

ARB6 Arc Flash Protection Relay

Operational Manual v1.0

DECLARATION

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Chapter 1 Brief introduction

1 Device Introduction

1.1 Information

The ARB6 series arc protection device integrates multiple functions such as protection, measurement, monitoring, control, communication, fault recording, event recording, etc. It can monitor arc signals, protect current or voltage signals in real time, and achieve arc protection function for 0.4kV~35kV medium and low voltage distribution systems.

The device hardware adopts an integrated design, which internally integrates hardware circuits such as power module, CPU module, arc light acquisition module, current and voltage acquisition module, input/output module, communication module, etc; The software is equipped with specialized protection algorithms, with flexible implementation methods, strong anti-interference performance, and high reliability.

The ARB6 series arc protection device is easy to operate, abundant in resources, stable and reliable, and easy to maintain. It is widely used in industries such as electricity, water conservancy, transportation, industry, minerals, new energy, ships, and construction buildings.

1.2 Feature

➤ **High-performance hardware platform**

The device adopts a processor with a main frequency of 550MHz, 16 bit synchronous sampling A/D, high-speed sampling of 48 points per week, and real-time parallel computing; Configure 512K bytes of Flash, (192+4) K bytes of Sram, external 4M bytes of NorFlash, and external 512K bytes of Sram, with sufficient hardware resources and high reliability.

➤ **Mature and perfect protection function**

Suitable for arc protection and automatic control functions in power systems with voltage levels of 35kV and below. The device can achieve functions such as arc protection, arc fault point positioning, real-time self inspection of arc probes and fiber optic links, failure protection, CT disconnection monitoring, non electric quantity protection, device abnormal alarm, fault recording, etc.

➤ **Rich interface resources**

12 AC current channels and 3 AC voltage channels, measuring 4 sets of three-phase currents and 3 sets of zero sequence voltages;

22 active switch input channels (optional)+1 device power loss input channel;

16 independent passive switch output channels (14 normally open contacts and 2 normally closed contacts), including 4 fast relay outlets;

2 RS485 serial communication interfaces, supporting IEC60870-5-103 and Modbus protocols;

3-way Ethernet interface (optional), supporting TCP IEC60870-5-103 and TCP Modbus protocol;

1 GPS timing interface, supporting IRIG-B timing method (RS485 interface);

1 USB interface, which can be used to upgrade device programs through a USB drive, and can also export device settings and fault recording data, facilitating fault analysis.

➤ **Humanization**

The device adopts a fully Chinese large screen LCD display, with a clear and easy to understand human-machine interface.

Flexible and comfortable button design, simple and convenient menu style operation.

The outlet of the protection function can be set through the trip matrix, making it convenient for users to choose the relay to operate.

➤ **Transparency**

Real time recording of traffic flow, arc, input, output, and the status of all protection modules.

The device records the action behavior and time of various internal components, and can view event records (no less than 200), system records (no less than 500), and operation logs (no less than 2000).

The device records fault waveform information, which can be directly viewed on the device or exported as a waveform file. 16 fault recording information, each recording can trigger 4 segments of recording. Each segment of recording can record the first 2 cycles of the fault and the last 10 cycles of the fault.

➤ **High reliability design**

The device adopts full graphic programming technology to design each protection function, in order to improve the reliability and correctness of the program.

The software and hardware have continuously improved self checking functions, good anti-interference performance, and the device has passed multiple electromagnetic compatibility testing certifications. The electrical fast transient pulse group, electrostatic discharge, and surge anti-interference performance all meet the IV level standard.

1.3 Device Selection Table

1.3.1 Selection Table of Arc Protection Device

ARB - - - -			Ethernet interface:		One	1
					Three	3
			Power : AC/DC 110V			1
			AC/DC 220V			2
			DC 48V、DC 24V			3
			Current input: 1A			1
			5A			5
			Code: Collect 6 arc sensor signals		A6	
			Collect 12 arc sensor signals		A12	
			Collect 18 arc sensor signals		A18	
			Collect 24 arc sensor signals		A24	
			Collect 30 arc sensor signals		A30	
			Serial number			6
			Arc Flash Protection Relay			

1.3.2 Selection Table for Arc Sensors

ARB-S		
	Code	: Visible light
		0
		Ultraviolet light
		1
	Arc sensor	

1.4 Selection guide

Function \ Model		ARB6-A6	ARB6-A12	ARB6-A18	ARB6-A24	ARB6-A30
Hardware	Arc sensor signal acquisition	6	12	18	24	30
	Current collection	4 sets of 3-phase currents, a total of 12 current channels				

	Voltage acquisition		3 zero sequence voltages, a total of 3 voltage channels				
	Digital Input		5	22	5	22	5
	Digital Output		14 normally open exits (including 4 High speed relay outlet) and 2 normally closed exits				
	2 485 interface		√				
	1 Ethernet interface		√				
	3 Ethernet interface		■				
	GPS timing interface		√				
	USB interface		√				
Function	Arc protection	Arc criterion	√				
		Arc&Current criterion	√				
		Arc&Voltage criterion	√				
	Arc monitoring and fault location		√				
	Real time self inspection of arc sensors and fiber optic links		√				
	failure protection		√				
	CT disconnection monitoring		√				
	non-electricity protection		√				
	Device abnormal alarm		√				
	Maintenance status lock		√				
	Fault recording		√				
Protocol	Modbus		√				
	IEC101		√				
	IEC103		√				
	IRIG-B		√				
	LoopBack		√				

Note: √ indicates having this function, and ■ indicates optional function.

2 ARB6 device technical Parameters

2.1 Rated parameters

2.1.1 Power supply

Power supply: AC/DC220V, AC/DC110V, DC48V ,DC24

Range: Power supply $\times (1 \pm 20\%)$

Maximum power consumption: $\leq 15\text{VA}$

2.1.2 Rated voltage

Rated voltage: AC 100V or $100/\sqrt{3}\text{V}$

Range: 0.1~120V

Accuracy: $\pm 1\%$

Power consumption: $\leq 0.5\text{VA}$ (single phase)

Overload capacity: 1.4 times rated voltage for continuous work;
2 times for 10 seconds.

2.1.3 Rated current (Protection current)

Rated current: AC 5A/1A

Range: $0.04I_n \sim 20I_n$

Power consumption: $\leq 0.5\text{VA}$ (single phase)

Overload capacity: 2 times rated current for continuous work;
40 times for 1 second.

2.1.4 Frequency

Rated frequency: 50Hz or 60Hz

Range: 40~70Hz

Accuracy: $\pm 0.1\text{Hz}$

2.1.5 Digital Input

Rated Voltage: AC/DC220V, AC/DC110V, DC48V, DC24V

Voltage range: Rated Voltage $\times (1 \pm 20\%)$

Power consumption: $\leq 1\text{W}$ (DC220V)

2.1.6 Digital Output

Mechanical life: ≥ 10000

Switching capacity: $\geq 1000\text{W}$, $L/R = 40\text{ms}$

On current: continuous $\geq 5\text{A}$, short time (200ms) $\geq 30\text{A}$

Interrupting capacity: $\geq 30\text{W}$, $L/R = 40\text{ms}$

2.2 Basic mechanical design feature

Voltage element: The allowable error of setting value should not be greater than $\pm 3\%$; the return coefficient of overpressure should be 0.95, and the return coefficient of underpressure should be 1.05.

Current element: The allowable error of setting value should not be greater than $\pm 3\%$; the return coefficient of overcurrent should be 0.95, and the return coefficient of undercurrent should be 1.05.

Frequency element: The allowable error of setting value should not be greater than $\pm 0.02\text{Hz}$.

Comparison element: Return coefficient is 0.95 or 1.05.

Timing element: Delay time within 2 seconds error is $\leq 40\text{ms}$, delay time is more than 2 seconds, error ($\leq 2\%$) tuning value $\pm 40\text{ms}$.

Arc protection action time: Arc single criterion $\leq 3.8\text{ms}$ (twice the arc action threshold value, electromagnetic relay output);

Arc current dual criterion $\leq 7.8\text{ms}$ (twice the arc action threshold value and twice the current constant value, electromagnetic relay output).

2.3 Normal working conditions

Ambient temperature: $-10^{\circ}\text{C} \sim +55^{\circ}\text{C}$.

Device storage, transport allows the ambient temperature is $-25^{\circ}\text{C} \sim +70^{\circ}\text{C}$.

Relative humidity: 5%~95% (The product does not condensation and freeze inside).

Altitude: $\leq 2500\text{m}$.

Protection level: IP40 (front panel, left and right side panels, and upper and lower bottom plates).

2.4 Insulating property

Insulation resistance: $>100\text{M}\Omega$, 500Vdc

Dielectric strength: Between the circuit and the ground, between the independent loop: power frequency voltage withstand 2kV

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

2.5 Electromagnetic compatibility performance

	Test item	Requirement
1	Radiation emission limit test	Meet the requirements of IEC 60255-26:2013
2	Conduction emission limit test	Meet the requirements of IEC 60255-26:2013
3	Radio-frequency electromagnetic field radiation immunity	Meet the requirements of IEC 60255-26:2013, severity is 10V/m.
4	Electrostatic discharge immunity	Meet the requirements of IEC 60255-26:2013, severity is IV level.
5	Disturbance immunity of RF Field Induction conduction	Meet the requirements of IEC 60255-26:2013, severe grade disturbance level is 10V.
6	Immunity of electric fast transient pulse group	Meet the requirements of IEC 60255-26:2013, severity is A level.
7	Slow-damped oscillation wave immunity	Meet the requirements of IEC 60255-26:2013, the common mode is 2.5 and the difference module is 1.
8	Surge immunity	Meet the requirements of IEC 60255-26:2013, severity is IV level.
9	Effect test of AC and DC voltage sag interruption	Meet the requirements of IEC 60255-26:2013
10	Power frequency magnetic field immunity	Meet the requirements of IEC 60255-26:2013, severity is IV level.

