measuring current Ia*
Measuring current Ib 109 110 Measuring current Ib*
Measuring current Ic 111 112 Measuring current Ic*
Zero-sequence current I0 113 114 Zero-sequence current I0*
115 116
117 118
119 120

TYL8691S Buscoupler/Subsection Protection And Control Equipment

1 Functions

- 3-zone overcurrent protection (Can be started by composite voltage)
- 3-zone zero-sequence overcurrent protection
- Current inverse time-limit protection
- Overload alarm
- Charging protection
- I，U，P，Q，Cosφ，kWh，kVarh，15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 3-zone overcurrent protection

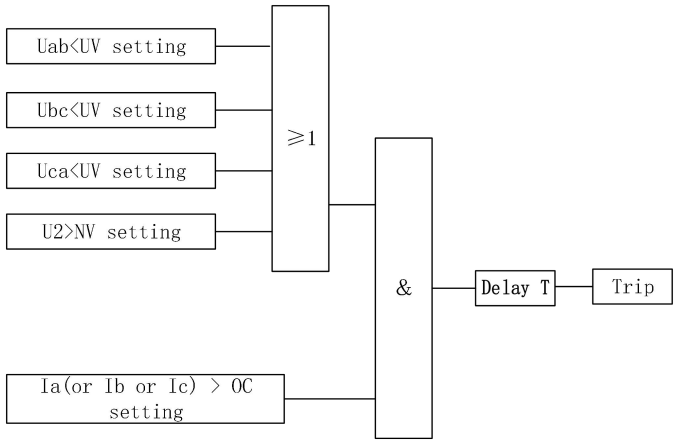
As any phase current is higher than the setting, the protection will trip after a time delay.

3-zone overcurrent protection control words may be represented by an independent selection inputs or exit, whether by the composite voltage required to start.

When start by compound-voltage is selected: phase current is started by low voltage or negative sequence voltage, low voltage means that any line voltage is less than the low voltage setting value.

When the device detected Bus TV disconnected, the device will quit the overcurrent protection automatically which started by by composite voltage, for pure overcurrent protection without composite voltage start from TV disconnection.

The 3-zone overcurrent alarm is a pure overcurrent alarm without re-pressure blocking.



2.2 3-zone zero-sequence overcurrent protection

When a system uses a low resistance grounded approach, such as greater than 3I0 value by delay, zero-sequence I and II above tripping, zero-sequence III zone selection control word may be tripping or alarm.

The zero-sequence 3-zone alarm is not affected by the zero-sequence voltage or TV disconnection, and is a pure overcurrent alarm.

2.3 Overcurrent inverse time-limit protection

Three performance curves can be selected:

Normal inverse time limit: $t = \frac{0.14}{(I/I_p)^{0.02} - 1} t_p$

Strong inverse time-limit: $t = \frac{13.5}{(I/I_p) - 1} t_p$

Extreme inverse time-limit: $t = \frac{80}{(I/I_p)^2 - 1} t_p$

In the formula,

t is the operating time delay of the inverse time-limit overcurrent protection.

I is the actual current value at the secondary side of a transformer.

Ip is the starting value of the inverse time-limit current protection. As I >Ip, protection will start.

tp is the time constant of inverse time-limit.

2.4 Overload protection

As any phase current is larger than the setting, the protection will signal after a time delay.

2.5 Charging protection

When charged bus charges to uncharged bus, there is a need to trip switch buscoupler switch quickly if faults occur in uncharged bus. With the purpose of avoiding maloperation due to selection loss when system fault occurs in the process of normal operation, the protection will open within 3s after the changing of buscoupler switch turning from open to close.

The action criterion of charging protection is:

$$\begin{cases} I_{max} \geq I_{cddz} \\ t \geq t_{jsdz} \end{cases}$$

The position closing signal changes from 0 to 1 in 3S time

Where, I_{max}: Maximum current (A)

I_{cddz}: Charging protection current action value (A)

T_{jsdz}: Charging protection operation time (S)

2.6 TV disconnection alarm

The device has TV disconnection check function, when the device detects the TV disconnection, it will send alarm siginal.

1) The difference between any two-phase line voltage>30V;
2) Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

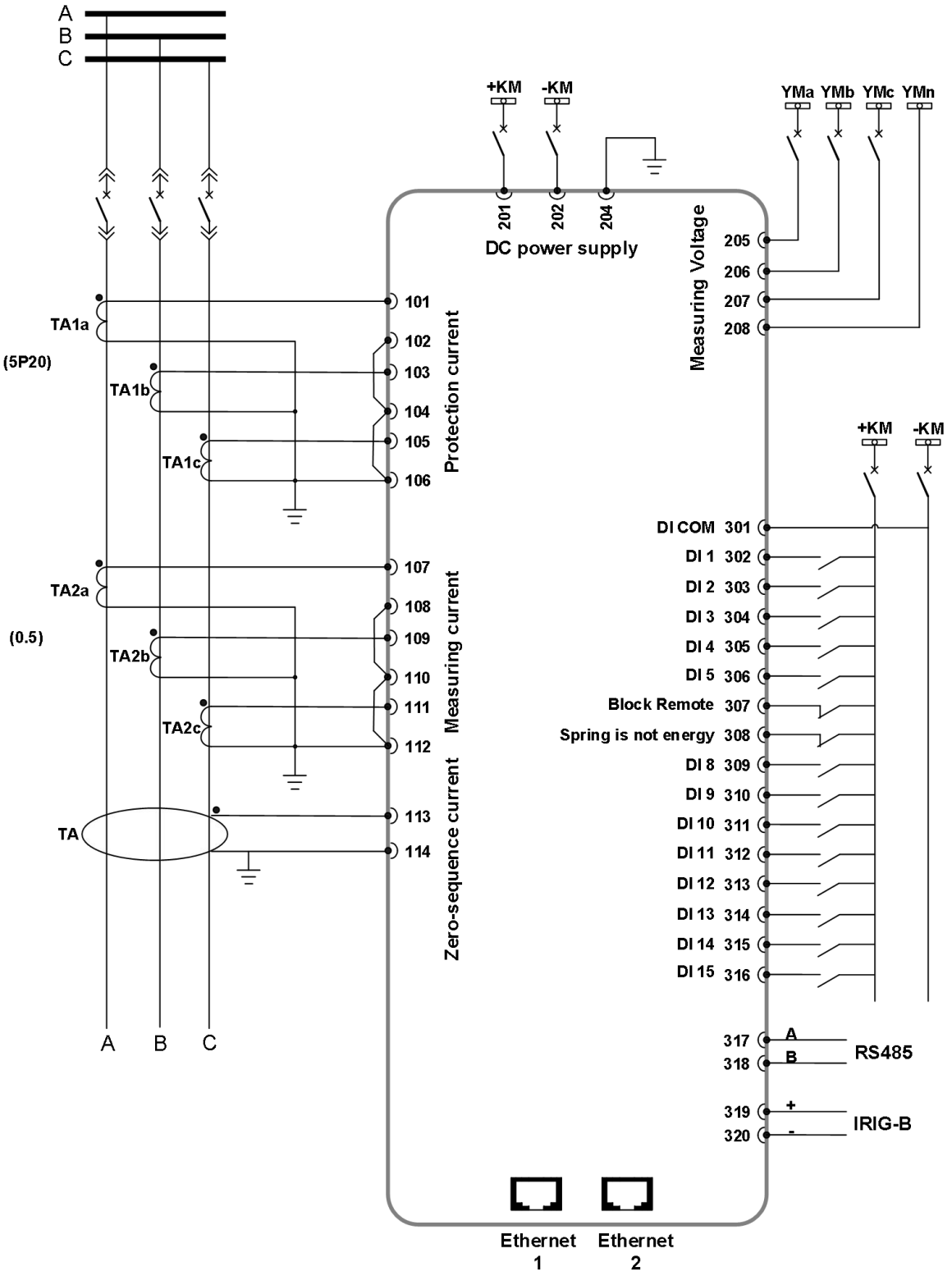
Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

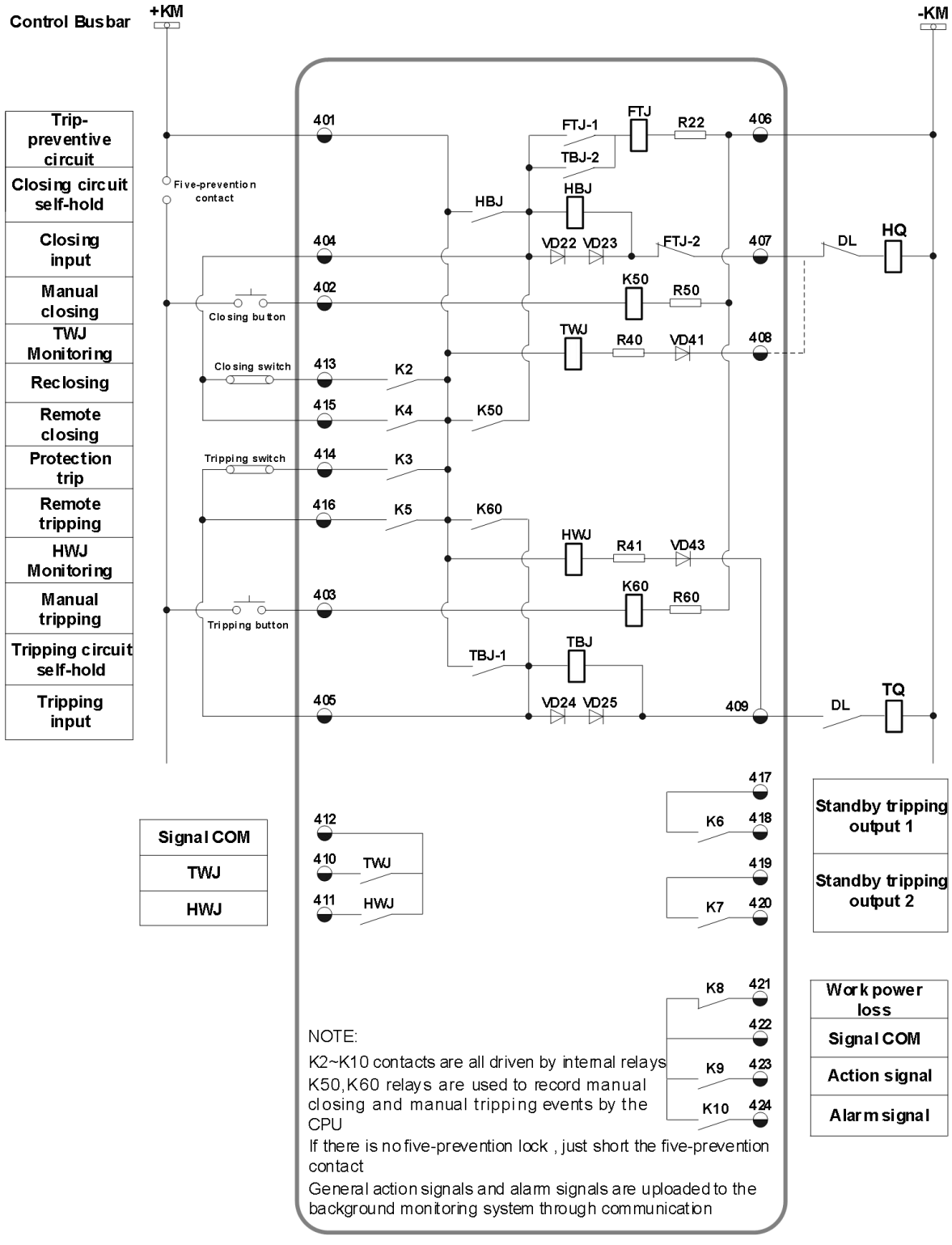
3 Setting

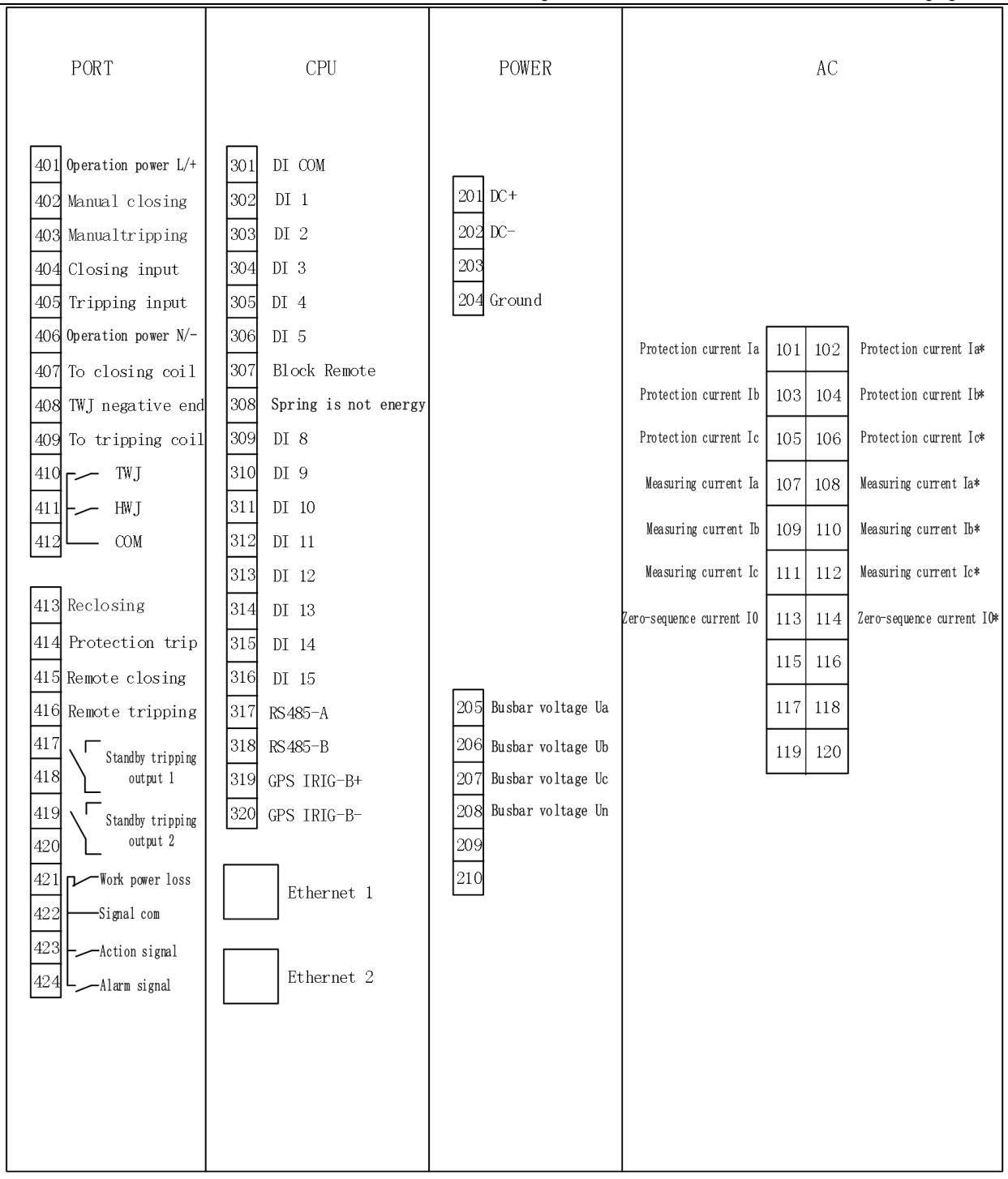
Setting Value Table				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	OC-I current	Overcurrent zone I current	A	0.05～99.99
2	OC-I time	Overcurrent zone I time	S	0～60
3	OC-II current	Overcurrent zone II current	A	0.05～99.99
4	OC-II time	Overcurrent zone II time	S	0～60
5	OC-III current	Overcurrent zone III current	A	0.05～99.99
6	OC-III time	Overcurrent zone III time	S	0～60
7	CV UV-I setting	Complex-voltage Undervoltage zone I setting	V	10～90
8	CV UV-II SET	Complex-voltage Undervoltage zone II setting	V	10～90
9	CV UV-III SET	Complex-voltage Undervoltage zone III setting	V	10～90
10	CV NV setting	Complex-voltage negative-sequence voltage setting	V	1～99.99
11	OC IT current	Overcurrent inverse time-limit current	A	0.05～99.99
12	OC IT constant	Overcurrent inverse time-limit constant	S	0～60
13	ZOC-I current	Zero-sequence zone I current	A	0.05～30
14	ZOC-I time	Zero-sequence zone I time	S	0～60
15	ZOC-II current	Zero-sequence zone II current	A	0.05～30
16	ZOC-II time	Zero-sequence zone II time	S	0～60
17	ZOC-III current	Zero-sequence zone III current	A	0.05～30
18	ZOC-III time	Zero-sequence zone III time	S	0～60
19	OVLD current	Overload current	A	0.1～99.99
20	OVLD time	Overload time	S	0～60
21	Charging PRO setting	Charging Protection setting	A	0.05～99.99
22	Charging PRO time	Charging Protection time	S	0～3
压 板 状 态				
Ser.No.	Abbreviation	Name of control characters	Options	
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON	
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON	
3	Two to three	2 phase – 3 relay (measure Ia, Ic) calculate Ib= - (ia+ic)	□OFF □ON	
4	OC-I switch	Overcurrent zone I switching on/off	□OFF □ON	

5	OC-I CV ST	Overcurrent zone I Complex-voltage starting	□OFF □ON
6	OC-II switch	Overcurrent zone II switching on/off	□OFF □ON
7	OC-II CV ST	Overcurrent zone II Complex-voltage starting	□OFF □ON
8	OC-III switch	Overcurrent zone III switching on/off	□OFF □ON
9	OC-III CV ST	Overcurrent zone III Complex-voltage starting	□OFF □ON
10	OC-III trip	Overcurrent zone III trip	□OFF □ON
11	OC-III alarm	Overcurrent zone III alarm	□OFF □ON
12	OC NOR-IT switch	Overcurrent normal inverse time switching on/off	□OFF □ON
13	OC STR-IT switch	Overcurrent strong inverse time switching on/off	□OFF □ON
14	OC EXT-IT switch	Overcurrent extremely inverse time switching on/off	□OFF □ON
15	ZOC-I switch	Zero-sequence overcurrent zone I switching on/off	□OFF □ON
16	ZOC-II switch	Zero-sequence overcurrent zone II switching on/off	□OFF □ON
17	ZOC-III switch	Zero-sequence overcurrent zone III switching on/off	□OFF □ON
18	ZOC-III trip	Zero-sequence overcurrent zone III trip	□OFF □ON
19	ZOC-III alarm	Zero-sequence overcurrent zone III alarm	□OFF □ON
20	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
21	Charging PRO SW	Charging protection switching on/off	□OFF □ON
22	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
23	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
24	2 wattmeter PWR	2 wattmeters measure way(power) (If select off, 3 wattmeters measure way auto on)	□OFF □ON

4 Device secondary wiring schematic diagram




Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Reclosing
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Closing switch
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
FTJ
FTJ-1
TBJ-2
R22
406
HBJ
VD22 VD23
FTJ-2
407
DL
HQ
K50
R50
TWJ
R40
VD41
408
K2
K4
K3
K5
K60
HWJ
R41
VD43
TBJ
TBJ-1
VD24 VD25
409
TQ
412
410
411
TWJ
HWJ
417
K6
418
419
K7
420
K8
421
422
K9
423
K10
424
Signal COM
TWJ
HWJ
Standby tripping output 1
Standby tripping output 2
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Reclosing
414 Protection trip
415 Remote closing
416 Remote tripping
417
418
Standby tripping output 1
419
420
Standby tripping output 2
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 DI 1
303 DI 2
304 DI 3
305 DI 4
306 DI 5
307 Block Remote
308 Spring is not energy
309 DI 8
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 DI 13
315 DI 14
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209
210
AC
Protection current Ia 101 102 Protection current Ia*
Protection current Ib 103 104 Protection current Ib*
Protection current Ic 105 106 Protection current Ic*
Measuring current Ia 107 108 Measuring current Ia*
Measuring current Ib 109 110 Measuring current Ib*
Measuring current Ic 111 112 Measuring current Ic*
Zero-sequence current I0 113 114 Zero-sequence current I0*
115 116
117 118
119 120

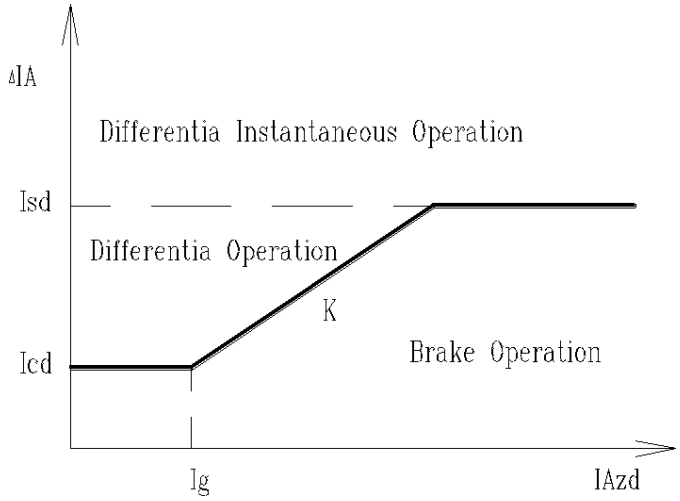
TYT8691 Transformer Differential Protection Equipment

1 Functions

- Differential protection
- The proportion differentia protection which is braked with 2nd harmonic
- Differential instantaneous protection
- Differential current overcurrent alarm
- TA wire break blocking
- Non-electric quantity acquisition
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 The proportion differentia protection which is braked with 2nd harmonic



IAzd —Brake current of phase A;

ΔIA —Differentia current of phase A;

ΔIAF2－The 2nd harmonic of IA;

ΔIAF3－The 3rd harmonic of IA

K2－The brake scale of 2nd harmonic (setting);

K3－The brake scale of 3rd harmonic (setting);

Icd—The setting of differentia;

Ig —The current vlaue of inflexion.

The current vlaue of inflexion is o.7 of Ie.

The K can be modified.

2.1.1 A The proportion differentia protection of phase A:

The device sampling each phase's original current (High of phase A is Hia, High of phase B is Hib, High of

phase C is Hic,Middle of phase A is Mia, Middle of phase B is Mib, Middle of phase C is Mic,Low of phase A is Lia, Low of phase B is Lib, Low of phase C is Lic).Because the methods of connection,the different voltage of transformers' different side,the connection's methods of TA and so on,we change the original current to the tranformer current (High transforner current of phase A is Thia, High transforner current of phase B is Thib, High transforner current of phase C is Thic, Middle transforner current of phase A is Tmia, Middle transforner current of phase B is Tmib, Middle transforner current of phase C is Tmic, Low transforner current of phase A is Tlia, Low transforner current of phase B is Tlib, Low transforner current of phase C is Tlic). IAzd = Max(Thia，Tmia，Tlia)

ΔIA = | Thia + Tmia + Tlia |

If IAzd<Ig, the action equation of phase A is IA＞Icd;

If IAzd>Ig, the action equation of phase A is IA＞Icd＋(IAzd－Ig)＊K;

2.1.2 The action equation of 2nd harmonic and 3rd harmonic brake the differentia protection:

$$\frac{\Delta IAF2}{\Delta IA} < K2 \quad \text{and} \quad \frac{\Delta IAF3}{\Delta IA} < K3$$

2.1.3 The proportion differentia protection action with each phase,so the phase B and phase C are same as the phase A.

2.2 Differential instantaneous protection

As the differential current of any phase is larger than the setting for the differential instantaneous protection, the protection will have an output without a time delay.

2.3 Differential current overreach alarm

As the protection detects that the differential current of any phase reaches the setting for the differential current overreach alarm, the protection will send the alarm signal after a certain time delay.

2.4 TA wire break blocking or alarm

As the TA wire break occurs at any phase at any side during motor operation at the rated current, the protection can signal or block the differential protection based on the control characters.

2.5 Set calculate

2.5.1 Calculate the rated current of transfomer's each side as following, which is the balance current of one side.

$$I_B = \frac{P}{\sqrt{3}U}$$

P — The rated capacity of transformer (KVA), If the capacity of each side is not equal, the capacity of the side with the largest capacity should be taken, and the bridge wire and factory branch connected to the differential circuit should also adopt the same capacity.

U — The rated line voltage of transformer's each side(KV), For the corresponding side with a voltage

regulating tap, the middle tap voltage is generally used. If it is impossible to change the tap in the actual operation, the voltage of the actual tap can be taken.

2.5.2 Calculate the secondary balance current Ib of TA.

$$I_b = \frac{K_{jx} I_B}{K_{LH}}$$

IB — Primary balance current.

KLH — Current transformer ratio.

Kjx — The scale of connection,the KJX=1 when the connection of TA is Y, the Kjx= $\sqrt{3}$ when the connection of TA is △

The secondary balance current on the high voltage side is represented as IHb, the secondary balance current on the medium voltage side is represented as IMb, and the secondary balance current on the low voltage side is represented as ILb.

2.5.3 The selection of transformer's connection methods and TA the banlance current.

Generally, the external TA is required to be connected in a Y-shaped connection (Kjx on each side is 1), the angle and amplitude of the current on each side are compensated by the software inside the device, and the wiring method of transformer Y or △ is selected by the control word (such as ydd1 , yyd11).

If the current turning angle is carried out through the external TA, the transformer wiring mode should be selected as yyy when setting, that is, the internal software of the device will no longer carry out the turning angle, and pay attention to the Kjx on each side.

The TA balance current is the secondary balance current IHb on the high voltage side. (The setting action value of differential element and differential quick-break element is based on this)

The current's converted arithmetic of Y side as the following when the high is Y:

$$\vec{I}_0 = (\vec{I}_a + \vec{I}_b + \vec{I}_c)/3$$

$$\vec{T}_{ia} = \text{Balance Coefficient} \times (\vec{i}_a - \vec{i}_0),\ \vec{T}_{ib} = \text{Balance Coefficient} \times (\vec{i}_b - \vec{i}_0),$$

$$\vec{T}_{ic} = \text{Balance Coefficient} \times (\vec{i}_c - \vec{i}_0)$$

The current's converted arithmetic of △ －11 side as the following when the high is Y:

$$\vec{T}_{ia} = \text{BBalance Coefficient} \times (\vec{i}_a - \vec{i}_c)/\sqrt{3},$$

$$\vec{T}_{ib} = \text{Balance Coefficient} \times (\vec{i}_b - \vec{i}_a)/\sqrt{3},$$

$$\vec{T}_{ic} = \text{Balance Coefficient} \times (\vec{i}_c - \vec{i}_b)/\sqrt{3}$$

The current's converted arithmetic of △ －1 side as the following when the high is Y:

$$\vec{T}_{ia} = \text{Balance Coefficient} \times (\vec{i}_a - \vec{i}_b)/\sqrt{3},$$

$$\vec{T}_{ib} = \text{Balance Coefficient} \times (\vec{i}_b - \vec{i}_c)/\sqrt{3},$$

$$\vec{T}_{ic} = \text{Balance Coefficient} \times (\vec{i}_c - \vec{i}_a)/\sqrt{3}$$

The current's converted arithmetic of △ side as the following when the high is △:

$\vec{T}_{ia}$ = Balance Coefficient × $\vec{i}_a$, $\vec{T}_{ib}$ = Balance Coefficient × $\vec{i}_b$,

$\vec{T}_{ic}$ = Balance Coefficient × $\vec{i}_c$

The current's converted arithmetic of Y－11side as the following when the high is △:

$\vec{T}_{ia}$ = Balance Coefficient × ($\vec{i}_a$ − $\vec{i}_c$) / $\sqrt{3}$,

$\vec{T}_{ib}$ = Balance Coefficient × ($\vec{i}_b$ − $\vec{i}_a$) / $\sqrt{3}$,

$\vec{T}_{ic}$ = Balance Coefficient × ($\vec{i}_c$ − $\vec{i}_b$) / $\sqrt{3}$

The current's converted arithmetic of Y－1 side as the following when the high is △:

$\vec{T}_{ia}$ = Balance Coefficient × ($\vec{i}_a$ − $\vec{i}_b$) / $\sqrt{3}$,

$\vec{T}_{ib}$ = Balance Coefficient × ($\vec{i}_b$ − $\vec{i}_c$) / $\sqrt{3}$,

$\vec{T}_{ic}$ = Balance Coefficient × ($\vec{i}_c$ − $\vec{i}_a$) / $\sqrt{3}$

2.5.4 The middle balance factor PH MXS and low balance PH LXS are followings:

$$PH_{MXS} = \frac{I_{Hb}}{I_{Mb}} \qquad PH_{LXS} = \frac{I_{Hb}}{I_{Lb}}$$

The high balance factor is 1 and couldn't set.

2.5.5 The action setting of differentia commonly is 25%~50% of Ie which is the secondary rated current of TA (High side).

2.5.6 Differential instantaneous element set，oprate value shout meet the three conditions:

a) Less than between converter and current transformer saturation current;

b) In the most serious external fault steady-state current imbalance is not maloperation;

c) Avoid transformer inrush current, in the absence of enough setting the basis of not more than 12 times the transformer rated current, the general setting of 8 ~ 9 Times the transformer rated current.

2.5.7 The action setting of K commonly is 0.5~0.7.

2.5.8 The action setting of IAF2 commonly is 0.12~0.15; The action setting of IAF2 commonly is 0.15~0.2.

2.6 Non - electric quantity acquisition

Alarm category for non-power protection, such as light gas alarm, over-temperature alarm, oil level anomalies, such as jump switch does not involve the protection of non-electricity can be directly access the device collection, and sending automation systems.

For the tripping of non-power protection, such as gas re-tripping, over-temperature trip, tripping, such as pressure release switch required a direct jump non-power protection, should be ontology access protection devices, protection devices by the ontology jump switch. Ontology protection device at the same time the corresponding output action contact access the device to record movements, the action by the device will upload information automation systems.

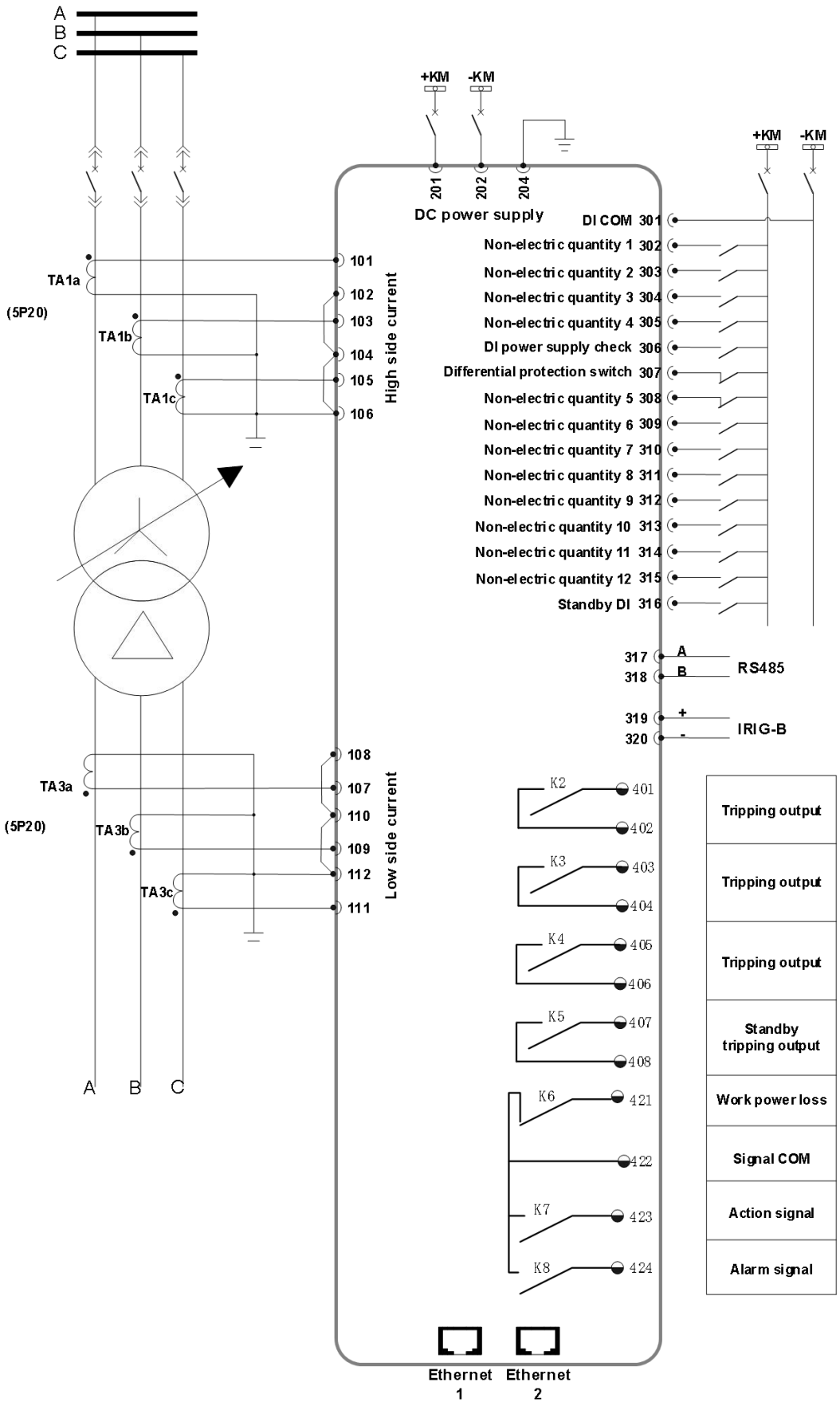
The device has12-channel DI, you can collect and record the 12 non-electricity protection action information.

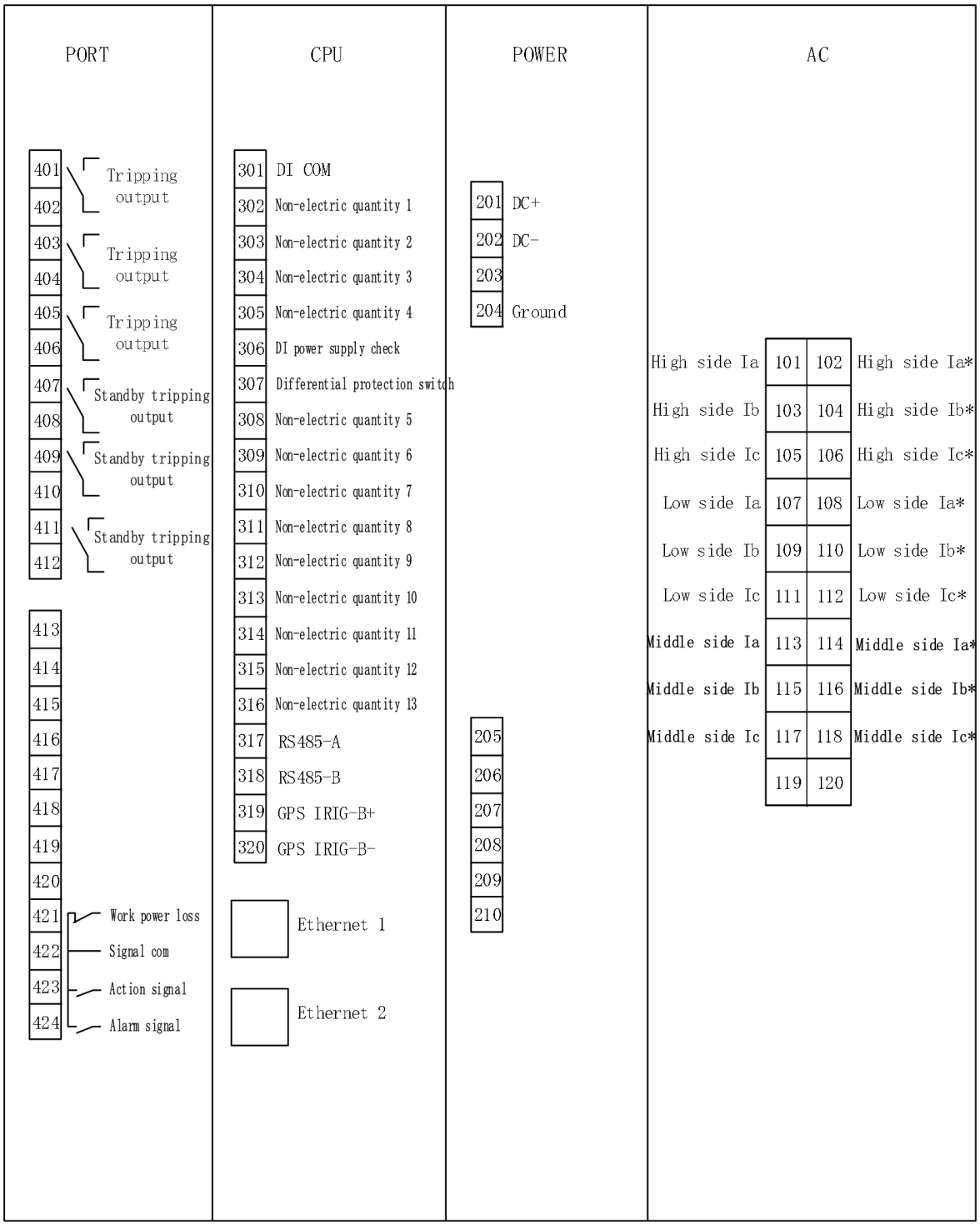
2.7 The differential of two sides.

If the device is the differential of two sides, the (107，108)，(109，110)，(111，112) which is the terminal couldn't connection and the middle balance must be setted to be 0.

3 Setting

List of Setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	T 2nd rated CURT	Transformer secondary rated current	A	0.05～30
2	DIF CURT	Differential current	Ie	0.1～2
3	INS DIF CURT	Differential instantaneous current	Ie	0.1～20
4	RT-BRK factor	Ratio differential braking factor		0.3～1
5	2nd-H BRK factor	Second harmonics braking factor		0.1～0.3
6	3nd-H BRK factor	Third harmonics braking factor		0.1～0.3
7	MV BAL factor	Balance factor of Medium Voltage side		0～10
8	LV BAL factor	Balance factor of Low Voltage side		0～10
9	DIF CURT OR alm	Differential current overreach alarm setting	Ie	0.1～1
10	DIF CURT OR time	Differential current overreach time	S	0.1 ～ 20.00
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	yyy	yyy connection	□OFF □ON	
2	ydd1	ydd1 connection	□OFF □ON	
3	ydy1	ydy1 connection	□OFF □ON	
4	yyd1	yyd1 connection	□OFF □ON	
5	ydd11	ydd11 connection	□OFF □ON	
6	ydy11	ydy11 connection	□OFF □ON	
7	yyd11	yyd11 connection	□OFF □ON	
8	dyy11	dyy11 connection	□OFF □ON	
9	dyy1	dyy1 connection	□OFF □ON	
10	INS DIF switch	Differential instantaneous current switching on/off	□OFF □ON	
11	2nd-H BRK switch	Second harmonics braking switching on/off	□OFF □ON	
12	3nd-H BRK switch	Third harmonics braking switching on/off	□OFF □ON	
13	A-phase DIF	A-phase differential switching on/off	□OFF □ON	
14	B-phase DIF	B-phase differential switching on/off	□OFF □ON	
15	C-phase DIF	C-phase differential switching on/off	□OFF □ON	
16	DIF OR ALM SW	Differential current overreach alarm switching on/off	□OFF □ON	
17	CT DISCON ALM SW	CT disconnection alarm switching on/off	□OFF □ON	
18	CT DISCON BLK SW	CT disconnection blocking differential switching	□OFF □ON	


A
B
C
+KM
-KM
201
202
204
DC power supply
+KM
-KM
DI COM 301
Non-electric quantity 1 302
Non-electric quantity 2 303
Non-electric quantity 3 304
Non-electric quantity 4 305
DI power supply check 306
Differential protection switch 307
Non-electric quantity 5 308
Non-electric quantity 6 309
Non-electric quantity 7 310
Non-electric quantity 8 311
Non-electric quantity 9 312
Non-electric quantity 10 313
Non-electric quantity 11 314
Non-electric quantity 12 315
Standby DI 316
317 A
318 B
RS485
319 +
320 -
IRIG-B
TA1a
(5P20)
TA1b
TA1c
101
102
103
104
105
106
High side current
TA3a
(5P20)
TA3b
TA3c
108
107
110
109
112
111
Low side current
K2
401
402
K3
403
404
K4
405
406
K5
407
408
K6
421
422
K7
423
K8
424
Tripping output
Tripping output
Tripping output
Standby tripping output
Work power loss
Signal COM
Action signal
Alarm signal
Ethernet 1
Ethernet 2


PORT
401
402
Tripping output
403
404
Tripping output
405
406
Tripping output
407
408
Standby tripping output
409
410
Standby tripping output
411
412
Standby tripping output
413
414
415
416
417
418
419
420
421
Work power loss
422
Signal com
423
Action signal
424
Alarm signal
CPU
301 DI COM
302 Non-electric quantity 1
303 Non-electric quantity 2
304 Non-electric quantity 3
305 Non-electric quantity 4
306 DI power supply check
307 Differential protection switch
308 Non-electric quantity 5
309 Non-electric quantity 6
310 Non-electric quantity 7
311 Non-electric quantity 8
312 Non-electric quantity 9
313 Non-electric quantity 10
314 Non-electric quantity 11
315 Non-electric quantity 12
316 Non-electric quantity 13
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205
206
207
208
209
210
AC
High side Ia 101 102 High side Ia*
High side Ib 103 104 High side Ib*
High side Ic 105 106 High side Ic*
Low side Ia 107 108 Low side Ia*
Low side Ib 109 110 Low side Ib*
Low side Ic 111 112 Low side Ic*
Middle side Ia 113 114 Middle side Ia*
Middle side Ib 115 116 Middle side Ib*
Middle side Ic 117 118 Middle side Ic*
119 120

TYT8691F Transformer's Noumenon Protection Equipment

1 Functions

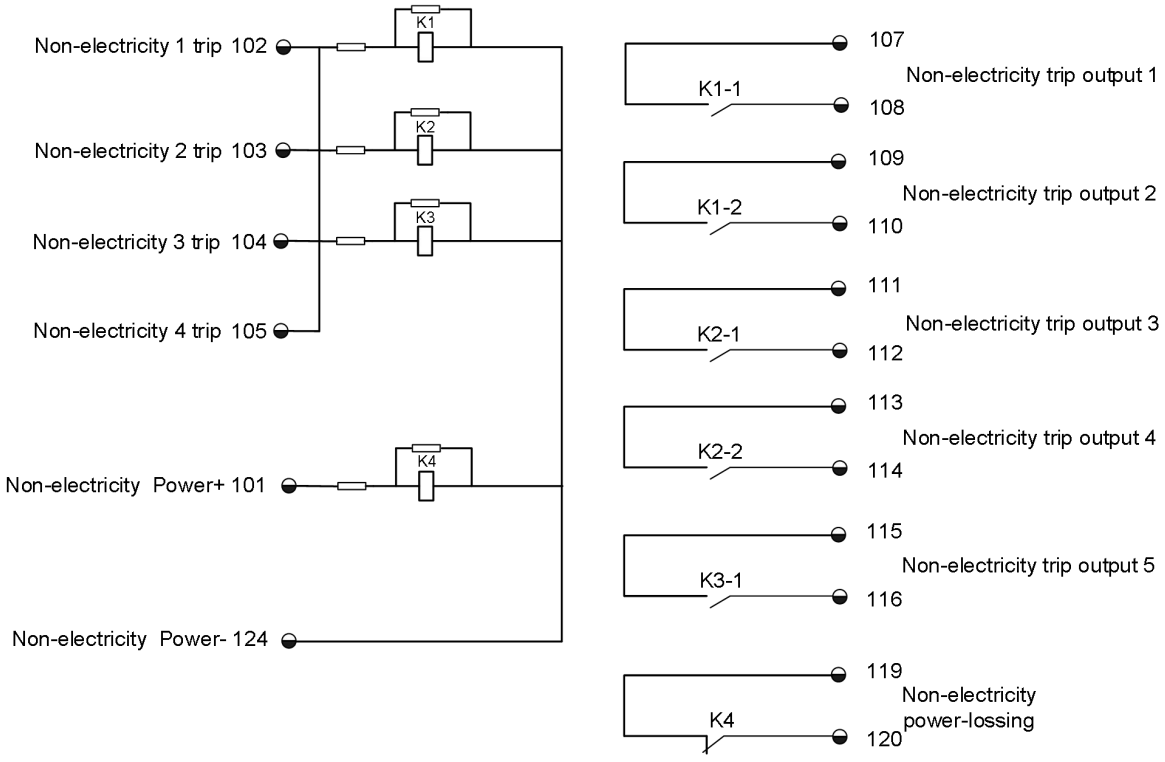
The device is composed by 5 modules. Among them, the starting power of the non-electri input module is greater than 5 watts, and there is no need to increase the external power relay.

Project 1: 1 non-electric input module, 1 non-electric output module, 3 operate circuit module.

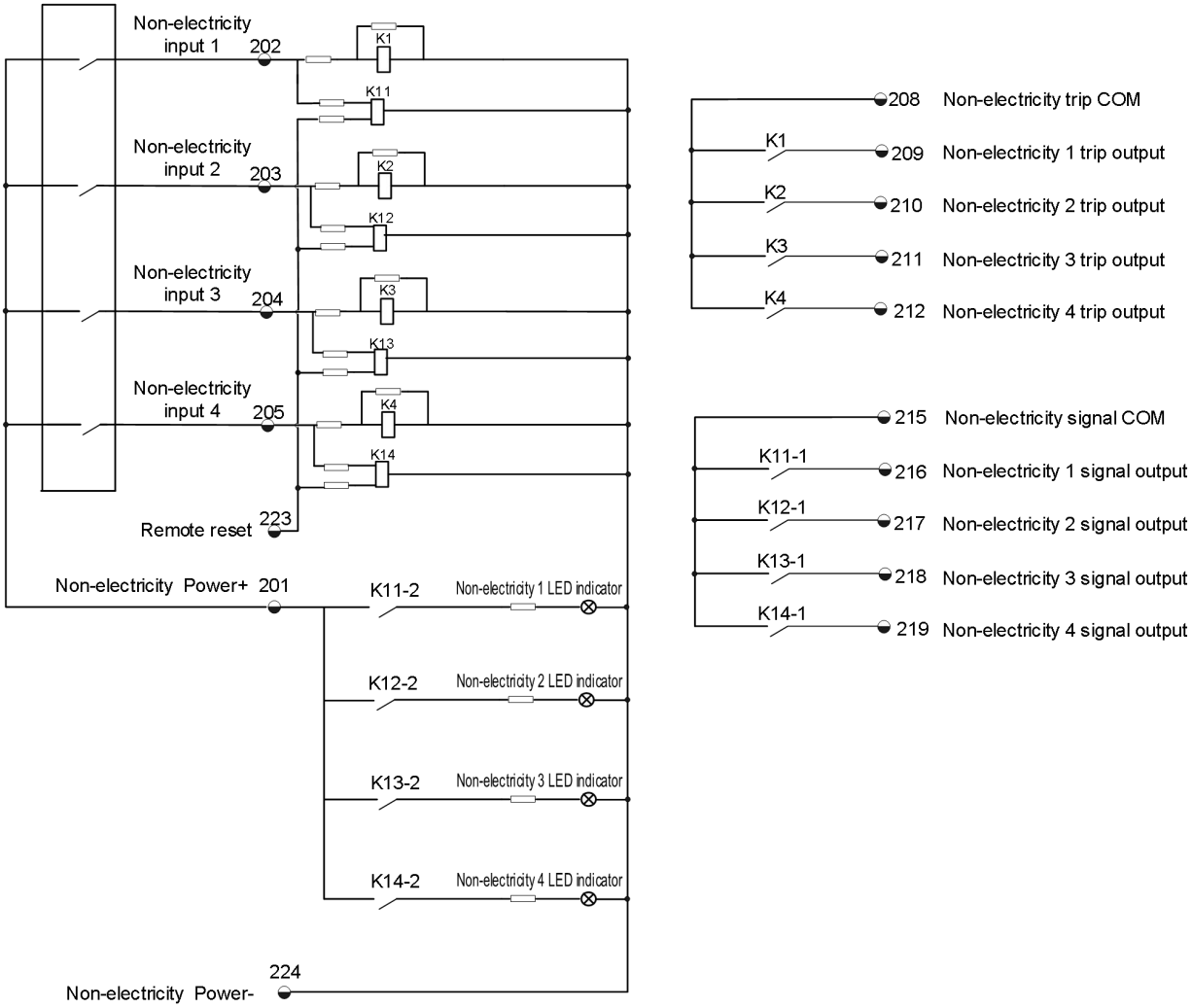
Project 2: 2 non-electric input module, 1 non-electric output module, 2 operate circuit module.

Project 3: 5 operate circuit module.

