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User Manual

Relay Protection Devices

Selectric – SRP-MJ

Version: 1.4

Danger and warning

This equipment can only be installed by professionals and the manufacturer will bear no responsibility for the failures caused by operations which do not conform to this manual.

Thank you for using the product of Selectric.
For safe, correct and efficient use of the SRP-MJ, please note the following important notes:
The user manual is only applicable to the SRP-MJ multifunctional protection relay.
Please read the user manual carefully, and carry out setting, testing and operation according to the User Manual. If some documents are provided together with SRP-MJ, they shall prevail.

Please test and check SRP-MJ with qualified testing instrument and equipment.
In case SRP-MJ has any abnormality, please contact our after-sales technical service.
Default password for SRP-MJ: **0000.**

We have checked this manual for consistency in describing hardware and software. Since it is impossible to eliminate errors completely, we cannot guarantee complete consistency. The data in this manual will be reviewed periodically and necessary changes will be made in the new edition of the document, and suggestions for changes are welcome. Changes in future editions will not be announced.

Contents

1. Introduction

1.1 Overview

SELECTRIC specializes in power automation for industrial users. To meet user requirements for low-voltage motor protection, measurement, and control, the company has developed the SRP-M series of low-voltage motor protection controllers.

The SRP-MJ low-voltage motor protection controller incorporates advanced network communication technologies. Operating in conjunction with contactors, soft starters, circuit breakers, and other devices, it provides a comprehensive package of professional solutions that integrate control, protection, measurement, metering, and communication for low-voltage AC motor circuits. It has replaced multiple separate protection controllers such as thermal relays, thermal protection controllers, leakage protection controllers, and anti-dry-running controllers. It has also replaced a vista of additional elements like time relays, intermediate relays, auxiliary relays, instruments, control and selection switches, indicator lights, programmable controllers, and transmitters. It is an ideal choice for intelligent MCC (Motor Control Center). It is applicable to numerous industries such as power, petrochemical, light industry, coal, paper-making, iron and steel, and metallurgy.

Table 1-1 Functions List

Function	Description
Protection function	Long Start Protection, Thermal Overload Protection (Inverse Time), Jam Protection, Ground Fault Protection, MTA Failure Protection, Phase Current Loss Protection, Current Imbalance Protection, Underpower Protection, Short Circuit Protection, Undervoltage Protection, Overvoltage Protection, Underload Protection, tE Time Protection, Overload Protection, Interlock Protection, Loss of Potential, Phase Reversal Protection, Closed-loop Abnormal Protection, Contactor Protection, Emergency Stop Alarm Protection, Contactor Failure Protection, Shunt Trip Unit, Contactor Position Abnormal Protection, Thermal Overload Pre-Fault, Residual Current Protection, Negative Sequence Overcurrent Protection, Temperature Protection.
Motor start control function	Direct-on-line Start, FWD/REV Start, Two-Speed Start, Reduce Voltage Start (Star-Delta Start, Resistance Start, Auto-transformer Start, Series-Reactor Start, Soft-start coordination), Variable-Frequency Drive, Large Motor Auxiliary Control, Undervoltage Restart Function, Power-On Automatic Start Function, Quick Restart Function, Start Control.
Measuring function	Three-phase Currents, Percentage of Three-Phase Current,

	Phase Currents, Zero Sequence Current, Current Imbalance, Three-phase Line Voltage, Three-phase Line Voltage phase angle, Three-phase total active power, Three-phase total reactive power, Three-phase total power factor, Frequency, Active Energy Import, Reactive Energy Import, Residual current, Temperature, etc.
Maintenance management function	Run state Indication, Device Running Time(total), Total Running Time of motor, Current Running Time of Motor, Total Stop Time of Motor, current Stop Time of Motor, Start Time, Start Current, Start Counter, Trip Counter, Three-phase Fault Current, DI/DO state Query, Alarm Query, Event Record, Fault Diagnosis, Start Report, Stop Report, Waveform Fault Record, Waveform Start Record, Waveform Record By Timer.
Communication function	Modbus Protocol, the maximum communication rate can reach 19,200 bps. PROFIBUS Protocol, the maximum communication rate can reach 1.5 bps. Supports standard PROFIBUS-DP protocol, which includes 1 USB Type-C port with Modbus RTU protocol support, configuration capabilities, and online firmware update functionality.

1.2 Functions

- Extensive metering, including: three-phase current, three-phase voltage, current/voltage phase angle, total active power, active electric energy, power factor, etc.
- Power quality monitoring function, which conduct harmonic analysis on three-phase voltage and three-phase current, up to the 31st harmonic.
- Protection functions. The product has abundant built-in protection functions, which can make selections to enable or disable protection as well as to set alarm or tripping.
- Phase sequence adjustment function, which supports the adjustment of voltage and current phase sequences to adapt to various wiring situations of drawer cabinets.
- It has a linked output function. When the protection logic is configured with a linked output, the linked output will also operate when the protection acts, and the broadening time of the linked output can be set, and you can choose automatic or manual return.
- The "tE Time Protection" complies with the national standard (GB3836.3) and is applicable to increased safety type explosion-proof motors.
- Contactor Protection function, which can judge the magnitude of the fault current, correctly detect the Overcurrent fault greater than the maximum breaking current of the contactor, control the circuit breaker to trip, making the field application more reliable.
- MTA failure protection function. An alarm signal can be sent out after the secondary disconnection of MTA, and it is possible to choose to block the phase failure protection and Current Imbalance Protection to prevent the protection from malfunctioning.
- "Anti-power sag" function, which can identify power sag events as short as 10 ms to ensure the continuity of the production process.

- Undervoltage Restart function, which enables the motor to restart under under-voltage conditions without using a UPS power supply, and can meet the requirements of restart motors in batches to ensure the safe and reliable restart of motors.
- Power-on self-start function. After a short power outage in the main circuit or power supply switching, time-sharing sequential start can be achieved according to the set parameters.
- A programmable logic function, which adopts a graphical logic setting interface, and has more than 40 kinds of logic controls available for selection to meet the needs of different control and protection logics.
- The AO output function, which can conveniently convert the measured quantities of the motor (such as three-phase current, average phase current, active power, zero-sequence current, residual current, average phase current, average line voltage, programmable data, etc.) into a direct current quantity of 4-20 mA, implementing the function of a conventional fully isolated transmitter.
- Complete control methods. Built-in control methods such as Direct-on-line Start, Step-down Start, Two-way Start, Two-speed Start, Frequency Conversion Start coordination, and auxiliary control for large motors. Simple settings can realize the logical conversion of different control functions, with high flexibility and universality.
- Additional residual current transformer, which can measure the residual current of the motor circuit, implementing the on-feeder monitoring of the insulation to the ground and the functions of Residual Current Protection and early warning.
- The SOE (Sequence of Events) recording function, which can record relevant data of protection action events, remote signal change events, operation events, and device self-inspection events, facilitating fault diagnosis. Further analysis of the SOE-recorded fault information can help diagnose the specific cause of the fault.
- The function of recording waveforms triggered by protection actions and motor start-ups, recording and storing data on motor start-up characteristics and protection fault characteristics, facilitating the analysis of characteristic curves during motor start-up or fault processes, and providing data support for the health state assessment of motors.
- A timed recording function, which records and stores key information data for easy reading by the master station software without losing historical data.
- A start-up report recording function, providing inquiries about start-up sources, start-up currents, start-up voltages, and start-up times. It also has a shutdown report function, providing inquiries about shutdown sources, three-phase currents, and shutdown times. It has a real-time state information recording and statistical function, facilitating the reasonable statistics of production efficiency.
- The display and indication are intuitive, and the operation is simple. It adopts a Chinese liquid crystal display, which can intuitively display and indicate various parameters, information, and states.
- Standard configuration with 5-way relay output functions (including 1 normally closed relay, 1 relay with an option of normally open or normally closed, and 3 normally open relays), and the outputs can be freely defined.
- The "DO start-up control" and "DO protection/shutdown control" are separated.
- Standard configuration with 8-way discrete input, which can be configured with extensive state and command signal functions.

- Optional 1-way or 3-way temperature detection function, which can directly sample the resistance value of thermal resistors, supports NTC as the type of thermal resistor, implementing temperature alarms for key element and parts in low-voltage distribution cabinets.
- Optional 2-way RS-485 communication interfaces, using the standard Modbus-RTU protocol, and the communication point table can be configured to efficiently improve communication efficiency.
- Optional 1-way PROFIBUS communication interface, supporting the standard PROFIBUS-DP communication protocol.
- Also, there is support of the standard Type-C communication port. It allows the device to be connected to a PC from the front panel to configure settings and read real-time data, historical data, SOE event logs, waveform analysis, and other information.

2. Technical specifications

2.1. Environment parameters

1) Operating temperature:	-25℃～+55℃
2) Storage temperature:	-40℃～+85℃
3) Relative humidity:	5%～95% (non-condensing)
4) Altitude:	3000m (max)
5) Atmospheric pressure:	70 kPa～110 kPa
6) IP rating:	IP40

2.2. Rated parameters

1) Power supply
Voltage range: 88 - 264V AC/DC
AC power supply frequency range: 47 - 440Hz.
AC power supply waveform: Sinusoidal, with the waveform distortion factor not greater than 5%.
DC power supply ripple factor: ≤ 5%.
Allowable power-off time: ≥ 30 s.
2) AC input
Three-phase current circuit (external thru-hole current transformer (MTA)): (800A, 400A, 300A, 100A, 25A, 5A, 1A) / 1.25VAC
Note: when using the MTA-1A or MTA-5A sensor to pass through the secondary circuit of a common 1A/5A transformer, the common transformer is required to meet the accuracy requirement of 5P10.
Residual current circuit (External through-hole residual current sensor (MIR)): 1 A / 1 V AC
AC voltage (line-to-line voltage): 690V/380V
Frequency: 50Hz/60Hz
3) Temperature sensor input
Temperature input type: supports NTC.
Resistant measurement range: 0 - 60kΩ.
Temperature measurement range: 0 to 150 °C
4) Discrete inputs
Power supply method: internal 24 V DC power supply, which can be connected to a 220 V AC/DC power source using the SRP-KI module. Debounce time: 20 - 9999ms, which can be flexibly set according to user requirements.
5) Digital input
a) DO1-DO4
Contact form: DO1 is normally closed, DO2 can be either normally open or normally closed, and DO3 - DO4 are normally open.
Contact rating: 250 V AC / 24 V DC, 10 A (max.)
Maximum breaking voltage: 400 V AC / 300 V DC

Breaking capacity: L/R = 40 ms, 10,000 times
220 V DC, 0.2 A
110 V DC, 0.3 A
48 V DC, 1 A
Operating time: < 10 ms;
Return time: < 5 ms
b) DO5
Contact form: normally open
Contact rating: 250V AC/30V DC, 5A (continuous)
Maximum breaking voltage: 277V AC/30V DC
Operating time: < 10 ms; Return time: < 5 ms
Notes:
DO1 - DO5 do not support the control voltage of 380V AC.
DO5 does not support the control voltages of DC110V/220V.
6) AO output
Output range: (4 - 20) mA
Load impedance: 750 Ω
7) Consumed power
AC voltage circuit: < 0.75 VA/phase (at rated value)
Device power consumption: < 5 W
8) Maximum Overload capacity
AC current circuit: 2 × rated current for continuous operation.
10 × rated current allowed for 10 s.
10 × rated current allowed for 10 s.
AC voltage circuit: 1.2 × rated voltage for continuous operation.
1.4 times the rated voltage, allowed for 10s.
1) Voltage measurement range: 10V - 828V (Line-to-line voltage), Accuracy: ±0.5%
2) Current measurement range:
Three-phase current: (0.05 - 1.2) times the rated current; Accuracy: ±0.5%
Residual current: 20mA - 1200mA, Accuracy: ±1.0%
1200mA - 5000mA, Accuracy: ±3.0%
(3) Measurement accuracy:
Active power: ±1.0%
Reactive energy: ±1.0%
Active energy: ±1.0%
Reactive energy: ±2.0%
Frequency: ±0.02Hz
Power factor: ±1.0% Analog output (AO): ±2.0%
Harmonics: Class B
Temperature: within the range of 15 - 80°C, ±1.0°C; within the range of 80 - 150°C, ±2°C

2.4. Protection accuracy

1) Operating value:
Current: ±50mA or ±2.5% of the set value

Voltage: ±1 V or ±2.5% of the set value
2) Operating time:
Definite time limit: within the range from 0 s to 3 s (including 3 s), not more than 40 ms; within the range from 3 s to 99.9 s, not more than ±1% of the set value.
Inverse time limit: within the range from 0 s to 3 s (including 3 s), not more than ±100 ms; over 3 s, not more than ±5% of the calculated value.
3) Reset ratio:
Overload protection: 0.95
Underload protection 1.05

2.5 Electrical insulation characteristics

1) Dielectric strength
Complies with IEC 60255-5:2000 (GB/T 14598.3-2006);
Power-frequency withstand voltage: 2 kV for 1 minute.
2) Insulation resistance
Complies with IEC 60255-5:2000 (GB/T 14598.3-2006);
Tested with a 500 V megohmmeter; the insulation resistance value must be at least 100 MΩ.
3) Impulse voltage:
Complies with IEC 60255-5:2000 (GB/T 14598.3-2006);
Withstands the impact of a standard lightning impulse with a peak value of 5 kV and a 1.2/50 μs waveform.

2.6 Mechanical properties

1) Vibration characteristics
Vibration response: complies with IEC 60255-21-1:1988, severity class 1.
Vibration endurance: complies with IEC 60255-21-1:1988, severity class 1.
2) Shock resistance
Shock response: complies with IEC 60255-21-2:1988, severity class 1.
Shock withstand: complies with IEC 60255-21-2:1988, severity class 1.
3) Collision
Complies with IEC 60255-22-1:1988, severity class 1.

2.7 Electromagnetic compatibility characteristics

1) Electrostatic discharge immunity
Complies with IEC 61000-4-2:2008, severity class 4.
2) Radiated radio-frequency electromagnetic field immunity
Complies with IEC 61000-4-3:2020, severity class 3.
3) Electrical fast transient/burst immunity
Complies with the regulations of IEC 61000 - 4 - 4:2012, with a severity level of 4.
4) Surge immunity
Complies with IEC 61000-4-5:2014, severity class 4.
5) Immunity to conducted disturbances induced by radio-frequency fields
Complies with IEC 61000-4-6:2013, severity class

6) Power-frequency magnetic field immunity
Complies with IEC 61000-4-8:2001, severity class 4.
7) Impulse magnetic field immunity
Complies with IEC 61000-4-9:2001, severity class 4.
8) Damped oscillatory magnetic field immunity
Complies with IEC 61000-4-10:2001, severity class [specify level]
9) Voltage dips, short interruptions and voltage variations immunity
Complies with IEC 61000-4-11:2020, severity class [specify level]
10) Ripple on DC input power port immunity
Complies with IEC 61000-4-17:2002, severity class
11) Damped oscillatory waves immunity
Complies with IEC 61000-4-18:2011, severity class 3.
12) Power-frequency immunity
Complies with IEC 60255-26:2013, severity class A.
13) Immunity to DC power supply voltage ramps / dips and rises
Complies with IEC 60255-26:2013.
14) Radiated emission limits, conducted emission limits
Complies with IEC 60255-26:2013.

3. Functions

The protection controller collects data such as electrical quantities and digital quantities related to the motor, conducts operational processing, and determines various operating conditions or faults during the motor's operation. Long Start Protection, Thermal Overload Protection (Inverse Time), Jam Protection, Ground Fault Protection, MTA Failure Protection, Phase Current Loss Protection, Current Imbalance Protection, Underpower Protection, Short Circuit Protection, Undervoltage Protection, Overvoltage Protection, Underload Protection, tE Time Protection, Overload Protection, Interlock Protection, Loss of Potential, Phase Reversal Protection, Closed-loop Abnormal Protection, Contactor Protection, Emergency Stop Alarm Protection, Contactor Failure Protection, Circuit Breaker InterTriping Contactor, Residual Current Protection, Negative Sequence Overcurrent Protection, Temperature protection, etc., so as to achieve comprehensive protection, monitoring, and (start-up) control of the motor, cut off faults at an early stage, reduce the maintenance time of the motor, and ensure safe production.

3.1. Protection functions

According to the different working conditions during the Start and running processes of the motor, the SRP-MJ has carried out relevant logical processing for protection and control functions in the principal design.

Table 3.1 The processing of protection & control functions during motor operation and start

Protection functions	Start process	Operating process
Long Start Protection	√	--
Thermal Overload Protection (Inverse Time)	√	√
Jam Protection	--	√
Ground Fault Protection	√	√
MTA Failure Protection	√	√
Phase failure protection	√	√
Current Imbalance Protection	√	√
Underpower Protection	--	√
Short Circuit Protection	√	√
Undervoltage protection	--	√
Overvoltage protection	--	√
Underload protection	--	√
tE Time Protection	--	√
Overload Protection	--	√
Interlock Protection	√	√
Temperature Protection	√	√

Loss of Potential	√	√
Phase Reversal Protection	√	√
Contactor Protection	√	√
Emergency Stop Alarm Protection	√	√
Contactor Failure Protection	√	√
Circuit Breaker InterTriping Contactor	√	√
Residual Current Protection	√	√
Negative Sequence Overcurrent Protection	√	√
Closed-loop Abnormal Protection	√	√
Contactor Position Abnormal Protection	√	√
Protection Block When Start	√	√
Undervoltage Restart Function	--	√

Notes: "√" indicates that the relevant protection and control functions are enabled, while "--" indicates that the relevant protection and control functions are disabled.

3.1.1. Auxiliary elements

Motor: with flow current judgement:

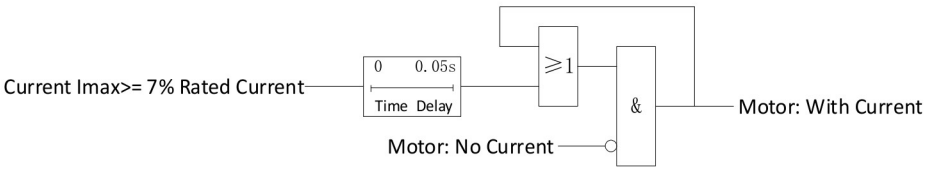


Figure 3.1-1 Judgement of current elements logic diagram

Motor: no flow current judgement:

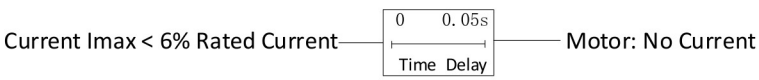


Figure 3.1-2 Judgement of no-flow current elements logic diagram

KM configuration enable judgement:

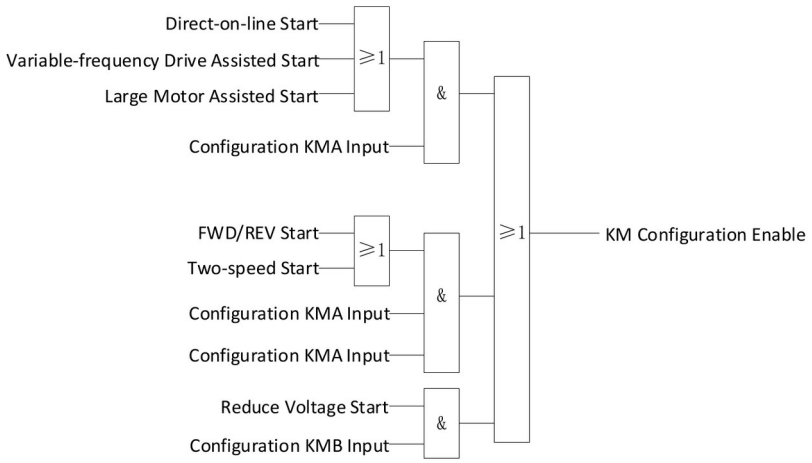


Figure 3.1-3 Logical diagram for KM configuration enabling decision KM status evaluation

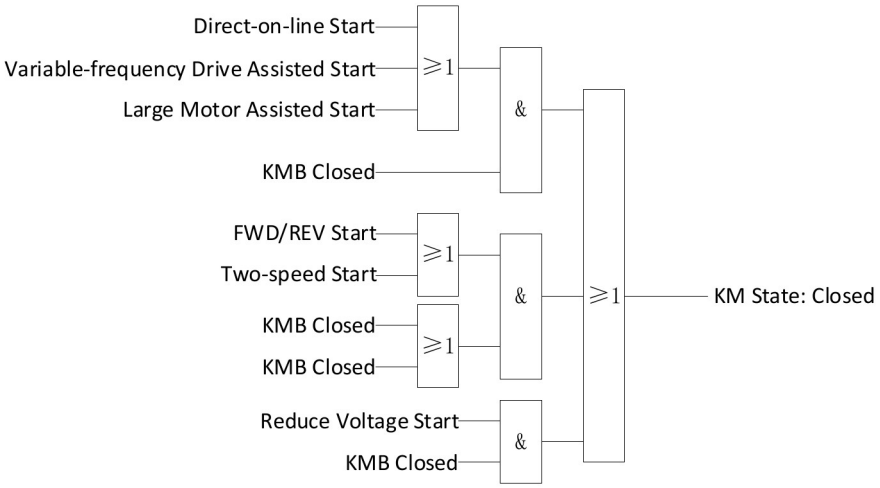


Figure 3.1-4 Logical diagram for KM status evaluation

3.1.2. Judgement of motor running state

The device automatically judges the motor state in two cases: MTA Connected (i.e., MTA Enabled) and MTA Not Connected (i.e., MTA Not Enabled.) When MTA Connected is enabled, the motor running state is judged by the current; when MTA is not enabled, the motor running state is judged by the KM state.

1. When MTA is connected, motor operation state judgement is made according to current.
Stopped state judgement:

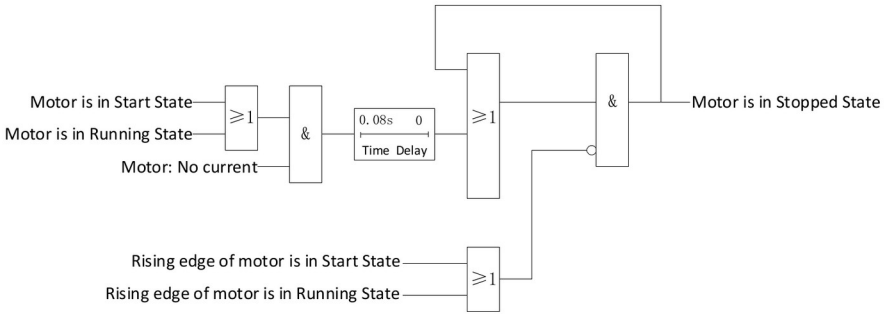


Figure 3.1-5 Stopped state

Start status evaluation:

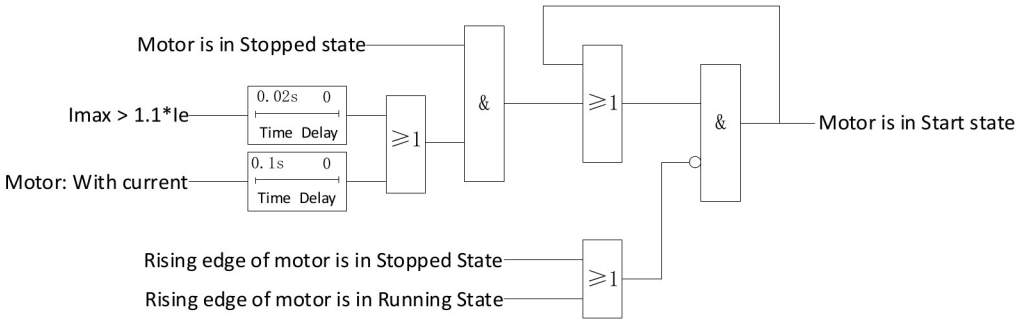


Figure 3.1-6 Start state judgement logic diagram

Start current judgement:

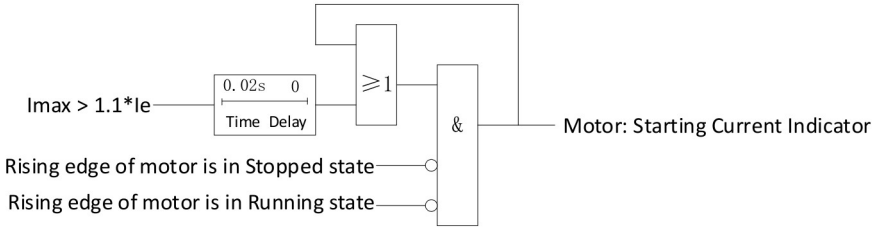


Figure 3.1-7 Starting current judgement logic

Running status evaluation:

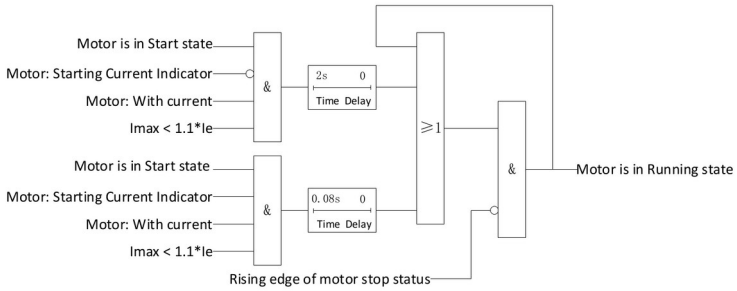


Figure 3.1-8 Operation state judgement logic diagram

2. When MTA is not connected, motor operation state judgement is carried out according to KM state.
Stopped state judgement:

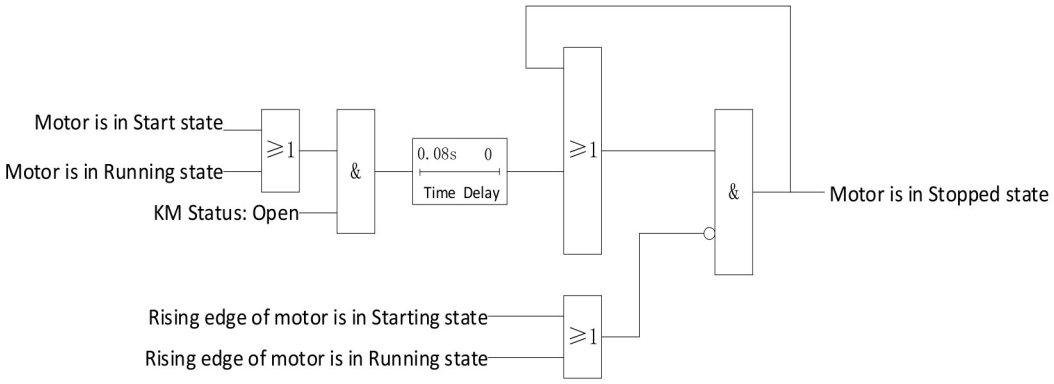


Figure 3.1-9 Stopped state judgement Logic Diagram

Start state judgement:

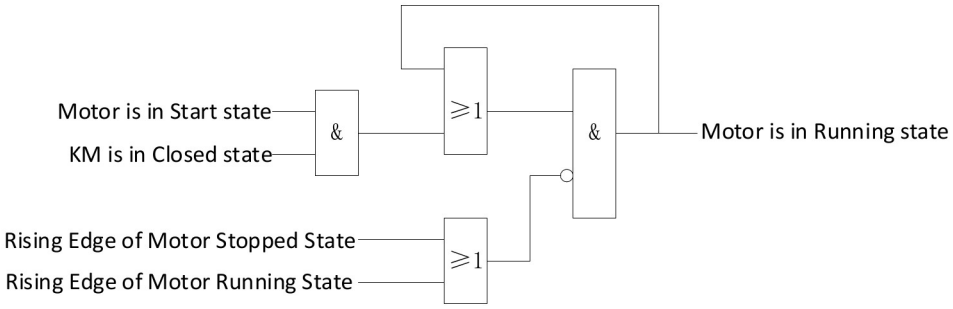


Figure 3.1-10 Start state judgement logic diagram

Operation state judgement:

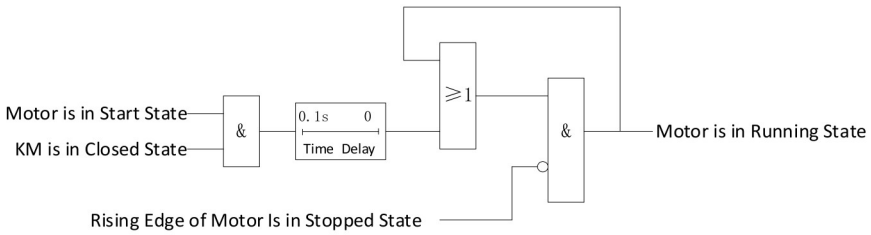


Figure 3.1-11 Operating state judgement logic diagram

3.1.3. Long start protection

The Long Start Protection is the motor Start process protection, which automatically exits when the motor is not in the start state. If the motor does not finish Start within the set start time, the protection will be activated.

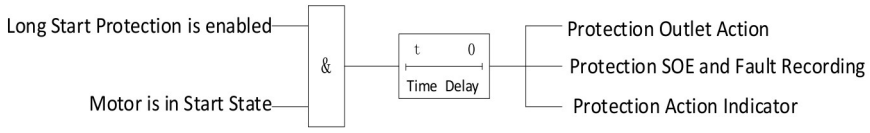


Figure 3.1-12 Long Start Protection Logic Diagram

3.1.4. Thermal overload protection (inverse time)

Digital thermal element is adopted to replace the conventional thermal element to realize protection against motor Overload heating, with inverse time limit characteristic. Users can select the appropriate protection action curve by changing the parameters. The Thermal Overload Protection (Inverse Time) action logic is shown in the following figure:

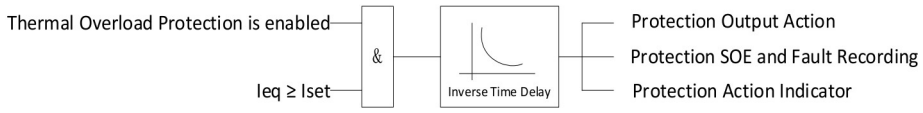


Figure 3.1-13 Thermal Overload Protection (Inverse Time) Logic Diagram

The thermal element is modelled as:

$$t = \frac{35 \times T_c}{\left(\frac{I_{eq}}{I_{ov}}\right)^2 - 1.05^2}$$

$$I_{eq} = \sqrt{K_1 \times {I_1}^2 + K_2 \times {I_2}^2}$$

Where:
T denotes the protection action time
Tc indicates the time factor (heating time constant)
Ieq represents the equivalent current of the motor
Iov represents the fixed value of protection current
I1 indicates the motor positive sequence current
I2 Negative sequence current of motor
K1 positive sequence current heating coefficient, cold process K1 = 0.5, hot process K1 = 1
K2 Negative sequence current heating coefficient, K2 = 6
The default motor cooling time is 4Tp. Tp is the protection action time when the motor is started from cold and the Start current is 7.2 times the rated current. For example, if Iov=1.0Ie and Tc=1.0s are selected, then Tp=1.41s.
This protection is designed with an Overload pre-warning function, and the pre-warning threshold can be set to 1%~99% of the thermal capacity of the Thermal Overload Protection (Inverse Time) action. When the accumulated thermal capacity of the motor operation is > the Overload pre-warning threshold, a pre-warning is prompted, and the remaining time T from the protection action is estimated according to the current value.
After the protection action, when the heat dissipation method is selected as equation, the heat is dissipated according to the model of heat dissipation equation, the device will calculate and display the remaining time for heat dissipation, and the protection returns when the thermal capacity of the system is less than the threshold value of heat dissipation; when the heat dissipation

method is selected as immediate heat dissipation, the protection will return immediately when the maximum value of the current is less than 0.95 times the current fixed value.
The resumption mode of Thermal Overload Protection (Inverse Time) can be set separately in the Thermal Overload Protection (Inverse Time) Configure Setup menu. If the function recovery mode is set to manual, the output must be manually activated after the protection activates. If the recovery mode is set to automatic, the output is automatically activated after the protection recovers. Generally, Iov is set to 1.0 times the rated motor current, and the corresponding Tc value can be set according to the nameplate data of the motor. For example, a motor nameplate specifies that when 7.2 times the rated current, the allowable running time is 8s, then the following table shows that the motor protection level is 10, and the Tc can be selected to be 6.5.

Refer to Table 5.5-1 Thermal overload protection (inverse time) action characteristic table.

Table 3.1-2 Motor time factors for various protection levels

GB14048.4 standard: Different protection levels of release time requirements					**Overload multiplier**
Overload factor Time factor Level of protection	1. 05	1.2	1.5	7.2	Iov=1.0Ie
10A	No action within 2h	Action within 2h	≤ 2 min	2s<Tp ≤ 10s	Tc=3.5
10			≤ 4 min	4s<Tp ≤ 10s	Tc=6.5
20			≤ 8 min	6s<Tp ≤ 20s	Tc=10.0
30			≤ 12 min	9s<Tp ≤ 30s	Tc=16.0

Note: if the Thermal Overload Protection (Inverse Time) fails to operate when the motor is started normally, it is recommended that the time factor value be set larger to avoid the abnormal start process; do not modify the protection current value arbitrarily, or the motor may be damaged due to the motor Overloading during operation but the Thermal Overload Protection (Inverse Time) fails to operate.

3.1.5. Jam protection

Jam Protection is a protection unique to motors. During the operation of a motor, if the motor shaft gets stuck due to excessive load or mechanical reasons of the motor itself, depending on its Overload capacity, it is allowed to operate for a short period of time. However, if the fault cannot be removed in a timely manner, it will cause the motor winding to be Overloaded, the insulation to degrade, and eventually the motor to burn out. The Jam Protection is only enabled when the motor is in the running state. Different from Short Circuit Protection, the characteristic of Jam Protection is that the current of the motor rises rapidly on the basis of the normal load current. After a jam occurs, the device will automatically identify and judge it. For the protection, three output modes can be selected: tripping, alarming or tripping + alarming.

The setting of the Jam Protection current can be adjusted according to half of the jam current indicated on the motor nameplate or set as 3.5 times the rated current (the jam current of a low-voltage motor is generally 7 times the rated current). The setting of the Jam Protection time can refer to the allowable jam time of the motor and is generally set as 0.9 times the allowable jam time.

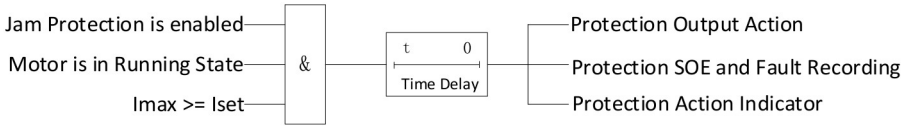


Figure 3.1-14 Jam protection logic diagram

Where Imax is the maximum three-phase current and Iset is the fixed value of Jam Protection current.

3.1.6. Ground fault protection

The Ground Fault Protection provides protection for motor ground fault, when the zero-sequence current is greater than the set value (Iset) and reaches the set delay time, the protection exits and operates.

The ground fault protection operating delay time is divided into "running delay" and "starting delay". When the motor is in running state, the Ground Fault Protection action delay time adopts “running delay time”; when the motor is in start process, the Ground Fault Protection action delay time adopts “Start delay time”.

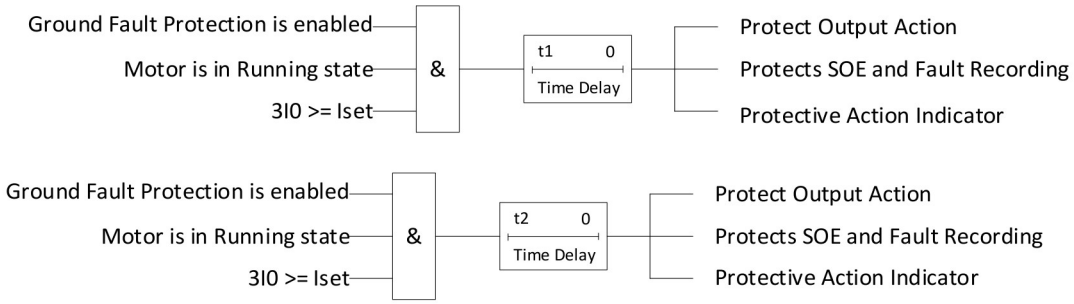


Figure 3.1-15 Ground Fault Protection Logic Diagram

Where 3I0 is the calculated zero sequence current, Iset is the fixed value of Ground Fault Protection current, t1 is the Start delay and t2 is the running delay.