2.6 Flame retardant performance

Test item	Requirement
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Horizontal Burning	Meet the requirements of GB/T 5169.16-2017, with a severity level of HB
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3 ARB-S arc sensor and fiber optic technical parameters

3.1 Technical parameters of ARB-S arc sensor

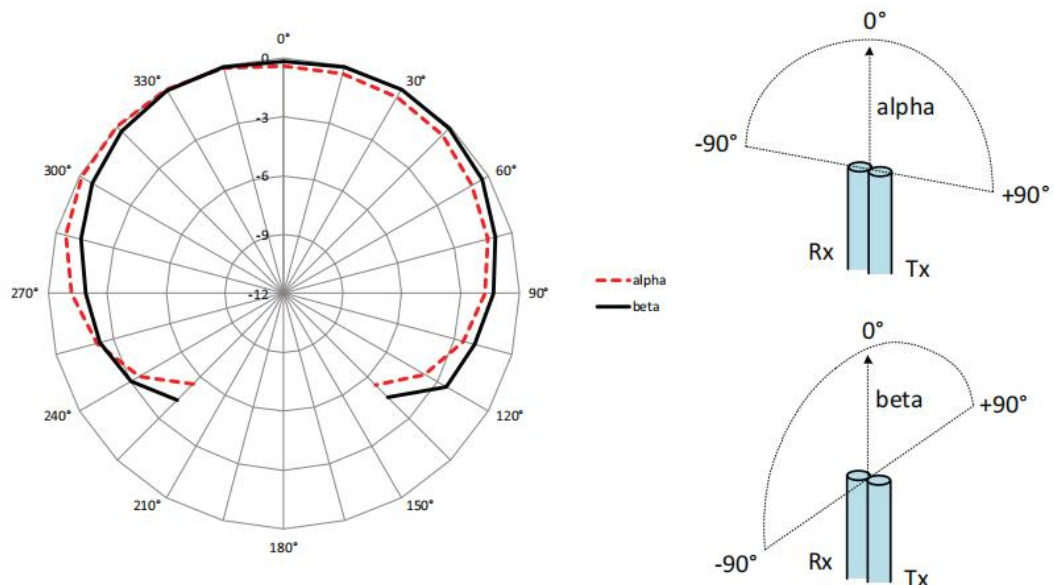
Acceptance cone exceeds 180° spherical with high Homogeneity; Operating temperature range -40° C to 85° C.

	ARB-S0	Passive wide-angle ultraviolet arc sensor (no power supply, maintenance free); Fully insulated, metal free (no electrical safety hazards).
	ARB-S1	Passive wide-angle ultraviolet arc sensor (no power supply, maintenance free); ST standard interface.

Acceptance Cone

Minimum 180° spherical.

Figure 1 Typical Acceptance Cone



NOTE The values in the vertical axis are in dB.

Figure 3.1 ARB-S0 Acceptance Cone

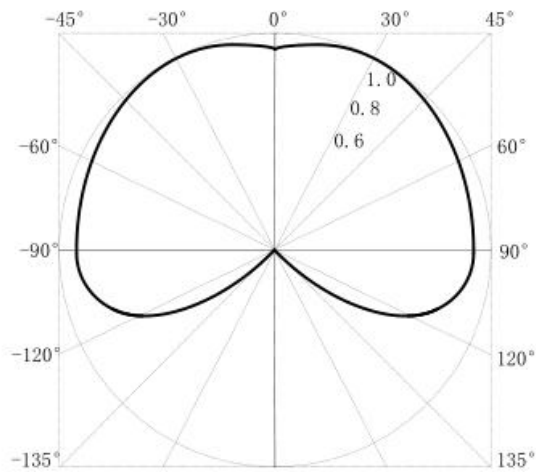


Figure 3.2 ARB-S1 Acceptance Cone

3.2 Technical parameters of double core plastic optical fiber

Operating temperature range - 55° C to 70° C.

Item			Technical parameter	Notes
Optical performance	Attenuation		@650nm	≤160dB/km
Plastic optical fiber	Core material		PMMA	
	Cladding material		Fluorinated polymer	
	Core refractive index		1.49	
	Cladding refractive index		1.41	
	Numerical aperture		0.5	
	Core diameter		980±60	μm
	Cladding diameter		1000±60	μm
	Number of cores		2	cores
Jacket	Dimensions	Short side	2.2±0.07	mm
		Long side	4.4±0.14	mm
	Colour		黑色(Black)	
	Flame retardant grade		VW-1	
Product standard			ROHS,REACH,SGS,（YD/T 1447—2013）	

4 Hole size and installation position

The ARB6 series arc protection scheme mainly consists of ARB6 arc protection device, ARB-S arc sensor, and plastic optical fiber (double stranded, flame

retardant).



Figure 4.1 Actual diagram of arc protection device, arc sensor, and optical fiber

4.1 Device opening size and installation position

4.1.1 Device Outline Drawing and Opening Dimensions

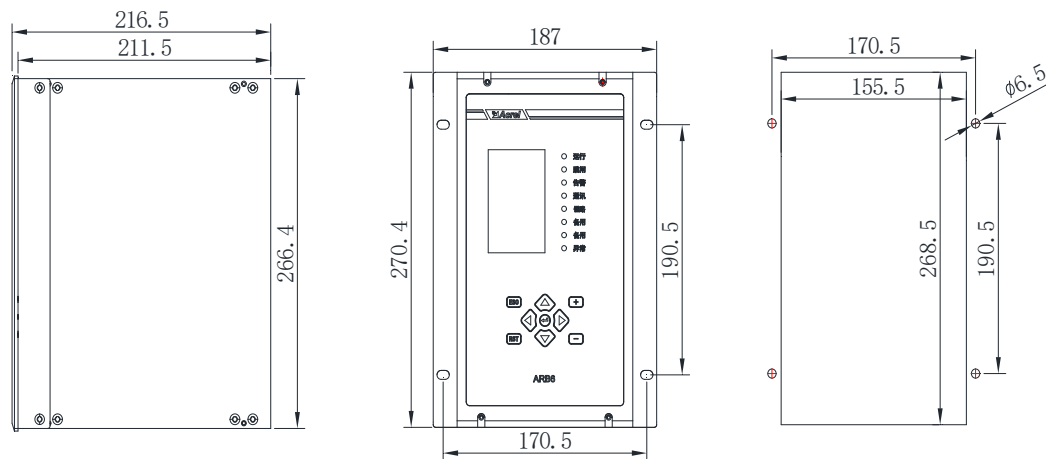


Figure 4.2 Outline and Opening Dimensions of arc Protection Device

Note: The size of the opening is in millimeters (mm).

4.1.2 Installation position of the device

When installing the arc protection device, the installation space of the switchgear should be considered, and it should be connected to the TA circuit of the power supply incoming circuit and the protection tripping circuit within the protection range. In principle, it should be installed nearby to avoid the TA acquisition circuit and tripping circuit wiring being too long. It is generally installed on the main transformer, low-voltage side incoming cabinet or TV cabinet door, and it is recommended to use panel opening installation.

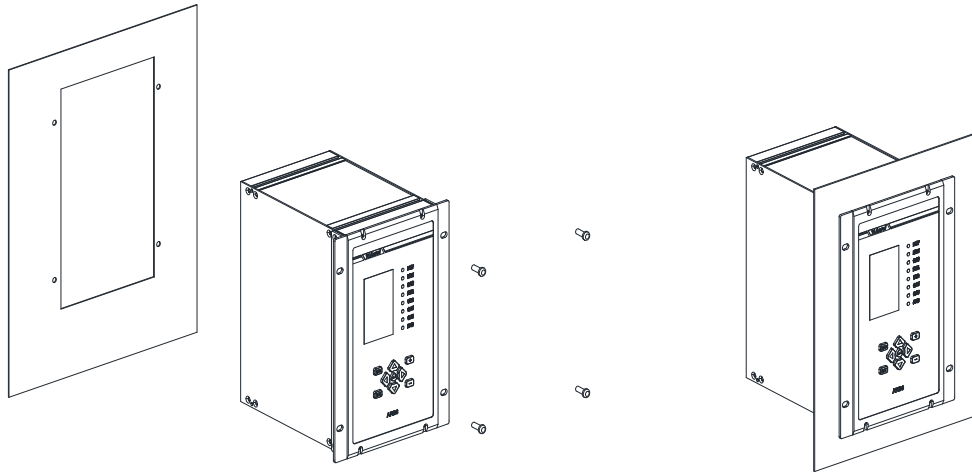


Figure 4.3 Installation diagram of arc protection device

4.2 Sensor hole size and installation position

4.2.1 Sensor Outline Drawing and Opening Dimensions

The arc sensor is equipped with a buckle bracket, which needs to be installed with holes. The opening size of the buckle bracket is 20mm (diameter).



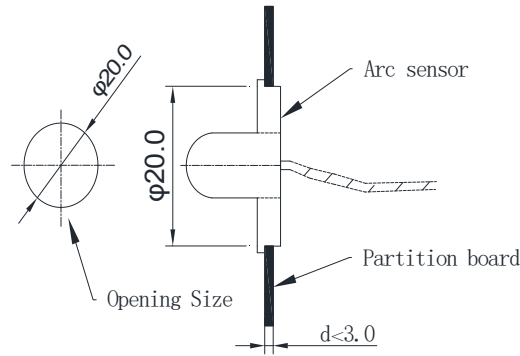


Figure 4.4 Appearance and Opening Dimensions of Arc Sensor

4.2.2 Sensor installation position

The detection range of the arc sensor is a fan-shaped area with an angle of 180° and a radius of 0.5m. Therefore, when selecting the sensor installation point, this element should be fully considered to avoid blind spots in detection.