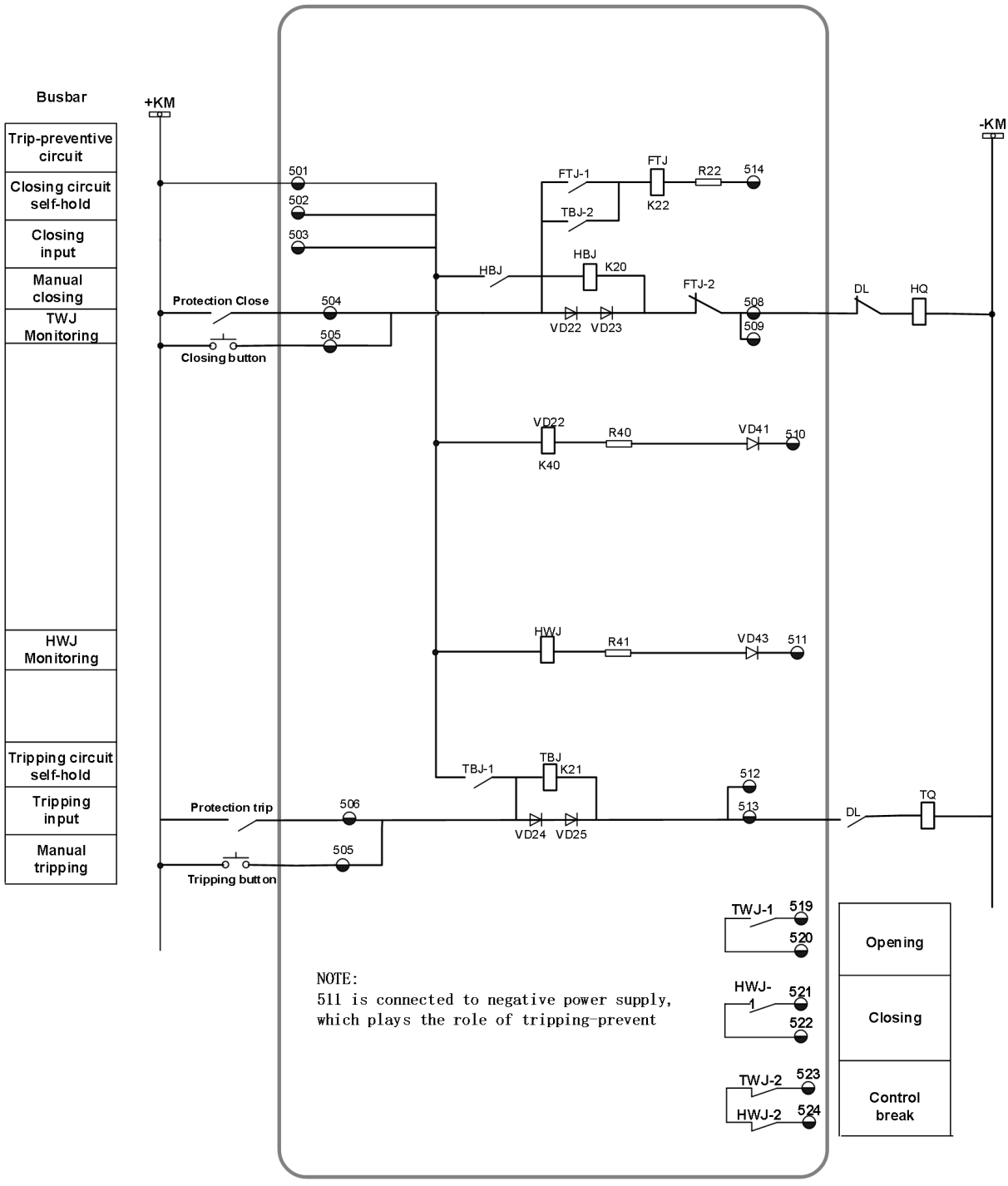
The sketch map of non-electric input module:

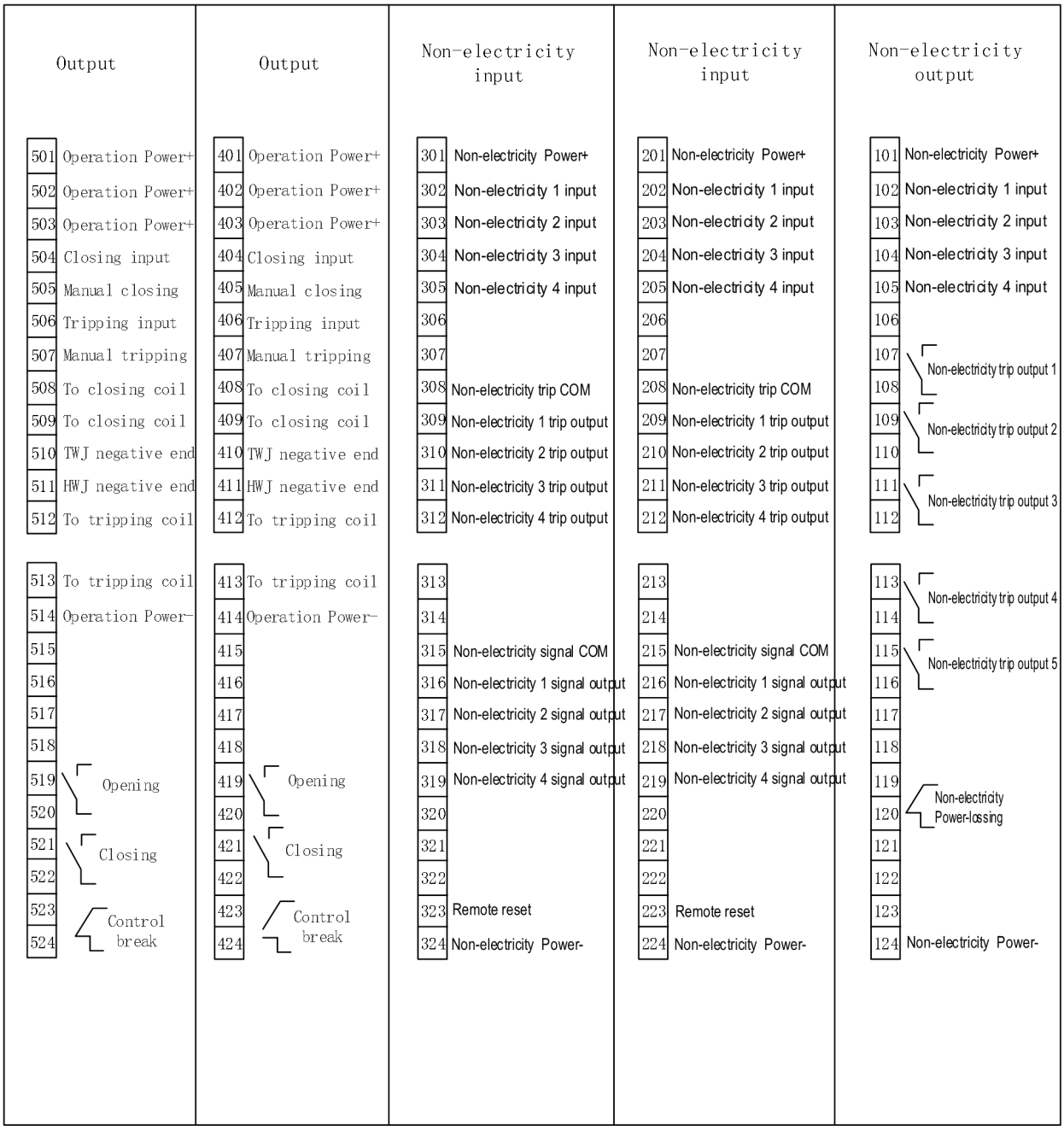


The sketch map of non-electric output module:



The sketch map of operate circuit module:




Output
501 Operation Power+
502 Operation Power+
503 Operation Power+
504 Closing input
505 Manual closing
506 Tripping input
507 Manual tripping
508 To closing coil
509 To closing coil
510 TWJ negative end
511 HWJ negative end
512 To tripping coil
513 To tripping coil
514 Operation Power-
515
516
517
518
519
520
521
522
523
524
Opening
Closing
Control break
Output
401 Operation Power+
402 Operation Power+
403 Operation Power+
404 Closing input
405 Manual closing
406 Tripping input
407 Manual tripping
408 To closing coil
409 To closing coil
410 TWJ negative end
411 HWJ negative end
412 To tripping coil
413 To tripping coil
414 Operation Power-
415
416
417
418
419
420
421
422
423
424
Opening
Closing
Control break
Non-electricity input
301 Non-electricity Power+
302 Non-electricity 1 input
303 Non-electricity 2 input
304 Non-electricity 3 input
305 Non-electricity 4 input
306
307
308 Non-electricity trip COM
309 Non-electricity 1 trip output
310 Non-electricity 2 trip output
311 Non-electricity 3 trip output
312 Non-electricity 4 trip output
313
314
315 Non-electricity signal COM
316 Non-electricity 1 signal output
317 Non-electricity 2 signal output
318 Non-electricity 3 signal output
319 Non-electricity 4 signal output
320
321
322
323 Remote reset
324 Non-electricity Power-
Non-electricity input
201 Non-electricity Power+
202 Non-electricity 1 input
203 Non-electricity 2 input
204 Non-electricity 3 input
205 Non-electricity 4 input
206
207
208 Non-electricity trip COM
209 Non-electricity 1 trip output
210 Non-electricity 2 trip output
211 Non-electricity 3 trip output
212 Non-electricity 4 trip output
213
214
215 Non-electricity signal COM
216 Non-electricity 1 signal output
217 Non-electricity 2 signal output
218 Non-electricity 3 signal output
219 Non-electricity 4 signal output
220
221
222
223 Remote reset
224 Non-electricity Power-
Non-electricity output
101 Non-electricity Power+
102 Non-electricity 1 input
103 Non-electricity 2 input
104 Non-electricity 3 input
105 Non-electricity 4 input
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124 Non-electricity Power-
Non-electricity trip output 1
Non-electricity trip output 2
Non-electricity trip output 3
Non-electricity trip output 4
Non-electricity trip output 5
Non-electricity Power-lossing

TYT8692 Transformer Backup Protection Equipment

By the side of the device configuration, the three-column high-voltage side of the transformer installed separately back-up protection and medium voltage side of back-up protection, backup protection for low-voltage side. Three sets of back-up protection function identical to the corresponding configuration for different functions of the side.

1 Functions

- 3-zone composite voltage overcurrent protection
- Zero-sequence overcurrent protection
- Gap zero-sequence overcurrent protection
- Zero-sequence overvoltage protection
- Overload protection
- Starting ventilation
- On-load voltage-regulated blocking
- I, U, P, Q, Cosφ, kWh, kVarh, 15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 Composite voltage block (direction) overcurrent protection

As any phase current is higher than the setting and the composite voltage or directional element is started, the protection will trip after a time delay.

a) Composite voltage element：

If the transformer has three sides of high, medium and low, three backup protections of high, medium and low is installed. The protection of each side adopts the voltage of its own side, so the protection of this side can judge whether the composite voltage element on the side is operating, and whether the composite voltage element on the other side is operating needs to be judged by the switch input. The backup protection on the high-voltage side transmits the action of the recompression element on the high-pressure side to the backup protection on the medium-voltage side and the low-voltage side through the contact; Backup protection: The backup protection on the low-voltage side transmits the action of the re-pressure element on the low-voltage side to the backup protection on the high-voltage side and the medium-voltage side through the contacts.

Action criterion of the composite voltage element on this side: the minimum value of the three line voltages is less than the low voltage setting value, or the negative sequence voltage is greater than the negative voltage setting value, the composite voltage element operates. Considering that the transformer is closed at no-load or a certain side of the transformer is out of operation, the compound voltage element will always act because the bus has no voltage. The device adds an auxiliary switch position criterion, and the compound voltage element can only operate when the switch on this side is closed.

b) Directional element:

The positive terminal of TA is on the bus side, and the positive direction of the current is considered to flow from the bus to the transformer.

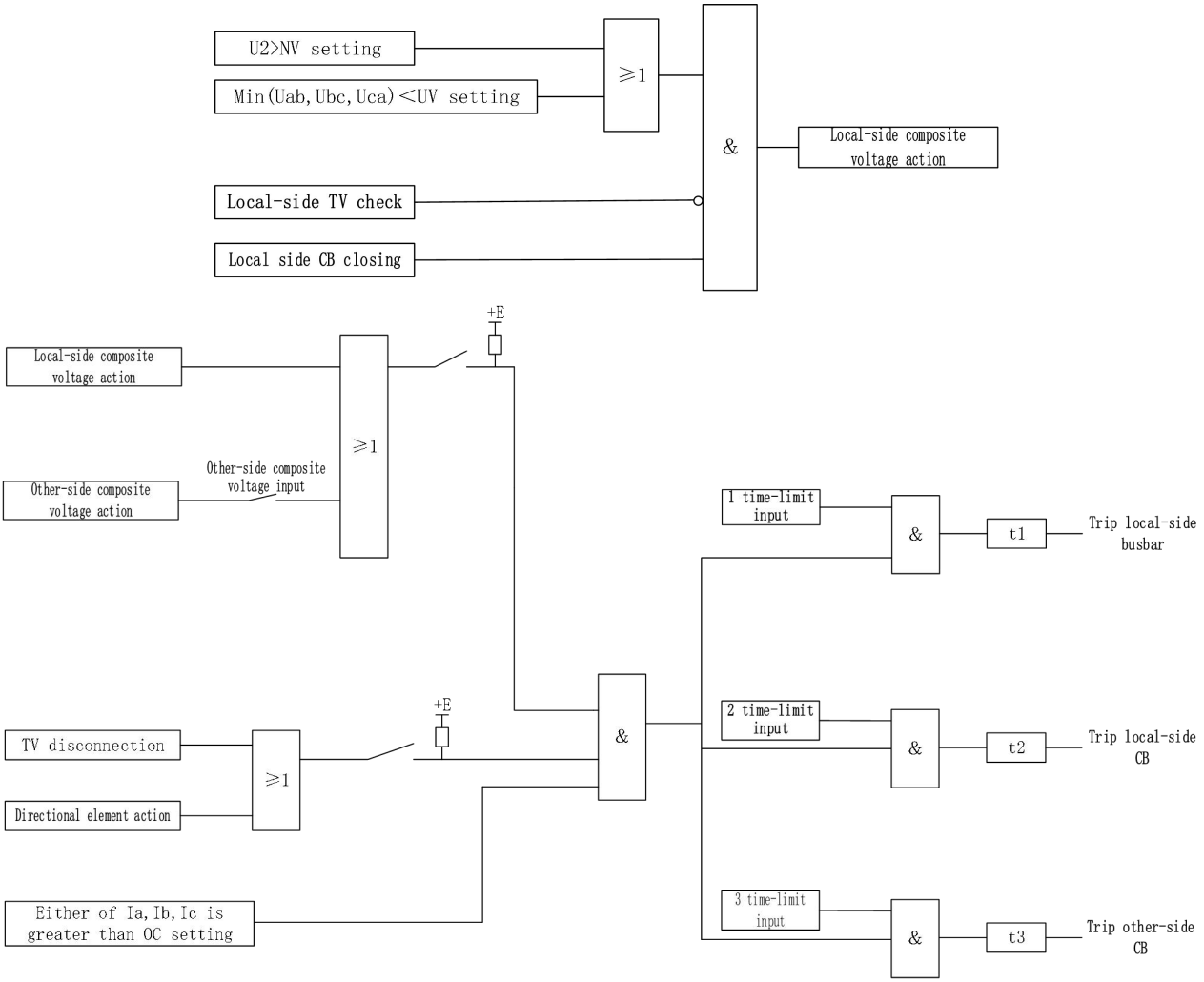
Ia and Ubc form an A-phase directional element, Ib and Uca form a B-phase directional element, and Ic and Uab form a C-phase directional element. When the current in the directional element is in the range of -45°～+135° relative to the voltage, it is the positive direction, and the direction points to the transformer; otherwise, it is the reverse direction, and the direction points to the bus. The directional element has a memory function to eliminate the dead zone of the directional element when the near-end three-phase short circuit occurs.

c) Overcurrent element:

Any value of the three-phase current on this side is greater than the fixed value, and the overcurrent element operates.

d) TV disconnection:

When the device judges that there is TV disconnection, it automatically exits the directional element.



2.2 Zero-sequence overcurrent protection

This protection responds to single-phase ground faults and can be used as backup protection for transformers. Zero sequence protection is provided with a hard pressure plate.

The action criterion is: 3I0 > the fixed value of zero sequence overcurrent.

Among them: 3I0 is the zero-sequence current, which is taken from the zero-sequence TA on this side.

This protection is configured with two-time limits, the first time limit jumps to this side, and the second time limit jumps to each side.

2.3 Gap zero-sequence overcurrent protection

This protection reacts to the zero-sequence current of the transformer gap breakdown, and can be used as a backup protection when the transformer is not grounded.

The protection has automatic switching function, when the neutral point grounding switch of the transformer is opened, it will automatically switch on the gap zero-sequence current protection.

The action criterion is: 3I0jx> gap zero sequence current fixed value.

Among them: 3I0jx is the gap zero sequence current, which is taken from the neutral point gap TA on the side.

This protection is configured with two time limits, the first time limit jumps to this side, and the second time limit jumps to each side.

2.4 Zero-sequence voltage protection

This protection reflects the zero-sequence voltage on the ground side, and can be used as a backup protection when the transformer is not grounded.

This protection has the function of automatic switching on and off. When the neutral point grounding switch of the transformer is opened, the zero-sequence voltage protection is automatically switched on.

The action criterion is: 3U0> zero sequence voltage fixed value.

Among them: 3U0 is the zero-sequence voltage, which is taken from the 3U0 winding of the TV on this side.

This protection is configured with two time limits, the first time limit jumps to this side, and the second time limit jumps to each side.

Note: When this protection is used on the medium and low voltage sides, it only sends an alarm signal, and does not trip.

2.5 Overload protection

As any phase current is larger than the setting, the protection will signal after a time delay.

2.6 Starting ventilation

As any phase current is larger than the setting, the protection will start ventilation after a time delay.

2.7 On-load voltage-regulated blocking

As any phase current is larger than the setting, the protection will block On-load voltage-regulated after a time delay.

2.8 TV disconnection alarm

The device has a TV disconnection check function, when the device detects that the TV is disconnected, the alarm signal will be sended.

The difference between any two-phase line voltage>30V;

Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

2.9 Remote signaling function

The spare remote signaling of the device is 2-4 binary input and 8-13 binary input. These 9 binary inputs can be used as ordinary remote signaling. Other binary inputs and protection functions are bound and cannot be used as ordinary remote signaling.

2.10 Output Matrix

401, 402 trip the bus on this side. 403,404 trip this side. 405,406 trip on the mid-voltage side. 407,408 trip the low-voltage side. 409,410 compound voltage on this side action. 411,412 compound voltage on this side action. 413,415 starting ventilation. 417, 418 on-load voltage-regulated blocking.

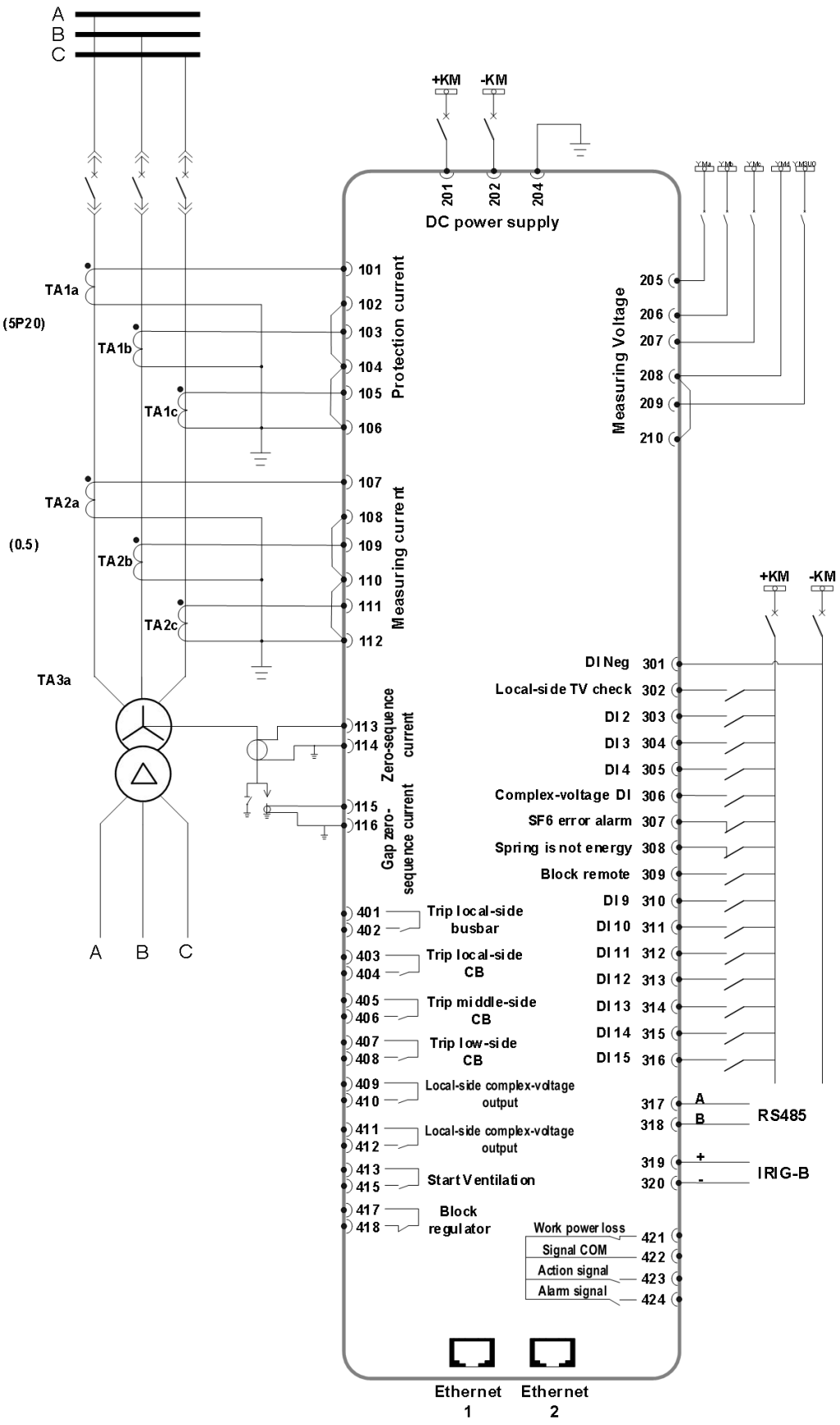
Output / Element	401, 402	403, 404	405, 406	407, 408	409, 410	411, 412	413, 414	413, 415	417, 418	417, 419
OC-I time 1	X									
OC-I time 2		X								
OC-I time 3		X	X	X						
OC-II time 1	X									
OC-II time 2		X								
OC-II time 3		X	X	X						
OC-III time 1		X								
OC-III time 2		X	X	X						
Tth-Side CV					X	X				
ZOC time 1		X								
ZOC time 2		X	X	X						
Gap ZOC time 1		X								
Gap ZOC time 2		X	X	X						
ZS OV time 1		X								
ZS OV time 2		X	X	X						
OVLD										
ST vent								X		
OLVR BLK									X	
TV DISCON										

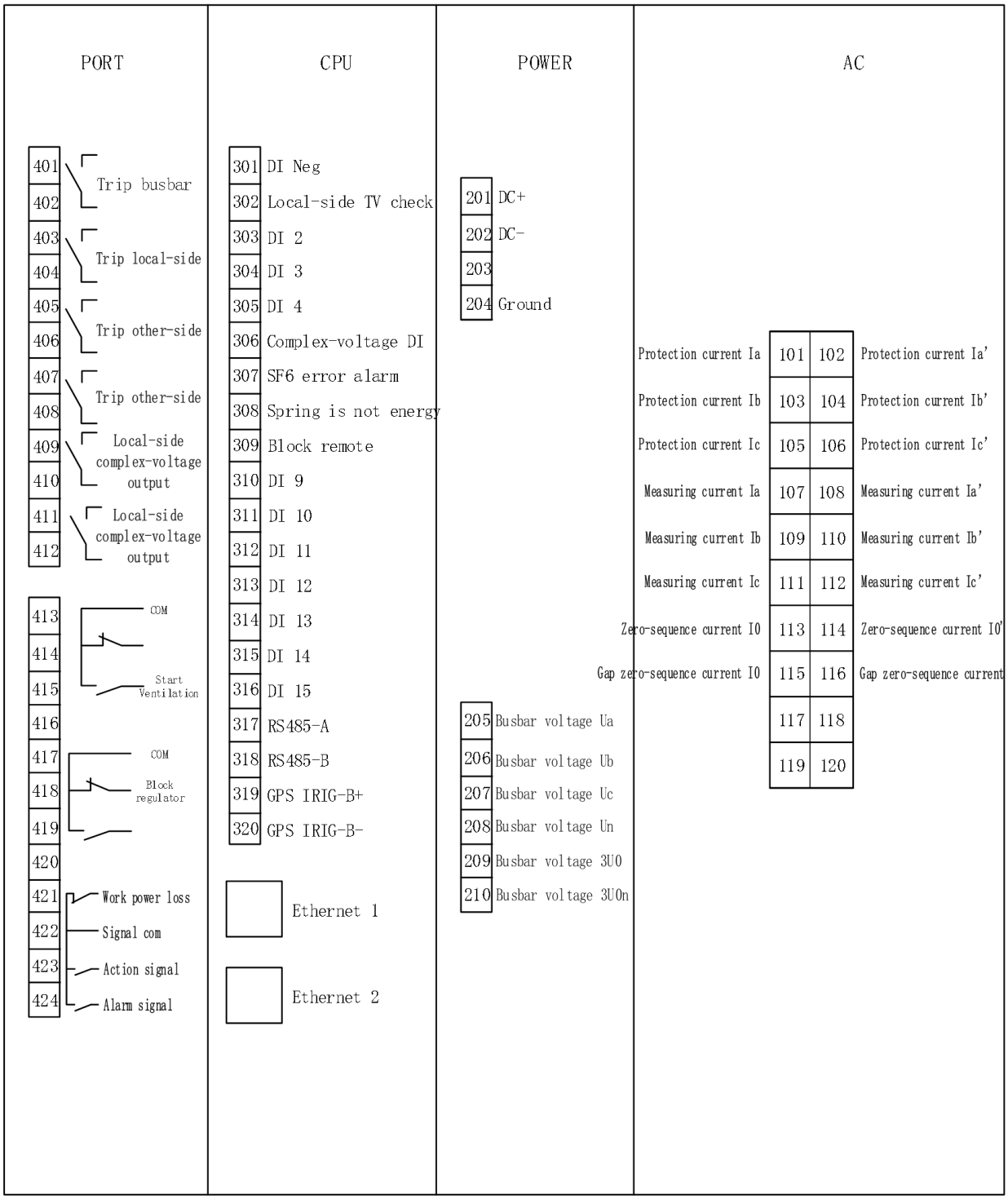
The X position in the table is the default output node of the component, which can be changed by the user.

3 Setting

List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	OC-I current	Overcurrent zone I current	A	0.05～99.99
2	OC-I time 1	Overcurrent zone I time-limit 1	S	0～60
3	OC-I time 2	Overcurrent zone I time-limit 2	S	0～60
4	OC-I time 3	Overcurrent zone I time-limit 3	S	0～60
5	OC-II current	Overcurrent zone II current	A	0.05～99.99
6	OC-II time 1	Overcurrent zone II time-limit 1	S	0～60
7	OC-II time 2	Overcurrent zone II time-limit 2	S	0～60
8	OC-II time 3	Overcurrent zone II time-limit 3	S	0～60
9	OC-III current	Overcurrent zone III current	A	0.05～99.99
10	OC-III time 1	Overcurrent zone III time-limit 1	S	0～60
11	OC-III time 2	Overcurrent zone III time-limit 2	S	0～60
12	CV UV setting	Complex-voltage Undervoltage setting	V	10～90
13	CV NV setting	Complex-voltage negative-sequence voltage setting	V	1～99.99
14	ZOC current	Zero-sequence overcurrent current	A	0.05～99.99
15	ZOC time 1	Zero-sequence overcurrent time-limit 1	S	0～60
16	ZOC time 2	Zero-sequence overcurrent time-limit 2	S	0～60
17	Gap ZOC current	Gap zero-sequence overcurrent current	A	0.05～99.99
18	Gap ZOC time 1	Gap zero-sequence overcurrent time-limit 1	S	0～60
19	Gap ZOC time 2	Gap zero-sequence overcurrent time-limit 2	S	0～60
20	ZS OV setting	Zero-sequence Overvoltage setting	V	1～140
21	ZS OV time 1	Zero-sequence Overvoltage time-limit 1	S	0～60
22	ZS OV time 2	Zero-sequence Overvoltage time-limit 2	S	0～60
23	OVLD current	Overload current	A	0.05～99.99
24	OVLD time	Overload time	S	0～60
25	ST vent CURT	Starting ventilation current	A	0.05～99.99
26	ST vent time	Starting ventilation time	S	0～60
27	OLVR BLK CURT	On-load voltage-regulated blocking setting	A	0.05～99.99
28	OLVR BLK time	On-load voltage-regulated blocking time	S	0～60
List of control characters				
Ser.No.	Abbreviation	Name of setting	Options	
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON	
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON	
3	Two to three	2 phase – 3 relay (measure Ia, Ic) calculate Ib= - (ia+ic)	□OFF □ON	
4	OC-I time 1 SW	Overcurrent zone I time-limit 1 switching on/off	□OFF □ON	

5	OC-I time 2 SW	Overcurrent zone I time-limit 2 switching on/off	□OFF □ON
6	OC-I time 3 SW	Overcurrent zone I time -limit 3 switching on/off	□OFF □ON
7	OC-I DRCT	Overcurrent zone I direction	□OFF □ON
8	OC-I CV ST	Overcurrent zone I Complex-voltage starting	□OFF □ON
9	OC-II time 1 SW	Overcurrent zone II time-limit 1 switching on/off	□OFF □ON
10	OC-II time 2 SW	Overcurrent zone II time-limit 2 switching on/off	□OFF □ON
11	OC-II time 3 SW	Overcurrent zone II time-limit 3 switching on/off	□OFF □ON
12	OC-II DRCT	Overcurrent zone II direction	□OFF □ON
13	OC-II CV ST	Overcurrent zone II Complex-voltage starting	□OFF □ON
14	OC-III time 1 SW	Overcurrent zone III time-limit 1 switching on/off	□OFF □ON
15	OC-III time 2 SW	Overcurrent zone III time-limit 2 switching on/off	□OFF □ON
16	OC-III CV ST	Overcurrent zone III Complex-voltage starting	□OFF □ON
17	Oth-Side CV SW	Other-side complex-voltage switching on/off	□OFF □ON
18	Spare	Spare	□OFF □ON
19	ZOC time 1 SW	Zero-sequence overcurrent time-limit 1 switching on/off	□OFF □ON
20	ZOC time 2 SW	Zero-sequence overcurrent time-limit 2 switching on/off	□OFF □ON
21	GZOC time 1 SW	Gap zero-sequence overcurrent time-limit 1 switching on/off	□OFF □ON
22	GZOC time 2 SW	Gap zero-sequence overcurrent time-limit 2 switching on/off	□OFF □ON
23	ZS OV time 1 SW	Zero-sequence Overvoltage time-limit 1 switching on/off	□OFF □ON
24	ZS OV time 2 SW	Zero-sequence Overvoltage time-limit 2 switching on/off	□OFF □ON
25	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
26	ST vent switch	Starting ventilation switching on/off	□OFF □ON
27	OLVR BLK switch	On-load voltage-regulated blocking switching on/off	□OFF □ON
28	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
29	2 wattmeter PWR	2 wattmeters measure way(power) (If select off, 3 wattmeters measure way auto on)	□OFF □ON


A
B
C
+KM
-KM
201
202
204
DC power supply
TA1a
(5P20)
TA1b
TA1c
TA2a
(0.5)
TA2b
TA2c
TA3a
101
102
103
104
105
106
Protection current
107
108
109
110
111
112
Measuring current
113
114
Zero-sequence current
115
116
Gap zero-sequence current
205
206
207
208
209
210
Measuring Voltage
DI Neg 301
Local-side TV check 302
DI 2 303
DI 3 304
DI 4 305
Complex-voltage DI 306
SF6 error alarm 307
Spring is not energy 308
Block remote 309
DI 9 310
DI 10 311
DI 11 312
DI 12 313
DI 13 314
DI 14 315
DI 15 316
401
402
Trip local-side busbar
403
404
Trip local-side CB
405
406
Trip middle-side CB
407
408
Trip low-side CB
409
410
Local-side complex-voltage output
411
412
Local-side complex-voltage output
413
415
Start Ventilation
417
418
Block regulator
317
318
A
B
RS485
319
320
+
-
IRIG-B
Work power loss 421
Signal COM 422
Action signal 423
Alarm signal 424
Ethernet 1
Ethernet 2


PORT
401
402
Trip busbar
403
404
Trip local-side
405
406
Trip other-side
407
408
Trip other-side
409
410
Local-side complex-voltage output
411
412
Local-side complex-voltage output
413
414
415
COM
Start Ventilation
416
417
418
419
COM
Block regulator
420
421
422
423
424
Work power loss
Signal com
Action signal
Alarm signal
CPU
301 DI Neg
302 Local-side TV check
303 DI 2
304 DI 3
305 DI 4
306 Complex-voltage DI
307 SF6 error alarm
308 Spring is not energy
309 Block remote
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 DI 13
315 DI 14
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209 Busbar voltage 3U0
210 Busbar voltage 3U0n
AC
Protection current Ia 101 102 Protection current Ia'
Protection current Ib 103 104 Protection current Ib'
Protection current Ic 105 106 Protection current Ic'
Measuring current Ia 107 108 Measuring current Ia'
Measuring current Ib 109 110 Measuring current Ib'
Measuring current Ic 111 112 Measuring current Ic'
Zero-sequence current I0 113 114 Zero-sequence current I0'
Gap zero-sequence current I0 115 116 Gap zero-sequence current I0'
117 118
119 120

TYT8693 Transformer Protection And Control Equipment

1 Functions

- 3-zone composite voltage overcurrent protection
- Overcurrent inverse time-limit protection
- 2-zone negative sequence overcurrent protection
- HV side zero-sequence overcurrent protection
- LV side zero-sequence overcurrent protection
- LV side zero-sequence inverse time-limit overcurrent protection
- Overload protection
- Overvoltage protection
- Undervoltage protection
- Noumenon protection
- F-C blocking
- I，U，P，Q，Cosφ，kWh，kVarh，15-channel DI
- 4-20mA DC Output (Optional, please declare when ordering)
- B code time-check and NTP time-check

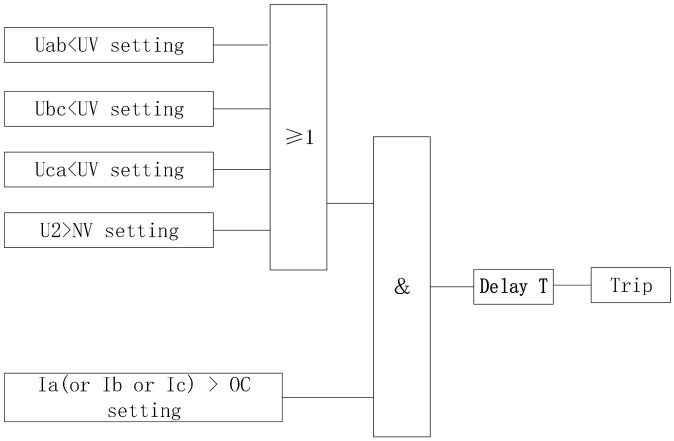
2 Principle Descriptions

2.1 3-zone composite voltage overcurrent protection

As any phase current is higher than the setting and the composite voltage is started, the protection will trip after a time delay.

The function of the composite voltage starting element: the phase current is started by the low voltage or negative sequence voltage, and the low voltage means that any line voltage is less than the low voltage fixed value. If the re-voltage start-up element is withdrawn, the over-current protection does not need to be composite voltage started.

After the PT is disconnected, the current protection with composite voltage is blocked.



2.2 Overcurrent inverse time-limit protection

Three performance curves can be selected:

Normal inverse time limit: $t = \frac{0.14}{(I/I_p)^{0.02} - 1} t_p$

Strong inverse time-limit: $t = \frac{13.5}{(I/I_p) - 1} t_p$

Extreme inverse time-limit: $t = \frac{80}{(I/I_p)^2 - 1} t_p$

In the formula,

t is the operating time delay of the inverse time-limit overcurrent protection.

I is the actual current value at the secondary side of a transformer.

Ip is the starting value of the inverse time-limit current protection. As I >Ip, protection will start.

tp is the time constant of inverse time-limit.

2.3 2-zone negative sequence overcurrent protection

When the negative sequence current is greater than the setting value, the device will act after a delay. Generally, one zone is used for tripping, and the second zone is used for alarming.

2.4 High voltage side zero-sequence overcurrent protection

The high-voltage side definite time zero-sequence overcurrent measurement range is 0.05~30A (secondary value), which is used for indirect grounding systems.

When the 3I0 on the high-voltage side of the transformer is greater than the fixed value, the device will trip or send a letter after a delay.

2.5 Low voltage side zero-sequence overcurrent protection

Low-voltage side definite time zero-sequence overcurrent protection measuring range 0.2~100A (secondary value), used for direct grounding system.

When the transformer's low zero sequence 3I0 overcurrent is greater than the fixed value, the device will trip or send a letter after a delay.

2.6 Low voltage side zero-sequence inverse time-limit overcurrent protection

The range of current is 0.2~100A (secondary value)，for use in directly grounded systems.

Performance curves:

$$t = \frac{t_p}{I_{0L}^{*} - I_{re}}$$

In the formula,

t is the operating time of the zero-sequence inverse time-limit protection.

Tp is the inverse-time-limit time constant.

IoL* is the ratio of the actually measured zero-sequence current to the reference value of zero-sequence

current.

Ire is the starting threshold for zero-sequence inverse time-limit (Generally take 0.25).

2.7 Overload protection

As any phase current is larger than the setting, the protection will trip or signal after a time delay.

2.8 Overvoltage protection

As any line voltage is higher than the setting, the protection will trip after a time delay.

2.9 Undervoltage protection

As the line voltage are all lower than the setting, the protection will trip after a time delay.

When the bus is not powered, the low-voltage protection will act. To avoid this situation, the device is equipped with low-voltage open conditions and jumping block. The open conditions must be met before the low-voltage protection is activated; when the switch is tripping, blocking low voltage protection. The low-voltage open condition can be enabled (used) or withdrawn (not used) by the user.

When the low-voltage protection acts, the switch jumps, and the low-voltage protection returns immediately; when the low-voltage protection acts, the protection does not take the switch jumping position, and the protection returns with a delay of 10S.

Low-voltage open condition: If one of the three line voltages is greater than 80V, and the delay is 100ms, the low-voltage open condition is considered to be valid all the time.

After the low-voltage action returns (greater than the low-voltage action value), delay 10S, restart the judgment of the low-voltage open condition, and this condition can be switched off.

TV disconnection blocking low voltage protection.

2.10 Noumenon protection

The protection is provided with 4 channels contacter input as non-electric-quantity protection.

If contacter become closed，the protection will trip or signal after a time delay.

2.11 TV disconnection alarm

The device has a TV disconnection check function, and when the device detects that the TV is disconnected, an alarm signal is issued.

The difference between any two-phase line voltage>30V;

Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

2.12 F-C blocking

If one of Ia, Ib, Ic is lager than setting with delay, all protection will auto block. This fuction can guarantee contactor don't trip, on the other hand fast acting fuse melts.

2.13 4-20mA DC output (Optional)

Terminal device (302, 303) output all the way 4-20mA DC, for access to the DCS system analog acquisition cards (AI).

The DC output can be set up in the device by the user to select the corresponding Ia or Uab or P.

3 Setting

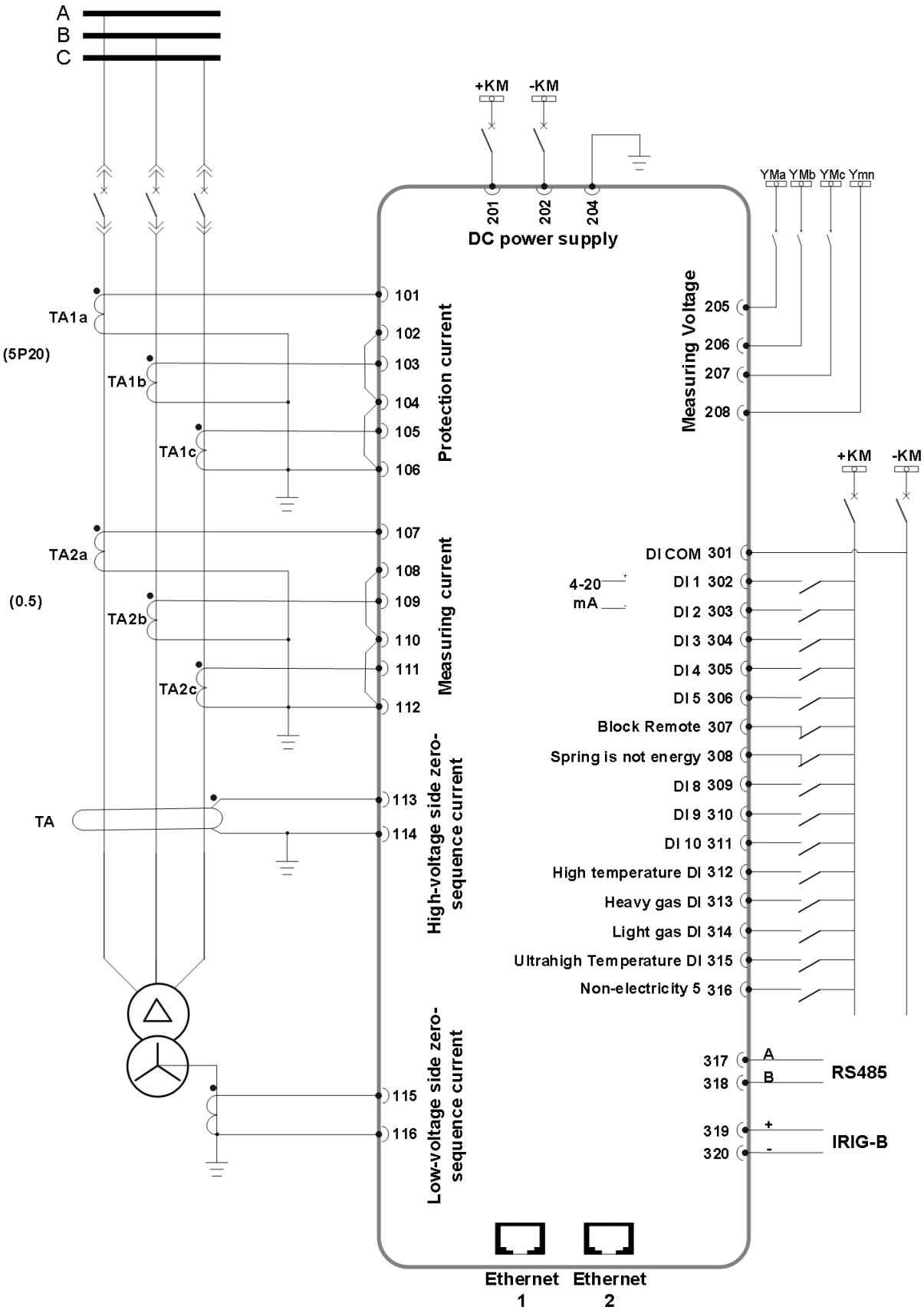
List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	OC-I current	Overcurrent zone I current	A	0.05～99.99
2	OC-I time	Overcurrent zone I time	S	0～60
3	OC-II current	Overcurrent zone II current	A	0.05～99.99
4	OC-II time	Overcurrent zone II time	S	0～60
5	OC-III current	Overcurrent zone III current	A	0.05～99.99
6	OC-III time	Overcurrent zone III time	S	0～60
7	CV UV-I setting	Complex-voltage Undervoltage zone I setting	V	10~90
8	CV UV-II SET	Complex-voltage Undervoltage zone II setting	V	10~90
9	CV UV-III SET	Complex-voltage Undervoltage zone III setting	V	10~90
10	CV NV setting	Complex-voltage negative-sequence voltage setting	V	1～99.99
11	OC IT current	Overcurrent inverse time-limit current	A	0.05～99.99
12	OC IT constant	Overcurrent inverse time-limit constant	S	0～60
13	NS OC-I current	Negative-sequence overcurrent zone I current	A	0.05～99.99
14	NS OC-I time	Negative-sequence overcurrent zone I time	S	0～60
15	NS OC-II CURT	Negative-sequence overcurrent zone II current	A	0.05～99.99
16	NS OC-II time	Negative-sequence overcurrent zone II time	S	0～60
17	HV ZOC current	High voltage zero-sequence overcurrent setting	A	0.05～30
18	HV ZOC time	High voltage zero-sequence overcurrent time	S	0～60
19	LV ZOC current	Low voltage zero-sequence overcurrent setting	A	0.2～99.99
20	LV ZOC time	Low voltage zero-sequence overcurrent time	S	0～60
21	LV ZOC IT rated	Low voltage zero-sequence current inverse time-limit rated value	A	0.05～99.99
22	LV ZOC IT const	Low voltage zero-sequence inverse time-limit constant	S	0～60

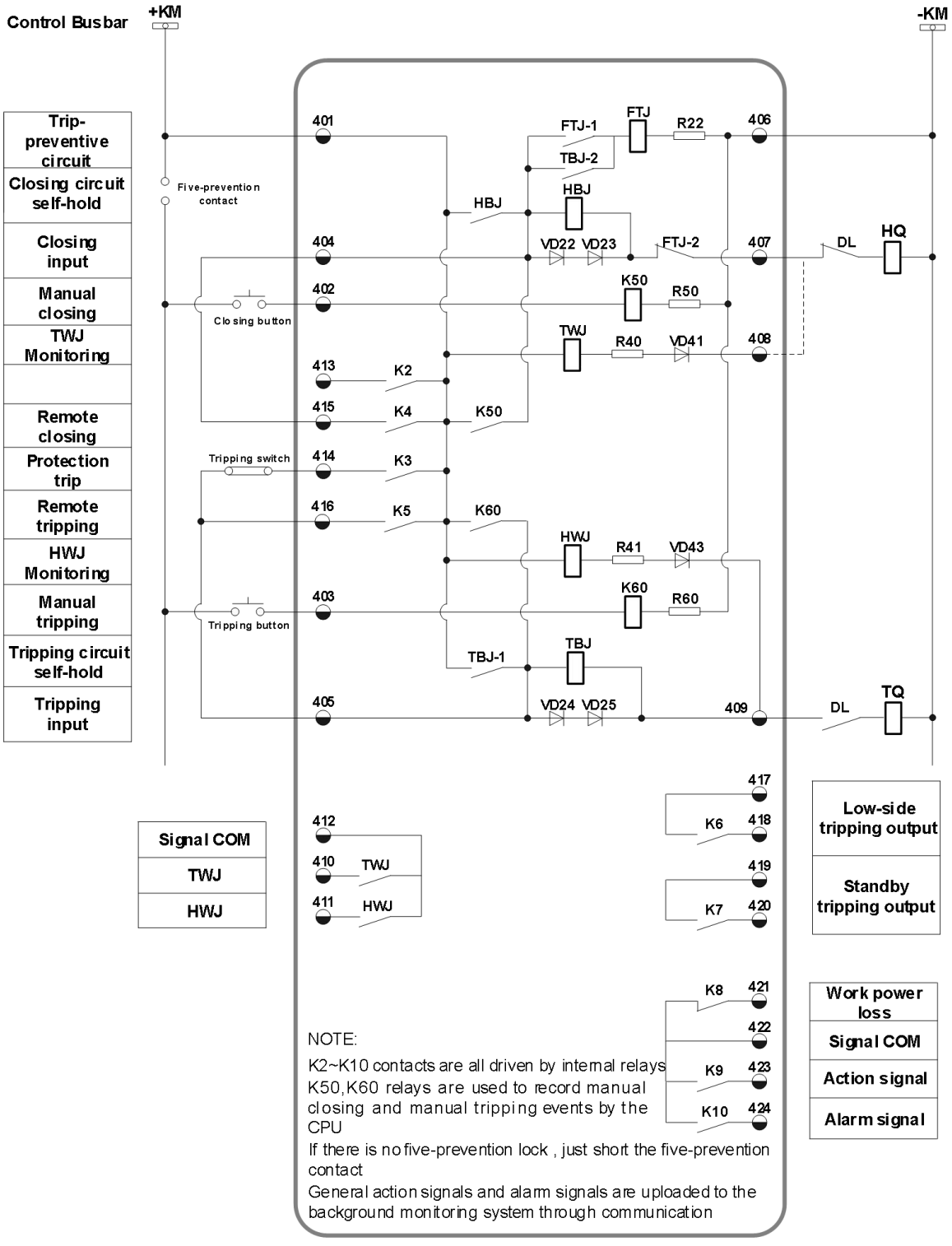
23	LV ZOC IT THLD	Low voltage zero-sequence inverse time-limit threshold	Ie	0～20
24	OVLD setting	Overload setting	A	0.05～99.99
25	OVLD time	Overload time	S	0～60
26	OV setting	Overvoltage setting	V	15～140
27	OV time	Overvoltage time	S	0.1～60
28	UV setting	Undervoltage setting	V	15～99.99
29	UV time	Undervoltage time	S	0.1～60
30	F-C BLK current	F-C blocking current	A	0.1～99.99
31	F-C BLK time	F-C blocking time	S	0～60

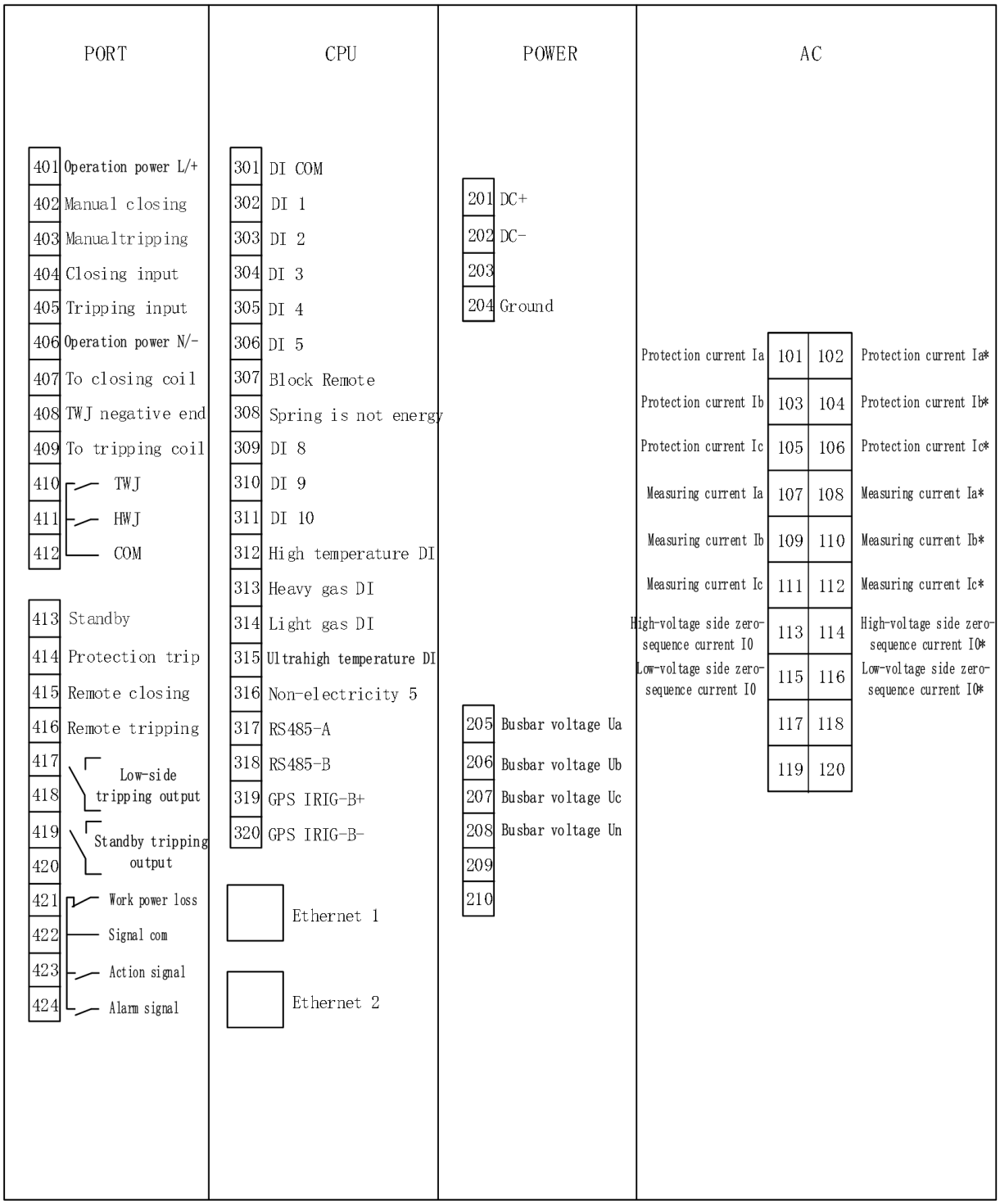
List of control characters

Ser.No.	Abbreviation	Name of control characters	Options
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON
3	Two to three	2 phase – 3 relay (measure Ia, Ic	□OFF □ON
4	High TEMP trip	High temperature trip switching on/off	□OFF □ON
5	High TEMP ALM	High temperature alarm switching on/off	□OFF □ON
6	Heavy Gas trip	Heavy gas trip switching on/off	□OFF □ON
7	Heavy Gas ALM	Heavy gas alarm switching on/off	□OFF □ON
8	Light Gas trip	Light gas trip switching on/off	□OFF □ON
9	Light Gas ALM	Light gas alarm switching on/off	□OFF □ON
10	Ultrahigh TEMP trip	Ultrahigh temperature trip switching on/off	□OFF □ON
11	Ultrahigh TEMP ALM	Ultrahigh temperature alarm switching on/off	□OFF □ON
12	Non-elect SB trip	Non-electricity standby trip switching on/off	□OFF □ON
13	Non-elect SB ALM	Non-electricity standby alarm switching on/off	□OFF □ON
14	OC-I switch	Overcurrent zone I switching on/off	□OFF □ON
15	OC-I CV ST	Overcurrent zone I Complex-voltage starting	□OFF □ON
16	OC-II switch	Overcurrent zone II switching on/off	□OFF □ON
17	OC-II CV ST	Overcurrent zone II Complex-voltage starting	□OFF □ON
18	OC-III switch	Overcurrent zone III switching on/off	□OFF □ON
19	OC-III CV ST	Overcurrent zone III Complex-voltage starting	□OFF □ON
20	OC NOR-IT switch	Overcurrent normal inverse time switching on/off	□OFF □ON
21	OC STR-IT switch	Overcurrent strong inverse time switching on/off	□OFF □ON
22	OC EXT-IT switch	Overcurrent extremely inverse time switching on/off	□OFF □ON
23	NS OC-I switch	Negative-sequence overcurrent zone I switching on/off	□OFF □ON
24	NS OC-II switch	Negative-sequence overcurrent zone II switching on/off	□OFF □ON
25	HV ZOC alarm	High voltage zero-sequence overcurrent	□OFF □ON

		alarm switching on/off	
26	HV ZOC trip	High voltage zero-sequence overcurrent trip switching on/off	□OFF □ON
27	LV ZOC alarm	Low voltage zero-sequence overcurrent alarm switching on/off	□OFF □ON
28	LV ZOC trip	Low voltage zero-sequence overcurrent trip switching on/off	□OFF □ON
29	LV ZOC IT switch	Low voltage zero-sequence inverse time-limit switching on/off	□OFF □ON
30	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
31	OV switch	Overvoltage switching on/off	□OFF □ON
32	UV switch	Undervoltage switching on/off	□OFF □ON
33	UV COND switch	Undervoltage condition switching on/off	□OFF □ON
34	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
35	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
36	2 wattmeter PWR	2 wattmeters measure way(power) (If select off, 3 wattmeters measure way auto on)	□OFF □ON
37	FC BLK switch	F-C blocking switching on/off	□OFF □ON


A
B
C
+KM
-KM
201
202
204
DC power supply
YMa YMb YMc Ymn
TA1a
(5P20)
TA1b
TA1c
101
102
103
104
105
106
Protection current
Measuring Voltage
205
206
207
208
+KM
-KM
TA2a
(0.5)
TA2b
TA2c
107
108
109
110
111
112
Measuring current
DI COM 301
4-20 mA
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
Block Remote 307
Spring is not energy 308
DI 8 309
DI 9 310
DI 10 311
High temperature DI 312
Heavy gas DI 313
Light gas DI 314
Ultrahigh Temperature DI 315
Non-electricity 5 316
TA
113
114
High-voltage side zero-sequence current
317 A
318 B
RS485
319 +
320 -
IRIG-B
115
116
Low-voltage side zero-sequence current
Ethernet 1
Ethernet 2


Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
406
407
408
409
FTJ
FTJ-1
TBJ-2
R22
HBJ
VD22 VD23
FTJ-2
DL
HQ
K50
R50
TWJ
R40
VD41
K2
K4
K50
K3
K5
K60
HWJ
R41
VD43
K60
R60
TBJ-1
TBJ
VD24 VD25
TQ
Signal COM
TWJ
HWJ
412
410
411
417
K6
418
419
K7
420
Low-side tripping output
Standby tripping output
K8
421
422
K9
423
K10
424
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Standby
414 Protection trip
415 Remote closing
416 Remote tripping
417
418
Low-side tripping output
419
420
Standby tripping output
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 DI 1
303 DI 2
304 DI 3
305 DI 4
306 DI 5
307 Block Remote
308 Spring is not energy
309 DI 8
310 DI 9
311 DI 10
312 High temperature DI
313 Heavy gas DI
314 Light gas DI
315 Ultrahigh temperature DI
316 Non-electricity 5
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209
210
AC
Protection current Ia 101 102 Protection current Ia*
Protection current Ib 103 104 Protection current Ib*
Protection current Ic 105 106 Protection current Ic*
Measuring current Ia 107 108 Measuring current Ia*
Measuring current Ib 109 110 Measuring current Ib*
Measuring current Ic 111 112 Measuring current Ic*
High-voltage side zero-sequence current I0 113 114 High-voltage side zero-sequence current I0*
Low-voltage side zero-sequence current I0 115 116 Low-voltage side zero-sequence current I0*
117 118
119 120

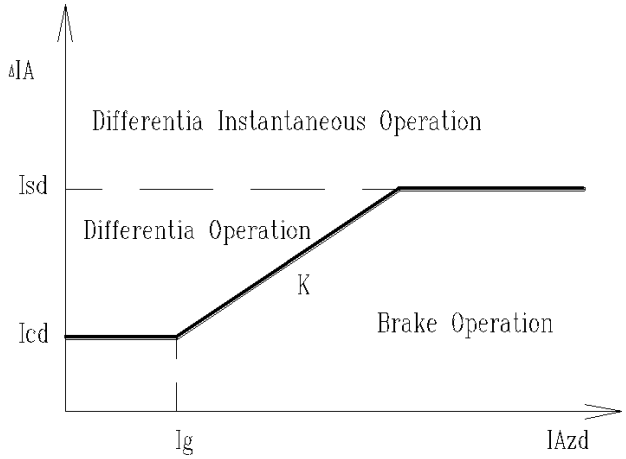
TYT8694 Transformer Comprehensive Protection And Control Equipment

1 Functions

- Differential protection
- Differential instantaneous protection
- Differential current overcurrent
- 3-zone composite voltage overcurrent protection
- Overcurrent inverse time-limit protection
- 2-zone negative sequence overcurrent protection
- HV side zero-sequence overcurrent protection
- LV side zero-sequence overcurrent protection
- LV side zero-sequence inverse time-limit overcurrent protection
- Overload protection
- Overvoltage protection
- Undervoltage protection
- Noumenon protection
- F-C blocking
- I，U，P，Q，Cosφ，kWh，kVarh，15-channel DI
- 4-20mA DC Output (Optional, please declare when ordering)
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 The proportion differentia protection which is braked with 2nd harmonic



IAzd —Brake current of phase A;

ΔIA —Differentia current of phase A;

ΔIAF2－The 2nd harmonic of IA;

ΔIAF3－The 3rd harmonic of IA

K2－The brake scale of 2nd harmonic (setting);

K3－The brake scale of 3rd harmonic (setting);

Icd—The setting of differentia;

Ig —The current vlaue of inflexion.