3.1.7. MTA failure protection

Device current detection is realized by accessing the external MTA, if the MTA secondary side is disconnected, it may lead to Phase Current Loss Protection and Current Imbalance Protection false operation. Therefore, it is necessary to monitor whether the MTA is disconnected or not, and when the MTA is disconnected, it can be selected to block the Phase Current Loss Protection and Current Imbalance Protection.

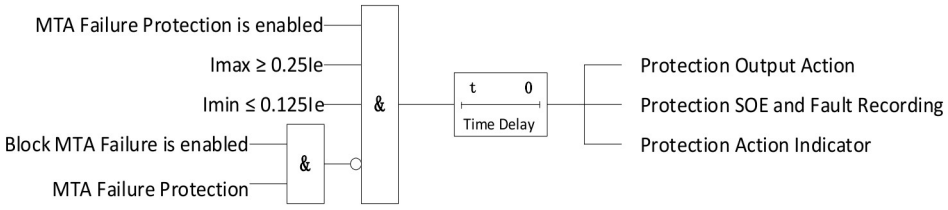


Figure 3.1-16 MTA failure protection logic diagram

3.1.8. Phase current loss protection

Nearly one-third of the low-voltage motor damage accidents are caused by phase break operation, and the Phase Current Loss Protection is set for this situation. The output mode can be selected as trip, alarm, trip + alarm.

In order to avoid the device external MTA disconnection caused by Phase Current Loss Protection failure, Phase Current Loss Protection supports MTA disconnection blocking function, to ensure the continuity of the process to the greatest extent possible, MTA Failure Protection starts to block the Phase Current Loss Protection.

Action conditions: three-phase maximum current ≥ 0.25*Ie, and three-phase minimum current ≤ 0.125Ie.

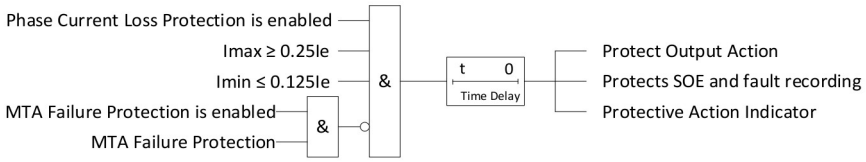


figure 3.1-17 Phase current loss protection logic diagram

3.1.9. Current imbalance protection

If the three-phase current is not symmetrical when the motor is running, there will be a large negative sequence current, and the negative sequence current will generate two times the industrial frequency current in the rotor, which will greatly increase the additional heat of the rotor and jeopardize the safe operation of the motor.

To prevent tripping of the external MTA caused by a false operation of the current imbalance protection, this protection features an MTA trip block function to ensure process continuity as much as possible. In this case, the MTA failure protection is initiated and starts to block the current imbalance protection.

When the current imbalance exceeds the allowable value, the protection will be activated after the set delay time.

The formula for calculating the Imbalance degree is as follows:

$$\frac{\max[(I_{\max}-I_{av}),(I_{av}-I_{\min})]}{\max(I_{av},I_e)}\times 100\%$$

Where Imax: three-phase maximum current; Imin: three-phase minimum current; Iav: three-phase average current; Ie: rated current of the motor.

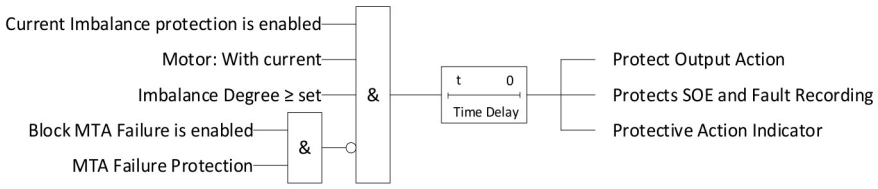


Figure 3.1-18 Logical diagram for current imbalance protection

where "set" is the fixed current imbalance threshold.

3.1.10. Underpower protection

Dry running of a magnetic drive pump or desynchronization between the internal and external magnetic rotors (due to demagnetization of the internal or external magnetic rotor, or other reasons) will lead to a low motor load, causing the current to drop. To ensure reliable operation of the magnetic drive pump, a motor low-load monitoring device is required. If operating conditions do not change, the low-loaded motor can automatically trip, stop, and simultaneously trigger audible and visual alarms. Underpower Protection is designed for this purpose, when the motor load power is lower than the Underpower fixed value, after the set delay time, the protection action. The protection can be set to trip, alarm, or trip + alarm.

The Underpower Protection function is only put into operation when the motor is in running state, and the function is blocked when the motor has no current or low voltage.

Furthermore, the protection power setting value supports negative values, which enables reverse power protection for special purposes.

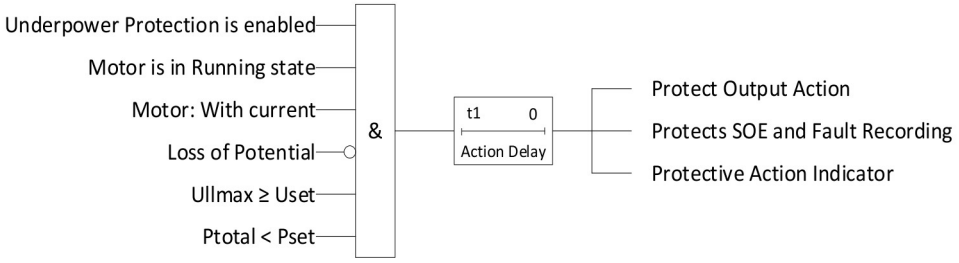


Figure 3.1-19 Logical diagram for underpower protection

Note: when the Underpower Protection is put into operation, make sure that the polarity and phase sequence of the three-phase voltage and current of the device are correct, otherwise the protection may be activated incorrectly.

When the Trip Contactor Protection Reset mode is set to “manual”, the Underpower Protection enables the Trip Contactor Protection Reset Delay Time. After the protection returns, the trip output will be restored after the set delay time, and the logic of Trip Contactor Protection Reset Delay Time is shown in the following figure:

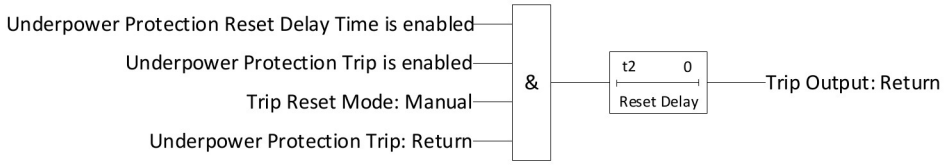


Figure 3.1-20 Trip contactor protection reset delay time logic diagram

3.1.11. Short circuit protection

Short Circuit Protection is a protection function set up to prevent the motor from causing serious consequences in case of phase-to-phase short-circuit and winding turn-to-turn short-circuit. When the current of any of the three phases exceeds the set value, the protection will be activated after a set delay time.

Short Circuit Protection is based on the judgement standard of reliably avoiding the start current of the motor to protect the safety of the power supply system. The Short Circuit Protection value can generally be adjusted to 1.2 to 1.6 times of the start current. In order to improve the protection sensitivity of the device short circuit protection, the short circuit protection start doubling function is added, during the start process, the fixed value of short circuit protection will be automatically increased by the corresponding multiple, and the fixed value will be automatically restored after the start is completed. The doubling value can be set from 1.00 to 2.00, and the maximum current value after doubling is 10 times the rated value of the external MTA (if the TA ratio is not 1, it needs to be multiplied by the corresponding TA ratio). The protection can choose three exit modes: trip, alarm, trip + alarm. The short circuit has a relatively high current, carefully consider the parameters of the contactor.

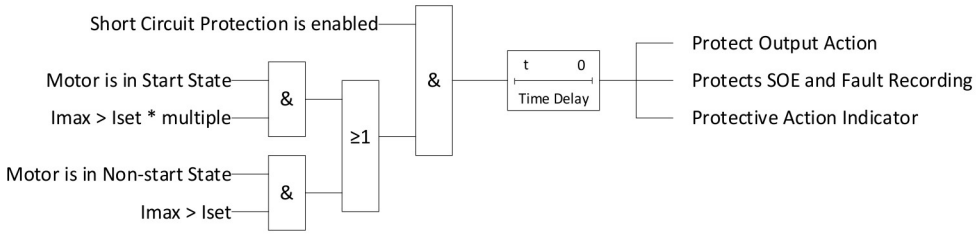


Figure 3.1-21 Short circuit protection logic diagram

Where Imax is the maximum three-phase current and Iset is the fixed value of Short Circuit Protection current.

3.1.12. Undervoltage protection

When the motor power supply voltage drops, the motor torque decreases quadratically; once the voltage drops to a certain level, the motor operation will be disrupted. Thus, to ensure the normal operation of critical motors, some non-critical motors shall be tripped, making it necessary to configure Undervoltage protection. When all three-phase line-to-line voltages drop below the operating threshold and the set delay time is reached, the protection activates. This device can be configured with a no-current block function. When the no-current block function is enabled, the Undervoltage protection will be blocked if there is no current flowing through the motor. In the event of a loss of potential, the Undervoltage protection will be blocked.

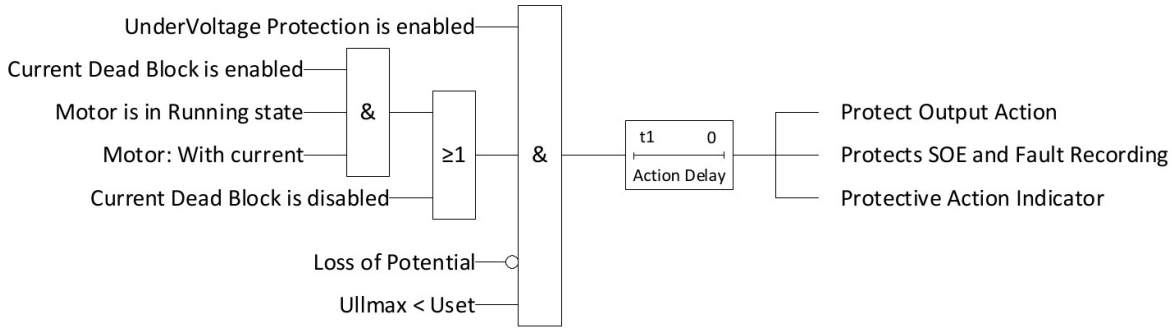


Figure 3.1-22 Undervoltage protection logic diagram

Where Ullmax is the maximum value of the three-phase line-to-line voltage, and Uset is the fixed Undervoltage protection threshold.

When the trip output reset mode is set to “manual”, the Undervoltage Protection supports the function of automatic reversion of tripping output delay time. After the protection returns, the tripping output will be restored after the set delay time, and the logic of tripping output delayed automatic restoration is shown in the following figure:

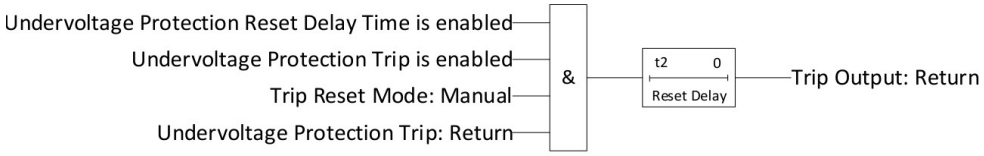


Figure 3.1-23 Delay auto reset logic diagram

3.1.13. Overvoltage protection

Overvoltage can lead to a degradation of the motor insulation characteristics. The device is equipped with an Overvoltage protection function, which is enabled only when the motor is running.
When the voltage exceeds the operating threshold, the protection activates. The protection can be set to trip, alarm, or trip + alarm.

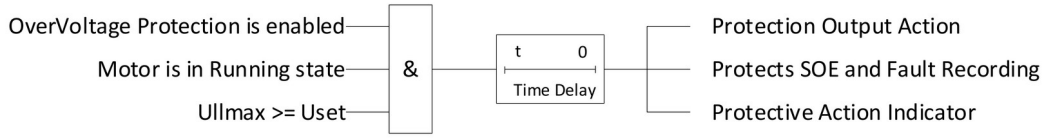


Figure 3.1-24 Overvoltage protection logic diagram

Ullmax is the maximum value of three-phase line voltage and Uset Overvoltage Protection fixed value.

3.1.14. Underload protection

During the operation of motor, due to the change of process conditions or load, sometimes the motor may work in light load or no-load state for a long time, while the equipment related to it is not allowed to work in light load state, Underload Protection is configured for this working condition. For example, in some motors such as (shielded pump) Underpower Protection action, the Automated Process Control System (APCS) will adjust the relevant parameters to restore the motor operating conditions, you can enable the automatic reversion function, after a set period of time reversion of the protection of the output, by the control system to start the motor again to restore the production process. Since the no-load current of the motor is about 30% of the rated current, the protection can be set arbitrarily within the range of 10%~100%.

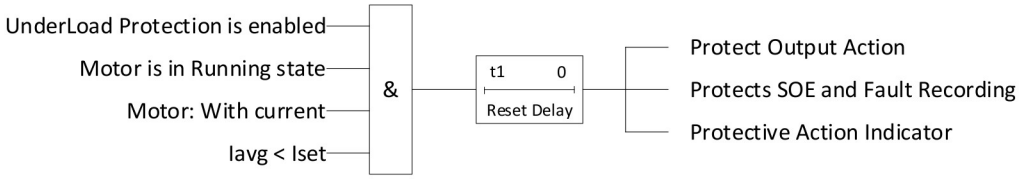


Figure 3.1-25 Underload protection logic diagram

Iavg is the three-phase average current, and Iset is the fixed value of Underload Protection current.

When the trip output recovery mode is set to "manual," the Undervoltage protection supports an automatic reset function for the trip output delay time. After the protection returns, it will return to the trip output after the set delay time, and the logic of automatic restoration of trip output delay is shown in the following figure:

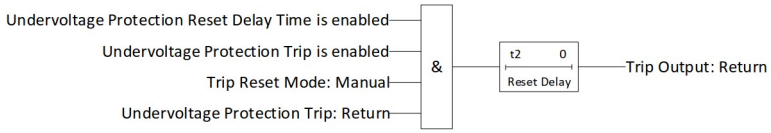


Figure 3.1-26 Logical diagram for automatic trip delay reset

3.1.15 tE Time protection

This protection is applicable to increased safety motors. The tE time refers to the period from the onset of the initial starting current Is (the maximum current at rated voltage and rated frequency supplied from the power line when the AC motor is in a stationary state) to rising to the limiting temperature, after the AC winding has reached a stable temperature for rated operation at the maximum ambient temperature. The tE time is specified by the motor manufacturer.

The tE Time Protection belongs to the overcurrent protection with inverse time limit, which starts from 1.2 times of the rated current. Equation (1) is used for 1.2Ie<Is<2Ie; Equation (2) is used for 2Ie≤Is≤7Ie; Equation (3) is used for Is>7Ie:

Tp refers to the tE time when the Start current ratio is 7. This value needs to be adjusted by the user. Setting range: 0.1s~99.9s.

The action characteristic curve is shown in Fig. 3.1-27, and the user can select the appropriate action curve according to the data provided by the motor manufacturer or the motor nameplate.

This protection is only put into operation when the motor is in running state.

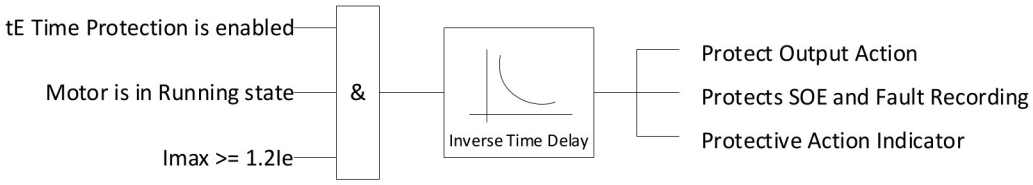


Figure 3.1-27 tE time protection logic diagram

Setting of Tp: the allowable blocking time of 7 times rated current is generally given for ampere motor, and the Tp value can be set to 85% of the allowable time, e.g., if the 7 times rated blocking time of an ampere motor is 6.0s, then Tp = 5.1 when setting this protection, refer to **the Table 5-2 for the characteristics of the tE Time Protection.**

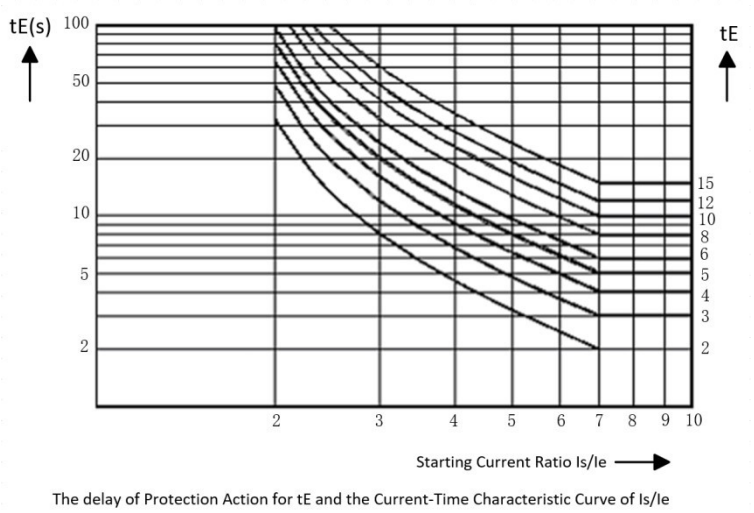


Figure 3.1-28 tE protection action time characteristic curve

3.1.16. Overload protection

When the motor runs over its rated value for a long period of time, it will cause Overloading of the motor, insulation degradation and burning of the motor.
Overload protection can be configured as: trip, alarm, or trip+alarm.
The allowable engine Overload factor is typically between 1.8 and 2.5, and the specific Overload setpoint can be adjusted according to the site operation requirements. Overload protection triggers 1.2 times more frequently when configured for alarm, and 1.4 times more frequently when configured for trip.

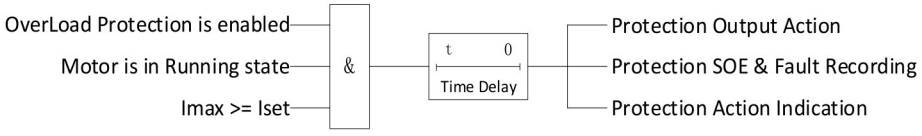


Figure 3.1-29 Overload protection logic diagram

Imax is the maximum three-phase current, and Iset is the Overload Protection current pickup value.

3.1.17. Interlock protection

This protection is used for Interlock Protection. A pair of passive contacts provided by the user to the SRP-MJ device is connected to the discrete input of interlock (to be configured), which will be activated after a set delay time. The discrete input type can be "normally open" or "normally closed" depending on the requirements. The protection can be set to trip, alarm, or trip + alarm.

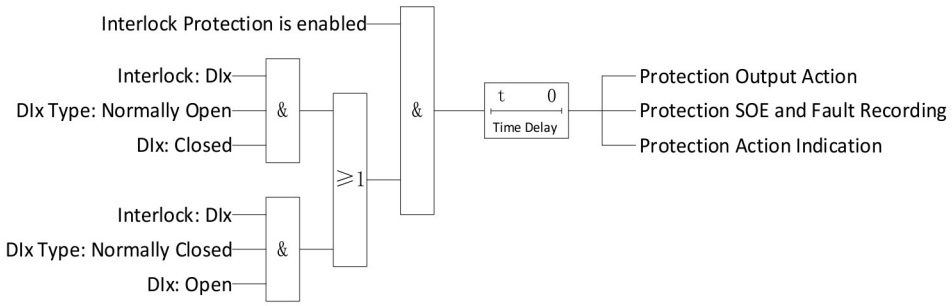


Figure 3.1-30 Interlock protection logic diagram

Note: multiple DIs can be simultaneously configured as process interlocks. As long as any of the DIs meets the function trigger conditions, the protection action conditions are considered satisfied and the delay time is initiated.

3.1.18. Loss of potential

This protection is used in the case of potential disconnection during motor operation. After a delay of 2s, an alarm signal and alarm message will be issued to prompt the user to carry out inspection.

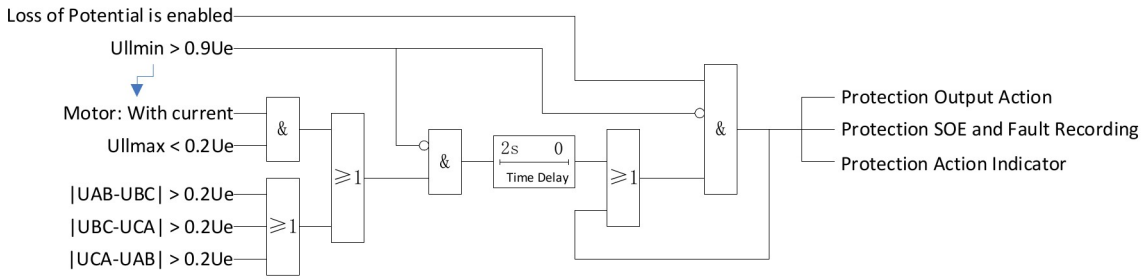


Figure 3.1-31 Loss of potential logic diagram

3.1.19. Phase reversal protection

This protection is used to detect the voltage and current phase problem of the motor to ensure the safe operation of the motor equipment. When the controller detects the wrong phase of the motor, the protection will act after a delay of 200ms. This protection can be set to trip/exit.

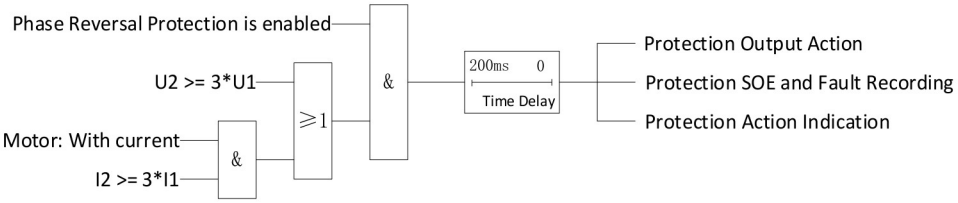


Figure 3.1-32 Phase reversal protection logic diagram

U2 is the negative sequence element of voltage, U1 is the positive sequence element of voltage; I2 is the negative sequence element of current, I1 is the positive sequence element of current.

3.1.20. Closed-loop abnormal protection

Closed-loop Abnormal Protection is mainly used to monitor whether the motor circuit is normal or not to protect the safety of motor equipment. The protection can be set to trip, alarm, or trip + alarm. The protection action conditions are described below:

Protection is blocked during engine startup and is activated only after the startup process control is completed.

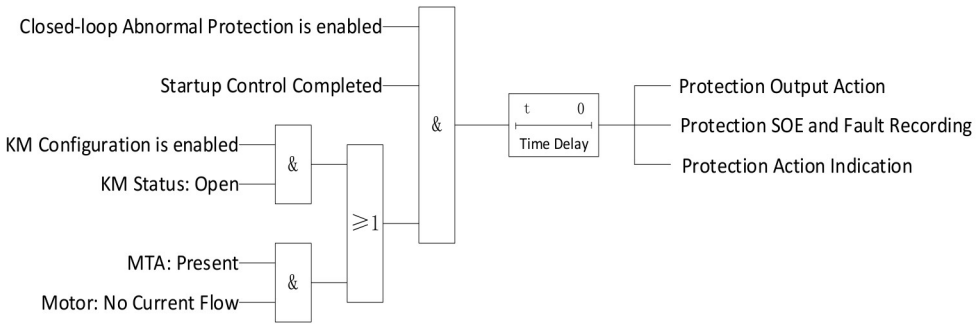


Figure 3.1-33 Closed-loop abnormal protection logic diagram

3.1.21. Contactor protection

Generally, the permissible breaking capacity of the contactor is 6~8 times of the rated current. If the fault current of the motor circuit exceeds the breaking capacity of the contactor, and the contactor still goes to disconnect the fault current, it will lead to the main contact of the contactor burning or pulling arc phenomenon, which will lead to the further expansion of the accident. When a fault occurs, the protection controller decides whether to disconnect the fault current by the contactor by determining whether the fault current of the motor circuit is greater than the maximum breaking current of the contactor. If the fault current is less than the maximum breaking current of the contactor, the protection action breaks the fault circuit by disconnecting the main contact of the contactor; if the fault current is greater than the maximum breaking current of the contactor, it breaks the fault circuit by driving the shunt coil of the circuit breaker, thus implementing more reliable protection. The Contactor Protection of the device can be put into and out of operation, and the maximum breaking current of the contactor can be adjusted by the user.

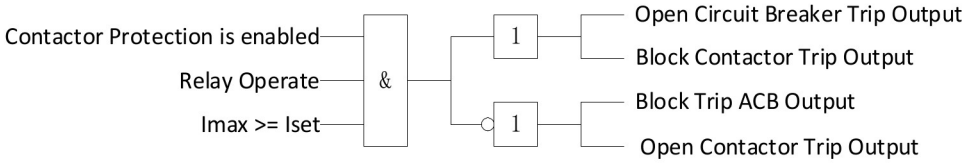


Figure 3.1-34 contactor protection logic diagram

3.1.22. Contactor position abnormal protection

The abnormal contactor position protection is mainly used to monitor whether the corresponding contactor status is normal or not when the motor is energized. If the contactor position does not match the actual operating state, an alarm message will be issued to remind the user to troubleshoot.

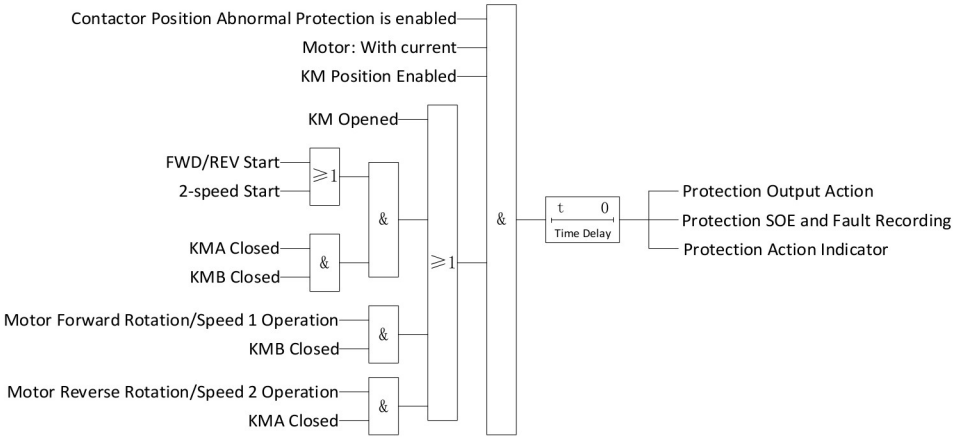


Figure 3.1-35 Contactor position abnormal protection logic diagram

3.1.23. Emergency stop alarm protection

This protection is used for the emergency stop process. A pair of dry contacts provided by the user for SRP-MJ is connected to the emergency stop DI. The emergency stop DI can be configured as normally closed or normally open. If the DI is normally closed, an alarm is triggered when the DI opens; if the DI is normally open, an alarm is triggered when the DI closes.

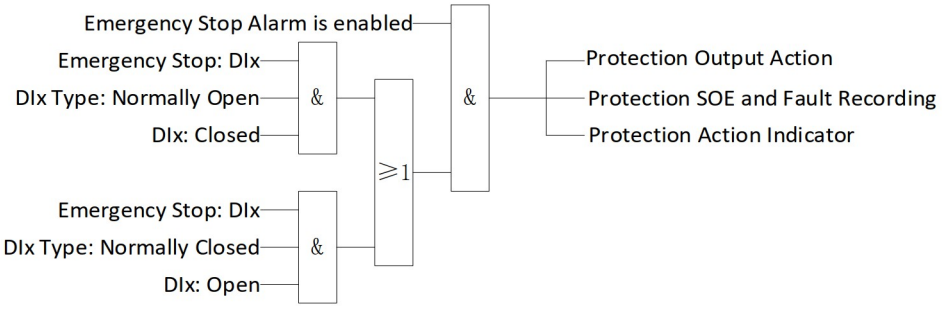


Figure 3.1-36 Emergency stop alarm protection logic diagram

Note: Multiple digital inputs can be simultaneously configured for the emergency stop function. In this case, if at least one DI meets the operating conditions, the protection will trip immediately.

3.1.24. Contactor failure protection

If an emergency trip occurs or normal operation is interrupted while the motor is running, and the contactor fails to respond, the motor will continue to operate under fault conditions, leading to further extension of the damage. The Contactor Failure Protection cuts off the fault circuit by driving the shunt coil of the circuit breaker after detecting the contactor refusal to trip, thus ensuring the safe operation of the motor more reliably.

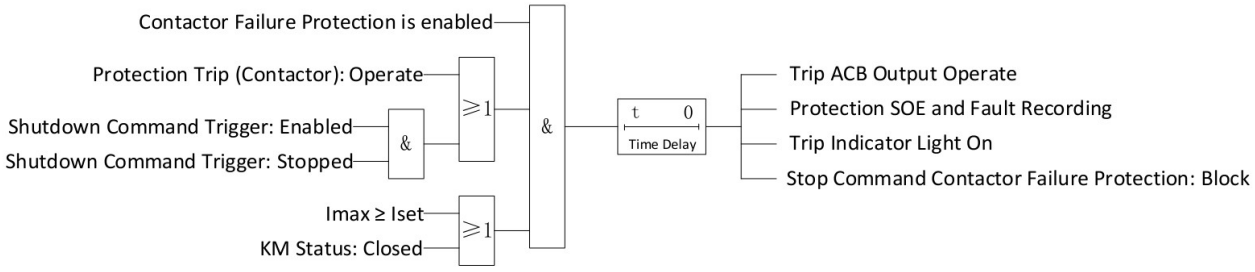


Figure 3.1-37 Contactor failure protection logic diagram

3.1.25. Circuit breaker InterTriping contactor

In field applications, the APCS usually confirms whether the motor has stopped based on the auxiliary contact of the contactor. When the contactor control circuit power is taken upstream of the circuit breaker, if the circuit breaker trips and stops the motor but the contactor fails to open, the contactor remains closed. In this case, the APCS will determine that the motor is still running based on the contactor status, which does not match the actual situation and causes process issues. The function of Circuit Breaker InterTriping Contactor is to simultaneously trip the contactor after the circuit breaker is tripped and after the set delay time, so that the contactor can correctly respond to the actual state of the motor to meet the needs of the process.

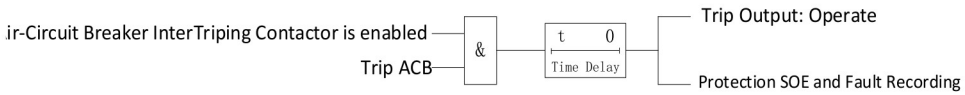


Figure 3.1-38 Circuit breaker InterTriping contactor logic diagram

3.1.26. Residual current protection

Residual Current Protection requires external dedicated residual current sensors, which determine whether to activate the residual current protection function by comparing the measured residual current value with the function setpoint. The Residual Current Protection function can provide more sensitive ground fault detection and is mainly used for non-direct Ground Fault Protection to ensure personal safety.

The residual current protection features a multiplication function during the startup process. During startup, the residual current protection setpoint is automatically increased by a corresponding multiplier, and then automatically restored once the startup process is completed. The setpoint multiplier can be adjusted in the range from 1.00 to 2.00, while the multiplied current setpoint can be up to 5 times the rated value of the external MIR.

Residual Current Protection is a two-stage protection, which can choose three modes: “trip”, “alarm” or “trip+alarm”.

The action logic diagram is as follows:

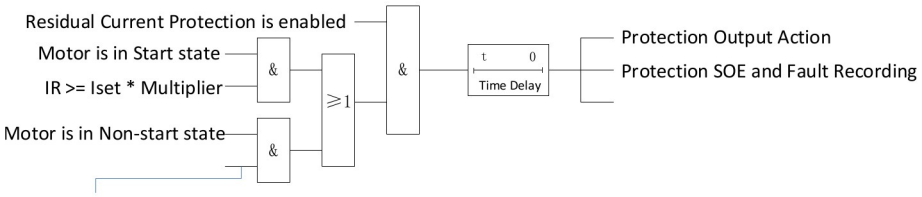


Figure 3.1-39 Residual current protection logic diagram

3.1.27. Negative sequence overcurrent protection

Negative Sequence Overcurrent Protection is mainly used to react to motor asymmetrical faults, phase breaks, phase reversal, turn-to-turn short circuit and asymmetrical Overload.

In order to prevent the Negative Sequence Overcurrent Protection from activating incorrectly during the Start process of the motor, the protection is set with two-time limits: the start state delay and the running state delay.

The start state delay time can be set to be greater than the motor start time, and the running state delay time can be set according to the actual permissible negative sequence overcurrent time of the motor.

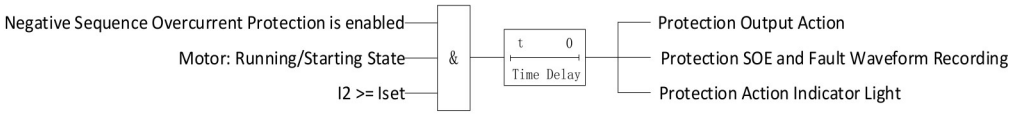


Figure 1-41 Negative sequence overcurrent protection logic diagram

3.1.28. Temperature protection

The device has a temperature protection function, which is used to monitor the temperature of key devices and parts in the low-voltage distribution cabinet to inmplement the protection of the motor. At the same time, the device has an internal algorithm for assessing short-circuit and open-circuit of temperature probes to avoid protection error due to hardware failure.

Each temperature protection is a two-stage protection, which can choose three modes: “trip”, “alarm” or “trip+alarm”.

The action logic diagram is as follows:

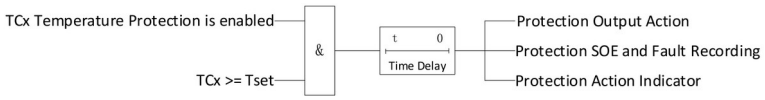


Figure 3.1-40 Temperature protection logic diagram

3.1.29. Function blocks during startup

"Protection blocking upon startup selection" is used to block selected protections during motor startup. The protection functions which can be blocked are: Thermal Overload Protection (Inverse Time), Jam Protection, Ground Fault Protection, Phase Current Loss Protection, Current Imbalance Protection, Underpower Protection, short circuit protection, Underload Protection, tE Time Protection, Overload Protection, Interlock Protection, Phase Reversal Protection, Residual

Current Protection, Negative Sequence Overcurrent Protection, etc. The protection logic is shown in the following figure.

The protection logic is shown in the figure below: when the motor changes from “non-start state” to “start state”, the selected protection is blocked, and the blocking time can be adjusted.

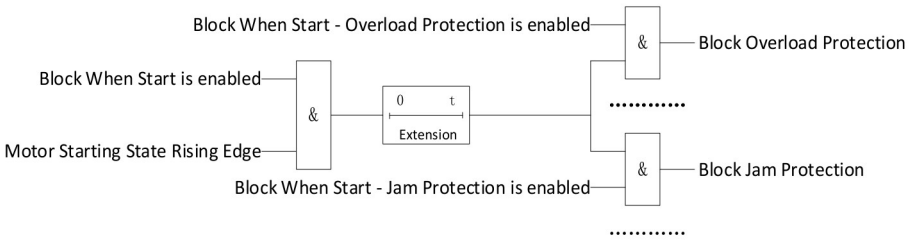


Figure 3.1-41 Protection function blocking during motor startup

3.2. Control functions

The protection controller can implement various motor startup control modes through appropriate configurations, and monitor the contactor operating status via the contactor auxiliary contact feedback to ensure reliable electrical interlocking.

3.1.2. Electrical interference protection function (anti-interference electricity function)

The protection controller supports the Anti-Interference Electricity function, which can release the AC contactor when the voltage drops suddenly for a short period of time, and then ensure the continuous operation of the motor after the power supply is restored, without restart process. The following figure shows the typical application schematic of the Anti-Interference Electricity function. When voltage sag occurs, DO3 (Start A output) closes immediately to ensure that the motor runs directly after the voltage sag is over, and it can recognize the voltage sag event of the system in 10ms at the minimum.

During the period of voltage sag, DO4 (motor running DO) can be kept closed and transmitted to the DSC system in parallel with the auxiliary contact of the contactor to ensure the continuity of the process during the voltage sag time.