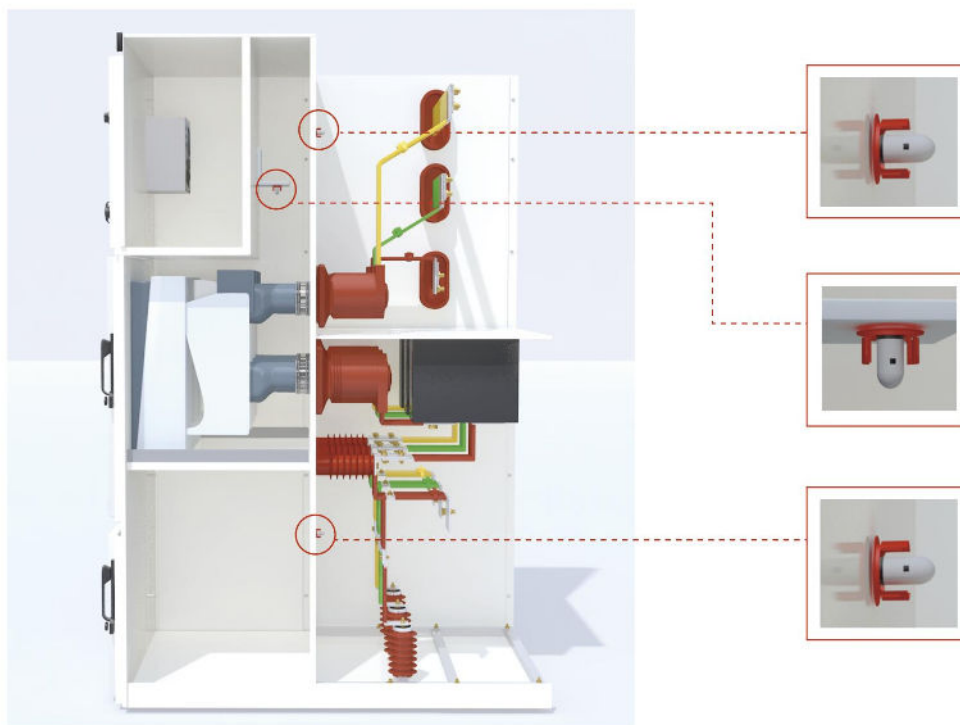
The installation of arc sensors should follow the following principles:

The recommended installation locations for arc sensors include (but are not limited to) busbar rooms, circuit breaker rooms, and cable rooms.

In the case of a circuit breaker in the switchgear, it is recommended to install the arc sensor in a location that is prone to arc generation (such as at the connection of the busbar contact, the contact of the upper or lower isolation switch (2 positions), the contact of the current transformer, and the cable joint). In the absence of a circuit breaker in the switchgear, it is recommended to install the arc sensor at the busbar contact connection, upper and lower isolation switch contacts (1 point), and cable joints.

A closed busbar bridge requires the installation of arc sensors at both ends of the bridge. If considering the overall protection of the switchgear, one arc sensor can be installed in each of the circuit breaker room and cable room of the switchgear.

The installation example of the arc sensor is as follows.



4.3 Note

The arc sensor and arc protection device are connected using optical fibers, and the following precautions are required.

(1) Fiber optic cables should be avoided from being laid in cable trenches or cable trays. It is not recommended to pass through existing gaps or screw holes in the switchgear. If passing through gaps or screw holes, insulation and protection processes for the holes should be done to avoid damage to the fiber optic cables caused by sharp corners of the screen;

(2) Fiber optic cables should be laid away from high-voltage equipment such as busbars, circuit breaker contacts, and cable joints;

(3) When laying optical fibers, it is necessary to consider that when the fixed components are detached, they cannot be directly overlapped to the high-voltage electrical part to prevent the phenomenon of crawling caused by dust on the surface of the optical fibers;

(4) The installation position and angle of sensors should consider the impact of environmental pollution, and avoid various obstructions and direct light sources in front of the sensor's photosensitive surface;

(5) Fiber optic cables are recommended to be fixed with point patches or ties;

(6) Fiber optic cables are strictly prohibited from being bent at right angles. When bending and routing, a certain curvature should be maintained, and the bending diameter should be greater than 15 centimeters.

For other installation matters, please refer to the "Appendix B Typical Installation of Arc Protection Devices" section in the "NB/T 42076-2016 Arc Protection Device Selection Guidelines".

5 Operational Manual

5.1 Surface

The human-computer interaction of the device is mainly carried out on the panel, including three parts: LCD display, LED light indication, and buttons.

The LCD display screen adopts a 256 * 160 dot matrix, which can display remote measurement values such as arc intensity, current, voltage, remote signal quantity, event recording, fault recording, communication parameters, fixed value parameters, device time, device version number information, etc.

LED lights are used to indicate the operating status, tripping, alarm, communication, link, abnormality, and other information of the device. They can also be customized according to user needs. Figure 5.1 shows the factory default configuration.

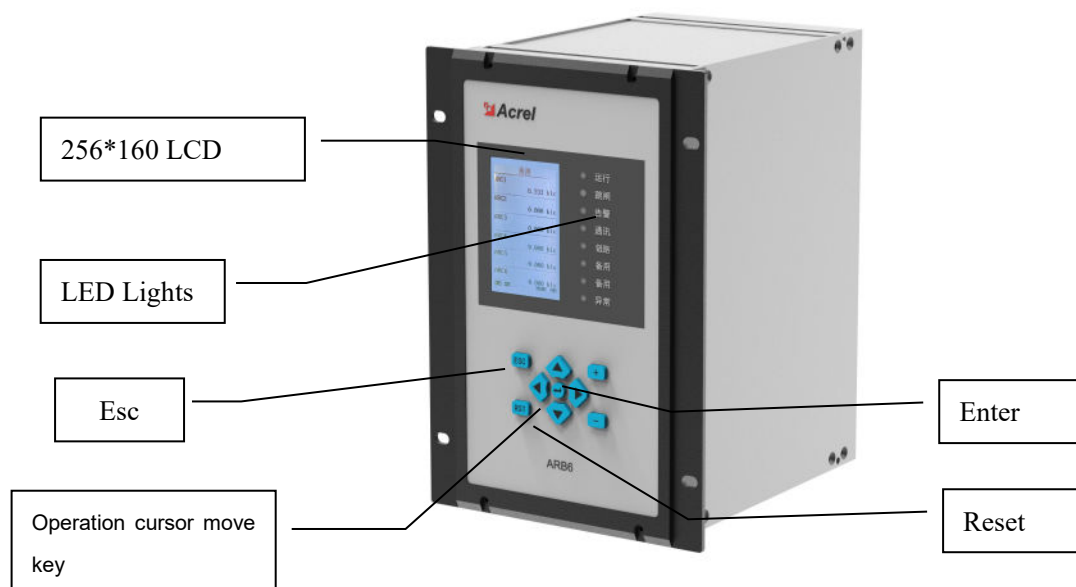


Figure 5.1 ARB6 Front Panel

5.2 Key instructions

The keys include up, down, left, right, enter, return and function keys to realize human-computer interaction.

Table 5.2 ARB6 Key Function Description

Key	Function	Key	Function
	Enter		Up/Increase
	Reset		Down/Decrease
	Esc		Left
			Right

5.3 Menu instructions

When the device is powered on, it enters the main interface, which is divided into four interfaces for display: operation interface, telemetry interface, remote signaling interface, and exit mapping interface, as shown in Figures 5.2-5.5. The display can be switched between different interfaces through left and right keys.

ARB6		
I_IA	0.000	A
I_IB	0.000	A
I_IC	0.000	A
II_IA	0.000	A
II_IB	0.000	A
II_IC	0.000	A
III_IA	0.000	A
III_IB	0.000	A
III_IC	0.000	A
IV_IA	0.000	A
IV_IB	0.000	A
IV_IC	0.000	A
	50.0	Hz

Figure 5.2 Running Interface

RemoteMeter		
ARC1	0.000	klx
ARC2	0.000	klx
ARC3	0.000	klx
ARC4	0.000	klx
ARC5	0.000	klx
ARC6	0.000	klx

Figure 5.3 Telemetry Interface

RemoteSignal	
Maintenance	OFF
ResetSignal	OFF
Remote	OFF
Non-elec.1	OFF
Non-elec.2	OFF
Non-elec.3	OFF
Non-elec.4	OFF
DI8	OFF
DI9	OFF
DI10	OFF
DI11	OFF
DI12	OFF

Figure 5.4 Remote Communication Interface

DO Mapping
ArcGroup1 00000 00000 00000 0
ArcGroup2 00000 00000 00000 0
ArcGroup3 00000 00000 00000 0
ArcGroup4 00000 00000 00000 0
ArcGroup5 00000 00000 00000 0
ArcGroup6 00000 00000 00000 0

Figure 5.5 Export Mapping Interface

In the export mapping interface, the mapping relationship between the protection export and the output relay is represented by a 1-16 bit binary number in the table below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The 1st to 16th bits respectively represent passive outputs of DO1 to DO16, where DO1 to DO14 are normally open contacts (where DO1 to DO4 are fast outputs), and DO15 to DO16 are normally closed contacts. If one of the digits in numbers 1-16 is 1, it indicates that the protection function is activated (tripped or alarmed) and configured to that exit; If it is 0, it indicates that the exit has not been configured.

5.3.1 Fast navigation

The device menu is a multi-level menu. Press the confirm button in any main interface to enter the main menu. The main menu is divided into 9 sub menus, as shown in Figure 5.6, consisting of sub menu names and icons. After selecting any submenu, press the confirm button to enter the menu, and press the return button to return to the higher-level menu. Figure 5.7 is a quick navigation diagram of the device, which can be used to quickly search for relevant parameters.