The current vlaue of inflexion is o.7 of Ie.

The K can be modified.

2.1.1 A The proportion differentia protection of phase A:

The device sampling each phase's original current (High of phase A is Hia, High of phase B is Hib, High of phase C is Hic,Middle of phase A is Mia, Middle of phase B is Mib, Middle of phase C is Mic,Low of phase A is Lia, ,Low of phase B is Lib, Low of phase C is Lic).Because the methods of connection,the different voltage of transformers' different side,the connection's methods of TA and so on,we change the original current to the tranformer current (High transforner current of phase A is Thia, High transforner current of phase B is Thib, High transforner current of phase C is Thic, Middle transforner current of phase A is Tmia, Middle transforner current of phase B is Tmib, Middle transforner current of phase C is Tmic, Low transforner current of phase A is Tlia, Low transforner current of phase B is Tlib, Low transforner current of phase C is Tlic).

IAzd = Max(Thia，Tmia，Tlia)

ΔIA = | Thia + Tmia + Tlia |

If IAzd<Ig, the action equation of phase A is IA＞Icd

If IAzd>Ig, the action equation of phase A is IA＞Icd＋(IAzd－Ig)＊K

2.1.2 The action equation of 2nd harmonic and 3rd harmonic brake the differentia protection:

$$\frac{\Delta IAF2}{\Delta IA} < K2 \quad \text{and} \quad \frac{\Delta IAF3}{\Delta IA} < K3$$

2.1.3 The proportion differentia protection action with each phase, so the phase B and phase C are same as the phase A.

2.2 Differential instantaneous protection

As the differential current of any phase is larger than the setting for the differential instantaneous protection, the protection will have an output without a time delay.

2.3 Differential current overreach alarm

As the protection detects that the differential current of any phase reaches the setting for the differential current overreach alarm, the protection will send the alarm signal after a certain time delay.

2.4 TA wire break blocking or alarm

As the TA wire break occurs at any phase at any side during motor operation at the rated current, the protection can signal or block the differential protection based on the control characters.

2.5 Set calculate

2.5.1 Calculate the rated current of transfomer's each side as following, which is the balance current of one side.

$$I_B = \frac{P}{\sqrt{3}U}$$

P — The rated capacity of transformer (KVA), If the capacity of each side is not equal, the capacity of the side with the largest capacity should be taken, and the bridge wire and factory branch connected to the differential circuit should also adopt the same capacity.

U — The rated line voltage of transformer's each side(KV), for the corresponding side with a voltage regulating tap, the middle tap voltage is generally used. If it is impossible to change the tap in the actual operation, the voltage of the actual tap can be taken.

2.5.2 Calculate the secondary balance current Ib of TA.

$$I_b = \frac{K_{jx} I_B}{K_{LH}}$$

I_B — Primary balance current.

K_{LH} — Current transformer ratio.

Kjx — The scale of connection,the K_{JX}=1 when the connection of TA is Y, the Kjx=$\sqrt{3}$ when the connection of TA is △

The secondary balance current on the high voltage side is represented as I_{Hb}, the secondary balance current on the medium voltage side is represented as I_{Mb}, and the secondary balance current on the low voltage side is represented as I_{Lb}.

2.5.3 The selection of transformer's connection methods and TA the banlance current

Generally, the external TA is required to be connected in a Y-shaped connection (Kjx on each side is 1), the angle and amplitude of the current on each side are compensated by the software inside the device, and the wiring method of transformer Y or △ is selected by the control word (such as ydd1 , yyd11).

If the current turning angle is carried out through the external TA, the transformer wiring mode should be selected as yyy when setting, that is, the internal software of the device will no longer carry out the turning angle, and pay attention to the Kjx on each side.

The TA balance current is the secondary balance current IHb on the high voltage side. (The setting action value of differential element and differential quick-break element is based on this)

The current's converted arithmetic of Y side as the following when the high is Y:

$$\vec{I}_0 = (\vec{I}_a + \vec{I}_b + \vec{I}_c)/3$$

$$\vec{T}_{ia} = \text{Balance Coefficient} \times (\vec{I}_a - \vec{I}_0),\ \vec{T}_{ib} = \text{Balance Coefficient} \times (\vec{I}_b - \vec{I}_0),$$

$$\vec{T}_{ic} = \text{Balance Coefficient} \times (\vec{I}_c - \vec{I}_0)$$

The current's converted arithmetic of △ －11 side as the following when the high is Y:

$\vec{T}_{ia}$ = BBalance Coefficient × ($\vec{i}_a - \vec{i}_c$) / $\sqrt{3}$,

$\vec{T}_{ib}$ = Balance Coefficient × ($\vec{i}_b - \vec{i}_a$) / $\sqrt{3}$,

$\vec{T}_{ic}$ = Balance Coefficient × ($\vec{i}_c - \vec{i}_b$) / $\sqrt{3}$

The current's converted arithmetic of △ －1 side as the following when the high is Y:

$\vec{T}_{ia}$ = Balance Coefficient × ($\vec{i}_a - \vec{i}_b$) / $\sqrt{3}$,

$\vec{T}_{ib}$ = Balance Coefficient × ($\vec{i}_b - \vec{i}_c$) / $\sqrt{3}$,

$\vec{T}_{ic}$ = Balance Coefficient × ($\vec{i}_c - \vec{i}_a$) / $\sqrt{3}$

The current's converted arithmetic of △ side as the following when the high is △:

$\vec{T}_{ia}$ = Balance Coefficient × $\vec{i}_a$, $\vec{T}_{ib}$ = Balance Coefficient × $\vec{i}_b$,

$\vec{T}_{ic}$ = Balance Coefficient × $\vec{i}_c$

The current's converted arithmetic of Y －11side as the following when the high is △:

$\vec{T}_{ia}$ = Balance Coefficient × ($\vec{i}_a - \vec{i}_c$) / $\sqrt{3}$,

$\vec{T}_{ib}$ = Balance Coefficient × ($\vec{i}_b - \vec{i}_a$) / $\sqrt{3}$,

$\vec{T}_{ic}$ = Balance Coefficient × ($\vec{i}_c - \vec{i}_b$) / $\sqrt{3}$

The current's converted arithmetic of Y －1 side as the following when the high is △:

$\vec{T}_{ia}$ = Balance Coefficient × ($\vec{i}_a - \vec{i}_b$) / $\sqrt{3}$,

$\vec{T}_{ib}$ = Balance Coefficient × ($\vec{i}_b - \vec{i}_c$) / $\sqrt{3}$,

$\vec{T}_{ic}$ = Balance Coefficient × ($\vec{i}_c - \vec{i}_a$) / $\sqrt{3}$

2.5.4 The middle balance factor PH MXS and low balance PH LXS are followings:

$$PH_{MXS} = \frac{I_{Hb}}{I_{Mb}} \qquad PH_{LXS} = \frac{I_{Hb}}{I_{Lb}}$$

The high balance factor is 1 and couldn't set.

2.5.5 The action setting of differentia commonly is 25%~50% of Ie which is the secondary rated current of TA (High side).

2.5.6 Differential instantaneous element set，oprate value shout meet the three conditions:

a) Less than between converter and current transformer saturation current;

b) In the most serious external fault steady-state current imbalance is not maloperation;

c) Avoid transformer inrush current, in the absence of enough setting the basis of not more than 12 times the transformer rated current, the general setting of 8 ~ 9 Times the transformer rated current.

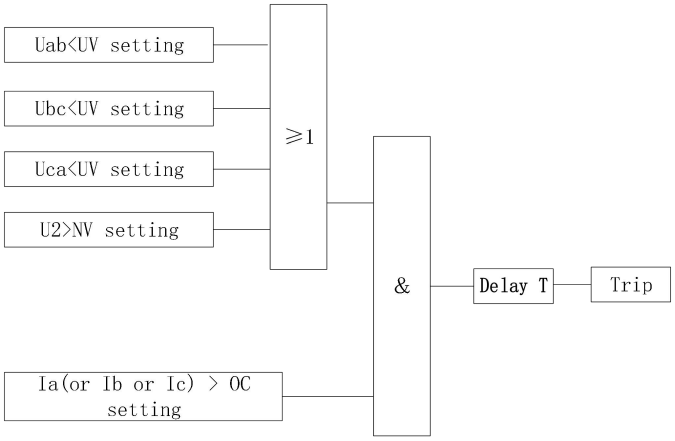
2.5.7 The action setting of K commonly is 0.5~0.7.

2.5.8 The action setting of IAF2 commonly is 0.12~0.15; The action setting of IAF2 commonly is 0.15~0.2.

2.6 3-zone composite voltage overcurrent protection

As any phase current is higher than the setting and the composite voltage is started, the protection will trip after a time delay.

The function of the composite voltage starting element: the phase current is started by the low voltage or negative sequence voltage, and the low voltage means that any line voltage is less than the low voltage fixed value. If the re-voltage start-up element is withdrawn, the over-current protection does not need to be composite voltage started.



2.7 Overcurrent inverse time-limit protection

Three performance curves can be selected:

Normal inverse time limit: $t = \frac{0.14}{(I/I_p)^{0.02} - 1} t_p$

Strong inverse time-limit: $t = \frac{13.5}{(I/I_p) - 1} t_p$

Extreme inverse time-limit: $t = \frac{80}{(I/I_p)^2 - 1} t_p$

In the formula,

t is the operating time delay of the inverse time-limit overcurrent protection.

I is the actual current value at the secondary side of a transformer.

Ip is the starting value of the inverse time-limit current protection. As I >Ip, protection will start.

tp is the time constant of inverse time-limit.

2.8 2-zone negative sequence overcurrent protection

When the negative sequence current is greater than the setting value, the device will act after a delay. Generally, one zone is used for tripping, and the second zone is used for alarming.

2.9 High voltage side zero-sequence overcurrent protection

The high-voltage side definite time zero-sequence overcurrent measurement range is 0.05~30A (secondary

value), which is used for indirect grounding systems.

When the 3I0 on the high-voltage side of the transformer is greater than the fixed value, the device will trip or send a letter after a delay.

2.10 Low voltage side zero-sequence overcurrent protection

Low-voltage side definite time zero-sequence overcurrent protection measuring range 0.2~100A (secondary value), used for direct grounding system.

When the transformer's low zero sequence 3I0 overcurrent is greater than the fixed value, the device will trip or send a letter after a delay.

2.11 Low voltage side zero-sequence inverse time-limit overcurrent protection

The range of current is 0.2~100A (secondary value)，for use in directly grounded systems.

Performance curves:

$$t = \frac{t_p}{I_{0L}^{*} - I_{re}}$$

In the formula,

t is the operating time of the zero-sequence inverse time-limit protection.

Tp is the inverse-time-limit time constant.

IoL* is the ratio of the actually measured zero-sequence current to the reference value of zero-sequence current.

Ire is the starting threshold for zero-sequence inverse time-limit (Generally take 0.25).

2.12 Overload protection

As any phase current is larger than the setting, the protection will trip or signal after a time delay.

2.13 Overvoltage protection

As any line voltage is higher than the setting, the protection will trip after a time delay.

2.14 Undervoltage protection

As the line voltage are all lower than the setting, the protection will trip after a time delay.

When the bus is not powered, the low-voltage protection will act. To avoid this situation, the device is equipped with low-voltage open conditions and jumping block. The open conditions must be met before the low-voltage protection is activated; when the switch is tripping, blocking low voltage protection. The low-voltage open condition can be enabled (used) or withdrawn (not used) by the user.

When the low-voltage protection acts, the switch jumps, and the low-voltage protection returns immediately; when the low-voltage protection acts, the protection does not take the switch jumping position, and the protection returns with a delay of 10S.

Low-voltage open condition: If one of the three line voltages is greater than 80V, and the delay is 100ms, the low-voltage open condition is considered to be valid all the time.

After the low-voltage action returns (greater than the low-voltage action value), delay 10S, restart the judgment of the low-voltage open condition, and this condition can be switched off.

TV disconnection blocking low voltage protection.

2.15 Noumenon protection

The protection is provided with 4 channels contacter input as non-electric-quantity protection.

If contacter become closed，the protection will trip or signal after a time delay.

2.16 TV disconnection alarm

The device has a TV disconnection check function, and when the device detects that the TV is disconnected, an alarm signal is issued.

The difference between any two-phase line voltage>30V;

Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

2.17 F-C blocking

If one of Ia, Ib, Ic is lager than setting with delay, all protection will auto block. This fuction can guarantee contactor don’t trip, on the other hand fast acting fuse melts.

2.18 4-20mA DC output (Optional)

Terminal device (302, 303) output all the way 4-20mA DC, for access to the DCS system analog acquisition cards (AI).

The DC output can be set up in the device by the user to select the corresponding Ia or Uab or P.

3 Setting

List of Setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	T 2nd rated CURT	Transformer secondary rated current	A	0.05~30
2	DIF CURT	Differential current	Ie	0.2～2
3	INS DIF CURT	Differential instantaneous current	Ie	1～20
4	RT-BRK factor	Ratio differential braking factor		0.3～1
5	2nd-H BRK factor	Second harmonics braking factor		0.1～0.3
6	3nd-H BRK factor	Third harmonics braking factor		0.1～0.3
7	LV BAL factor	Balance factor of low-voltage side		0.1～10

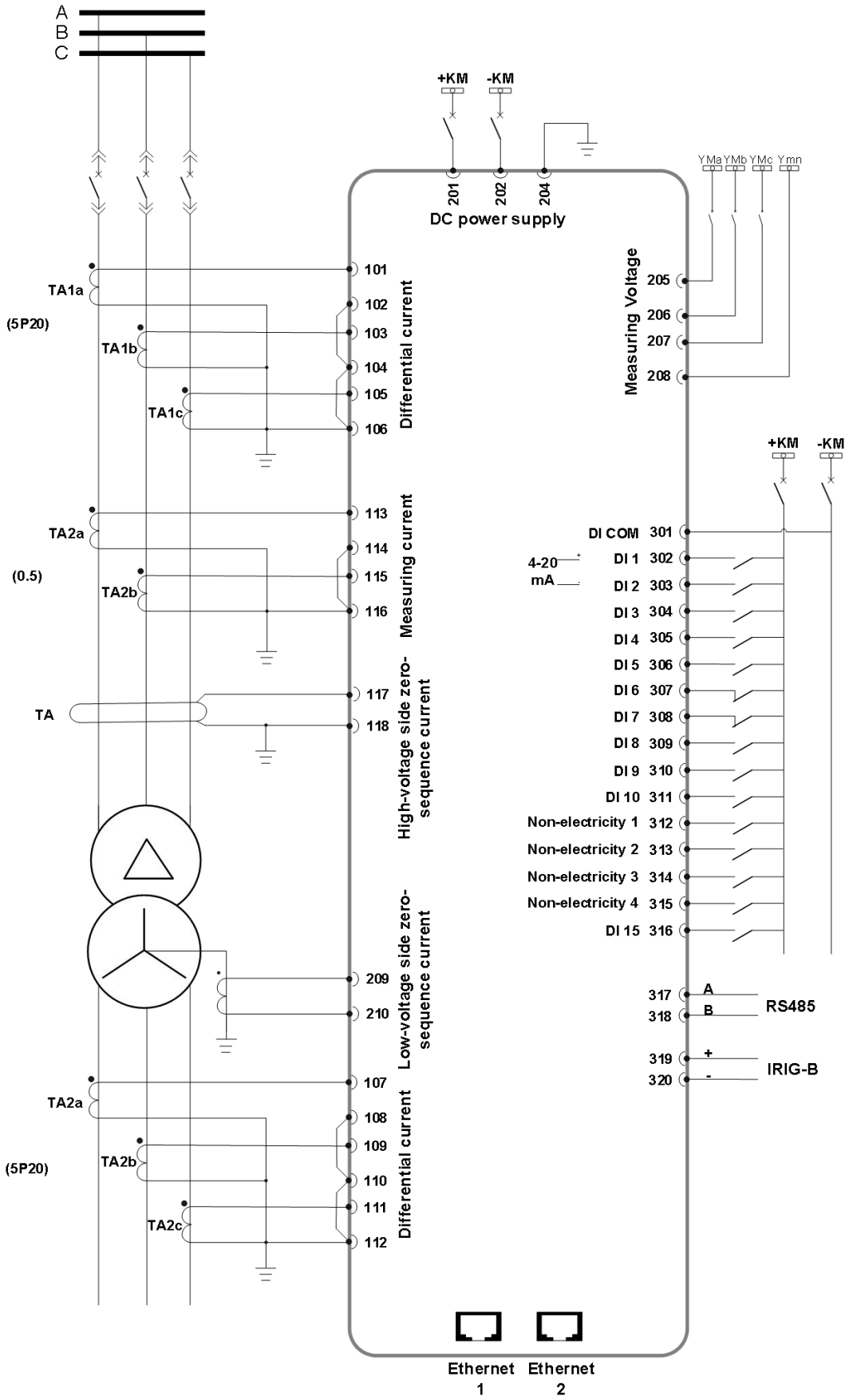
8	DIF CURT OR alm	Differential current overreach alarm setting	Ie	0.1～1
9	DIF CURT OR time	Differential current overreach time	S	0.1～50.00
10	OC-I current	Overcurrent zone I current	A	0.05～99.99
11	OC-I time	Overcurrent zone I time	S	0～60
12	OC-II current	Overcurrent zone II current	A	0.05～99.99
13	OC-II time	Overcurrent zone II time	S	0～60
14	OC-III current	Overcurrent zone III current	A	0.05～99.99
15	OC-III time	Overcurrent zone III time	S	0～60
16	CV UV-I setting	Complex-voltage Undervoltage zone I setting	V	10~90
17	CV UV-II SET	Complex-voltage Undervoltage zone II setting	V	10~90
18	CV UV-III SET	Complex-voltage Undervoltage zone III setting	V	10~90
19	CV NV setting	Complex-voltage negative-sequence voltage setting	V	1～99.99
20	OC IT current	Overcurrent inverse time-limit current	A	0.05～99.99
21	OC IT constant	Overcurrent inverse time-limit constant	S	0～60
22	NS OC-I current	Negative-sequence overcurrent zone I current	A	0.05～99.99
23	NS OC-I time	Negative-sequence overcurrent zone I time	S	0～60
24	NS OC-II CURT	Negative-sequence overcurrent zone II current	A	0.05～99.99
25	NS OC-II time	Negative-sequence overcurrent zone II time	S	0～60
26	HV ZOC current	High voltage zero-sequence overcurrent setting	A	0.05～30
27	HV ZOC time	High voltage zero-sequence overcurrent time	S	0～60
28	LV ZOC current	Low voltage zero-sequence overcurrent setting	A	0.2～99.99
29	LV ZOC time	Low voltage zero-sequence overcurrent time	S	0～60
30	LV ZOC IT rated	Low voltage zero-sequence current inverse time-limit rated value	A	0.05～99.99
31	LV ZOC IT const	Low voltage zero-sequence inverse time-limit constant	S	0～60
32	LV ZOC IT THLD	Low voltage zero-sequence inverse time-limit threshold	Ie	0～20
33	OVLD setting	Overload setting	A	0.05～99.99
34	OVLD time	Overload time	S	0～60
35	OV setting	Overvoltage setting	V	15～140
36	OV time	Overvoltage time	S	0.1～60
37	UV setting	Undervoltage setting	V	15～99.99
38	UV time	Undervoltage time	S	0.1～60
39	F-C BLK current	F-C blocking current	A	0.1～99.99

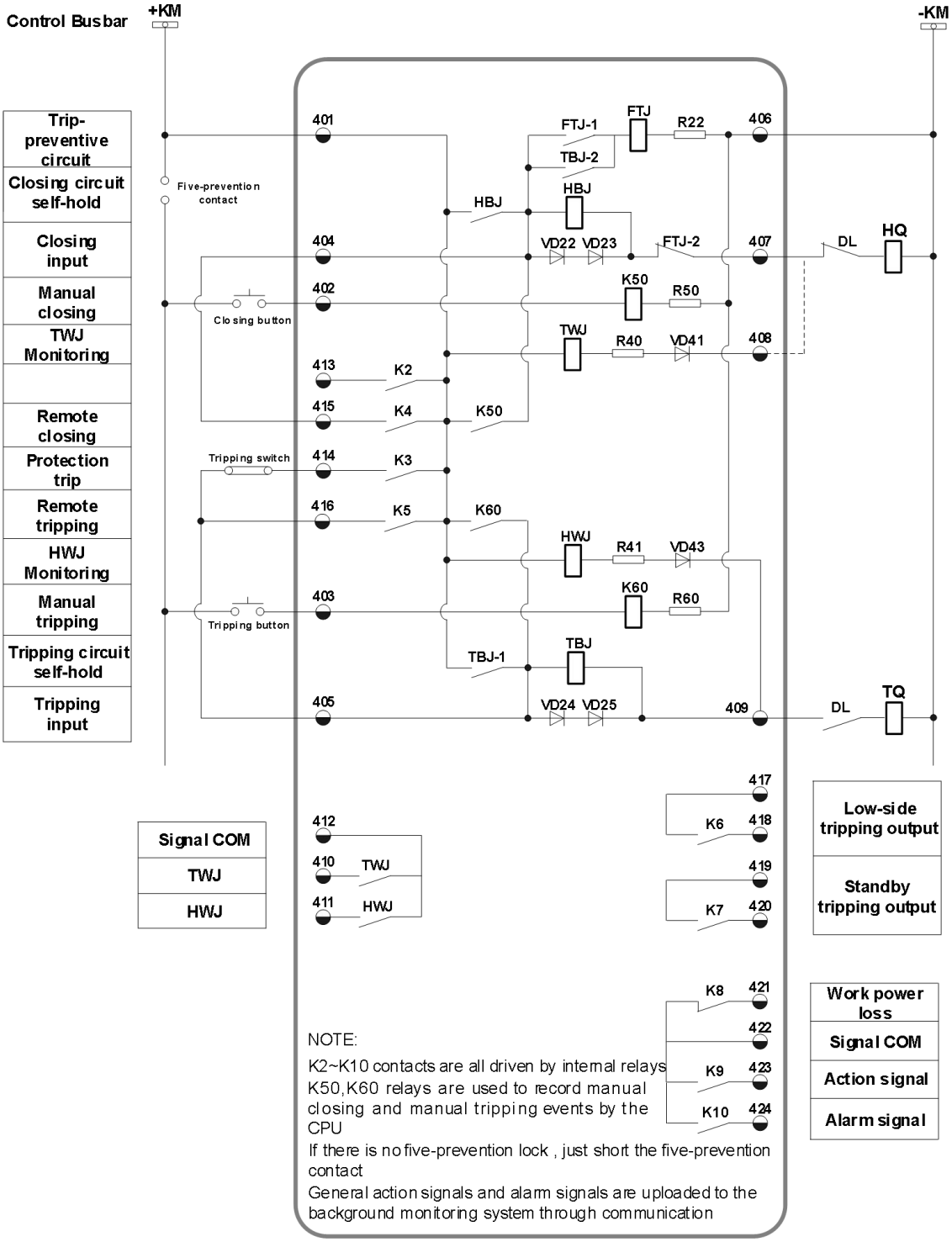
40	F-C BLK time	F-C blocking time	S	0～60

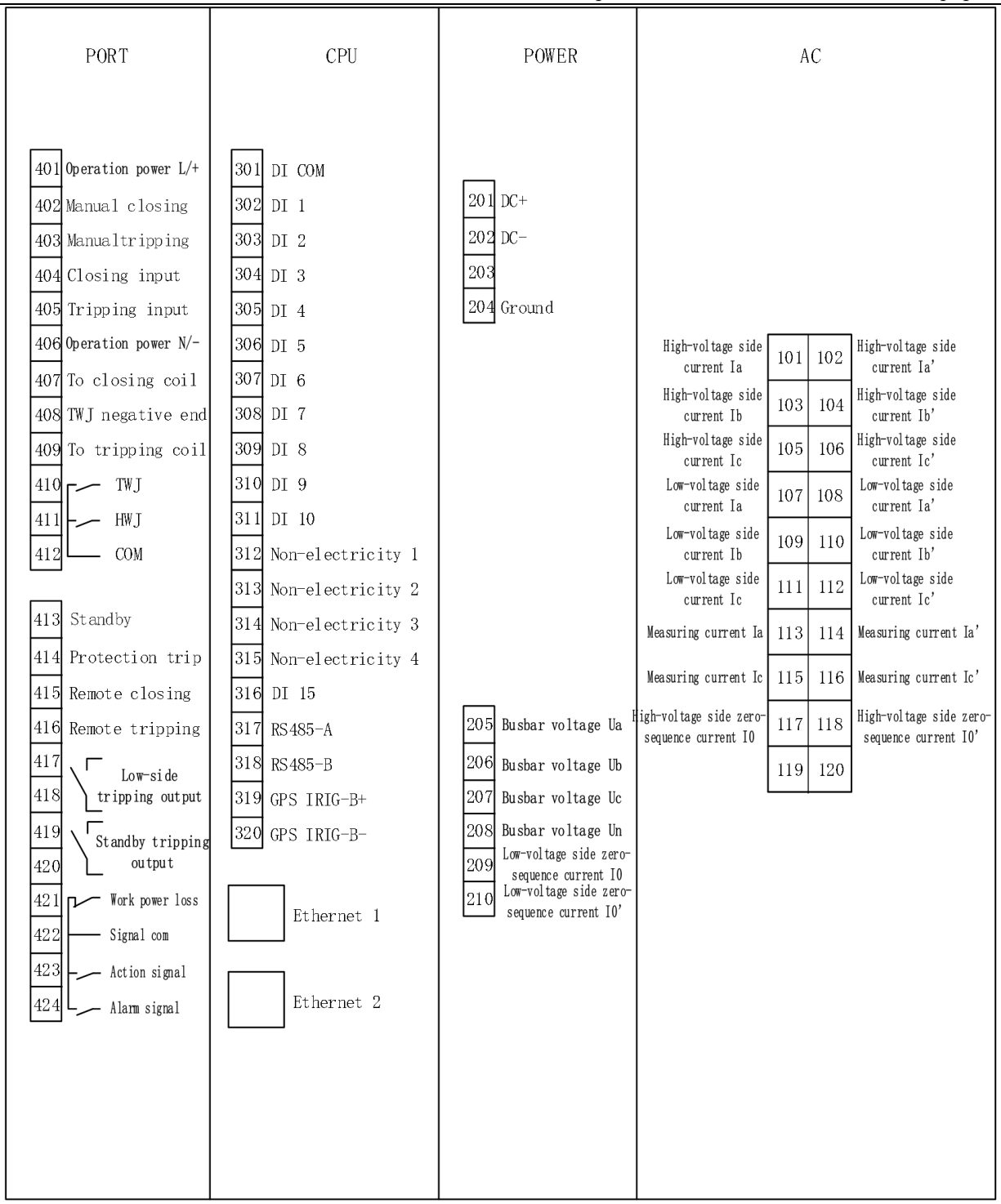
List of control characters

Ser.No.	Abbreviation	Name of control characters	Options
1	YY	YY Connection	□OFF □ON
2	YD1	YD1 Connection	□OFF □ON
3	YD11	YD11 Connection	□OFF □ON
4	DY11	DY11 Connection	□OFF □ON
5	DY1	DY1 Connection	□OFF □ON
6	Non-elect 1 trip	Non-electric 1 trip switching on/off	□OFF □ON
7	Non-elect 1 ALM	Non-electric 1 alarm switching on/off	□OFF □ON
8	Non-elect 2 trip	Non-electric 2 trip switching on/off	□OFF □ON
9	Non-elect 2 ALM	Non-electric 2 alarm switching on/off	□OFF □ON
10	Non-elect 3 trip	Non-electric 3 trip switching on/off	□OFF □ON
11	Non-elect 3 ALM	Non-electric 3 alarm switching on/off	□OFF □ON
12	Non-elect 4 trip	Non-electric 4 trip switching on/off	□OFF □ON
13	Non-elect 4 ALM	Non-electric 4 alarm switching on/off	□OFF □ON
14	INS DIF switch	Differential instantaneous current switching on/off	□OFF □ON
15	2nd-H BRK switch	Second harmonics braking switching on/off	□OFF □ON
16	3nd-H BRK switch	Third harmonics braking switching on/off	□OFF □ON
17	A-phase DIF	A-phase differential switching on/off	□OFF □ON
18	B-phase DIF	B-phase differential switching on/off	□OFF □ON
19	C-phase DIF	C-phase differential switching on/off	□OFF □ON
20	DIF OR ALM SW	Differential current overreach alarm switching on/off	□OFF □ON
21	TA DISCON ALM SW	TA disconnection alarm switching on/off	□OFF □ON
22	TA DISCON BLK SW	TA disconnection blocking differential switching	□OFF □ON
23	OC-I switch	Overcurrent zone I switching on/off	□OFF □ON
24	OC-I CV ST	Overcurrent zone I Complex-voltage starting	□OFF □ON
25	OC-II switch	Overcurrent zone II switching on/off	□OFF □ON
26	OC-II CV ST	Overcurrent zone II Complex-voltage starting	□OFF □ON
27	OC-III switch	Overcurrent zone III switching on/off	□OFF □ON
28	OC-III CV ST	Overcurrent zone III Complex-voltage starting	□OFF □ON
29	OC NOR-IT switch	Overcurrent normal inverse time switching on/off	□OFF □ON
30	OC STR-IT switch	Overcurrent strong inverse time switching on/off	□OFF □ON
31	OC EXT-IT switch	Overcurrent extremely inverse time switching on/off	□OFF □ON
32	NS OC-I switch	Negative-sequence overcurrent zone I switching on/off	□OFF □ON
33	NS OC-II switch	Negative-sequence overcurrent zone II switching on/off	□OFF □ON

34	HV ZOC alarm	High voltage zero-sequence overcurrent alarm switching on/off	□OFF □ON
35	HV ZOC trip	High voltage zero-sequence overcurrent trip switching on/off	□OFF □ON
36	LV ZOC alarm	Low voltage zero-sequence overcurrent alarm switching on/off	□OFF □ON
37	LV ZOC trip	Low voltage zero-sequence overcurrent trip switching on/off	□OFF □ON
38	LV ZOC IT switch	Low voltage zero-sequence inverse time-limit switching on/off	□OFF □ON
39	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
40	OV switch	Overvoltage switching on/off	□OFF □ON
41	UV switch	Undervoltage switching on/off	□OFF □ON
42	UV COND switch	Undervoltage condition switching on/off	□OFF □ON
43	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
44	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
45	FC BLK switch	F-C blocking switching on/off	□OFF □ON


A
B
C
+KM
-KM
201
202
204
DC power supply
YMa YMb YMc Ymn
Measuring Voltage
205
206
207
208
TA1a
(5P20)
TA1b
TA1c
101
102
103
104
105
106
Differential current
TA2a
(0.5)
TA2b
113
114
115
116
Measuring current
TA
117
118
High-voltage side zero-sequence current
209
210
Low-voltage side zero-sequence current
TA2a
(5P20)
TA2b
TA2c
107
108
109
110
111
112
Differential current
+KM
-KM
DI COM 301
4-20 mA
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
DI 6 307
DI 7 308
DI 8 309
DI 9 310
DI 10 311
Non-electricity 1 312
Non-electricity 2 313
Non-electricity 3 314
Non-electricity 4 315
DI 15 316
317 A
318 B
RS485
319 +
320 -
IRIG-B
Ethernet 1
Ethernet 2


Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
FTJ-1
FTJ
R22
406
TBJ-2
HBJ
VD22 VD23
FTJ-2
407
DL
HQ
K50
R50
TWJ
R40
VD41
408
K2
K4
K50
K3
K5
K60
HWJ
R41
VD43
K60
R60
TBJ-1
TBJ
VD24 VD25
409
DL
TQ
417
K6
418
419
K7
420
K8
421
422
K9
423
K10
424
412
410
TWJ
411
HWJ
Signal COM
TWJ
HWJ
Low-side tripping output
Standby tripping output
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Standby
414 Protection trip
415 Remote closing
416 Remote tripping
417
418
Low-side tripping output
419
420
Standby tripping output
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 DI 1
303 DI 2
304 DI 3
305 DI 4
306 DI 5
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 Non-electricity 1
313 Non-electricity 2
314 Non-electricity 3
315 Non-electricity 4
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209 Low-voltage side zero-sequence current I0
210 Low-voltage side zero-sequence current I0'
AC
High-voltage side current Ia
101
102
High-voltage side current Ia'
High-voltage side current Ib
103
104
High-voltage side current Ib'
High-voltage side current Ic
105
106
High-voltage side current Ic'
Low-voltage side current Ia
107
108
Low-voltage side current Ia'
Low-voltage side current Ib
109
110
Low-voltage side current Ib'
Low-voltage side current Ic
111
112
Low-voltage side current Ic'
Measuring current Ia
113
114
Measuring current Ia'
Measuring current Ic
115
116
Measuring current Ic'
High-voltage side zero-sequence current I0
117
118
High-voltage side zero-sequence current I0'
119
120

TYC8691 Capacitor Protection And Control Equipment

1 Functions

Model / Functions	TYC8691A	TYC8691B	TYC8691C
Instantaneous overcurrent protection	√	√	√
Overcurrent protection	√	√	√
Overvoltage protection	√	√	√
Undervoltage protection	√	√	√
Zero-sequence overcurrent protection	√	√	√
Neutral unbalance overcurrent protection	√		
Neutral unbalance overvoltage protection	√		
Phase voltage differential protection		√	
Bridge differential current protection			√
Three-phase measurement	√		
Two-phase measurement		√	√
GPS time-check and NTP time-check	√	√	√

2 Principle Descriptions

2.1 Instantaneous overcurrent protection

As any phase current is larger than the setting, the protection will trip after a time delay.

By three-phase capacitor-side operation mode at the smallest two-phase short circuit occurs, the protection of enough sensitivity to tuning action current, Such as $I_{OP}=\frac{I_{k.\min}}{K_{sen}}$。 $I_{k.\min}=\frac{\sqrt{3}}{2}\mathrm{X}\frac{1}{x_{s.\max}}$, $x_{s.\max}$ is the maximum reactance of the system in the minimum operating mode. K_{sen} ≥ 2.0, the sensitivity coefficient. In order to reliably avoid the closing inrush current at the moment when the capacitor is put into operation, it is appropriate to add a short delay (about 0.2S). If I_{OP} is greater than the closing inrush current, the delay will not be added.

2.2 Overcurrent protection

As any phase current is larger than the setting, the protection will trip or signal after a time delay.

The operating current should be considered: the capacitance of the capacitor bank has a deviation of +10%, which increases the load current; the capacitor is allowed to work for a long time at 1.3 times the rated current; it will not malfunction under the impact of closing inrush current. $I_{OP}=\frac{K_{rel}}{K_{re}}I_{\ln}$. K_{rel} is the reliability factor,

K_{rel}=1.5～2.0; K_{re} is the return coefficient, K_{rel}=0.85; $I_{\ln}$ is the rated line current of the three-phase capacitor bank.

2.3 Overvoltage protection

As any phase current is larger than the setting, the protection will trip or signal after a time delay.

The action voltage of overvoltage protection can be taken as U_{OP} = 120V (secondary value), and the delay time can be longer.

2.4 Undervoltage protection

When the three line voltages are all less than the fixed value, the device trips after a delay. When the TV is disconnected, the low-voltage protection is automatically blocked.

The operating voltage can be taken as U_{OP} =(0.5～0.6) U_n /n_{bv} . U_n is the rated voltage of the system. n_{bv} is the TV ratio. In order to avoid the short-circuit of the same-level voltage outgoing line, the low-voltage protection mistakenly cuts the capacitor bank, which should be avoided after a time limit.

When the bus is not powered, the low-voltage protection will act. To avoid this situation, the device is equipped with low-voltage open conditions and jumping block. The open conditions must be met before the low-voltage protection is activated; when the switch is jumping, blocking low voltage protection. The low-voltage open condition can be enabled (used) or withdrawn (not used) by the user.

When the low-voltage protection acts, the switch jumps, and the low-voltage protection returns immediately; when the low-voltage protection acts, the protection does not take the switch jumping position, and the protection returns with a delay of 10S.

Low-voltage open condition: If one of the three line voltages is greater than 80V, and the delay is 100ms, the low-voltage open condition is considered to be valid all the time.

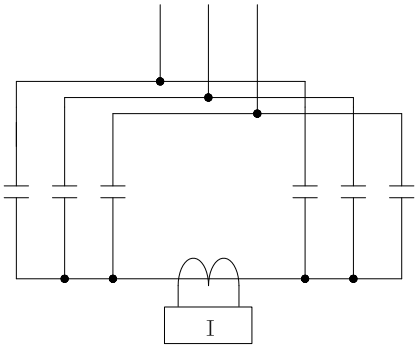
After the low-voltage action returns (greater than the low-voltage action value), delay 10S, restart the judgment of the low-voltage open condition, and this condition can be switched off.

2.5 Zero-sequence overcurrent protection

For the small resistance grounding system, when the zero-sequence overcurrent is greater than the fixed value, the device will trip or send a signal after a delay. For the ungrounded system, the device cooperates with the integrated automation system to complete the function of grounding line selection.

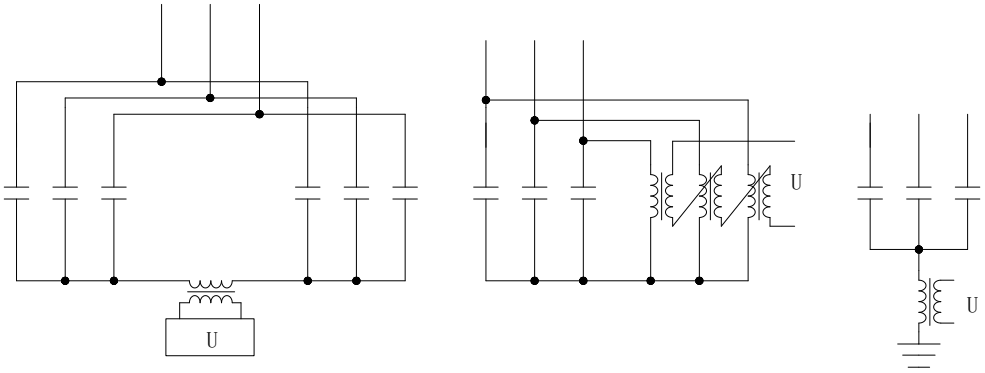
2.6 Neutral unbalance overcurrent protection

As neutral unbalance current is larger than the setting, the protection will trip after a time delay. Applicable to Y-Y connection.



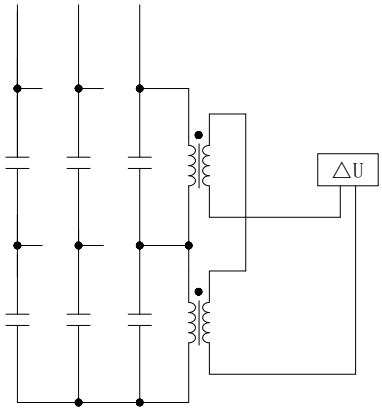
2.7 Neutral unbalance overvoltage protection

It is suitable for ungrounded Y connection. When the unbalanced voltage is greater than the fixed value, the device will trip after a delay.



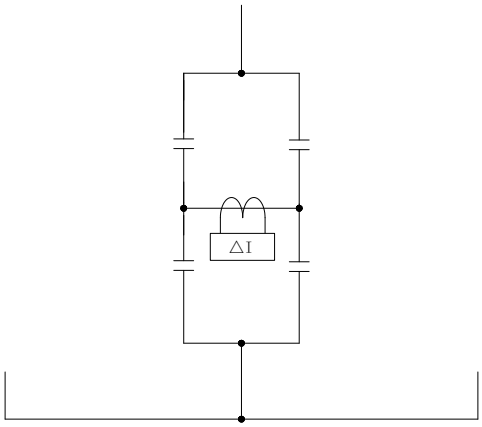
2.8 Phase voltage differential protection

It is suitable for single Y capacitor bank with two or more series zones. When any phase difference voltage is greater than a fixed value, the device will trip after a delay.



2.9 Bridge differential current protection

It is suitable for a single Y capacitor bank with four bridge arms connected to each phase. When any phase difference current is greater than a fixed value, the device will trip after a delay.



2.10 Remote signaling function

Digital input 1-15, 15 digital input can be used as ordinary remote signaling, not bound with the protection function.

2.11 TV disconnection alarm

The device has a TV disconnection check function, and when the device detects that the TV is disconnected, an alarm signal is issued.

The difference between any two-phase line voltage>30V;

Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

3 Setting

3.1 TYC8691A

List of setting (Type A configuration)				
Ser No.	Abbreviation	Name of setting	Unit	Range
1	INS OC current	Instantaneous overcurrent setting	A	0.05~99.99
2	INS OC time	Instantaneous overcurrent time	S	0～60
3	OC current	Overcurrent setting	A	0.05~99.99
4	OC time	Overcurrent time	S	0～60
5	OV setting	Overvoltage setting	V	70～140
6	OV time	Overvoltage time	S	0.1～60

7	UV setting	Undervoltage setting	V	10～90
8	UV time	Undervoltage time	S	0.1～60
9	ZOC current	Zero-sequence overcurrent	A	0.05～30
10	ZOC time	Zero-sequence overcurrent time	S	0～60
11	Unbal OC setting	Unbalance overcurrent setting	A	0.05～99.99
12	Unbal OC time	Unbalance overcurrent time	S	0～60
13	Unbal OV setting	Unbalance overvoltage setting	V	1～70
14	Unbal OV time	Unbalance overvoltage time	S	0～60
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON	
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON	
3	Two to three	2 phase – 3 relay (measure Ia, Ic calculate Ib= - (ia+ic)	□OFF □ON	
4	INS OC switch	Instantaneous overcurrent switching on/off	□OFF □ON	
5	OC switch	Overcurrent switching on/off	□OFF □ON	
6	OV switch	Overvoltage switching on/off	□OFF □ON	
7	UV switch	Undervoltage switching on/off	□OFF □ON	
8	UV COND switch	Undervoltage condition switching on/off	□OFF □ON	
9	ZOC alarm switch	Zero-sequence overcurrent alarm switching on/off	□OFF □ON	
10	ZOC trip switch	Zero-sequence overcurrent trip switching on/off	□OFF □ON	
11	Unbal OC alarm	Unbalance overcurrent time trip switching on/off	□OFF □ON	
12	Unbal OC trip	Unbalance overcurrent time trip switching on/off	□OFF □ON	
13	ZS OV alarm	Zero-sequence overvoltage alarm switching on/off	□OFF □ON	
14	ZS OV trip	Zero-sequence overvoltage trip switching on/off	□OFF □ON	
15	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON	
16	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON	
17	2 wattmeter PWR	2 wattmeters measure way(power) (If select off, 3 wattmeters measure way auto on)	□OFF □ON	

3.2 TYC8691B

List of setting (Type B configuration)				
Ser No.	Abbreviation	Name of setting	Unit	Range
1	INS OC current	Instantaneous overcurrent setting	A	0.04In～20In
2	INS OC time	Instantaneous overcurrent time	S	0～60

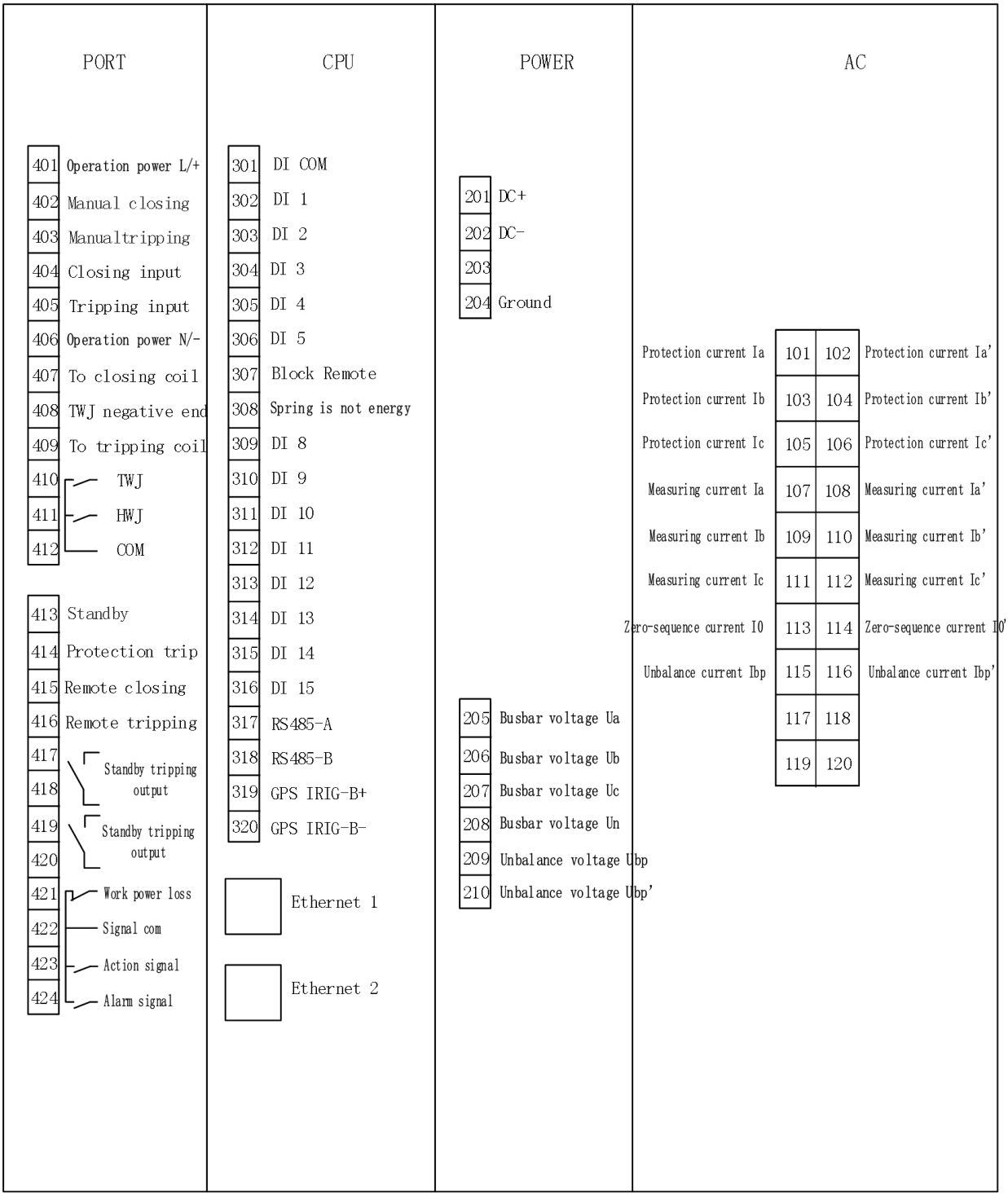
3	OC current	Overcurrent setting	A	0.04In～20In
4	OC time	Overcurrent time	S	0～60
5	OV setting	Overvoltage setting	V	90～140
6	OV time	Overvoltage time	S	0～60
7	UV setting	Undervoltage setting	V	10～90
8	UV time	Undervoltage time	S	0～60
9	ZOC current	Zero-sequence overcurrent setting	A	0.05～30
10	ZOC time	Zero-sequence overcurrent time	S	0～60
11	DV setting	Differential voltage protection setting	V	0.5～70
12	DV time	Differential voltage protection time	S	0～60
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON	
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON	
3	Two to three	2 phase – 3 relay (measure Ia, Ic calculate Ib= - (ia+ic)	□OFF □ON	
4	INS OC switch	Instantaneous overcurrent switching on/off	□OFF □ON	
5	OC switch	Overcurrent switching on/off	□OFF □ON	
6	OV switch	Overvoltage switching on/off	□OFF □ON	
7	UV switch	Undervoltage switching on/off	□OFF □ON	
8	UV COND switch	Undervoltage condition switching on/off	□OFF □ON	
9	ZOC alarm switch	Zero-sequence overcurrent alarm switching on/off	□OFF □ON	
10	ZOC trip switch	Zero-sequence overcurrent trip switching on/off	□OFF □ON	
11	DV alarm switch	Differential voltage protection setting	□OFF □ON	
12	DV trip switch	Differential voltage protection time	□OFF □ON	
13	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON	
14	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON	

3.3 TYC8691C

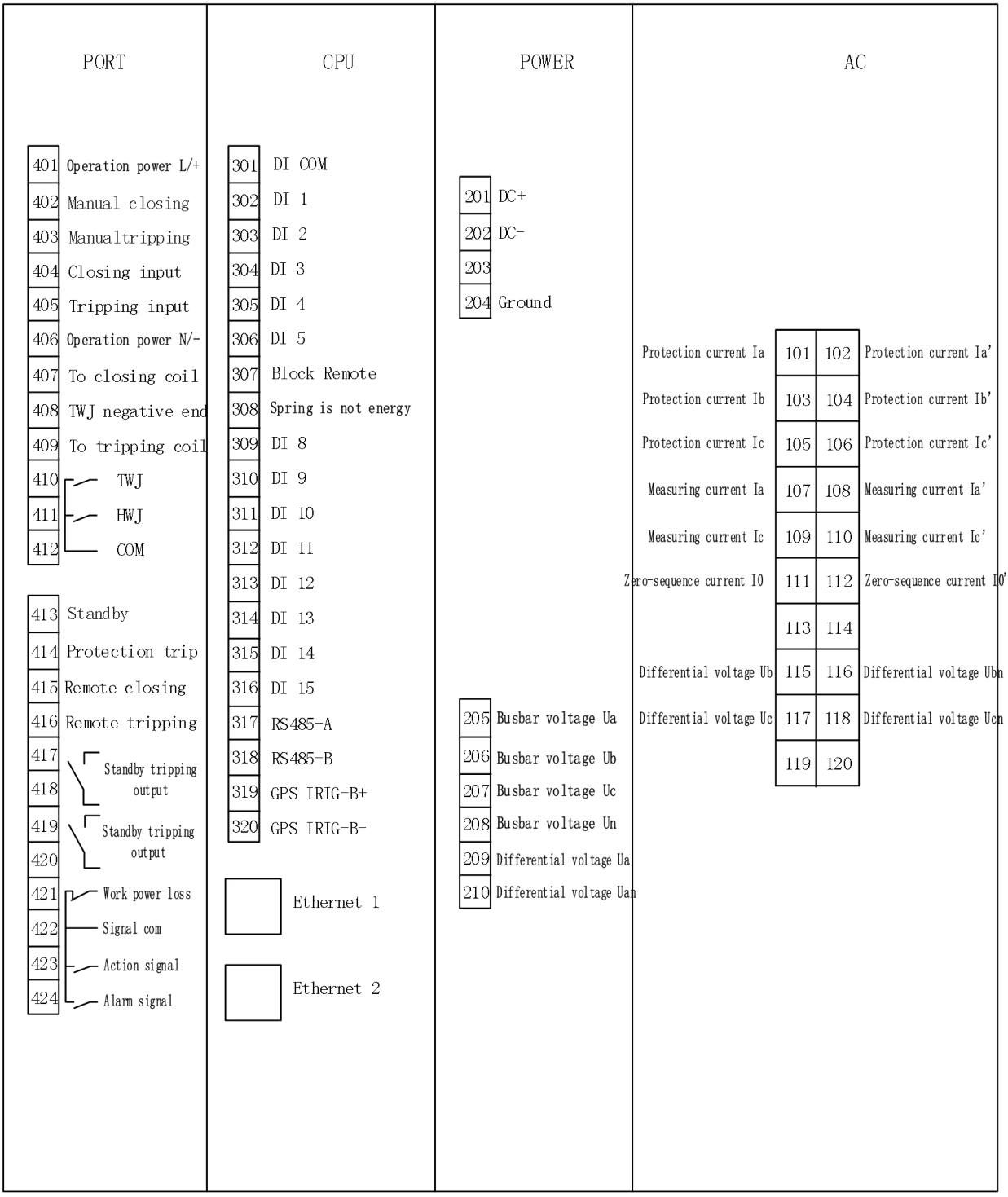
List of setting (Type C configuration)				
Ser No.	Abbreviation	Name of setting	Unit	Range
1	INS OC current	Instantaneous overcurrent setting	A	0.04In～20In
2	INS OC time	Instantaneous overcurrent time	S	0～60
3	OC current	Overcurrent setting	A	0.04In～20In
4	OC time	Overcurrent time	S	0～60
5	OV setting	Overvoltage setting	V	90～140
6	OV time	Overvoltage time	S	0～60

7	UV setting	Undervoltage setting	V	10～90
8	UV time	Undervoltage time	S	0～60
9	ZOC current	Zero-sequence overcurrent setting	A	0.05～30
10	ZOC time	Zero-sequence overcurrent time	S	0～60
11	DC setting	Differential current protection setting	A	0.02～10
12	DC time	Differential current protection time	S	0～60
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON	
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON	
3	Two to three	2 phase – 3 relay (measure Ia, Ic calculate Ib= - (ia+ic)	□OFF □ON	
4	INS OC switch	Instantaneous overcurrent switching on/off	□OFF □ON	
5	OC switch	Overcurrent switching on/off	□OFF □ON	
6	OV switch	Overvoltage switching on/off	□OFF □ON	
7	UV switch	Undervoltage switching on/off	□OFF □ON	
8	UV COND switch	Undervoltage condition switching on/off	□OFF □ON	
9	ZOC alarm switch	Zero-sequence overcurrent alarm switching on/off	□OFF □ON	
10	ZOC trip switch	Zero-sequence overcurrent trip switching on/off	□OFF □ON	
11	DC alarm switch	Differential current protection setting	□OFF □ON	
12	DC trip switch	Differential current protection time	□OFF □ON	
13	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON	
14	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON	

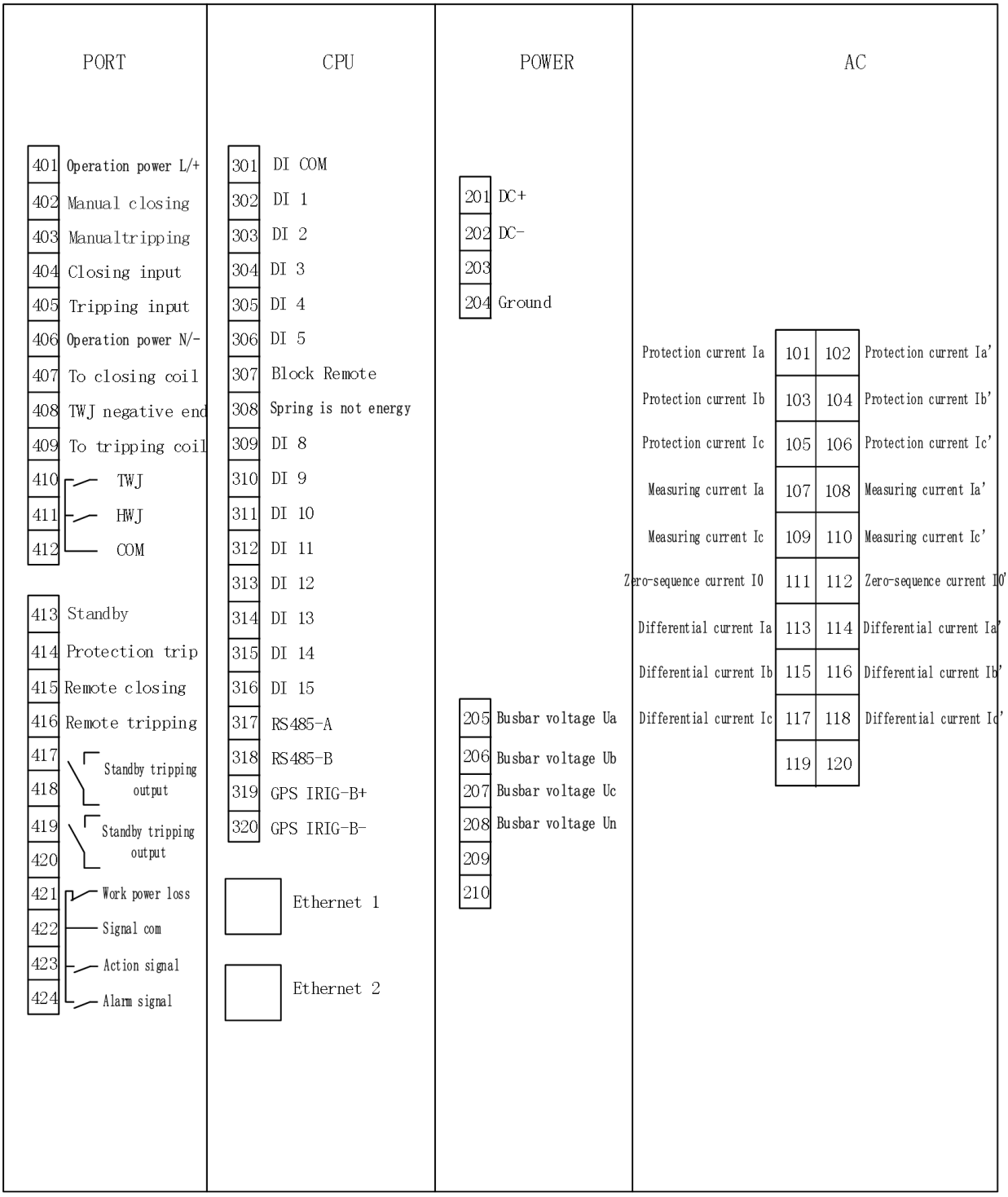
Attached map 1: Terminal definition diagram of TYC8691A



Attached map 1: Terminal definition diagram of TYC8691B



Attached map 1: Terminal definition diagram of TYC8691C



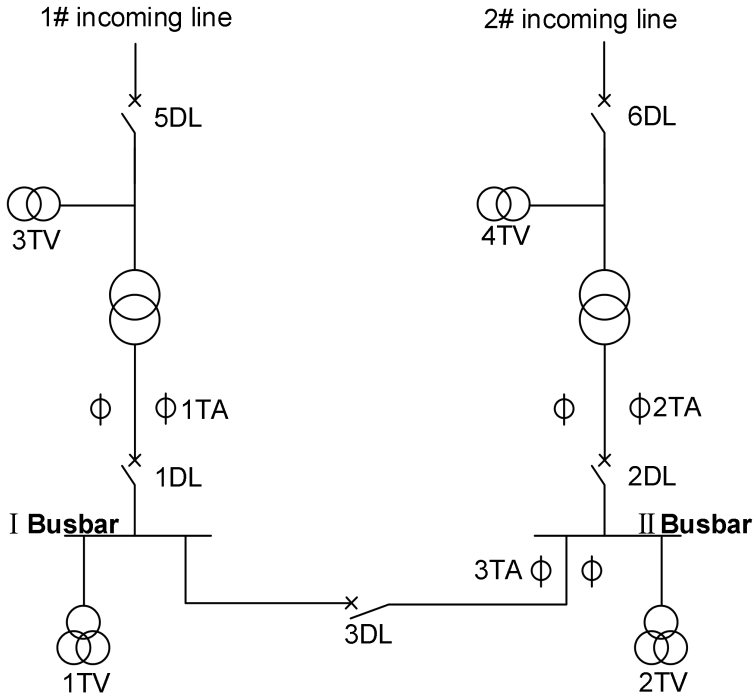
TYP8691A Standby Power Supply Automatic Throw-over Equipment

1 Functions

- Buscoupler BZT
- Incoming line BZT and self recovery
- Overload cutoff
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 Automatic throw-over method I(Buscoupler BZT)



1) When in normal operation, two busbar separately operating and two transformers separately bear one section of busbar. After one incoming line switched off since power supply fault or other causation, section breaker should automatic connect and could only operate one time.
2) When incoming line breaker manually tripped, device is not charging or external locking occurred, section breaker could not automatically connect into.
3) Charging prerequisites: 3 phase of busbarIand II have voltage, 1DL and 2DL in closing position, 3DL in tripping position. Device will charge and ready to operate after those prerequisites are satisfied for 15 seconds.
4) Discharging prerequisites: 3 phase of busbar Iand II no voltage, or 3DL in closing position, or external locking occurred. Device will discharge instantaneously and not ready to operate after those prerequisites are satisfied.