Parameter configuration for Anti-Interference Electric and UnderVolt functions. Restart function and output configuration parameters along with rectification, rectification path:

Configure →Setup →Control Function →Undervolt. Restart Params.

The main parameters related to the electrical interference protection function:

Table 3.2-1 Description of parameters related to Anti-Interference Electricity function

Parameter name	Range	Description
Allowable time for voltage sag	0.00~9.99s	"0.00" indicates that the Anti-Interference Electricity function is disabled. If the motor voltage sag duration is within the allowable limit, the startup output will close directly upon voltage restoration, allowing the motor to restart immediately. If the motor's voltage loss time exceeds the

		allowable time for voltage sag, the motor's restart control shall be implemented according to the UnderVolt. Restart logic.
Pre-closure of start output	0: Disabled 1: Enabled	When the pre-closure of the start output is enabled, during the process of voltage sag, the start output of the controller will remain closed all the time. After the voltage recovers, the motor can be restarted in the shortest time possible. When the pre-closure of the start output is disabled, the controller will close the start output after confirming that the voltage has recovered.
Motor run DO Undervoltage time extension	0.00c~30.00 c	If it is required to maintain the motor run digital output closed during a voltage dip, the extended time can be configured to be greater than or equal to the allowable voltage dip duration.

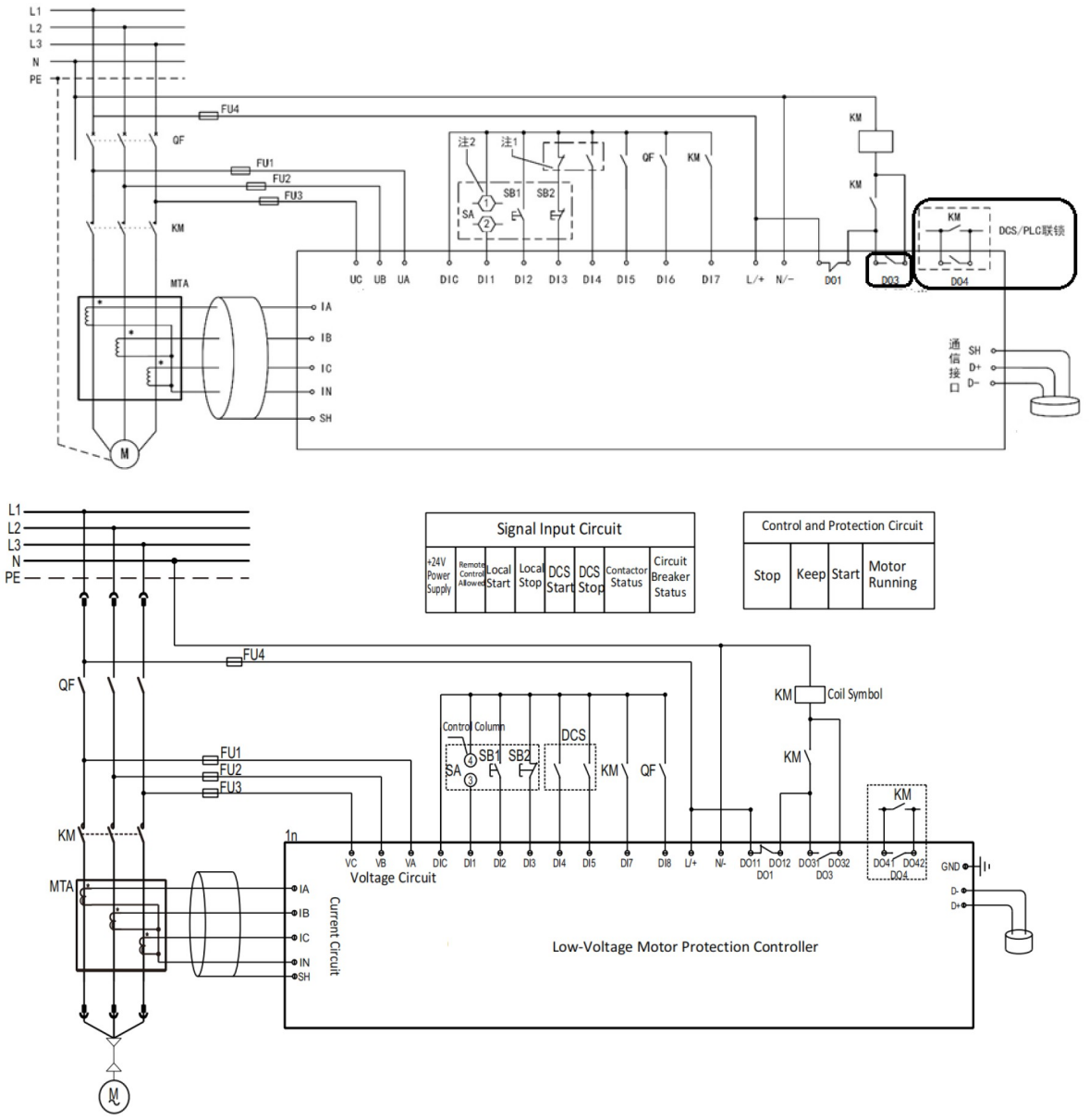


Figure 3.2-1 Anti-interference protection function

3.2.2. Undervoltage restart function

To minimize production losses, it is possible to quickly restart the motor after an Undervoltage event or disturbance. This function aims to allow low-voltage motors to restart within a predetermined time and in a specific sequence after voltage restoration. These abnormal voltage conditions can be caused by upstream short circuits in the system, external power grid outages, or simple automatic transfer switching (ATS) during selective substation secondary operations.
The relay detects the start of an Undervoltage event when Ullmax falls below the Dip Threshold and the end when Ullmin is equal to or above the Voltage Recovery. The relay can record an Undervoltage event with a maximum resolution of 10ms. To implement the Undervoltage restart function, the following parameters must be configured:

Table 3.2-2 Undervoltage (loss of voltage) restart function parameter description

Parameter name	Range	Description
Function Enable/Disable	0: Disabled 1: Enabled	Only when it is set to "Enabled" will this function be activated.
Restart Delay	0.1s~999.9s	This delay can be used to make the motors start in batches after the voltage recovers.
Undervoltage Allowed Time	0.5s~999.9s	Maximum allowable Undervoltage duration. Once the Undervoltage time exceeds this value, the restart will not be carried out. This time must be greater than the sum of the allowable voltage sag time and the restart-delay setting time. For example, if the allowable voltage sag duration is 1.5 seconds and the restart delay time is 0.1 seconds, then the allowable function time must be set to at least 1.6 seconds.
Dip Threshold	0.30Ue~0.95Ue	The threshold for determining Undervoltage.
Voltage recovery	0.80Ue~1.60 Ue	The threshold for determining voltage recovery.
Auxiliary DO	0~5	0 indicates that the auxiliary DO is disabled; 1 - 5 respectively represent choosing DO1 - DO5 as the auxiliary DO.
Auxiliary DO Operate Delay	0.0s~300.0s	After the voltage recovers, the Auxiliary DO will operate after this delay time (the delay time ≤ the restart delay time).

When the motor voltage (the minimum value of the three - phase line - to - line voltage) is lower than the restart loss of voltage pickup value, the protection controller starts timing.
The period from this point until the system voltage returns to normal (the system voltage is greater than the restart recovery voltage) is called the "motor Undervoltage (loss of voltage)" time.
The Undervoltage restart control process is mainly divided into three stages: the motor Undervoltage evaluation stage, the system voltage recovery evaluation stage, and the restart stage. The restart stage includes Anti-Interference Electricity start, Undervoltage restart, and Auxiliary DO control. The judgement logic of each stage is as follows:

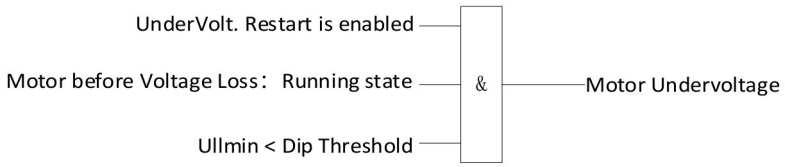


Figure 3.2-2 Motor undervoltage judgement logic diagram

System Voltage Recovery Judgement Stage:

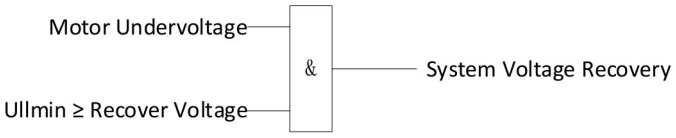


Figure 3.2-3 System voltage recovery judgement logic diagram

Restart Stage — Anti-Interference Electricity Start:

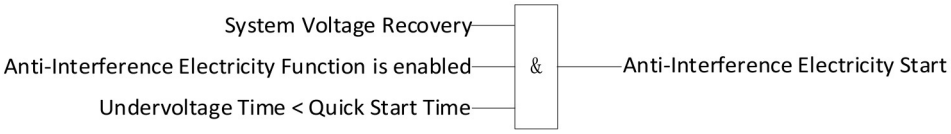


Figure 3.2-4 Anti-interference electricity start logic diagram

For Anti-Interference Electricity start, the corresponding start output will be directly actuated according to the start control mode, instead of sending a start command and start the motor through the start control logic.

Restart Stage — Undervoltage Restart:

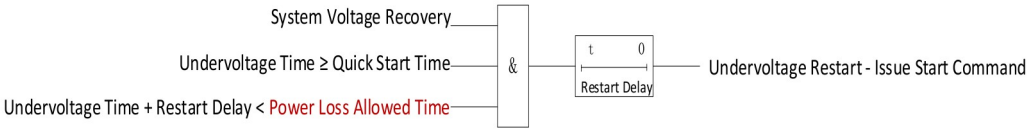


Figure 3.2-5 Undervoltage restart logic diagram

For Undervoltage restart, a start command is issued and the motor is started through the start control logic.

Restart Stage — Auxiliary DO Control:

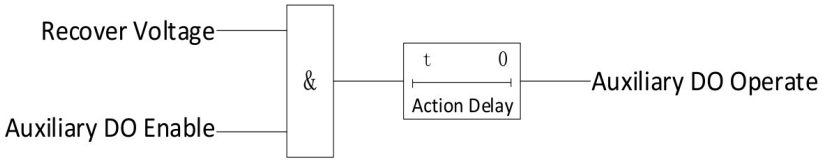
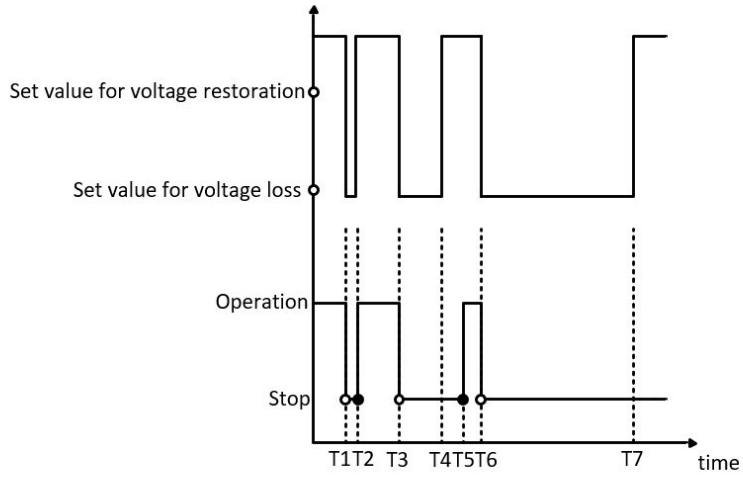


Figure 3.2-6 Auxiliary DO control logic diagram

The schematic diagram of Undervoltage restart is as follows:



T1-T2 Loss of voltage time is less than immediate start time

T3-T4 Loss of voltage time is less than immediate start time and less than the allowable power loss time

T4-T5 Start delay time

T6-T7 Power loss time is greater than the allowable power loss time

- ○ Loss of voltage action
- ● Restart

Figure 3.2-7 Schematic diagram of Undervoltage / loss of voltage restart

Example of auxiliary DO application:

In some projects, the motor protection controller is used in conjunction with a soft starter to control the motor. This soft-starter will send out a warning signal when it is powered off and then powered on again. If a start command is to be sent to it, a reset command must first be sent to reset the warning. The soft starter can be reset via the auxiliary DO. The Configure Setups are as follows:

1. Set the operating DO of the Auxiliary DO to: DO3.
2. Set the operating delay to: 0s.
3. Set the Undervoltage restart delay time to: 1.5s.

With the above configuration settings, upon system voltage restoration, the auxiliary DO3 will trigger immediately to reset the VFD and acknowledge the alarm; after a 1.5-second delay, the start command will be issued, and the VFD will start normally.

3.2.3. Power-on automatic start function

The device power-on auto-restart includes two auto-restart methods: device power-on auto-restart and motor power-on auto-restart.

1. Device Power-On Automatic Start Function: when the device power and the motor power are both taken from the same system power supply, the Device Power-On Automatic Start function can be used. During the device power restoration process, the controller will determine whether the device power-on auto-restart is enabled according to the system settings, and implement the auto-restart function with time splitting after the device power is restored.

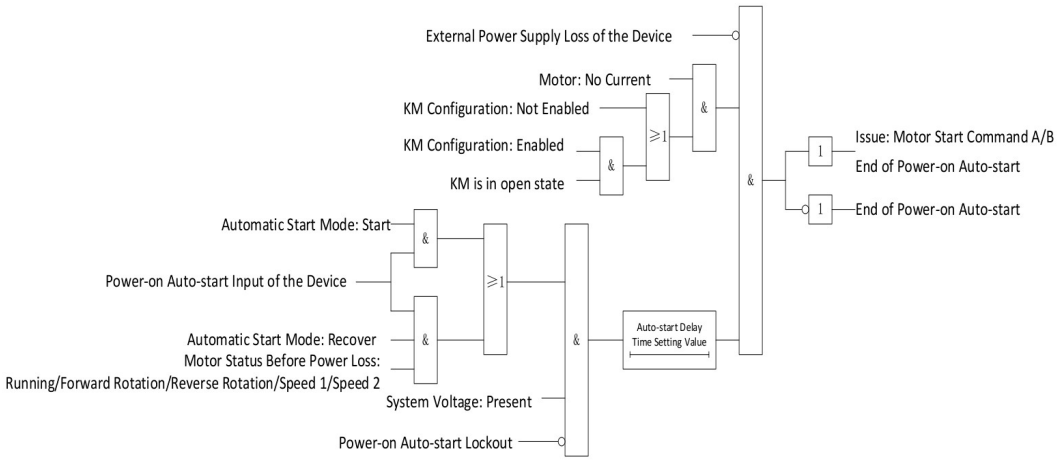
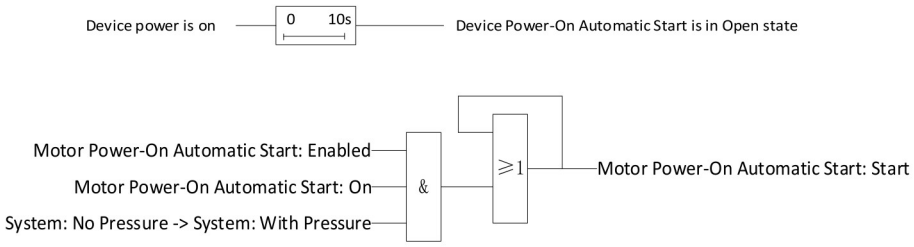


Figure 3.2-8 Logic diagram of motor power-on automatic start

If no voltage is detected within 60 seconds after the device is powered on, the device power-on auto-restart will be blocked.
When the following conditions are met, the controller will automatically start the motor after the set delay time.

1. The Device Power-On Automatic Start is enabled.
2. The Device Power-On Automatic Start is not blocked.
3. The automatic start mode is "start". Or when the automatic start mode is "recovery", the motor was in the running state before the power failure.
4. The system detects that there is voltage.
5. No current in the motor.

2. Motor Power-On Automatic Start Function: when the device power and the motor power are both taken from different system power supplies, the Motor Power-On Automatic Start function can be used to prevent the device from sending a Device Power-On Automatic Start command without delay when the system has voltage during the device power-on, which may cause the motors to start simultaneously and affect the stability of the system.
The Motor Power-On Automatic Start function will be enabled 10 seconds after the device power is powered on. During the enabling period, if the device detects that the system changes from no voltage to having voltage, the Motor Power-On Automatic Start will be activated.



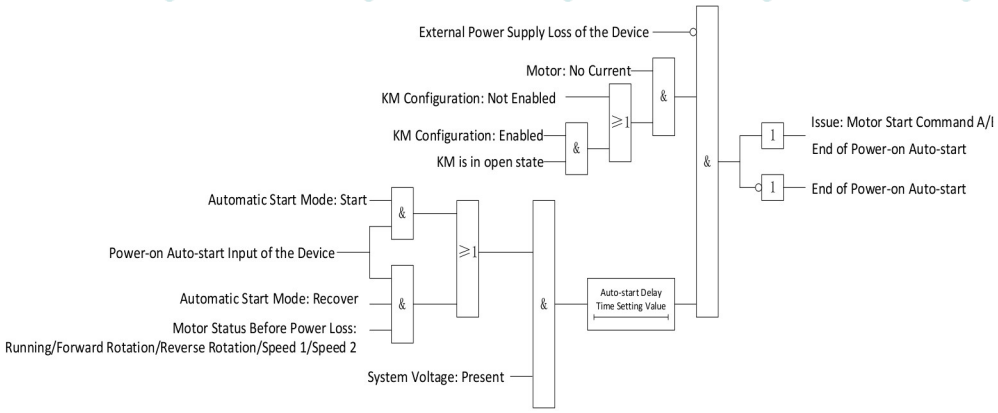


Figure 3.2-9 Motor power-on auto-restart logic diagram

When the following conditions are met, the controller will automatically start the motor after the set delay time.

1) The Motor Power-On Automatic Start is enabled.
2) The external power supply of the device is normal.
3) The automatic start mode is "start". Or when the automatic start mode is "recovery", the motor was in the running state before the power failure.
4) The system detects that there is voltage.
5) No current in the motor.

Notes:

1) When the automatic start mode is set to "start", regardless of the state of the motor before the power failure, the "start A" command will be sent after the power is on and the conditions are met; when the automatic start mode is set to "recovery", if the motor was in the running, forward rotation, or speed 1 state before the power failure, the "start A" command will be sent after the power is on and the conditions are met. If the motor was in the reverse rotation or speed 2 state before the power failure, the "start B" command will be sent after the power is on and the conditions are met. 2) The recovery voltage pickup value for Device Power-On Automatic Start is the same as that for Undervoltage restart. 3) The device power-on auto-restart delay does not include the device power-on initialization time.

3.2.4. Start interval control function

For high power motors, frequent Start and Stops of the motors will cause great damage to the motors and also bring relatively large impacts to the entire system. The start interval control function is to limit the number of motor starts within a certain period of time to ensure the safety of the system. The function includes startup control, start-stop control, and maximum number of starts control, which are described in detail below:

Start control function:

After the device detects one motor starting (meaning that the motor passes from the stopped state to the started state), it starts timing. During the starting interval time, the received start commands are invalid. This function can be enabled or disabled. When the starting interval time is set to 0, the function is disabled.

Start - Stop control function:

After the device detects one motor stop (meaning the motor passing from the started/running state to the stopped state), it starts timing. During the start-stop interval time, the received start commands are invalid. This function can be enabled or disabled. When the start-stop interval time is set to 0, the function is disabled.

Controlling maximum number of starts (max start count):

The start control function is implemented jointly by the Max Start Count and the interval period. During the interval period, after the number of motor starts reaches the set maximum Max Start Count, the received start commands are invalid. This function can be enabled or disabled. When the Max Start Count is set to 0, the function is disabled.

3.2.5. Motor control authority

The operation and control authority of SRP-MJ is in the "two-position" mode. The "two-position" control authority includes "local" control and "remote" control. The DI "local/remote" function can implement passage between the control modes. The logic of the control authority is shown in the following figure.

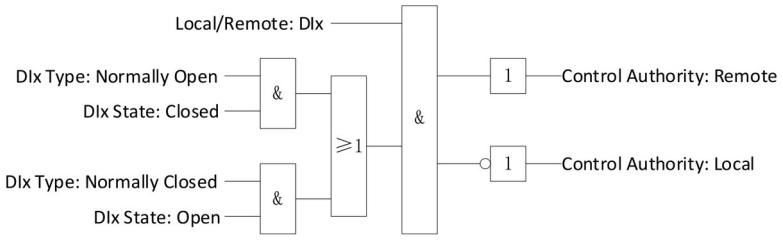


Figure 3.2-10 Logic diagram of motor control authority

The following gives a specific description of the DI control commands, panel control authority, and communication remote control operation authority.

➢DI Control Commands

DI control commands can be divided into three main categories based on control authority: local control commands: Local Start A, Local Start B, Local Stop, Local Forward - Braking, Local Reverse - Braking; remote control commands: Remote Start A, Remote Start B, Remote Stop, Remote Forward - Braking, Remote Reverse - Braking; full control authority commands: Emergency Start A, Emergency Start B, Emergency Stop, Stop Command, Forward - Braking, Reverse - Braking.

Local control commands are valid only when local DI control is enabled;

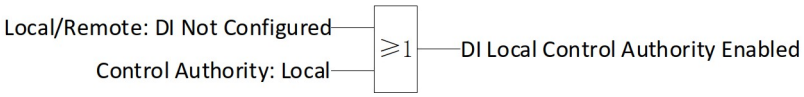


Figure 3.2-11 Logic diagram of local DI control enabled

Remote control commands are valid only when remote DI control is enabled;

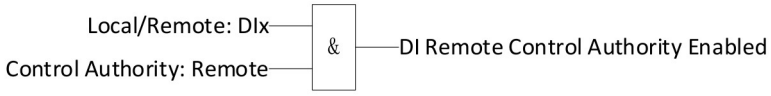


Figure 3.2-12 Logic diagram of remote DI control enabled

Full control authority commands are not restricted by DI control permissions and are valid under all modes.

➢ Panel control commands

The device panel features three buttons, namely "Start A", "Start B", and "Stop", which can be used to issue motor start and stop commands. The panel control authority can be set to prohibited/emergency/local/remote as required, and the authority restriction methods vary with different configuration parameters.

If the panel control authority is set to "prohibited", panel control is deactivated, and the panel button control becomes invalid;

If the panel control authority is set to "emergency", panel control is not restricted by authority and is valid under any authority level;

If the panel control authority is set to "local", it is valid only when the local panel control authority is enabled;

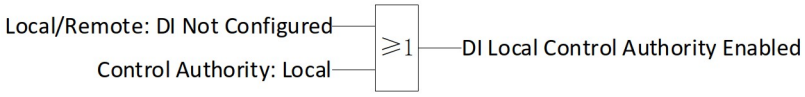


Figure 3.2-13 Logic diagram of panel with local control enabled

If the panel control authority is set to remote mode, it is valid only when the remote panel control permission is activated.

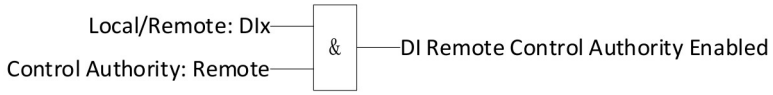


Figure 3.2-14 Logic diagram of panel remote control authority enabled

➢ Communication Control Commands

The device can receive remote control commands sent by the host computer through communication. The remote-control commands are valid only when the communication remote control authority input is enabled.

Figure 3.2-15 Logic Diagram of communication remote control authority enabled

Note: The logic of communication remote control authority enabled is different from that of panel remote control authority and DI remote control authority enabled.

3.3 Blocking of start

The protection controller can also implement various motor startup control modes through appropriate configurations, and monitor the contactor operating status based on the feedback from the contactor's auxiliary contacts to ensure the reliability of the electrical interlocking.

The start control function of the protection controller can be skipped on the spot, and the control of the contactor can be implemented through traditional external wiring. At this time, the protection device only uses functions such as protection trip and Undervolt. Restart. **See 6.1 Schematic diagram of direct start control wiring (without DI control).**

The motor start control methods have the following options:

- Direct-on-line start
- Reduced-voltage starting (including Y/Δ starting, autotransformer reduced-voltage starting, series reactor/resistor reduced-voltage starting, and coordinated control with a soft starter)
- FWD/REV Start
- Two-speed Start
- Variable-Frequency Drive Start
- Auxiliary for Large Motors

3.1.3. Blocking of start

When the device meets one of the following conditions, the start command will be blocked. Only in the absence of a blocked start command signal can the controller respond to a start command, activate the start port, and start the motor.

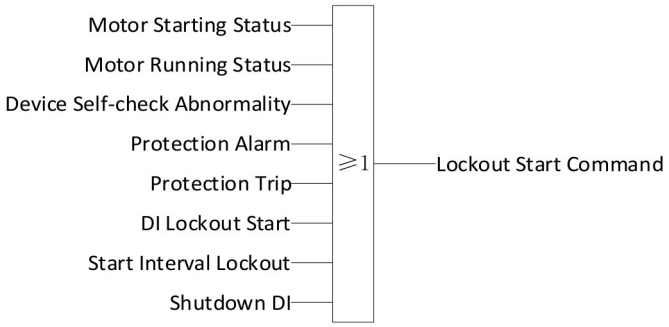


Figure 3.3-1 Logic diagram of start blocking

3.2.3. Direct-on-line start control

This device can control the start and stop of the motor through the digital inputs of the device, panel buttons and remote-control start. Upon receiving start A command, the start port contactor closes and the motor starts. Upon receiving the stop command, the stop port contactor closes and the motor stops. **See 6.2 Schematic diagram of direct-on-line start control wiring (with di control).**

3.3.3. Reduced-voltage startup control

At the moment of motor start, the start current is very large, which has an impact on the power supply network voltage. The start time of some motors is longer, and the harm is even greater. In order to reduce the impact caused by the motor start, a soft-starter and reduced-voltage start methods can generally be used. This function mainly targets the reduced-voltage start method and can achieve the following start methods: (Y/△ start) star - delta reduced - voltage start, autotransformer - reduced - voltage start, series - resistor/series - reactor - reduced - voltage start,

soft - starter start, etc. For various different start methods, the specific wiring may be different, but the control logic is the same. **See 6.3 Schematic diagram of star-delta reduced-voltage start wiring, 6.4 Schematic diagram of autotransformer - reduced-voltage start wiring, 6.5 Schematic diagram of reactor - reduced-voltage start wiring.**

The reduced-voltage start control process is divided into two stages: the reduced-voltage start evaluation stage and the full-voltage connection stage. Among them, in the full-voltage connection stage, the logic is different according to the different reduced-voltage start control start methods.

➢ Reduced-Voltage Start Judgement Stage

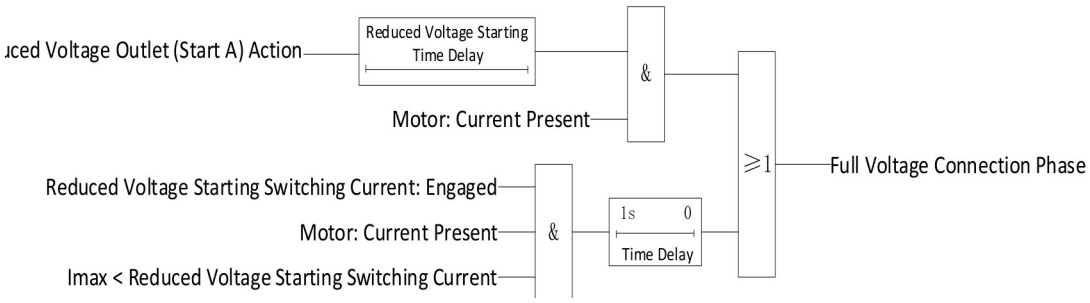


Figure 3.3-2 Logic diagram of reduced-voltage start judgement stage

After the start command A is given, the device start A output (Undervoltage output) is activated, the contactor closes for the Undervoltage start, and the motor starts. When the set **reduced-voltage delay time** is reached or the current switching conditions are met, if there is current, it enters the "full-voltage connection stage"; if there is no current, a warning message is issued and the start process is stopped at the same time.

➢ Full-Voltage Connection Stage (First trip, then connection)

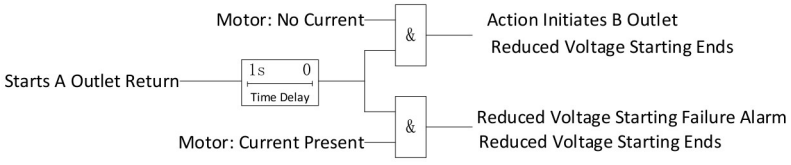


Figure 3.3-3 Logic diagram of full-voltage connection stage (first trip, then connection)

After entering the full-voltage connection stage, the start A output (reduced-voltage output) immediately trips. After a 1-second delay, if the no-current condition is met, the start B output (full-voltage output) is then closed and the reduced-voltage start process is completed. If the motor still has current, a warning message is issued and the start process stops at the same time.

➢ Full-Voltage Connection Stage (First connect, then trip)

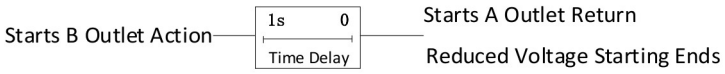


Figure 3.3-4 Logic diagram of full-voltage connection stage (first connect, then trip)

After entering the full-voltage connection stage, the start B output (full-voltage output) immediately actuates. After a 1-second delay, the start A output (reduced-voltage output) trips, and the reduced-voltage start process is completed.
Under the reduced-voltage start mode, in order to better ensure the continuity of the production process, it is expected that the full-voltage output can be directly closed to start the motor immediately when the motor experiences a short power dip. The reduced-voltage start control of the SRP-MJ device has the function of closing the full-voltage during power dips, which can implement the logic of directly closing the full-voltage output when start against power dips.

Note 1: for star-delta reduced-voltage start, the "first connect, then trip" mode is prohibited for the start method, otherwise it will directly lead to a short circuit accident!

The current switching condition means that during the reduced-voltage process, if the system has current and the current is continuously less than the set switching current for 1 second, it will switch to the full-voltage start process. The switching current value can be set, and the setting range is: disabled / 0.01 ~ 3.00Ie.

When adopting the reduced-voltage start control, it is necessary to refer to Table 4.4-6 to set the reduced-voltage start output expansion to "0.0s (hold)"; when testing the reduced-voltage start control function on site without a motor, it is necessary to set the system parameter "MTA Connected" to "none".

3.3.4. FWD/REV rotation control

In many cases, motors need to be frequently controlled to rotate in both directions. This protection controller is designed with this control function.
When the motor is in the stopped state, if the controller receives the "start A" command (forward rotation start), the start A output (forward rotation start) closes, causing the forward rotation start contactor to close, and the motor starts to rotate forward. When the controller receives the "start B" command (reverse rotation start), the start B output (reverse rotation start) closes, causing the reverse rotation start contactor to close, and the motor starts to rotate in reverse.
When the motor is in the forward rotation state, the controller will no longer respond to the "start A" command (forward rotation start). When the controller receives the "start B" command (reverse rotation start), the stop output acts to stop the motor. After the set delay time, the start B output (reverse rotation start) closes, causing the reverse rotation start contactor to close, and the motor starts to rotate in reverse.
When the motor is in the reverse rotation state, the controller will no longer respond to the "start B" command (reverse rotation start). When the controller receives the "start A" command (forward rotation start), the stop output actuates to stop the motor. After the set delay time, the

start A output (forward rotation start) closes, causing the reverse rotation start contactor to close, and the motor starts to rotate in reverse.
To prevent inter-phase short circuits, the start A output and the start B output will never close simultaneously under any circumstances. **See 6.6 Schematic diagram of FWD/REV start wiring.**

3.3.5. Two-speed start control

The logic of two-speed start is similar to that of FWD/REV Start in principle. In this control mode, there are two rated current fixed values corresponding to different speed operations. When the motor operates at different speeds, the controller will automatically switch different rated current setpoint values to ensure that all protection functions correctly protect the safe operation of the motor. **See 6.7 Schematic diagram of two-speed start wiring.**

3.3.6. Start control with a frequency inverter.

Before starting the frequency inverter, the cooling fan starts, and then the start command is executed. For turning off, the actions occur in reverse order. First, the switch actuates, and then, after a cooling period, the cooling fan stops.
The controller, upon receiving the start A command, starts the cooling fan first. When the set delay T elapses, it checks whether the cooling fan is closed and then starts the frequency converter to complete the control of the entire start process. Once the controller receives the stop command, it sends a stop command to the frequency converter to cut off the operation of the frequency converter first, and then delays to stop the cooling fan.
There are two methods to control the Start and Stop of the cooling fan. One is to use one DO of the "closing the cooling fan" output to control the Start and Stop of the cooling fan, and the second is to configure two DOs, namely the "cooling fan trip" output and the "closing the cooling fan" output for control. **See 6.8 Schematic wiring diagram for start control with a frequency inverter.**

3.3.7. Auxiliary starting means for a large motor

The logic principle for starting a large motor with a cooling fan is similar to the operation principle with a variable frequency drive. After the controller receives the start A command, before starting the large motor, the small motor is started first. After the set delay T, it detects whether the small motor is running, and then starts the large motor to complete the control of the entire starting process. After the controller receives the stop command, it first disconnects the operation of the large motor, and then delays to stop the small motor.
Similar to the operation with a variable frequency drive, there are two methods for controlling small motors. The operating mode is implemented in the same way as in the variable frequency drive mode.
See 6.9 Schematic diagram of large motor auxiliary start wiring.

Notes: In the variable frequency drive control and large motor auxiliary control modes, 1 DI must be configured as the status signal of the cooling fan (small motor). This DI state signal directly reflects whether the cooling fan (small motor) is in the running state or the stopped state. If it is detected that the frequency converter is in the running state while the cooling fan is in the stopped

state, a contactor state abnormal warning signal will be issued and the frequency converter will be tripped at the same time. If the controller detects that the large motor is in the running state while the small motor is in the stopped state, a contactor state abnormal warning signal will be issued. The contactor state abnormal warning can be configured, and it can be set to Configure Setup→Protection Parameters→Abnormal Contactor State in the menu parameters.

3.4. DI/DO function

SRP-MJ is typically equipped with 8 channels of DI and 5 channels of DO. All DI/DO can be freely configured to facilitate wiring and use.
The detailed configuration description of DI/DO can be found in Section 4.4.4.3.

3.5. Event record log

SRP-MJ device has an event record function, which can record the latest 64 protection SOE (Sequence of Events) event records and 64 other types of SOE event records, including remote signal change events, self-check events and operation events. The event records will be automatically numbered according to the order in which they occur, with the latest record numbered "01". When the number of records exceeds 64, the last record will be overwritten.
In the Event Record menu, the above types of event records can be viewed separately. As shown in Figure 3-61, it is the protection trip event record.

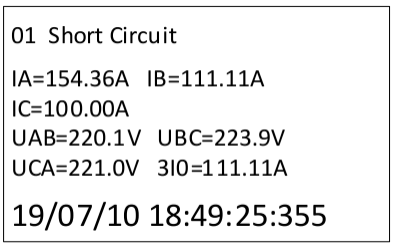


Figure 3.5-1 Display of protection event records

3.6. Timed recording

The timed recording function can be used for the accurate analysis of the motor's operating state and load. The data of timed recordings are all marked with date and time, which are provided for the MCC system to read, display and analyze. SRP-MJ supports 1 group of timed recording data, which will not be lost when power is off. Each piece of timed recording data includes three-phase line voltages, three-phase currents, total active power and time stamps.
The parameters for timed recording are set as follows:

1) Starting mode: start prohibited / direct start.
If the starting mode is set to "Start Prohibited", the time-based recording function will be disabled. If the startup mode is set to Direct-on-line Start, variable collection will start at the next time interval point after the setting.
2) Record mode: Record Area Full / Circular Recording.
When the recording mode is set to Record Area Full, the timed recording will automatically stop after recording 10,000 pieces of data once it starts. When the recording mode is set to Circular

Recording, after the timed recording records 10,000 pieces of data, new records will start to overwrite previous records from the first one.
3) Recording interval: The time interval that users can set is from 1s to 600s. For example, if the interval time is 60s, it means that a group of variables will be collected and recorded at intervals of 1 minute (for example, if Direct-on-line Start is successfully set at 09:59:30, variables will be collected at the following time points: 10:00, 10:01, 10:02,...).