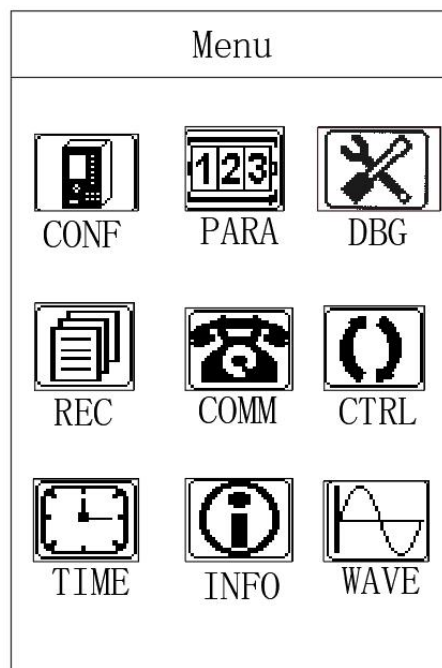


Figure 5.6 Main Menu

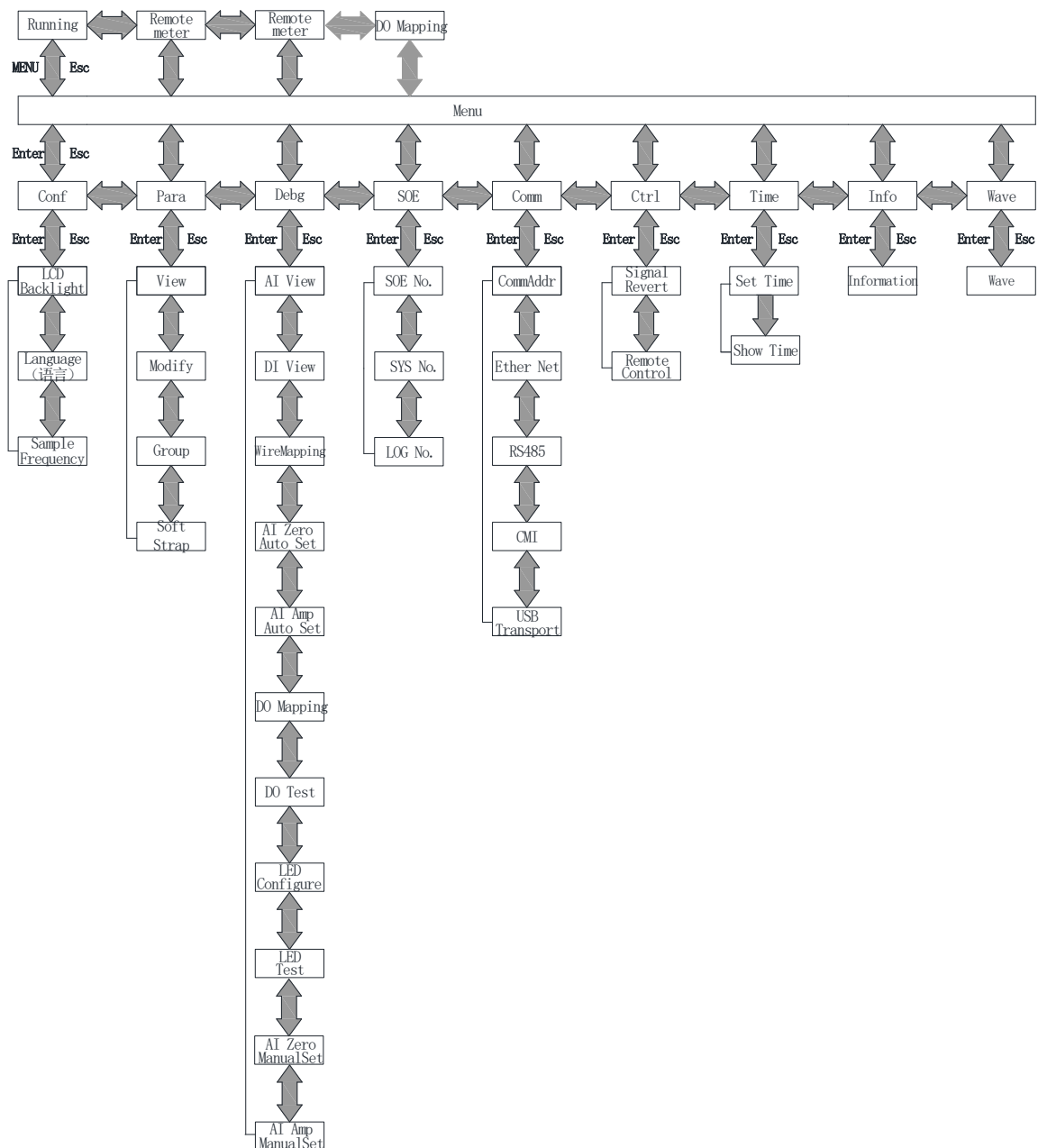


Figure 5.7 Quick Navigation Diagram

5.3.2 Configuration

The "Configuration" menu can set the LCD backlight time, language, and sampling frequency, as shown in Figure 5.8. After the modification is completed, press the "Confirm" button to exit the modification, and then press the "Return" button to return. The device will pop up the data saving interface, as shown in Figure 5.9. Press the "Confirm" button to save the modification and return to the main menu. Press the "Return" button to not save the modification and return to the main menu.



Figure 5.8 LCD backlight time setting

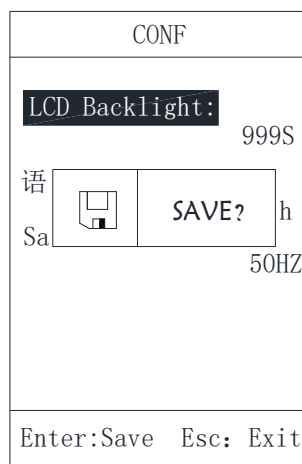


Figure 5.9 Data saving

5.3.3 Parameter

The "Para." menu has four sub menus: Value View, Value modify, Switch Group, and Soft Strap, as shown in Figure 5.10.

5.3.3.1 Value View

The "Value View" menu has two submenus, which are selected value section and running value section. The selected value section has 4 section: 00, 01, 02 and 03, as shown in figure 5.11. Each section can be set different values. The running value section is shown the nowadays value, all value pagination displays, press left and right key to view, as shown in figure 5.12.

PARA
Value View Value Modify Switch Group Soft Strap

Figure 5.10 Parameter

Value Group
Selected: 00 Running: 00

Figure 5.11 Selection area

View[00]	(001)
1#I Mode	3CT
2#I Mode	3CT
3#I Mode	3CT
4#I Mode	3CT
Ie	5.000A
Ue	100.000V

Figure 5.12 View

5.3.3.2 Modify

The “Modify” menu has two submenus in the selected value area and the running value area. The initial password of this menu is “0008”.

Set the value area code to be modified in the fixed value area, and press “Enter” to enter the value modification interface. Here pagination displays all the value information, and use can select the value that needs to be modified by selecting the left and right keys, press the “Enter” button first, and then press the up and down key to set the modified content, as shown in figure 5.14. After the set is completed, press the “Enter” button, then set the next one as the same way.

When the all setting is completed, press “Esc” button to exit, at this time if the data changes, the device will pop up with the data dialog box shown in figure 5.9, press “enter” button to save the changes and return to value management menu, click “Esc” button is not saved and to return to value management menu.

The running value area only displays the current running value area of the device. and no modification is made here.

Value Modify	
 <i>acred</i>	0008

Figure 5.13 entering password

Modify[00]	(001)
1#I Mode	3CT
2#I Mode	3CT
3#I Mode	3CT
4#I Mode	3CT
Ie	5. 000A
Ue	100. 000V

Figure 5.14 Value Modify

5. 3. 3. 3 Switch Group

The “Switch Group” menu has two sub-menus: selected value section and running value section. The password of this menu is “0008”. The selected section shows the expected section users want to set, which can be set as 00-03. After making the selection, press the “Enter” button to determine, and then press the “esc” key to return to the main menu. The running value section will display the current running value area of the device, as shown in Figure 5.15.

Switch Group
Selected: 00
Running: 00

Figure 5.15 Switch Group

5. 3. 3. 4 Soft Strap

The password for the "Soft Strap" menu is "0008". Press the confirmation button to enter the Soft Strap interface. Here, all the input and output information of the Soft Strap is displayed in pages. You can select the Soft Strap to be modified by pressing the "up", "down", "left", and "right" buttons. First, press the "confirm" button, and then press the "up" and "down" buttons to set the modification content, as shown in Figure 5.16. After the modification is completed, press the confirm button to confirm, and then modify the next Soft Strap that needs to be modified. After all fixed are completed, press the return button to exit. If there are any changes to the data, the device will pop up a data saving dialog box as shown in Figure 5.9. Press the confirm button to save the modifications and return to the main menu. Press the return button to not save and return to the main menu.

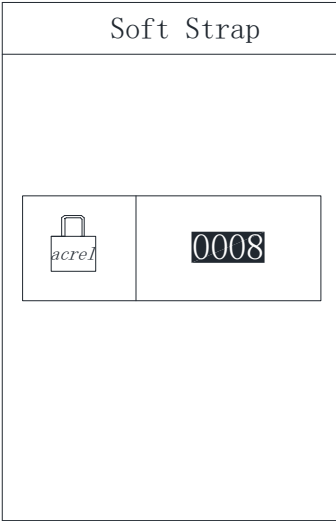


Figure 5.16 entering password

Soft Strap	
ARC1. E	ON
ARC2. E	OFF
ARC3. E	OFF
ARC4. E	OFF
ARC5. E	OFF
ARC6. E	OFF
	OFF

Figure 5.17 Soft Strap modify

5. 3. 4 Debugging

The "Debg" menu is used to test the device before it leaves the factory. The function includes zero adjustment, amplitude adjustment, relay output test, indicator output test, indicator color configuration, and relay output configuration.

Please contact the manufacturer when using this menu function.

5. 3. 5 Record

In the "REC" menu, users can view three types of information: SOE Record、SYS Record and LOG Record.

5. 3. 5. 1 SOE Record

The "SOE Record" menu displays the event sequence, total number of events, event code, event time, event name, action type (action or alarm), and other information. If the event is caused by a protection action, the action value and time of the action element at the time of the event are also recorded, as shown in Figure 5.18. The device can save over 200 event records.

5. 3. 5. 2 SYS Record

The "SYS Record" menu displays the system records sequence, total number of system records, system records time, system records name, system records code and other information, as shown in Figure 5.19. The device can save more than 500 records.