5) Bus coupler standby #1 incoming line breaker (3DL standby 1DL)

If busbar I no voltage or 1DL in tripping position and 1TA has no current, and busbar II have voltage, 1DL will trip after a time delay and close 3DL after ensuring that 1DL is in tripping position (Namely 1DL in tripping position and 1TA has no current).

6) Bus coupler standby #2 incoming line breaker (3DL standby 2DL)

If busbar II no voltage or 2DL in tripping position and 2TA no current, and busbar I have voltage, 2DL will trip after a time delay and close 3DL after ensuring that 2DL is in tripping position (Namely 2DL in tripping position and 2TA has no current).

7) TV wire disconnection alarm:

If the difference of three lines voltage large than 30% Ue, TV wire break would action after 3 seconds delay (2 phase wire break or 1 phase wire break). If incoming line has voltage, incoming line breaker is in closing and busbar is in undervoltage, the protection will alarm for TV wire break (3 phase wire break). TV wire break could select only alarm or blocking protection device. In order to avoid out of voltage when TV is in 2 phase wire break, we strongly recommend that customer connect line N into device.

2.2 Automatic throw-over method II:(Incoming line mutual switching)

1) When in normal operation, #1(#2) incoming line with working bus, #2(#1) incoming line for backup. 1DL(2DL) is in closing position, 2DL(1DL) is in open position, 2DL(1DL) is spare. If #1(#2) incoming line power supply is disconnected or disconnected for other reasons, #2(#1) incoming line switch shall be automatically put in, and only one operation is allowed.

2) When the incoming line switch is manually tripped, or the device is not charged, or there is an external blocking, the standby incoming line switch shall not be automatically put in.

3) Charging conditions: three-phase of working bus has voltage (at least one of bus I and bus II has voltage), and # 2 (# 1) incoming line has voltage. 1DL (2DL) is in closing position and 2DL (1DL) is in opening position.

The charging is completed after 15s of charging conditions are met, and the standby automatic switching is ready.

4) Discharge condition: 2DL (1DL) is in closing position or # 2 (# 1) line has no voltage or external blocking input.

The discharge is completed instantaneously after the discharge conditions are met, and the standby automatic switch is not ready.

5) Automatic throw-over device blocking prerequisites:

5.1) 1DL or 2DL manually tripped.

5.2) External switch-in variable blocking

5.3) Device operates failure.

5.4) Circuit breaker abnormal position.

5.5) TV wire break alarm of busbar I

5.6) TV wire break alarm of busbar II

To release the block, need block release and standby power supply automatic throw-over return.

6) #2 incoming line is spare (2DL standby 1DL)

If the working bus has no voltage and Ux2 has voltage, trip 1DL after delay. After confirming that 1DL has tripped (1DL is tripped and 1TA has no current), close 2DL.

7) #1 incoming line is spare (1DL standby 2DL)

If the working bus has no voltage and Ux1 has voltage, trip 2DL after delay. After confirming that 2DL has tripped (2DL is tripped and 2TA has no current), close 1DL.

2.3 Automatic throw-over method III:(Incoming line recovery)

1) When in normal operation, #1(#2) incoming line bear two busbar, #2(#1) incoming line is power failure caused by some faults. 1DL(2DL)and 3DL are in closing position, 2DL in tripping position. If #2 (#1)incoming line power is restored, trip 3DL, then close 2DL(1DL).

2) Charging prerequisite: 3 phase of busbar Iand II have voltage, 1DL(2DL)and 3DL in closing position, 2DL(1DL)in tripping position. Device will charge and ready to operate after those prerequisites are satisfied for 15S.

3) Disharging prerequisite: 3 phase of busbar Iand II have no voltage, or 2DL(1DL) in closing position, or external locking occurred. Device will discharge instantaneously and not ready to operate after those prerequisites are satisfied.

4) Automatic restoration of #1 incoming line power supply

If Ux1 have voltage, 3DL will trip after a time delay and close 1DL after ensuring that 3DL is in tripping position.

5) Automatic restoration of #2 incoming line power supply

If Ux2 have voltage, 3DL will trip after a time delay and close 2DL after ensuring that 3DL is in tripping position.

2.4 Appendent explanation:

1) If the function of high-voltage side coupling hopping and low-voltage side hopping is not required, the contact point of high-voltage side switch (5DL, 6DL) position may not be connected to the device, and the function of high-voltage side coupling hopping and low-voltage side hopping will quit.

2) Automatic throw-over device blocking prerequisites:

2.1) 1DL or 2DL manually tripped.

2.2) External switch-in variable blocking (307，308).

2.3) Device operates failure.

2.4) Circuit breaker abnormal position.

2.5) TV wire break alarm of busbar I

2.6) TV wire break alarm of busbar II

3) To release the block, need block release and standby power supply automatic throw-over return.

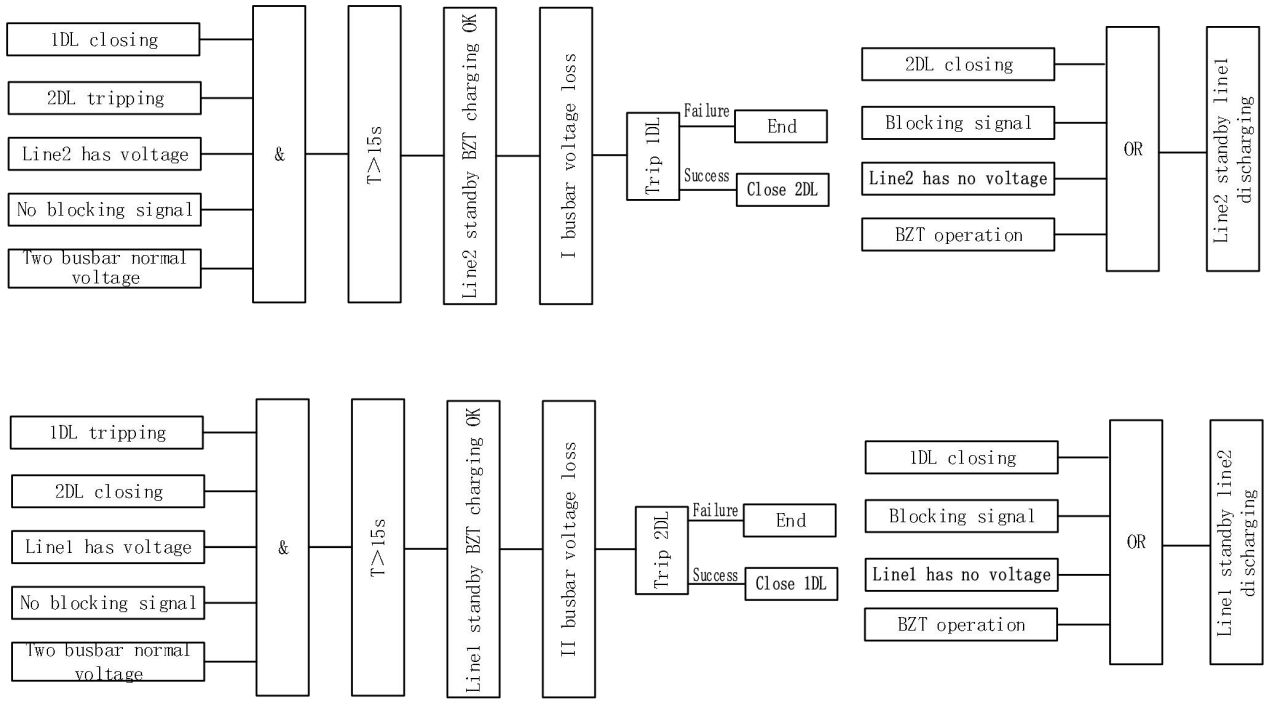
4) The external blocking input can be connected to I busbar TV position, II busbar TV position, TV air-switch auxiliary contact and other contacts requiring blocking standby power supply automatic throw-over function.

3 Setting

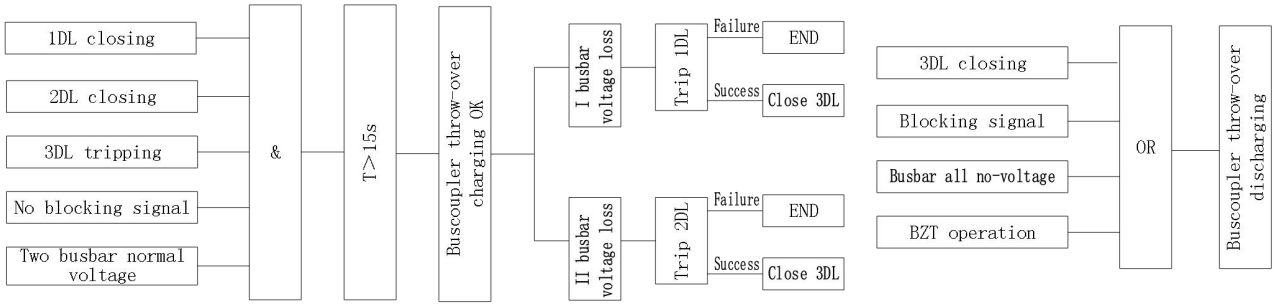
List of settings				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	Bus Nor-Voltage	Busbar normal voltage setting	V	0～400
2	Bus UV setting	Busbar undervoltage setting	V	0～400
3	L1# Nor-Voltage	1# incoming line normal voltage setting	V	0～400
4	L2# Nor-Voltage	2# incoming line normal voltage setting	V	0～400
5	L1# No-current	1# incoming line no-current current	A	0.04In～20In
6	L2# No-current	2# incoming line no-current current	A	0.04In～20In
7	BZT Trip time	BZT tripping delay time	S	0～60
8	BZT Close time	BZT closing delay time	S	0～60
9	BZT CHA time	BZT charging time	S	0～60
10	TC output PW time	Tripping and closing output pulse width time	S	0～60
11	L1# OL CO current	1# line overload cutoff current	A	0.04In～20In
12	L1# 1st CO time	1# line the first round cutoff time	S	0～60
13	L1# 2nd CO time	1# line the second round cutoff time	S	0～60
14	L2# OL CO current	2# line overload cutoff current	A	0.04In～20In
15	L2# 1st CO time	2# line the first round cutoff time	S	0～60
16	L2# 2nd CO time	2# line the second round cutoff time	S	0～60
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	Bus-COUP breaker	Bus coupler breaker contact switching NO/NC (normally open/normally closed)	□ON □OFF	
2	L1# breaker	1# incoming line breaker contact switching NO/NC (normally open/normally closed)	□ON □OFF	
3	L2# breaker	2# incoming line breaker contact switching NO/NC (normally open/normally closed)	□ON □OFF	
4	L1# UV alarm	1# incoming line undervoltage alarm switching on/off	□ON □OFF	
5	L2# UV alarm	2# incoming line undervoltage alarm switching on/off	□ON □OFF	
6	L1# No-CURT SW	1# incoming line no-current discriminant switching on/off	□ON □OFF	
7	L2# No-CURT SW	2# incoming line no-current discriminant switching on/off	□ON □OFF	
8	Bus-COUP BZT1-1	Bus-coupler type BZT1-1 switching on/off	□ON □OFF	

9	Bus-COUP BZT1-2	Bus-coupler type BZT1-2 switching on/off	□ON □OFF
10	L2# BZT2	2# incoming line BZT2 switching on/off	□ON □OFF
11	L1# BZT3	1# incoming line BZT3 switching on/off	□ON □OFF
12	L1# SR BZT4	1# incoming line self-recovery BZT4 switching on/off	□ON □OFF
13	L2# SR BZT5	2# incoming line self-recovery BZT5 switching on/off	□ON □OFF
14	Bus-COUP SR BZT6	Buscoupler self-recovery BZT6 switching on/off	□ON □OFF
15	WL VOL check	Working line voltage check switching on/off	□ON □OFF
16	SL VOL check	Standby line voltage check switching on/off	□ON □OFF
17	L1# UT Bus-COUP	1# incoming line united trip buscoupler switching on/off	□ON □OFF
18	L2# UT Bus-COUP	2# incoming line united trip buscoupler switching on/off	□ON □OFF
19	L1# OL CO SW	1# line overload cutoff switching on/off	□ON □OFF
20	L2# OL CO SW	2# line overload cutoff switching on/off	□ON □OFF
21	B1 TV DISCON ALM	Busbar I TV disconnection alarm switching on/off	□ON □OFF
22	B1 TV DISCON BLK	Busbar I TV disconnection blocking switching on/off	□ON □OFF
23	B2 TV DISCON ALM	Busbar II TV disconnection alarm switching on/off	□ON □OFF
24	B2 TV DISCON BLK	Busbar II TV disconnection blocking switching on/off	□ON □OFF

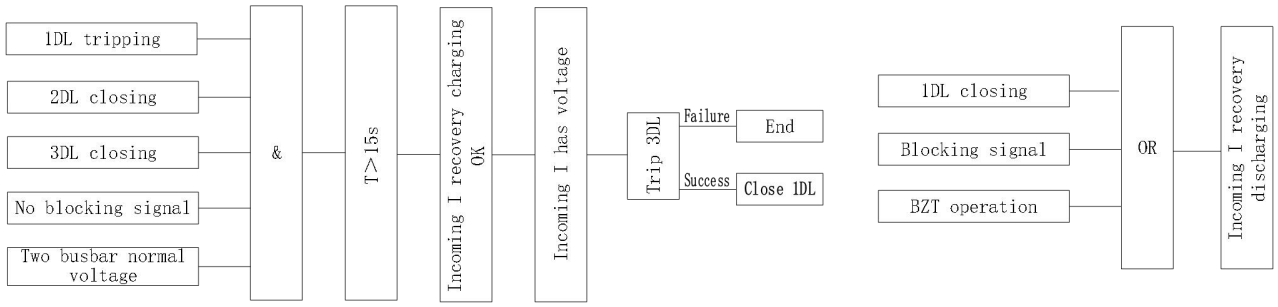
The principle of incoming line mutual switching is as follows:

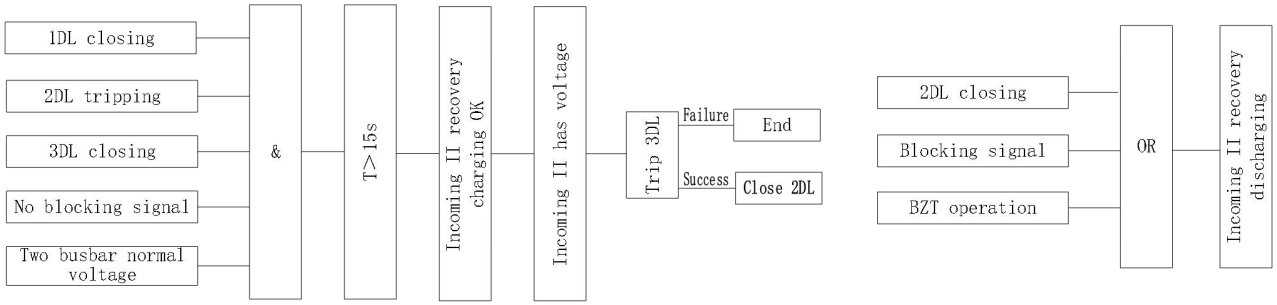


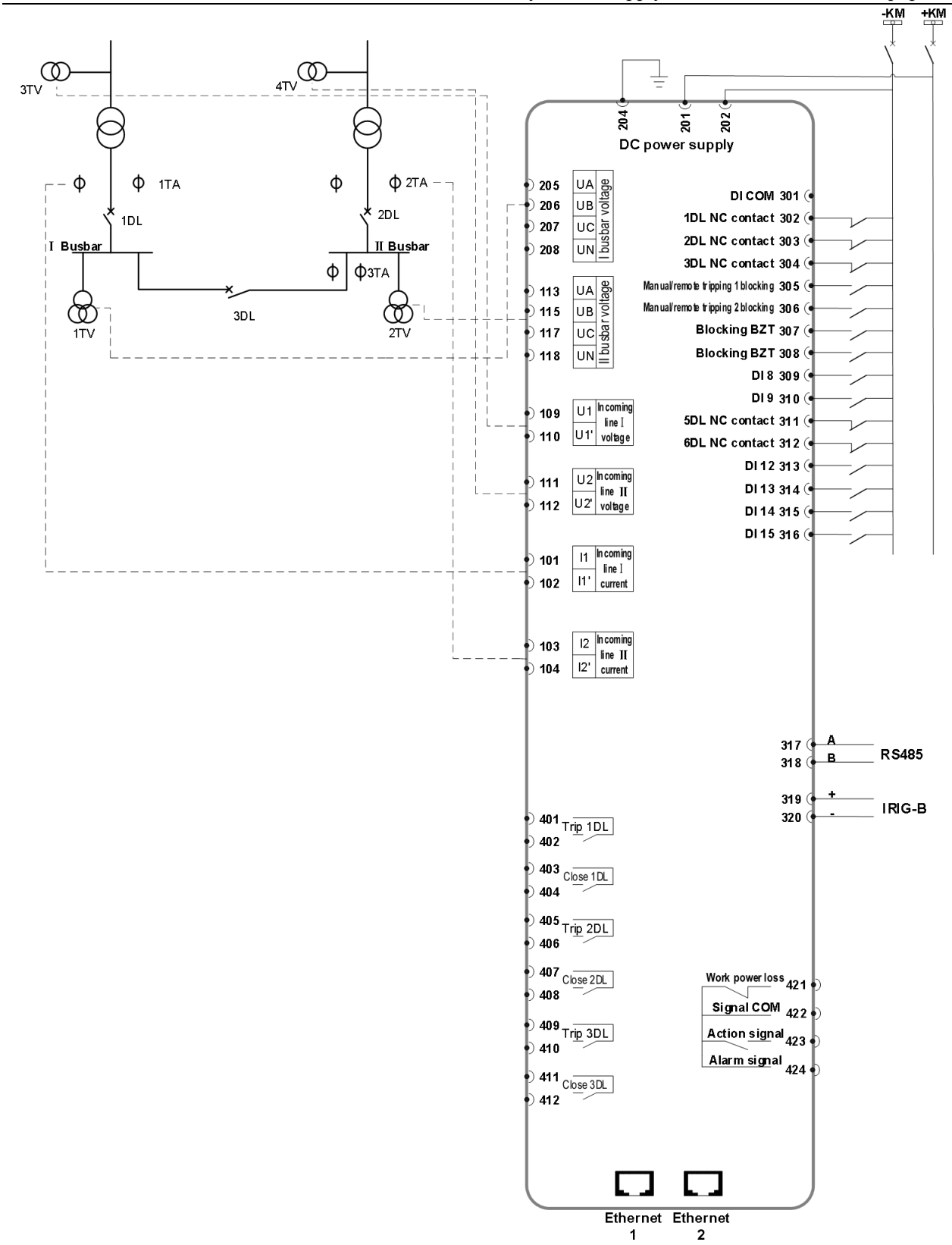
The principle of buscoupler BZT is as follows:

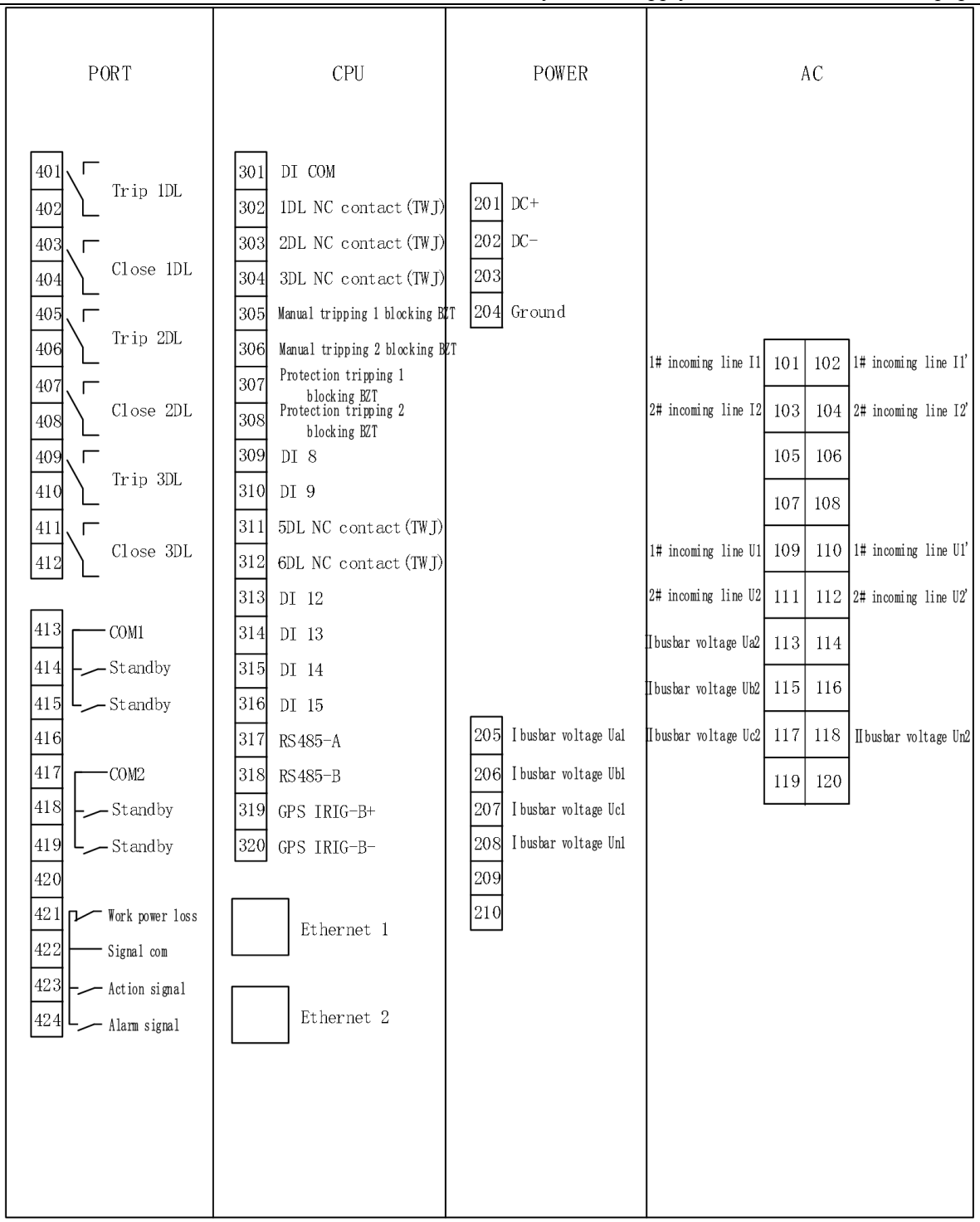


The principle of incoming self-recovery is as follows:






-KM
+KM
3TV
4TV
1TA
2TA
1DL
2DL
I Busbar
II Busbar
3TA
3DL
1TV
2TV
204
201
202
DC power supply
205 UA
206 UB
207 UC
208 UN
I busbar voltage
113 UA
115 UB
117 UC
118 UN
II busbar voltage
109 U1
110 U1'
Incoming line I voltage
111 U2
112 U2'
Incoming line II voltage
101 I1
102 I1'
Incoming line I current
103 I2
104 I2'
Incoming line II current
DI COM 301
1DL NC contact 302
2DL NC contact 303
3DL NC contact 304
Manual/remote tripping 1 blocking 305
Manual/remote tripping 2 blocking 306
Blocking BZT 307
Blocking BZT 308
DI 8 309
DI 9 310
5DL NC contact 311
6DL NC contact 312
DI 12 313
DI 13 314
DI 14 315
DI 15 316
317 A
318 B
RS485
319 +
320 -
IRIG-B
401 Trip 1DL
402
403 Close 1DL
404
405 Trip 2DL
406
407 Close 2DL
408
409 Trip 3DL
410
411 Close 3DL
412
Work power loss 421
Signal COM 422
Action signal 423
Alarm signal 424
Ethernet 1
Ethernet 2


PORT
401
402
Trip 1DL
403
404
Close 1DL
405
406
Trip 2DL
407
408
Close 2DL
409
410
Trip 3DL
411
412
Close 3DL
413
414
415
COM1
Standby
Standby
416
417
418
419
COM2
Standby
Standby
420
421
422
423
424
Work power loss
Signal com
Action signal
Alarm signal
CPU
301 DI COM
302 1DL NC contact(TWJ)
303 2DL NC contact(TWJ)
304 3DL NC contact(TWJ)
305 Manual tripping 1 blocking BZT
306 Manual tripping 2 blocking BZT
307 Protection tripping 1 blocking BZT
308 Protection tripping 2 blocking BZT
309 DI 8
310 DI 9
311 5DL NC contact(TWJ)
312 6DL NC contact(TWJ)
313 DI 12
314 DI 13
315 DI 14
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Ⅰbusbar voltage Ua1
206 Ⅰbusbar voltage Ub1
207 Ⅰbusbar voltage Uc1
208 Ⅰbusbar voltage Un1
209
210
AC
1# incoming line I1 101 102 1# incoming line I1'
2# incoming line I2 103 104 2# incoming line I2'
105 106
107 108
1# incoming line U1 109 110 1# incoming line U1'
2# incoming line U2 111 112 2# incoming line U2'
Ⅰbusbar voltage Ua2 113 114
Ⅰbusbar voltage Ub2 115 116
Ⅰbusbar voltage Uc2 117 118 Ⅱbusbar voltage Un2
119 120

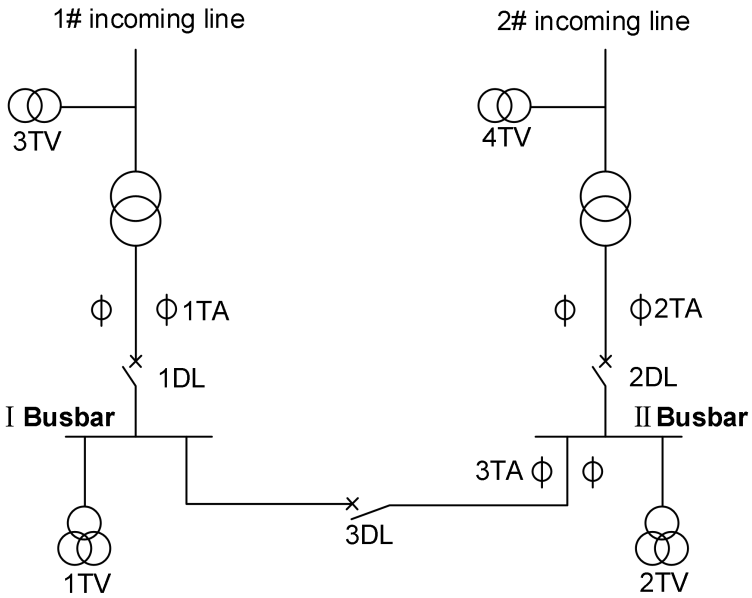
TYP8691C Standby Power Supply Automatic Throw-over Equipment

1 Functions

- Buscoupler BZT, incoming line mutual switching, self-recovery function
- Two phase 3-zone overcurrent protection of buscoupler breaker
- Post-acceleration protection of buscoupler breaker
- With buscouple switch operating circuit and remote control function
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 Automatic throw-over method I(Buscoupler BZT)



1) When in normal operation, two busbar separately operating and two transformers separately bear one section of busbar. After one incoming line switched off since power supply fault or other causation, section breaker should automatic connect and could only operate one time.
2) When incoming line breaker manually tripped, device is not charging or external locking occurred, section breaker could not automatically connect into.
3) Charging prerequisites: 3 phase of busbarIand II have voltage, 1DL and 2DL in closing position, 3DL in tripping position. Device will charge and ready to operate after those prerequisites are satisfied for 15 seconds.
4) Discharging prerequisites: 3 phase of busbar Iand II no voltage, or 3DL in closing position, or external locking occurred. Device will discharge instantaneously and not ready to operate after those prerequisites are satisfied.
5) Bus coupler standby #1 incoming line breaker (3DL standby 1DL)

   If busbar I no voltage or 1DL in tripping position and 1TA has no current, and busbar II have voltage, 1DL

will trip after a time delay and close 3DL after ensuring that 1DL is in tripping position (Namely 1DL in tripping position and 1TA has no current).

6) Bus coupler standby #2 incoming line breaker (3DL standby 2DL)

If busbar II no voltage or 2DL in tripping position and 2TA no current, and busbar I have voltage, 2DL will trip after a time delay and close 3DL after ensuring that 2DL is in tripping position (Namely 2DL in tripping position and 2TA has no current).

7) TV wire disconnection alarm:

If the difference of three lines voltage large than 30% Ue, TV wire break would action after 3 seconds delay (2 phase wire break or 1 phase wire break). If incoming line has voltage, incoming line breaker is in closing and busbar is in undervoltage, the protection will alarm for TV wire break (3 phase wire break). TV wire break could select only alarm or blocking protection device. In order to avoid out of voltage when TV is in 2 phase wire break, we strongly recommend that customer connect line N into device.

2.2 Automatic throw-over method II:(Incoming line thow-over for each other)

1) When in normal operation, #1(#2) incoming line with working bus, #2(#1) incoming line for backup. 1DL(2DL) is in closing position, 2DL(1DL) is in open position, 2DL(1DL) is spare. If #1(#2) incoming line power supply is disconnected or disconnected for other reasons, #2(#1) incoming line switch shall be automatically put in, and only one operation is allowed.

2) When the incoming line switch is manually tripped, or the device is not charged, or there is an external blocking, the standby incoming line switch shall not be automatically put in.

3) Charging conditions: three-phase of working bus has voltage (at least one of bus I and bus II has voltage), and # 2 (# 1) incoming line has voltage. 1DL (2DL) is in closing position and 2DL (1DL) is in opening position.

The charging is completed after 15s of charging conditions are met, and the standby automatic switching is ready.

4) Discharge condition: 2DL (1DL) is in closing position or # 2 (# 1) line has no voltage or external blocking input.

The discharge is completed instantaneously after the discharge conditions are met, and the standby automatic switch is not ready.

5) Automatic throw-over device blocking prerequisites:

5.1) 1DL or 2DL manually tripped.
5.2) External switch-in variable blocking
5.3) Device operates failure.
5.4) Circuit breaker abnormal position.
5.5) TV wire break alarm of busbar I
5.6) TV wire break alarm of busbar II

To release the block, need block release and standby power supply automatic throw-over return.

6) #2 incoming line is spare (2DL standby 1DL)

If the working bus has no voltage and Ux2 has voltage, trip 1DL after delay. After confirming that 1DL has

tripped (1DL is tripped and 1TA has no current), close 2DL.

7) #1 incoming line is spare (1DL standby 2DL)

If the working bus has no voltage and Ux1 has voltage, trip 2DL after delay. After confirming that 2DL has tripped (2DL is tripped and 2TA has no current), close 1DL.

2.3 Automatic throw-over method III:(Incoming line recovery)

1) When in normal operation, #1(#2) incoming line bear two busbar, #2(#1) incoming line is power failure caused by some faults. 1DL(2DL)and 3DL are in closing position, 2DL in tripping position. If #2 (#1)incoming line power is restored, trip 3DL, then close 2DL(1DL).
2) Charging prerequisite: 3 phase of busbar Iand II have voltage, 1DL(2DL)and 3DL in closing position, 2DL(1DL)in tripping position. Device will charge and ready to operate after those prerequisites are satisfied for 15S.
3) Disharging prerequisite: 3 phase of busbar Iand II have no voltage, or 2DL(1DL) in closing position, or external locking occurred. Device will discharge instantaneously and not ready to operate after those prerequisites are satisfied.
4) Automatic restoration of #1 incoming line power supply

   If Ux1 have voltage, 3DL will trip after a time delay and close 1DL after ensuring that 3DL is in tripping position.
5) Automatic restoration of #2 incoming line power supply

   If Ux2 have voltage, 3DL will trip after a time delay and close 2DL after ensuring that 3DL is in tripping position.

2.4 Overcurrent protection

1) Two phase 3-zone overcurrent protection: if Ia > Izd or Ic > Izd, trip after setting delay time.
2) Post-acceleration protection: after the bus coupler switch is closed, monitor the current flowing through the bus coupler switch within the set post acceleration effective time, if Ia > Izd or Ic > Izd, trip after setting delay time. Otherwise, after the set effective time of post acceleration, the post acceleration section will exit automatically.
3) TV wire disconnection alarm:：

   If the difference of three lines voltage large than 30% Ue, TV wire break would action after 3 seconds delay (2 phase wire break or 1 phase wire break). If incoming line has voltage, incoming line breaker is in closing and busbar is in undervoltage, the protection will alarm for TV wire break (3 phase wire break). TV wire break could select only alarm or blocking protection device. In order to avoid out of voltage when TV is in 2 phase wire break, we strongly recommend that customer connect line N into device.

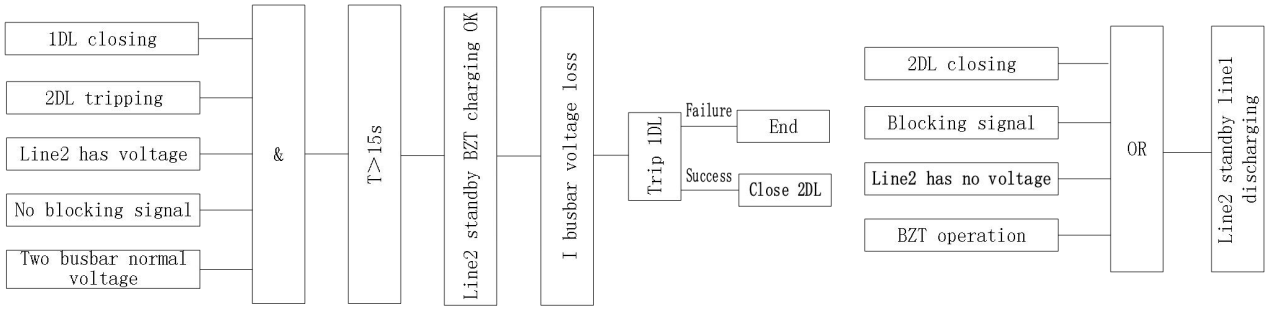
3 Setting

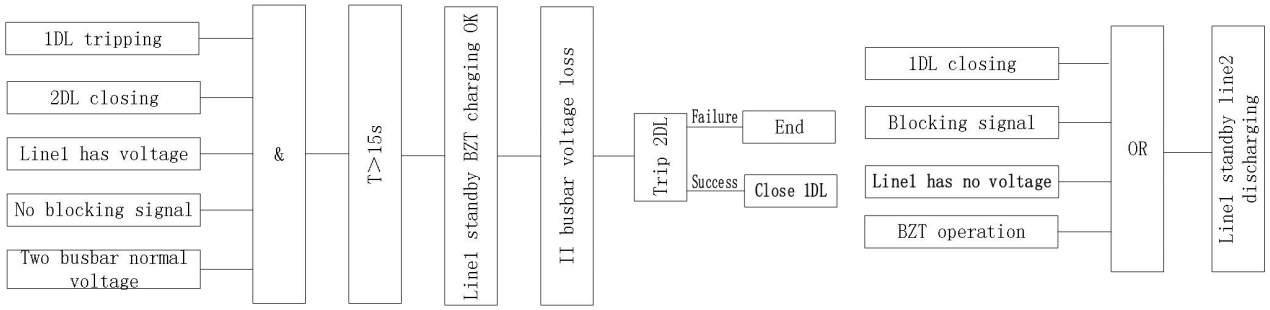
List of settings				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	Bus Nor-Voltage	Busbar normal voltage setting	V	50～400
2	Bus UV setting	Busbar undervoltage setting	V	15～400

3	L1# Nor-Voltage	1# incoming line normal voltage setting	V	50～400
4	L2# Nor-Voltage	2# incoming line normal voltage setting	V	15～400
5	L1# No-current	1# incoming line no-current current	A	0.05～99.99
6	L2# No-current	2# incoming line no-current current	A	0.05～99.99
7	BZT Trip time	BZT tripping delay time	S	0～60
8	BZT Close time	BZT closing delay time	S	0～60
9	BZT CHA time	BZT charging time	S	0～60
10	TC output PW time	Tripping and closing output pulse width time	S	0～60
11	OC-I current	Overcurrent zone I current	A	0.1～99.99
12	OC-I time	Overcurrent zone I time	S	0～60
13	OC-II current	Overcurrent zone II current	A	0.1～99.99
14	OC-II time	Overcurrent zone II time	S	0～60
15	OC-III current	Overcurrent zone III current	A	0.1～99.99
16	OC-III time	Overcurrent zone III time	S	0～60
17	Post-ACC current	Post-acceleration current	A	0.1～99.99
18	Post-ACC Input TIM	Post-acceleration input time	S	0～60
19	Post-ACC time	Post-acceleration input time	S	0～60
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	Bus-COUP breaker	Bus coupler breaker contact switching NO/NC (normally open/normally closed)	□OFF □ON	
2	L1# breaker	1# incoming line breaker contact switching NO/NC (normally open/normally closed)	□OFF □ON	
3	L2# breaker	2# incoming line breaker contact switching NO/NC (normally open/normally closed)	□OFF □ON	
4	L1# UV alarm	1# incoming line undervoltage alarm switching on/off	□OFF □ON	
5	L2# UV alarm	2# incoming line undervoltage alarm switching on/off	□OFF □ON	
6	L1# No-CURT SW	1# incoming line no-current discriminant switching on/off	□OFF □ON	
7	L2# No-CURT SW	2# incoming line no-current discriminant switching on/off	□OFF □ON	
8	Bus-COUP BZT1-1	Bus-coupler type BZT1-1 switching on/off	□OFF □ON	
9	Bus-COUP BZT1-2	Bus-coupler type BZT1-2 switching on/off	□OFF □ON	
10	L2# BZT2	2# incoming line BZT2 switching on/off	□OFF □ON	
11	L1# BZT3	1# incoming line BZT3 switching on/off	□OFF □ON	
12	L1# SR BZT4	1# incoming line self-recovery BZT4 switching on/off	□OFF □ON	
13	L2# SR BZT5	2# incoming line self-recovery	□OFF □ON	

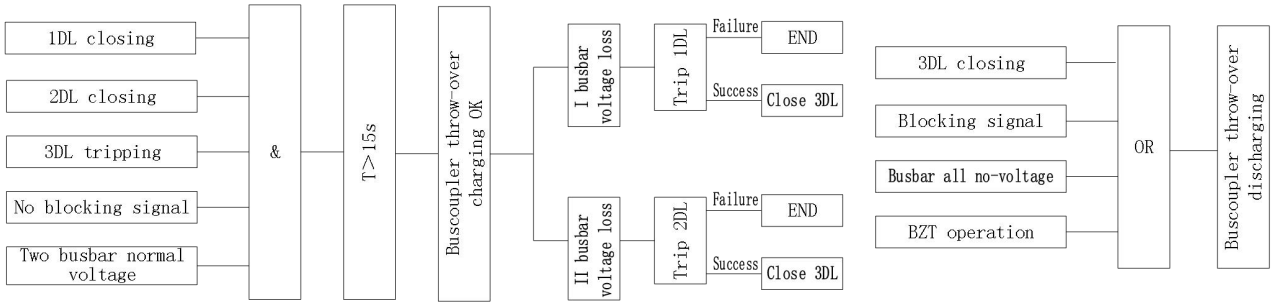
		BZT5 switching on/off	
14	Bus-COUP SR BZT6	Buscoupler self-recovery BZT6 switching on/off	□OFF □ON
15	WL VOL check	Working line voltage check switching on/off	□OFF □ON
16	SL VOL check	Standby line voltage check switching on/off	□OFF □ON
17	L1# UT Bus-COUP	1# incoming line united trip buscoupler switching on/off	□OFF □ON
18	L2# UT Bus-COUP	2# incoming line united trip buscoupler switching on/off	□OFF □ON
19	OC-I switch	Overcurrent zone I switching on/off	□OFF □ON
20	OC-II switch	Overcurrent zone II switching on/off	□OFF □ON
21	OC-III switch	Overcurrent zone III switching on/off	□OFF □ON
22	Post-ACC SW	Post-acceleration protection switching on/off	□OFF □ON
23	B1 TV DISCON ALM	Busbar I TV disconnection alarm switching on/off	□OFF □ON
24	B1 TV DISCON BLK	Busbar I TV disconnection blocking switching on/off	□OFF □ON
25	B2 TV DISCON ALM	Busbar II TV disconnection alarm switching on/off	□OFF □ON
26	B2 TV DISCON BLK	Busbar II TV disconnection blocking switching on/off	□OFF □ON
27	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON

The principle of incoming line mutual switching is as follows:

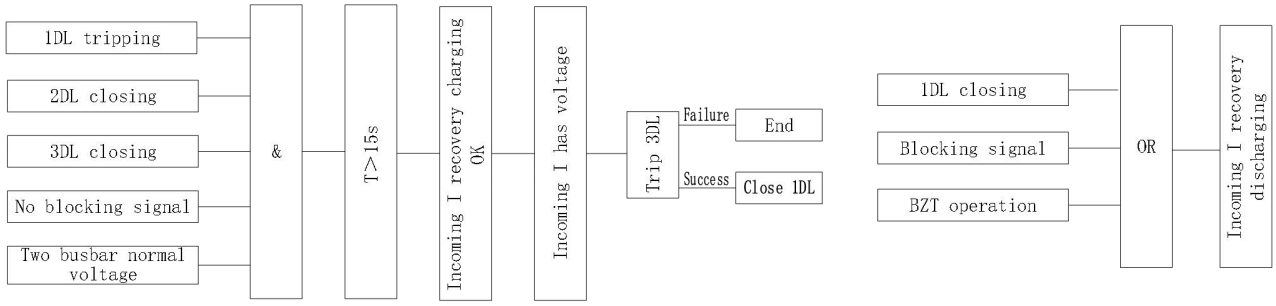


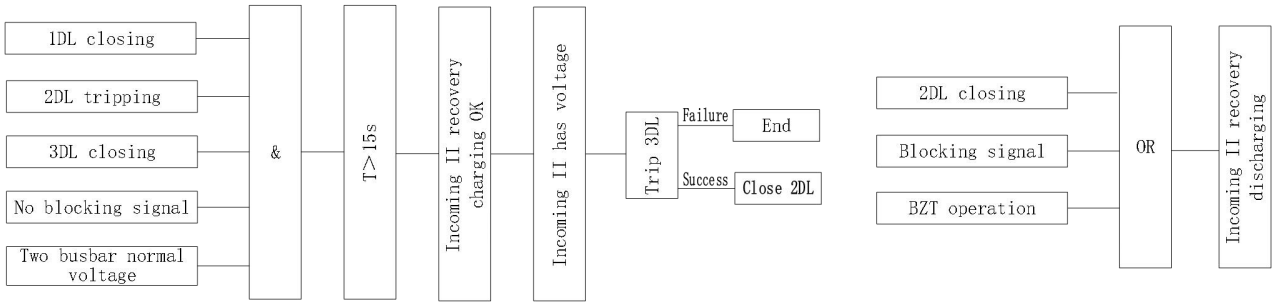


The principle of buscoupler BZT is as follows:

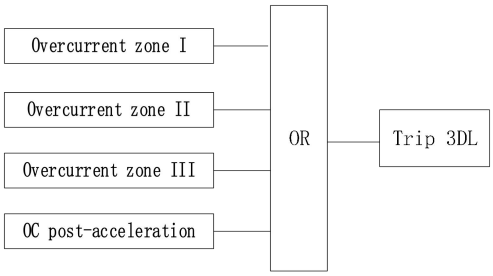


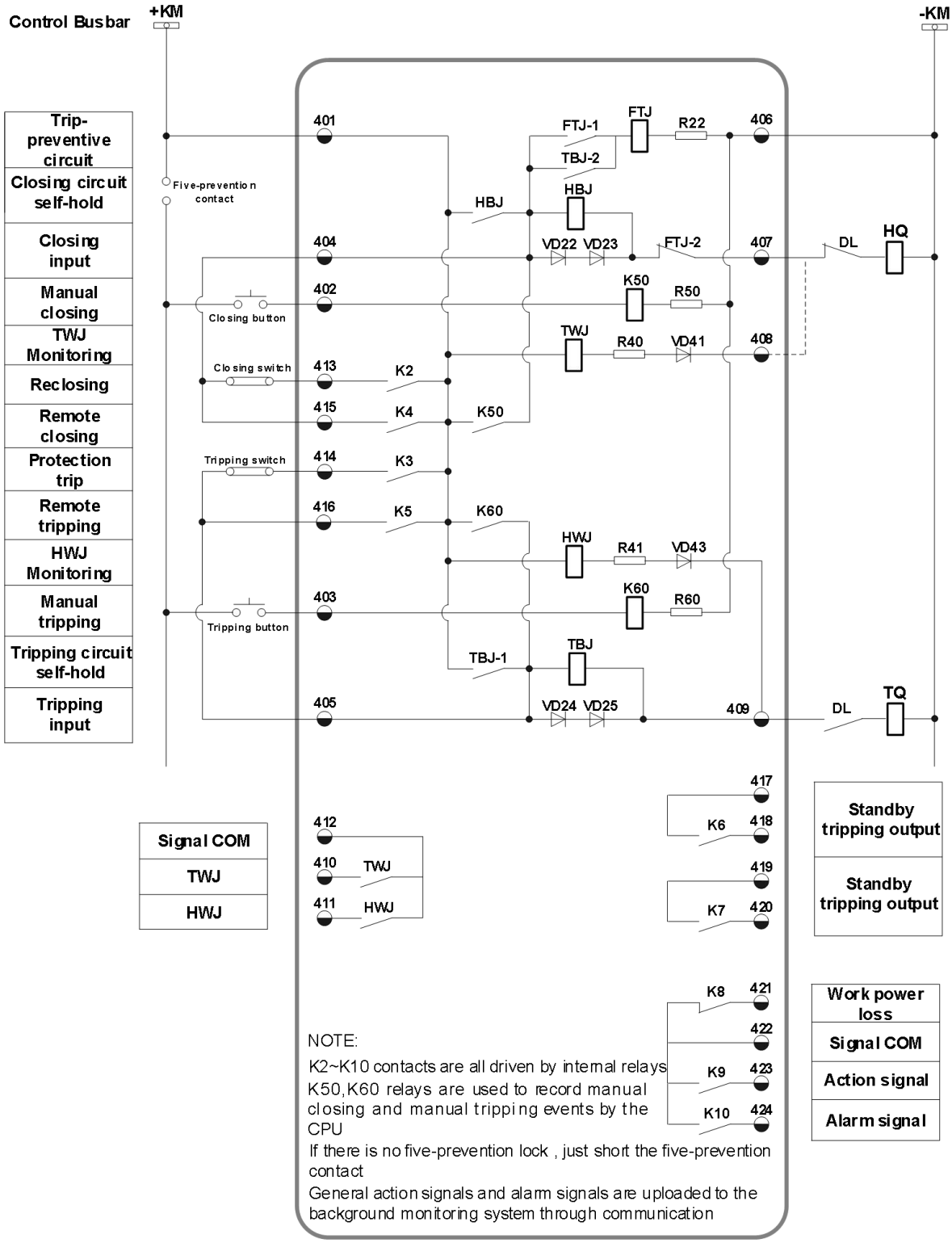
The principle of incoming self-recovery is as follows:

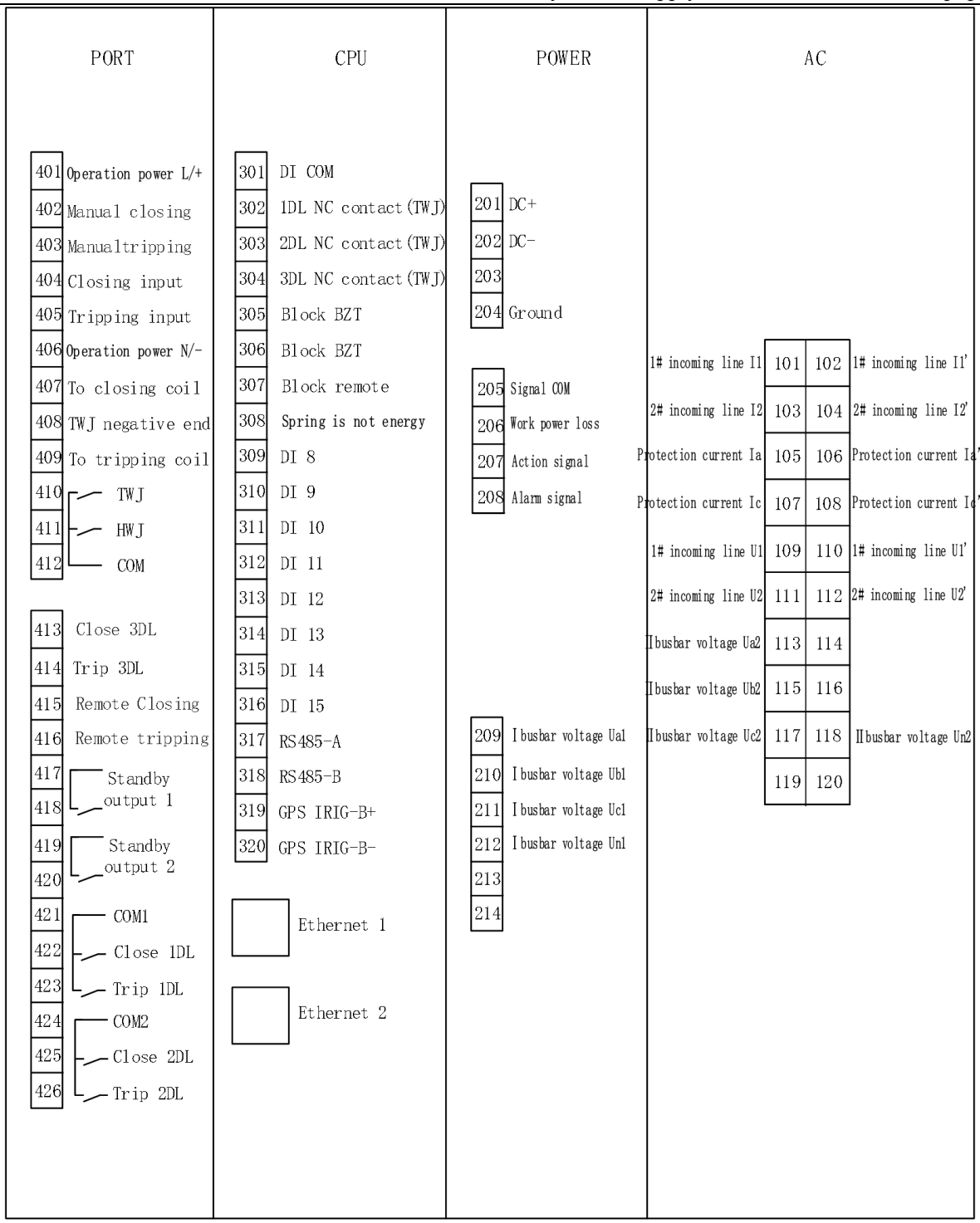




The principle of buscoupler overcurrent protection is as follows:




Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Reclosing
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Closing switch
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
FTJ
FTJ-1
TBJ-2
R22
406
HBJ
VD22 VD23
FTJ-2
407
DL
HQ
K50
R50
TWJ
R40
VD41
408
K2
K4
K3
K5
K60
HWJ
R41
VD43
TBJ-1
TBJ
VD24 VD25
409
TQ
417
K6
418
419
K7
420
K8
421
422
K9
423
K10
424
412
410
411
Signal COM
TWJ
HWJ
Standby tripping output
Standby tripping output
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Close 3DL
414 Trip 3DL
415 Remote Closing
416 Remote tripping
417
418 Standby output 1
419
420 Standby output 2
421 COM1
422 Close 1DL
423 Trip 1DL
424 COM2
425 Close 2DL
426 Trip 2DL
CPU
301 DI COM
302 1DL NC contact(TWJ)
303 2DL NC contact(TWJ)
304 3DL NC contact(TWJ)
305 Block BZT
306 Block BZT
307 Block remote
308 Spring is not energy
309 DI 8
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 DI 13
315 DI 14
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Signal COM
206 Work power loss
207 Action signal
208 Alarm signal
209 Ⅰbusbar voltage Ual
210 Ⅰbusbar voltage Ubl
211 Ⅰbusbar voltage Ucl
212 Ⅰbusbar voltage Unl
213
214
AC
1# incoming line I1 101 102 1# incoming line I1'
2# incoming line I2 103 104 2# incoming line I2'
Protection current Ia 105 106 Protection current Ia'
Protection current Ic 107 108 Protection current Ic'
1# incoming line U1 109 110 1# incoming line U1'
2# incoming line U2 111 112 2# incoming line U2'
Ⅱbusbar voltage Ua2 113 114
Ⅱbusbar voltage Ub2 115 116
Ⅱbusbar voltage Uc2 117 118 Ⅱbusbar voltage Un2
119 120

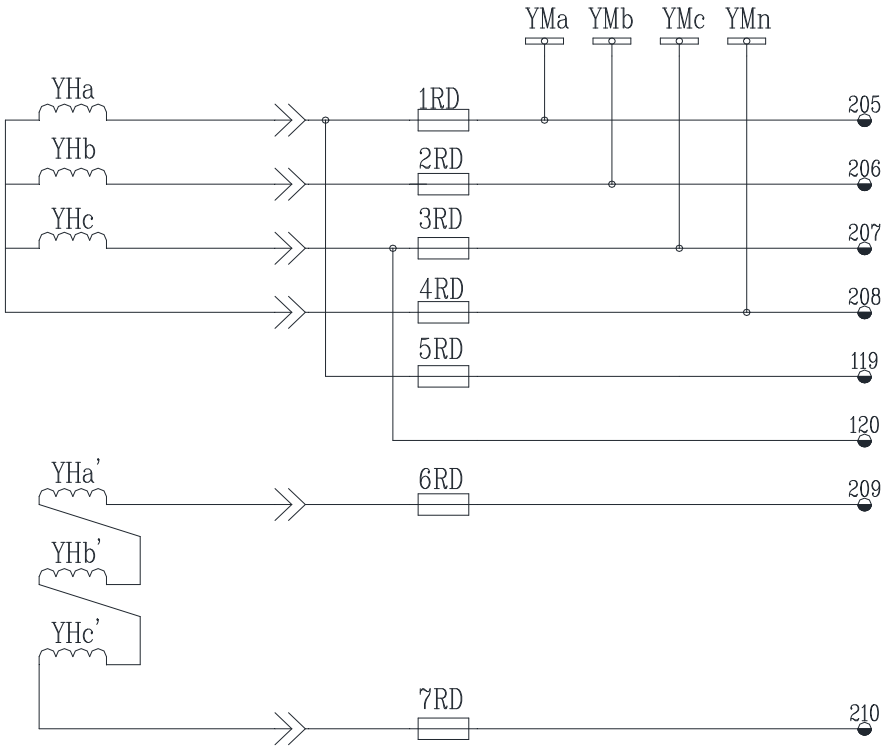
TYV8691 TV Protection Equipment

1 Functions

- 2-zone undervoltage protection
- Busbar insulation Check
- Ua，Ub，Uc，Uab，Ubc，Uca，U0，15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 The sketch map of TV's secondary circuit



The device sampling the Uab, Ubc, Uca, Uac' and a zero-voltage.The Uac' is the circuit of 5RD which is only supplied to the deviceself and don't connect to small bus,so the circuit of 5RD could be a short circuit is small possibility.

2.2 2-zone undervoltage protection

As the 4 line-voltage are smaller than the setting, the protection will to trip some motors or transformers.The delay of under-voltage I is 0.5S, it used to trip the moters of II， III. The delay of under-voltage II is 9S, it's used to trip the moters of I.

2.3 Bus insulation check

As the zero-sequence voltage is larger than the setting, the protection will trip after a time delay.

2.4 TV disconnection alarm

TV disconnection send alarm signal and block undervoltage protection.

If the difference between the maximum voltage and minimum voltage of the four line-voltage is greater than 30V and the delay is 3 seconds, it is considered as the TV disconnection.

If Uab is greater than 30V and the difference between the maximum voltage and minimum voltage of the four line-voltage is less than 30V, the TV disconnection is returned.

2.5 TV disconnection function

The TV's open-posidition is connected into the device. When the posidition is open the under-voltage protection is locked.

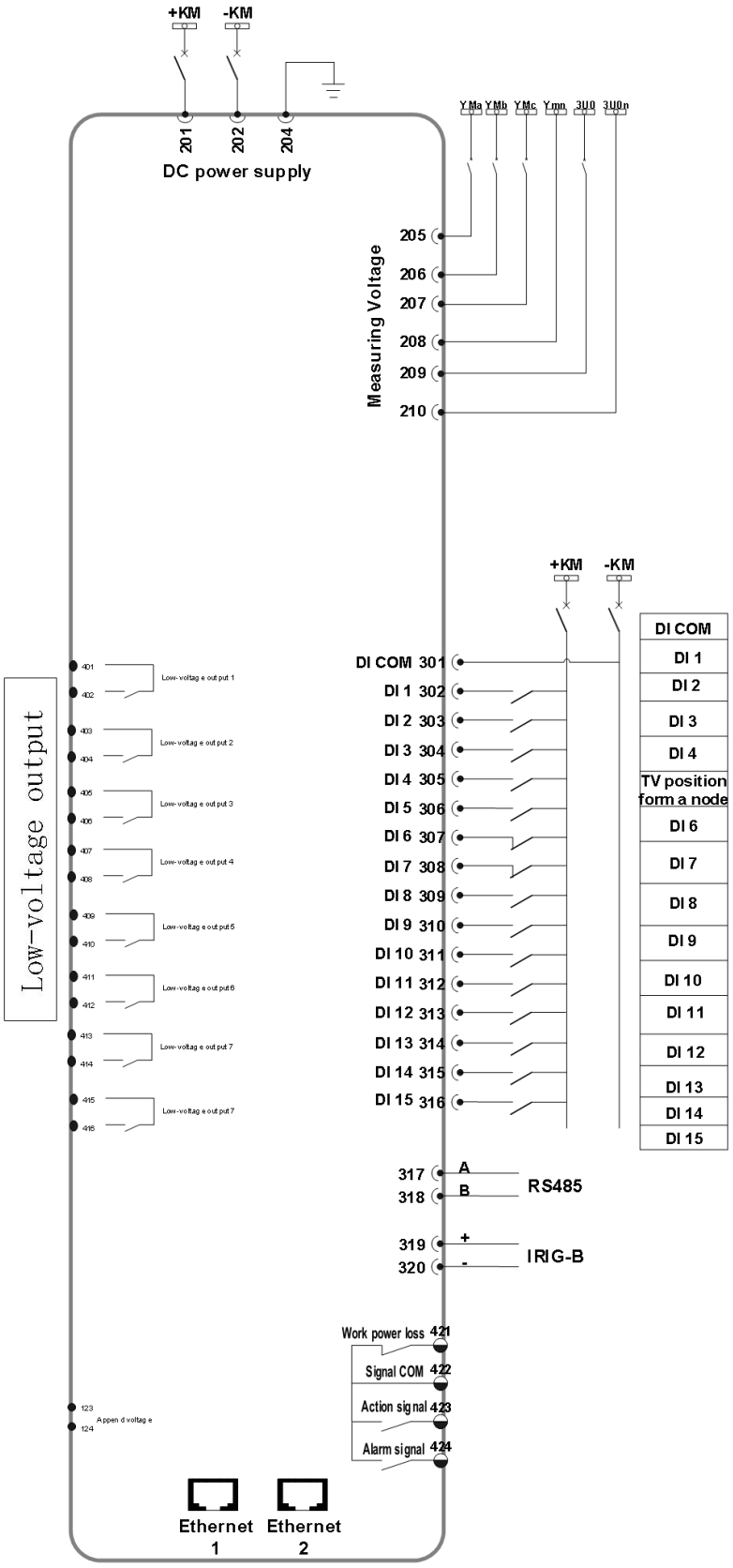
2.6 Undervoltage usage

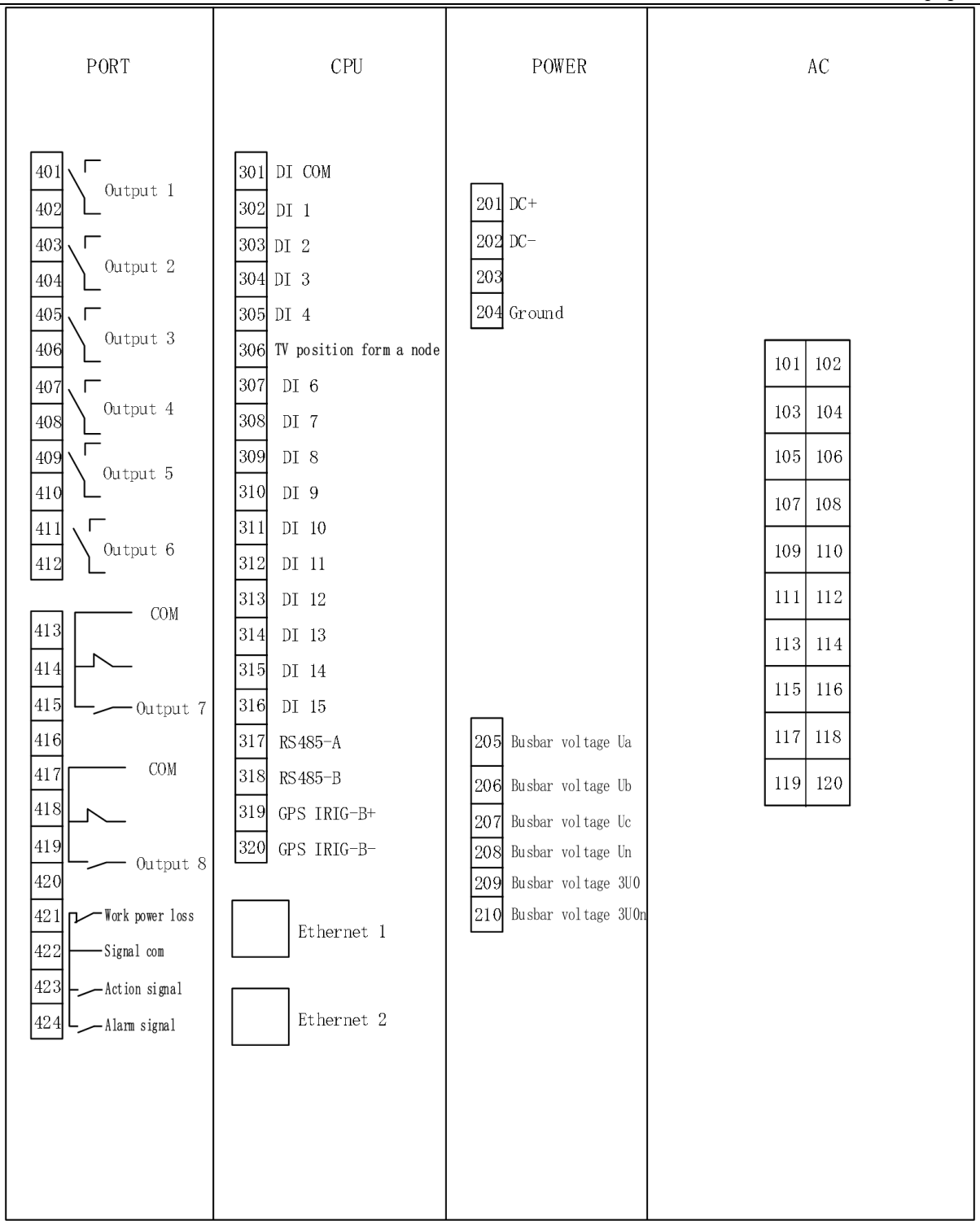
Exports of undervoltage nodes put into operation of motor protection tripping in the external circuit. Although the motor has the protection of undervoltage protection, but suggested the use of this protection, because this protection Uac 'loop the possibility of failure is extremely small, low-voltage maloperation therefore unlikely. Maintenance and operation of TV at the scene directly out of TV car will not make undervoltage maloperation.

3 Setting

List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	UV-I setting	Undervoltage Zone I setting	V	10~100
2	UV-I time	Undervoltage Zone I time	S	0~60
3	UV-II setting	Undervoltage Zone II setting	V	10~100
4	UV-II time	Undervoltage Zone II time	S	0~60
5	ZS OV setting	Zero-sequence overvoltage setting	V	1~100
6	ZS OV time	Zero-sequence overvoltage time	S	0~60
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	306 blocking UV	306 blocking the undervoltage	□OFF □ON	
2	307 blocking UV	307 blocking the undervoltage	□OFF □ON	
3	308 blocking UV	308 blocking the undervoltage	□OFF □ON	
4	309 blocking UV	309 blocking the undervoltage	□OFF □ON	

5	310 blocking UV	310 blocking the undervoltage	□OFF □ON
6	UV-I switch	Undervoltage Zone I switching on/off	□OFF □ON
7	UV-II switch	Undervoltage Zone II switching on/off	□OFF □ON
8	ZS OV switch	Zero-sequence overvoltage switching on/off	□OFF □ON
9	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON


+KM
-KM
201
202
204
DC power supply
YMa YMb YMc Ymn 3U0 3U0n
Measuring Voltage
205
206
207
208
209
210
+KM
-KM
DI COM
DI 1
DI 2
DI 3
DI 4
TV position form a node
DI 6
DI 7
DI 8
DI 9
DI 10
DI 11
DI 12
DI 13
DI 14
DI 15
DI COM 301
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
DI 6 307
DI 7 308
DI 8 309
DI 9 310
DI 10 311
DI 11 312
DI 12 313
DI 13 314
DI 14 315
DI 15 316
Low-voltage output
401
402
Low-voltage output 1
403
404
Low-voltage output 2
405
406
Low-voltage output 3
407
408
Low-voltage output 4
409
410
Low-voltage output 5
411
412
Low-voltage output 6
413
414
Low-voltage output 7
415
416
Low-voltage output 7
317
318
A
B
RS485
319
320
+
-
IRIG-B
Work power loss 421
Signal COM 422
Action signal 423
Alarm signal 424
123
124
Appendd voltage
Ethernet 1
Ethernet 2


PORT
401
402
Output 1
403
404
Output 2
405
406
Output 3
407
408
Output 4
409
410
Output 5
411
412
Output 6
413
414
415
COM
Output 7
416
417
418
419
COM
Output 8
420
421
422
423
424
Work power loss
Signal com
Action signal
Alarm signal
CPU
301 DI COM
302 DI 1
303 DI 2
304 DI 3
305 DI 4
306 TV position form a node
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 DI 13
315 DI 14
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209 Busbar voltage 3U0
210 Busbar voltage 3U0n
AC
101 102
103 104
105 106
107 108
109 110
111 112
113 114
115 116
117 118
119 120

TYV8692 TV Parallel Equipment

1 Functions

The equipment is intended as a single busbar section of primary connections in the substation, can be used as secondary voltage switching of segment voltage transformer.

DC rated voltage: 220V or 110V

DC circuit power consumption: less than 18W

Signal circuit contacts carrying capacity: 5A

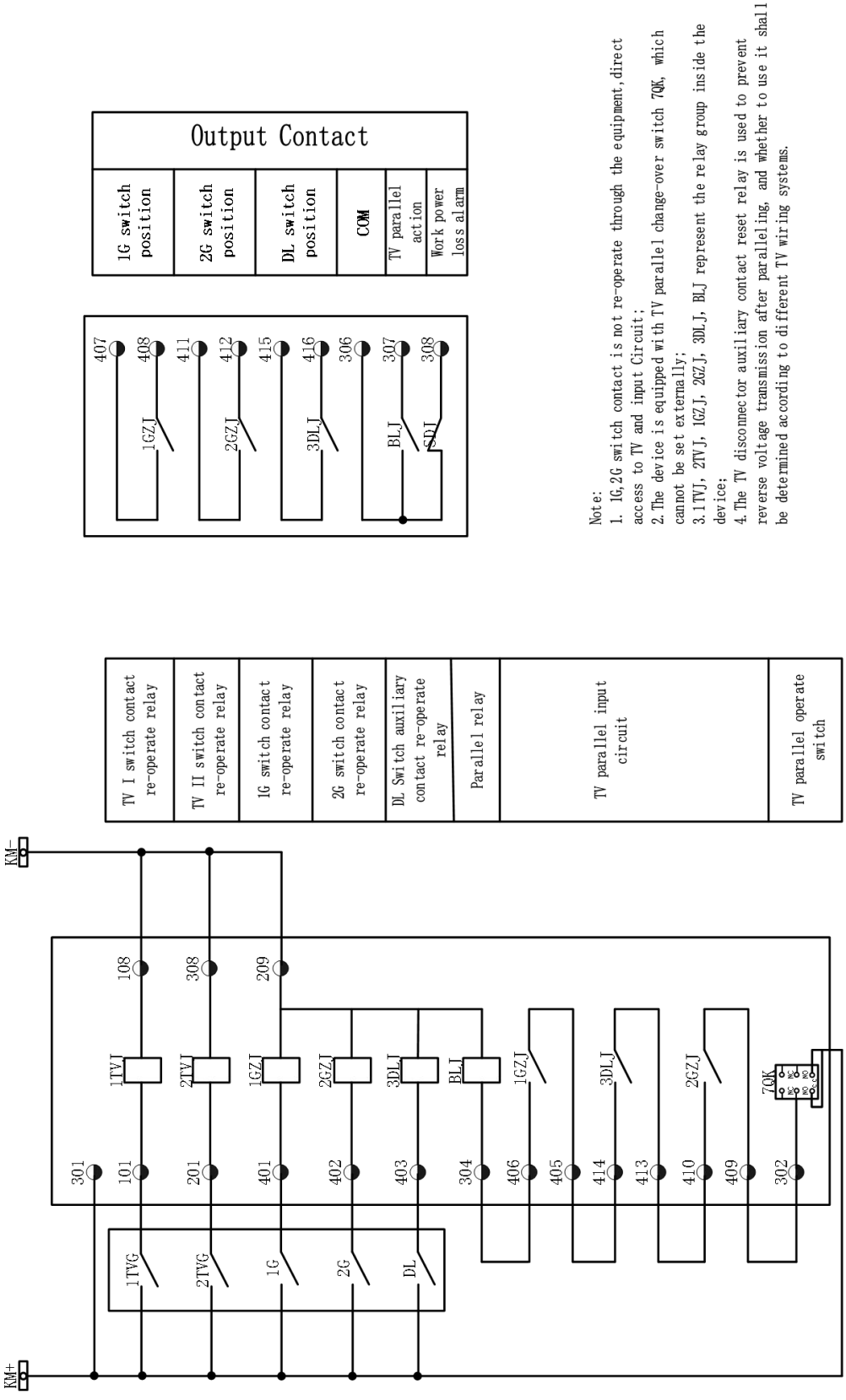
AC voltage circuit contacts current-carrying capacity: 5A

2 Principle Descriptions

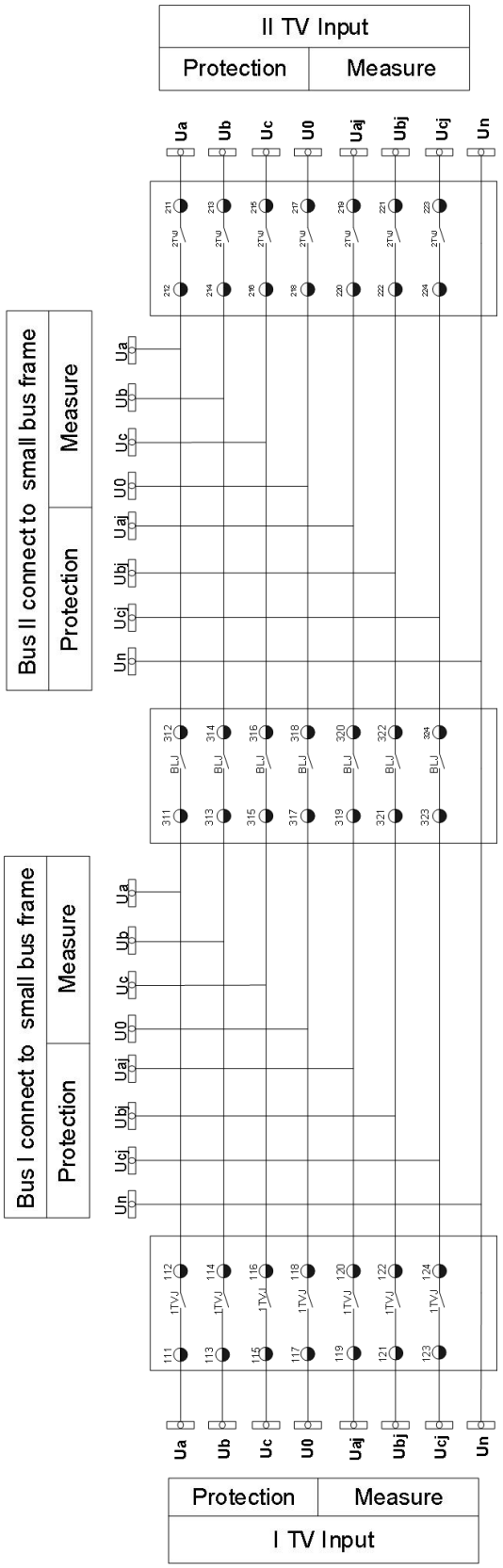
The equipment consists of two re-operate module in PT isolating switch contacts, an AC voltage parallel module and a signal module.

Figure 1 and figure 2 is a principle of TYV8692. In figure, TVJ is re-operate relay of the voltage transformer isolating switch contact, GZJ is re-operate relay of the bus coupler switch contact, BLJ is the AC voltage parallel relay. Bus coupler isolation switch 1G and 2G started two GZJ respectively, its contacts in series, string into BLJ start circuit. BLJ parallel switch from the bus voltage QK contact, closing the relay contacts and two positions respectively by 1G, 2G contacts initiated GZJ series started, it contacts the second AC voltage to the PT side by side.

Principle Figure 1：

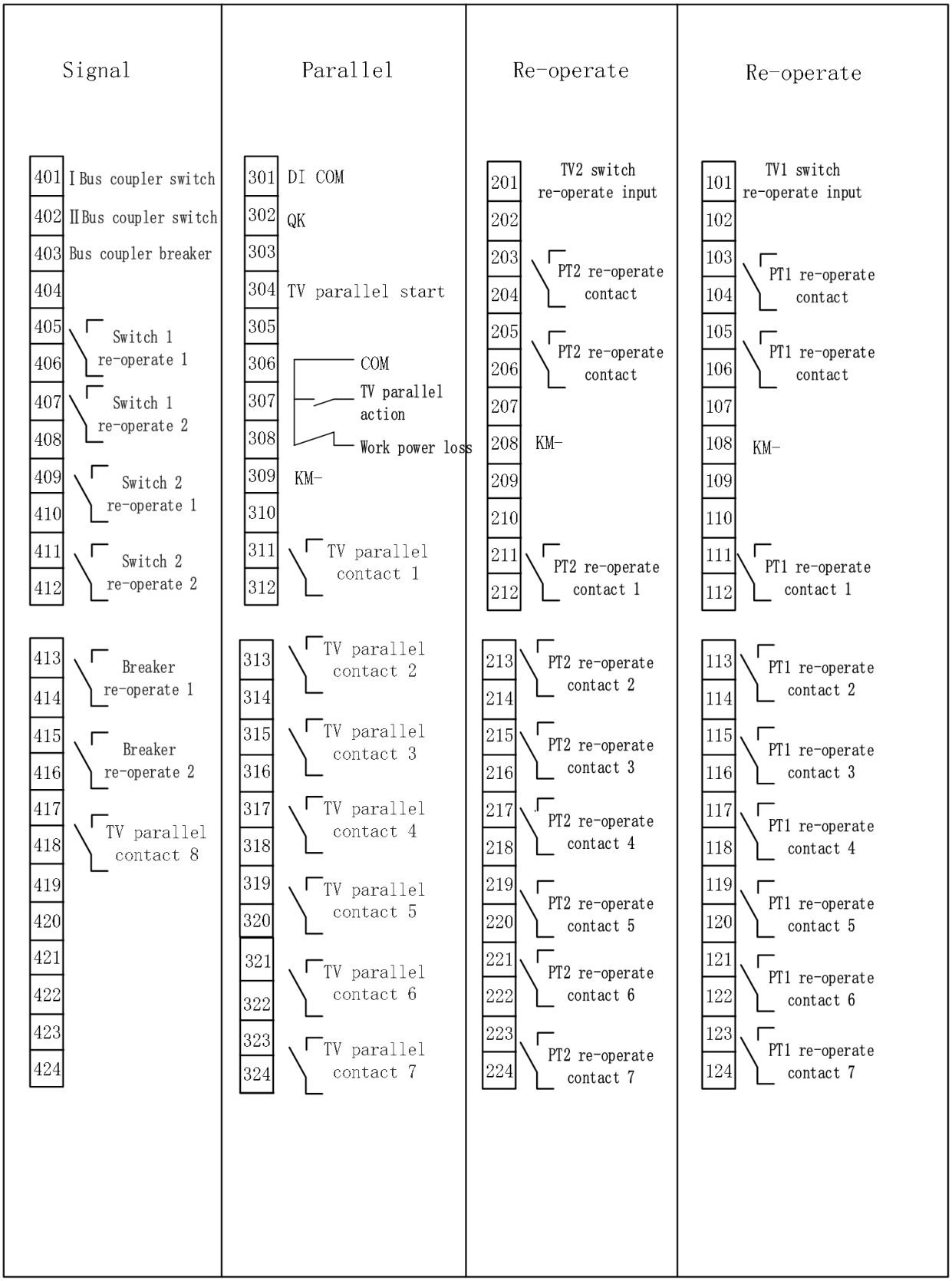


Principle Figure 2：



Note：Unit I to prevent the voltage anti-transfer after voltage parallel, if do not need this function, directly introduce voltage from the front of unit II.

Terminal Figure



TYV8693 TV Parallel Protection Equipment

1 Functions

The equipment is intended as a single busbar section of primary connections in the substation, can be used as secondary voltage switching of segment voltage transformer.

The device power supply can be adapted to DC 220V or 110V, also adapted to AC 220V power supply.

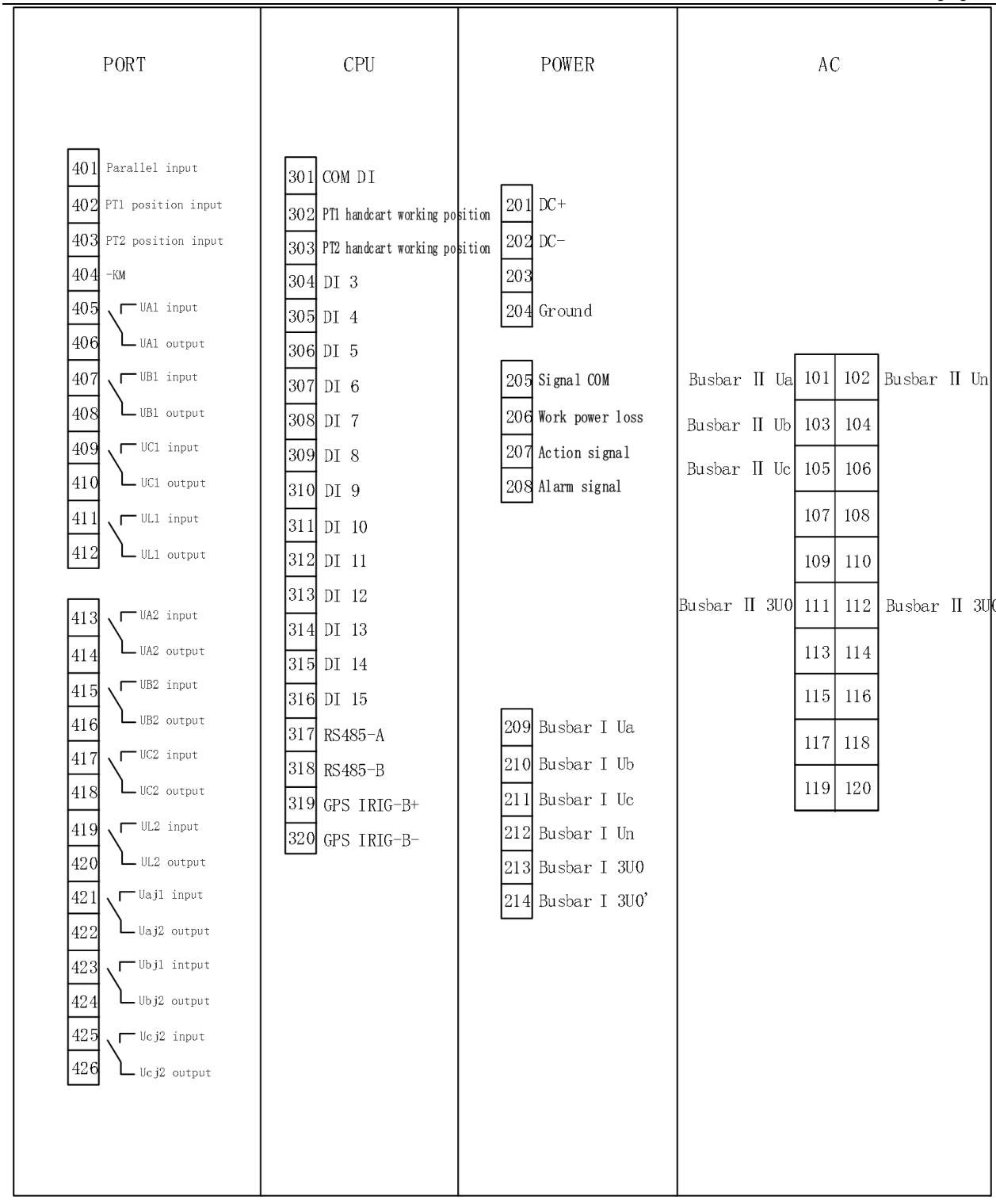
Signal circuit contacts carrying capacity: 8A

AC voltage circuit contacts current-carrying capacity: 8A

2 Principle Descriptions

The equipment is composed by 4 modules.

1. AC module, Completing voltage acquisition function.
2. Power module, Transforming 220V AC or DC 5V voltage for the CPU available, but also Completing voltage acquisition function.
3. CPU module, Completing calculation of the PT voltage sampling, digital input, PT parallel logic, low voltage protection judgments function.
4. Digital output module, Formed by the relay, the output PT parallel contacts, or under-voltage protection action contacts. The plug-in output of up to 8 pairs of contacts, each contact can be set according to whether the PT side by side action.


PORT
401 Parallel input
402 PT1 position input
403 PT2 position input
404 -KM
405 UA1 input
406 UA1 output
407 UB1 input
408 UB1 output
409 UC1 input
410 UC1 output
411 UL1 input
412 UL1 output
413 UA2 input
414 UA2 output
415 UB2 input
416 UB2 output
417 UC2 input
418 UC2 output
419 UL2 input
420 UL2 output
421 Uaj1 input
422 Uaj2 output
423 Ubj1 intput
424 Ubj2 output
425 Ucj2 input
426 Ucj2 output
CPU
301 COM DI
302 PT1 handcart working position
303 PT2 handcart working position
304 DI 3
305 DI 4
306 DI 5
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 DI 13
315 DI 14
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
POWER
201 DC+
202 DC-
203
204 Ground
205 Signal COM
206 Work power loss
207 Action signal
208 Alarm signal
209 Busbar I Ua
210 Busbar I Ub
211 Busbar I Uc
212 Busbar I Un
213 Busbar I 3U0
214 Busbar I 3U0'
AC
Busbar II Ua 101 102 Busbar II Un
Busbar II Ub 103 104
Busbar II Uc 105 106
107 108
109 110
Busbar II 3U0 111 112 Busbar II 3U0'
113 114
115 116
117 118
119 120

TYM8691 Motor Differential And Integrated Protection

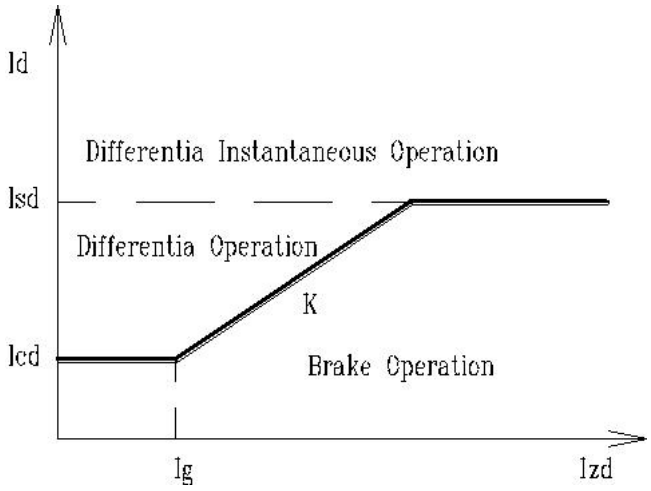
1 Functions

- Differential protection
- Differential instantaneous protection
- Differential current overcurrent alarm
- TA wire break blocking
- Current instantaneous protection
- Definite time-limit overcurrent protection
- 2 zone definite time-limit negative-sequence protection /Inverse time-limit negative-sequence protection
- Overheat protection
- Locked-rotor protection
- Single-phase ground protection
- Undervoltage protection
- Overload protection
- Non-electric quantity protection
- 4-20mA DC Output
- 16 fault waveform-recording
- I, U, P, Q, Cosφ, kWh, kVarh,15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 Differential protection

2.1.1 Proportion restraint



The protection will acquire the current I1, I2 at both sides of the phases A, B, C. The computation is made to get the following:

Izd = Max(I 1 , I 2)

Id = | I1 — I2 | (Same polarity connection is made for TAs at both sides)

$$K = \frac{Id - Icd}{Izd - Ig}$$

Operating equation:

If the restraint current Izd is smaller than the kneepoint current Ig, the operating equation is Id＞Icd

If the restraint current Izd is larger than the kneepoint current Ig, the operation is Id＞Icd＋(Izd－Ig)×K

Where,

Izd – Restraint current, take the maximum phase current

Id – Differential current

Icd – Differential setting

Ig – Kneepoint current

The kneepoint current is 0.7 multiples of the rated current Ie.

The restraint coefficient can be set.

2.1.2 Harmonic Restraint

Considering that TA saturation may be resulted from the heavy load on the TA at the primary side at the end of the motor or from the effects of the transient components, the harmonic restraint is adopted to effectively prevent the misoperations of the motor differential protection.

The action equation of second and third harmonic restraint differential protection in phase A is:

$$\frac{\text{NIAF2}}{\text{NIA}} < K2 \quad \text{and} \quad \frac{\text{NIAF3}}{\text{NIA}} < K3$$

NIAF2 is amplitude of the second harmonic of the tail A phase

NIAF3 is amplitude of the third harmonic of the tail A phase

NIA is amplitude of the A-phase fundamental wave at the tail

K2 is the second-harmonic restraint coefficient, generally 0.15

K3 is the third-harmonic restraint coefficient, generally 0.15

C phase harmonic restraint is the same as A phase.

In the meanwhile, the recognition elements for both motor internal and external faults are added in the protection. As the internal fault occurs, the harmonic restraint element will be switched off to ensure the fast operation of the differential protection.

2.2 Differential instantaneous protection

As the differential current of any phase is larger than the setting for the differential instantaneous protection, the protection will have an output without a time delay.

2.3 Differential current overcurrent alarm

As the protection detects that the differential current of any phase reaches the setting for the differential

current overreach alarm, the protection will send the alarm signal after a certain time delay.

2.4 TA wire break blocking

As the TA wire break occurs at any phase at any side during motor operation at the rated current, the protection can signal or block the differential protection based on the control characters.

2.5 Current instantaneous protection

Asynchronous motor current is large during startup, usually up to 5 to 8 times rated current (Ie), startup time can be up to tens of seconds. Equipment has two Instantaneous overcurrent setting, the startup process, the constant use of "Starting instantaneous overcurrent setting", according to the value of the escape motor starting current setting, such as motor starting process is completed, the automatic use of "Runing instantaneous overcurrent setting", according to the value of the escape motor self-starting current and the maximum feedback current of external fault short circuit, whichever is maximum.

a) Starting time tst is using the longest startup time, tst＞tst.max。

b) Starting instantaneous overcurrent setting Iop.h, according to the value of the escape motor starting current Ist, namely:

When t≤tst, Iop.h＝krel×Ist, in order to avoid the influence the impact of acyclic component, krel is 1.5,Ist is (6～8)Ie.

c) Running instantaneous overcurrent setting Iop.l, according to the value of the escape motor self-starting current and the maximum feedback current of external fault short circuit, since the self-starting current and the standby power supply to the delay and other factors, in the auxiliary power fast throw-over is successful, motor almost is non-existent self-start process, because the motor speed has not decreased, but only in synchronism capture or residual voltage, the motor speed has been significantly reduced, since the self-starting current will be larger, according to the traditional method, since the self-starting current Iast=5Ie, Iop.l= krel ×Iast×Ie =1.3×5×Ie =6.5Ie.

External three-phase fault protection usually contain the inherent delay time (40 ~ 60ms) , the feedback current Ifb=6Ie.

Iop.l = krel ×Ifb=1.3×6 Ie =7.8Ie.

d) Instantaneous overcurrent time is the match with F-C.

2.6 Definite overcurrent protection

As the 3-phase currents IA, IB, IC of the motor is larger than the setting for the overcurrent protection, the protection will have an output after a time delay.

The setting for the overcurrent protection can be set based on the starting current, generally, it is (1.2 ~ 2) Ie. When the motor starts, the overcurrent protection will quit, and after the motor starts, it will be automatically input.

2.7 Negative-sequence protection

As the 3-phase imbalance, open phase, opposite phase and the interturn short-circuit occur in motor, the negative-sequence current will be produced.

Assuming that the positive-sequence current is I1, negative-sequence current is I2, if the 3-phase current are all connected to the protection, then

$$\dot{I}_1 = (\dot{I}_A + a\dot{I}_B + a^2\dot{I}_C)/3 \quad ; \quad \dot{I}_2 = (\dot{I}_A + a^2\dot{I}_B + a\dot{I}_C)/3 \quad ; \quad a = e^{j2\pi/3}$$

In general, only two phase (phases A, C) currents are connected to the motor protection, its positive and negative-sequence current can be computed by the following equation:

$$\dot{I}_1 = (\dot{I}_A + \beta\dot{I}_C)/\sqrt{3} \quad ; \quad \dot{I}_2 = (\dot{I}_C + \beta\dot{I}_A)/\sqrt{3} \quad ; \quad \beta = e^{-j\pi/3}$$

The operation of the negative-sequence protection takes the inverse time-limit performance and its operating equation is:

$$t = \frac{T}{(I_2 / Ied)}$$

Where, T — Negative-sequence inverse time-limit constant

I2— Measured value of the negative-sequence current

Ied— Secondary rated current value of the motor

As the external fault or the imbalance in the external power supply system occurs, the feedback negative-sequence current of the motor may result in the misoperations of the negative-sequence overcurrent protection. As the asymmetrical short-circuits occur either inside or outside of the protected area, the ratio I2/I1 may vary. When the following conditions are satisfied, the negative-sequence overcurrent protection can be blocked:

I2≥1.2I1, where, I1 is positive-sequence current, I2 is negative-sequence current.

2.8 Overheat protection

Motor overload, too long starting time and rocked-rotor of a motor will all produce the larger positive-sequence current; whereas the open phase, asymmetrical short-circuit and input voltage will result in the larger positive-and negative-sequence current at simultaneously. Based on the heating features caused by the positive-and negative-sequence current in the motor stator, the overheat protection may be produced for the above faults.

The integrated measured value of the positive-and negative-sequence current Ieq is used as the equivalent current to model the heating effectives of the motor, i.e.:

$$Ieq^2 = K_1 \times I_1^2 + 6I_2^2$$

Where, Ieq —Equivalent current

I1 —Positive-sequence current (p.u.)

I2 —Negative-sequence current (p.u.)

K1 —Heating coefficient of the positive-sequence current. During the starting of the motor,K1 = 0.5; as the starting is computed, K1 = 1.

Based on the inverse time-limit performance of the heating model of the motor and in order to effectively protect the motor, the following two curves can be selected to express the relationship between the operating time of the protection and the equivalent current Ieq:

$$1)\, t = \frac{\tau}{Ieq^2 - I\infty^2}$$

Where, τ—Overheat time constant

I∞—Maximum current that can permit the long-duration operation of the motor, generally, 1.1 can be set up.

$$2)\, t = \tau \ln \frac{Ieq^2 - Ip^2}{Ieq^2 - I\infty^2}$$

Where, τ—Overheat time constant

I∞—Maximum current that can permit the long-duration operation of the motor, generally, 1.1 can be set up.

Ip —Load current prior to overload. If it is in the cold state, Ip = 0

Select one of the above two curves to do computation, when the heat accumulation value reaches τ, the device will trip.

Note: After the motor is overheated, the protection action node is always closed to avoid overheating closing to protect the motor. When the heat dissipation process is over, the protection node will return. At this point, the motor can be switched off.

2.9 Locked-rotor protection

Due to the causes, e.g., mechanical faults, two heavy load and too low voltage, etc. the rotor can be caused to be in the locked-rotor state. For a locked –rotor motor at the total voltage, the current is large enough to be especially easy to be burnt out.

The device calculates the positive sequence current according to the collected phase currents. When the positive sequence current is greater than the fixed value of the lock-rotor current, the protection will trip after delay.

The locked-rotor protection does not exit from operation at startup, so the delay of lock-in protection should be longer than the motor startup time.

2.10 Single-phase ground protection

Zero sequence overcurrent measurement ranges from 0.050 to 30A (secondary value). It is used in indirectly grounded systems.

When 3I0 is greater than zero sequence overcurrent protection setting value, the protection will trip after delay.

2.11 Undervoltage protection and TV wire break block

As the power supply voltage of the motor is reduced for a short time or is interrupted for a short time and

then recovered, it is necessary to switch off the less important motors to ensure the auto-starting of the important motors.

As the three line voltages Uab, Ubc, and Uca input into the protection are lower than the undervoltage setting simultaneously, the undervoltage protection will operate to act on the output after a time delay. In order to prevent the misoperations of the protection caused by the TV wire break, the TV wire break blocking is provided. As the TV wire break occurs, the protection will send the alarm signals and block the undervoltage protection.

The setting for the undervoltage protection is set based on being able to free from the lowest voltage for the auto-starting of a group of motors.

When the bus does not deliver power, undervoltage protection will act, in order to avoid this situation, the device is provided with undervoltage opening conditions and tripping position lock, must first meet the opening conditions, undervoltage protection input; When the switch is in the tripping position, the undervoltage protection will be locked. Undervoltage open conditions can be set by the user for input (use) or quit (not use).

When the undervoltage protection action, switch tripping, undervoltage protection immediately return; After the undervoltage protection operation, the switch tripping position is not detected, and the protection will return after 10 seconds delay.

Undervoltage open condition: If one of the three line voltages is greater than 80V and the delay is 100ms, the undervoltage open condition is always in effect.

After the undervoltage action returns (greater than the undervoltage action value), delay for 10 seconds and restart the low voltage open condition identification. This condition can be turned back.

The device has a TV disconnection check function, and when the device detects that the TV is disconnected, an alarm signal is issued.

The difference between any two-phase line voltage>30V;

Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

2.12 Overload protection

As the 3-phase currents of the motor IA,IB, IC are larger than the setting for the overload protection, the protection will signal or trip to have an output (can be selected by the control characters). The overload setting should be lower than the overcurrent protections setting. Because of the larger current during starting of the motor, the overload time delay setting should be set to free from the auto-starting time of the motor.

2.13 Non - electric quantity protection

Device with two-channel non-power protection for transformer fault motor group or process required tripping and so on. Each non-power protection can be defined as the whole trip or alarm or quit. If we do not as a non-power protection, the entire set at exit, these points can be entered as an ordinary amount of use.

2.14 4-20mA DC Output(Optional)

Terminal device (302, 303) output all the way 4-20mA DC, for access to the DCS system analog acquisition cards (AI).

The DC output can be set up in the device by the user to select the corresponding Ia or Uab or P.