3.7 Waveform recording

SRP-MJ device supports the functions of fault waveform recording and start waveform recording, and can record 16 pieces of fault waveform recording data, which are stored in non-volatile memory, and the 16 pieces of waveform recording data are stored in a circular and overwriting manner. The startup modes of waveform recording are: protection start, motor start, manual start, and logic programmable start.
Waveform capturing start modes: start protection, motor startup , manual start, and logic-programmable start.
Waveform recording duration: record the data 2 seconds before and 15 seconds after the start.
The waveform recording data: Three-line voltages, three phase currents and one zero-sequence current.

3.8 Communication point-to-point

The communication point-to-point of the SRP-MJ has the functions of uploading protection state, uploading remote signals and uploading telemetry, which can be used for background verification. During the testing process of the communication point-to-point function, the protection function and measurement function will not be executed. For the protection, self-check, alarm, remote signal and telemetry of the communication point-to-point, the internal logic functions of the device will not be executed. Only the change of the remote signal state bit in the communication protocol or the SOE event will be triggered.

3.9 Data transmission function

The SRP-MJ device has a non-stop transmission function. It can be operated through the human-machine interface to realize the function of transmitting the circuit breaker under the condition that the protected equipment is not powered off.
The SRP-MJ has a protection transmission function, which can be used to debug the device functions when it is inconvenient to add quantities on site. When the protection is enabled, the protection transmission acts according to the protection configuration; when the protection is disabled, the default is trip + alarm.
The SRP-MJ has a DI transmission function, and the DI state can be manually set for adjusting the control logic.
The SRP-MJ device has an output data transmission function. Such transmission can be used to check the trip output circuit on site, and the output contacts can be activated without protection tests.

3.10 Programmable logic function

The device supports the logic programmable language based on the IEC 61131-3 Function Block Diagram (FBD). By using the graphically logical editing software SRP-Designer independently developed by our company, rich custom logic functions that meet the actual application requirements on site can be realized.

Programmable logic includes two elements. One is what logical elements, also known as data tags, are available inside the device, and the other is what function block diagrams, also known as logical controls, are provided inside the device. Combining the two forms the custom logic function.

The SRP-MJ supports multiple logical elements, including: protection data elements, measurement data elements, inherent protection elements, input and output elements, basic logic elements, custom data elements, etc.; it also supports multiple logical controls, including: logical judgement controls such as AND, OR, NOT, logical operation controls such as addition, subtraction, multiplication, division, basic comparison controls, timer controls, connector controls, accumulators and other controls.

For the schematic diagram of making programmable logic using SRP-Designer, see Figure 3.10.

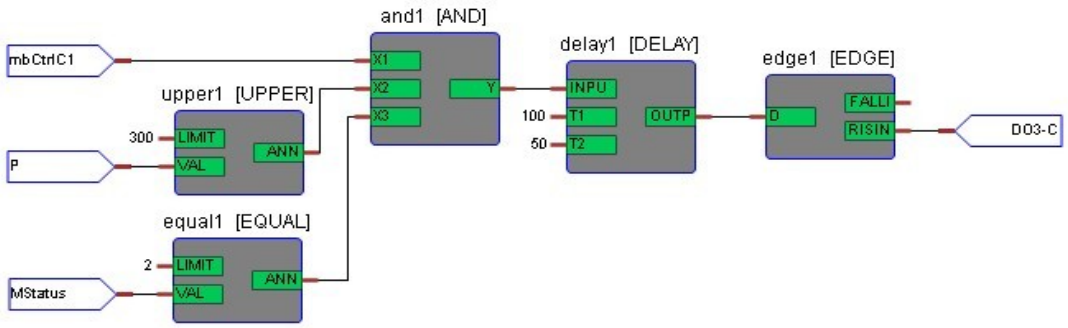


Figure 3.10 Schematic diagram of programmable logic

3.11. Motor operating state monitoring

The protection controller provides abundant motor operating information, including a variety of parameters and states. The monitoring data can be uploaded to the host computer through communication for centralized management and can also be directly displayed through the display panel of the device. This information includes electrical parameters, operating states, etc.

Table 3.11 Motor Operating State Monitoring Function Table

Motor operation monitoring items	Standard configuration	Standard configuration + AO (analog output)
Fault Information	★	★
Alarm Information	★	★
Three-phase Current / Current Phase	★	★

Angle		
Three-phase Voltage / Voltage Phase Angle	★	★
Power factor	★	★
Active Power / Reactive Power	★	★
Active Electric Energy / Reactive Electric Energy	★	★
Frequency	★	★
Calculated Zero-sequence Current	★	★
Temperature Protection Temperature Value	★	★
Residual current:	★	★

Note: the zero-sequence current is calculated via the vector sum of the three-phase currents.

3.12. Motor operation maintenance monitoring

The protection controller can provide real-time state information, fault analysis parameters and abundant daily maintenance monitoring information for motors, which is convenient for understanding the operation state of motors, counting production efficiency and knowing the operation life of contactors. It helps operators to achieve more economical and reasonable maintenance management.

Table 3.12 Device control information list

Info for controlling	Trip Current
	Trip Times
	Start Current (for the last start)
	Start time (for the last start)
	Start Times
	Total Running Time
	Current Running Time
	Total Stopped Time
	Current Stopped Time
	Total Running Time of the Device
	Alarm Information
	The latest 64 protection SOE (Sequence of Events) event records and 64 other types of SOE event records, including remote alarm,

	self-checking and operation events.
	The latest 64 start reports and 64 stop reports.
	The latest 16 waveform records.
	Pre-warning Time for Overheating (Overload)
	Remaining Heat Dissipation Time for Overload
	Thermal Capacity (Used Thermal Capacity)
	Input/Output state Monitoring

Note: The current running time refers to the motor continuous operating time recorded by the SRP-MJ device during the most recent run cycle. The timing starts when there is current in the motor and stops when there is no current in the motor.

3.13. Analog output function

The analog output (AO) of the device is an isolated 4-20mA DC current output, which can be associated with three-phase current, active power, residual current and zero-sequence current, equivalent to a conventional electrical quantity transmitter. The terminals are marked as (AO+) and (AO-). Setting the analog output requires setting three parameter items:

a) Variable selection: this parameter defines the electrical parameter proportional to the analog output. The available electrical parameters for selection are: three-phase current [Ia, Ib, Ic], three-phase total active power [P], residual current [IR], zero-sequence current [3I0], average phase current [Iavg], average line voltage [Ullavg], programmable data [VARA1].

b) Zero scale value: this parameter corresponds to the electrical value when the initial analog output (4 mA) is generated. The setting range is -999999 to 999999.

c) Full scale value: this parameter corresponds to the electrical value when the analog output reaches its full-scale value (20 mA). The setting range is 999999 to 999999.

d) The above three parameter items can be set through the panel or through the communication port using dedicated software.

⚠ **Analog output (AO) of the SRP-MJ device features an integrated 24 V DC power supply, therefore the connected analog input (AI) (for instance APCS) shall not have own supply source. Pay attention to reasonable selection and relevant use.**

3.14. Start/stop report recording function

SRP-MJ supports start report and stop report functions. Start/stop report records help operators easily maintain and manage motors.

3.14.1. Starts record

The SRP-MJ provides start report records that log detailed motor startup information (the startup signal source, maximum current during startup, minimum voltage during startup, startup duration, and startup time). This data is retained upon power failure, the non-volatile memory stores up to 64 records. Retrieving start report records from Menu Event Log → Startup report as shown in Figure 3.14-1. When the start is triggered by the panel, in this motor start, the maximum current (Imax) during the start process is 974.21A, the minimum voltage (Umin) during the start process is 342.50V, the time used in the start process is 15.5s, the start occurrence date is 2020-05-30, and the start occurrence time is 13:38:42:657. By querying the start report records, the motor start information can be understood in detail, which is convenient for motor maintenance and control. Startup sources include: panel start, DI1 - DI8 start, start via Modbus, voltage sag start, and Undervoltage start. Restart, self-start when powered on, start triggered by a non-local device.

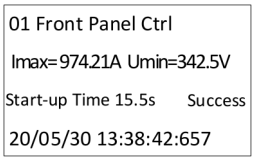


Figure 3.14-1 Display of start report records

3.14.2 Stops report

The SRP-MJ provides stop report records, which record the motor stop information in detail (stop signal source, three-phase currents before stop, stop occurrence time). This data is saved when power is off, and up to 64 records can be provided. The stop report records can be queried in the event record stop report menu, as shown in Figure 3.14-2. A stop operation is triggered from the panel. By querying the stop report records, the motor start information can be seen in detail, which is convenient for motor maintenance and control.

The stop sources include: panel stop, stop by DI1 - DI8, stop via Modbus, stop triggered by a non-local device, stop due to loss of voltage, stop due to control parameter update, stop due to bidirectional switching, stop due to two-speed switching, stop due to protection trip.

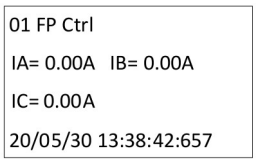


Figure 3.14-2 Display of stop report records

3.15. Device self-check function

The SRP-MJ can poll each key element when powered on or during operation to determine whether it is normal. If a certain element is abnormal, the alarm light will stay on constantly, and the self-check abnormal information will pop up on the interface, and all protection functions will be disabled.

Explanation: if the self-test alarm output is configured, the self-test alarm output will be activated after a successful self-test. If the check fails, the output will be deactivated.

3.16. Self-Diagnosis of wiring

The device has its own voltage and current wiring diagnosis function, which is used for wiring fault detection and troubleshooting. The description of wiring faults is shown in Table 3.16-1, Query Voltage and Current Wiring Diagnostic Results from Menu Device Maintenance and Diagnostic Information.

Table 3.16-1 Description of wiring faults diagnostics

Fault Type		Description
Voltage	Normal	The three-phase voltage wiring is normal.
	Phase Sequence Error	The reverse phase sequence of the three-phase voltage is detected, which is caused by the reversal of any two phases among UA/UB/UC.
Current	Normal	The three-phase current wiring is normal.
	Phase Sequence Error	The reverse phase sequence of the three-phase current and abnormal voltage wiring are detected, which is caused by incorrect routing of any two phases of the primary cables of IA/IB/IC in the MTA or the reversal of any two phases of the secondary lead-out wires IA/IB/IC of the MTA.
	IA and IB are reversed	Both incorrect routing in the main circuit and incorrect wiring of the secondary lead-out wires of the MTA may lead to this problem. In particular, the primary cable of phase A in the main circuit is routed into phase B of the MTA, and the primary cable of phase B in the main circuit is routed into phase A of the MTA; or the secondary lead-out wire of phase A of the MTA is connected to the terminal of phase B of the device, and the secondary lead-out wire of phase B is connected to the terminal of phase A of the device.
	IB and IC are reversed	Both incorrect routing in the main circuit and incorrect wiring of the secondary lead-out wires of the MTA may lead to this problem. In particular, the primary cable of phase B in the main circuit is connected into phase C of the MTA, and the primary cable of phase C in the main circuit is connected into phase B of the MTA; or the secondary lead-out wire of phase B of the MTA is connected to the terminal of phase C of the device, and the secondary lead-out wire of phase C is connected to the terminal of phase B of the device.
	IC and IA are	Both incorrect routing in the main circuit and incorrect

	reversed	wiring of the secondary lead-out wires of the MTA may lead to this problem. In particular, the primary cable of phase C in the main circuit is connected into phase A of the MTA, and the primary cable of phase A in the main circuit is routed into phase C of the MTA; or the secondary lead-out wire of phase C of the MTA is connected to the terminal of phase A of the device, and the secondary lead-out wire of phase A is connected to the terminal of phase C of the device.
	IA, IB, IC Incorrect Direction	The primary cables of IA/IB/IC are not routed into the MTA according to the marked routing direction.

3.17. Fault diagnostics function

This function conducts further analysis based on the SOE (Sequence of Events) information recorded by the SRP-MJ device to obtain more detailed and specific fault results, so as to facilitate onsite fault handling. For example, in the SOE display example in Section 4.4.5, the short - circuit protection alarm SOE information and the corresponding fault diagnosis information are provided. The protection and control functions that support fault diagnosis include: phase loss protection, ground protection, short-circuit protection, phase - sequence protection, Undervoltage restart, etc.

3.18. Phase-sequence adjustment

The phase-sequence adjustment function can achieve the adjustment of current direction, current phase-sequence adjustment and voltage phase-sequence adjustment, which is used to solve the problem of abnormal onsite wiring. Connection error troubleshooting information is shown in Table 3.18-1: Configuration System parameter through the corresponding menu in Configure Setup.

Table 3.18-1 Phase Sequence Adjustment Description

Phase sequence Adjustment type		Phase sequence adjustment content
Voltage	Phase Sequence	ABC/CBA
Current	A-phase Current Direction	Forward / Reverse
	B-phase Current Direction	Forward / Reverse
	C-phase Current Direction	Forward / Reverse
	Phase Sequence	ABC/CBA/ACB/CAB/BAC/BCA

3.19. Communication function

The motor protection controller can communicate with the host computer control system through the communication interface to achieve the data transmission function. It can adopt the RS485 communication interface and use the standard Modbus-RTU protocol for communication. Alternatively, it can also choose the standard PROFIBUS interface and support the standard PROFIBUS-DP protocol. The Type-C communication interface supports the standard Modbus-RTU communication protocol. When connected to a PC, it can implement functions such as adjusting configuration, data reading and online upgrading.

SRP-MJ supports the customized function of the Modbus communication point table, enabling free definition of data registers. For real-time data with discontinuous register addresses, by utilizing the custom communication mapping table function and configuring parameters appropriately, all data can be read in a single frame, thereby reducing the required communication time.

3.20 Online upgrade function

SRP-MJ supports the online upgrade function. By using the PMC-Upgrader online upgrade software developed by our company, the online upgrade of the device software can be achieved. This function is easy to operate and is convenient for the maintenance and controlling of the device.

When performing online upgrade through the RS-485 port, it is only necessary to wire it according to the ordinary RS-485 communication mode, as shown in Figure 3.20-1.

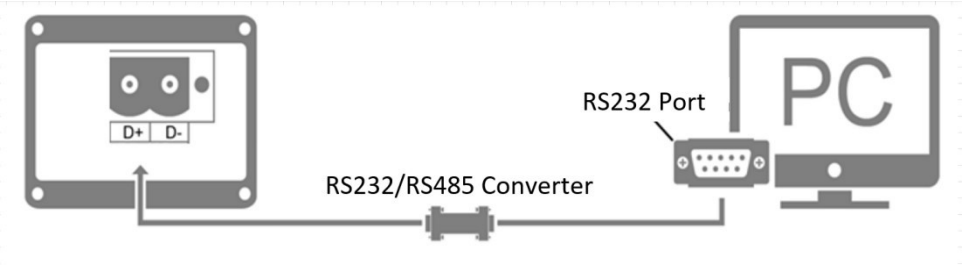


Figure 3.20-1 Schematic diagram of RS-485 port wiring

The Type-C interface supports the online upgrade function. A special connecting cable for converting Type-C to RS-232 or USB is required. The specific wiring is shown in Figure 3.20 - 2.

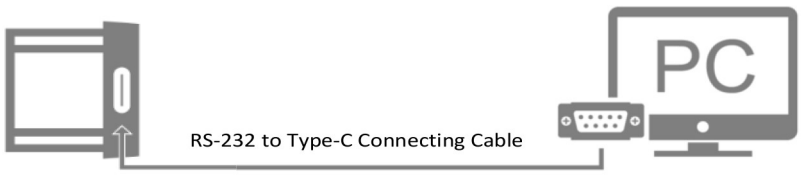


Figure 3.20-2 Schematic diagram of type-c port wiring

4. Operation and use

The display interface enables displaying measurement parameters, counter readings, data logs, maintenance data and device version.

4.1. Description of key functions

Below the display screen on the front panel of the SRP-MJ, there are four function keys, from left to right: <Setup>, <▲>, <↵>, <Reset> as shown in table 4.1-1.

Table 4.1-1 Definition of display key functions

Keys	Setup mode	
	Key action	For operation with parameters
◀	Down Arrow	Move the cursor to the left. When it reaches the leftmost end, press the key again to return to the rightmost digit.
▲	Up Arrow	Increase the number pressing the button. When it reaches 9 and the key is pressed again, it will change back to 0.
Setup ↵	Enter the current item.	Confirm the data modification and exit.
Reset	Return to the previous level menu.	Do not modify the data and exit.

For the "<Reset>" keys, pressing and holding them for 1 second means resetting.
On the right side of the front panel of the display module of the SRP-MJ, there are three control keys, namely "<Start up A>", "<Start up B>", and "<Stop>". To prevent misoperation, the control keys will only take effect when pressed and held for 1 second. The functions of the control keys are defined as follows in the table below:

Table 4.1-2 Definition of control key functions

Start mode	Direct-on-	Reduced-	Bi-	Two-speed	Coordination	Auxiliary

Key	line start	voltage start	directional start	start	with frequency converter	for large motors
Start up A	Start command	Start command	Forward rotation	Speed 1 Start	Start command	Start command
Start up B	Invalid command	Invalid command	Reverse rotation start command	Speed start command 2	Invalid command	Invalid command
Stop	Stop Command					

The control authority of the panel can be set as prohibited, emergency, local or remote according to needs. If panel control is enabled, use the "**Start A,** **Start B,** **Stop**" keys with caution. **Otherwise, it may easily lead to accidents such as accidental shutdown or startup caused by human errors.**

4.2 LED indicator descriptions

There are three LED indicators on the front panel of the device: < Operation >、< Trip > < Alarm >.

Indicator light	Description
Operation light (**green**)	When the device is operating normally, it blinks once every 2 seconds: it stays on for 1 second and then goes off for 1 second.
Trip light (**red**)	When a trip event occurs, this light turns on.
Alarm light (**yellow**)	When an alarm event occurs, this light turns on.

Only when the faults of the trip event and the alarm event disappear can the tripping light and the alarm light be reset and go out. 4.3.

4.3 Menu structure

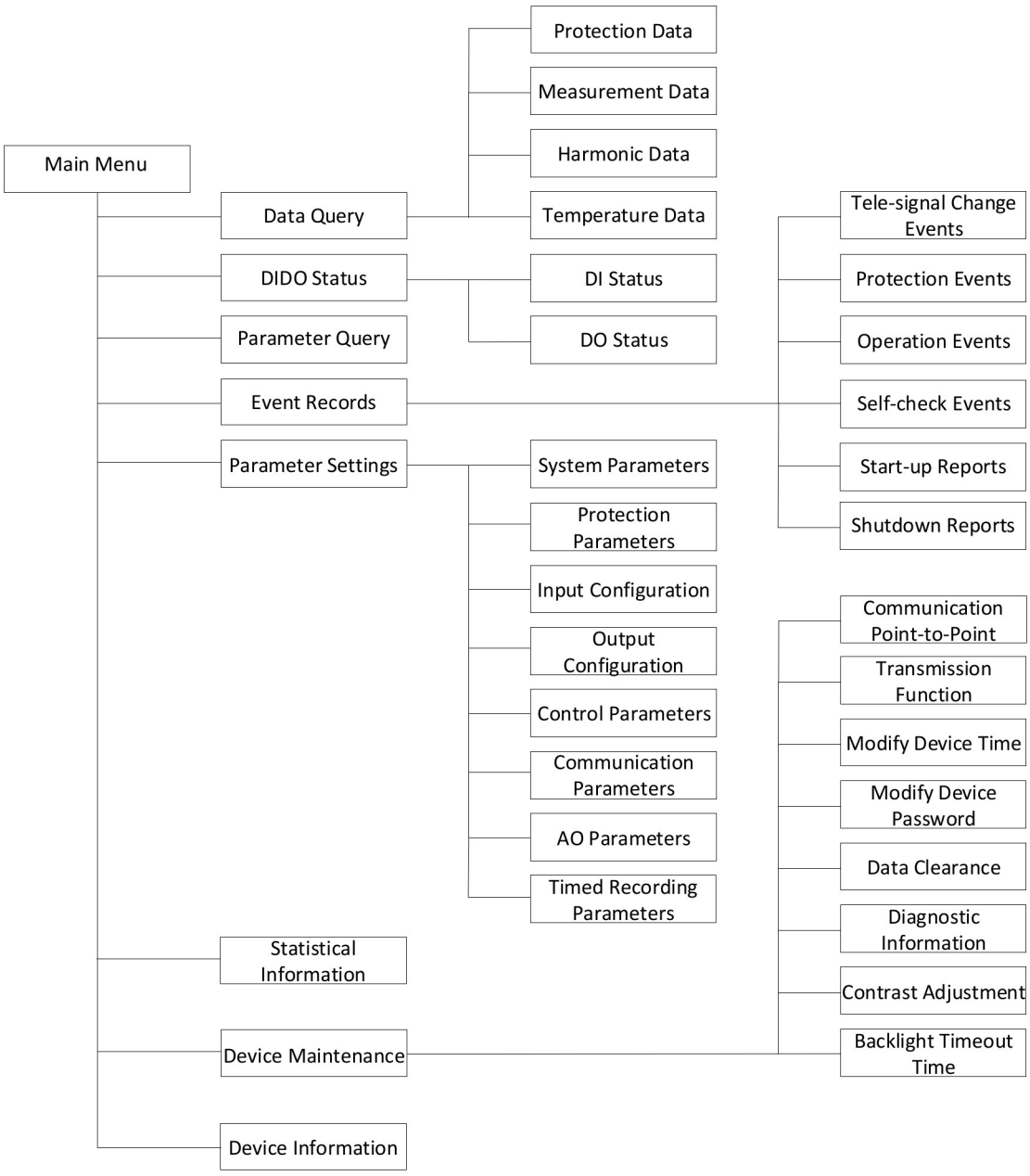


Figure 4.3-1 Menu structure diagram

4.4 Description of the display interface

After the device is powered on, it starts self-checking. After passing the self-check, it enters the default display interface.

The default interface is displayed in two pages and can be cyclically switched by pressing the keys "◁▷" and "△▽".

The content displayed on the first page includes: measured values U and I, the percentage of the measured current to the rated current, the local/remote control state, the communication state of COM (when there is no communication, it shows CM, and when it is RS-485 communication, CM blinks), the operating state of the motor (stopped, Start, running, forward rotation, reverse rotation, speed 1, speed 2), the state of DI (1 means closed, 0 means open, from left to right they

are DI1 to DI8 in sequence), the state of DO (1 indicates that the relay operates, 0 indicates that the relay returns, from left to right they are DO1 to DO5 in sequence). If a programmable logic scheme is loaded into the device, the programmable logic download indicator "AAAA" will be displayed on the right.

Default Interface (First Screen):

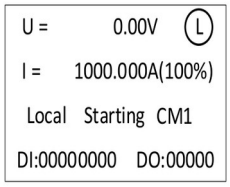


Figure 4.4-1a Default interface for dual serial port selection

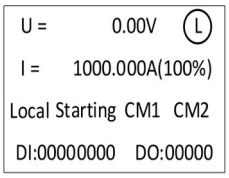


Figure 4.4-1b Default interface for single serial port selection

The second page displays whether the motor start is blocked or not. If it is not blocked, it shows "Motor Start is not blocked"; if it is blocked, it will display the reason for the block and the remaining blocking time. For example, if it is in the start-stop interval blocking, and the blocking time is 9999 seconds, it means that all Start commands are invalid within 9999 seconds.
Default Interface (Second Screen):

Figure 4.4-2 Default interface

In order to extend the service life of the liquid crystal display screen, the SRP-MJ is equipped with a screen saver function. When there is no operation within 3 minutes, the screen saver will be activated, the backlight will go out, and the display interface will pass to the default interface. After entering screen saver mode, pressing any key on the panel can turn on the backlight. The backlight timeout duration can be set in the Maint parameters within the range of 0 to 60 minutes: when set to 0, the backlight will be permanently on.
Pressing the confirmation key on the default interface opens the main menu. The main menu consists of 8 items:

Data Query	DI/DO state	Parameter Query	Event Log
Configure Setup	Statistical Information	Device Maintenance	Device information.

The liquid crystal display can show 4 feeders on each screen. If the content of the menu is more than 4 feeders, use the "<◀>" and "<▲>" keys to scroll the display screen by screen. The selected feeder (menu item) will be displayed highlighted.
Press the "<Setup>" key to enter the next-level menu. The specific display interfaces are as follows:

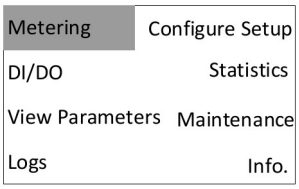


Figure 4.4-3 Main menu interface

4.1.1. Data query

In the Data Query menu, there are protection data, measurement data, harmonic data, and temperature data.

Use the "◀▶" and "◀▶" keys to make selections. The menu display is as follows:

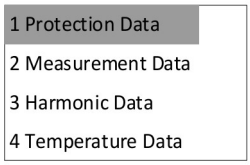
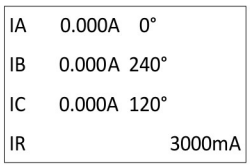


Figure 4.4-4 Main menu of data query

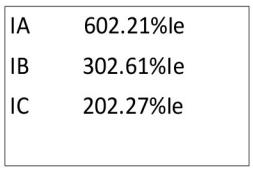
1. Protection data:

Use the "◀▶" and "◀▶" keys to make selections. The display of the Protection Data menu is as follows:

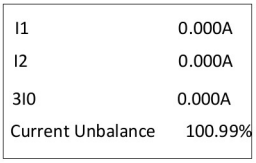
Protection Data (First Screen)



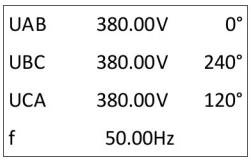
Protection Data (Second Screen)



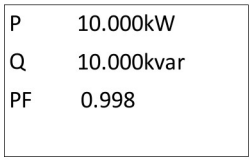
Protection Data (Third Screen)



Protection Data (Fourth Screen)



Protection Data (Fifth Screen)



Protection Data (Sixth Screen)

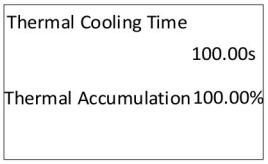


Figure 4.4-5 Protection data interface

2. Metering data

Use the "◀▶" and "◀▶" keys for selection, and the measurement data menu is displayed as follows:

Measurement data (first screen) Measurement data (second screen)

Ia	0.000A	0°
Ib	0.000A	240°
Ic	0.000A	120°

Measurement data (third screen)

Ia	602.21%Ie
Ib	302.61%Ie
Ic	202.27%Ie

Measurement data (fourth screen)

Uab	380.00V	0°
Ubc	380.00V	240°
Uca	380.00V	120°

Measurement data (fifth screen)

P	10.000kW
Q	10.000kvar
PF	0.998

Measurement data (sixth screen)

Active Energy Import
9999999.99kWh
Reactive Energy Import
9999999.99kvarh

Active Energy Export
9999999.99kWh
Reactive Energy Export
9999999.99kvarh

Figure 4.4-6 Measurement data interface

3. Harmonic data

Use the "◁▭▷" and "◁▭▷" keys to select the harmonic items to be displayed. The harmonic data menu is displayed as follows:

Harmonic data (First Screen)

1 Uab Harmonic Distortion
2 Ubc Harmonic Distortion
3 Uca Harmonic Distortion
4 Ia Harmonic Distortion

Harmonic data (Second Screen)

5 Ib Harmonic Distortion
6 Ic Harmonic Distortion

Figure 4.4 - 7 Harmonic display main interface

Harmonic data display content is as follows:

Harmonic data (First Screen)

THD	100.00%
TOHD	100.00%
TEHD	100.00%
2nd Harmonic Ratio	100.00%

Harmonic data (Second Screen)

3rd Harmonic Ratio	100.00%
4th Harmonic Ratio	100.00%
5th Harmonic Ratio	100.00%
6th Harmonic Ratio	100.00%

Harmonic data (eighth screen)

27th Harmonic Ratio	100.00%
28th Harmonic Ratio	100.00%
29th Harmonic Ratio	100.00%
30th Harmonic Ratio	100.00%

Harmonic data (ninth screen)

31th Harmonic Ratio	100.00%

Figure 4.4 - Interface for displaying 8 harmonic data items

4. Temperature data

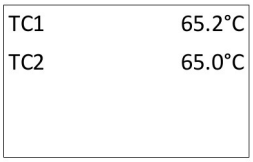


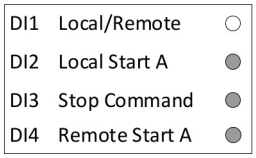
Figure 4.4-9 Temperature data display interface

4.1.2. DI/DO state

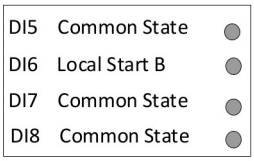
To display real-time input/output digital signal information, you can use the following format where "●" represents the ON state and "○" represents the OFF state. Here is the display format:

1. DI Status

DI state (First Screen)

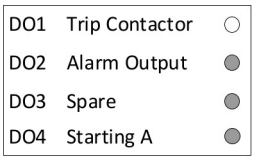


DI state(Second Screen)



2. DO status

DO state(First Screen)



DO state (Second Screen)

Figure 4.4-10: DI/DO state interface

4.1.3. Configuration settings

Configure Setup interface allows modification of system parameters, protection parameters, digital input configurations, digital output configurations, control parameters, communication parameters, analog output (AO) parameters, timed records, etc. A password is required to access Configure Setup, the default password is 0000.

Each settings page exists in two states: reading and editing. In the reading state, you can use the <Setup> and <Reset> keys to select the option you wish to modify. At this point, a large cursor is displayed to indicate the selected item. After selecting the item for modification, pressing the <↵> key will enter the editing state, at which point the cursor will change to a small one. In the editing state, the <▲> key is used to change the value or option under the cursor, while the <◀> key can be used to move the cursor. After completing the modifications, pressing the <↵> key will confirm the changes and return to the non-editing state. Pressing the <↶> key will cancel the modifications and also return to the reading state.

When transitioning from the editing state back to the reading state, pressing the <Setup↵> key will save the modifications, while pressing the <Reset↶> key will discard them. If the set value exceeds the system's default maximum or falls below the minimum, pressing the <↵> key will automatically adjust it to the maximum or minimum value, respectively.

Non-modification state

MTA Connected	Yes
MTA Type	300 A
Phase TA Ratio	1
Ie	300.0 A

Modification state

MTA Connected	Yes
MTA Type	300 A
Phase TA Ratio	1
Ie	300.0A

Figure 4.4-11: Parameter modification interface

1. System parameters

The system parameters section primarily allows for the modification and setting of the rated parameters of the electric motor.

System Parameters (First Screen)

MTA Connected	Yes
MTA Type	300 A
Phase TA Ratio	1
Ie	300.0 A

System Parameters (Second Screen)

Rated Primary Voltage	380V
Rated Secondary Voltage	380V
Ctrl Key	Disable
Select Before Operate	Off

System Parameters (Third Screen)

Language	Chinese
Ia Polarity	Normal
Ib Polarity	Normal
Ic Polarity	Normal

System Parameters (Forth Screen)

Voltage Sequence	ABC
Current Sequence	ABC
PLC	On

Figure 4.4-12 System configuration setup interface

2. Protection Parameters

You can use the <> and <> keys to page through the settings in the protection parameter menu. Select the corresponding protection item to modify the setting value. The following figure shows the interface for selecting all protection items:

Protection Parameters (First Screen)

Reset Method
Long Start Protection
Thermal Overload Protection
Jam Protection

Protection Parameters (Second Screen)

Ground Fault
MTA Failure
Phase Current Loss
Imbalance

Protection Parameters (Third Screen)

Under Power
Short Circuit
Undervoltage
Overvoltage

Protection Parameters (Fourth Screen)

Underload
tE Time
Overload
Interlock

Protection Parameters (Fifth Screen) Protection Parameters (Sixth Screen)

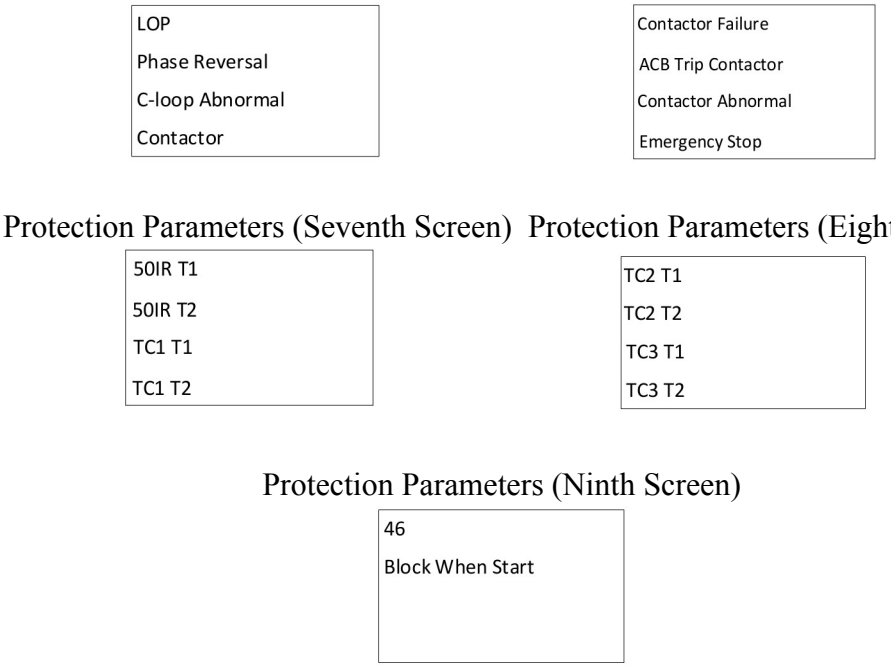


Figure 4.4-13 Protection parameter interface

Now, using "Block Protection" as an example, we will explain the setting of protection parameters in the protection parameter interface. Assume that the block protection configuration is set to "Trip + Alarm," with a current setting of 3.0Ie, a time setting of 4s, and a linked output of R2, which is associated with DO3 (relay output). The specific setting steps are as follows:

1. Select the "Parameter setting" option in the main menu;
2. Enter the correct password at the cursor prompt and press the <Setup> key to enter the next submenu;
3. Move the cursor down and select the "Protection Parameters" option, then press the <Setup> key to enter the next submenu.
4. Select the "Block Protection" option and press the <Setup> key;
5. After entering the "Block Protection" menu, select "Trip + Alarm" for the "Configuration" setting and press the <Setup> key to confirm;
6. Move the cursor down to the "Current Setting," change the number to 3.50 (Note: although the example states 3.0Ie, for clarity in this translation, we'll assume a specific value of 3.50A or adjust accordingly based on actual Ie value), and press the <Setup> key to confirm;
7. Move the cursor down to the "Time Setting," change the number to 4.00, and press the <Setup> key to confirm;
8. Move the cursor down to set the "R1/R2/R3" as the protection linked output. Move the cursor to the "□" to the left of "R2" and check it (mark with a "√");
9. Enter the "Configure Setup → DI/DO Configuration → DO Configuration" menu, move the cursor to DO2, select "R2" press the <Setup> key to save the modified parameters, and then press the <Setup> key to exit the menu. The relevant Configure Setups for block protection are now complete.

After completing the above operations, the display contents of the Block Protection menu and DO Configuration menu will be as follows:

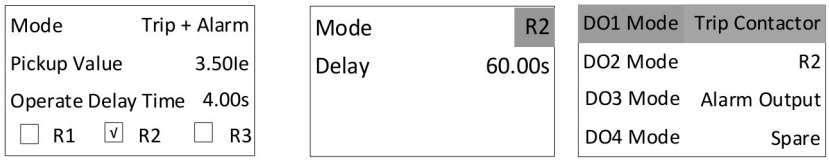


Figure 4.4-14 Jam protection function setting interface

Corresponding to the above settings, when the Jam Protection operates, the SRP-MJ low - voltage motor protection controller will have 3 output relays closed: DO1, DO2, and DO3.

1. Input Configuration

The input configuration menu is used for programmable input settings. The input configuration options under different Start methods are shown in the DI/DO configuration list 4.4-3 in Section 4.4.4.3. The specific configuration interfaces are as follows:

Input configuration (first screen) Input configuration (second screen)

Figure 4.4-15 Input configuration interface

When configuring the panel DI, the configurations of local/remote, KMA, KMB, and QF state shall not be repeated.