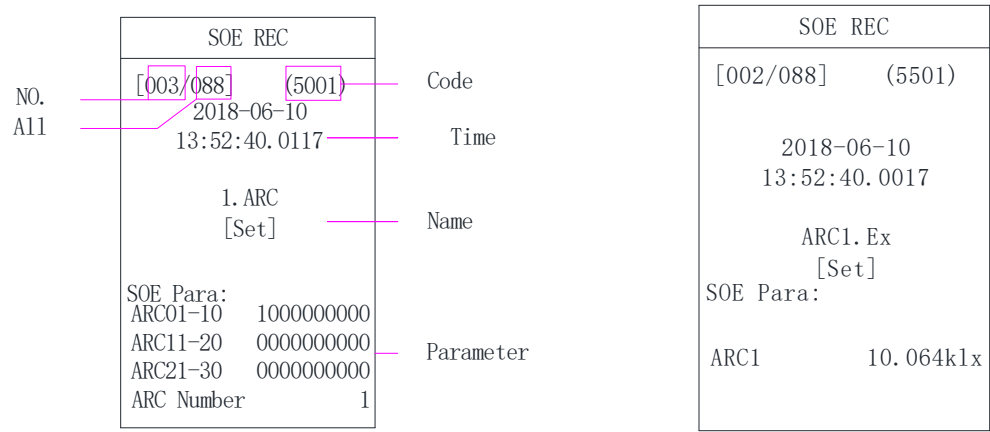


Figure 5.18 Event record screen

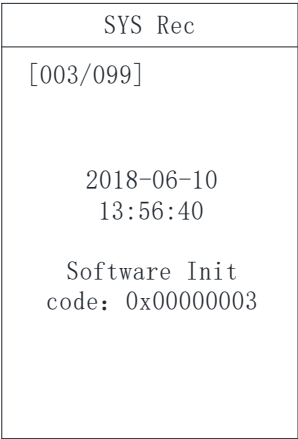


Figure 5.19 System record screen

5. 3. 5. 3 System log

As shown in Figure 5.20, the "System Log" menu records all operation and setting changes of the device. The device can save more than 2000 records.

LOG Rec	[001/033]
20011223-123456.0123	
Device power on/off	
ON	

Figure 5.20 Log record screen

5.3.6 Communication

As shown in Figure 5.21, the "Comm" menu can set the device's communication address and mode. Figure 5.22 shows the device's communication address set, and the communication mode has four interface settings: Ethernet interface, RS485 interface, RS232 interface, and USB interface.

As shown in Figure 5.23 and Table 5.3, three Ethernet ports (A network,B network and C network) communication parameters can be set.

Table 5.3 Ethernet port communication parameters setting

Local TCP mode	Set on demand, can be set to the same within
Local TCP port	Set on demand, can be set to the same within the same network
Local UDP port	Set on demand, can be set to the same within the same network
Local Mac address	Non-repeatable within the same network
Local IP address	Non-repeatable within the same network
Remote TCP port	The TCP of the backend machine, which can be set to the same within the same network
Remote IP address	The IP of the backend machine, which can be set to the same within the same network
Gateway	Set on demand, can be set to the same within the same network
Subnet Mask	Set on demand, can be set to the same within the same network

As shown in Figure 5.24, the communication parameters of two RS485 ports (com1 and com2) can be set.

As shown in Figure 5.21, users can directly enter the "USB Transport" menu to upgrade the program of the device, and enter the "CMI" menu . **Please contact the manufacturer when using this menu function.**

Communication parameters can be set by selecting parameters from Table 5.4. After setting, press "Esc" to exit, then press "Enter" to save and then press "Esc" to return to the main menu.

COMM
CommAddr
Ether Net
RS-485
CMI
USB Transport

Figure 5.21 Communication menu

CommAddr
CommAddr00001

Figure 5.22 Device address setting interface

Ether Net	Enet_A
Protocol:	Modbus
LocalTcpMode:	Server
LocalTcpPort:	7710
LocalUdpPort:	1032
LocalMacAddr:	00-08-DC-65-6C-41
LocalIpAddr:	192.168.001.002

Figure 5.23 A_net communication parameters

RS-485
COM1 Protocol
COM1 Baudrate
COM1 DataBit
COM1 StopBit
COM1 Parity
COM2 Protocol

Figure 5.24 RS-485 communication parameters

Table 5.4 Communication parameter setting

Setting quantity	Parameter
Device address	0~255
Baud rate	110、300、600、1200、2400、4800、9600、14400、19200、38400、56000、57600、115200、128000、256000
Data bits	8、9
Stop bits	1、1.5、2
Calibration mode	No calibration, Even calibration, Odd calibration
Protocol selection	Modbus、IEC101、IEC103、LoopBack、IRIG-B
Local TCP mode	Server、Client

5.3.7 Control

The "Control" menu is used to test the device before it leaves the factory, which allows remote control of the device for breaking, closing, and signal restoration operations.

Please contact the manufacturer when using this menu function.

5. 3. 8 Time

The "Time" menu is used to modify the clock. As shown in Figure 5.25, press the "Enter" button after the time setting is completed, then press the "Esc" button to return to the main menu.

Time Modify	
Current Time	
2023-06-20	
11:24:14	
Y-M-D:	2023-06-20
H:M:S	11:22:18

Figure 5.25 Time Setting

5. 3. 9 Information

The "Information" menu can display the basic information of the device, including device name, software version number, check code, hardware configuration generation time, software configuration generation time, protection logic diagram generation time and logic diagram version number, etc., as shown in Figure 5.26.

INFO
ARB6
HalVer: 1.00
CRC Code: 0x1f37
Hardware:
2018-06-10_13:42:34
Software:
2018-06-10_13:42:38
LogicVer: V0020 1.00
2018-06-10_15:50:46

Figure 5.26 Device information

5.3.10 Waveform

The "Wave" menu can directly display the waveform data of accident current, voltage, and arc intensity stored by the device when the protection function is activated. The device can store no less than 16 fault recording information.

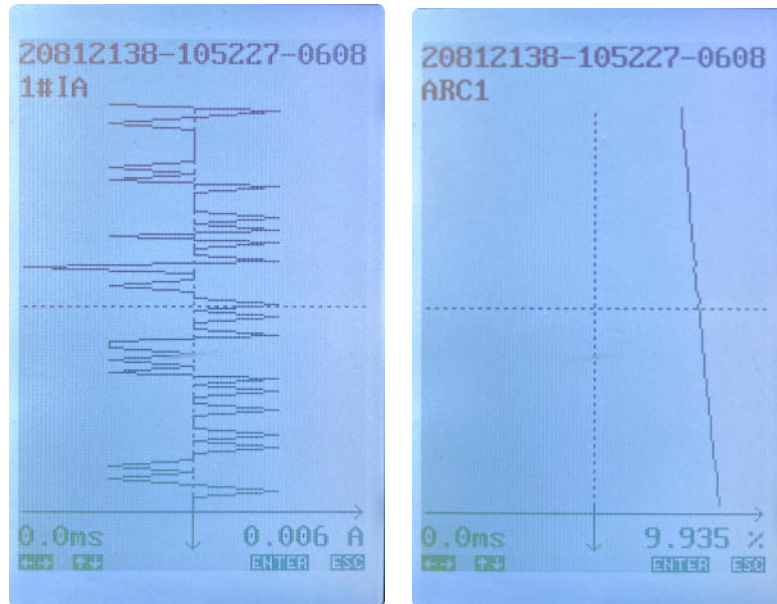


Figure 5.27 waveform data information

Chapter 2 Technical Description

1 Protection Principle

1.1 Arc protection

There are three possible criteria for starting arc protection: single arc criterion, arc and current criterion, and arc and zero sequence voltage criterion.

(1) Single criteria for arc criterion

When the arc intensity exceeds its set value, after a delay, the arc protection will activate.

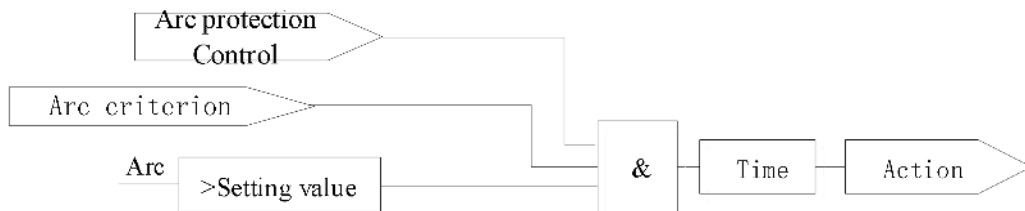


Figure 1.1 Schematic diagram of arc single criterion protection logic

(2) Dual criteria for arc and current

When an arc fault occurs, the arc intensity will increase and the current value will suddenly change. Adding a current criterion to the starting conditions of arc protection can effectively eliminate interference from external light sources and improve reliability.

When the arc intensity is greater than its set value and any current value associated with it is greater than the current set value, the arc protection will activate after a delay.

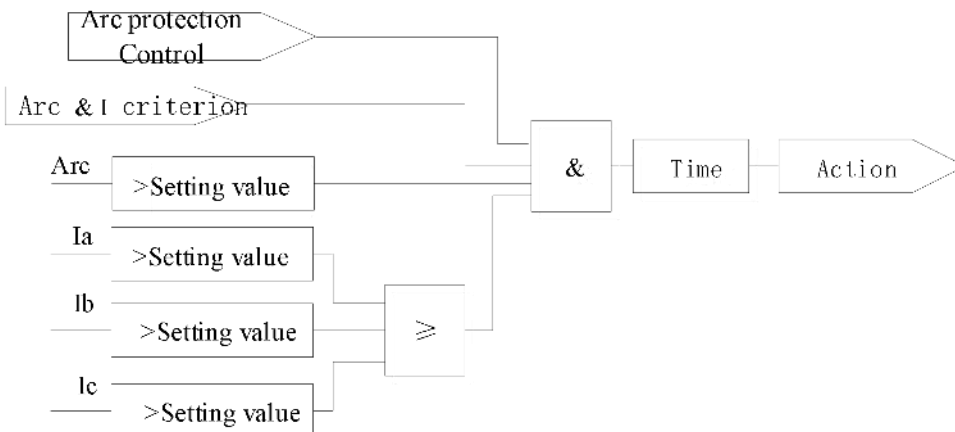


Figure 1.2 Schematic diagram of dual criterion protection logic for arc and current

(3) Dual criteria for arc and zero sequence voltage

Adding a zero sequence voltage criterion to the starting conditions of arc protection in ungrounded systems and arc suppression coil grounded systems can improve the sensitivity of identifying single-phase grounding arc faults.