3 Setting

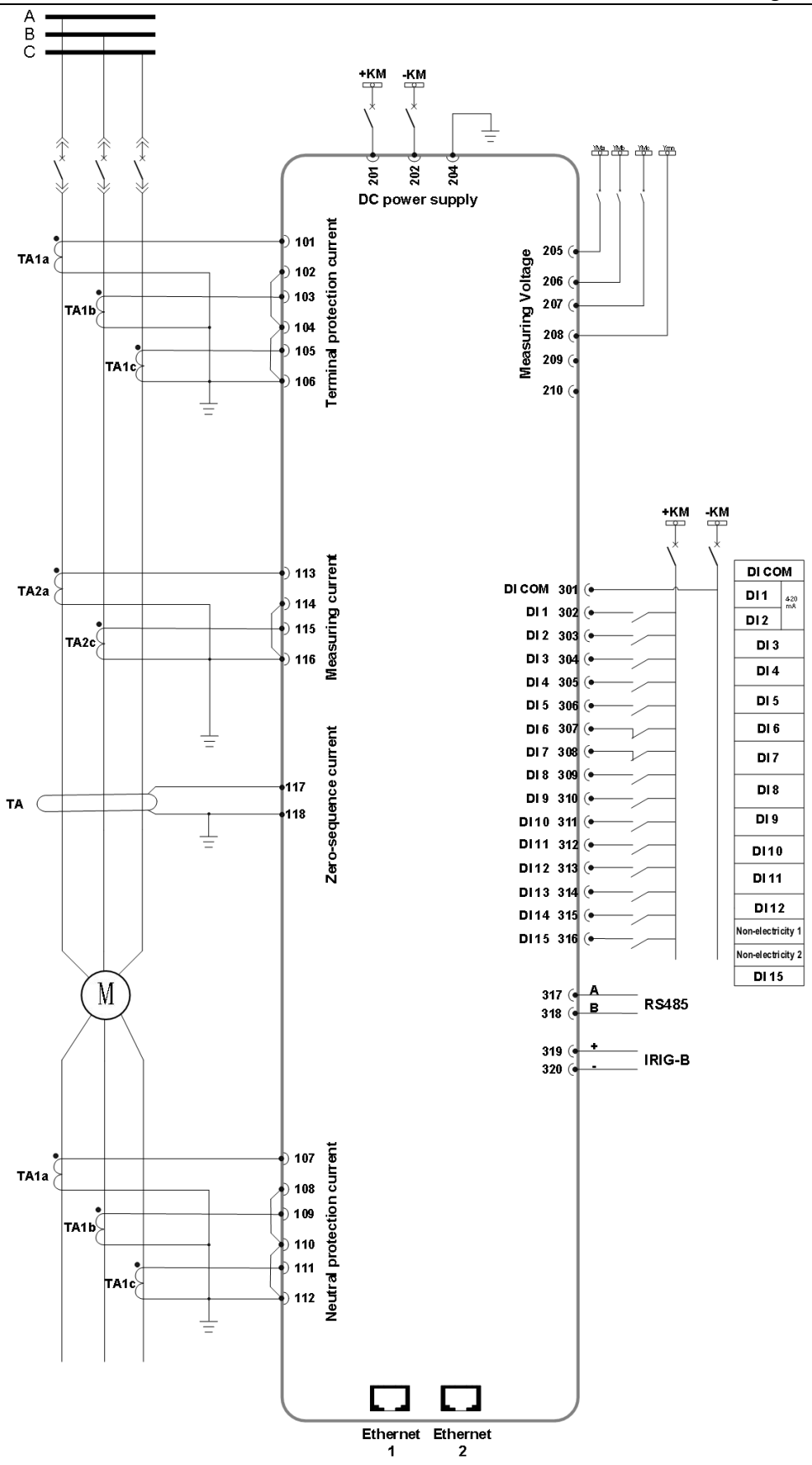
List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	2nd rated CURT	Motor secondary rated current (Ie)	A	0.05～30
2	DIF CURT	Differential current	Ie	0.20～2.00
3	INS DIF CURT	Differential instantaneous current	Ie	1.00～20.00
4	RT-BRK factor	Ratio differential braking factor		0.30～1.00
5	Balance factor	Balance factor of contralateral side		0.10～9.99
6	DIF CURT OR alm	Differential current overreach alarm setting	Ie	0.10～1.00
7	DIF CURT OR time	Differential current overreach time	S	0.10～50.00
8	Motor ST time	Motor starting time	S	0.00～99.99
9	ST INS OC CURT	Motor starting Instantaneous overcurrent	Ie	0.05～20.00
10	RUN INS OC CURT	Motor running Instantaneous overcurrent	Ie	0.05～20.00
11	INS OC time	Instantaneous overcurrent time	S	0.00～10.00
12	OC current	Overcurrent	Ie	0.05～20.00
13	OC time	Overcurrent time	S	0.00～60.00
14	OVLD current	Overload current	Ie	0.00～20.00
15	OVLD time	Overload time	S	0.00～60.00
16	NS OC-I current	Negative-sequence overcurrent zone I current	Ie	0.30～10.00
17	NS OC-I time	Negative-sequence overcurrent zone I time	S	0.00～60.00
18	NS OC-II CURT	Negative-sequence overcurrent zone II current	Ie	0.30～10.00
19	NS OC-II time	Negative-sequence overcurrent zone II time	S	0.00～60.00
20	NS OC-IT THLD	Negative-sequence current threshold	Ie	0.05～20.00
21	NS OC-IT CST	Negative-sequence inverse time-limit constant	S	0.00～99.98
22	LRotor current	Locked-rotor current	Ie	0.05～10.00
23	LRotor time	Locked-rotor time	S	0.00～60.00
24	Overheat ST CURT	Overheat starting current	Ie	1.00～2.00
25	OHT time CONST	Overheat time constant	S	0～600
26	OHT alarm factor	Overhead alarm factor		0.05～1.00

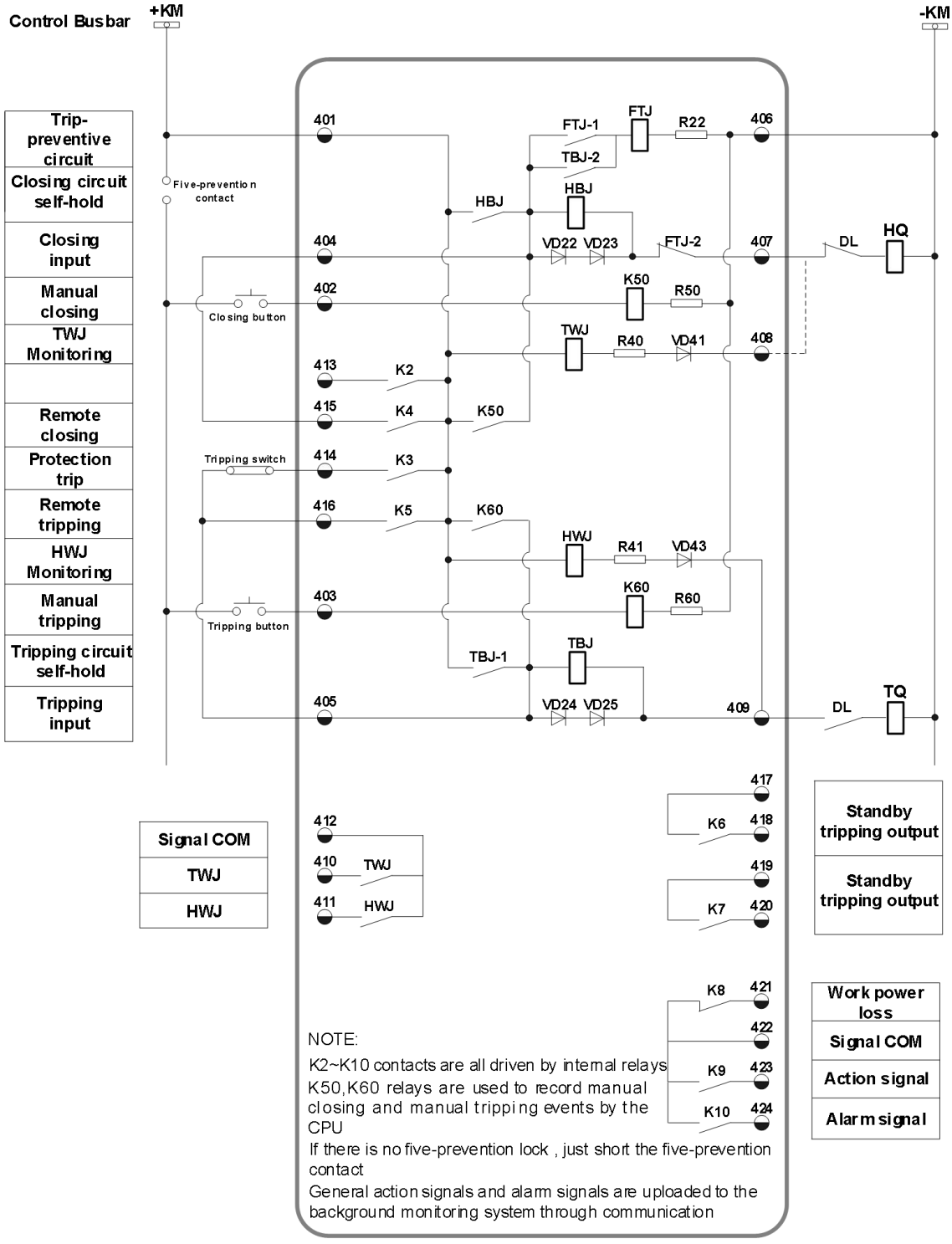
27	ZOC current	Zero-sequence overcurrent	A	0.05～30.00
28	ZOC time	Zero-sequence overcurrent time	S	0.00～60.00
29	UV setting	Undervoltage setting	V	15.00 ～ 99.99
30	UV time	Undervoltage time	S	0.10～60.00
31	F-C BLK current	F-C blocking current	Ie	0.05～20.00
32	F-C BLK time	F-C blocking time	S	0.00～60.00

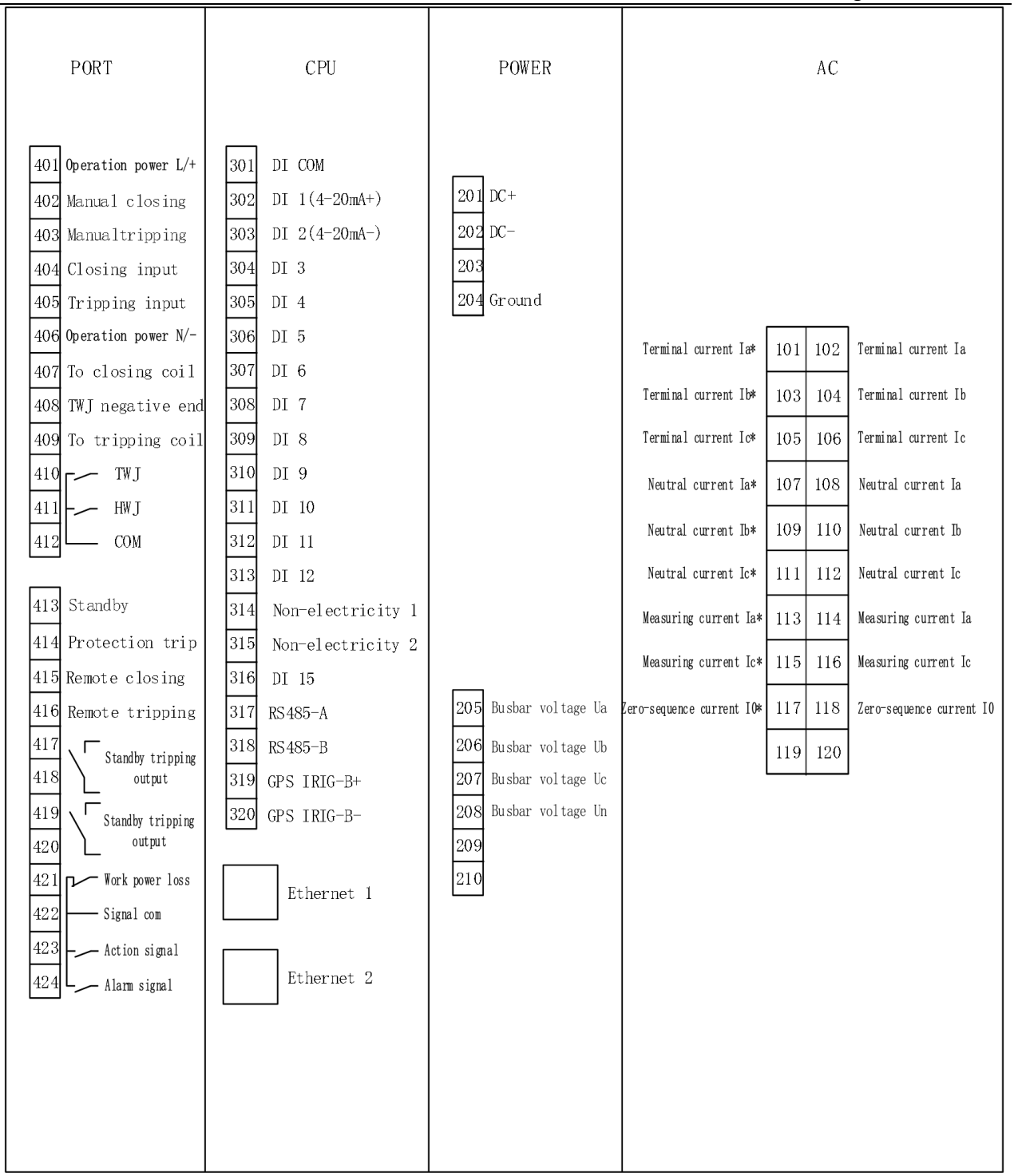
List of control characters

Ser.No.	Abbreviation	Name of control characters	Options
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON
3	Two to three	2 phase – 3 relay (measure Ia, Ic calculate Ib= -(ia+ic))	□OFF □ON
4	Non-elect 1 trip	Non-electric 1 trip switching on/off	□OFF □ON
5	Non-elect 1 ALM	Non-electric 1 alarm switching on/off	□OFF □ON
6	Non-elect 2 trip	Non-electric 2 trip switching on/off	□OFF □ON
7	Non-elect 2 ALM	Non-electric 2 alarm switching on/off	□OFF □ON
8	INS DIF switch	Differential instantaneous current switching on/off	□OFF □ON
9	A-phase DIF SW	A-phase differential switching on/off	□OFF □ON
10	B-phase DIF SW	B-phase differential switching on/off	□OFF □ON
11	C-phase DIF SW	C-phase differential switching on/off	□OFF □ON
12	DIF OR ALM SW	Differential current overreach alarm switching on/off	□OFF □ON
13	TA DISCON ALM SW	TA disconnection alarm switching on/off	□OFF □ON
14	CT DISCON BLK SW	CT disconnection blocking differential switching on/off	□OFF □ON
15	INS OC switch	Instantaneous overcurrent switching on/off	□OFF □ON
16	OC switch	Overcurrent switching on/off	□OFF □ON
17	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
18	NS OC-I switch	Negative-sequence overcurrent zone I switching on/off	□OFF □ON
19	NS OC-II switch	Negative-sequence overcurrent zone II switching on/off	□OFF □ON
20	NS FB OC switch	Negative-sequence feedback overcurrent blocking switching on/off	□OFF □ON
21	NS OC IT switch	Negative-sequence overcurrent inverse time switching on/off	□OFF □ON
22	NS OC IT BLK SW	Negative-sequence overcurrent inverse time blocking switching on/off	□OFF □ON
23	LRotor switch	Locked-rotor protection switching on/off	□OFF □ON
24	OHT Logarithmic	Overhead Logarithmic curve switching on/off	□OFF □ON
25	OHT Inverse	Overhead Inverse curve switching on/off	□OFF □ON
26	Overheat trip	Overhead protection trip switching on/off	□OFF □ON
27	Overheat alarm	Overhead protection alarm switching on/off	□OFF □ON
28	ZOC alarm switch	Zero-sequence overcurrent alarm switching on/off	□OFF □ON
29	ZOC trip switch	Zero-sequence overcurrent trip switching on/off	□OFF □ON

30	UV switch	Undervoltage switching on/off	□OFF □ON
31	UV COND switch	Undervoltage condition switching on/off	□OFF □ON
32	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
33	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
34	F-C BLK switch	F-C blocking switching on/off	□OFF □ON


A
B
C
+KM
-KM
201
202
204
DC power supply
TA1a
TA1b
TA1c
101
102
103
104
105
106
Terminal protection current
205
206
207
208
209
210
Measuring Voltage
TA2a
TA2c
113
114
115
116
Measuring current
TA
117
118
Zero-sequence current
M
TA1a
TA1b
TA1c
107
108
109
110
111
112
Neutral protection current
DI COM 301
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
DI 6 307
DI 7 308
DI 8 309
DI 9 310
DI10 311
DI11 312
DI12 313
DI13 314
DI14 315
DI15 316
DI COM
DI 1
DI 2
4-20 mA
DI 3
DI 4
DI 5
DI 6
DI 7
DI 8
DI 9
DI10
DI11
DI12
Non-electricity 1
Non-electricity 2
DI15
317
318
A
B
RS485
319
320
+
-
IRIG-B
Ethernet 1
Ethernet 2


Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
FTJ-1
TBJ-2
FTJ
R22
406
HBJ
VD22 VD23
FTJ-2
407
DL
HQ
K50
R50
TWJ
R40
VD41
408
K2
K4
K3
K5
K60
HWJ
R41
VD43
TBJ-1
TBJ
VD24 VD25
409
TQ
412
410
411
TWJ
HWJ
417
K6
418
419
K7
420
K8
421
422
K9
423
K10
424
Signal COM
TWJ
HWJ
Standby tripping output
Standby tripping output
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Standby
414 Protection trip
415 Remote closing
416 Remote tripping
417
418 Standby tripping output
419
420 Standby tripping output
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 DI 1(4-20mA+)
303 DI 2(4-20mA-)
304 DI 3
305 DI 4
306 DI 5
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 Non-electricity 1
315 Non-electricity 2
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209
210
AC
Terminal current Ia* 101 102 Terminal current Ia
Terminal current Ib* 103 104 Terminal current Ib
Terminal current Ic* 105 106 Terminal current Ic
Neutral current Ia* 107 108 Neutral current Ia
Neutral current Ib* 109 110 Neutral current Ib
Neutral current Ic* 111 112 Neutral current Ic
Measuring current Ia* 113 114 Measuring current Ia
Measuring current Ic* 115 116 Measuring current Ic
Zero-sequence current I0* 117 118 Zero-sequence current I0
119 120

TYM8692 Integrated Motor Protection And Control Equipment

1 Functions

- Current instantaneous protection
- Definite time-limit overcurrent protection
- 2 zone definite time-limit negative-sequence protection /Inverse time-limit negative-sequence protection
- Overheat protection
- Locked-rotor protection
- Single-phase ground protection
- Undervoltage protection
- Overload protection
- Non-electric quantity protection
- F-C blocking
- 4-20mA DC Output
- 16 fault waveform-recording
- I, U, P, Q, Cosφ, kWh, kVarh,15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 Current instantaneous protection

Asynchronous motor current is large during startup, usually up to 5 to 8 times rated current (Ie), startup time can be up to tens of seconds. Equipment has two Instantaneous overcurrent setting, the startup process, the constant use of "Starting instantaneous overcurrent setting", according to the value of the escape motor starting current setting, such as motor starting process is completed, the automatic use of "Runing instantaneous overcurrent setting", according to the value of the escape motor self-starting current and the maximum feedback current of external fault short circuit, whichever is maximum.

a) Starting time tst is using the longest startup time, tst＞tst.max。

b) Starting instantaneous overcurrent setting Iop.h, according to the value of the escape motor starting current Ist, namely:

When t≤tst, Iop.h＝krel×Ist, in order to avoid the influence the impact of acyclic component, krel is 1.5,Ist is (6～8)Ie.

c) Running instantaneous overcurrent setting Iop.l, according to the value of the escape motor self-starting current and the maximum feedback current of external fault short circuit, since the self-starting current and the standby power supply to the delay and other factors, in the auxiliary power fast throw-over is successful, motor almost is non-existent self-start process, because the motor speed has not decreased, but only in synchronism

capture or residual voltage, the motor speed has been significantly reduced, since the self-starting current will be larger, according to the traditional method, since the self-starting current Iast=5Ie, Iop.l= krel ×Iast×Ie =1.3×5×Ie =6.5Ie.

External three-phase fault protection usually contain the inherent delay time (40 ~ 60ms) , the feedback current Ifb=6Ie.

Iop.l = krel ×Ifb=1.3×6 Ie =7.8Ie.

d) Instantaneous overcurrent time is the match with F-C.

2.2 Definite overcurrent protection

As the 3-phase currents IA, IB, IC of the motor is larger than the setting for the overcurrent protection, the protection will have an output after a time delay.

The setting for the overcurrent protection can be set based on the starting current, generally, it is (1.2 ~ 2) Ie. When the motor starts, the overcurrent protection will quit, and after the motor starts, it will be automatically input.

2.3 Negative-sequence protection

As the 3-phase imbalance, open phase, opposite phase and the interturn short-circuit occur in motor, the negative-sequence current will be produced.

Assuming that the positive-sequence current is I1, negative-sequence current is I2, if the 3-phase current are all connected to the protection, then

$$\dot{I}_1 = (\dot{I}_A + a\dot{I}_B + a^2\dot{I}_C)/3 \quad ; \quad \dot{I}_2 = (\dot{I}_A + a^2\dot{I}_B + a\dot{I}_C)/3 \quad ; \quad a = e^{j2\pi/3}$$

In general, only two phase (phases A, C) currents are connected to the motor protection, its positive and negative-sequence current can be computed by the following equation:

$$\dot{I}_1 = (\dot{I}_A + \beta\dot{I}_C)/\sqrt{3} \quad ; \quad \dot{I}_2 = (\dot{I}_C + \beta\dot{I}_A)/\sqrt{3} \quad ; \quad \beta = e^{-j\pi/3}$$

The operation of the negative-sequence protection takes the inverse time-limit performance and its operating equation is:

$$t = \frac{T}{(I_2 / Ied)}$$

Where, T — Negative-sequence inverse time-limit constant

I2— Measured value of the negative-sequence current

Ied— Secondary rated current value of the motor

As the external fault or the imbalance in the external power supply system occurs, the feedback negative-sequence current of the motor may result in the misoperations of the negative-sequence overcurrent protection. As the asymmetrical short-circuits occur either inside or outside of the protected area, the ratio I2/I1 may vary. When the following conditions are satisfied, the negative-sequence overcurrent protection can be blocked:

I2≥1.2I1, where, I1 is positive-sequence current, I2 is negative-sequence current.

2.4 Overheat protection

Motor overload, too long starting time and rocked-rotor of a motor will all produce the larger positive-sequence current; whereas the open phase, asymmetrical short-circuit and input voltage will result in the larger positive-and negative-sequence current at simultaneously. Based on the heating features caused by the positive-and negative-sequence current in the motor stator, the overheat protection may be produced for the above faults.

The integrated measured value of the positive-and negative-sequence current Ieq is used as the equivalent current to model the heating effectives of the motor, i.e.:

$$Ieq^2 = K_1 \times I_1^2 + 6I_2^2$$

Where, Ieq —Equivalent current

I1 —Positive-sequence current (p.u.)

I2 —Negative-sequence current (p.u.)

K1 —Heating coefficient of the positive-sequence current. During the starting of the motor,K1 = 0.5; as the starting is computed, K1 = 1.

Based on the inverse time-limit performance of the heating model of the motor and in order to effectively protect the motor, the following two curves can be selected to express the relationship between the operating time of the protection and the equivalent current Ieq:

$$1)\, t = \frac{\tau}{Ieq^2 - I\infty^2}$$

Where, τ—Overheat time constant

I∞—Maximum current that can permit the long-duration operation of the motor, generally, 1.1 can be set up.

$$2)\, t = \tau \ln \frac{Ieq^2 - Ip^2}{Ieq^2 - I\infty^2}$$

Where, τ—Overheat time constant

I∞—Maximum current that can permit the long-duration operation of the motor, generally, 1.1 can be set up.

Ip —Load current prior to overload. If it is in the cold state, Ip = 0

Select one of the above two curves to do computation, when the heat accumulation value reaches τ, the device will trip.

Note: After the motor is overheated, the protection action node is always closed to avoid overheating closing to protect the motor. When the heat dissipation process is over, the protection node will return. At this point, the motor can be switched off.

2.5 Locked-rotor protection

Due to the causes, e.g., mechanical faults, two heavy load and too low voltage, etc. the rotor can be caused to be in the locked-rotor state. For a locked –rotor motor at the total voltage, the current is large enough to be especially easy to be burnt out.

The device calculates the positive sequence current according to the collected phase currents. When the

positive sequence current is greater than the fixed value of the lock-rotor current, the protection will trip after delay.

The locked-rotor protection does not exit from operation at startup, so the delay of lock-in protection should be longer than the motor startup time.

2.6 Single-phase ground protection

Zero sequence overcurrent measurement ranges from 0.050 to 30A (secondary value). It is used in indirectly grounded systems.

When 3I0 is greater than zero sequence overcurrent protection setting value, the protection will trip after delay.

2.7 Undervoltage protection and TV wire break block

As the power supply voltage of the motor is reduced for a short time or is interrupted for a short time and then recovered, it is necessary to switch off the less important motors to ensure the auto-starting of the important motors.

As the three line voltages Uab, Ubc, and Uca input into the protection are lower than the undervoltage setting simultaneously, the undervoltage protection will operate to act on the output after a time delay. In order to prevent the misoperations of the protection caused by the TV wire break, the TV wire break blocking is provided. As the TV wire break occurs, the protection will send the alarm signals and block the undervoltage protection.

The setting for the undervoltage protection is set based on being able to free from the lowest voltage for the auto-starting of a group of motors.

When the bus does not deliver power, undervoltage protection will act, in order to avoid this situation, the device is provided with undervoltage opening conditions and tripping position lock, must first meet the opening conditions, undervoltage protection input; When the switch is in the tripping position, the undervoltage protection will be locked. Undervoltage open conditions can be set by the user for input (use) or quit (not use).

When the undervoltage protection action, switch tripping, undervoltage protection immediately return; After the undervoltage protection operation, the switch tripping position is not detected, and the protection will return after 10 seconds delay.

Undervoltage open condition: If one of the three line voltages is greater than 80V and the delay is 100ms, the undervoltage open condition is always in effect.

After the undervoltage action returns (greater than the undervoltage action value), delay for 10 seconds and restart the low voltage open condition identification. This condition can be turned back.

The device has a TV disconnection check function, and when the device detects that the TV is disconnected, an alarm signal is issued.

The difference between any two-phase line voltage>30V;

Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

2.8 Overload protection

As the 3-phase currents of the motor IA, IB, IC are larger than the setting for the overload protection, the protection will signal or trip to have an output (can be selected by the control characters). The overload setting should be lower than the overcurrent protections setting. Because of the larger current during starting of the motor, the overload time delay setting should be set to free from the auto-starting time of the motor.

2.9 Non-electric quantity protection

Device with two-channel non-power protection for transformer fault motor group or process required tripping and so on. Each non-power protection can be defined as the whole trip or alarm or quit. If we do not as a non-power protection, the entire set at exit, these points can be entered as an ordinary amount of use.

2.10 4-20mA DC Output (Optional)

Terminal device (302, 303) output all the way 4-20mA DC, for access to the DCS system analog acquisition cards (AI).

The DC output can be set up in the device by the user to select the corresponding Ia or Uab or P.

2.11 F-C Blocking

As the 3-phase currents IA, IB, IC of the motor at larger than the setting for F-C blocking protection, the protection will have an atresia of all trip contactor protection element after a time delay, to ensure that the first fuse fuse. As the 3-phase currents IA, IB, IC of the motor less than the setting for F-C blocking protection, open trip contactor protection element after 100ms delay.

3 Setting

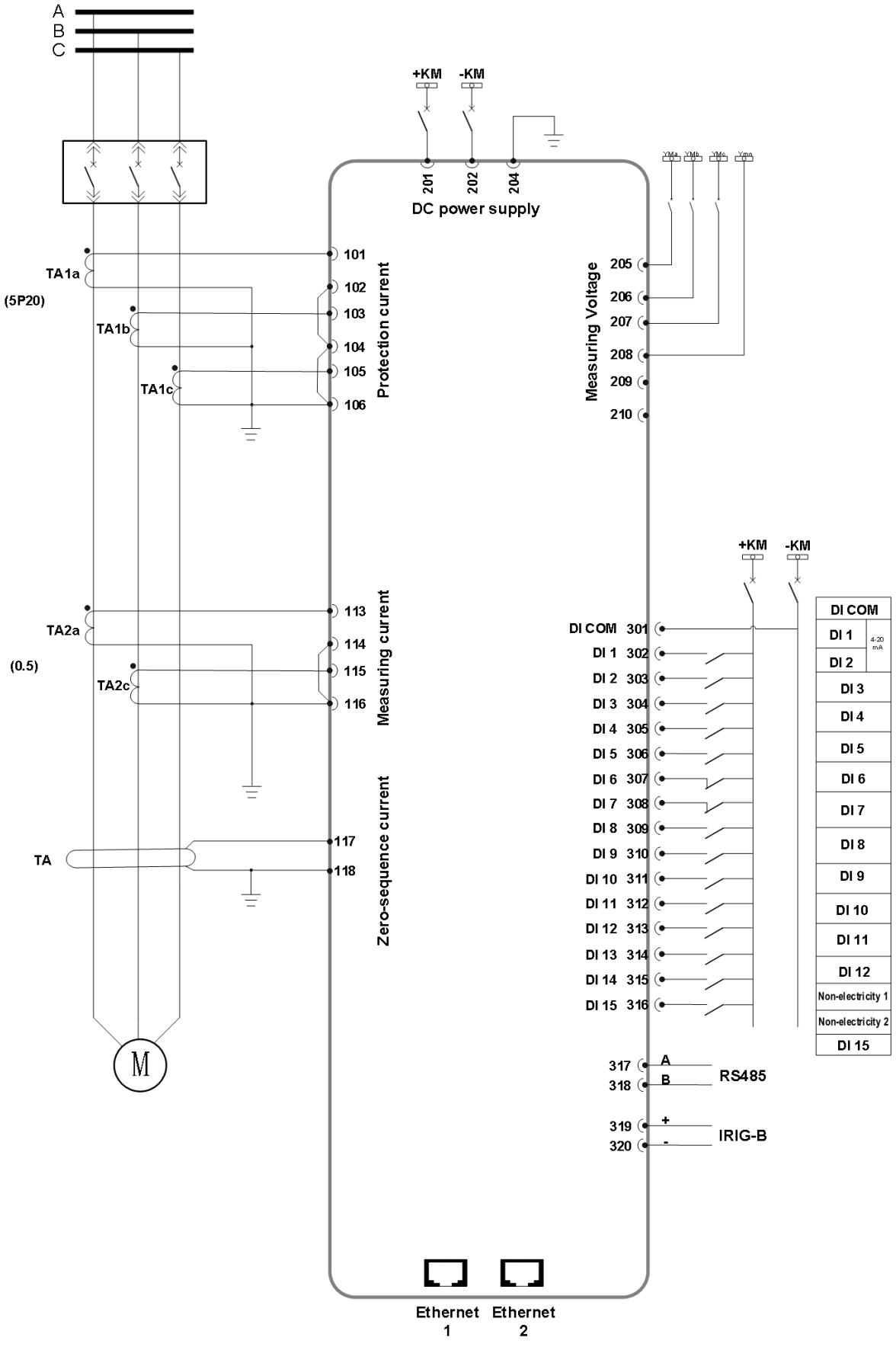
List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	2nd rated CURT	Motor secondary rated current (Ie)	A	0.05～30
2	Motor ST time	Motor starting time	S	0.00～99.99
3	ST INS OC CURT	Motor starting Instantaneous overcurrent	Ie	0.05～20.00
4	RUN INS OC CURT	Motor running Instantaneous overcurrent	Ie	0.05～20.00
5	INS OC time	Instantaneous overcurrent time	S	0.00～10.00
6	OC current	Overcurrent	Ie	0.05～20.00
7	OC time	Overcurrent time	S	0.00～60.00
8	OVLD current	Overload current	Ie	0.00～20.00
9	OVLD time	Overload time	S	0.00～60.00
10	NS OC-I current	Negative-sequence overcurrent zone I current	Ie	0.30～10.00

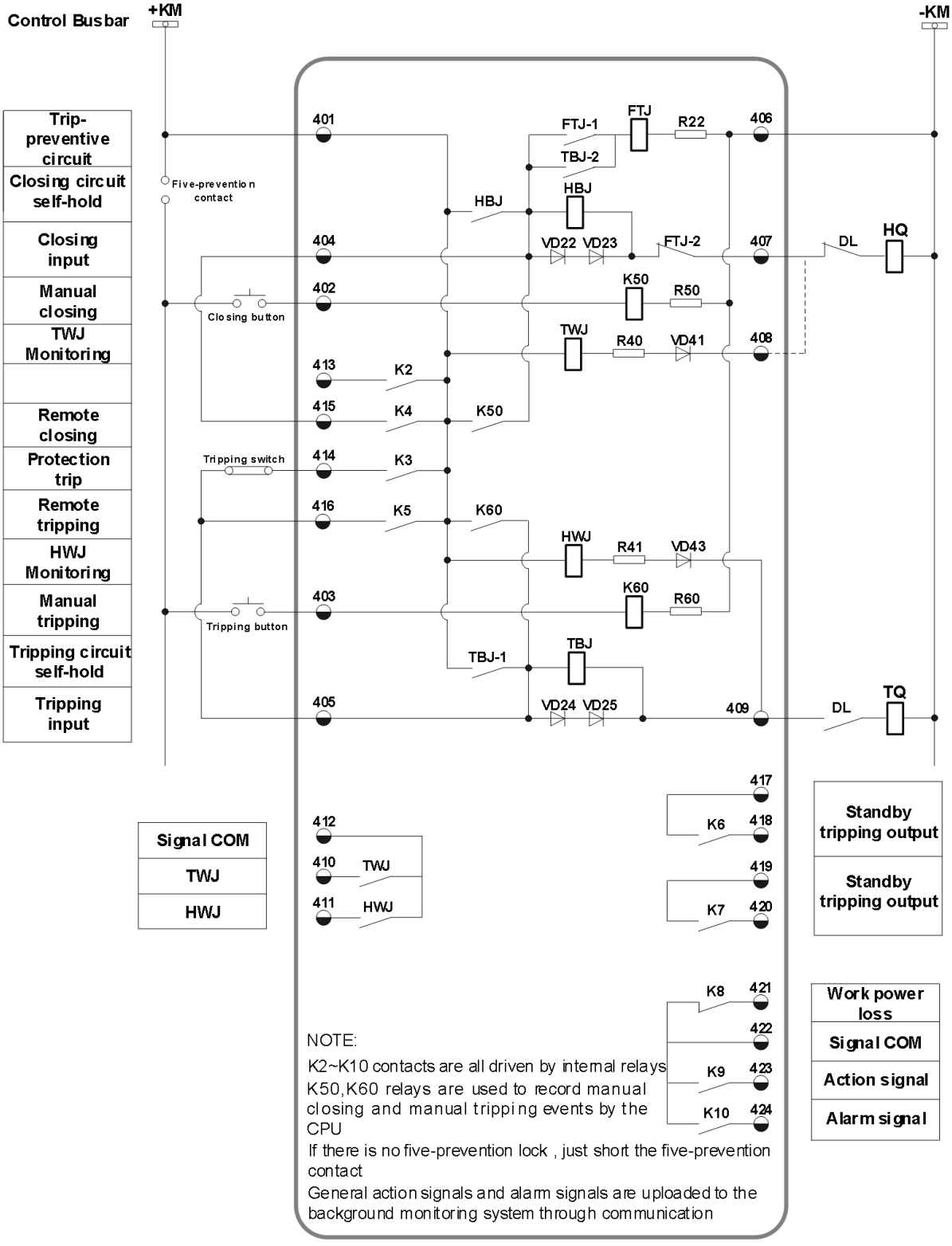
11	NS OC-I time	Negative-sequence overcurrent zone I time	S	0.00～60.00
12	NS OC-II CURT	Negative-sequence overcurrent zone II current	Ie	0.30～10.00
13	NS OC-II time	Negative-sequence overcurrent zone II time	S	0.00～60.00
14	NS OC-IT CST	Negative-sequence inverse time-limit constant	S	0.00～99.98
15	NS OC-IT THLD	Negative-sequence current threshold	Ie	0.05～20.00
16	LRotor current	Locked-rotor current	Ie	0.05～10.00
17	LRotor time	Locked-rotor time	S	0.00～60.00
18	Overheat ST CURT	Overheat starting current	Ie	1.00～2.00
19	OHT time CONST	Overheat time constant	S	0～600
20	OHT alarm factor	Overhead alarm factor		0.05～1.00
21	ZOC current	Zero-sequence overcurrent	A	0.05～30.00
22	ZOC time	Zero-sequence overcurrent time	S	0.00～60.00
23	UV setting	Undervoltage setting	V	15.00 ～ 99.99
24	UV time	Undervoltage time	S	0.10～60.00
25	F-C BLK current	F-C blocking current	Ie	0.05～20.00
26	F-C BLK time	F-C blocking time	S	0.00～60.00

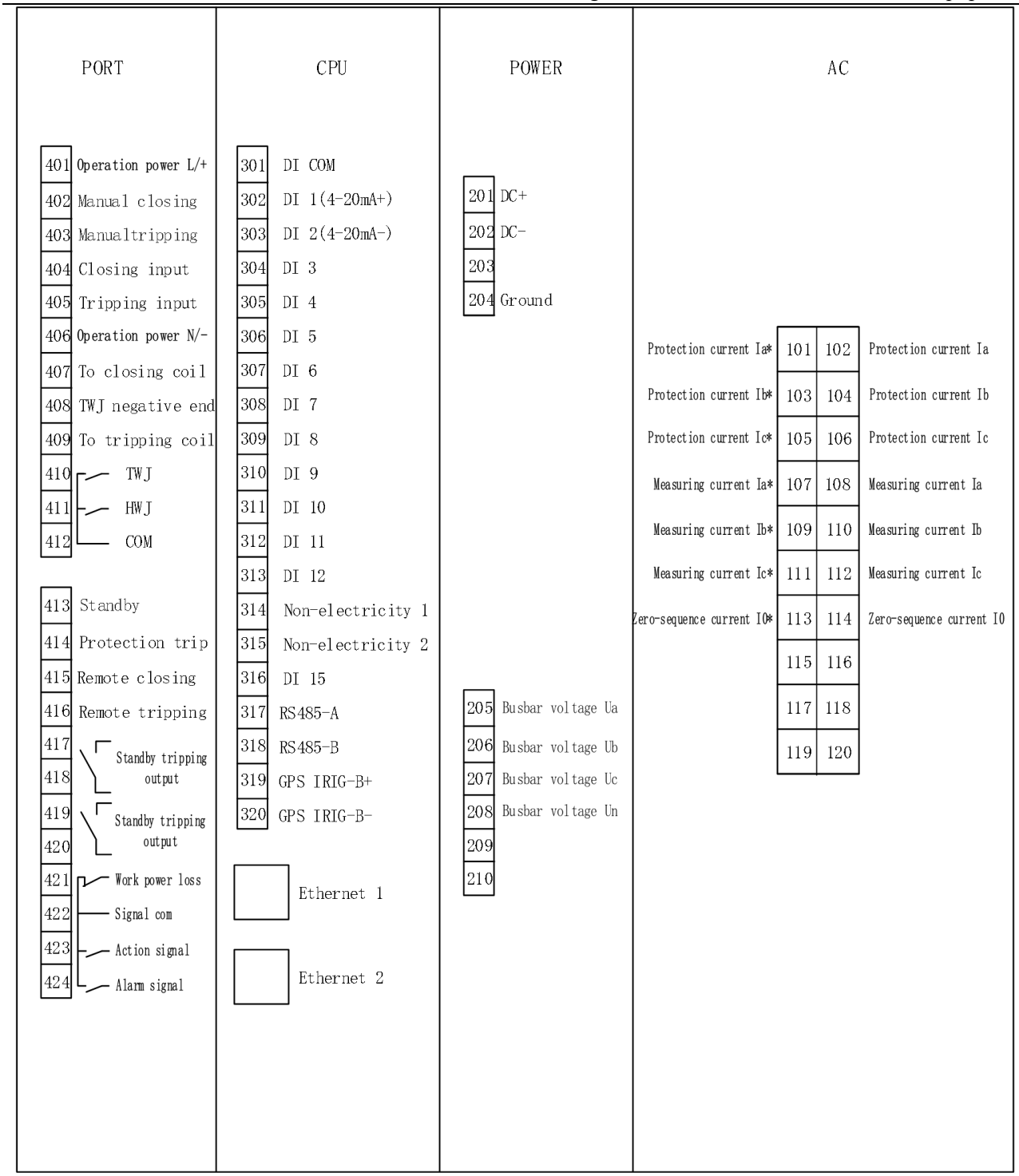
List of control characters

Ser.No.	Abbreviation	Name of control characters	Options
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON
3	Two to three	2 phase – 3 relay (measure Ia, Ic calculate Ib= -(ia+ic))	□OFF □ON
4	Non-elect 1 trip	Non-electric 1 trip switching on/off	□OFF □ON
5	Non-elect 1 ALM	Non-electric 1 alarm switching on/off	□OFF □ON
6	Non-elect 2 trip	Non-electric 2 trip switching on/off	□OFF □ON
7	Non-elect 2 ALM	Non-electric 2 alarm switching on/off	□OFF □ON
8	INS OC switch	Instantaneous overcurrent switching on/off	□OFF □ON
9	OC switch	Overcurrent switching on/off	□OFF □ON
10	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
11	NS OC-I switch	Negative-sequence overcurrent zone I switching on/off	□OFF □ON
12	NS OC-II switch	Negative-sequence overcurrent zone II switching on/off	□OFF □ON
13	NS FB OC switch	Negative-sequence feedback overcurrent blocking switching on/off	□OFF □ON
14	NS OC IT switch	Negative-sequence overcurrent inverse time switching on/off	□OFF □ON
15	NS FB OC IT SW	Negative-sequence feedback overcurrent inverse time switching on/off	□OFF □ON
16	LRotor switch	Locked-rotor protection switching on/off	□OFF □ON
17	OHT Logarithmic	Overhead Logarithmic curve switching on/off	□OFF □ON

18	OHT Inverse	Overhead Inverse curve switching on/off	□OFF □ON
19	Overheat trip	Overhead protection trip switching on/off	□OFF □ON
20	Overheat alarm	Overhead protection alarm switching on/off	□OFF □ON
21	ZOC alarm switch	Zero-sequence overcurrent alarm switching on/off	□OFF □ON
22	ZOC trip switch	Zero-sequence overcurrent trip switching on/off	□OFF □ON
23	UV switch	Undervoltage switching on/off	□OFF □ON
24	UV COND switch	Undervoltage condition switching on/off	□OFF □ON
25	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
26	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
27	2 wattmeter PWR	2 wattmeters measure way(power) (If select off, 3 wattmeters measure way auto on)	□OFF □ON
28	F-C BLK switch	F-C blocking switching on/off	□OFF □ON


A
B
C
+KM
-KM
201
202
204
DC power supply
TA1a
(5P20)
TA1b
TA1c
101
102
103
104
105
106
Protection current
TA2a
(0.5)
TA2c
113
114
115
116
Measuring current
TA
117
118
Zero-sequence current
M
205
206
207
208
209
210
Measuring Voltage
+KM
-KM
DI COM 301
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
DI 6 307
DI 7 308
DI 8 309
DI 9 310
DI 10 311
DI 11 312
DI 12 313
DI 13 314
DI 14 315
DI 15 316
DI COM
DI 1
DI 2
4-20 mA
DI 3
DI 4
DI 5
DI 6
DI 7
DI 8
DI 9
DI 10
DI 11
DI 12
Non-electricity 1
Non-electricity 2
DI 15
317 A
318 B
RS485
319 +
320 -
IRIG-B
Ethernet 1
Ethernet 2


Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
FTJ
FTJ-1
TBJ-2
R22
406
HBJ
VD22 VD23
FTJ-2
407
DL
HQ
K50
R50
TWJ
R40
VD41
408
K2
K4
K50
K3
K5
K60
HWJ
R41
VD43
K60
R60
TBJ
TBJ-1
VD24 VD25
409
TQ
417
K6
418
419
K7
420
412
410
411
TWJ
HWJ
Signal COM
TWJ
HWJ
Standby tripping output
Standby tripping output
K8
421
422
K9
423
K10
424
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Standby
414 Protection trip
415 Remote closing
416 Remote tripping
417
418
Standby tripping output
419
420
Standby tripping output
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 DI 1(4-20mA+)
303 DI 2(4-20mA-)
304 DI 3
305 DI 4
306 DI 5
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 DI 11
313 DI 12
314 Non-electricity 1
315 Non-electricity 2
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209
210
AC
Protection current Ia* 101 102 Protection current Ia
Protection current Ib* 103 104 Protection current Ib
Protection current Ic* 105 106 Protection current Ic
Measuring current Ia* 107 108 Measuring current Ia
Measuring current Ib* 109 110 Measuring current Ib
Measuring current Ic* 111 112 Measuring current Ic
Zero-sequence current I0* 113 114 Zero-sequence current I0
115 116
117 118
119 120

TYM8693 Synchronous Motor Differential And Integrated Protection

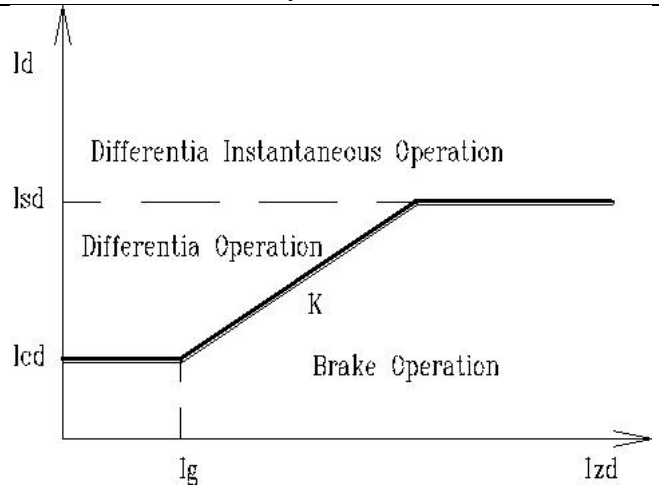
1 Functions

- Differential protection
- Differential instantaneous protection
- Differential current overcurrent alarm
- TA wire break alarm and TA wire break blocking
- Current instantaneous protection
- Definite time-limit overcurrent protection
- Negative-sequence protection
- Overheat protection
- Locked-rotor protection
- Single-phase ground protection
- Undervoltage protection
- Overload protection
- TV wire break alarm
- Reverse power protection
- Power factor protection
- Non-electric quantity protection
- 16 fault waveform-recording
- Remote switch off/on
- I, U, P, Q, Cosφ, kWh, kVarh,15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 Differential protection

2.1.1 Proportion restraint



The protection will acquire the current I1, I2 at both sides of the phases A, B, C. The computation is made to get the following:

Izd = Max(I 1 , I 2)

Id = | I1 — I2 | (Same polarity connection is made for TAs at both sides)

$$K = \frac{Id - Icd}{Izd - Ig}$$

Operating equation:

If the restraint current Izd is smaller than the kneepoint current Ig, the operating equation is Id＞Icd

If the restraint current Izd is larger than the kneepoint current Ig, the operation is Id＞Icd＋(Izd－Ig)×K

Where,

Izd – Restraint current, take the maximum phase current

Id – Differential current

Icd – Differential setting

Ig – Kneepoint current

The kneepoint current is 0.7 multiples of the rated current Ie.

The restraint coefficient can be set.

2.1.2 Harmonic Restraint

Considering that TA saturation may be resulted from the heavy load on the TA at the primary side at the end of the motor or from the effects of the transient components, the harmonic restraint is adopted to effectively prevent the misoperations of the motor differential protection.

The action equation of second and third harmonic restraint differential protection in phase A is:

$$\frac{\text{NIAF2}}{\text{NIA}} < K2 \quad \text{and} \quad \frac{\text{NIAF3}}{\text{NIA}} < K3$$

NIAF2 is amplitude of the second harmonic of the tail A phase

NIAF3 is amplitude of the third harmonic of the tail A phase

NIA is amplitude of the A-phase fundamental wave at the tail

K2 is the second-harmonic restraint coefficient, generally 0.15

K3 is the third-harmonic restraint coefficient, generally 0.15

C phase harmonic restraint is the same as A phase.

In the meanwhile, the recognition elements for both motor internal and external faults are added in the protection. As the internal fault occurs, the harmonic restraint element will be switched off to ensure the fast operation of the differential protection.

2.2 Differential instantaneous protection

As the differential current of any phase is larger than the setting for the differential instantaneous protection, the protection will have an output without a time delay.

2.3 Differential current overcurrent alarm

As the protection detects that the differential current of any phase reaches the setting for the differential current overreach alarm, the protection will send the alarm signal after a certain time delay.

2.4 TA wire break blocking

As the TA wire break occurs at any phase at any side during motor operation at the rated current, the protection can signal or block the differential protection based on the control characters.

2.5 Current instantaneous protection

When the three-phase current IA, IB, IC of the motor is greater than the setting value of the quick-break protection, the protection device will move out. During the motor starting time, the fixed value of quick-break protection is increased by the setting multiple (the doubling time is determined by the fixed value of the motor starting time). After the end of starting, the fixed value of quick break protection will automatically revert to the original value. This can prevent the starting current is too large in the starting process caused by misoperation, but also in the motor running process has a higher sensitivity.

The quick-break setting value is set as avoding starting up current, and the time limit can be set as no delay or very short delay.

$$\text{Isd} = \frac{K \times \text{Istart}}{\text{Motor starting quick-break multiple}}$$

Where, K—Safety factor, take 1.2~1.3; Istart —Maximum motor starting current, generally, it is (8～10)Ie.

2.6 Definite overcurrent protection

As the 3-phase currents IA, IB, IC of the motor is larger than the setting for the overcurrent protection, the protection will have an output after a time delay.

When the motor starts, the overcurrent protection will quit.

The setting for the overcurrent protection can be set based on the starting current, generally, it is (1.2 ~ 2) Ie.

2.7 Negative-sequence protection

As the 3-phase imbalance, open phase, opposite phase and the interturn short-circuit occur in motor, the negative-sequence current will be produced.

Assuming that the positive-sequence current is I1, negative-sequence current is I2, if the 3-phase current are all connected to the protection, then

$$\dot{I}_1 = (\dot{I}_A + a\dot{I}_B + a^2\dot{I}_C)/3 \quad ; \quad \dot{I}_2 = (\dot{I}_A + a^2\dot{I}_B + a\dot{I}_C)/3 \quad ; \quad a = e^{j2\pi/3}$$

In general, only two phase (phases A, C) currents are connected to the motor protection, its positive and negative-sequence current can be computed by the following equation:

$$\dot{I}_1 = (\dot{I}_A + \beta\dot{I}_C)/\sqrt{3} \quad ; \quad \dot{I}_2 = (\dot{I}_C + \beta\dot{I}_A)/\sqrt{3} \quad ; \quad \beta = e^{-j\pi/3}$$

The operation of the negative-sequence protection takes the inverse time-limit performance and its operating equation is:

$$t = \frac{T}{\left(I_2 / I_{ed}\right)}$$

Where, T — Negative-sequence inverse time-limit constant.

I2— Measured value of the negative-sequence current.

Ied— Secondary rated current value of the motor.

Note: A starting element is set in the negative sequence overcurrent protection. Only when the negative sequence current of the motor is greater than the threshold value of the starting element, the reverse time timing can be started. What's more, as the external fault or the imbalance in the external power supply system occurs, the feedback negative-sequence current of the motor may result in the misoperations of the negative-sequence overcurrent protection. As the asymmetrical short-circuits occur either inside or outside of the protected area, the ratio I2/I1 may vary. When the following conditions are satisfied, the negative-sequence overcurrent protection can be blocked:

I2≥1.2I1,

Where, I1—Positive-sequence current

I2—Negative-sequence current.

Motor overload, too long starting time and rocked-rotor of a motor will all produce the larger positive-sequence current; whereas the open phase, asymmetrical short-circuit and input voltage will result in the larger positive-and negative-sequence current at simultaneously. Based on the heating features caused by the positive-and negative-sequence current in the motor stator, the overheat protection may be produced for the above faults.

The integrated measured value of the positive-and negative-sequence current Ieq is used as the equivalent current to model the heating effectives of the motor, i.e.:

$$Ieq^2 = K_1 \times I_1^2 + 6I_2^2$$

Where, Ieq —Equivalent current

I1 —Positive-sequence current (p.u.)

I2 —Negative-sequence current (p.u.)

K1 —Heating coefficient of the positive-sequence current. During the starting of the motor,K1 = 0.5; as the starting is computed, K1 = 1.

Based on the inverse time-limit performance of the heating model of the motor and in order to effectively protect the motor, the following two curves can be selected to express the relationship between the operating time of the protection and the equivalent current Ieq:

1)

$$t = \frac{\tau}{Ieq^2 - I\infty^2}$$

Where, τ—Overheat time constant

I∞—Maximum current that can permit the long-duration operation of the motor, generally, 1.1 can be set up.

2)

$$t = \tau \ln \frac{Ieq^2 - Ip^2}{Ieq^2 - I\infty^2}$$

Where, τ—Overheat time constant

I∞—Maximum current that can permit the long-duration operation of the motor, generally, 1.1 can be set up.

Ip —Load current prior to overload. If it is in the cold state, Ip = 0

Select one of the above two curves to do computation, let Ka be the overheating alarm coefficient (0 < Ka≤1)， when the heat accumulation value reaches Ka×τ, the device will send an alarm message. When the heat accumulation value reaches τ, the device will trip or alarm.

Note: After the motor is overheated, the protection action node is always closed to avoid overheating closing to protect the motor. When the heat dissipation process is over, the protection node will return. At this point, the motor can be switched off.

2.9 Locked-rotor protection

Due to the causes, e.g., mechanical faults, two heavy load and too low voltage, etc. the rotor can be caused to be in the locked-rotor state. For a locked –rotor motor at the total voltage, the current is large enough to be especially easy to be burnt out.

The device calculates the positive sequence current according to the collected phase currents. When the positive sequence current is greater than the fixed value of the lock-rotor current, the protection will trip after delay.

The locked-rotor protection does not exit from operation at startup, so the delay of lock-in protection should be longer than the motor startup time.

2.10 Single-phase ground protection

For system powered by high-voltage motors, it is usually the little current ground system. The action current

of single-phase ground protection is small, generally the setting value range is less than 200mA, but it requires high precision. The measurement accuracy of this device is very high, up to 1mA.

When the zero sequence current of the input protection is greater than the set value of the zero sequence protection, the protection will send alarm siginal or trip after delay (optional by the control word).

2.11 Undervoltage protection and TV wire break block

As the power supply voltage of the motor is reduced for a short time or is interrupted for a short time and then recovered, it is necessary to switch off the less important motors to ensure the auto-starting of the important motors.

As the three line voltages Uab, Ubc, and Uca input into the protection are lower than the undervoltage setting simultaneously, the undervoltage protection will operate to act on the output after a time delay. In order to prevent the misoperations of the protection caused by the TV wire break, the TV wire break blocking is provided. As the TV wire break occurs, the protection will send the alarm signals and block the undervoltage protection.

The setting for the undervoltage protection is set based on being able to free from the lowest voltage for the auto-starting of a group of motors.

When the bus does not deliver power, undervoltage protection will act, in order to avoid this situation, the device is provided with undervoltage opening conditions and tripping position lock, must first meet the opening conditions, undervoltage protection input; When the switch is in the tripping position, the undervoltage protection will be locked. Undervoltage open conditions can be set by the user for input (use) or quit (not use).

When the undervoltage protection action, switch tripping, undervoltage protection immediately return; After the undervoltage protection operation, the switch tripping position is not detected, and the protection will return after 10 seconds delay.

Undervoltage open condition: If one of the three line voltages is greater than 80V and the delay is 100ms, the undervoltage open condition is always in effect.

After the undervoltage action returns (greater than the undervoltage action value), delay for 10 seconds and restart the low voltage open condition identification. This condition can be turned back.

The device has a TV disconnection check function, and when the device detects that the TV is disconnected, an alarm signal is issued.

The difference between any two-phase line voltage>30V;

Umax<0.1Un, any current is greater than the no-current setting.

When any of the above criteria is satisfied, it is judged that the TV is disconnected, the alarm is delayed for 3s, and a "TV disconnection alarm" is reported.

Remarks: No-current setting is 0.05In, In is the value of TA secondary rated current in the parameter setting menu.

2.12 Overload protection

As the 3-phase currents of the motor IA, IB, IC are larger than the setting for the overload protection, the protection will signal or trip to have an output (can be selected by the control characters). The overload setting

should be lower than the overcurrent protections setting. Because of the larger current during starting of the motor, the overload time delay setting should be set to free from the auto-starting time of the motor.

2.13 Asynchronous impact protection (Reverse power protection)

When the reverse power is greater than the setting value of the reverse power, the cold start time of the motor is greater than the delay of the reverse power start, there is no TV wire break lock, and the negative sequence voltage is less than 5% of the rated voltage, the device will send alarm signal or trip after the reverse power protection delay.