For example, if DI1 is configured as QF state and DI2 is also configured as QF state, this situation is not allowed. At this time, if you select "Yes" on the parameter saving interface, a prompt message will pop up, indicating that the modifications cannot be saved, as shown in the following figure:

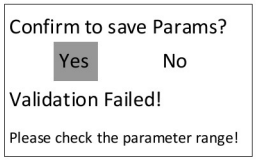


Figure 4.4-16 Parameter error prompt page

At this time, pressing the <Reset> key can return to the upper-level interface.

2. Output Configuration

The output configuration menu is used for programmable DO settings. The DO configuration options under different startup methods are shown in Section 4.4.4.3, DI/DO Configuration List 4.4-4. The specific configuration interface is as follows:

Output Configuration (First Screen) Output Configuration (Second Screen)

Figure 4.4-17 DO configuration interface

3. Control Parameters

The control parameter interface allows you to set and view Undervoltage (loss of voltage) restart, power-on auto-start, start interval control, control parameters, and start-stop signal methods.

Control Parameters (First Screen) Control Parameters (Second Screen)

Figure 4.4-18 Control configure setup interface

Except for the control Configure Setup interface, the Configure Setups of other interfaces are similar to those mentioned above. Now only the control Configure Setups will be described in detail. The control parameter interface is used to set parameters under different startup methods. The control method option on the first line can set the startup method. When different startup methods are set, the parameters under that startup method will be displayed automatically, and the corresponding parameters can be set at this time. The following figure shows the content displayed when Direct-on-line Start and step-down start are selected. The Configure Setups under other startup methods will not be described in detail.

Direct-on-line Start Reduced-voltage Start

Figure 4.4-19 Control configure setup interface

4. Communication parameters

The communication configuration interface allows you to set the communication port parameters. The adjustable parameters depend on the selected device.

Modbus Protocol Profibus-DP Protocol

Figure 4.4-20 Communication port parameter interface

5. AO parameters

The AO parameter menu can set the corresponding output parameters, the values corresponding to 4mA output and 20mA output.

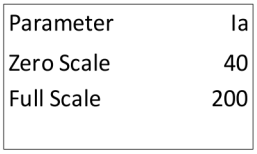


Figure 4.4-21 AO parameter interface

Note: This page will not be displayed if AO is not selected.

8. Timed recording parameters

The timed recording parameter menu can set timed recording related parameters, and the specific setting items are shown in the following table.

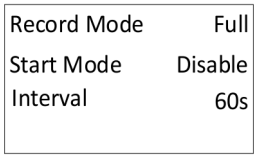


Figure 4.4-22 Timing record parameter interface

4.4.4 List of fixed values

4.4.4.1 List of fixed values for configuration setup

Table 4.4-1 Configuration setup menu table

First-level menu Second-level menu Third-level menu	Description	Range	Default value
Please enter the password	To access the Configuration Setups, you must enter the correct password	0~9999	0000
System setup			
MTA Connected Setup	Whether the device has MTA Connected or not. It can also be used in situations where there is no MTA	No/Yes	Yes
Technical specifications MTA [Note 1]	Specification of External Through Core Current Sensor	1A~5000A	100A
Three phase TA Transformation Ratio	Three Phase TA Turns Ratio Setting	1~5000	1

[Note 2]			
Motor Rated Current [Note 3]	Motor Rated Current Ie Setting	0.1~6000.0 A	100.0A
Primary rated voltage	Motor Rated Voltage Ue Setting, Phase to Phase Voltage	100V~800V	380V
Secondary rated voltage	Device Input Rated Voltage U Setting, Phase to Phase Voltage	100V~800V	380V
Panel control authority [Note 4]	Setting for the Validity of Control Keys "Start A/Start B/Stop"	Prohibit / Emergency / Local / Remote	Prohibit
Remote control presetting	Whether the control of the remote-controlled DO requires preset operations	Off/On	On
Language selection	Select the device display language	Chinese / English	Chinese
Setting of Phase A Current Direction	The connection direction of Phase A of MTA is used for connection adjustment	Forward / Reverse	Forward
Setting of Phase B Current Direction	The connection direction of Phase B of MTA is used for connection adjustment	Forward / Reverse	Forward
Setting of Phase C Current Direction	The connection direction of Phase C of MTA is used for connection adjustment	Forward / Reverse	Forward
Voltage phase sequence setting	Voltage Phase Sequence Adjustment: if the actual wiring is CBA, then set the phase sequence as CBA	ABC/CBA	ABC
Current phase sequence setting	Current Phase Sequence Adjustment: If the actual wiring is ACB, then set the phase sequence as ACB	ABC/ CBA/AC B/CAB/ BAC/B CA/	ABC
Enable/Disable of Logic Programmable Function	Setting of Enabling/Disabling the Logic Programmable Function	Off/On	Off
Communication parameters			
Communication Port	Settings for relevant parameters of		

1	Communication Port 1		
Communication protocol	Modbus		
Communication Address	Settings for the communication address of the communication port	1~247	1
Baudrate	Settings for the baud rate of the communication port, unit: bps	1200/2400/4800/9600/19200	9600
Parity Check Method	Communication Port Check Mode Setting	8N2/8O1/8E1/8N1/8O2/8E2	8E1
Communication Port 2 [Note 5]	Settings for relevant parameters of Communication Port 2		
Communication protocol	Modbus		
Communication Address	Communication address setting for Communication Port 2	1~247	2
Baudrate	Communication Port 2 Baud Rate Setting, Unit: bps	1200/2400/4800/9600/19200	9600
Parity Check Method	Communication Port 2 Check Mode Setting	8H2/8O1/8E1/8H1/8O2/8E2	8E1
Communication Port 2 [Note 5]	Settings for relevant parameters of Communication Port 2		
Communication protocol	Profibus		
Communication Address	Communication address setting for Communication Port 2	1~125	1
Baudrate	Settings for the baud rate of Communication Port 2, unit: kbps	9.6/19.2/45.45/93.75/187.5/500/1500	1500
Protection Function Setups			
Reset Mode	Settings for the reset mode of trip output and alarm output		
Trip Reset Mode	Settings for the reset mode of trip output after protection return	Auto / Manual	Manual

Alarm reset mode	Settings for the reset mode of alarm output after protection recovery	Auto / Manual	Automatic
Start-up Timeout Protection	Settings for the related parameters of start-up timeout protection function		
Configuration	Selection of the alarm mode of start-up timeout protection function	Alarm / Tripping / Tripping + Alarm / Off	Off
Time Setting	Settings for the alarm delay time of start-up timeout protection function	0.10s~99.99 s	30.00s
R1/R2/R3 **[Note6]**	Selection of Linked output from startup timeout	P1/P2/P3	Uncheck
Thermal Overload Protection (Inverse Time)	Settings for the related parameters of Thermal Overload Protection (Inverse Time) function		
Configuration	Selection of the alarm mode of Thermal Overload Protection (Inverse Time) function	Alarm / Tripping / Tripping + Alarm / Off	Tripping+Alarm
Current Setting	Current threshold for Start Thermal Overload Protection (Inverse Time)	1.00Ie~10.00Ie	1.00Ie
Time factor	Settings for the time factor of Thermal Overload Protection (Inverse Time) function	0.10~99.99	2.00s
Heat Dissipation Method	Cooling mode after protection withdrawal	Immediately / equation	Equation
Warning Threshold	Settings for the pre-warning threshold of overheating	0~99% (0 means disabled)	0
Heat Dissipation Threshold	Settings for the return threshold of Thermal Overload Protection (Inverse Time)	0~100%	60%
Reset Output Method	Settings for the reset mode of trip output after protection return	Manual/ Automatic	Manual
R1/R2/R3 **[Note6]**	Selection of the linked output of Thermal Overload Protection (Inverse Time)	P1/P2/P3	Uncheck
Jam Protection	Settings for relevant parameters of the Jam Protection function		
Configuration	Selection of alarm mode for the	Alarm / Trip	Off

	Jam Protection function	/ Tripping + Alarm / Off	
Fixed Current Value	Settings for the alarm current value of the Jam Protection function	1.00Ie~10.00Ie	3.50Ie
Fixed Time Value	Settings for the alarm delay time of the Jam Protection function	0.10s~99.99s	4.00s
R1/R2/R3 **[Note6]**	Selection of the Jam Protection - Linked output	P1/P2/P3	Uncheck
Ground Fault Protection	Settings of Related Parameters for Ground Fault Protection Function		
Configuration	Selection of Alarm Mode for Ground Fault Protection Function	Alarm / Trip / Tripping + Alarm / Off	Tripping + Alarm
Current Setting	Zero-sequence current alarm settings for ground fault protection function	0.10Ie~10.00Ie	1.00Ie
Running Delay	Settings of Alarm Delay Time for Ground Fault Protection Function during Motor Operation	0.00c-99.99s	0.10s
Start Delay	Settings of Alarm Delay Time for Ground Fault Protection Function during Motor Startup	0.00c-99.99s	0.50s
R1/R2/R3 **[Note6]**	Selection of Linked output for Ground Fault Protection	P1/P2/P3	Uncheck
Alarm for MTA Disconnection	Settings of related parameters for the MTA open circuit alarm function		
Configuration	Enabling/disabling the MTA open circuit alarm	Off/On	On
Time Setting	Settings of Delay Time for MTA Open-circuit Alarm	0.10~99.99s	0.50s
R1/R2/R3 **[Note6]**	Selection of the related output for the MTA open circuit alarm	P1/P2/P3	Uncheck
Phase failure protection	Settings of Related Parameters for Phase Failure Protection Function		
Configuration	Selection of Alarm Mode for Phase Failure Protection Function	Alarm / Tripping / Tripping +	Tripping + Alarm

		Alarm / Off	
Time Setting	Settings of Alarm - Delay Time for Phase Failure Protection Function	0.10s~99.99 s	2.50s
MTA Open circuit blocking	Enabling/disabling phase loss protection with MTA open circuit blocking	Off/On	On
R1/R2/R3 **[Note6]**	Selection of the related output for phase loss protection	P1/P2/P3	Uncheck
Unbalancing protection	Settings of Related Parameters for Unbalancing Protection Function		
Configuration	Selection of Alarm Mode for Unbalancing Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Alarm
Imbalance Degree Value	Settings of Alarm Imbalance Degree Value for Unbalancing Protection Function	10~100%	30%
Time Setting	Settings of Alarm Delay Time for Imbalance Degree Protection Function	0.10s~99.99 s	5.00s
MTA Open circuit blocking	Enabling/disabling imbalance protection blocked by MTA disconnection	Off/On	On
R1/R2/R3 **[Note6]**	Selection of Linked output for Imbalance Degree Protection	P1/P2/P3	Uncheck
Underpower Protection	Settings of Related Parameters for Underpower Protection Function		
Configuration	Selection of Alarm Mode for Underpower Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
Power Setpoint	Settings of Alarm Power Value for Underpower Protection Function	-999.9kW~999.9 kW	35.0 kW
Low voltage blocking	Low voltage blocking value	0.30Ue~0.9	0.60Pe

setpoint	settings for underpower protection function	5Ue	
Time Setting	Settings of Alarm - Delay Time for Underpower Protection Function	0.50s~99.99 s	5.00s
Automatic Output Reset	Settings of Automatic Reset Delay for Trip output of Underpower Protection Function	0~6000.0s (0 means disabled)	0 (Off)
R1/R2/R3 **[Note6]**	Selection of Linked output for Underpower Protection	P1/P2/P3	Uncheck
Short Circuit Protection	Settings of Related Parameters for Short-circuit Protection Function		
Configuration	Selection of Alarm Mode for Short-circuit Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Tripping + Alarm
Current Setting	Settings of Alarm Current Value for Short-circuit Protection Function	1.00Ie~10.00Ie	7.5Ie
Time Setting	Settings of Alarm - Delay Time for Short - circuit Protection Function	0.00c~99.99 s	0.00s
Start-up Doubling	Settings of Multiple of Alarm Current Setpoint during Motor Startup Process	1.00 - 2.00	1.00
R1/R2/R3 **[Note6]**	Selection of Linked output for Short-circuit Protection	P1/P2/P3	Uncheck
Undervoltage protection	Settings of Related Parameters for Undervoltage Protection		
Configuration	Selection of Alarm Mode for Undervoltage Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off

Voltage Setpoint	Settings of Alarm Voltage Value for Undervoltage Protection Function	0.30Ue~0.95Ue	0.45Ue
Time Setting	Settings of Alarm Delay Time for Undervoltage Protection Function	0.10s~99.99s	9.00s
No current Blocking	No current Blocking Undervoltage Protection Function	On/Off	On
Automatic Output Reset	Automatic Reset Delay of Trip output for Undervoltage Protection Function	0~6000.0s (0 means disabled)	0 (Off)
R1/R2/R3 **[Note6]**	Selection of Linked output for Undervoltage Protection Function	P1/P2/P3	Uncheck
Overvoltage protection	Settings of Related Parameters for Overvoltage Protection		
Configuration	Selection of Alarm Mode for Overvoltage Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
Voltage Setpoint	Settings of Alarm Voltage Value for Overvoltage Protection Function	1.05Ue~1.60Ue	1.20Ue
Time Setting	Settings of Alarm Delay Time for Overvoltage Protection Function	0.10s~99.99s	4.00s
R1/R2/R3 **[Note6]**	Selection of Linked output for Overvoltage Protection	P1/P2/P3	Uncheck
Underload Protection	Settings of Related Parameters for Underload Protection		
Configuration	Selection of Alarm Mode for Underload Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
Current Setting	Settings of Alarm Current Value	(0.10~10.00)	0.40Ie

	for Underload Protection Function	Ie	
Time Setting	Settings of Alarm Delay Time for Underload Protection Function	1c~9999s	20s
Automatic Output Reset	Automatic Reset Delay of Trip output for Underload Protection Function	0~6000.0s (0 means disabled)	0 (Off)
R1/R2/R3 **[Note6]**	Selection of Linked output for Over and Underload Protection	P1/P2/P3	Uncheck
tE - time Protection	Settings of Related Parameters for tE - time Protection		
Configuration	Selection of Alarm Mode for tE - time Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
Time factor	Settings of Time Parameters for tE - time Protection Function	0.10s~99.99 s	6.00s
R1/R2/R3 **[Note6]**	Selection of Linked output for tE - time Protection	P1/P2/P3	Uncheck
Thermal Overload Protection (Inverse Time)	Settings for relevant parameters of Thermal Overload Protection (Inverse Time)		
Configuration	Selection of alarm mode for Thermal Overload Protection (Inverse Time) function	Alarm / Tripping / Tripping + Alarm / Off	Off
Current Setting	Setting of alarm current value for Thermal Overload Protection (Inverse Time) function	1.00Ie~10.00Ie	1.20Ie
Time Setting	Setting the alarm signal delay time for the thermal overload protection function (with inverse time delay)	0.10s~99.99 s	30.00s
R1/R2/R3 **[Note6]**	Selection of linked output for Thermal Overload Protection (Inverse Time)	P1/P2/P3	Uncheck
Interlock Protection	Settings of Related Parameters for Interlock Protection		

Configuration	Selection of Alarm Modes for Interlock Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
Time Setting	Time parameter settings for the block protection function	0.00c~99.99 c	0.00c
R1/R2/R3 **[Note6]**	Selection of related outputs for block protection	P1/P2/P3	Uncheck
Voltage loss alarm	Settings of linked parameters for the voltage loss alarm function		
Configuration	Selection of the alarm mode for the voltage loss alarm function	Off / On	On
R1/R2/R3 **[Note6]**	Selection of the linked output for the voltage loss alarm function	P1/P2/P3	Uncheck
Phase Reversal Protection	Settings of Related Parameters for Phase Reversal Protection Function		
Configuration	Selection of Alarm Mode for Phase Reversal Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
R1/R2/R3 **[Note6]**	Selection of Linked output for Phase Reversal Protection Function	P1/P2/P3	Uncheck
Closed-loop Abnormal Protection	Settings of Related Parameters for Closed-loop Abnormal Protection Function		
Configuration	Selection of Alarm Mode for Closed-loop Abnormal Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
Time Setting	Settings of Time-related Parameters for Closed-loop Abnormal Protection Function	0.10s~99.99 s	1.00s
R1/R2/R3 **[Note6]**	Selection of Linked output for Closed-loop Abnormal Protection	P1/P2/P3	Uncheck

Contactor Protection	Settings of Related Parameters for Contactor Protection		
Configuration	Selection of Contactor Protection Enable/Disable	On/Off	On
Current Setting	Maximum contactor breaking current settings	4.00Ie~20.00Ie	8.00Ie
Contactor Failure Protection	Settings of Related Parameters for Contactor Failure Protection Function		
Configuration	Selection of Alarm Mode for Contactor Failure Protection Function	On/Off	Off
Current Setting	Settings of Alarm Current Value for Contactor Failure Protection Function	1.00Ie~5.00Ie	0.30Ie
Time Setting	Settings of Alarm Delay Time for Contactor Failure Protection Function	0.10s~99.99s	0.50s
Triggered by the Stop Command	Settings of Contactor Failure Protection Triggered by Stop Command	On/Off	On
R1/R2/R3 **[Note6]**	Selection of Linked output for Closed-loop Abnormal Protection	P1/P2/P3	Uncheck
Circuit breaker related Tripping of Contactor	Settings of Related Parameters for the Function of Circuit breaker related Tripping of Contactor		
Configuration	Enable/Disable the Function of Circuit breaker related Tripping of Contactor	Off / On	Off
Delay Time Setting	Settings of Delay Time for Circuit breaker related Tripping of Contactor	0.10s~99.99s	1.00s
Incorrect Contactor Position	Settings of Related Parameters for Contactor Position – Incorrect Alarm Function		
Configuration	Selection of Alarm Mode for Contactor Position – Incorrect Alarm Function	Alarm / Tripping / Tripping + Alarm / Off	Off

Time Setting	Time-related parameter settings for contactor position — contactor position protection function	0.10s~99.99 s	5.00s
R1/R2/R3 **[Note6]**	Selection of Linked output for Contactor Position	P1/P2/P3	Uncheck
Emergency Stop Alarm Protection	Settings of Related Parameters for Emergency Stop Alarm Protection Function		
Configuration	Selection of Alarm Mode for Emergency Stop Alarm Protection Function	On/Off	Off
R1/R2/R3 **[Note6]**	Selection of Linked output for Phase sequence Protection Function	P1/P2/P3	Uncheck
Residual Current Protection, Stage 1	Settings of Related Parameters for Function of Residual Current Protection Stage I		
Configuration	Selection of the alarm mode for the stage I differential protection function	Alarm / Tripping / Tripping + Alarm / Off	Off
Current Setting	Current fixed value settings for residual current — stage I protection function	20~5000mA	300mA
Time Setting	Time Setting – Parameter for Function of Residual Current Protection Stage I	0.00~99.99s	5.00s
Start Multiplier Setting	Alarm multiplier setting — residual current fixed value during startup for stage I residual current protection	1.00～2.00	1.00
R1/R2/R3 **[Note6]**	Selection of Linked output for Residual Current Protection Stage I	P1/P2/P3	Uncheck
Residual Current Protection, Stage 1	Settings of Related Parameters for Function of Residual Current		

	Protection Stage II		
Configuration	Selection of Alarm Mode for Function of Residual Current Protection Stage II	Alarm / Tripping / Tripping + Alarm / Off	Off
Current Setting	Current fixed value settings for residual current — stage II protection function	20~5000mA	500mA
Time Setting	Time Setting – Parameter for Function of Residual Current Protection Stage II	0.00~99.99s	1.00s
Start Multiplier Setting	Alarm multiplier setting — residual current fixed value during startup for stage II residual current protection	1.00～2.00	1.00
R1/R2/R3 **[Note6]**	Selection of Linked output for Residual Current Protection Stage II	P1/P2/P3	Uncheck
Stage I of TC1 temperature protection	Settings for relevant parameters of Stage I of TC1 temperature protection		
Configuration	Selection of alarm mode for Stage I of TC1 temperature protection	Alarm / Tripping / Tripping + Alarm / Off	Off
Temperature Setpoint	Setting of fixed temperature value for Stage I of TC1 temperature protection	20.0~150.0 ℃	70°C
Time Setting	Setting of time parameters for Stage I of TC1 temperature protection	0.00~99.99s	2.00s
R1/R2/R3 **[Note6]**	Selection of linked output for Stage I of TC1 temperature protection	P1/P2/P3	Uncheck
Stage II of TC1 temperature protection	Settings for relevant parameters of Stage II of TC1 temperature protection		

Configuration	Selection of alarm mode for Stage II of TC1 temperature protection	Alarm / Tripping / Tripping + Alarm / Off	Off
Temperature Setpoint	Setting of fixed temperature value for Stage II of TC1 temperature protection	20.0~150.0 ℃	100°C
Time Setting	Setting of time parameters for Stage II of TC1 temperature protection	0.00~99.99s	2.00s
R1/R2/R3 **[Note6]**	Selection of linked output for Stage II of TC1 temperature protection	P1/P2/P3	Uncheck
Stage I of TC2 temperature protection	Settings for relevant parameters of Stage I of TC2 temperature protection		
Configuration	Selection of alarm mode for Stage I of TC2 temperature protection	Alarm / Tripping / Tripping + Alarm / Off	Off
Temperature Setpoint	Setting of fixed temperature value for Stage I of TC2 temperature protection	20.0~150.0 ℃	70°C
Time Setting	Setting of time parameters for Stage I of TC2 temperature protection	0.00~99.99s	2.00s
R1/R2/R3 **[Note6]**	Selection of linked output for Stage I of TC2 temperature protection	P1/P2/P3	Uncheck
Stage II of TC2 temperature protection	Settings for relevant parameters of Stage II of TC2 temperature protection		
Configuration	Selection of alarm mode for Stage II of TC2 temperature protection	Alarm / Tripping / Tripping + Alarm / Off	Off
Temperature Setpoint	Setting of fixed temperature value	20.0~150.0	100°C

	for Stage II of TC2 temperature protection	℃	
Time Setting	Setting of time parameters for Stage II of TC2 temperature protection	0.00c~99.99c	2.00s
R1/R2/R3 **[Note6]**	Selection of linked output for Stage II of TC2 temperature protection	P1/P2/P3	Uncheck
TC3 Temperature Protection Stage I	Settings for relevant parameters of Stage I of TC3 temperature protection		
Configuration	Selection of alarm mode for Stage I of TC3 temperature protection	Alarm / Tripping / Tripping + Alarm / Off	Off
Temperature Setpoint	Setting of fixed temperature value for Stage I of TC3 temperature protection	20.0~150.0℃	70°C
Time Setting	Setting of time parameters for Stage I of TC3 temperature protection.	0.00~99.99s	2.00s
R1/R2/R3 **[Note6]**	Selection of linked output for Stage I of TC3 temperature protection	P1/P2/P3	Uncheck
TC3 Temperature Protection Stage II	Settings for relevant parameters of Stage II of TC3 temperature protection		
Configuration	Selection of alarm mode for Stage II of TC3 temperature protection	Alarm / Tripping / Tripping + Alarm / Off	Off
Temperature Setpoint	Setting of fixed temperature value for Stage II of TC3 temperature protection	20.0~150.0℃	100°C
Time Setting	Setting of time parameters for Stage II of TC3 temperature protection	0.00c~99.99c	2.00s

R1/R2/R3 **[Note6]**	Selection of linked output for Stage II of TC3 temperature protection	P1/P2/P3	Uncheck
Negative Sequence Overcurrent Protection	Settings of Related Parameters for Negative Sequence Overcurrent Protection Function		
Configuration	Selection of Alarm Mode for Negative Sequence Overcurrent Protection Function	Alarm / Tripping / Tripping + Alarm / Off	Off
Current Setting	Settings of Current Value for Negative Sequence Overcurrent Protection Function	0.10Ie ~10.00Ie	1.20Ie
Operation Delay	Settings of Operation Delay Time for Negative Sequence Overcurrent Protection Function	**0.10s ~99.99s**	2.00s
Start delay	Settings of Delay Time during Start-up Process for Negative Sequence Overcurrent Protection Function	0.10s ~99.99s	4.00s
P1/P2/P3	Selection of Linked output for Negative Sequence Overcurrent Protection Function	P1/P2/P3	(Uncheck)
Start-up Jam Protection	Settings of Related Parameters for Start-up Jam Protection Function Start-up Jam Protection Time		
Start-up Jam Protection Time	Settings of Duration of Motor Start-up Jam Protection	Off/0.10s～99.99s	10.00s
Thermal Overload Protection (Inverse Time)	Select whether to block Thermal Overload Protection (Inverse Time)	Uncheck/ check	Uncheck
Jam Protection	Select whether to block blockage protection	Uncheck/ check	Uncheck
Ground Fault Protection	Select whether to block ground fault protection	Uncheck/ check	Uncheck

Phase failure protection	Select whether to block phase failure protection	Uncheck/ check	Uncheck
Current Imbalance Protection	Select whether to block Current Imbalance Protection	Uncheck/ check	Uncheck
Underpower Protection	Select whether to block Underpower Protection	Uncheck/ check	Uncheck
Short Circuit Protection	Select whether to block short circuit protection	Uncheck/ check	Uncheck
Underload protection	Select whether to block underload protection.	Uncheck/ check	Uncheck
tE – time protection	Select whether to block tE – time protection.	Uncheck/ check	Uncheck
Overload Protection	Select whether to block Overload Protection	Uncheck/ check	Uncheck
Interlock protection	Select whether to Interlock Protection	Uncheck/c heck	Uncheck
Short Circuit Protection	Select whether to block short circuit protection	Uncheck/ check	Uncheck
Phase Reversal Protection	Select whether to block Phase Reversal Protection	Uncheck/ check	Uncheck
Residual current Stage I	Select whether to block Stage I of Residual Current Protection	Uncheck/ check	Uncheck
Residual current Stage II	Select whether to block Stage II of Residual Current Protection	Uncheck/ check	Uncheck
Negative Sequence Overcurrent Protection	Select whether to block the negative sequence overcurrent protection.	Uncheck/ check	Uncheck
Control Function Settings			
Undervoltage restart	Settings of Related Parameters for Undervoltage Restart Function		

Configuration	Selection of Undervoltage Restart Function	On/Off	Off
Pre-Closing	Undervoltage Pre-closing Startup output Function for Restart	On/Off	On
Permissible Time of Voltage Fluctuation	Settings of Immediate Startup Time of Motor	0.00s-9.99s (The number 0.00 stands for disabled)	2.50s
Permissible Time Limit of Undervoltage	Settings of Allowed Power-off Time before Motor Delayed Restart	0.5s~999.9s	20.0s
Restart Delay	Settings of Delay Time of Motor Delayed Restart Function	0.1s~999.9s	0.2s
Undervoltage Set Value	Settings of Voltage Value for Judging Motor Voltage Loss	0.30Ue~0.95Ue	0.75Ue
Recovery Voltage Set Value	Settings of Voltage Value for Motor Restart	0.80Ue~1.60Ue	0.85Ue
Auxiliary DO	Set the Auxiliary DO Corresponding to DO	No / DO1~DO5	No
Auxiliary DO action delay	Auxiliary DO action delay time	0.00s~99.99s	0.00s
Pulse-width Extension Time of DO Undervoltage during Motor Operation	Settings of DO Undervoltage Pulse-width Extension during Motor Operation	0.00s~30.00s	0.10s
Power-on Self-start	Settings of Related Parameters for Device Power-On Automatic Start Function		
Configuration	Selection of Device Power-On Automatic Start Function	On/Off	Off

Self-start Mode	Settings of Startup Mode of Device Power-On Automatic Start during Power-on	Start/ Recovery	Recovery
Time Value	Settings of Delayed Startup Time of Device Power-On Automatic Start	0.10s~99.99 s	0.10s
Startup Interval Control	Settings of Related Parameters for Startup Interval Control Function		
Start interval	Settings of Startup block, Time of Startup Interval, Control	0~9999s (The number 0 stands for disabled.)	0 (Off)
Start-stop interval	Startup blocking settings, start-stop time, control interval	0~9999s (The number 0 stands for disabled.)	0 (Off)
Start time	Maximum allowable startup time within the startup time monitoring interval	0~20 (The number 0 stands for disabled.)	0 (Off)
Interval Period	Startup time monitoring time interval	1~9999 min	30 min
Action mode of "Start-stop" signals	Startup and stop signals operating mode settings		
Operation mode of the trip output triggered by the shutdown DI	Operating mode of the trip output triggered by the DI trip signal	Keep/pulse	Keep
Control Parameters	See details in 4.4.4.2 Control Parameter Description		
Digital Input Configuration			
DI1	Settings for DI1 parameters		

Function Configuration	Input function configuration, see DI/DO configuration settings list	0~23	0 (Normal state)
Type	DI type setting, which allows to choose between normally open or normally closed	Normally Open / Normally Closed	Normally Open
Debounce time	Debounce time setting	20ms~9999 ms	40ms
Excitation Mode **[Note7]**	Selection of DI excitation mode	Direct Current / Alternating Current / External Excitation	DC
DI2	Settings for DI2 parameters		
Function Configuration	Input function configuration, see DI/DO configuration settings list	0~23	0 (Normal state)
Type	DI type setting, which allows to choose between normally open or normally closed	Normally Open / Normally Closed	Normally Open
Debounce time	Debounce time setting	20ms~9999 ms	40ms
Excitation Mode **[Note7]**	Selection of DI excitation mode	Direct Current / Alternating Current / External Excitation	DC
DI3	Settings for DI3 parameters		
Function Configuration	Input function configuration, see DI/DO configuration settings list	0~23	0 (Normal state)
Type	DI type setting, which allows to choose between normally open or normally closed	Normally Open / Normally Closed	Normally Open
Debounce time	Debounce time setting	20ms~9999 ms	40ms

Excitation Mode **[Note7]**	Selection of DI excitation mode	Direct Current / Alternating Current / External Excitation	DC
DI4	Settings for DI4 parameters.		
Function Configuration	Input function configuration, see DI/DO configuration settings list	0~23	0 (Normal state)
Type	DI type setting, which allows to choose between normally open or normally closed.	Normally Open / Normally Closed	Normally Open
Debounce time	Debounce time setting	20ms~9999 ms	40ms
Excitation Mode **[Note7]**	Selection of DI (Digital Input) Excitation Mode	Direct Current / Alternating Current / External Excitation	DC
DI5	Settings of DI5		
Function Configuration	Configuration of Digital Input Function, See the DI/DO Configuration Setting List for Details	0~23	0 (Normal state)
Type	Settings of DI Type allows to Select Normally Open or Normally Closed	Normally Open / Normally Closed	Normally Open
Debounce time	Debounce time setting	20ms~9999 ms	40ms
Excitation Mode **[Note7]**	Selection of DI excitation mode	Direct Current / Alternating Current / External Excitation	DC
DI6	Settings of DI6		
Function	Configuration of Digital Input	0~23	0 (Normal state)

Configuration	Function, See the DI/DO Configuration Setting List for Details		
Type	Settings of DI Type allows to Select Normally Open or Normally Closed	Normally Open / Normally Closed	Normally Open
Debounce time	Debounce time setting	20ms~9999 ms	40ms
Excitation mode [**Note 7**]	Selection of DI (Digital Input) Excitation Mode	Direct Current / Alternating Current / External Excitation	DC
DI7	Settings of DI7		
Function Configuration	Digital Input Function Configuration, See the DI/DO Configuration Setting List for Details	0~23	0 (Normal state)
Type	Settings of DI Type allows to Select Normally Open or Normally Closed	Normally Open / Normally Closed	Normally Open
Debounce time	Debounce time setting	20ms~9999 ms	40ms
Excitation Mode **[Note7]**	Selection of DI (Digital Input) Excitation Mode	Direct Current / Alternating Current / External Excitation	DC
DI8	Settings of DI8		
Function Configuration	Digital Input Function Configuration, See the DI/DO Configuration Setting List for Details	0~23	0 (Normal state)
Type	Settings of DI Type allows to Select Normally Open or Normally	Normally Open /	Normally Open

	Closed	Normally Closed	
Debounce time	Debounce time setting	20ms~9999 ms	40ms
Excitation mode [**Note 7**]	Selection of DI excitation mode	Direct Current / Alternating Current / External Excitation	DC
DO Configuration			
DO1	Settings of DO1		
Function Configuration	Output Function Configuration See the DI/DO Configuration Setting List for Details	0~11	1 (Tripping output)
Pulse stretching time	Settings of output Pulse-width Extension	0.01s～99.99s / Keep (0.00s)	1.00s
DO2	Settings of DO2		
Function Configuration	Output Function Configuration See the DI/DO Configuration Setting List for Details	0~11	0 (Reserve output)
Pulse stretching time	Settings of output Pulse-width Extension	0.01s～99.99s / Keep (0.00s)	1.00s
DO3	DO3 Configuration Setups		

Function Configuration	Output Function Configuration, See DI/DO Configuration Setting List for Details	0~11	3 (Start-up A / Step-down output / Close Frequency Converter / Close Large Motor)
Pulse stretching time	Output Pulse Stretching Setting	0.01s～99.99s / Keep (0.00s)	1.00s
DO4	DO4 Configuration Setups		
Function Configuration	Output function configuration, see the DI/DO configuration setting list for details.	0~11	Circuit breaker trip signal
Pulse stretching time	Output pulse-stretching setting	0.01s～99.99s/ Keep (0.00s)	1.00s
DO5	DO5 Configuration Setups		
Function Configuration	Output function configuration, see the DI/DO configuration setting list for details.	0~11	5 (Protection Alarm)
Pulse stretching time	Output pulse-stretching setting	0.01s～99.99s/ Keep (0.00s)	1.00s
AO Parameters			
Variable Selection	AO related Configure Setups	Ia/Ib/Ic/P/ IR/I0/ Iavg/ Ullavg/VA RA1	Ia

Zero Scale Value	The reading value when the AO is 4mA	-999999~999999	40
Full Scale Value	The reading value when the AO is 20mA	-999999~999999	200
Timed Recording	Timed recording parameters configuration		
Recording Method	Used for setting the storage mode of timed recording	Record area full / Cyclic recording	Record area full
Start method	Used for setting the trigger mode of timed recording	Fail to start / Start immediately / Logic 1 - Logic 6	Fail to start
Interval Cycle	Used for setting the interval cycle of timed recording	1~600s	60s

Note 1: According to the specifications of the external Motor Terminal Ammeter (MTA), the MTA specification can be set to the corresponding value. For example, if the specification of the external MTA is 5A, then the MTA specification parameter needs to be set to 5A. MTA specification × Three-phase TA transformation ratio ≤ 5000.

Note 2: Three-phase TA transformation ratio: for example, if the maximum specification of the Phase Current Sensor (MTA) is 800A, the corresponding maximum motor power is 400kW. For low-voltage motors with higher power, it is necessary to configure standard protection-level TAs. For example, for a 500kW motor, a standard protection-level TA with a ratio of 1200A/5A is configured. For the SRP-MJ device, an MTA with a specification of 5A also needs to be configured. At this time, the TA transformation ratio needs to be set, and the TA transformation ratio should be set to (1200/5 =) 240. MTA specification × Three-phase TA transformation ratio ≤ 5000.

Note 3: The setting range of the rated current is related to the MTA specification and the three-phase TA transformation ratio. When MTA specification × Three-phase TA transformation ratio < 100, the range of the motor rated current is (0.1～1.2) × MTA specification × Three-phase TA transformation ratio; when MTA specification × Three-phase TA transformation ratio ≥ 100, the range of the motor rated current is (0.2 ～ 1.2) × MTA specification × Three-phase TA transformation ratio. The details are shown in the following table. The following table only illustrates the relationship between the setting range of the rated current and the MTA

specification and the three-phase TA transformation ratio, and it is not used as a basis for MTA selection. To ensure the selection of a suitable MTA, please refer to the "Three-phase Current Sensor Selection Table" provided by our company.

MTA specification	Three-phase TA Transformation ratio	Rated current range
1A	1	0.1A~1.2A
1A	100	20.0A~120.0A
5A	1	0.5A~6.0A
5A	20	20.0A~120.0A
25A	1	2.5A~30.0A
25A	4	20.0A~120.0A
100A	1	20.0A~120.0A
300A	1	60.0A~360.0A
400A	1	80.0A~480.0A
800A	1	160.0A~960.0A

Note 4: When "Prohibited" is selected, the control buttons on the panel will be ineffective. When "Emergency" is selected, it will always be effective regardless of the "Local/Remote" Digital Input (DI). When "Local" is selected, the control buttons on the panel will be effective when the "Local/Remote" DI is turned on. When "Remote" is selected, it will be effective when the "Local/Remote" DI is closed.

Note 5: The communication interface shall be determined according to the actual selection.