When the arc intensity is greater than its set value and any voltage value in the associated zero sequence voltage is greater than the set value of the zero sequence voltage, after a delay, the arc protection will activate.

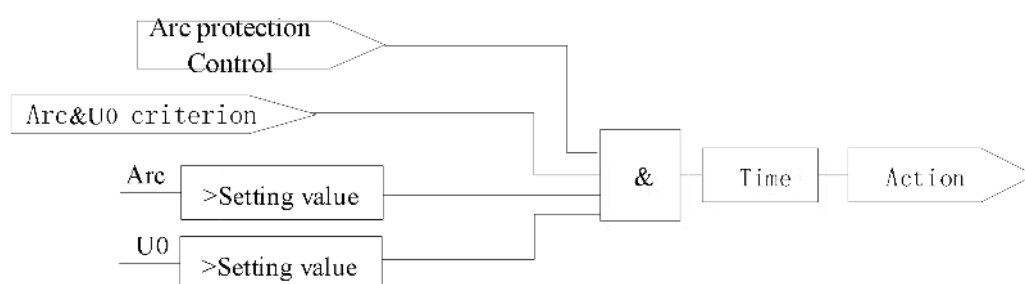


Figure 1.3 Schematic diagram of dual criterion protection logic for arc and zero sequence voltage

1.2 Arc monitoring and fault location function

After the "sensor monitoring enable" soft pressing plate is put into operation, the device can monitor the real-time light intensity value and sensor serial number of the arc sensor, and can determine whether to record the light intensity value of the arc sensor through the "sensor light intensity value recording" control word (when the arc intensity is greater than the set value). When the "Sensor Light Intensity Record" control word is activated, the device will record the light intensity value of each arc sensor; When exiting, the device will still monitor the light intensity value of the arc sensor in real time, but will not save its light intensity value.

When the arc fault triggers the arc protection logic action, the device will combine the sensor serial number and light intensity value at the location of the arc fault to achieve the fault point positioning function.

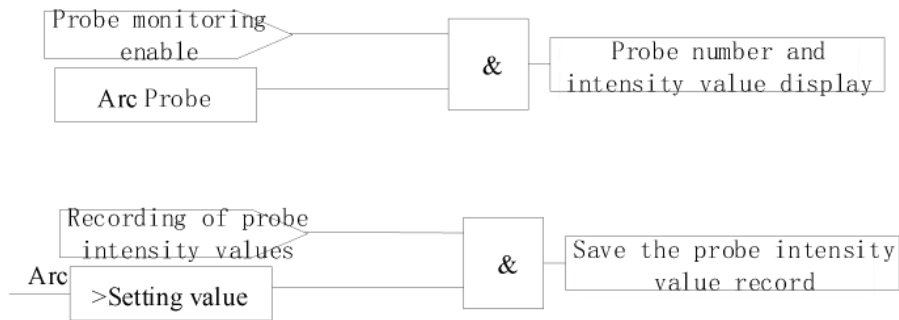


Figure 1.4 Logic diagram of arc sensor intensity monitoring and arc fault location

1.3 Arc sensor and fiber optic link monitoring

When the "sensor monitoring enable" soft pressing plate is put into use, the device monitors the link situation of each arc sensor in real time. When any arc sensor is damaged or the fiber optic link connected to the arc protection device is interrupted, after a delay, the arc link self checks and alarms.

When the arc acquisition port is not connected to a sensor, it is necessary to exit the corresponding sensor monitoring enable soft pressing plate or put in the corresponding locking sensor self check soft pressing plate, otherwise it will report an abnormal self check of the sensor link.

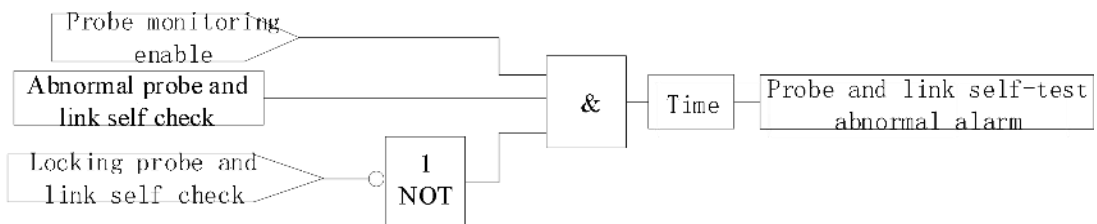


Figure 1.5 Schematic diagram of arc sensor and fiber optic link self-test logic

1.4 Failure protection

The failure protection logic can be associated with multiple sets of arc protection and current. When the associated arc protection is activated and the associated current is consistently greater than the failure set value, the failure protection will activate after a delay.

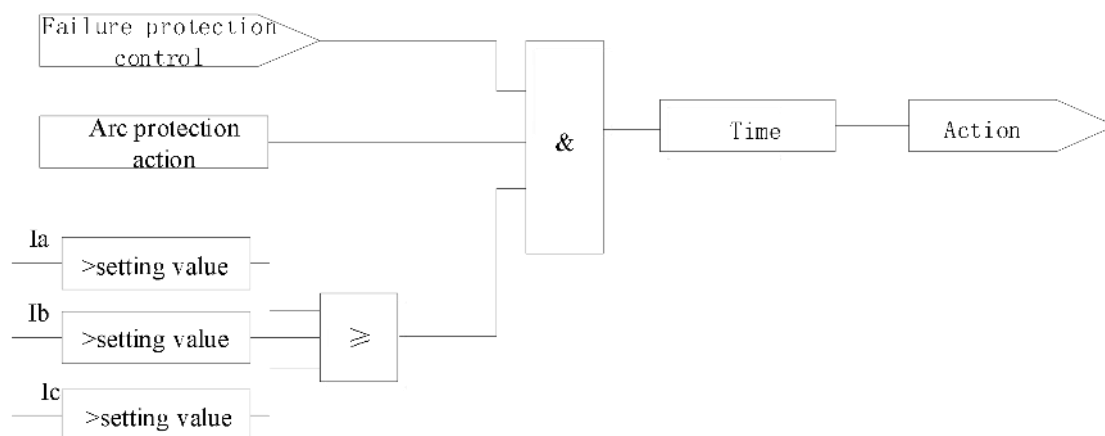


Figure 1.6 Schematic diagram of failure protection logic

1.5 CT monitoring

When using the 3CT current connection method, if any phase or two phases of the current are disconnected, after a delay, the CT disconnection alarm will activate; When using the 2CT current wiring method, if any phase current is disconnected and delayed, the CT disconnection alarm will activate.

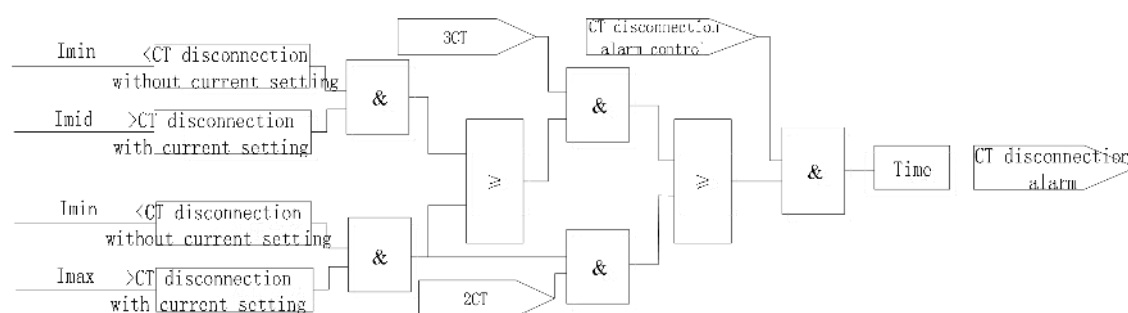


Figure 1.7 Schematic diagram of CT disconnection alarm logic

1.6 Non-electric quantity protection

Non-electric quantity protection is activated, and after a delay, the non electric quantity protection is activated.

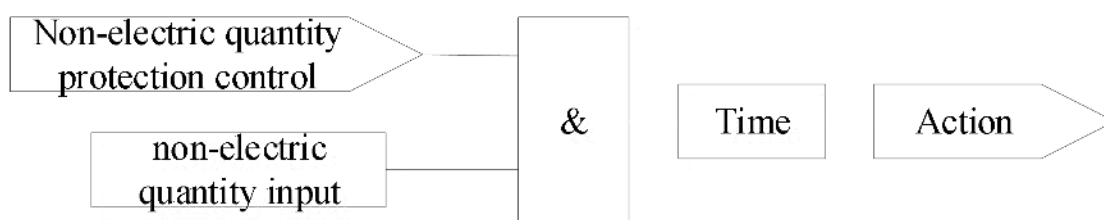


Figure 1.8 Schematic diagram of non-electric protection logic

1.7 Device Abnormal Self Test

When the device loses power or has internal faults, the device sends an alarm signal and the

abnormal indicator light of the device lights up.

1.8 Maintenance status locking

External input (maintenance status) can independently select the locking action outlet or communication transmission. If the "maintenance status locking outlet" is activated, only event records will be generated when the protection trips, and the device outlet will not act; If "maintenance status locking communication" is activated, communication cannot be achieved at this time, but the protection function can operate normally.