2.14 Loss of field and out of step protection (Power factor protection)

When the power factor is behind 30 degrees to 150 degrees, the cold start time of the motor is greater than the power factor start delay, there is no TV wire break lock, negative sequence voltage is less than 5% of the rated voltage, the device will send alarm signal or trip after the power factor protection delay.

2.15 Non - electric quantity protection

The device can provide 4 non-electric protection for excitation fault, process fault and other non-electric power.

2.16 Boot logic

Device 417,418 will close when the device 302 excitation ready, 303 process interlock and 304 auxiliary machine are running. When the boot logic is needed, 417,418 should be strung into the device hand closing loop.

3 Setting

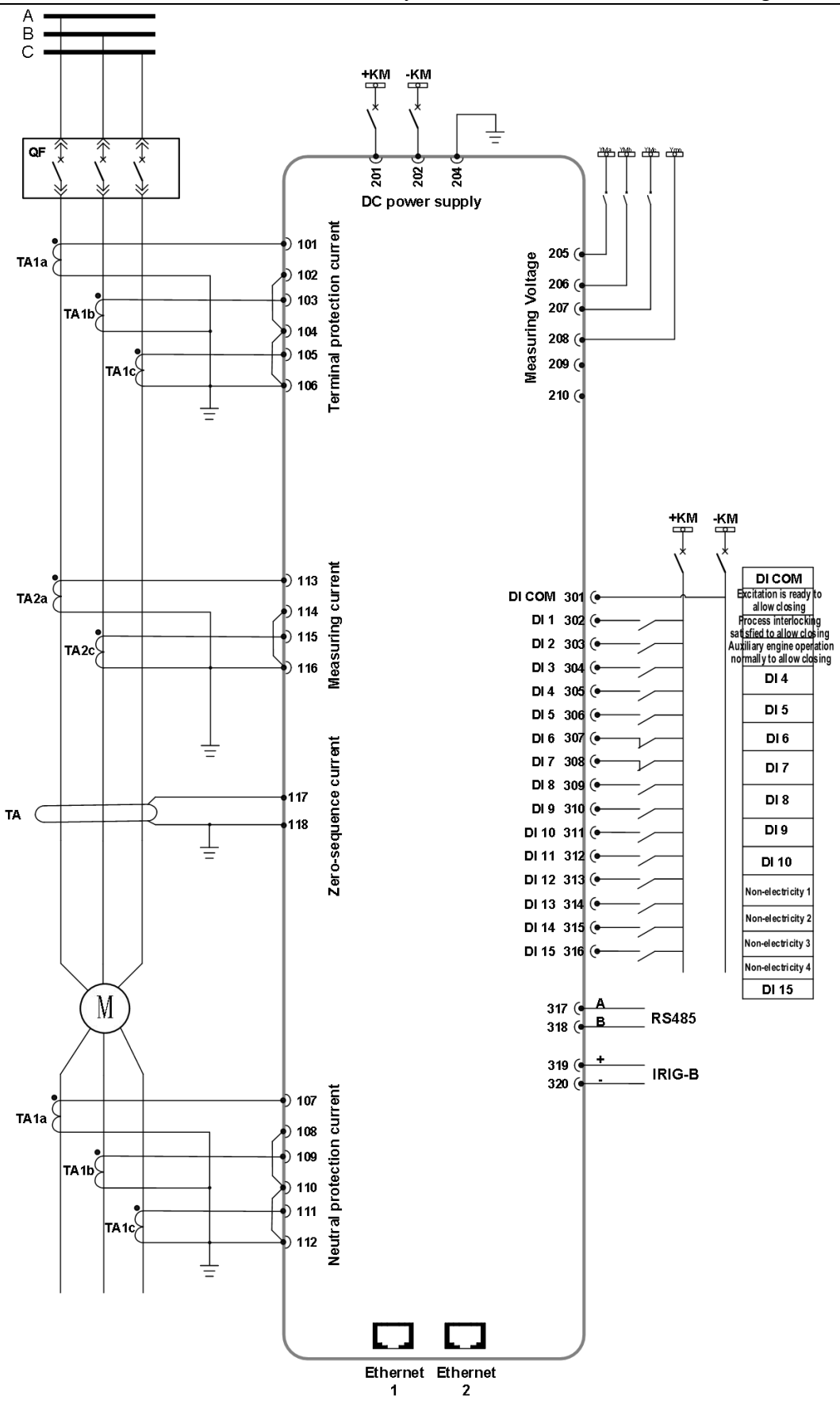
List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	2nd rated CURT	Motor secondary rated current (Ie)	A	1.00～9.99
2	DIF CURT	Differential current	Ie	0.3～16.0
3	INS DIF CURT	Differential instantaneous current	Ie	0.10～0.99
4	RT-BRK factor	Ratio differential braking factor		0.30～0.70
5	Balance factor	Balance factor of contralateral side		0.00～9.99
6	DIF CURT OR alm	Differential current overreach alarm setting	Ie	0.05～0.50
7	DIF CURT OR time	Differential current overreach time	S	0.00～9.99
8	Motor ST time	Motor starting time	S	0.00～50.00
9	INS OC CURT	Instantaneous overcurrent	Ie	0.00～20.00
10	INS OC time	Instantaneous overcurrent time	S	0.00～10.00
11	OC current	Overcurrent	Ie	0.00～10.00
12	OC time	Overcurrent time	S	0.00～50.00
13	OVLD current	Overload current	Ie	0.00～20.00

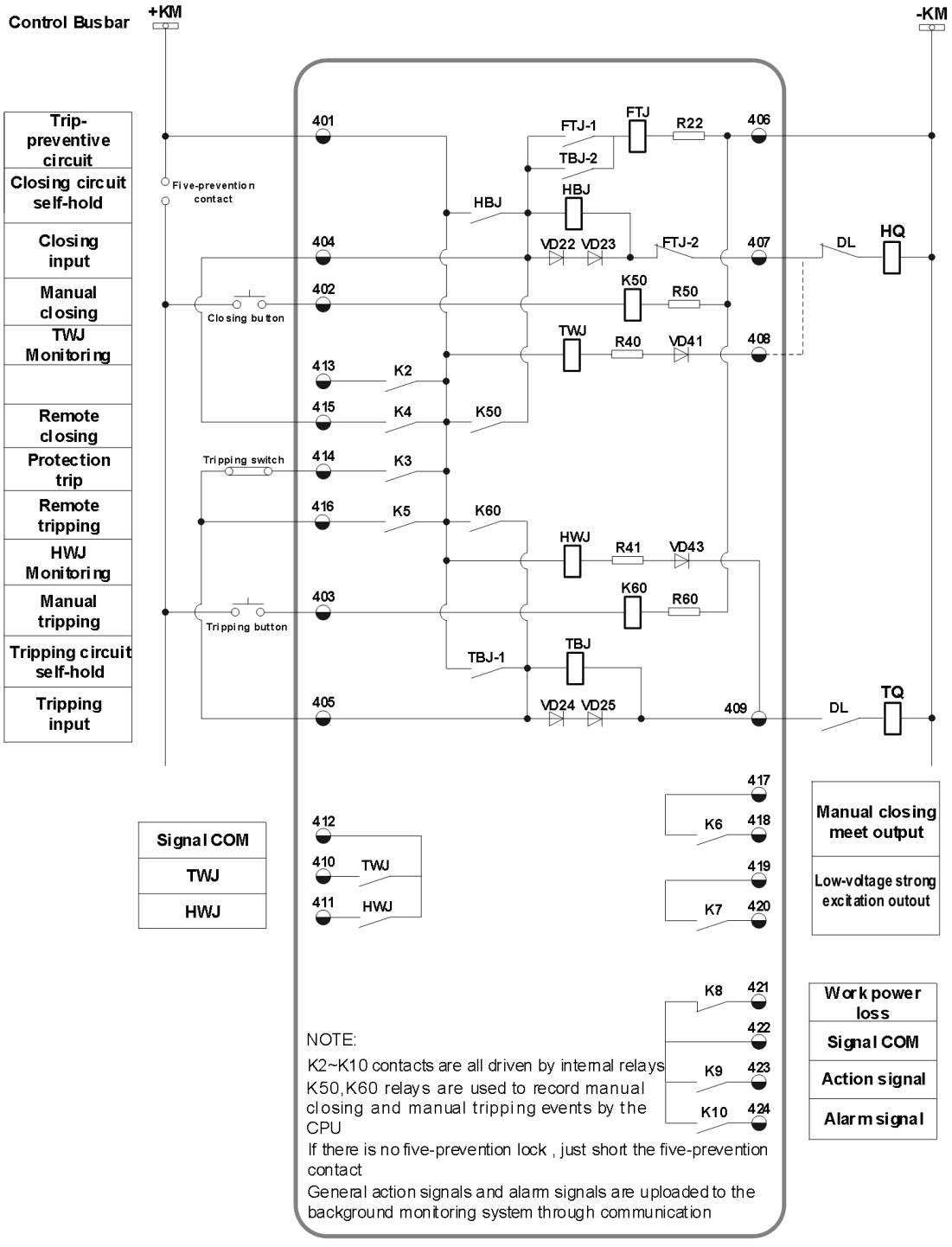
14	OVLD time	Overload time	S	0.00～50.00
15	NS OC-I current	Negative-sequence overcurrent zone I current	Ie	0.00～10.00
16	NS OC-I time	Negative-sequence overcurrent zone I time	S	0.00～50.00
17	NS OC-II CURT	Negative-sequence overcurrent zone II current	Ie	0.00～10.00
18	NS OC-II time	Negative-sequence overcurrent zone II time	S	0.00～50.00
19	LRotor current	Locked-rotor current	Ie	0.00～10.00
20	LRotor time	Locked-rotor time	S	0.00～20.00
21	Overheat ST CURT	Overheat starting current	Ie	1.10～2.00
22	OHT time CONST	Overheat time constant	S	0～2600
23	OHT alarm factor	Overhead alarm factor		0.00～1.00
24	ZOC current	Zero-sequence overcurrent	A	0.05～30.00
25	ZOC time	Zero-sequence overcurrent time	S	0.00～50.00
26	UV setting	Undervoltage setting	V	0.00～99.99
27	UV time	Undervoltage time	S	0.00～50.00
28	UV STR EXC setting	Undervoltage strong excitation	V	0.00～99.99
29	UV STR EXC time	Undervoltage strong excitation time	S	0.00～50.00
30	OV setting	Overvoltage setting	V	0.00～150
31	OV time	Overvoltage time	S	0.00～50.00
32	RP setting	Reverse power setting	W	0.00～600.00
33	RP ST time	Reverse power starting time	S	0～65535
34	RP PRO time	Reverse power protection time	S	0.00～50.00
35	PF ST time	Power factor starting time	S	0～65535
36	PF PRO time	Power factor protection time	S	0.00～50.00

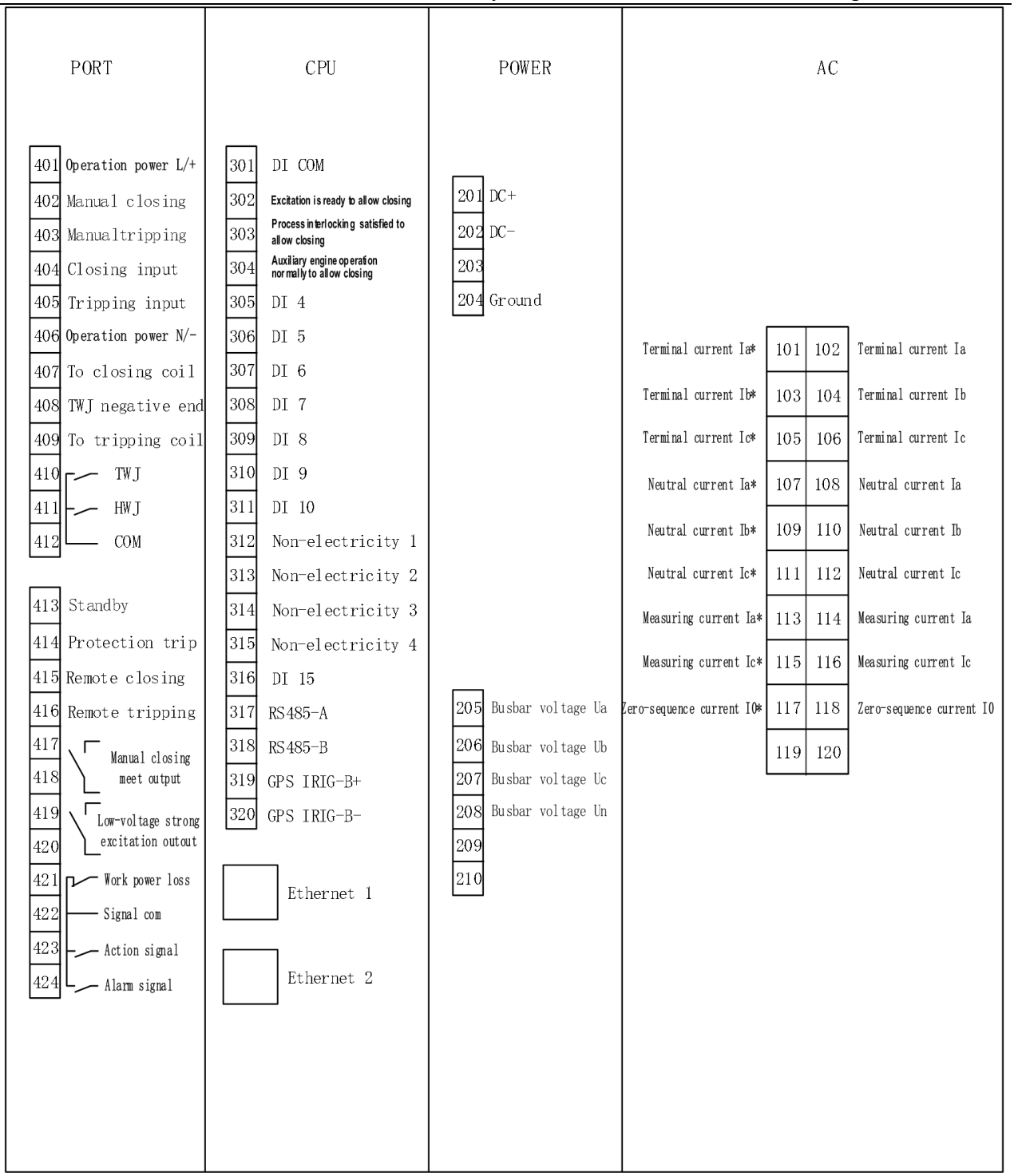
List of control characters

Ser.No.	Abbreviation	Name of control characters	Options
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON
3	Two to three	2 phase – 3 relay (measure Ia, Ic calculate Ib= - (ia+ic)	□OFF □ON
4	Non-elect 1 trip	Non-electric 1 trip switching on/off	□OFF □ON
5	Non-elect 1 ALM	Non-electric 1 alarm switching on/off	□OFF □ON
6	Non-elect 2 trip	Non-electric 2 trip switching on/off	□OFF □ON
7	Non-elect 2 ALM	Non-electric 2 alarm switching on/off	□OFF □ON
8	Non-elect 3 trip	Non-electric 3 trip switching on/off	□OFF □ON
9	Non-elect 3 ALM	Non-electric 3 alarm switching on/off	□OFF □ON

10	Non-elect 4 trip	Non-electric 4 trip switching on/off	□OFF □ON
11	Non-elect 4 ALM	Non-electric 4 alarm switching on/off	□OFF □ON
12	INS DIF switch	Differential instantaneous current switching on/off	□OFF □ON
13	INS DIF switch	Differential current switching on/off	□OFF □ON
14	DIF OR ALM SW	Differential current overreach alarm switching on/off	□OFF □ON
15	TA DISCON ALM SW	TA disconnection alarm switching on/off	□OFF □ON
16	TA DISCON BLK SW	TA disconnection blocking differential switching on/off	□OFF □ON
17	INS OC switch	Instantaneous overcurrent switching on/off	□OFF □ON
18	OC switch	Overcurrent switching on/off	□OFF □ON
19	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
20	NS OC-I switch	Negative-sequence overcurrent zone I switching on/off	□OFF □ON
21	NS OC-II switch	Negative-sequence overcurrent zone II switching on/off	□OFF □ON
22	NS FB BLK SW	Negative-sequence feedback blocking switching on/off	□OFF □ON
23	LRotor switch	Locked-rotor protection switching on/off	□OFF □ON
24	OHT Logarithmic	Overhead Logarithmic curve switching on/off	□OFF □ON
25	OHT Inverse	Overhead Inverse curve switching on/off	□OFF □ON
26	Overheat trip	Overhead protection trip switching on/off	□OFF □ON
27	Overheat alarm	Overhead protection alarm switching on/off	□OFF □ON
28	ZOC alarm switch	Zero-sequence overcurrent alarm switching on/off	□OFF □ON
29	ZOC trip switch	Zero-sequence overcurrent trip switching on/off	□OFF □ON
30	UV switch	Undervoltage switching on/off	□OFF □ON
31	UV COND switch	Undervoltage condition switching on/off	□OFF □ON
32	UV STR EXC SW	Undervoltage strong excitation switching on/off	□OFF □ON
33	OV switch	Overvoltage switching on/off	□OFF □ON
34	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
35	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
36	RP switch	Reverse power switching on/off	□OFF □ON
37	PF switch	Power factor switching on/off	□OFF □ON


A
B
C
QF
+KM
-KM
201
202
204
DC power supply
TA1a
TA1b
TA1c
101
102
103
104
105
106
Terminal protection current
205
206
207
208
209
210
Measuring Voltage
TA2a
TA2c
113
114
115
116
Measuring current
TA
117
118
Zero-sequence current
M
TA1a
TA1b
TA1c
107
108
109
110
111
112
Neutral protection current
DI COM 301
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
DI 6 307
DI 7 308
DI 8 309
DI 9 310
DI 10 311
DI 11 312
DI 12 313
DI 13 314
DI 14 315
DI 15 316
DI COM
Excitation is ready to allow closing
Process interlocking satisfied to allow closing
Auxiliary engine operation normally to allow closing
DI 4
DI 5
DI 6
DI 7
DI 8
DI 9
DI 10
Non-electricity 1
Non-electricity 2
Non-electricity 3
Non-electricity 4
DI 15
317
318
A
B
RS485
319
320
+
-
IRIG-B
Ethernet 1
Ethernet 2


Control Busbar
+KM
-KM
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Tripping switch
Tripping button
401
404
402
413
415
414
416
403
405
406
407
408
409
FTJ
FTJ-1
TBJ-2
R22
HBJ
VD22 VD23
FTJ-2
DL
HQ
K50
R50
TWJ
R40
VD41
K2
K4
K50
K3
K5
K60
HWJ
R41
VD43
K60
R60
TBJ
TBJ-1
VD24 VD25
TQ
417
K6
418
419
K7
420
K8
421
422
K9
423
K10
424
412
410
TWJ
411
HWJ
Signal COM
TWJ
HWJ
Manual closing meet output
Low-voltage strong excitation outout
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Standby
414 Protection trip
415 Remote closing
416 Remote tripping
417
418
Manual closing meet output
419
420
Low-voltage strong excitation outout
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 Excitation is ready to allow closing
303 Process interlocking satisfied to allow closing
304 Auxiliary engine operation normally to allow closing
305 DI 4
306 DI 5
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 Non-electricity 1
313 Non-electricity 2
314 Non-electricity 3
315 Non-electricity 4
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209
210
AC
Terminal current Ia* 101 102 Terminal current Ia
Terminal current Ib* 103 104 Terminal current Ib
Terminal current Ic* 105 106 Terminal current Ic
Neutral current Ia* 107 108 Neutral current Ia
Neutral current Ib* 109 110 Neutral current Ib
Neutral current Ic* 111 112 Neutral current Ic
Measuring current Ia* 113 114 Measuring current Ia
Measuring current Ic* 115 116 Measuring current Ic
Zero-sequence current I0* 117 118 Zero-sequence current I0
119 120

TYM8694 Synchronous Motor And Integrated Protection

1 Functions

- Current instantaneous protection
- Definite time-limit overcurrent protection
- Negative-sequence protection
- Overheat protection
- Locked-rotor protection
- Single-phase ground protection
- Undervoltage protection
- Overload protection
- TV wire break alarm
- Reverse power protection
- Loss of field and out of step protection
- Non-electric quantity protection
- 16 fault waveform-recording
- Remote switch off/on
- I, U, P, Q, Cosφ, kWh, kVarh,15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

TYM8694 has no differential protection function and the comprehensive protection function is exactly the same as TYM8693。

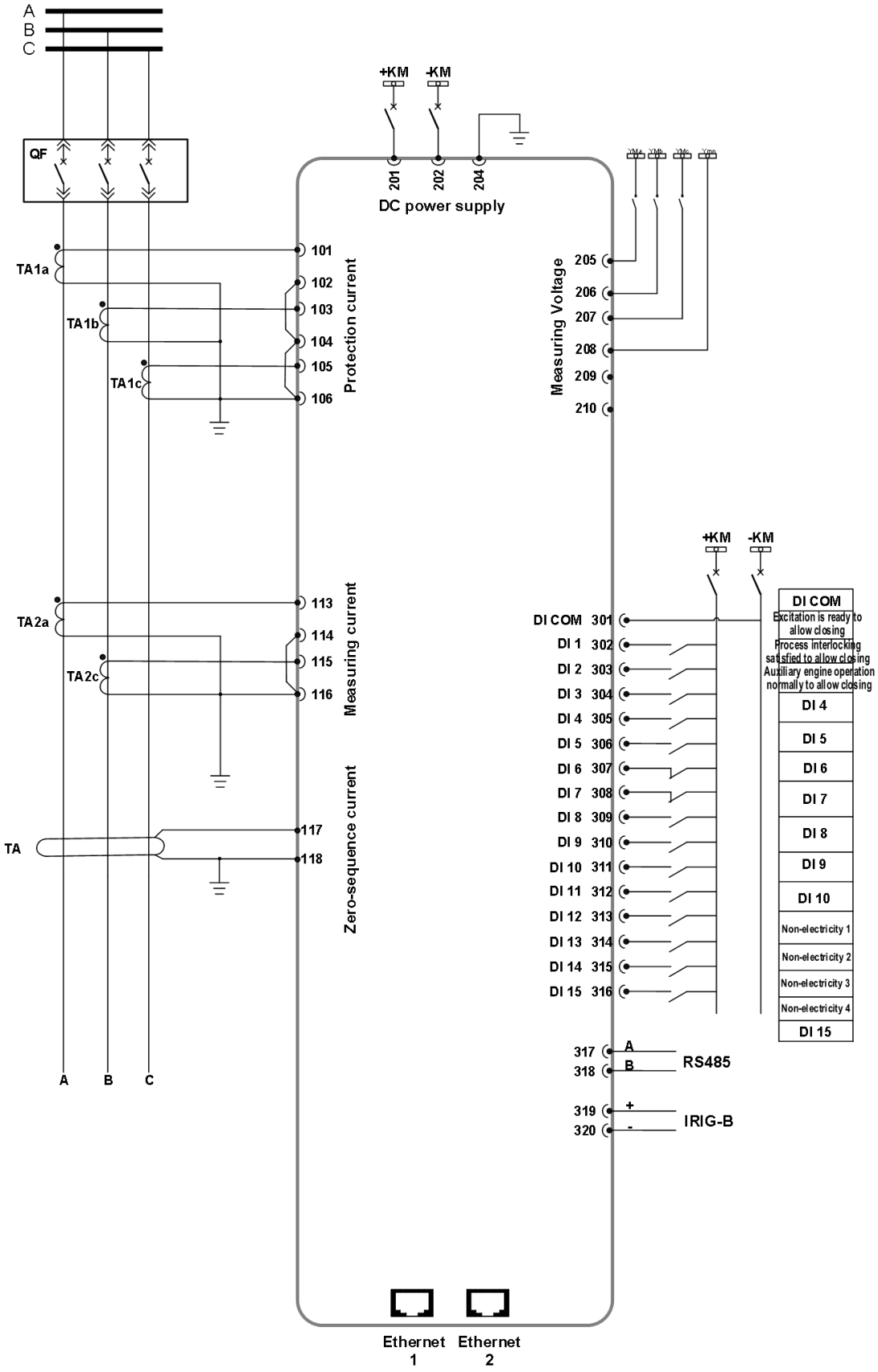
See Sections 2.5 to 2.16 of TYM8693 for the principle description.

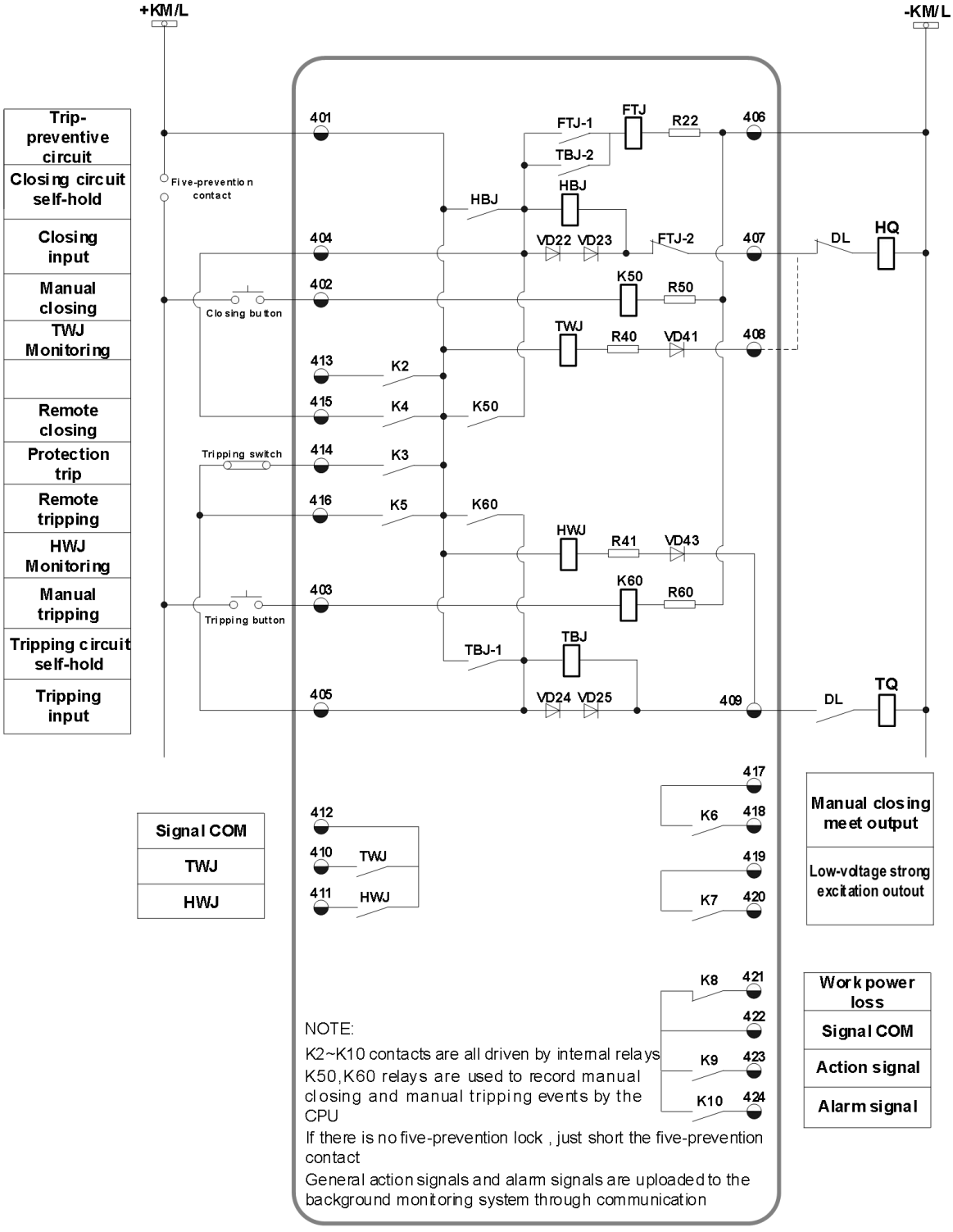
3 Setting

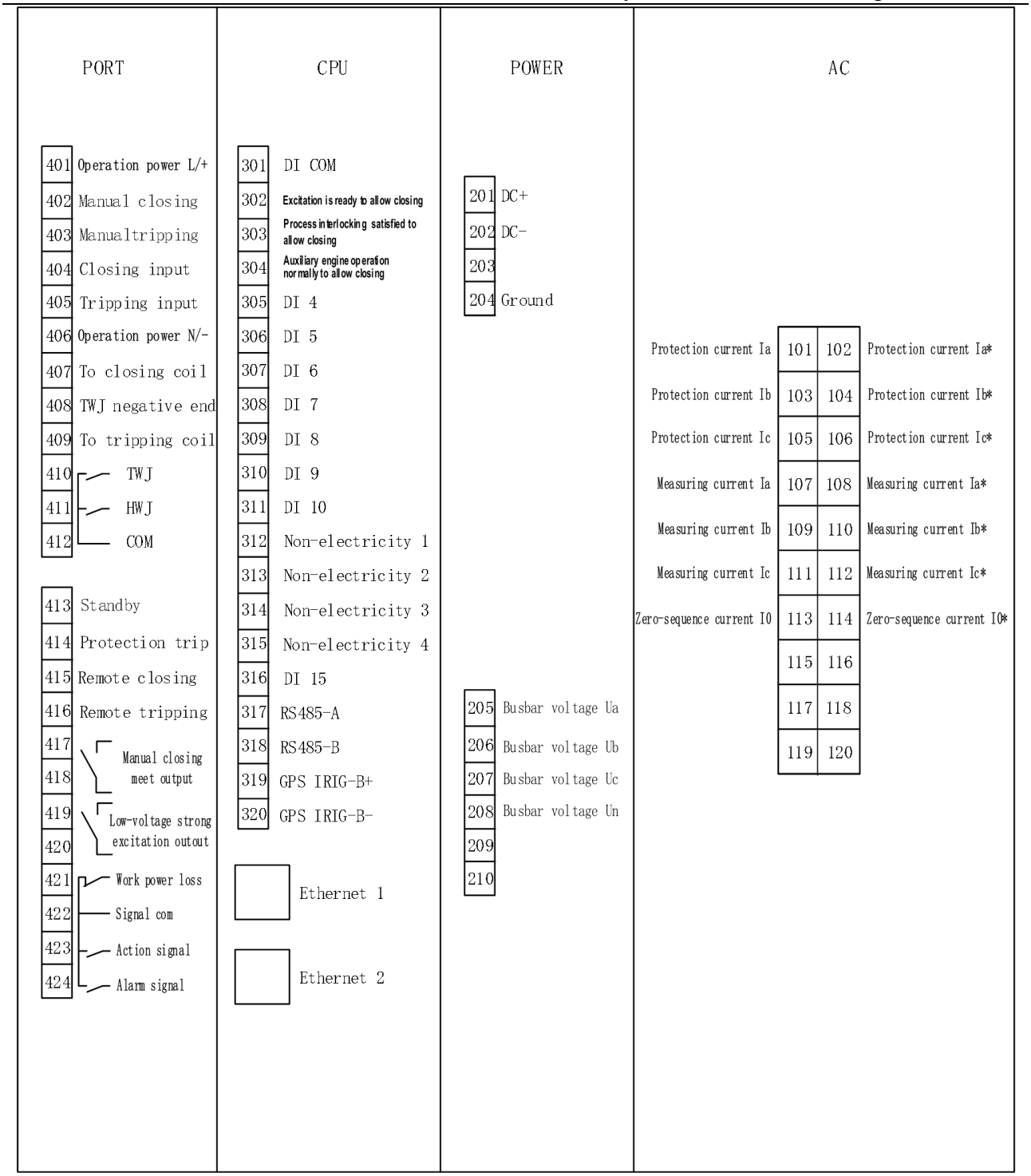
List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	2nd rated CURT	Motor secondary rated current (Ie)	A	1.00～9.99
2	Motor ST time	Motor starting time	S	0.00～50.00
3	INS OC CURT	Instantaneous overcurrent	Ie	0.00～20.00
4	INS OC time	Instantaneous overcurrent time	S	0.00～10.00
5	OC current	Overcurrent	Ie	0.00～10.00
6	OC time	Overcurrent time	S	0.00～50.00
7	OVLD current	Overload current	Ie	0.00～20.00
8	OVLD time	Overload time	S	0.00～50.00
9	NS OC-I current	Negative-sequence overcurrent zone	Ie	0.00～10.00

		I current		
10	NS OC-I time	Negative-sequence overcurrent zone I time	S	0.00～50.00
11	NS OC-II CURT	Negative-sequence overcurrent zone II current	Ie	0.00～10.00
12	NS OC-II time	Negative-sequence overcurrent zone II time	S	0.00～50.00
13	LRotor current	Locked-rotor current	Ie	0.00～10.00
14	LRotor time	Locked-rotor time	S	0.00～20.00
15	Overheat ST CURT	Overheat starting current	Ie	1.10～2.00
16	OHT time CONST	Overheat time constant	S	0～2600
17	OHT alarm factor	Overhead alarm factor		0.00～1.00
18	ZOC current	Zero-sequence overcurrent	A	0.05～30.00
19	ZOC time	Zero-sequence overcurrent time	S	0.00～50.00
20	UV setting	Undervoltage setting	V	0.00～99.99
21	UV time	Undervoltage time	S	0.00～50.00
22	UV STR EXC setting	Undervoltage strong excitation	V	0.00～99.99
23	UV STR EXC time	Undervoltage strong excitation time	S	0.00～50.00
24	OV setting	Overvoltage setting	V	0.00～150
25	OV time	Overvoltage time	S	0.00～50.00
26	RP setting	Reverse power setting	W	0.00～600.00
27	RP ST time	Reverse power starting time	S	0～65535
28	RP PRO time	Reverse power protection time	S	0.00～50.00
29	PF ST time	Power factor starting time	S	0～65535
30	PF PRO time	Power factor protection time	S	0.00～50.00
List of control characters				
Ser.No.	Abbreviation	Name of control characters	Options	
1	Three to three	3 phase – 3 relay (measure Ia, Ib, Ic)	□OFF □ON	
2	Two to two	2 phase – 2 relay (measure Ia, Ic)	□OFF □ON	
3	Two to three	2 phase – 3 relay (measure Ia, Ic calculate Ib= - (ia+ic)	□OFF □ON	
4	Non-elect 1 trip	Non-electric 1 trip switching on/off	□OFF □ON	
5	Non-elect 1 ALM	Non-electric 1 alarm switching on/off	□OFF □ON	
6	Non-elect 2 trip	Non-electric 2 trip switching on/off	□OFF □ON	
7	Non-elect 2 ALM	Non-electric 2 alarm switching on/off	□OFF □ON	
8	Non-elect 3 trip	Non-electric 3 trip switching on/off	□OFF □ON	
9	Non-elect 3 ALM	Non-electric 3 alarm switching on/off	□OFF □ON	
10	Non-elect 4 trip	Non-electric 4 trip switching on/off	□OFF □ON	
11	Non-elect 4 ALM	Non-electric 4 alarm switching	□OFF □ON	

		on/off	
12	INS OC switch	Instantaneous overcurrent switching on/off	□OFF □ON
13	OC switch	Overcurrent switching on/off	□OFF □ON
14	OVLD alarm SW	Overload alarm switching on/off	□OFF □ON
15	NS OC-I switch	Negative-sequence overcurrent zone I switching on/off	□OFF □ON
16	NS OC-II switch	Negative-sequence overcurrent zone II switching on/off	□OFF □ON
17	NS FB BLK SW	Negative-sequence feedback blocking switching on/off	□OFF □ON
18	LRotor switch	Locked-rotor protection switching on/off	□OFF □ON
19	OHT Logarithmic	Overhead Logarithmic curve switching on/off	□OFF □ON
20	OHT Inverse	Overhead Inverse curve switching on/off	□OFF □ON
21	Overheat trip	Overhead protection trip switching on/off	□OFF □ON
22	Overheat alarm	Overhead protection alarm switching on/off	□OFF □ON
23	ZOC alarm switch	Zero-sequence overcurrent alarm switching on/off	□OFF □ON
24	ZOC trip switch	Zero-sequence overcurrent trip switching on/off	□OFF □ON
25	UV switch	Undervoltage switching on/off	□OFF □ON
26	UV COND switch	Undervoltage condition switching on/off	□OFF □ON
27	UV STR EXC SW	Undervoltage strong excitation switching on/off	□OFF □ON
28	OV switch	Overvoltage switching on/off	□OFF □ON
29	TV DISCON ALM SW	TV disconnection alarm switching on/off	□OFF □ON
30	OC DISCON ALM SW	Operating circuit disconnection alarm switching on/off	□OFF □ON
31	2 wattmeter PWR	2 wattmeters measure way(power)	□OFF □ON
32	RP switch	Reverse power switching on/off	□OFF □ON
33	PF switch	Power factor switching on/off	□OFF □ON


A
B
C
QF
+KM
-KM
201
202
204
DC power supply
TA1a
TA1b
TA1c
101
102
103
104
105
106
Protection current
205
206
207
208
209
210
Measuring Voltage
TA2a
TA2c
113
114
115
116
Measuring current
TA
117
118
Zero-sequence current
DI COM 301
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
DI 6 307
DI 7 308
DI 8 309
DI 9 310
DI 10 311
DI 11 312
DI 12 313
DI 13 314
DI 14 315
DI 15 316
DI COM
Excitation is ready to allow closing
Process interlocking satisfied to allow closing
Auxiliary engine operation normally to allow closing
DI 4
DI 5
DI 6
DI 7
DI 8
DI 9
DI 10
Non-electricity 1
Non-electricity 2
Non-electricity 3
Non-electricity 4
DI 15
317 A
318 B
RS485
319 +
320 -
IRIG-B
Ethernet 1
Ethernet 2


+KM/L
-KM/L
Trip-preventive circuit
Closing circuit self-hold
Closing input
Manual closing
TWJ Monitoring
Remote closing
Protection trip
Remote tripping
HWJ Monitoring
Manual tripping
Tripping circuit self-hold
Tripping input
Five-prevention contact
Closing button
Tripping switch
Tripping button
401
402
403
404
405
406
407
408
409
413
415
414
416
FTJ
FTJ-1
TBJ-2
R22
HBJ
VD22 VD23
FTJ-2
DL
HQ
K50
R50
TWJ
R40
VD41
K2
K4
K3
K5
K60
HWJ
R41
VD43
TBJ
TBJ-1
VD24 VD25
TQ
Signal COM
TWJ
HWJ
412
410
411
417
418
419
420
K6
K7
Manual closing meet output
Low-voltage strong excitation outout
K8
421
422
K9
423
K10
424
Work power loss
Signal COM
Action signal
Alarm signal
NOTE:
K2~K10 contacts are all driven by internal relays
K50,K60 relays are used to record manual closing and manual tripping events by the CPU
If there is no five-prevention lock , just short the five-prevention contact
General action signals and alarm signals are uploaded to the background monitoring system through communication


PORT
401 Operation power L/+
402 Manual closing
403 Manualtripping
404 Closing input
405 Tripping input
406 Operation power N/-
407 To closing coil
408 TWJ negative end
409 To tripping coil
410 TWJ
411 HWJ
412 COM
413 Standby
414 Protection trip
415 Remote closing
416 Remote tripping
417
418
Manual closing meet output
419
420
Low-voltage strong excitation outout
421 Work power loss
422 Signal com
423 Action signal
424 Alarm signal
CPU
301 DI COM
302 Excitation is ready to allow closing
303 Process interlocking satisfied to allow closing
304 Auxiliary engine operation normally to allow closing
305 DI 4
306 DI 5
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 Non-electricity 1
313 Non-electricity 2
314 Non-electricity 3
315 Non-electricity 4
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205 Busbar voltage Ua
206 Busbar voltage Ub
207 Busbar voltage Uc
208 Busbar voltage Un
209
210
AC
Protection current Ia 101 102 Protection current Ia*
Protection current Ib 103 104 Protection current Ib*
Protection current Ic 105 106 Protection current Ic*
Measuring current Ia 107 108 Measuring current Ia*
Measuring current Ib 109 110 Measuring current Ib*
Measuring current Ic 111 112 Measuring current Ic*
Zero-sequence current I0 113 114 Zero-sequence current I0*
115 116
117 118
119 120

TYM8695 Motor Differential Protection Equipment

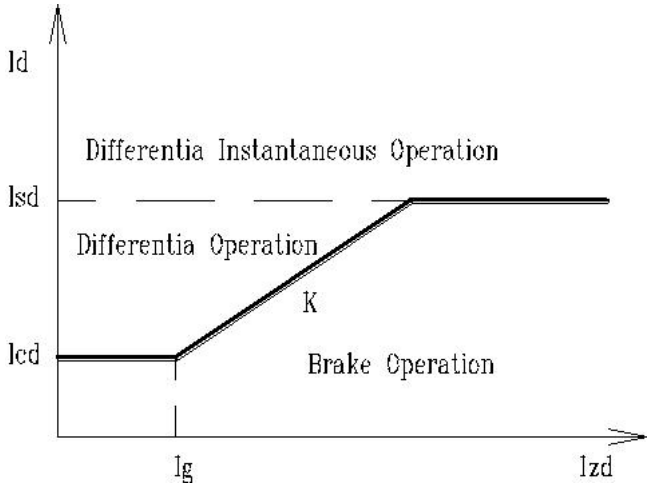
1 Functions

- Differential protection
- Differential instantaneous protection
- Differential current overcurrent alarm
- TA wire break blocking
- 16 fault waveform-recording
- 15-channel DI
- B code time-check and NTP time-check

2 Principle Descriptions

2.1 Differential protection

2.1.1 Proportion restraint



The protection will acquire the current I1, I2 at both sides of the phases A, B, C. The computation is made to get the following:

Izd = Max(I 1 , I 2)

Id = | I1－I2 | (Same polarity connection is made for TAs at both sides)

$$K = \frac{Id - Icd}{Izd - Ig}$$

Operating equation:

If the restraint current Izd is smaller than the kneepoint current Ig, the operating equation is Id＞Icd

If the restraint current Izd is larger than the kneepoint current Ig, the operation is Id＞Icd＋(Izd－Ig)×K

Where,

Izd – Restraint current, take the maximum phase current

Id – Differential current

Icd – Differential setting

Ig – Kneepoint current

The kneepoint current is 0.7 multiples of the rated current Ie.

The restraint coefficient can be set.

2.1.2 Harmonic Restraint

Considering that TA saturation may be resulted from the heavy load on the TA at the primary side at the end of the motor or from the effects of the transient components, the harmonic restraint is adopted to effectively prevent the misoperations of the motor differential protection.

The action equation of second and third harmonic restraint differential protection in phase A is:

$$\frac{\text{NIAF2}}{\text{NIA}} < K2 \quad \text{and} \quad \frac{\text{NIAF3}}{\text{NIA}} < K3$$

Where, NIAF2 is amplitude of the second harmonic of the tail A phase

NIAF3 is amplitude of the third harmonic of the tail A phase

NIA is amplitude of the A-phase fundamental wave at the tail

K2 is the second-harmonic restraint coefficient, generally 0.15

K3 is the third-harmonic restraint coefficient, generally 0.15

C phase harmonic restraint is the same as A phase.

In the meanwhile, the recognition elements for both motor internal and external faults are added in the protection. As the internal fault occurs, the harmonic restraint element will be switched off to ensure the fast operation of the differential protection.

2.2 Differential instantaneous protection

As the differential current of any phase is larger than the setting for the differential instantaneous protection, the protection will have an output without a time delay.

2.3 Differential current overcurrent alarm

As the protection detects that the differential current of any phase reaches the setting for the differential current overreach alarm, the protection will send the alarm signal after a certain time delay.

2.4 TA wire break blocking

As the TA wire break occurs at any phase at any side during motor operation at the rated current, the protection can signal or block the differential protection based on the control characters.

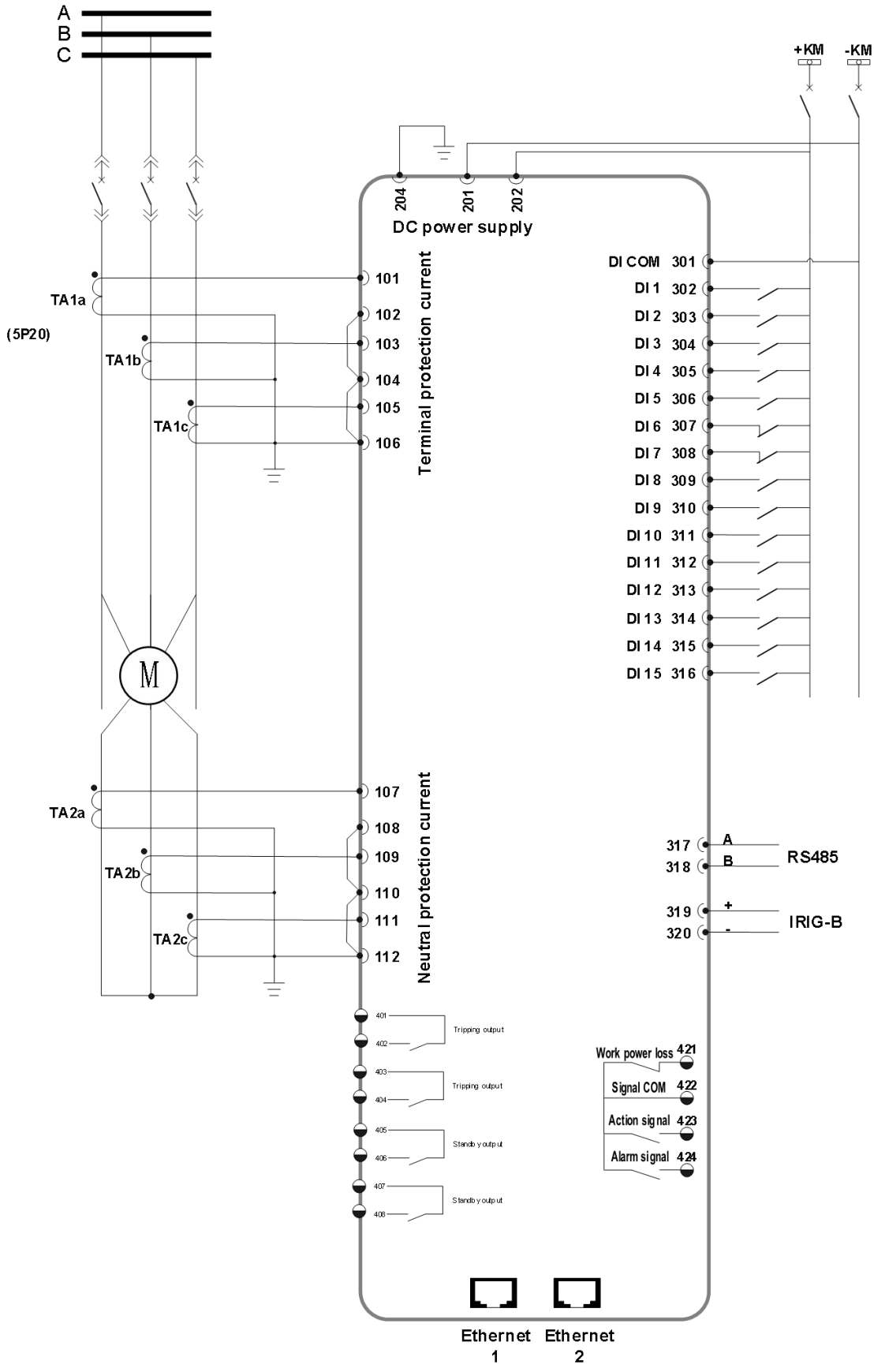
3 Setting

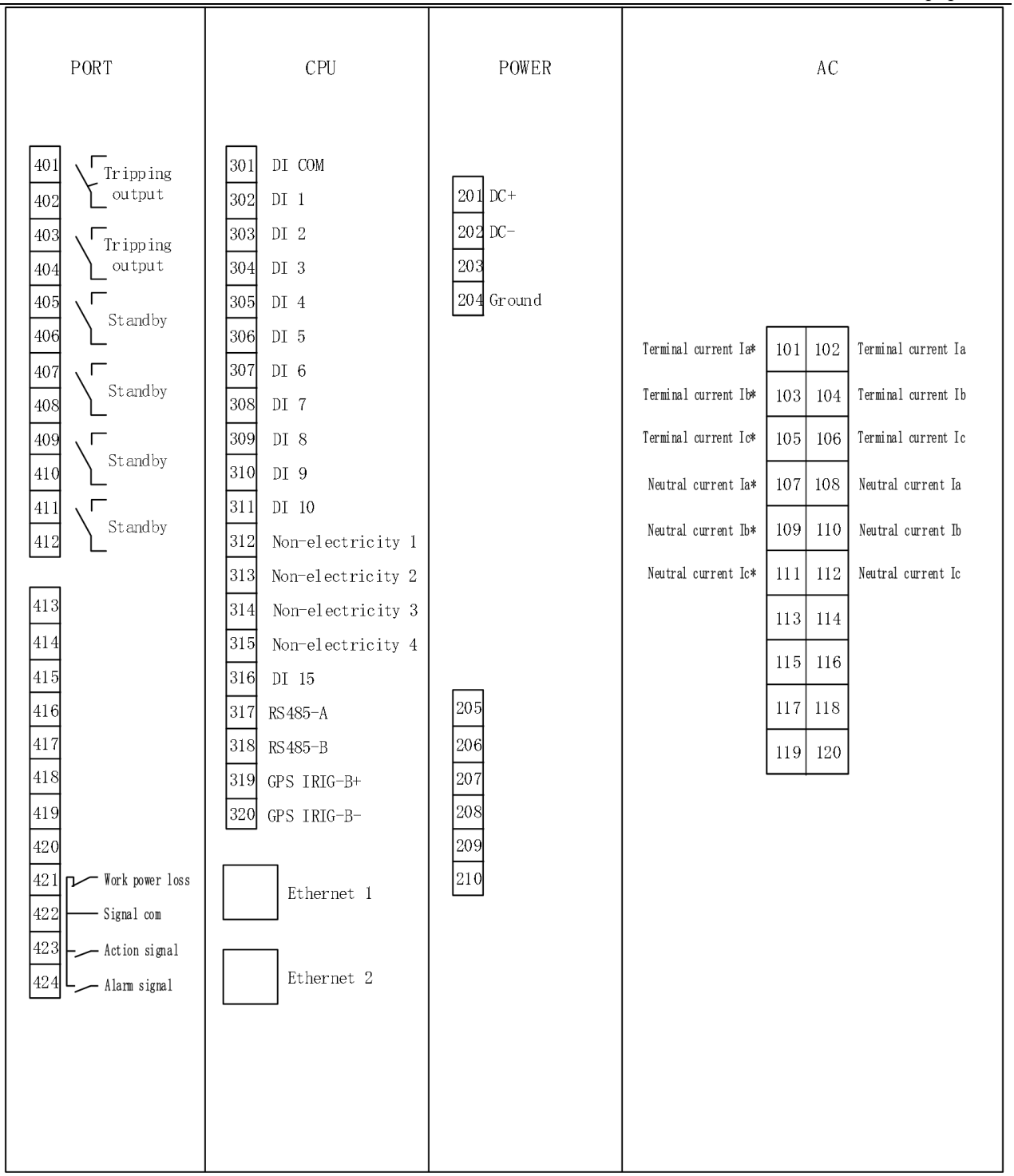
List of setting				
Ser.No.	Abbreviation	Name of setting	Unit	Range
1	2nd rated CURT	Motor secondary rated current (Ie)	A	0.04In～2In
2	DIF CURT	Differential current	Ie	3.0～16.0

3	INS DIF CURT	Differential instantaneous current	Ie	0.10～0.99
4	RT-BRK factor	Ratio differential braking factor		0.30～0.70
5	Balance factor	Balance factor of contralateral side		0.00～9.99
6	DIF CURT OR alm	Differential current overreach alarm setting	Ie	0.05～0.50
7	DIF CURT OR time	Differential current overreach time	S	0.00～9.99

List of control characters

Ser.No.	Abbreviation	Name of control characters	Options
1	INS DIF switch	Differential instantaneous current switching on/off	□OFF □ON
2	A-phase DIF SW	A-phase differential switching on/off	□OFF □ON
3	B-phase DIF SW	B-phase differential switching on/off	□OFF □ON
4	C-phase DIF SW	C-phase differential switching on/off	□OFF □ON
5	DIF OR ALM SW	Differential current overreach alarm switching on/off	□OFF □ON
6	TA DISCON ALM SW	TA disconnection alarm switching on/off	□OFF □ON
7	TA DISCON BLK SW	TA disconnection blocking differential switching on/off	□OFF □ON


A
B
C
+KM
-KM
204
201
202
DC power supply
TA1a
(5P20)
TA1b
TA1c
101
102
103
104
105
106
Terminal protection current
DI COM 301
DI 1 302
DI 2 303
DI 3 304
DI 4 305
DI 5 306
DI 6 307
DI 7 308
DI 8 309
DI 9 310
DI 10 311
DI 11 312
DI 12 313
DI 13 314
DI 14 315
DI 15 316
M
TA2a
TA2b
TA2c
107
108
109
110
111
112
Neutral protection current
317 A
318 B
RS485
319 +
320 -
IRIG-B
401
402
Tripping output
403
404
Tripping output
405
406
Standby output
407
408
Standby output
Work power loss 421
Signal COM 422
Action signal 423
Alarm signal 424
Ethernet 1
Ethernet 2


PORT
401
402
Tripping output
403
404
Tripping output
405
406
Standby
407
408
Standby
409
410
Standby
411
412
Standby
413
414
415
416
417
418
419
420
421
Work power loss
422
Signal com
423
Action signal
424
Alarm signal
CPU
301 DI COM
302 DI 1
303 DI 2
304 DI 3
305 DI 4
306 DI 5
307 DI 6
308 DI 7
309 DI 8
310 DI 9
311 DI 10
312 Non-electricity 1
313 Non-electricity 2
314 Non-electricity 3
315 Non-electricity 4
316 DI 15
317 RS485-A
318 RS485-B
319 GPS IRIG-B+
320 GPS IRIG-B-
Ethernet 1
Ethernet 2
POWER
201 DC+
202 DC-
203
204 Ground
205
206
207
208
209
210
AC
Terminal current Ia*
101
102
Terminal current Ia
Terminal current Ib*
103
104
Terminal current Ib
Terminal current Ic*
105
106
Terminal current Ic
Neutral current Ia*
107
108
Neutral current Ia
Neutral current Ib*
109
110
Neutral current Ib
Neutral current Ic*
111
112
Neutral current Ic
113
114
115
116
117
118
119
120

Chapter 3 Operation Manual

1 Introduction and Display

1.1 Panel Layout

1.2 Key functions

[Reset] ： Reset the signal (Indicate lamp、LCD)、Reset the signal relays；

[ENT]: Confirm the current modification or execute the current selection, or go to the next level menu;

[ESC]: Exit a menu or window and return to the menu above it, or cancel a change;

[∧]: Press the key: The cursor will move up or the value will increase.