Note 6: If the option of the linked output of R1 R2 R3 is not checked, it means that it is not enabled.

Note 7: There are three types of DI excitation methods, namely direct current sampling, alternating current sampling and external excitation. When used in combination with KI, it is necessary to select external excitation.

4.4.4.2 Explanation of control parameters

Configuration setup→Control function→Control parameters in menu items. In practical applications, the corresponding start-up mode should be selected according to the actual start-up mode of the motor. When setting parameters, first set the corresponding start-up mode, and then set the relevant parameters of the start-up mode. The setting contents of the motor start-up mode are shown as follows.

Table 4.4-2: Control Parameters in the Control Function Configuration Setup Menu

Startup mode setting	Display content in the control parameter menu			
	Contents	**Description**	**Range**	**Default VALUE**
Direct-On-Line Start	Control mode	Control Method for Motor Start	Direct-On-Line Start	Direct-On-Line Start
Reduce-voltage Start	Control mode	Control Method for Motor Start	Reduce-voltage Start	Reduce-voltage Start
	Start Delay Time	Delayed Time Setting for Reduced-Voltage Start of Motor	1.00s~99.99 s	**25.00s**
	Switching Current	Threshold Current for Switching from Reduced-Voltage to Full-Voltage	0.00Ie ~3.00Ie ((0.00 indicates exit)	**0.00Ie** (Disabled)
	Start Mode	Configure Setup for Reduced-Voltage Start Mode of Motor	Open Before Close / Close Before Open	Open Before Close
FWD/REV Start	Control mode	Control Method for Motor Start	FWD/REV Start	FWD/REV Start
	Switching Interval Delay Time	Delay Time Setting for FWD/REV Start Switching	1.00s~99.99s	**5.00c**
Two-Speed Start	Control mode	Control Method for Motor Start	Two-Speed Start	Two-Speed Start
	Rated Current Setting for Motor Operating at Speed 1	1.00Ie	0.20Ie~5.00Ie	**1.00Ie**
	Rated Current Setting for Motor Operating at Speed 2	Rated current setting for the motor operating at speed 2	0.20Ie~5.00Ie	**0.50Ie**
	Switching Interval Delay Time	Delay Time for Reversal/Forward Rotation State Switching of Motor	1.00s~99.99s	**5.00s**
Use with Variable	Control mode	Control Method for Motor Start	Cooperation with Variable	Cooperation with

Frequency Drive (VFD)			Frequency Drive	Variable Frequency Drive
	Start Delay Time	Delay Time Setting for Motor Start with Variable Frequency Drive (VFD) Cooperation	1.00s~99.99s	**10.00s**
Auxiliary Assistance for Large Motors	Control mode	Control Method for Motor Start	Auxiliary Assistance for Large Motors	Auxiliary Assistance for Large Motors
	Start Delay Time	Delay Time Setting for Auxiliary Assistance Start of Large Motor	1.00s~99.99s	**10.00s**

4.4.4.3 DI/DO configuration guidelines

Access the Input Configuration and Output Configuration Menus from the Configure Setups Menu. During practical application, it should be set with reference to the specific engineering drawings.

Under the digital input (DI) configuration, the option contents of DI can be classified into two categories according to functions, namely state signals and control commands. The specific signal meanings of the DI/DO configuration under the direct - start control mode are as follows.

Table 4.4-3 Explanation table for DI configuration

DI configuration		
Function	**Options**	**Explanation**
State Signals	Normal State	State monitoring signals that do not participate in protection and control logic and can be repeatedly configured.
	Local/Remote	Control for the selection of local and remote permissions. When this DI is closed, the control permission is remote; when the DI is open, the control permission is local. It cannot be repeatedly configured.
	Process Interlock	Process interlock trip signal.
	KMA State	Contact state. In the control with cooperation of frequency converter, it is the state signal of the frequency

		converter; in the auxiliary control for large motors, it is the state signal of the large motor; in other control modes, it is the state signal of contactor A. It cannot be repeatedly configured.
	KMB State	Contact state. In the control with cooperation of frequency converter, it is the state signal of the cooling fan; in the auxiliary control for large motors, it is the state signal of the small motor; in other control modes, it is the state signal of contactor B. It cannot be repeatedly configured.
	QF State	Circuit breaker status signal. It cannot be repeatedly configured.
Control Commands	Emergency Stop	Stop signal that is not affected by DI permissions and can generate an Emergency Stop Alarm Protection signal.
	Stop Command	Stop signal that is not affected by DI permissions.
	Remote stop	Remote stop signal. This DI control takes effect only when the control permission is remote.
	Local Stop	Local stop signal. This DI control takes effect only when the control permission is local.
	Remote start A	Control signal for remote start A. This DI control is active only when remote control is enabled.
	Remote start B	Control signal for remote start B. This DI control is active only when remote control is enabled.
	Local Start A	Control signal for local start A. This DI control is active only when local control is enabled.
	Local Start B	Control signal for local start B. This DI control is active only when local control is enabled.

	Remote forward start/stop	A single DI controls the forward start and stop of the motor and is affected by the control permission. This DI control takes effect only when the control permission is remote.
	Remote Reverse On/Off	A single DI controls the reverse start and stop of the motor and is affected by the control permission. This DI control takes effect only when the control permission is remote and is valid only in two-way start and two-speed start.
	Blocking of start	Start blocking signal that blocks all start commands. It can be selected as a normally open or normally closed signal through DI configuration.
	Reset Protection	Device protection reset signal, which has the same function as the reset key and is not affected by DI permissions.
	Emergency Start A	Emergency start A control signal that is not restricted by control permissions.
	Emergency Start B	Emergency start B control signal that is not restricted by control permissions.
	Local Forward On/Off	A single DI controls the forward start and stop of the motor and is affected by the control permission. This DI control takes effect only when the control permission is local.
	Local Reverse On/Off	A single DI controls the reverse start and stop of the motor and is affected by the control permission. This DI control takes effect only when the control permission is local and is valid only in two-way start and two-speed start.
	Forward On/Off	A single DI controls the forward start and stop of the motor and is not affected by control permissions.
	Reverse On/Off	A single DI controls the reverse start

		and stop of the motor and is not affected by control permissions and is valid only in two-way start and two-speed start.

Note: When the SRP-KImodule is used to connect to the Digital Input (DI), the external excitation mode needs to be selected, and the signal should last for at least 600ms or more.
The content of the digital output (DO) configuration options is related to the start-up mode configured by the device. Under different start-up modes, the corresponding DO configuration contents will be different. The table of DO configuration options is shown in the following table

Table 4.4-4 Explanation table for DO configuration

DO configuration	
Option	**Description**
Standby output	Standby output
Tripping output	Contactor Tripping output
Self-check Alarm	Self-check Alarm output of Protection Controller
Start A	Closing output, with different functions under different control modes, see Table 4.4-5
Start B	Closing output, with different functions under different control modes, see Table 4.4-5
Protection Alarm	Protection Alarm Signal output
Circuit Breaker Tripping	Circuit breaker Trip output
Tripping of Cooling Fan / Tripping of Small Motor	Trip the cooling fan in the control with cooperation of frequency converter, and trip the small motor in the auxiliary control mode for large motors.
R1 output	Linked output 1 Related to Protection. When the protection operates, the configured linked output will also operate.
R2 output	Linked output 2 Related to Protection. When the protection operates, the configured linked output will also operate.

R3 output	Linked output 3 Related to Protection. When the protection operates, the configured linked output will also operate.
Motor Running	Output for Monitoring the Real-time Running state of the Motor. Criteria for output operation: 1. There is current in the motor; 2. There is no current in the motor, the abnormal closing protection is deactivated and the configured contactor (KMA/KMB) state DI is in the closed state; When any of the above conditions is met, the motor running output will operate and remain in operation.

Notes: (1) The emergency start logic consists of "reset + start" and is only valid for Thermal Overload Protection. When the Thermal Overload Protection is in the heat dissipation process or after the heat dissipation is completed, an emergency start first executes the reset command and then executes the start A/B command; if other protections have not been reset, the emergency start command is invalid.

(2) This device is compatible with the situation of a single DO controlling a motor and two DOs controlling a motor. When the trip output is not configured, the device uses a single DO to control the start and stop of the motor. The "widening parameter" of the startup output must be set to "hold". After receiving the stop command, the startup output opens.
(3) Linked output logic: When a protection is associated with a linked - output, if this protection operates (trip, alarm or trip + alarm), the DO configured as a linked - output will also operate.
(4) Self-check alarm output: The operation of the self-check alarm output indicates that the device's self-check is normal; otherwise, it indicates a self-check error.
(5) The DI control commands Start A and Start B; the DO - output Start A and Start B have different functions under different control modes. See Table 4.4-5 for specific explanations.

Table 4.4-5 Explanation of startup DI/DO configuration

Control mode	DI control command		DO output	
	Start A	Start B	Start A	Start B
Direct-On-Line Start	Start Command	Invalid	Start A output	Invalid
Step-down Start	Start Command	Invalid	Step-down output	Full-voltage output
FWD/REV Start	Forward Rotation Command	Reverse Rotation Command	Forward Rotation output	Reverse Rotation

				output
Two-Speed Start	Speed 1 Start Command	Speed 2 Start Command	Speed 1 output	Speed 2 output
Cooperation with Frequency Converter	Start Command	Invalid	Frequency Converter output	Cooling Fan output
Auxiliary for Large Motor	Start Command	Invalid	Large Motor output	Small Motor output

DI/DO Configuration Example: The startup mode is Direct-on-line Start. See the following table for specific configuration.

Table 4.4 - 6 Explanation table for startup output widening configuration

Control mode	**Startup output**	**Control type**	**Output expansion settings requirements**
Direct-On-Line Start	Startup output A	Configured "Trip output" (Dual-Point Control)	Recommended Setting: 1.00S (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
Voltage reduced Start	Voltage reduced output (Start A)	____	Must be set to: Hold
	Full Voltage output (Startup B)	Configured "Trip output" (Dual-Point Control)	Recommended Setting: **1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
FWD/REV Start	Forward Rotation output (Startup A)	Configured "Trip output" (Dual-Point	Recommended Setting:

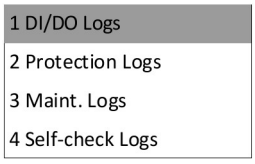
		Control)	**1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
	Reverse Rotation output (Start B)	Configured "Trip output" (Dual-Point Control)	Recommended Setting: **1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
Two-Speed Start	Speed 1 output (Start A)	Configured "Trip output" (Dual-Point Control)	Recommended Setting: **1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
	Speed 2 output (Start B)	Configured "Trip output" (Dual-Point Control)	Recommended Setting: **1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
Cooperation with Frequency Converter	Frequency Converter output	Configured "Trip output" (Dual-	Recommended Setting:

	(Start A)	Point Control)	**1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
	Cooling Fan output (Start B)	Configured "Trip output" (Dual-Point Control)	Recommended Setting: **1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
Auxiliary for Large Motor	Large Motor output (Start A)	Configured "Trip output" (Dual-Point Control)	Recommended Setting: **1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold
	Small Motor output (Startup B)	Configured "Trip Output" (Two-point control)	Recommended Setting: **1.00s** (Cannot be set to "Hold")
		Unconfigured "Trip output" (Single-Point Control)	Must be set to: Hold

4.4.5 Event record

The event record menu displays the relevant information of the Sequence of Events (SOE) record. The record information that can be viewed includes protection operation events, remote signal change events, operation events, device self-check events, and start-stop reports. Using the "<▲>" and "<▼>" keys, you can select a record to view. Press the "<↵>" key to enter the event record interface. At this time, all the records under this event can be viewed through the "<>" and "<◀>" and "<▲>" keys.

Event Record (First Screen)



Event Record (Second Screen)

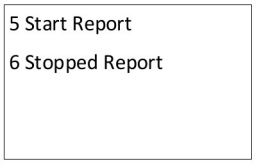
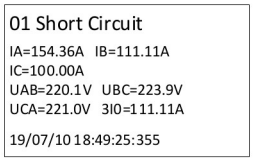


Figure 4.4-23 Event record selection interface

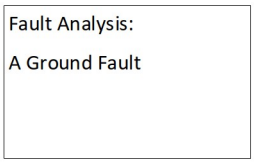
1. SOE Record: The SOE event record includes protection operation events, remote signal change events, operation events, and device self-check events. A maximum of 64 protection operation events can be recorded, and a combined maximum of 64 remote signal change events, operation events, and device self-check events can be recorded. The specific display is as follows, taking Short Circuit Protection alarm, DI1 operation, DO1 operation, device power failure, and parameter abnormality as examples.

Protection Operation Events:

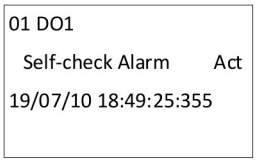
Short Circuit Protection (First Screen)



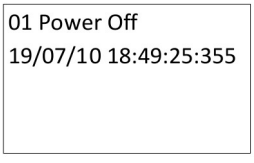
Short Circuit Protection (Second Screen)



Remote Signal Change Events:



Operation Events:



Device Self-check Events:

Figure 4.4-24 Example of SOE record display

2. Start-up Report: The start-up report records the start-up information of the motor, including the start-up trigger source, start-up current, start-up time, start-up voltage, and start-up occurrence time. Among them, the panel start-up indicates the start-up trigger source, Imax refers to the maximum current value during the motor start-up process, the start-up time is the time taken from the start to the end of the motor start-up, and Umin refers to the minimum voltage value during the motor start-up process. A maximum of 64 start-up reports can be recorded. The specific display content is shown in the figure below:

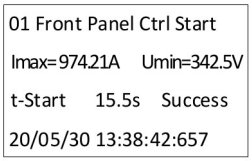


Figure 4.4-25 Example of Start-up Report Display

3. Stop Report: The stop report records the start-up information of the motor, including the stop trigger source, the three-phase current before Stopped, and the stop occurrence time. A maximum of 64 stop reports can be recorded. The specific display content is shown in the figure:

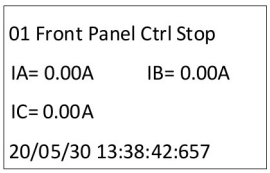


Figure 4.4-26 Example of stop report display

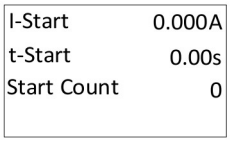
4.4.6 Statistical information

The statistical information menu displays the three-phase tripping current of the motor for the most recent time, the number of tripping times, the start-up current for the most recent time, the start-up time, the total number of start-ups, the total running time, the current running time, the stop time and so on.

You can turn pages by using the "◀" and "▲" keys.

Statistical Information (First Screen)

Statistical Information (Second Screen)



Statistical Information (Third Screen)

Statistical Information (Fourth Screen)

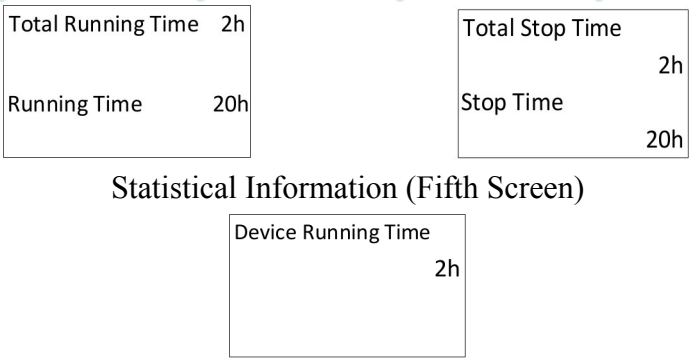


Figure 4.4-27 Statistical information interface

4.4.7 Device maintenance

There are a total of 10 (user) sub-menus on the device maintenance interface. You can make up and down selections by using the "◁" and "△" keys. The selected menu will be highlighted in reverse. To enter this menu, you need to enter a password (default password: 0000). The specific interfaces are as follows:

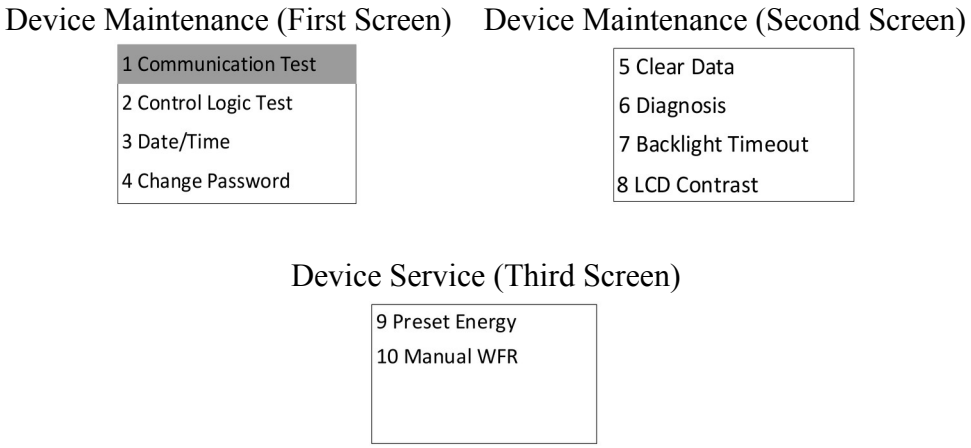


Figure 4.4-28 Device service interface

1. This menu is used to enter the communication point-to-point page. Entering the communication point-to-point page will generate an "Entering Communication Point-to-Point" SOE (operation event).

By pressing the "◁" and "△" keys, you can select the data or state that needs to be communicated point-to-point. When exiting the communication point-to-point page, an "Exiting Communication Point-to-Point" SOE will be generated. The protection data, measurement data, harmonic data, temperature data, DI state, and DO state are consistent with those on the data query and DI/DO state pages. The data is assigned values according to certain rules to facilitate identification and differentiation. The DI and DO states can be manually operated for change. The protection state is arranged in the order of trip and alarm state words, and the state can be manually operated for change.

Figure 4.4-29 Communication point-to-point setting interface

2. Transmission Function: This menu is used to enter the transmission page. Entering the transmission page will generate an "Entering Transmission Function" SOE (operation event). Using keys "<◀>" and "<▲>" keys, you can select the required transmission data. When exiting the transmission page, an "Exiting Transmission Function" SOE will be generated. The DI transmission sets the actual DI state, which can be used for logical judgment; for the DO transmission, the DO action can be executed and the logic can be returned. The output delay refers to the set widening time; the protection transmission executes the protection action logic and simultaneously triggers the trip and alarm SOEs, and the actions correspond to the configured outputs.

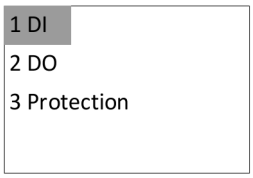


Figure 4.4-30 Transmission setting interface

1. Modify the Device Time: This menu is used to calibrate the system time.

By pressing the "<◀>" and "<▲>" keys, you can modify the required time. Press the "<Setup>" key to confirm the time setting. Press the "<Reset>" key to directly exit the time setting or return to the previous-level menu. The specific display interface is as follows:

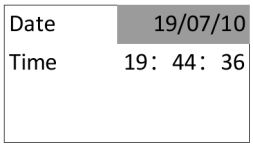


Figure 4.4-31 Time setting interface

2. Modify the Device Password: The password modification menu can be used to modify the general password of the device. If the newly entered password for the first time is different from that for the second time, a prompt of "Passwords do not match!" will be displayed. At this time, press the "<Setup>" key to re-enter the new password. Press the "<Reset>" button on Interface 1 and Interface 2, and the screen will return to the password modification menu, and the device password remains unchanged. If the password is successfully modified, the page will automatically return to the "Modify Password" menu item and be highlighted in reverse.

Interface 1 Interface 2

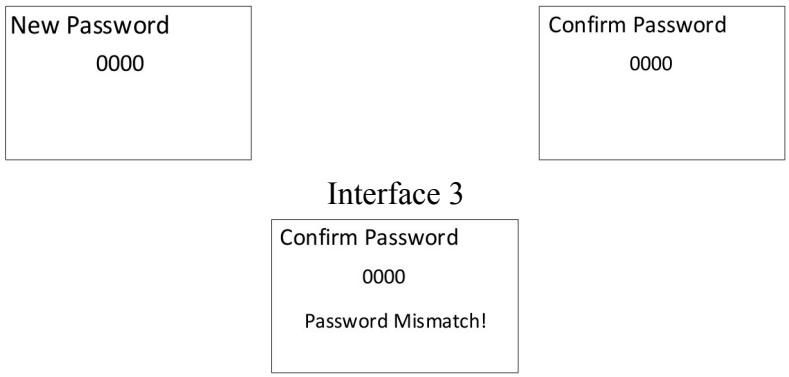


Figure 4.4-32 Password modification interface

1. Data Clearance: This menu clears the device's statistical information, Sequence of Events (SOE), electric energy, and start-up report records. By pressing the "<▲>" and "<▲>" keys, you can select the data to be cleared.

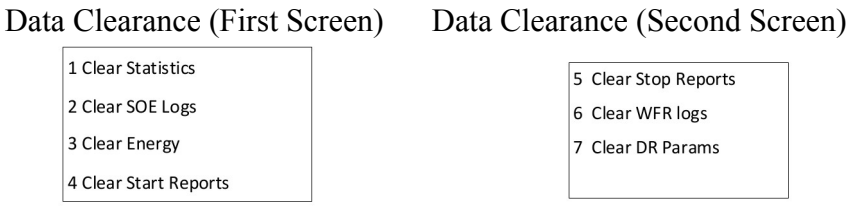


Figure 4.4-33 Data clearance selection interface

Now, taking the clearing of statistical data as an example for illustration, the operation methods for clearing other data are the same as this. After selecting Clear Statistics, press the "<Setup>>" key to enter the "Clear Statistics" interface. Press keys "<▲>" and "<▲>" keys to select "Yes" or "No". After pressing the "<Setup Reset>" key, the statistical data will be cleared or not cleared according to the selected option. If the "<↩>" key is pressed on this screen, it will directly exit and return to the previous-level menu. The specific display interface is as follows:

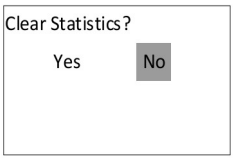


Figure 4.4-34 Clear statistics interface

1. Diagnostic Information: The diagnostic information menu is used to display the self-diagnostic state information of the voltage and current wiring. The specific display interface is as follows:

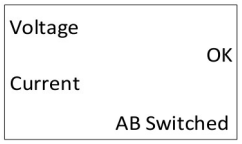


Figure 4.4-35 Diagnostic information display interface

Notes: The diagnostic information for voltage wiring includes: normal, phase sequence error. The diagnostic information for current wiring includes: normal, phase sequence error, IA and IB reversed, IB and IC reversed, IC and IA reversed, and the wrong threading direction of IA, IB and IC.

1. Backlight Timeout Time: The backlight timeout time menu is used to set the backlight timeout time. Press the "<Setup>" key to enter the modification state. At this time, press the "<▲>" key to make a selection. After selection, press the "<Setup>" key to confirm the selection. Press the "<↶>" key to exit the modification state or return to the previous-level menu. The specific display interface is as follows:

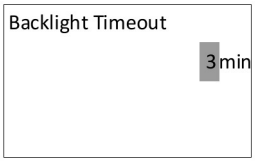


Figure 4.4-36 Contrast adjustment interface

2. Contrast Adjustment: The contrast adjustment menu is used to set the brightness level of the liquid crystal display. Press the "<>" key to enter the modification interface. At this time, press the "<▲>" key to make a selection. After selection, press the "<Setup>" key to confirm the selection. Press the "<↶>" key to exit the modification state or return to the previous-level menu. The specific display interface is as follows:

Figure 4.4-37 Contrast adjustment interface

3. Electric Energy Preset: Under this menu, the initial electric energy data of forward/reverse active electric energy and forward/reverse reactive electric energy can be set. After putting the motor into operation, electrical energy can be accumulated based on this data.

Press the "<◄>" and "<▲>" keys to select the electrical energy parameters that need to be preset. Press the "<Setup>" key to enter the modification interface. At this time, press the "<◄>" and "<▲>" keys to set the initial electric energy data. After selection, press the "<Setup>" key to confirm the selection. Press the "<↶>" key to exit the modification state or return to the previous-level menu. The specific display interfaces are as follows:

Electric Energy Preset (First Screen) Electric Energy Preset (Second Screen)

Figure 4.4-38 Electric energy preset interface

4. Manual Fault Waveform Recording: The manual fault waveform recording menu is used to manually start the fault waveform recording. Press the "<⏎>" key to enter the manual fault waveform recording interface. Press the "<◄>" and "<▲>" keys to select "Yes" or "No". After pressing the "<⏎>" key, it will be determined whether to manually start the waveform recording according to the selected option. If the "<↶>" key is pressed on this screen, it will directly exit and return to the previous-level menu. The specific display interface is as follows:

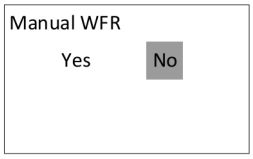


Figure 4.4-39 Manual fault waveform recording interface

4.4.8 Device information

The device information screen can be used to view the version information of the device. The specific display content is as follows:

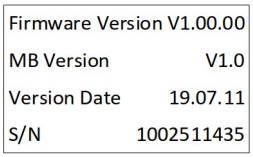


Figure 4.4-40 Device information interface

5. Installation and wiring

5.1 Device installation

5.1.1 Mechanical dimension diagram

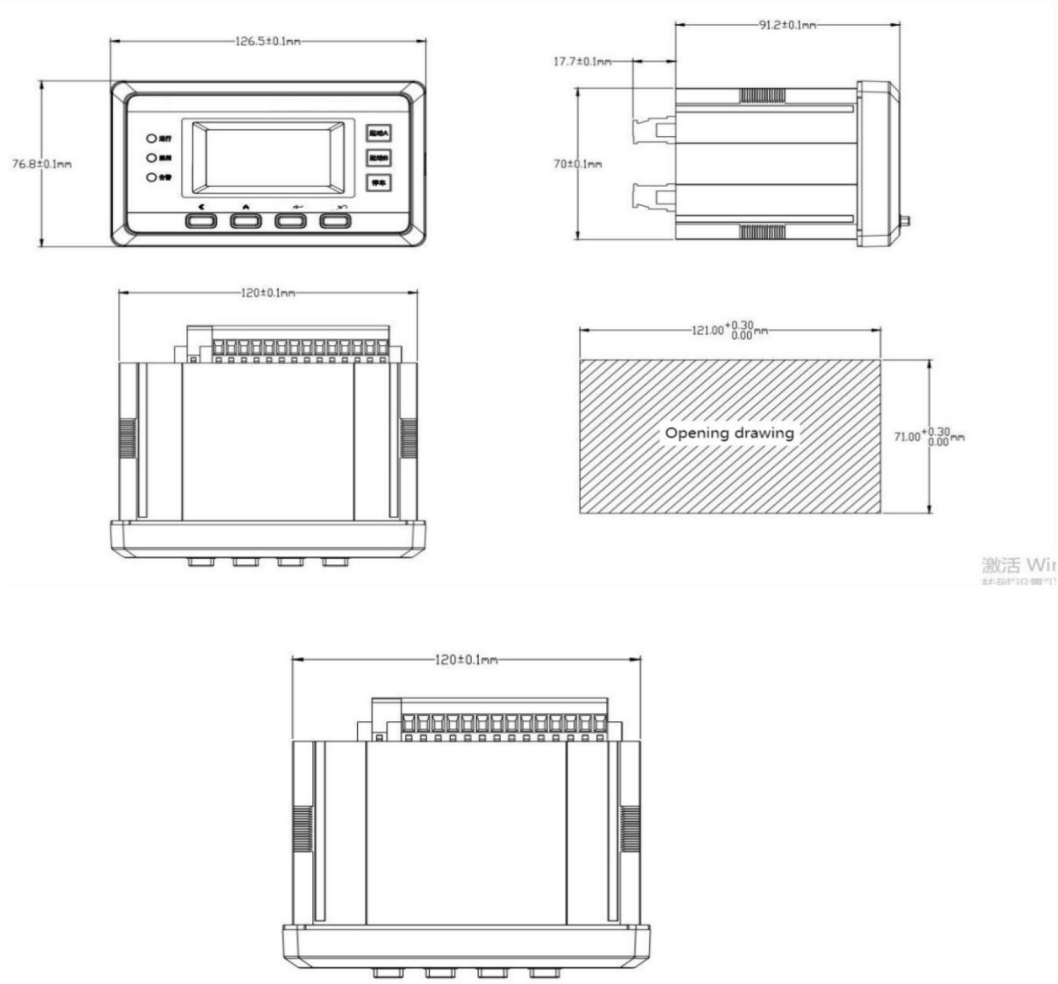


Figure 5.1-1 Mechanical dimension diagram of the device

The dimensions of the device are: 126.5mm (Length)×76.8mm (Width)×91.2mm (installation depth)

The dimensions of the opening are: 121.0mm (Length)×71.0mm (Width)

5.1.2 Installation diagram

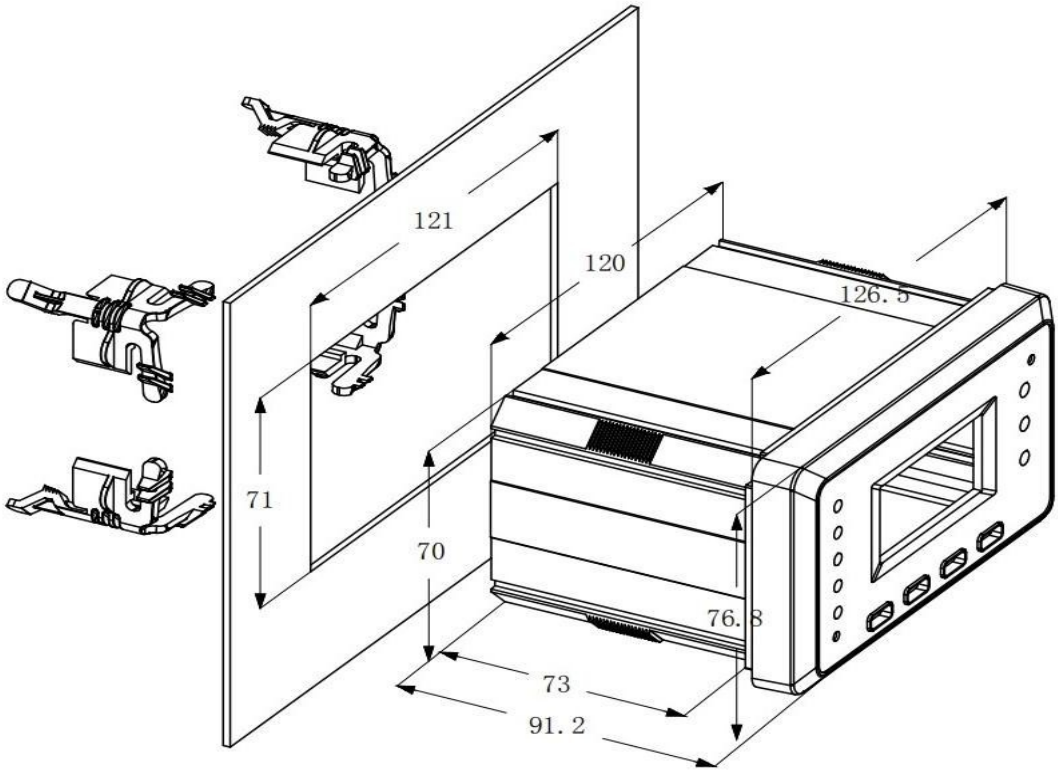


Figure 5.1-2 Installation diagram of the device

Move the device to the opening position of the switch gear according to the direction of the arrow, and then insert the fixing slider into the clamping grooves on both sides of the device.

5.1.3 Installation precautions

1. Installation Conditions

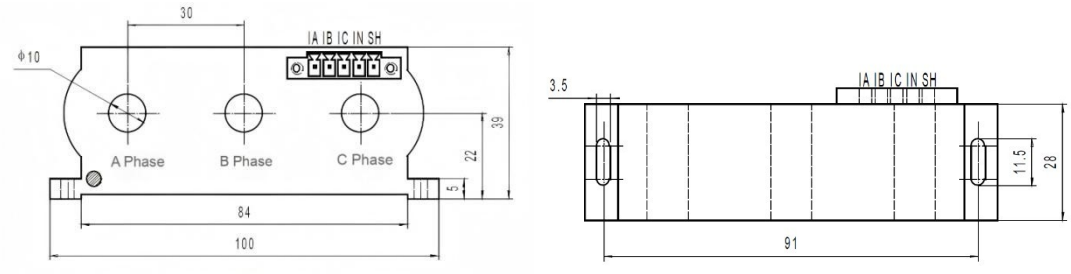
The device should be installed indoors, in a well-ventilated, dry, and clean location, away from heat sources and strong electromagnetic fields.

2. Installation place

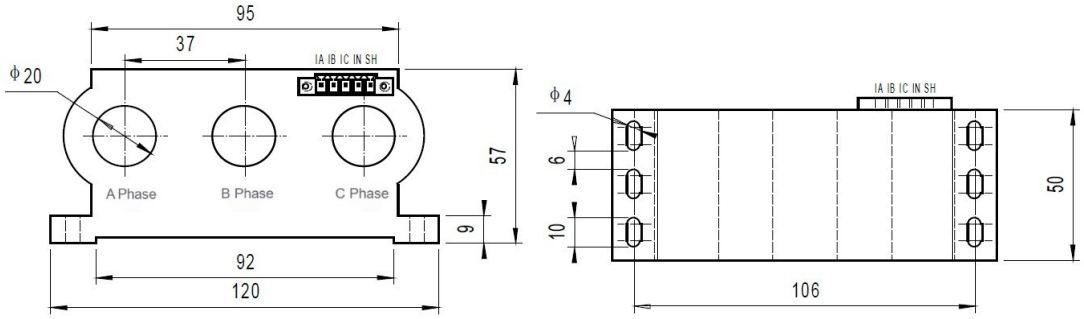
It is usually installed in the switch gear so that it can be protected from the invasion of oil, dirt, dust, corrosive gases or other harmful substances. During installation, attention should be paid to facilitating maintenance and ensuring there is sufficient space for placing relevant wires, terminal blocks, short-circuiting boards and other necessary equipment.

5.1.4 MTA external through-core current sensor

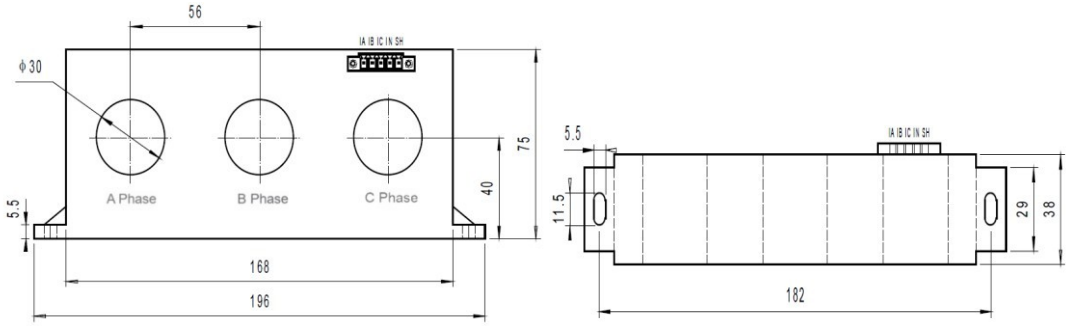
MTA-1A/5A, the diameter of the perforation is 10mm, Integrated design



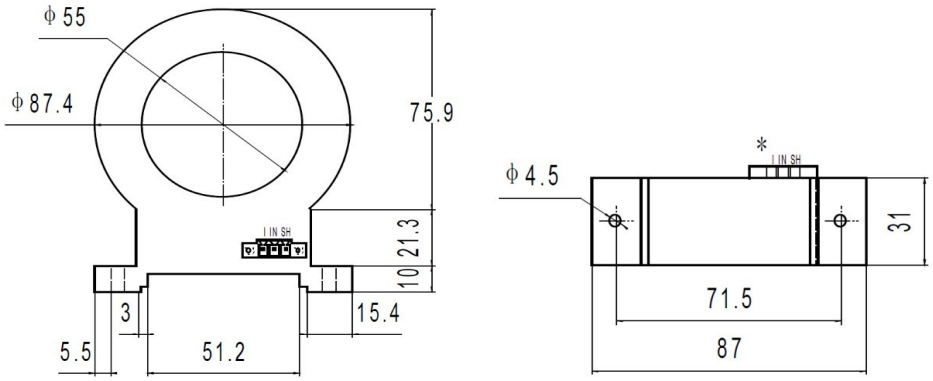
MTA -25A, The diameter of the perforation is 20mm, Integrated design



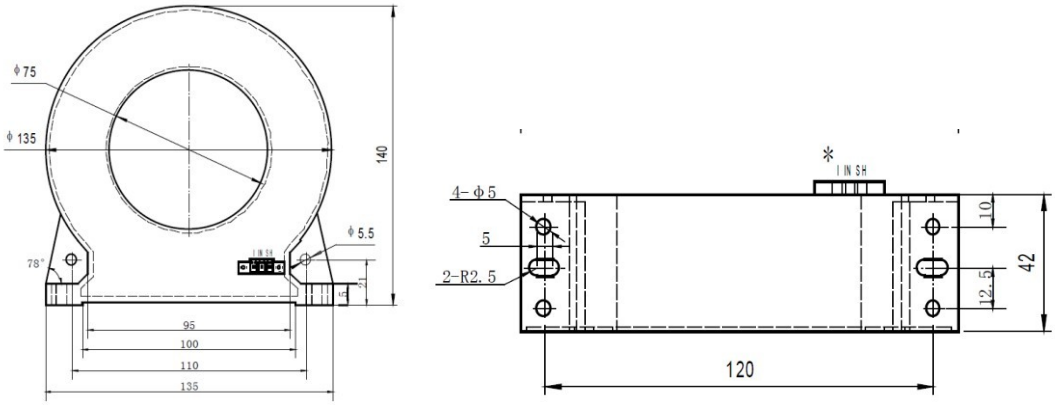
MTA -100A/300A, The perforation diameter is 30mm, Integrated design



MTA -400A, The diameter of the perforation is 55mm, Split Type (with 3 Units per Set).