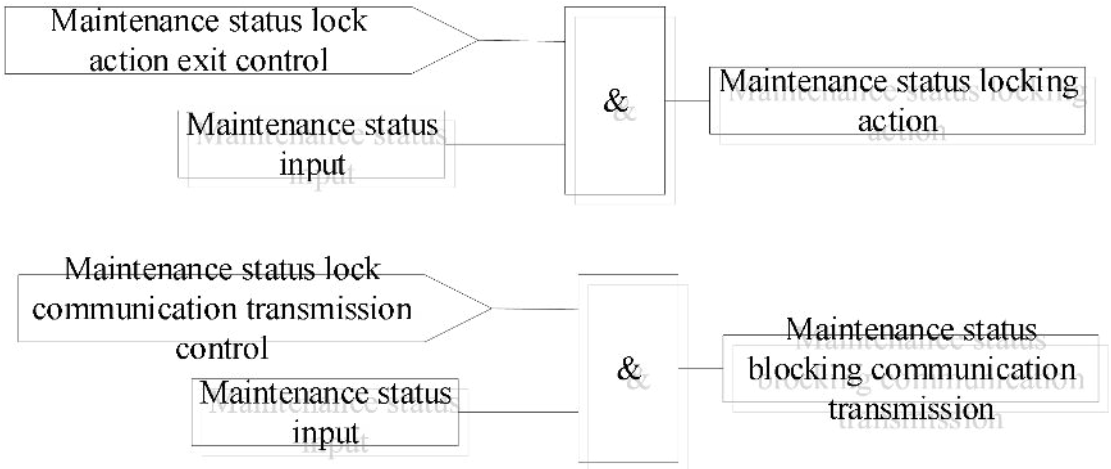


Figure 1.9 Maintenance Status Lockout Logic Diagram

2 Parameter Table

2.1 Fixed value setting table

Table 2.1 ARB6 Setting Table

ARB6 constant value setting				
No.	Protection Function	Value Name	Default	Notice
1		1#I Mode	3CT	3CT; 2CT
2		2#I Mode	3CT	3CT; 2CT
3		3#I Mode	3CT	3CT; 2CT
4		4#I Mode	3CT	3CT; 2CT
5		Ie	5A	0.001A~200A
6		Ue	100V	0.001V~400V
7	Group 1	1K	OFF	OFF; ON
8	Arc protection	1Crit	Arc & Current	Arc;

				Arc & Current; Arc & Voltage
9		1Arc.T	0s	0s~9999.999s
10		1I	1.2Ie	(0.001~200) Ie
11		1IM	000000000000	12 current channels (from left to right); Position 1: Associate with the current.
12		1U0	0.4Ue	(0.001~200) Ue
13		1UM	000	3 voltage channels; Position 1: Associate with the voltage.
14		1ARC	10klx	0klx~50klx
15		1M1	0000000000000000	Sensors 1-15 (from left to right); Position 1: Associate the sensor.
16		1M2	0000000000000000	Sensors 16-30 (from left to right); Position 1: Associate the sensor.
17		1DO	0000000000000000	16 relay outlets (from left to right); Position 1: Associate with the DO.
18				
●	Group 2-16 Arc protection			
●				
●				
182				
183	Group 1 Failure protection	E.1SL	OFF	OFF; ON
184		1SI	2Ie	(0.001~200) Ie
185		1IM	000000000000	12 current channels (from left to right); Position 1: Associate with the current.
186		1SL.T	0s	0s~9999.999s
187		1SD	0000000000000000	16 relay outlets (from left to right); Position 1: Associate with the DO.

188	● ● ● Group 2-4 Failure protection				
202					
203		arc sensor	E.Arc.E	OFF	OFF; ON
204		Light intensity event recording	Arc.E.S	10klx	0klx～50klx
205	Group 1 non-electric quantity protection	E.Non-el1	OFF	OFF; ON	
206		Non-el1.T	1s	0s～9999.999s	
207		EI.D	0000000000000000	16 relay outlets (from left to right); Position 1: Associate with the DO.	
208	● ● ● Group 2-4 non-electric quantity protection				
216					
217		CT disconnection alarm	E.CTBr.A	OFF	OFF; ON
218			CTBr.I.N	0.125A	0.04A～100A
219	CTBr.I.S		0.2A	0.04A～100A	
220	CTBr.T		5s	0s～9999.999s	
221	CTBr.D		0000000000000000	16 relay outlets (from left to right); Position 1: Associate with the DO.	
222	Maintenance status lock	E.M.BC	OFF	OFF; ON	
223		E.M.BE	OFF	OFF; ON	
224		link.D	0000000000000000	16 relay outlets (from left to right); Position 1: Associate with the DO.	
225		PpwerD	0000000000000001	16 relay outlets (from left to right); Position 1: Associate with the DO.	
226		S2	0000000000000000	16 relay outlets (from left to right); Position 1:	

				Associate with the DO.
227		Cir.Br.T	20ms	20ms~10000ms
228		Excess R.C	0.95	0.001~1.000
229		Under R.C	1.05	1.000~2.000

2.2 Soft pressing plate setting table

The device can independently control each arc acquisition port. When the optical fiber of the arc sensor is connected to the arc acquisition port, the corresponding sensor's monitoring and enabling soft pressing plate needs to be "put into operation". Only the arc sensor that enables the soft pressing plate to be monitored can its light intensity value be monitored, and its corresponding sensor and fiber real-time self check function will be activated. When the arc collection port is not connected to the fiber optic cable, the corresponding monitoring enable soft pressing plate must be "exited", otherwise the device will report an abnormal self check of the sensor link.

able 2.2 ARB6 Soft Pressing Plate Setting Table

ARB6 soft pressing plate		
No.	Soft pressing plate name	Notice
1	ARC1.E	For fiber optic connections, corresponding sensors must be installed to enable them; If there is no fiber optic connection, the corresponding sensor must be disabled.
●	●	
●	●	
●	●	Remember: You cannot throw too much or too little!
30	ARC30.E	
31	L1.B	
●	●	Exit: Sensor and Link Self Test Input: Sensor and link not self checking
●	●	
●	●	
60	L30.B	

3 Backboard terminal definition and secondary schematic diagram

3.1 Backboard terminal definition diagram

The ARB6 series arc protection device backplane terminals include AC input terminals, output terminals, arc acquisition terminals, communication terminals, input terminals, and device power terminals.

The X1 terminal is an AC input terminal. X1.1-X1.24 are 12 protection current connection terminals, and X1.25-X1.30 are three zero sequence voltage connection terminals.

The X2 terminal is a communication terminal, consisting of two RS485 communication terminals and one IRIG-B timing input terminal. X2.1, X2.2, and X2.3 are the first communication terminals, while X2.6, X2.7, and X2.8 are the second communication terminals. Both communication channels support IEC60870-5-103 and Modbus RTU communication protocols.

The X4 terminal is the device power terminal, and X4.4 is the device power protection ground, which must be reliably connected to the ground.

The X5 terminal is the switch input terminal. The ARB6 arc protection device comes standard with 5 inputs (X5.1-X5.7, X5.7 is the common end), among which ARB6-A12 and ARB6-A24 support extension to 22 inputs (X5.1-X5.7, X5.8-X5.24, X5.7 and X5.24 are the common end). The input to the same common terminal must have the same polarity. The input voltage must be externally connected to AC/DC 220V, AC/DC110V, DC48V or DC24V, and the voltage level to be connected must be specified before ordering.

The X6 terminal is the switch output terminal, with a total of 16 sets of passive relay output contacts, of which DO1-DO14 are normally open contacts and DO15-DO16 are normally closed contacts. The specific definition of 16 sets of switch outputs can be viewed through the "Exit Mapping" menu interface of the device.

The X8 terminal is the fiber optic connection terminal of the arc sensor. The connection sequence is from top to bottom, from left to right, that is, the arc acquisition board on the left is connected first, and the same arc acquisition board is connected to the arc sensor fiber from top to bottom.

The E1-E3 interface is an Ethernet port that supports TCP IEC60870-5-103, TCP, and Modbus RTU protocols.

The USB interface is the device program maintenance port.

3.2 schematic diagram

The secondary schematic diagram of the ARB6 series arc protection device is as follows.