[∨]: Press the key: The cursor will move down or the value will reduce.

[＜]: Press the key: The cursor will move left or the menu page turn forward.

[＞]: Press the key: The cursor will move right or the menu page turn backward.

[+]: Numerical value increase

[-]: Numerical value reduce

1.3 Indicating lamp

There are 8 Indicating Lamp.They are:Run、Operation、Alarm、Fault、GPS、Communicate、 Close and Trip.

Run (Green): The lamp indicate the product run normally or not.When the produt is running ,The lamp should scintilla.

Operation (Red):The lamp indicate the protection element trip or not. If it trip the lamp should brighten up.

Alarm (Red):The lamp indicate the product alarm or not. If it alarm the lamp should brighten up.

Fault (Red): The lamp indicate the hardware normally or not. If it fault or abnormity the lamp should brighten up.

GPS (Green):When the product have time pulse of GPS, The lamp should scintilla.

Comm (Green):When the function of communication is normally, The lamp should scintilla.

Trip (Green):When the product equip the operation circuit and the break is trip state, the lamp should brighten up.

Close (Red):When the product equip the operation circuit and the break is close state, the lamp should brighten up.

1.4 Serial interface

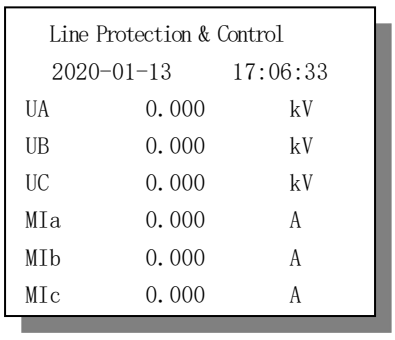
Through the serial interface can upgrade the device program, and the device can be debugged, monitored and read the protection fault record data through the serial interface.

1.5 Descriptions of turning off backlight

For increase the use time of LCD, the product is provided with the function of turning off backlight automated. When product's run time exceeded 3 minutes and no one operate the keyboard, the product will return to main picture and turn off the backlight. In this state ,press any key the backlight should turn on.

1.6 Main windows display statement

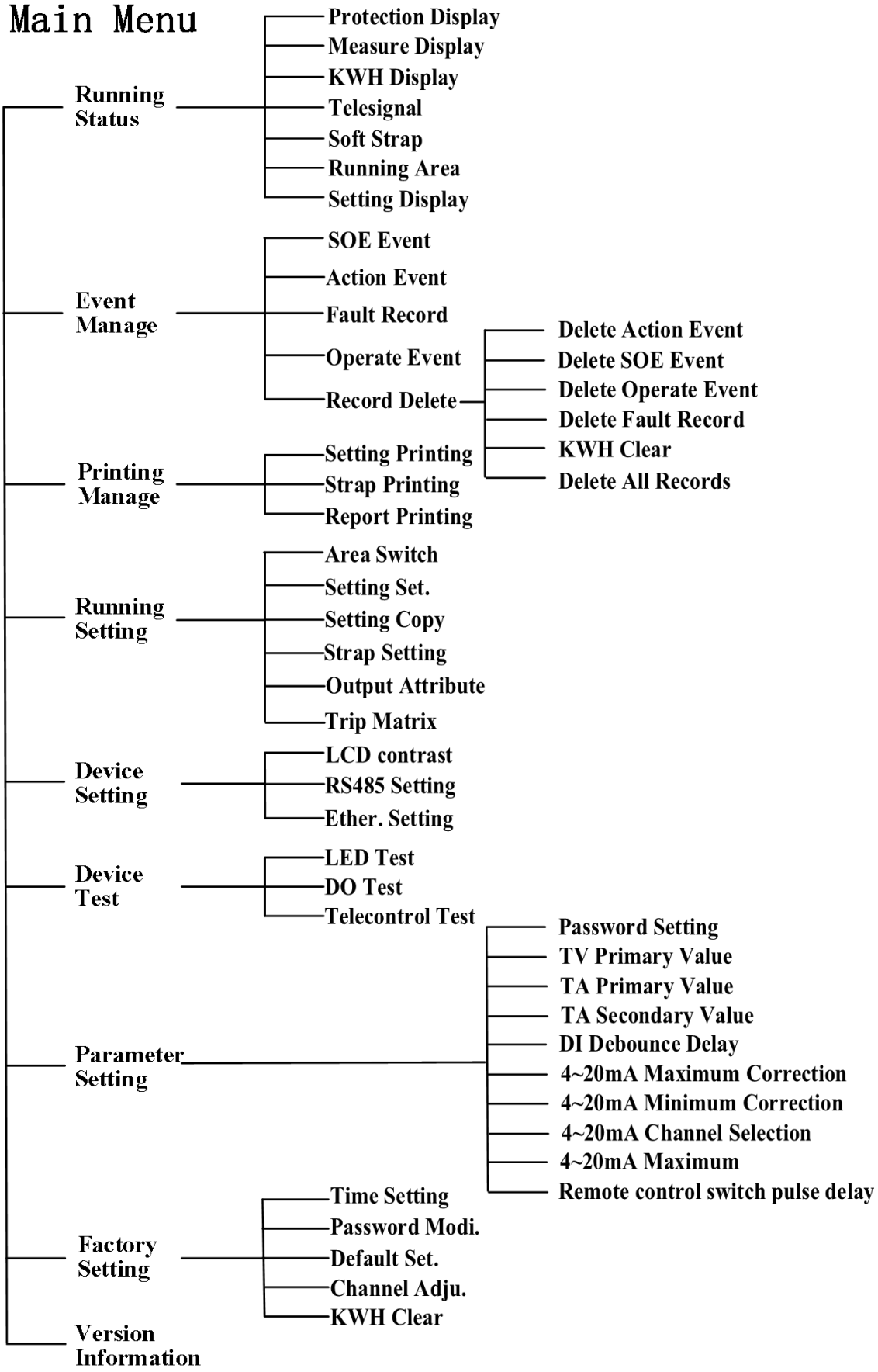
In the off-menu state, the main loop displays the measurements on the primary side.



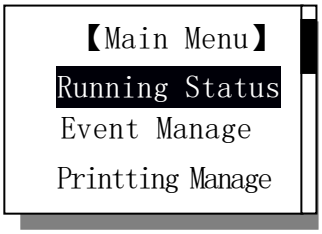
Display in non menu state

2 Menu display and operation statement

This device adopts menu display in both Chinese and English to realize human-machine interface interaction. The structure diagram of menu is as follows:


Main Menu
Running Status
Protection Display
Measure Display
KWH Display
Telesignal
Soft Strap
Running Area
Setting Display
Event Manage
SOE Event
Action Event
Fault Record
Operate Event
Record Delete
Delete Action Event
Delete SOE Event
Delete Operate Event
Delete Fault Record
KWH Clear
Delete All Records
Printing Manage
Setting Printing
Strap Printing
Report Printing
Running Setting
Area Switch
Setting Set.
Setting Copy
Strap Setting
Output Attribute
Trip Matrix
Device Setting
LCD contrast
RS485 Setting
Ether. Setting
Device Test
LED Test
DO Test
Telecontrol Test
Parameter Setting
Password Setting
TV Primary Value
TA Primary Value
TA Secondary Value
DI Debounce Delay
4~20mA Maximum Correction
4~20mA Minimum Correction
4~20mA Channel Selection
4~20mA Maximum
Remote control switch pulse delay
Factory Setting
Time Setting
Password Modi.
Default Set.
Channel Adju.
KWH Clear
Version Information

When the device operates normally, press [ENT] to enter the menu interface, and press [ESC] in the main menu to return to the normal operation display interface. The device menu consists of a main menu and multi-level submenus. The operation permissions of menus at all levels are different. When entering [Area Switch], [Setting Set.], [Strap Setting], [Trip Matrix], [Output Property], [Parameter Setting], etc. in the submenu [Running Setting] to modify parameters, password verification is required to prevent accidental modification of important operation parameters of the device, resulting in abnormal operation of the device or protection maloperation. The default password of the device is "1000".



Main menu

2.1 Menu functions statement

1st submenu	2st submenu	3st submenu	Functions statement
Running Status	Protection Display		Browse the value of protection analog quantity, including amplitude and angle
	Measure Display		Browse the value of measured analog quantity, including amplitude and angle
	KWH Display		Browse the accumulated KWH value of produce
	Telesignal		Browse the run status of digital in and alarm telesignal
	Soft Strap		Browse the soft strap is turning on or off
	Running Area		Browse the running setting zone number
	Setting Display		Browse the settings of per zone
Event Manage	SOE Event		Check the events of product, which is occur in sequence
	Action Event		Display the time and action value of protection action
	Fault Record		Display recorded sampling value recording
	Operate Event		Check device operation events (remote control, setting)
	Record Delete	Delete Action Event	Delete all protection action events
		Delete SOE Event	Delete all SOE events
		Delete Operate Event	Delete all operation events (remote control, setting)
		Delete Fault Record	Delete all fault recording records
		KWH Clear	Clear all accumulated electrical measurements of the device
		Delete All	Delete all action events, SOE events, operation

		Records	events and wave recording
Printing Manage	Setting Printing		Print the current running setting value
	Strap Printing		Print the current running strap
	Report Printing		Print the action events
Running Setting	Area Switch		Switching constant value operation area
	Setting Set.		Modify the current running setting of the device
	Setting Copy		Copy the entered setting value to another srtting value area to be set
	Strap Setting		Turn on or off the protection functions
	Output Atrribute		Modify the tripping or signaling atrributes of each output of the device
	Trip Matrix		Modify the output configuration of the protection function
Device Setting	LCD contrast		Adjust the contrast of LCD display in the device
	RS485 Setting		Setting 485 port communication parameters
	Ether. Setting		Set Ethernet communication parameters
Device Test	LED Test		Test device signal lamp
	DO Test		Test device output relay
	Telecontrol Test	Action	Send action event points in test status to the master station
		Alarm	Send alarm event points in test status to the master station
		Digital In	Send the test state input remote signal point to the master station
		Telemeasure	Send the device default telemetry value (non full scale value) under test status to the master station
Parameter Setting	Password Setting		Password setting
	TV Primary Value		Set TV primary value (TV secondary value default 100V)
	TA Primary Value		Set TA primary value
	TA Secondary Value		Set TA secondary value
	DI Debounce Delay		Digital input debounce delay
	4~20mA Maximum Correction		4~20mA maximum channel coefficient
	4~20mA Minimum Correction		4~20mA minimum channel coefficient
	4~20mA Channel Selection		Select a specific analog output 4~20mA
	4~20mA Maximum		Percentage of maximum analog value corresponding to 20mA output
	Remote control switch pulse delay		Remote control switch pulse delay
Factory Setting	Time Setting		View or modify the current time of the device
	Default Set.		Restore the default values of the setting value, strap, trip matrix, output property,

			communication parameters, etc. of the device
	Channel Adju.		Adjust channel coefficient for calibrating analog measurement value
	KWH Clear		Manually set the cumulative electricity measurement
Version Information			Display the version number and check code results of the program

2.2 Main functions statement

2.2.1 Running status browse

After enrering into the main menu window. Select the [Running Status] with cursor ,then press the [ENT] key. In the [Running Status], we can look over the following contents: protection value, measuring value, pulse value, telesignal status, running area, protection strap status, protection setting.

Operation steps for protection value displaying:

1） Enter into the main menu.

2） Select the [Running Status], then press the [ENT] key for entering into the menu, move cursor to the [Protection Display] which is the sub-menu.

3） Press the [ENT] key, enter into the window of protection value displaying.

Name	AMP	Angle
Ua	57.712V	0°
Ub	57.709V	240°
Uc	57.669V	120°
Uab	99.912V	30°
Ubc	100.109V	270°
Uca	99.8467V	150°
Ia	5.01A	0°
Ib	5.02A	240°

Protection value

4） Move up with [∧] and move down with [∨] in the window of protection value displaying.

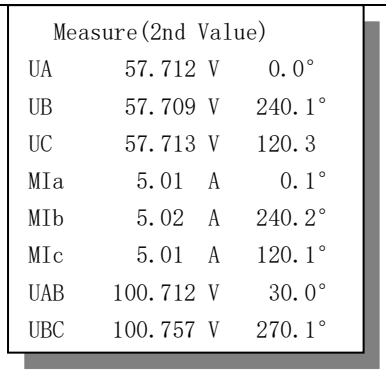
5） Press the [ESC] key step-by-step, return to the main menu.

Operation steps for measure value displaying:

1） Enter into the main menu.

2） Select the [Running Status], then press the [ENT] key for entering into the menu, move cursor to the [Measure Display] which is the sub-menu.

3） Press the [ENT] key, enter into the window of measure value displaying.



Measure value

4） Move up with [∧] and move down with [∨] in the window of measure value displaying.

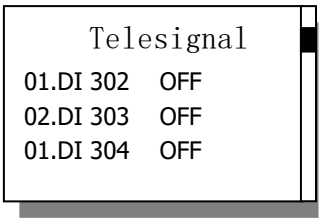
5） Press the [ESC] key step-by-step, return to the main menu.

Operation steps for telesignal status displaying:

1） Enter into the main menu.

2） Select the [Running Status], then press the [ENT] key for entering into the menu, move cursor to the [Telesignal] which is the sub-menu.

3） Press the [ENT] key, enter into the window of telesignal status displaying.



Telesignal status

4） Move up with [∧] and move down with [∨] in the window of telesignal status displaying.

5） Press the [ESC] key step-by-step, return to the main menu.

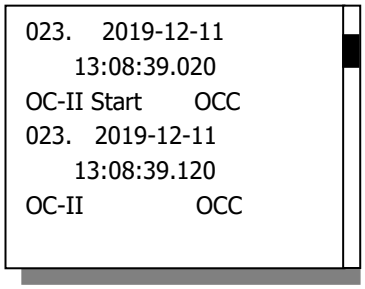
2.2.2 Browse Sequence Of Event (SOE)

The TY8690 series digital protection can memorize the lately SOE events more than 1000.They are memorized in the FRAM of protection element and memorized with the type of circular pointer. All SOE events can upload to the SCADA system with communication. If the device power down, all the SOE events would’t be lose when powerd on again.

1） Enter into the main menu.

2） Select the [Event Manage], then press the [ENT] key for entering into the menu, move cursor to the [SOE Event] which is the sub-menu.

3） Press the [ENT] key, enter into the window of SOE event displaying.



SOE event

4） Move up with [∧] and move down with [∨] in the window of SOE event displaying.

5） Press the [ESC] key step-by-step, return to the main menu.

2.2.3 Browse Acton Report

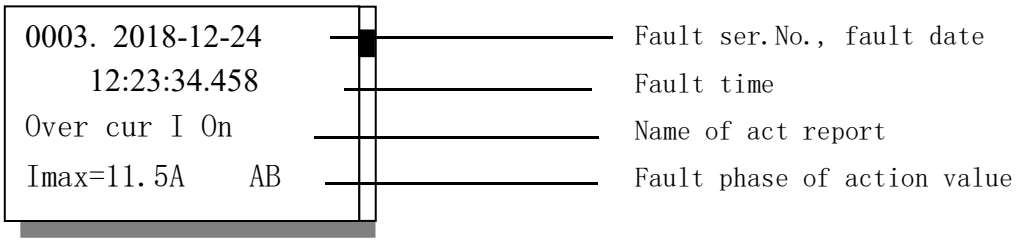
The PS690U series digital protection can memorize the lately 16 action reports which are recorded when device trip for the power system fault. Operation steps for action reports check:

1） Enter into the main menu.

2） Select the [Report Manage], then press the [ENT] key for entering into the menu, move cursor to the [Action Event] which is the sub-menu.

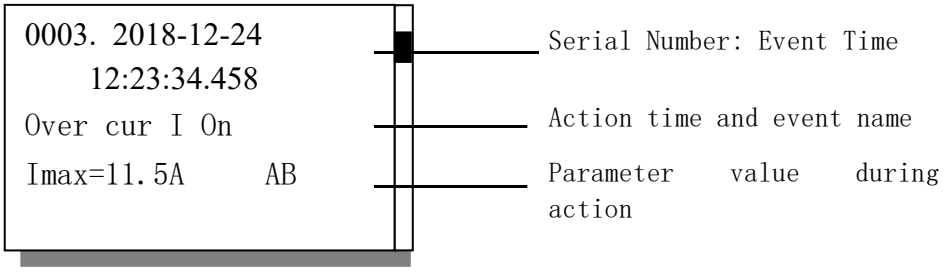
3） Enter into the display window of action report list by press the [ENT] key. The window display absolute time of current fault recording and its sequence number. The sequence number is used to distinguish from an event correlated to the function of relay protection element,the sequence number increase by 1 when the protection element start and it don't need reset.

4）



5） Move up with [∧] and move down with [∨] in the window of action report list displaying.

6） Press the [ENT] key, enter into the window of action report list displaying.



Report Sequence Events

7） Press the [ESC] key step-by-step, return to the main menu.

2.2.4 Browse Fault Record

Because there are too many wave recording points, it is more complicated to view. It is recommended to view the wave recording analysis software on the upper computer to draw a waveform diagram, which is more intuitive and convenient for analysis.

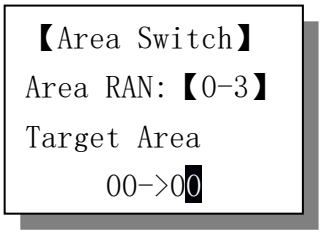
2.2.5 Area Switch

The TY8690 series digital protection contain 4 suit of setting, so the user can select the different setting zone when the device running in different modes. Operation steps for area switch:

1） Enter into the main menu.

2） Select the [Running Setting], then press the [ENT] key for entering into the menu, move cursor to the [Area Switch] which is the sub-menu.

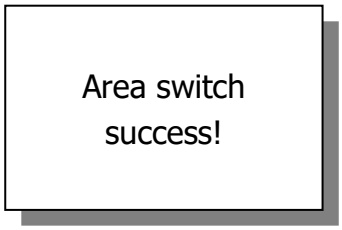
3） Press the [ENT] key, enter into the window of area switch.



Area Switch

4） Input the correct zone number which is the number of the aim zone.Move the cursor with the [＜] key and the [＞] key;Increase the zone number with the [+] key and decrease the zone number with the [-] key.

5） Press the [ENT] key to switch the area code, and the device displays the switching of fixed value successfully! Press [ESC], return to step 2).



Aera switch success

6） Press [ESC] to return to the main menu step by step.

Please pay attention to the following points during the above steps:

● In step 5), if the area code is incorrect, the setting value area code error message window will pop up, and the operation will skip to step 3).

●In step 3), if the password is entered incorrectly, the LCD will prompt that the password is incorrect, and you need to re-enter the correct password. Repeat step 6), input the password and continue to execute the curing command.

●Before entering the correct password and pressing the [ENT] key, the area code will not be solidified into the protection module. Press the [ESC] key to return to the main menu level by level and discard the changes made. Similarly, if the keyboard operation is stopped for 3 minutes before this, the area code switching will be automatically abandoned and the normal display screen will be returned.

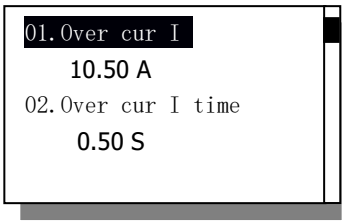
2.2.6 Setting Set.

Setting is to modify the setting value. In the constant value setting, the constant value display is divided into two states: browsing and modifying. In browse status, press [ENT] to switch to modify status; In the modified status, press [ESC] to return to the browsing status. The operation steps of setting value are as follows:

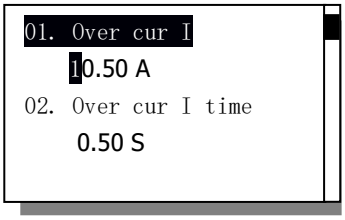
1） Enter into the main menu.

2） Select the [Running Setting], then press the [ENT] key for entering into the menu, move cursor to the [Setting Set.] which is the sub-menu.

3） Press the [ENT] key, enter into the window of setting set.



Setting browsing status

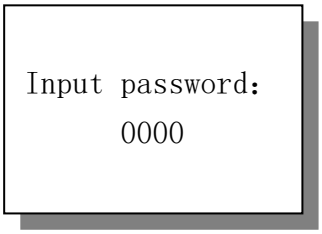


Setting modification status

4） In browsing status, use the [∧] or [∨] key to scroll the fixed value item to be modified. If the selected fixed value item needs to be modified, press the "OK" key to switch the fixed value item to be modified to the modified status. In the modification status, use the [＜] key or [＞] key to change the cursor position, and use the [+] key or [-] key to increase or decrease Arabic numerals. After modification, press the "OK" key to save the modification of the current fixed value item and return to the browsing status; If you press the Cancel key to cancel the modification of the current constant value item and return to the browsing status.

5） Repeat step 4) until the setting value is modified.

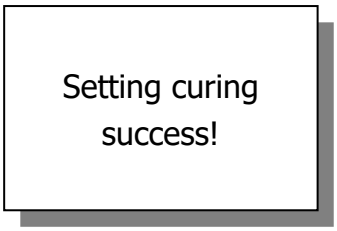
6） After the setting value is modified, press the [ESC] key to exit the setting value setting window and pop up the password verification window.



Password verification

7） Enter the password "1000" in the password window. The [＜] or [＞] key can be used to move the input position of multiple digits, and the [+] or [-] key can be used to enter the password.

8） Press the [ENT] key to cure the fixed value, and the device displays that the setting value curing is successful! If the [ESC] key is pressed, the setting value adjustment will be abandoned and the system will return to step 2).



Setting curing success

9） Press [ENT] or [ESC] to exit the message window and return to step 2).

10) Press [ESC] to return to the main menu step by step.

Please pay attention to the following points during the above steps:

●In step 4), in the modified status, after the setting value is modified, press [ENT] to save the current modification of the setting value item, and press [ESC] to cancel the current modification of the setting value item.

●In step 7), if the password is entered incorrectly, the LCD will prompt that the password is incorrect, and you need to re-enter the correct password. Repeat step 7), input the password and continue to execute the curing command.

●Before inputting the correct password and pressing the [ENT] key, the setting value will not be solidified into the protection module. Press the [ESC] key to return to the main menu level by level and discard the changes made. Similarly, if the keyboard operation is stopped for 3 minutes before this, the setting value change will be automatically abandoned and the normal display screen will be returned.

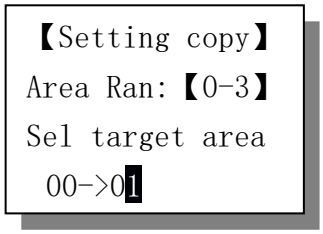
2.2.7 Setting Copy

The PS690U series digital protection can copy all the settings which is in the currently setting zone to another setting zone. When the difference between the two sets of setting values in operation is not large, the entered setting values can be copied to another setting value area to be set, and then modified, so that it is convenient to input multiple sets of setting values applicable to different operation modes. The operation steps of setting copy are as follows:

1） Enter into the main menu.

2） Select the [Running Setting], then press the [ENT] key for entering into the menu, move cursor to the [Setting Copy] which is the sub-menu.

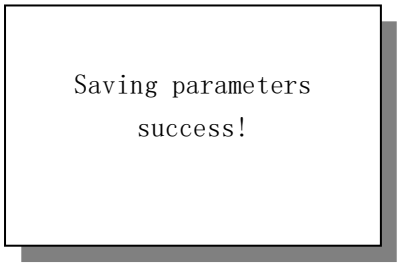
3） Press the [ENT] key, enter into the window of setting copy.



Setting copy

4） Enter the legal area code of the target copy setting value area in the setting value copy window. Use the [＜] key or [＞] key to move the cursor position, and use the [+] key or [-] key to increase or decrease the area code value.

5） Press the [ENT] key to copy the setting value, and the device displays that saving parameters success! If you press Cancel, you will return to step 2).



Saving parameters success

6） Press the [ESC] key to exit the message window and return to step 2).

7） Press [ESC] to return to the main menu step by step.

Please pay attention to the following points during the above steps:

● In step 3), the source area code is on the left and the target area code to be copied is on the right.

● In step 5), if the area code is incorrect, an error message window in the fixed value area will pop up, and the operation will skip to step 3).

● Before inputting the correct password and pressing the [ENT] key, the setting value will not be copied and solidified into the protection module. Press the [ESC] key to return to the main menu level by level and give up copying. Similarly, if the keyboard operation is stopped for 3 minutes before this, the setting value copying will be automatically given up and return to the normal display screen.

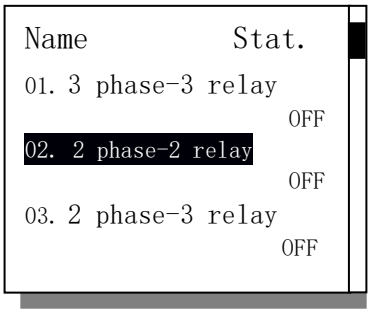
2.2.8 Strap Setting

If the strap exits, the corresponding protection function will exit, so please operate with caution! During the on/off of the strap, the strap displays two statuses: browsing and modifying. In browse status, press [ENT] to switch to modify status; In the modified status, press [ESC] to return to the browsing status. The operation steps of strap setting are as follows:

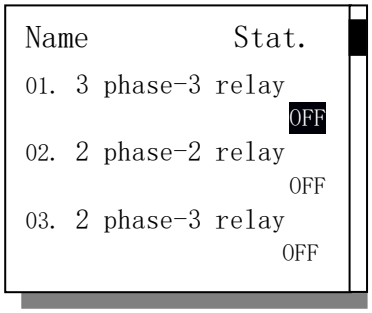
1) Enter into the main menu.

2) Select the [Running Setting], then press the [ENT] key for entering into the menu, move cursor to the [Strap Setting] which is the sub-menu.

3) Press the [ENT] key, enter into the window of strap setting.



Strap setting browsing status

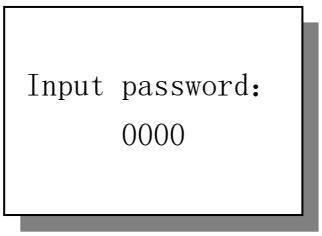


Strap setting modify status

4) In browsing status, use the [∧] or [∨] key to scroll the strap items to be modified. If the selected strap items need to be modified, press the [OK] key to switch the strap items to be modified to the modified status. In the modification status, use the [+] or [-] key to change the value of the strap to be set. After modification, press the [ENT] key to save the modification of the current strap item and return to the browsing status; If you press the [ESC] key to cancel the modification of the current strap item and return to the browsing status.

5) Repeat step 4) until the strap is modified.

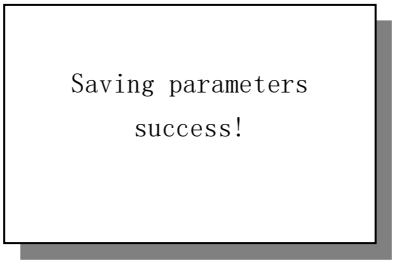
6) In the browsing status of the strap, press the [ESC] key to exit the strap on/off window and pop up the password verification window.



Password verification

7) Enter the password "1000" in the password window. The [＜] or [＞] key can be used to move the input position of multiple digits, and the [+] or [-] key can be used to enter the password.

8) Press the [ENT] key to solidify the strap, and the device displays that the saving parameters success! If the [ESC] key is pressed, the strap can be abandoned and return to step 2).



Saving parameters success

9) Press [ESC] to return to the main menu step by step.

Please pay attention to the following points during the above steps:

● In step 4), in the modified status, after the strap is modified, press [ENT] to save the current modification of the strap item, and press [ESC] to cancel the current modification of the strap item.

● In step 7), if the password is entered incorrectly, the LCD will prompt that the password is incorrect, and you need to re-enter the correct password. Repeat step 7), input the password and continue to execute the curing command.

● Before inputting the correct password and pressing the [ENT] key, the strap will not be solidified into the protection module. Press the [ESC] key to return to the main menu level by level and discard the changes made. Similarly, if the keyboard operation is stopped for 3 minutes before this, the strap will automatically discard the changes and return to the normal display screen.

2.2.9 Trip Matrix

The output of all protection functions of TY8690 series digital protection device can be set through the [Trip Matrix] menu to flexibly determine which output of a certain protection function are closed tripping switches. **Note: The default output mode is used for protection when leaving the factory (the default output is consistent with the manual), and general field users do not need to set it. If there is a need for this, please contact our technical support!**

A protection function consists of several output setting items, which correspond to specific terminal number (i.e. specific outlet relay). The output setting items of each protection function are completed by a control word. When an output of a protection function needs to be closed, change its corresponding position to "ON", or change this output to "OFF" when not in use.

Corresponding terminal of output relay: Output 1(401,413), Output 2(401,414), Output 3(422,424), Output 4 (422,424), action lights, warning lights, etc.

The tripping matrix is as follows:

Output / Elemts	401,413	401,414	422,423	422,424	Action lights	Warning lights
Over cur I	off	on	off	off	on	off
Over cur II	off	on	off	off	on	off
Over cur III	off	off	on	off	on	off
Over load	off	off	off	on	off	on
TV alarm	off	off	off	on	off	on
Control circuit disconnection alarm	off	off	off	on	off	on

Setting method: select "ON" in the space between the protection function and the corresponding terminal and signal lamp of the output relay to be actuated, and select "OFF" in other spaces to obtain the tripping mode. So the binary bit string corresponding to the above trip matrix table is:

Over cur I 0X0542

Over cur II 0X0542

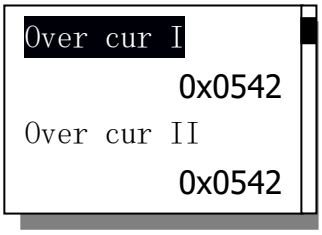
Over cur III	0X0542
Over load	0X0A80
TV alarm	0X0A80
Control circuit disconnection alarm	0X0A80

In TY8690 series digital protection, each protection function output is stored in hexadecimal format. To make the setting intuitive and convenient, the setting time is switched to the bit by bit setting mode. In the bit setting mode of trip matrix, the trip matrix displays two statuses: browsing and modifying. In browse status, press [ENT] to switch to modify status; In the modified status, press [ENT] or [ESC] to return to the browsing status. The operation steps of trip matrix setting are as follows:

1） Enter into the main menu.

2） Select the [Running Setting], then press the [ENT] key for entering into the menu, move cursor to the [Trip Matrix] which is the sub-menu.

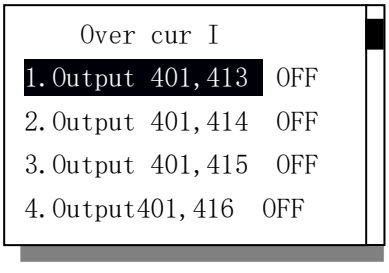
3） Press the [ENT] key, enter into the window of output setting.



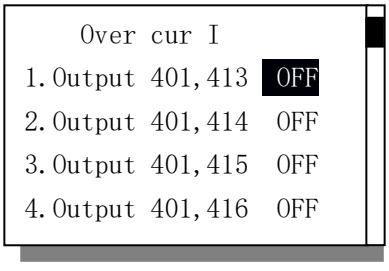
Trip matrix selection

4） Use the [∧] or [∨] key to scroll the protection element, and move the cursor to the protection element item to be modified.

5） Press the [ENT] key, enter into the window of trip matrix bit setting mode.



Trip matrix browsing status



Trip matrix modify status

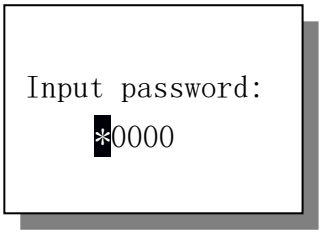
6） In the browsing state of the trip matrix mode, use the [∧] or [∨] key to scroll the component output position to be modified. If the selected output item needs to be modified, press the [ENT] key to switch the output item to be modified to the modified state. In the modified status, use [∧] or [∨] key to change the output to be set. After modification, press the [ENT] key to save the modification of the current component output item and return to the browsing status; If you press [ESC] to cancel the modification of the current output item, you will return to the browsing status.

7） Repeat step 6) until all output have been modified.

8） In the browsing state of trip matrix, press [ESC] to exit the trip matrix setting window and return to step 2).

9） Repeat steps 3) to 8).

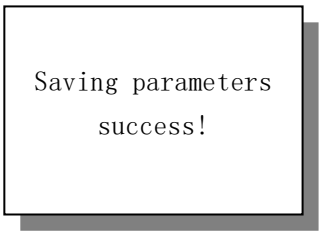
10) After all output are modified, press [ESC] to exit the trip matrix setting window and pop up the password verification window.



Password verification

11) Enter the password "1000" in the password window. The [＜] or [＞] key can be used to move the input position of multiple digits, and the [+] or [-] key can be used to enter the password.

12) Press the [ENT] key to solidify the trip matrix, and the device displays the message window of solidifying the trip matrix; If the [ESC] key is pressed, the trip matrix setting will be abandoned and return to step 2).



Curing process

13) Press [ENT] or [ESC] to exit the message window and return to step 2).

14) Press [ESC] to return to the main menu step by step.

Please pay attention to the following points during the above steps:

● In step 6), in the modified state, after modifying the trip matrix, press [ENT] to save the current exit modification, and press [ESC] to cancel the current exit modification.

● In step 10), if the output is not changed, press [ESC] to skip to step 2).

● In step 11), if the password is entered incorrectly, the LCD will prompt that the password is incorrect, and you need to re-enter the correct password. Repeat step 11), input the password and continue to execute the curing command.

● Before inputting the correct password and pressing the [ENT] key, the trip matrix will not be solidified into the protection module. Press the [ESC] key to return to the main menu level by level and discard the changes

made. Similarly, if the keyboard operation is stopped for 3 minutes before this, the tripping matrix setting will be automatically abandoned and the normal display screen will return.

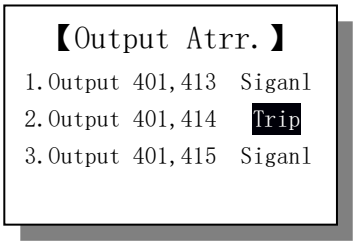
2.2.10 Output Atrribute Set

In TY8690 series digital protection, the protection output can be defined, and the action attribute of the output can also be defined, that is, whether the output trips or sends a signal can be defined. In the output attribute setting, the output attribute displays two statuses: browse and modify. In browse status, press [ENT] to switch to modify status; In the modified status, press [ENT] or [ESC] to return to the browsing status. Operation steps for the output attribute setting:

1） Enter into the main menu.

2） Select the [Running Setting], then press the [ENT] key for entering into the menu, move cursor to the [Output atrribute] which is the sub-menu.

3） Press [ENT] and enter the password to enter the output attribute setting window.

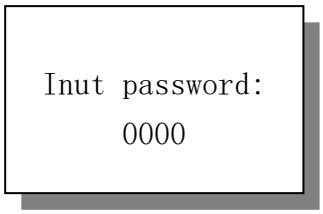


Output atrribute

4） In browsing status, use the [∧] or [∨] key to scroll through the output attribute items to be modified. If the selected output attribute items need to be modified, press the [ENT] key to switch the output attribute items to be modified to the modified status. In the modified status, use the [+] or [-] key to change the output attribute value to be set. After modification, press [ENT] to save the modification of the current output attribute item and return to the browsing status; If you press [ESC] to cancel the modification of the current output attribute item, you will return to the browsing status.

5） Repeat step 4) until the output attribute is modified.

6） In the output attribute browsing status, press [ESC] to exit the output attribute setting window and the password verification window will pop up.

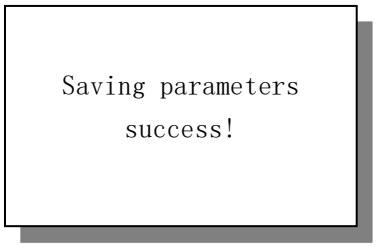


Password verification

7） Enter the password "1000" in the password window. The [＜] or [＞] key can be used to move the input position of multiple digits, and the [+] or [-] key can be used to enter the password.

8） After entering the password, press the [ENT] key, and the device prompts that Saving parameters success!

The modification is successful. If you press the [ESC] key, you will give up the output attribute setting and return to step 2).



Saving parameters success

9） Press [ENT] or [ESC] to exit the message window and return to step 2).

10) Press [ESC] to return to the main menu step by step.

Please pay attention to the following points during the above steps:

● In step 4), in Modify status, after modifying the output attribute, press [ENT] to save the modification of the output attribute item, or press [ESC] to cancel the modification of the output attribute item.

● In step 7), if the password is entered incorrectly, the LCD will prompt that the password is incorrect, and you need to re-enter the correct password. Repeat step 7), input the password and continue to execute the curing command.

● Before entering the correct password and pressing the [ENT] key, the output attribute will not be solidified into the protection module. Press the [ESC] key to return to the main menu level by level and discard the changes made. Similarly, if the keyboard operation is stopped for 5 minutes before this, the output attribute setting will be automatically abandoned and the normal display screen will be returned.

2.2.11 Parameter Setting

[Parameter Setting] menu contains parameters such as setting password, TA, TV transformation ratio, input debounce time, remote control switch pulse width, etc.

Device parameter table：

NO.	Subitem name	Function Description
1	Password Setting	Change the device password
2	TV Primary Value	Primary rated line voltage,Units: kV; The default secondary voltage is 100V
3	TA Primary Value	Primary rated current, Units: A
4	TA Secondary Value	Secondary rated current,Units: V; Options with 5A or 1A, set according to the actual situation of this interval
5	DI Debounce	Digital input flutter time, Units: s, minimum 0.02S
	4-20mA Maximum Correction	Correction of the maximum coefficient of 4~20mA
	4-20mA Minimum Correction	Correction of the minimum coefficient of 4~20mA
	4~20ma Channel Selection	The setting device specifically converts a phase current or a voltage or active/reactive/power factor into DC analog output
7	4-20mA Maximum	The percentage of 20mA corresponding to the maximum value of

		DC analog output. When the maximum value on site is required to be 25ma, the setting is 125%, and so on.
8	Remote control switch pulse delay	Set the pulse width at the outlet of remote tripping or remote closing, in seconds, with a minimum of 0.001s

If the primary voltage and current are not set correctly, the correct display of the primary side value on the main screen will be affected; **When the secondary current is delivered from the factory, it needs to be set in line with the site, otherwise the device will not sample correctly!**

2.2.12 Communication Parameters Setting

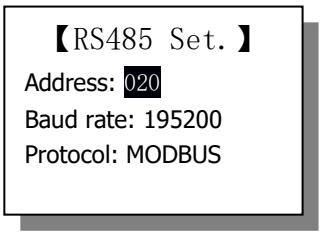
Enter the main menu, select the submenu item [Device Setting], press the [ENT] key to enter the device menu interface, and then select [Serial Port Setting] to set the RS485 serial port parameters in the device, and select [Ether. Setting] to set the Ethernet parameters of the device.

The communication parameter setting display is divided into two states: browse and modify. In browse state, press [ENT] to switch to modify state, and in modify state, press [ESC] to return to browse state.

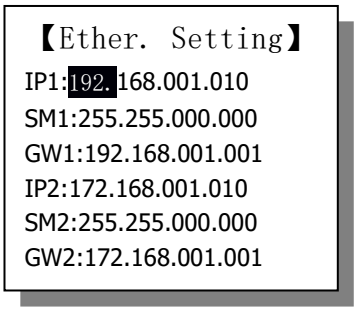
In browsing status, scroll through the sub items of communication parameters to be modified with [∧] and [∨].

Under the modification status, use the [＜] and [＞] keys to change the cursor position, and use the [+] and [-] keys to change the value of the communication parameter to be communicated. After modification, press the [ENT] key to save the modification of the current communication parameter item; Press the Cancel key to cancel the modification of the current communication parameter item.

After the communication parameters are modified, in browsing mode, press [ESC] to exit the communication parameter setting interface and pop up the password verification window. After entering the password verification window, enter the correct password, and then press [ENT] to solidify the communication parameters. If you give up solidifying the communication parameters, press Exit.



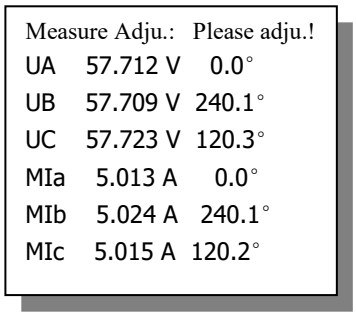
RS485 setting



Ethernet setting

2.2.13 Channel Factor Calibration

Enter the main menu, select the submenu item [Factory Setting] and press the [ENT] key to enter the factory setting menu interface, then select [Channel Adju.] and press the [ENT] key to enter the channel coefficient calibration display interface.



Channel Calibration

Calibration method: add rated voltage, rated current and power angle of - 45 ° to the measuring circuit of the device to ensure that the sampling error of active and reactive power is not large. Press the [ENT] key to calibrate the measuring channel directly inside the device without manually entering the relevant coefficient. After calibration, press the [ESC] key to exit the menu and enter the password to save the channel coefficient. Return to the measurement menu and observe whether the deviation between the sampling and the tester is within a reasonable range.

It should be noted that each channel should be calibrated at ± 5% of the rated value. If the deviation is too large, the external wiring should be checked. Otherwise, the accuracy cannot be calibrated.

Note: When leaving the factory, the devices have been calibrated by high-precision meters. Please operate carefully on site!!! If you need calibration, please contact our technical support!

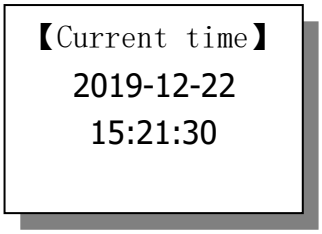
2.2.14 Time Setting

In time setting, the time display is divided into two states: browse and modify. In browse status, press [ENT] to switch to modify status; In the modified status, press [ENT] to return to the browsing status. The operation steps of time setting are as follows:

1） Enter into the main menu.

2） Select the [Factory Setting], then press the [ENT] key for entering into the menu, move cursor to the [Time Setting] which is the sub-menu.

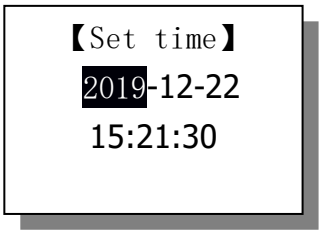
3） Press [ENT] and enter the password to enter the time setting window.



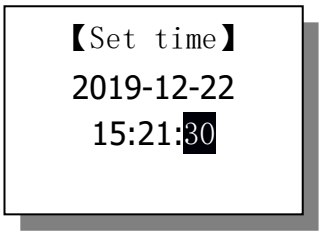
Current Time

4） In browsing status, press [ENT] to enter the time setting status. In the modified state, use the [＜] key or [＞] key to move the cursor position, and use the [+] key or [-] key to increase or decrease the value;

Press [Λ] or [∧] to switch between date setting and time setting.



Date Setting



Time Setting

5） Press [ENT] to save the set time; If you press the [ESC] button to cancel the setting time. Return to step 3) after execution.

6） Press [ESC] to return to the main menu step by step.

Please pay attention to the following points during the above steps:

● In step 3), the displayed time is the current running time.

● In step 4), after pressing the [ENT] key, first position the cursor on the date setting line. If you want to switch to the time setting line, press the [＜] or [＞] key to switch to the time setting state.

2.2.15 Password Setting

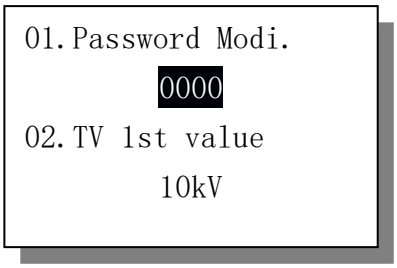
In order to prevent unauthorized persons to use the default password "1000" to amend the essential device operating parameters, device operation can be re-set the password.

Operation steps for password modification:

1） Enter into the main menu.

2） Select the [Parameter Setting], then press the [ENT] key for entering into the menu, move cursor to the [Password Setting] which is the sub-menu.

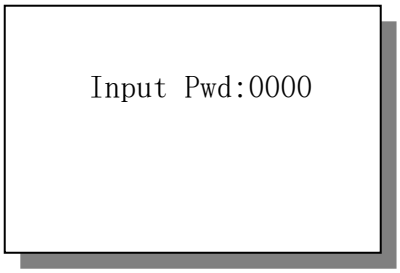
3） Press [ENT] and enter the window of password modify login.



Password modification login

4） Enter the current password in the password setting window. The[＜] or [＞] key can be used to move the input position of multiple digits, and the [+] or [-] key can be used to enter the password.

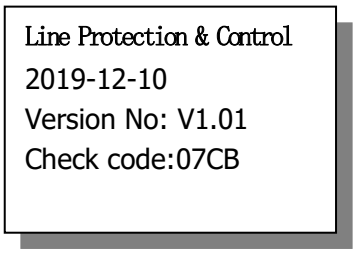
5） After the password is set, press the [ENT] key to save the password, and then press the [ESC] key. After entering the new password, it will be displayed that the parameters are saved successfully, indicating that the password is modified successfully.



After password Modi.

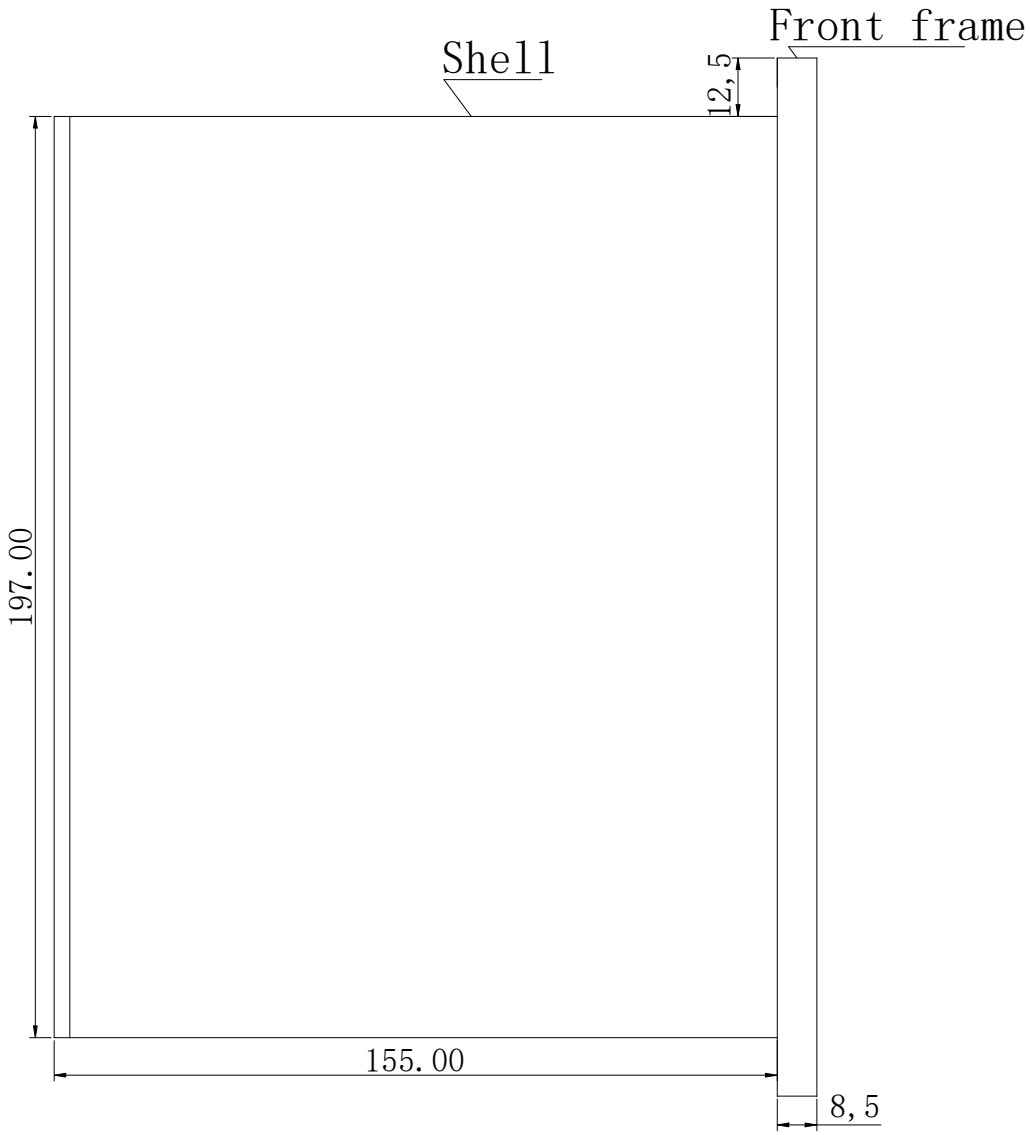
2.2.16 Version Information

Check code: enter the main menu, select the submenu item [Version information] and press OK to enter the version information menu interface, where the version number and check code result of the program will be displayed.



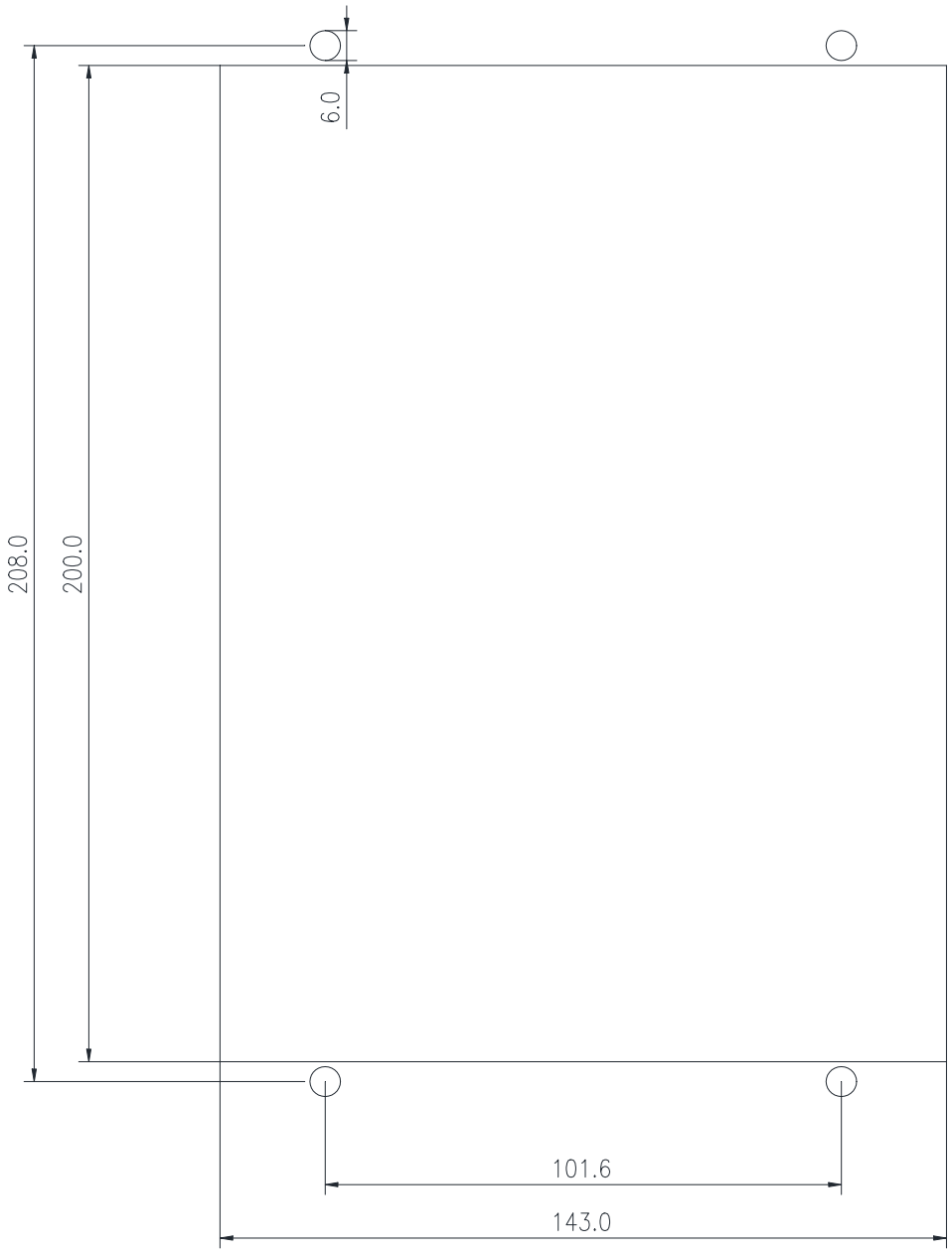
Version Information

3 Chassis Demensions Chart



Unit: mm

4 Installation dimensions



Unit: mm