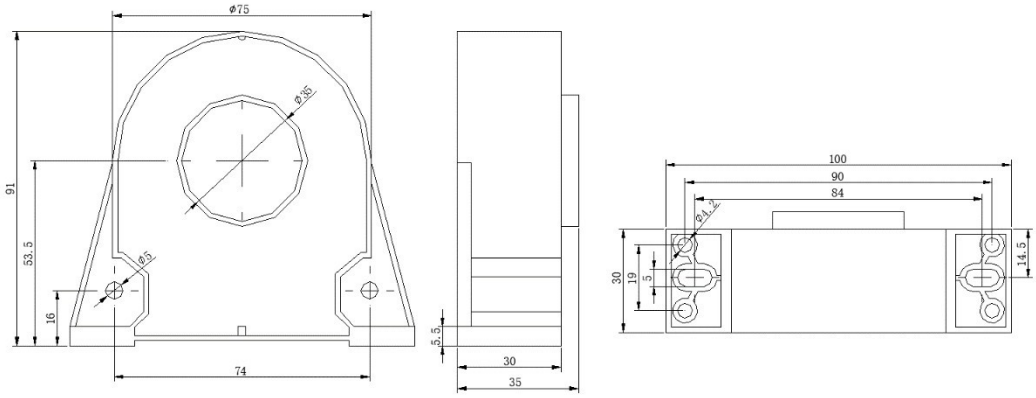


MTA -800A, The diameter of the perforation is 75mm, Split Type (with 3 Units per Set).

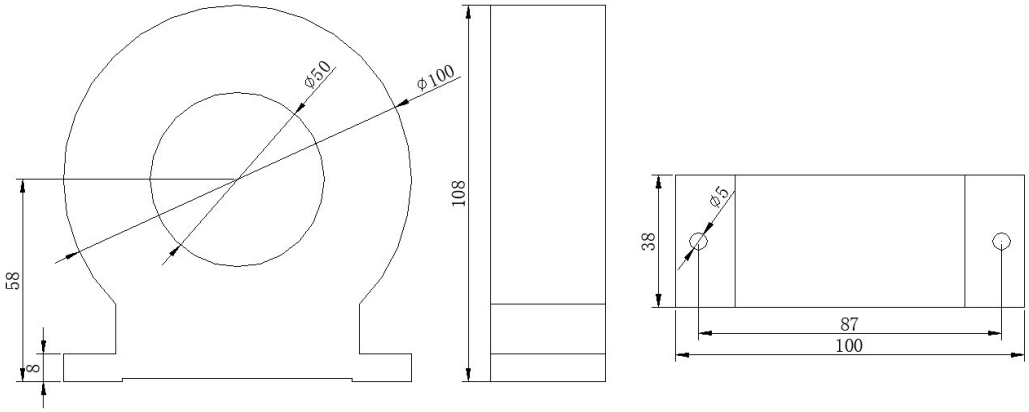


5.1.5 Residual current sensor

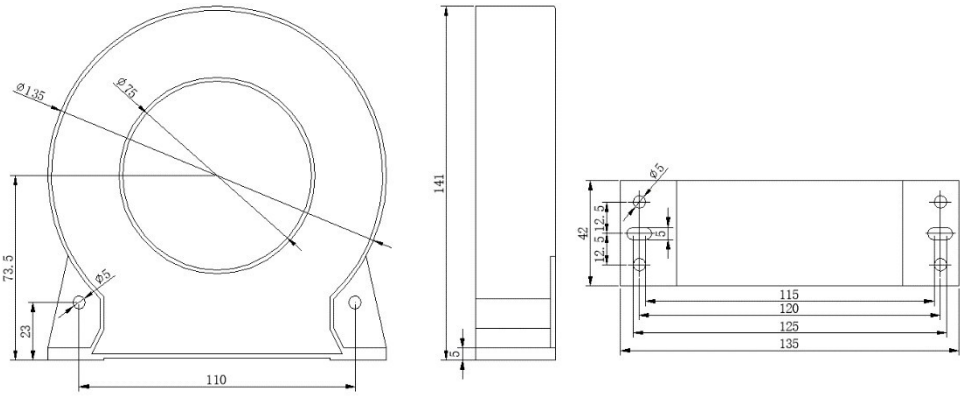
SRP-MIR-35, The diameter of the perforation is 35mm



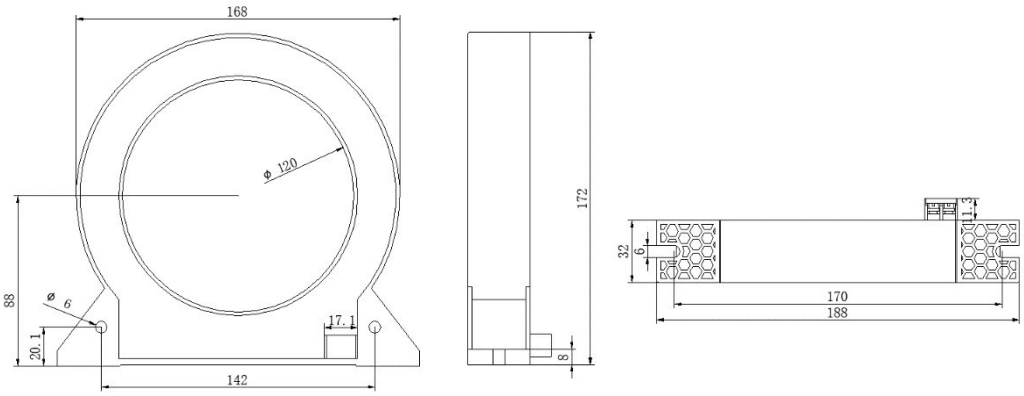
MIR-50, The diameter of the perforation is 50mm



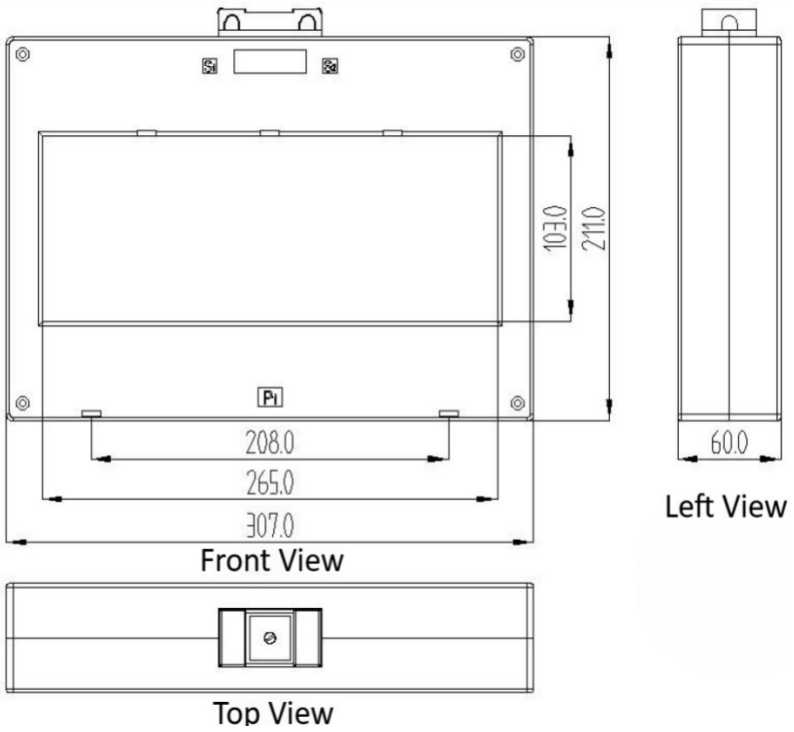
MIR-75, The diameter of the perforation is 75mm



MIR-120, The diameter of the perforation is 120mm



MIR-265*103, The diameter of the perforation is 265mm*103mm

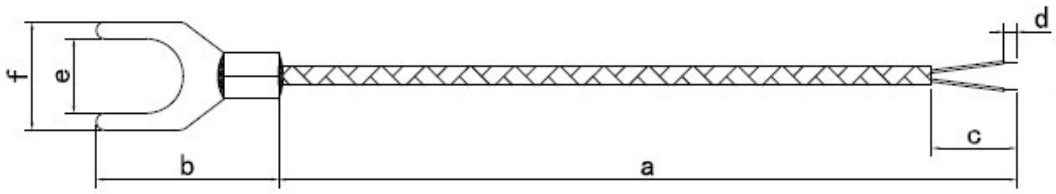


Notes:

The rated currents of the selected residual current sensors are all 1000mA.
MIR-35, MIR-50, MIR-75, and MIR-120 models come with built-in connecting cables; for MIR-265*103, a separate connecting cable needs to be selected.

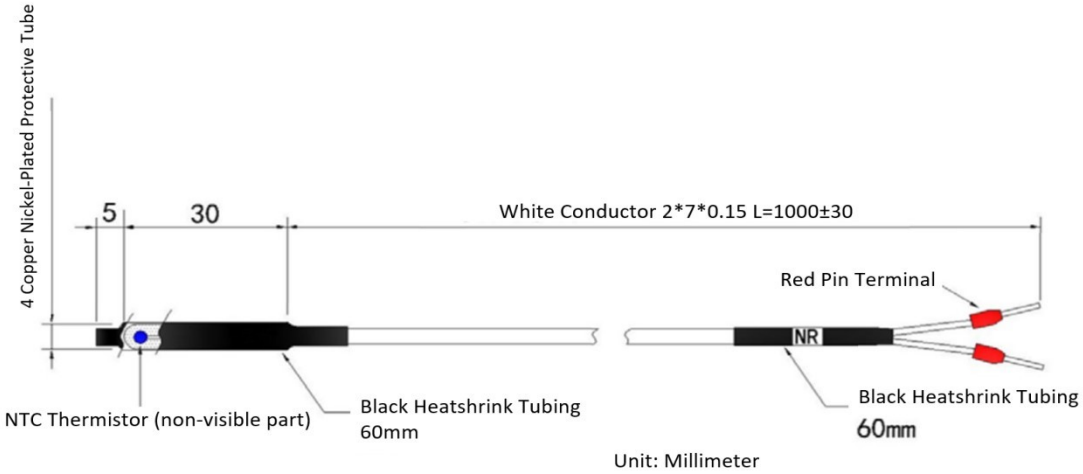
5.1.6 Temperature sensor

1) NTC-Y Type Sensor



Dimensions(mm) Specifications	a	b	s	d	e	f
NTC-Y4	1000	17.3	30	5	4.3	7.1
NTC-Y6	1000	25	30	5	6.3	11.4
NTC-Y12	1000	29.7	30	5	12.5	17.4

2) NTC-1041 type sensor



Notes: The NTC-1041 sensor is available in lengths of 2m, 3m, 5m, and 8m.

5.2. Terminal description

5.2.1 Device backplane terminal diagram

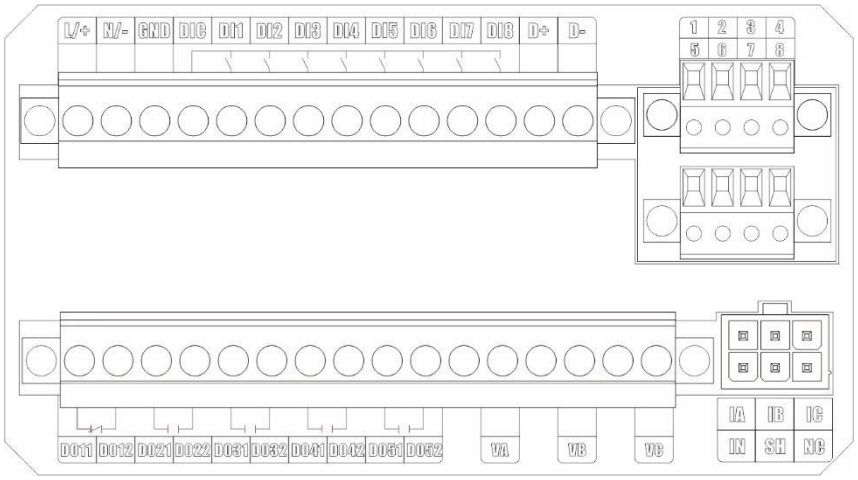


Figure 5.2-1: SRP-MJ backplane terminal diagram

5.2.2 Terminal description

Terminal marking		Description	
IA/IB/IC/IN/SH/NC		Three-phase current input (requires the use of SRP MTA in conjunction)	
VA/VB/VC		Three-phase voltage input	
DI1~DI8/DIC		DI1~DI8 are discrete inputs and DIC is the common terminal	
DO11~DO52		Discrete output DO1~DO5. **Example:** DO11 and DO12 are the terminals of DO1	
D+/D-		RS-485 communication, where D+ is for positive data and D- is for negative data	
L/+, N/-, GND		Power supply for the device. For direct current, + is positive, - is negative. For alternating current, L is the live wire, N is the neutral wire, GND is the ground wire	
1		AO+	AO output (4 - 20mA output)
2		AO-	
3		*IR	Residual current input (requires mutual use with SRP MIR)
4		IR	
Option 2T	**5**	**TC11**	Temperature signal input 1 (NTC)
	6	**TC12**	
	7	**TC21**	Temperature signal input 2 (NTC)
	8	**TC22**	
Option 2RS485+ 1T	**5**	**TC11**	Temperature signal input 1 (NTC)
	6	**TC12**	
	7	2D+	The second RS-485

	8	2D-	
RS485+D option P+1T	**5**	**TC11**	Temperature signal input 1 (NTC)
	6	**TC12**	
	7	B	Profibus-DP general communication interface
	8	A	
Option 1RS485+3 T	**5**	TCC	Temperature signal input common terminal
	6	**TC1**	Temperature signal input 1 (NTC)
	7	**TC2**	Temperature signal input 2 (NTC)
	8	**TC3**	Temperature signal input 3 (NTC)

5.3. Wiring the cores on the terminal block

There are two rows of terminal blocks on the rear panel of SRP-MJ. When wiring the cores on the terminal block, ensure the correct phase sequence and polarity of the AC voltage and current; otherwise, the measurement results will be directly affected.

⚠ **The tightening torque for the terminal blocks is 3.5 Lb-In / 0.4 Nm, and that for the additional function terminals is 2.21 Lb-In / 0.25 Nm. Please apply the right amount of force when wiring to avoid screw slippage.**

5.3.1 Power supply wiring

The working power supply required by the SRP-MJ can be either alternating current or direct current, with a voltage range of 88 - 264V AC/DC. If the applied voltage exceeds the allowable range, it may damage the device.

5.3.2 Ground wire connection

To ensure the normal operation of the device and personal safety, the GND (device ground) of the SRP-MJ must be connected to the protective earth (PE). Connect the grounding terminal GND of the device to the protective grounding terminal (PE) of the switchgear using a yellow-green wire.

5.3.3 Voltage and current input wiring

(1) Three-phase Voltage Input (VA, VB, VC)

For all measurements related to power and electrical energy, the phase takes the VAB input as a reference, and the frequency measurement also refers to the frequency of VAB. Therefore, the VAB input terminal must be correctly connected to ensure accurate readings of power, electrical energy, and frequency. However, VAB does not affect the measurement of other voltage and current circuits (except for the phase).

(2) Three-phase Current Input (IA, IB, IC, IN)

The motor current is connected to the SRP-MJ after being converted by the MTA. Use the current-carrying core connection method for the (cable) current of the MTA motor provided by our company. Please pay attention to the direction of the core penetration. The MTA outgoing wires

are connected to SRP-MJ. Modify the rated current of the 550J-S device accordingly based on the MTA specifications.

For the integrated MTA, its secondary wires are 4-core shielded flexible conductors, with each core wire diameter being Φ0.5mm. The wire ends in yellow, green, and red correspond to the A-phase, B-phase, and C-phase of the primary side of the MTA respectively, and are connected to the IA, IB, and IC terminals of the SRP-MJ device respectively. The black wire end is the common terminal of the MTA secondary wire and is connected to the IN terminal of the SRP-MJ device. A shielded wire with a black heat-shrinkable tube is correspondingly connected to the SH terminal of the SRP-MJ device.

For the split MTA, its secondary wires are 2-core shielded flexible conductors, with each core wire diameter being Φ0.5mm. When wiring, three MTAs form a group, corresponding to the A-phase, B-phase, and C-phase of the primary side respectively; the like-named terminals of the three MTAs are respectively connected to the IA, IB, and IC terminals of the SRP-MJ device (note that the terminal IA of the SRP-MJ device corresponds to the A-phase of the primary side, IB corresponds to the B-phase of the primary side, and IC corresponds to the C-phase of the primary side); the different-named terminals of the three MTAs are connected together and connected to the IN terminal of the SRP-MJ device; the shielded wires of the three MTAs are connected together and connected to the SH terminal of the SRP-MJ device.

Pay attention to the installation position of the three-phase current sensor (MTA). It should not be installed in the electrical circuit after frequency conversion, the star-delta reduced-voltage Start star-delta switching circuit, the switching circuit in the FWD/REV Start circuit, etc. The alternating current input (IA/IB/IC/IN) of the device is rated as a 1.25V voltage signal. Do not apply current or high voltage by mistake, and the IN terminal should not be grounded. The shielding layer of the secondary cable wire of the current loop should be reliably connected to the SH terminal. Pay attention to the phase sequence and polarity of the alternating current and voltage; otherwise, it will affect the measurement function and lead to incorrect protection actions.

5.3.4 Residual current input

Select the SRP-MIR residual current sensor according to the motor power. The primary phase current and neutral current (IA, IB, IC, IN) of the motor pass through the SRP-MIR through the core, and the PE wire should not pass through the core. The SRP-MIR outgoing wires are connected to the residual current signal input terminals 3 and 4 of SRP-MJ using special terminals. The selection of the SRP-MIR transformer is related to the rated current of the load circuit, and there is no need to set the CT transformation ratio.

5.3.5 Residual current input

The NTC thermistor output terminals are connected to the temperature sampling signal input terminals of SRP-MJ.
For the NTC connecting wires, please use shielded twisted pairs (the shielded wire should be connected to the grounding point on the device's casing). The length is related to the cross-

sectional area of the wire. For detailed data, please refer to the following table.

Cross-sectional area of the wire (copper wire)	Maximum Length
0.5mm^2	180m
1.5mm^2	550m
2.5mm^2	900 m

5.3.6 Discrete input wiring

The device has 8 channels of discrete inputs. The terminal markings are DIC, DI1, DI2, DI3, DI4, DI5, DI6, DI7, and DI8 in sequence. They are used to detect the state of external contacts and support the connection of dry contacts. Among them, DIC is the common terminal for the positive pole. **The excitation mode of DI is internal excitation with 24VDC. When wiring, it must be noted that external excitation voltages (such as 220VAC) must not be wrongly connected; otherwise, the device will be directly damaged.**

When connecting 220VDC/AC or 110VDC/AC input signals, it is necessary to use the SRP-KI module provided by our company for transfer (see Figure 5.2-2). For the specific use of the SRP-KI conversion module, please refer to its user manual. "DI excitation mode" (Configuration setup → System parameter → DI excitation) should be selected according to the input signal type. That is, when the input signal is 220VDC/110DC, the sampling type of this channel should be set to "0" for direct current sampling; when the input signal is 220VAC/110AC, the sampling type should be set to "1" for alternating current sampling. When connecting digital quantity through the SRP-KI module, the sampling should be set to "external excitation", and the input signal needs to last for at least 600ms or more.
When setting the alternating current and direct current DI sampling types, each channel of DI can be set separately.

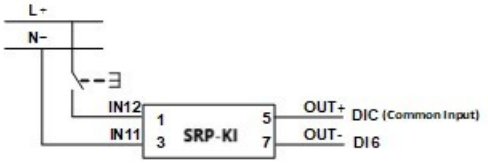


Figure 5.3-1 Schematic diagram of SRP-KI wiring

5.3.7 Relay output wiring

The device has 5 relays. The terminal markings are as follows: DO1 (DO11, DO12), DO2 (DO21, DO22), DO3 (DO31, DO32), DO4 (DO41, DO42), and DO5 (DO51, DO52) respectively. DO1 is a normally closed contact, DO2 can be either a normally open or a normally closed contact, and DO3, DO4 and DO5 are normally open contacts. Users can connect them to corresponding circuits according to actual applications.

5.3.8 AO output wiring

The AO of the SRP-MJ has a built-in 24V DC power supply. Its wiring is shown in the figure below. When wiring, please confirm the type of the AI acquisition module of the DCS. Do not carry the power supply.

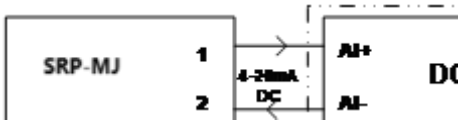


Figure 5.3-2 Schematic diagram of the AO wiring of the device

5.3.9 Communication wiring

(1) RS-485 Wiring

The device has one or two two-wire RS-485 communication ports, and the terminal markings are D+ and D-. It uses dedicated RS-485 isolation chips for isolation and is equipped with protection circuits, which can prevent common-mode and differential-mode voltage interference, lightning strikes and damage to the communication ports caused by incorrect wiring.

The RS-485 communication mode allows connecting a maximum of 32 smart devices to a single bus. Shielded twisted pairs are used as the communication cable, and the total length must not exceed 1200 meters. The positive and negative polarities of the RS-485 ports of each device must be connected correctly. The typical wiring diagram is shown in Figure 5.3-3:

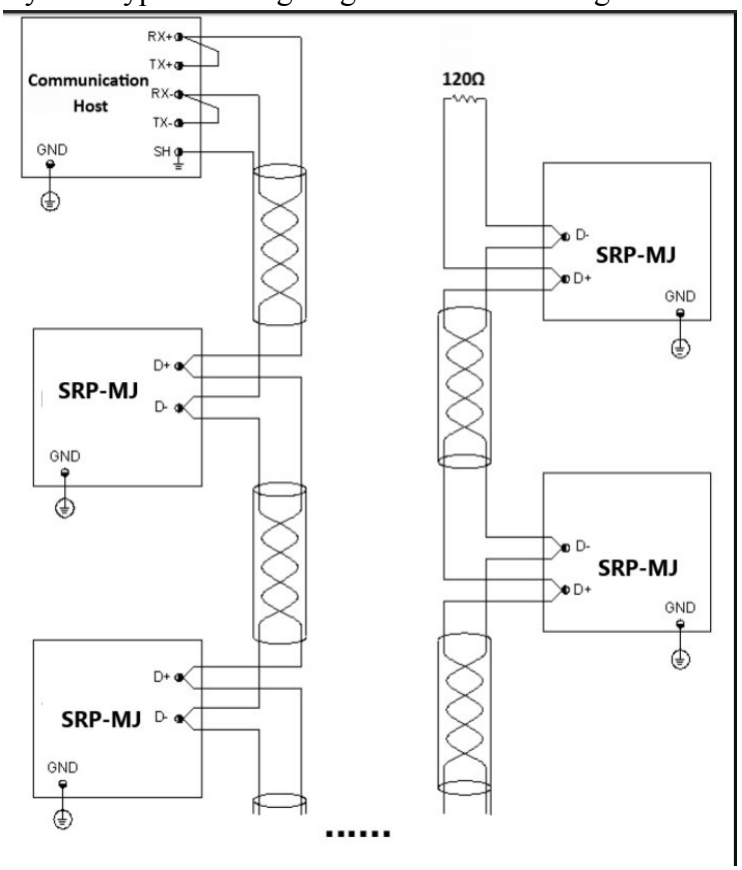


Figure 5.3-3 Schematic diagram of RS-485 wiring

(2) PROFIBUS Wiring

The physical interface for PROFIBUS DP communication supports the common terminal interface, and it can be connected using ordinary shielded cables. The pin definitions of its communication interface are as follows in the table below:

Terminal Marking	Signal Name	Meaning
B	RxD/TxD-P	Receive/Transmit Data - P
A	RxD/TxD-N	Receive/Transmit Data - N

5.4 Device fault analysis

1. Nothing is displayed
   - Check whether the power supply voltage and other wiring are correct. The required voltage is determined according to the working power supply range of the SRP-MJ.
   - Turn off the power supply and then turn it on again.
2. The device does not work normally after power-on
   - If the running light of the device does not blink, it may be that the power supply is not connected or the power supply voltage is not within the allowable range. Please use a multimeter to check whether the voltage applied to the L/+ and N/- terminals of the protection controller meets the requirements of the device.
   - Turn off the power supply and then turn it on again.
3. How does the protection controller implement the process interlock tripping function?

Connect the "process interlock" contact to the protection controller DI and set the Interlock Protection parameters properly. Corresponding menus: Configuration setup→ Input configuration; Configuration setup→ Protection parameters → Block protection; Configuration setup→ Output configuration.

4. RS-485 communication is abnormal
   - Check whether the communication attributes (baud rate, ID, etc.) of the upper computer are consistent with those of the SRP-MJ
   - Check whether the RS-232/RS-485 converter is normal.
   - Check whether there are any problems with the entire communication feeder (short circuit, open circuit, grounding, whether the shielded wire is correctly grounded at a single end, etc.).
   - If the communication feeder is long, it is recommended to connect a matching resistor of about 120Ω in parallel at the end of the feeder.
   - Turn off the SRP-MJ and the PC host, and then turn them on again to try.
5. Profibus communication is abnormal
   - Check the consistency between the communication address of the upper computer and the slave station setting of the SRP-MJ.
   - Check whether there are any problems with the entire Profibus communication channel and whether the communication feeder is connected normally.
   - Turn off the power supply of the SRP-MJ and the communication program, and then try again.

6. The current reading is incorrect
   - Check whether the MTA specification is set correctly.
   - Check whether the GND is correctly grounded. Neither the IN nor the SH terminal should be grounded.
   - Check whether the MTA is in good condition.
   - For circuits with frequency converters, the MTA should be installed in the circuit before frequency conversion.

7. The reading of power or power factor is incorrect while the readings of voltage and current are correct
   - Check whether the current phase relationship is correct.
   - Pay attention to the direction and position of the MTA cable passing through the core.
   - For motors with forward and reverse control, the MTA should not be installed in the switching circuit.

8. The protection controller reports an a/d sampling error and the sampling zero drift is large
   - Check whether there is incorrect grounding. It is emphasized again that neither the IN nor the SH terminal should be grounded. If the problem still cannot be determined, please call our company's after-sales service hotline at 400-9916-218.

9. After the protection controller operates, the output circuit of the protection controller cannot act correctly
   - Check whether the protection action output wiring of the protection controller is correct and reliable.
   - Check whether the protection action output parameters of the protection controller are set correctly.
   - If the above two checks are correct, please call our company's after-sales service hotline at 400-9916-218.

10. The protection controller di cannot reflect the actual signal correctly
    - Check whether the external auxiliary contacts act correctly and reliably.
    - Check whether the DI wiring is correct and reliable. (For internally excited DI, you can directly short-circuit DI and the common terminal with a wire to check the DI state.)

11. The protection controller's contactor protection cannot trip the circuit breaker
    - Check whether the relevant parameters related to this protection are set correctly. If they are correct, the corresponding DO port should be able to act reliably (you can use the resistance or on-off range of a multimeter to monitor).
    - Check whether the wiring to the circuit breaker is correct and reliable.
    - Check whether the circuit breaker has a shunt coil.

5.5 Instructions for the use of protection and control functions

5.5.1 Setting of protection and control parameters

The protection parameters should be set by electrical professional technicians according to the motor nameplate, electrical drawings and its actual operating conditions. **The default values in Table 4.4-1 Configure Setup Menu Table can be used for reference.** Users can set protection and control parameters through two methods: panel buttons and background communication. When setting parameters by using the panel button method, please refer to the instructions for button operation and display content; when setting parameters by using the background

communication method, please refer to the help documentation of the setting software. The specification of the MTA equipped with the device is related to the rated current of the motor. When selecting the MTA specification, please refer to the "Three-Phase Current Sensor Selection Table" provided by our company.

5.5.2 Quick look-up of thermal overload protection (inverse time) operating characteristics

Table 5.5-1 Thermal overload protection (inverse time) operating characteristic table (I2=0, Iov=1.0*Ie, Hot State, Unit: s)

Tc I/Iov	0.1	0.5	1.0	3.0	5.0	6.5	10.0	16.0	20.0
1.5	3.050	15.251	30.501	91.503	152.505	198.257	305.011	488.017	610.022
2.0	1.208	6.040	12.079	36.238	60.397	78.516	120.794	193.270	241.588
3.0	0.443	2.216	4.432	13.295	22.159	28.807	44.318	70.909	88.636
4.0	0.235	1.175	2.349	7.048	11.747	15.271	23.494	37.590	46.988
5.0	0.146	0.732	1.465	4.394	7.323	9.520	14.646	23.433	29.292
6.0	0.100	0.501	1.003	3.009	5.015	6.519	10.029	16.047	20.059
7.2	0.069	0.345	0.690	2.069	3.449	4.484	6.898	11.037	13.797
8.0	0.056	0.278	0.556	1.669	2.782	3.617	5.565	8.903	11.129
9.0	0.044	0.219	0.438	1.314	2.190	2.847	4.381	7.009	8.761
10.0	0.035	0.177	0.354	1.062	1.770	2.300	3.539	5.662	7.078

5.5.3 Quick look-up of tE time protection operating characteristics

Table 5.5-2 tE time protection characteristics table (unit: s)

Tp I/Ie	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
1.5	32.00	64.00	96.00	128.00	160.00	192.00	224.00	256.00
2.0	16.00	32.00	48.00	64.00	80.00	96.00	112.00	128.00
3.5	2.909	5.818	8.727	11.64	14.55	17.45	20.36	23.27
4.0	2.286	4.571	6.857	9.143	11.43	13.71	16.00	18.29
5.0	1.60	3.20	4.80	6.40	8.00	9.60	11.20	12.80
6.0	1.231	2.462	3.692	4.923	6.154	7.385	8.615	9.846
7.0	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
10.0	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00

5.5.4 Quick look-up of the rated current of the motor

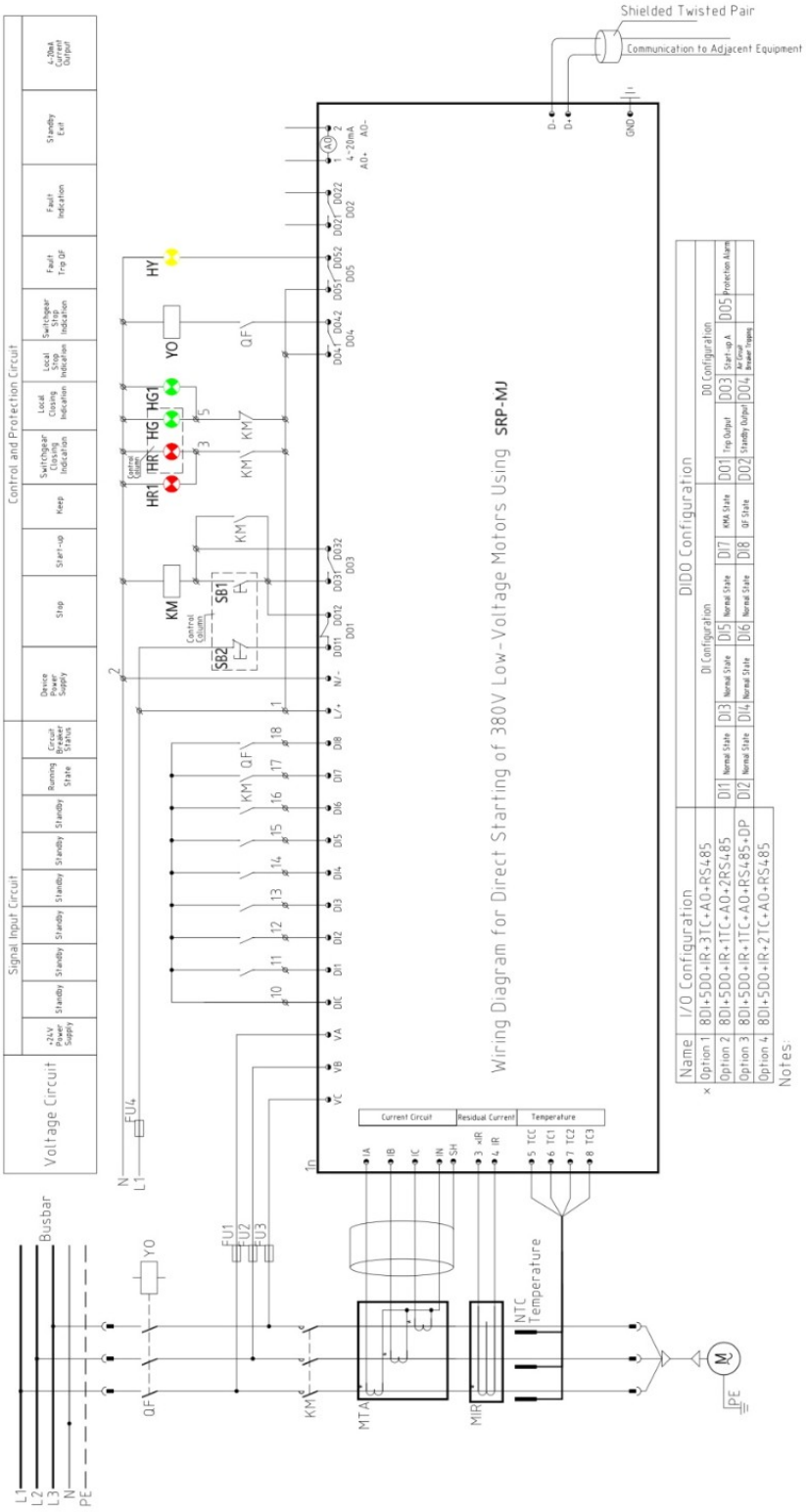
The data in this table is only applicable to motors with a rated voltage of 380V and can be used as a reference when there is no motor nameplate.
Base it on the actual rated value of the motor.

Table 5.5-3 Quick look-up table of the rated current of the motor

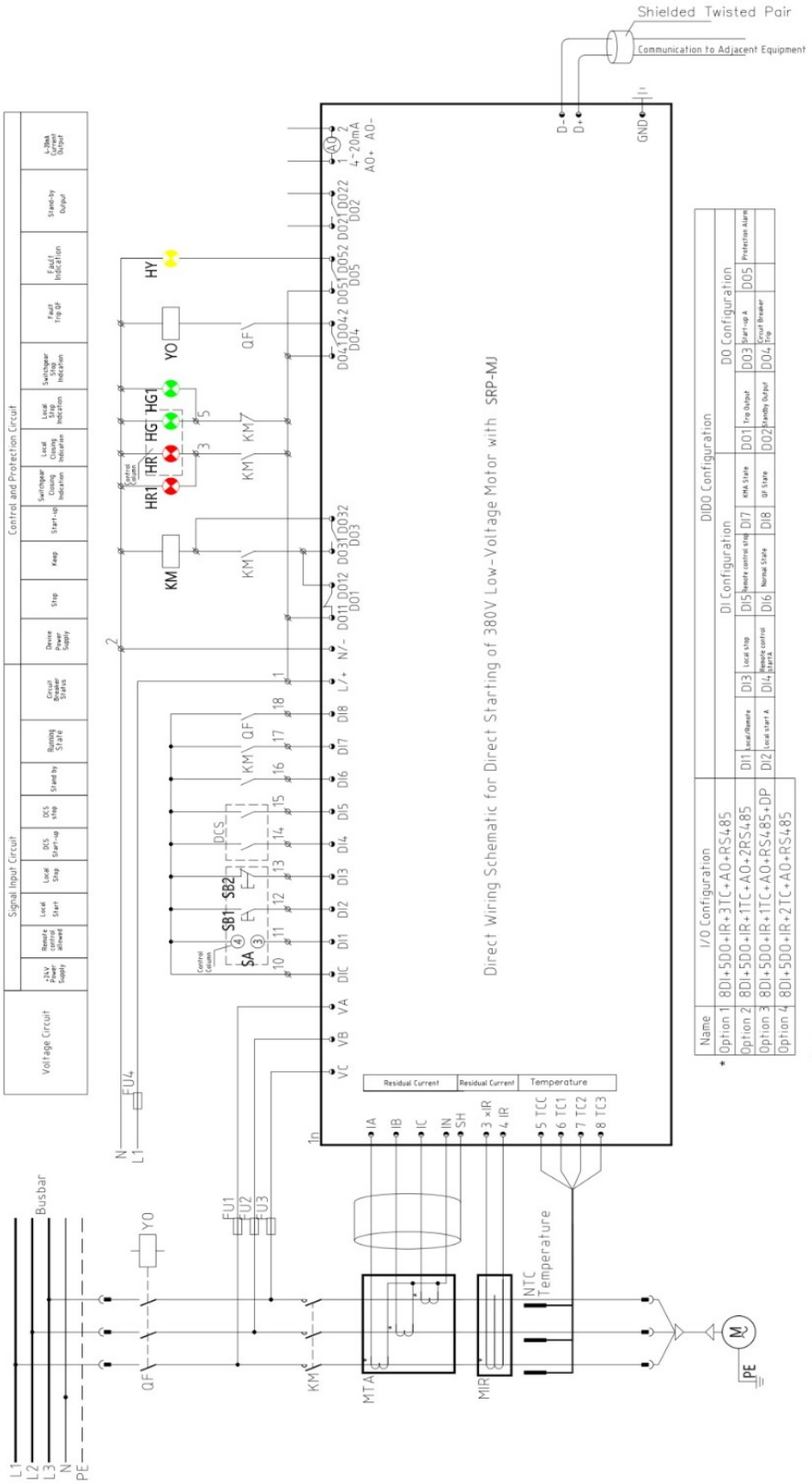
Rated power	Rated current	Current sensor selection	Rated power	Rated current	Current sensor selection
0.25kW	0.69A	MTA-1A	22kW	41.0A	MTA-100A
0.75kW	1.83A	MTA-5A	30kW	55.5A	MTA-100A
1.1kW	2.58A	MTA-5A	37kW	67.9A	MTA-100A
1.5kW	3.43A	MTA-5A	45kW	82.3A	MTA-100A
2.2kW	4.85A	MTA-5A	55kW	101.0A	MTA-300A
3.0kW	6.31A	MTA-25A	75kW	134.0A	MTA-300A
5.5kW	11.0A	MTA-25A	90kW	160.0A	MTA-300A
7.5kW	14.9A	MTA-25A	110kW	195.0A	MTA-300A
11kW	21.3A	MTA-25A	160kW	279.0A	MTA-300A
15kW	28.8A	MTA-100A	200kW	348.0A	MTA-400A
18.5kW	34.7A	MTA-100A	315kW	544.0A	MTA-800A

6. Typical wiring diagram

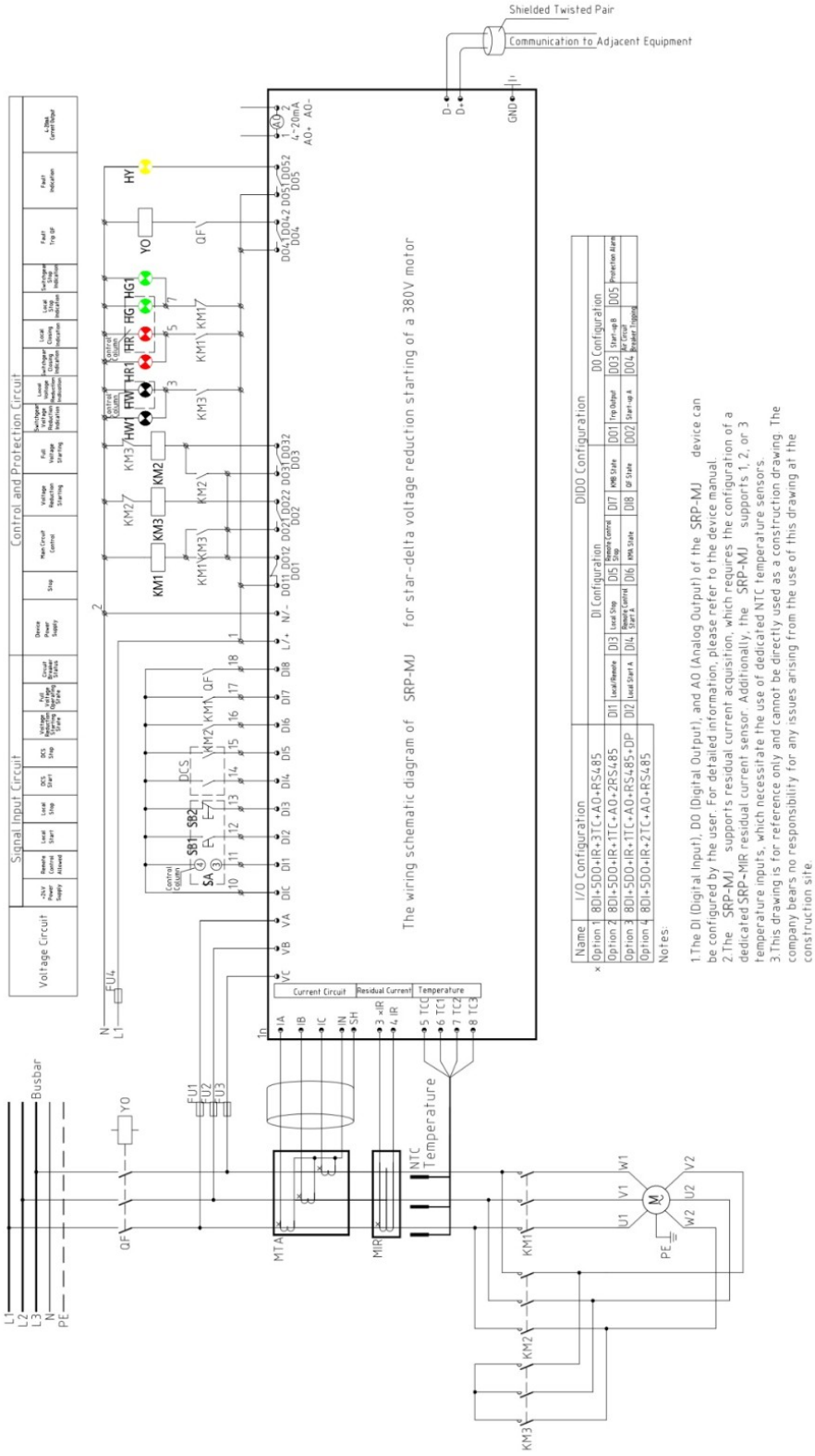
6.1 Direct-On-Line start wiring schematic diagram (without DI control)



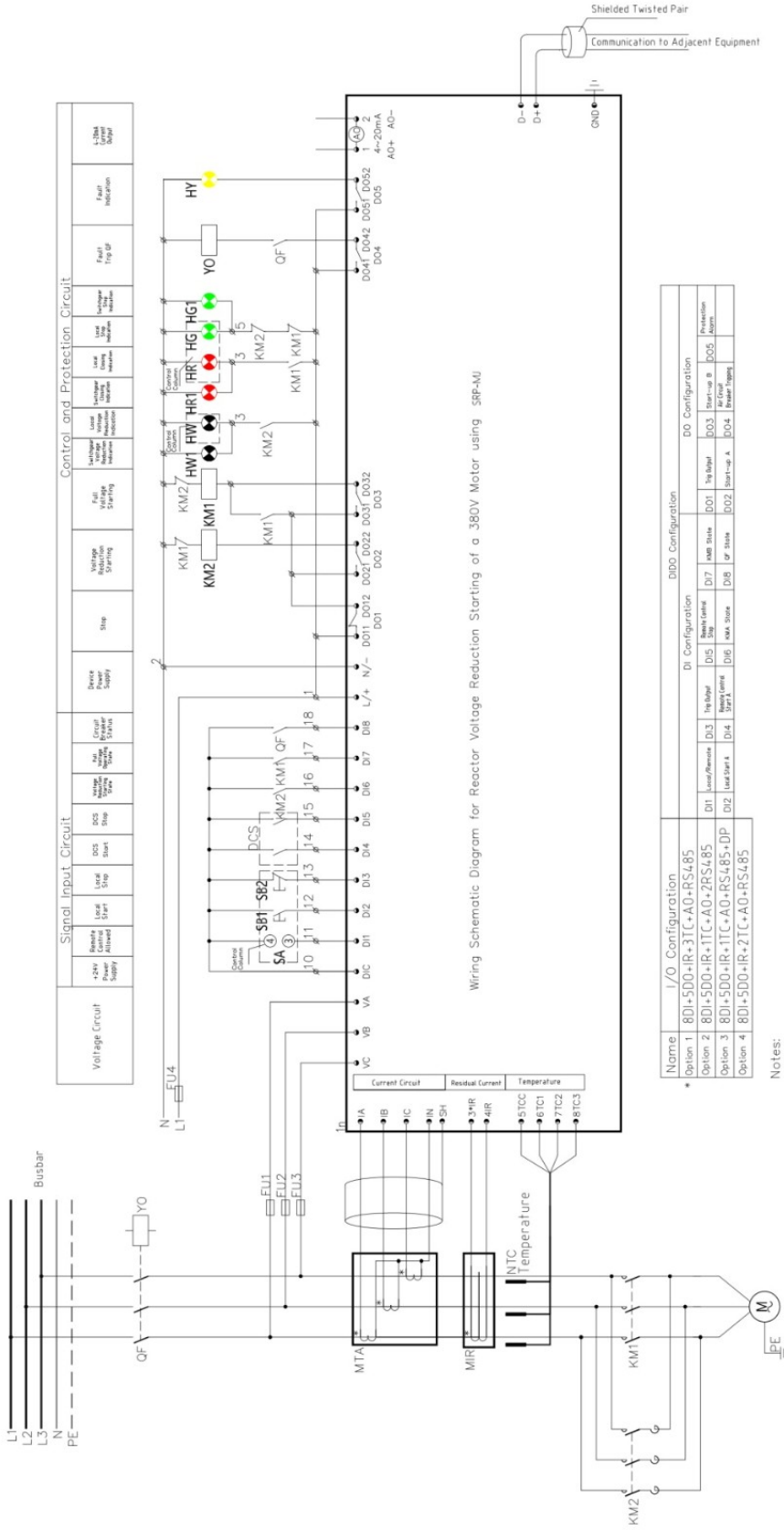
6.2 Direct-On-Line start wiring schematic diagram (with DI control)



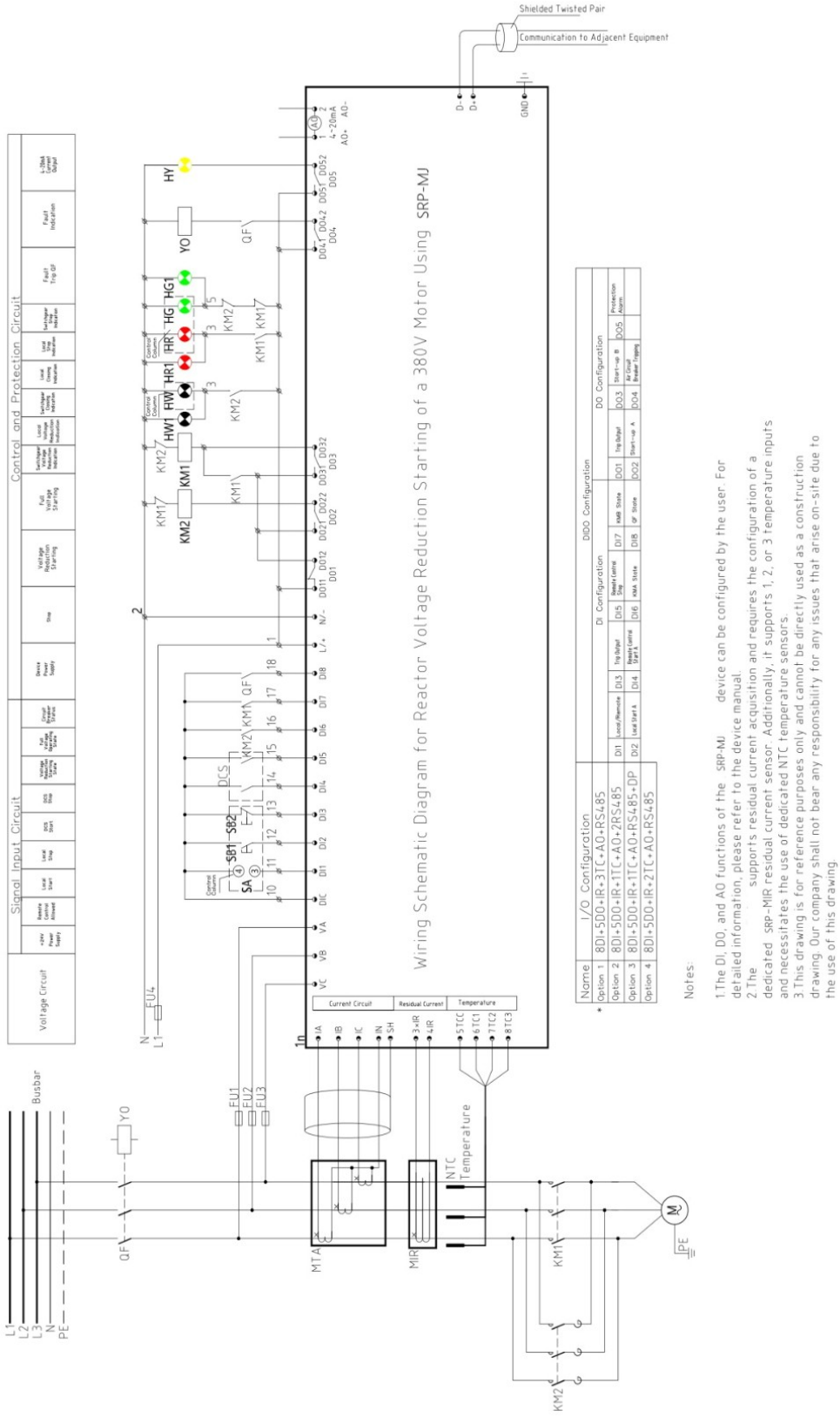
6.3 Star-Delta reduced voltage start wiring schematic diagram



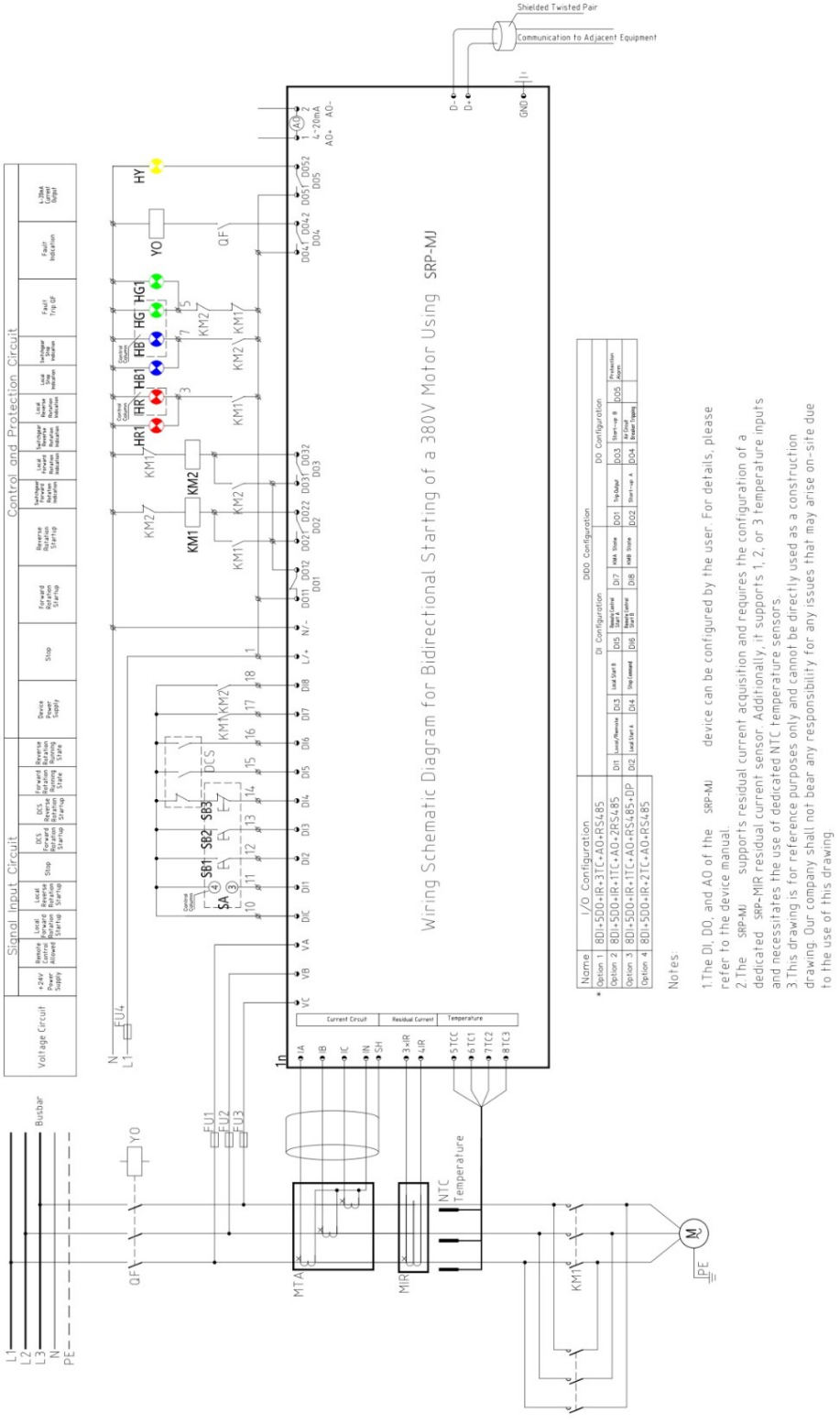
6.4 Autotransformer reduced voltage start wiring schematic diagram



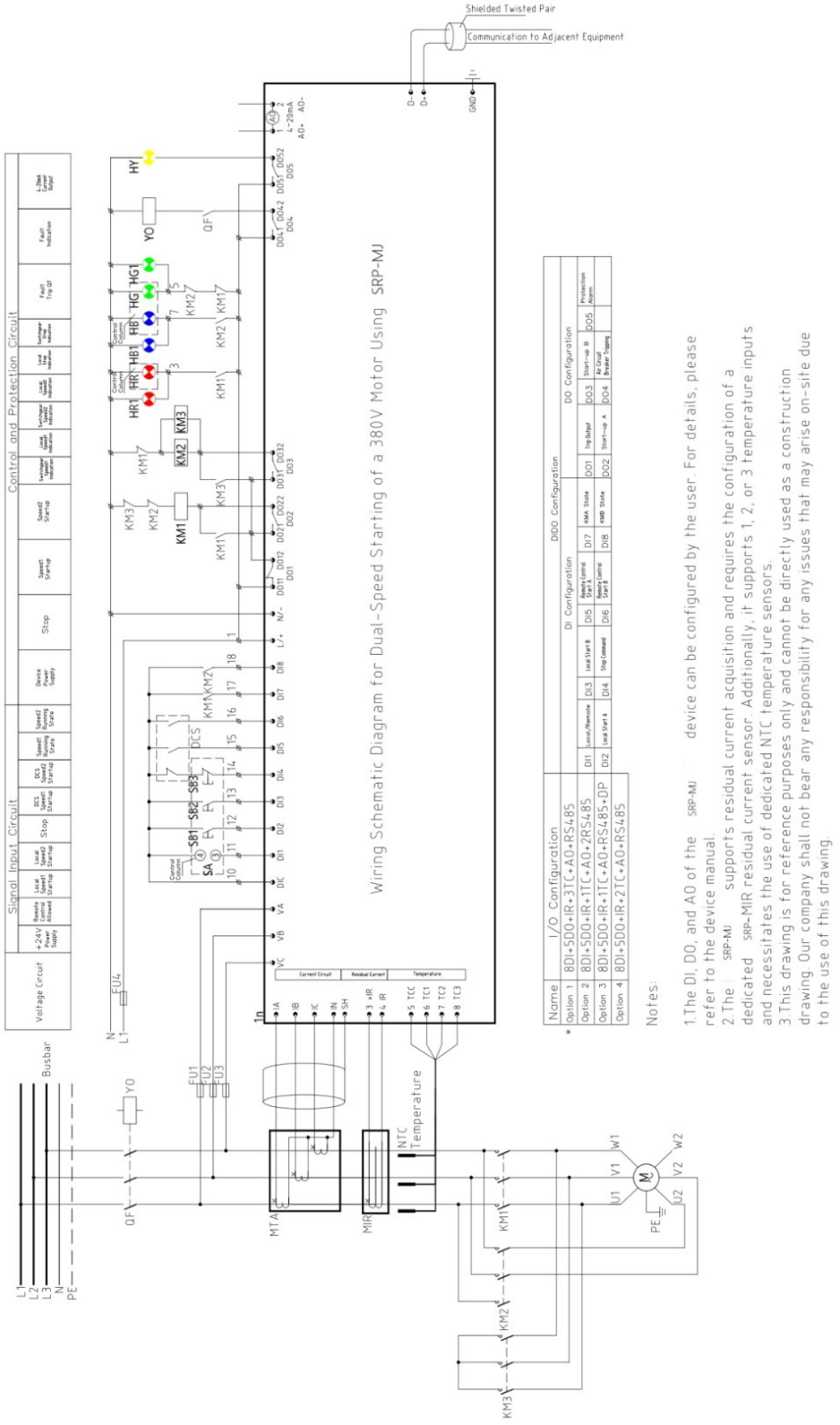
6.5 Reactor reduced voltage start wiring schematic diagram



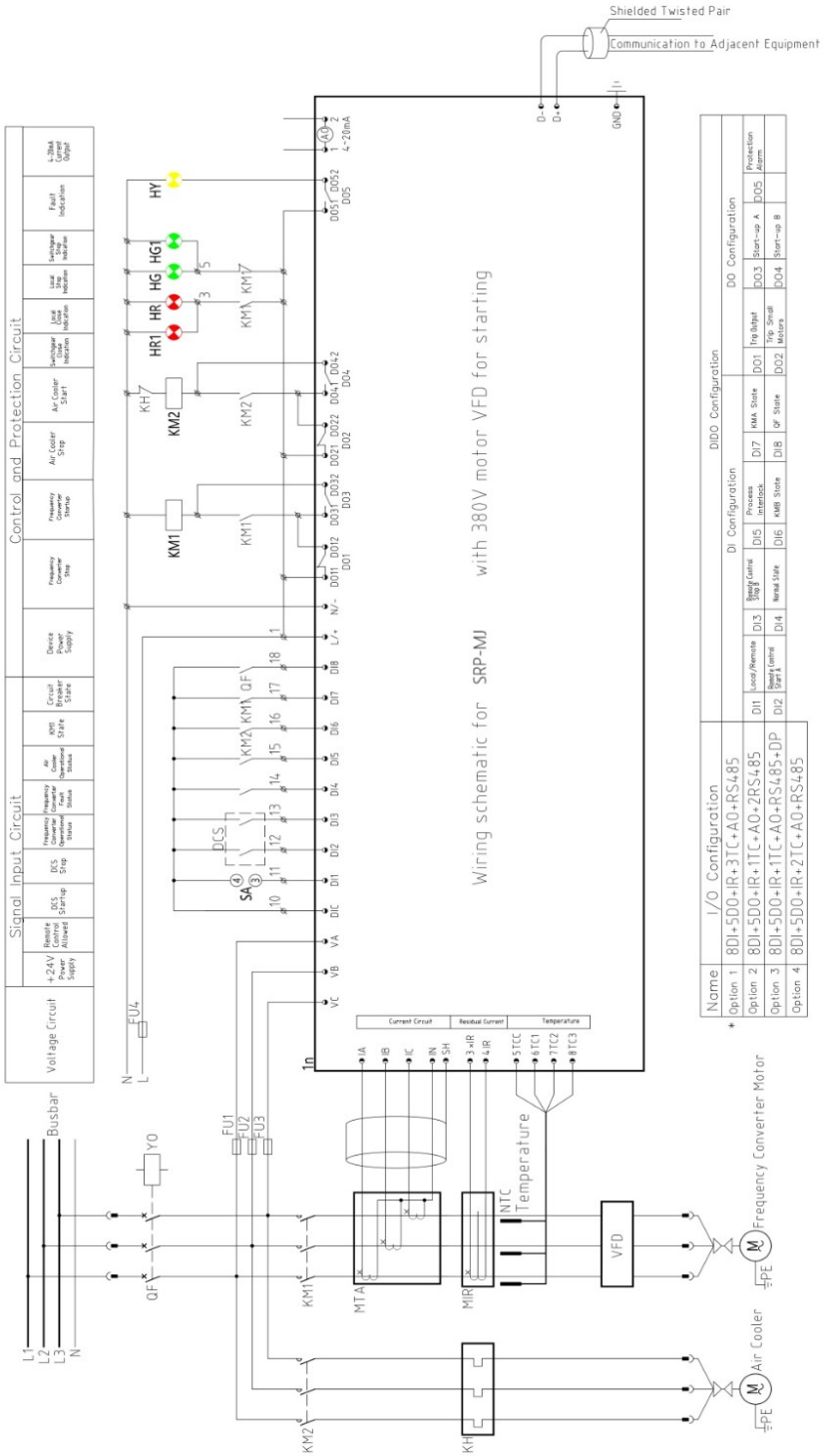
6.6 FWD/REV start wiring schematic diagram



6.7 2-Speed start wiring schematic diagram

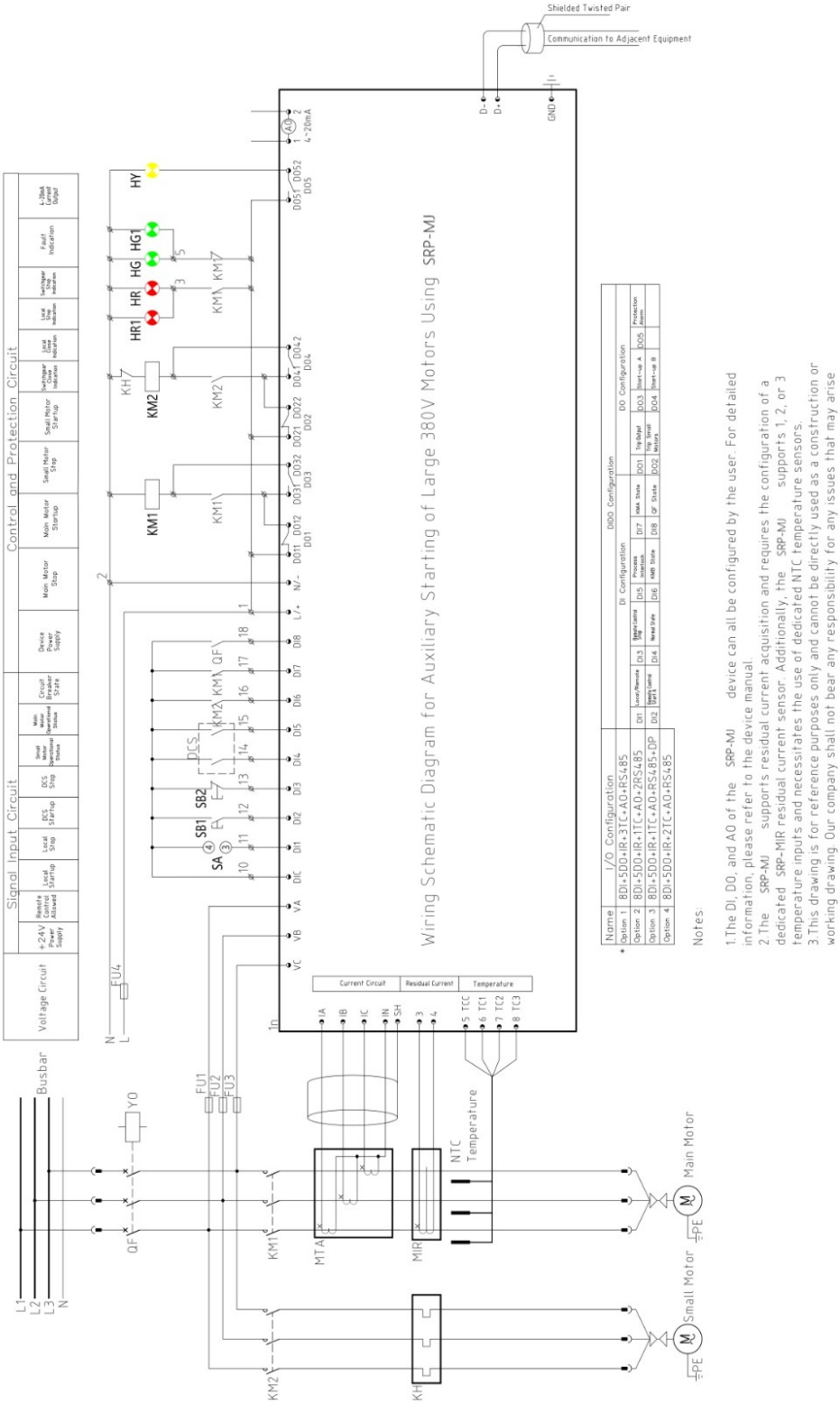


6.8 Variable frequency drive integration start wiring schematic diagram



Note:
1.The DI, DO, and AO of the SRP-MJ device can all be configured by the user. For details, please refer to the device manual.
2.The SRP-MJ supports residual current acquisition and requires the configuration of a dedicated SRP-MIR residual current sensor. Additionally, the SRP-MJ supports 1, 2, or 3 temperature inputs and necessitates the use of dedicated NTC temperature sensors.
3.This drawing is for reference only and cannot be directly used as a construction drawing. Our company assumes no responsibility for any on-site issues arising from the use of this drawing.

6.9 Large motors auxiliary start wiring schematic diagram



7. After-sales service commitment

7.1 Quality assurance for new devices

For all new devices sold to users, free quality assurance will be provided for failures caused by design, material or workmanship defects. If it is determined that the device meets the above quality assurance conditions, our company will repair and replace it for free.

Our company may require users to send the device back to our company to confirm whether the device falls within the scope of free quality assurance and to repair the device.

7.2 Device upgrades

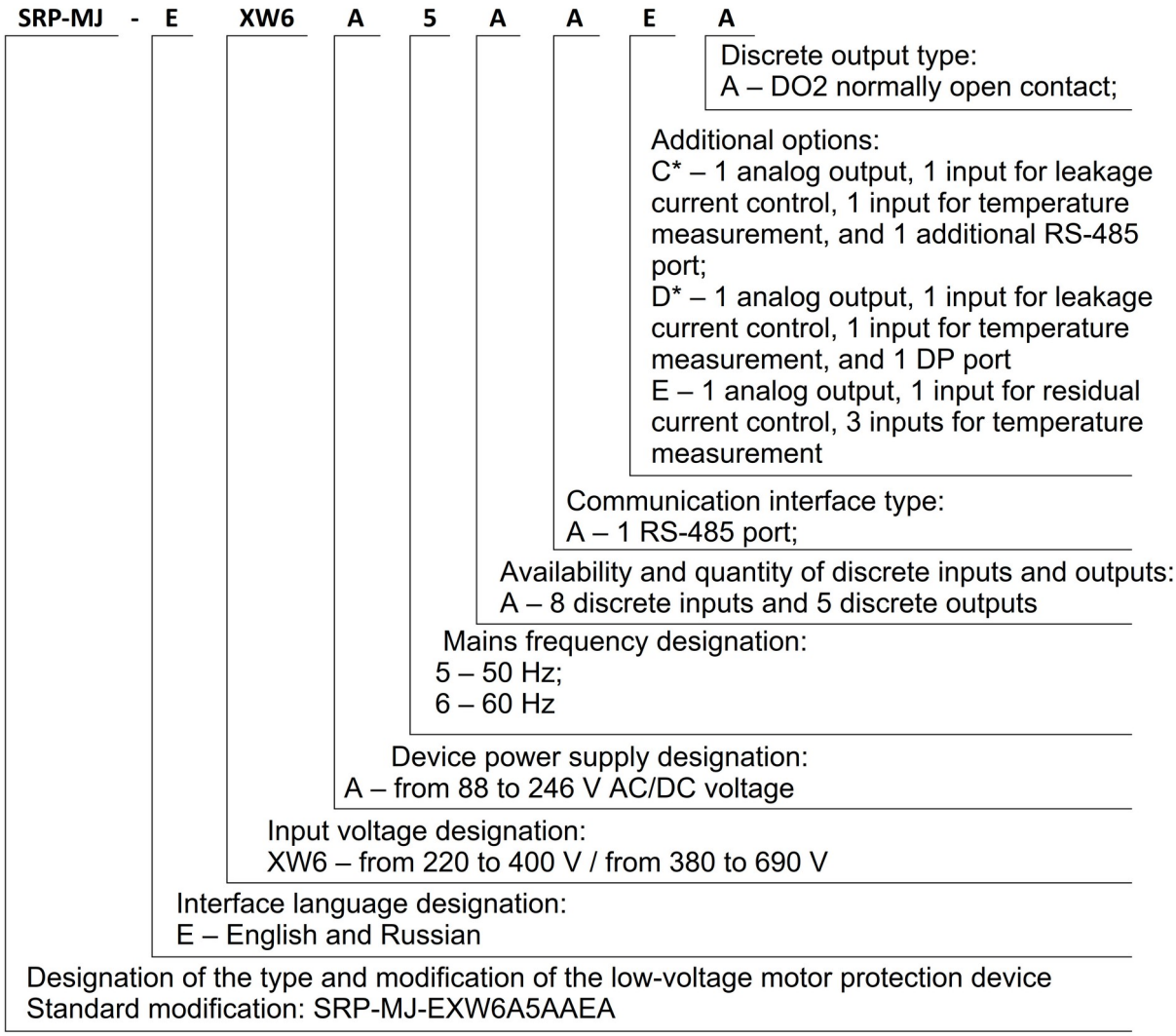
All users of new devices can use the upgrade software of the device for free. Our company will also notify users of information about software upgrades through various channels.

7.3 Limitations of device quality assurance

The following problems with devices are not within the scope of free quality assurance:

- Devices damaged due to incorrect installation, use or storage.
- Devices that operate and are applied under abnormal conditions beyond the specified ones.
- Devices repaired by organizations or personnel not authorized by our company.
- Devices that are beyond the free quality assurance period.

8. Appendix A – ordering guide



*Optional Features.

1. An external MTA current transformer is required for the 3-phase current input. For more details, please refer to the MTA current transformer datasheet.
2. The power ranges of applicable motors are represented by typical values calculated based on a motor with a rated voltage of 380 V. For a 690 V motor, please select according to the rated current.
3. Residual current protection requires 1 external SRP-MIR transformer. For more details, please refer to the MIR current transformer datasheet.
4. The DO1 contact is normally closed by default; the remaining contacts are normally open. Upon customer request, the manufacturer can provide the DO2 contact as normally closed.

Selectric

ELECTRICAL EQUIPMENT
DESIGNED FOR MAXIMUM RELIABILITY

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