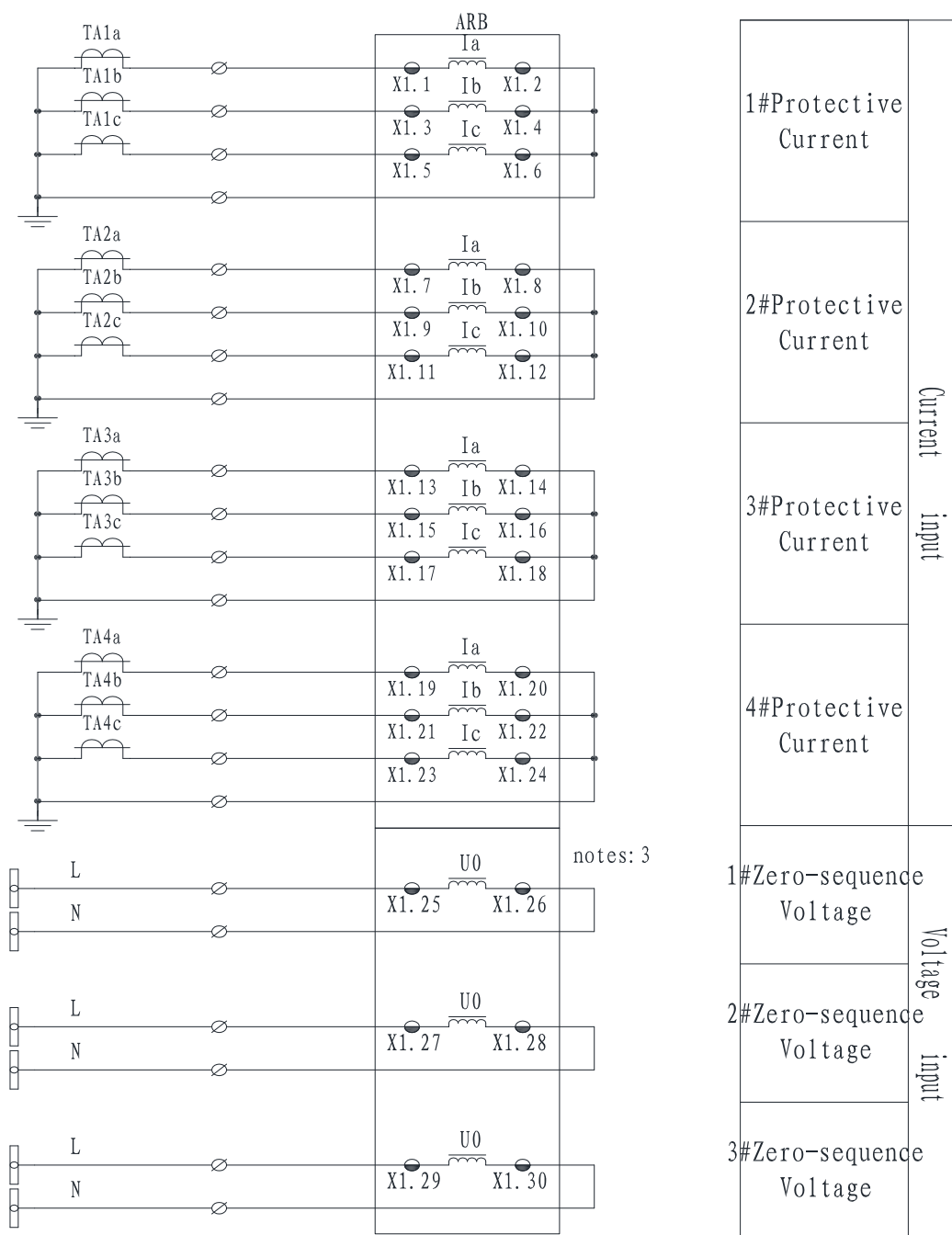


Figure 3.1 Secondary schematic diagram of current and voltage circuits

Note: The voltage circuit is optional. Please choose whether to connect the voltage circuit according to the actual situation of the project.

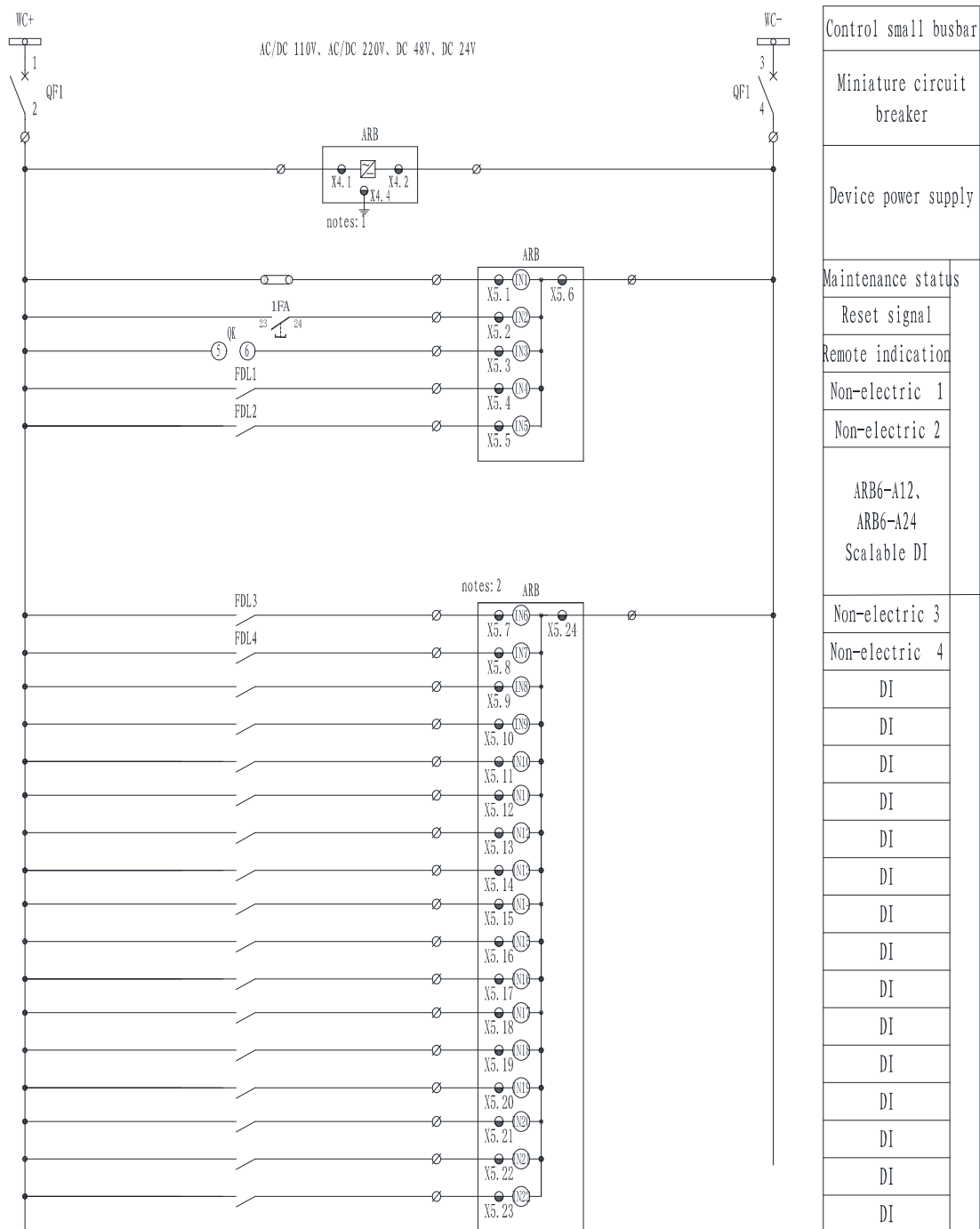


Figure 3.2 Secondary schematic diagram of device power supply and input circuit

Note:

1. The protective device is a common ground system and must be reliably grounded before operation
2. ARB6-A12 and ARB6-A24 are expandable inputs, while ARB6-A6, ARB6-A18, and ARB6-A30 are not expandable inputs.

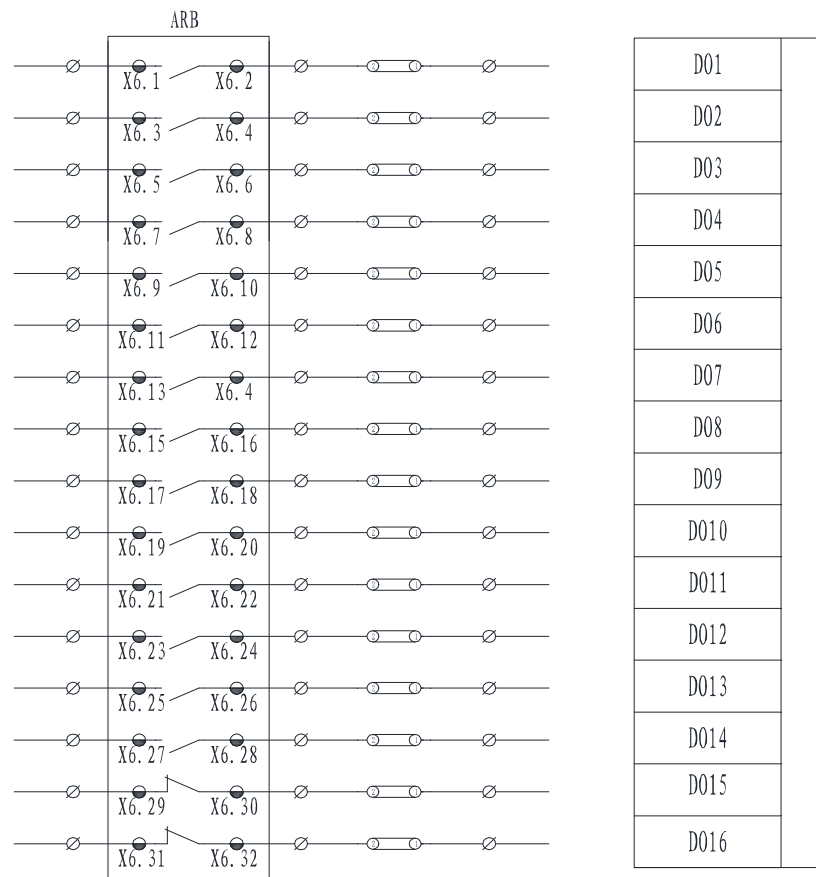


Figure 3.3 Secondary schematic diagram of control circuit

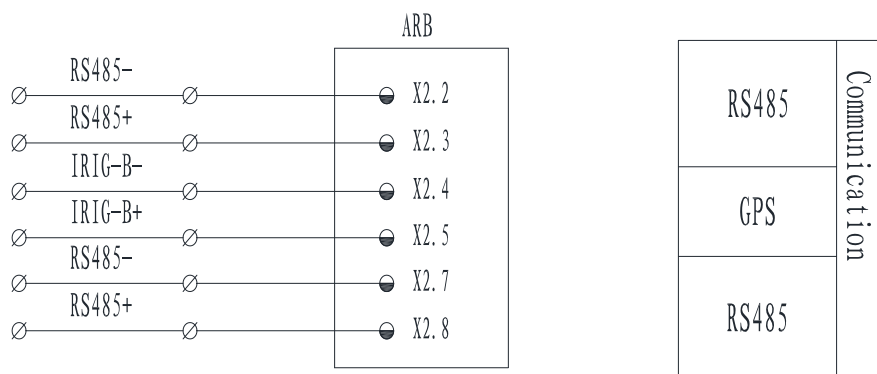


Figure 3.4 Communication Interface Diagram

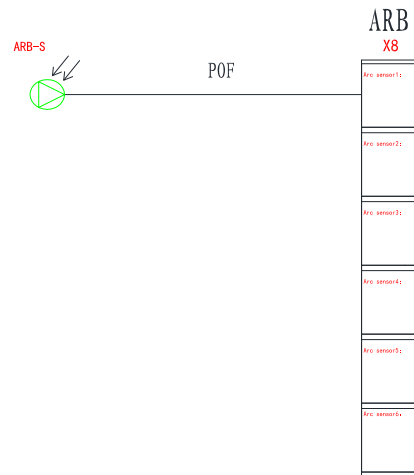


Figure 3.5 Schematic diagram of fiber optic connection for arc acquisition interface

Chapter 3 Typical Configuration and Application

1 Typical configuration of busbar arc protection

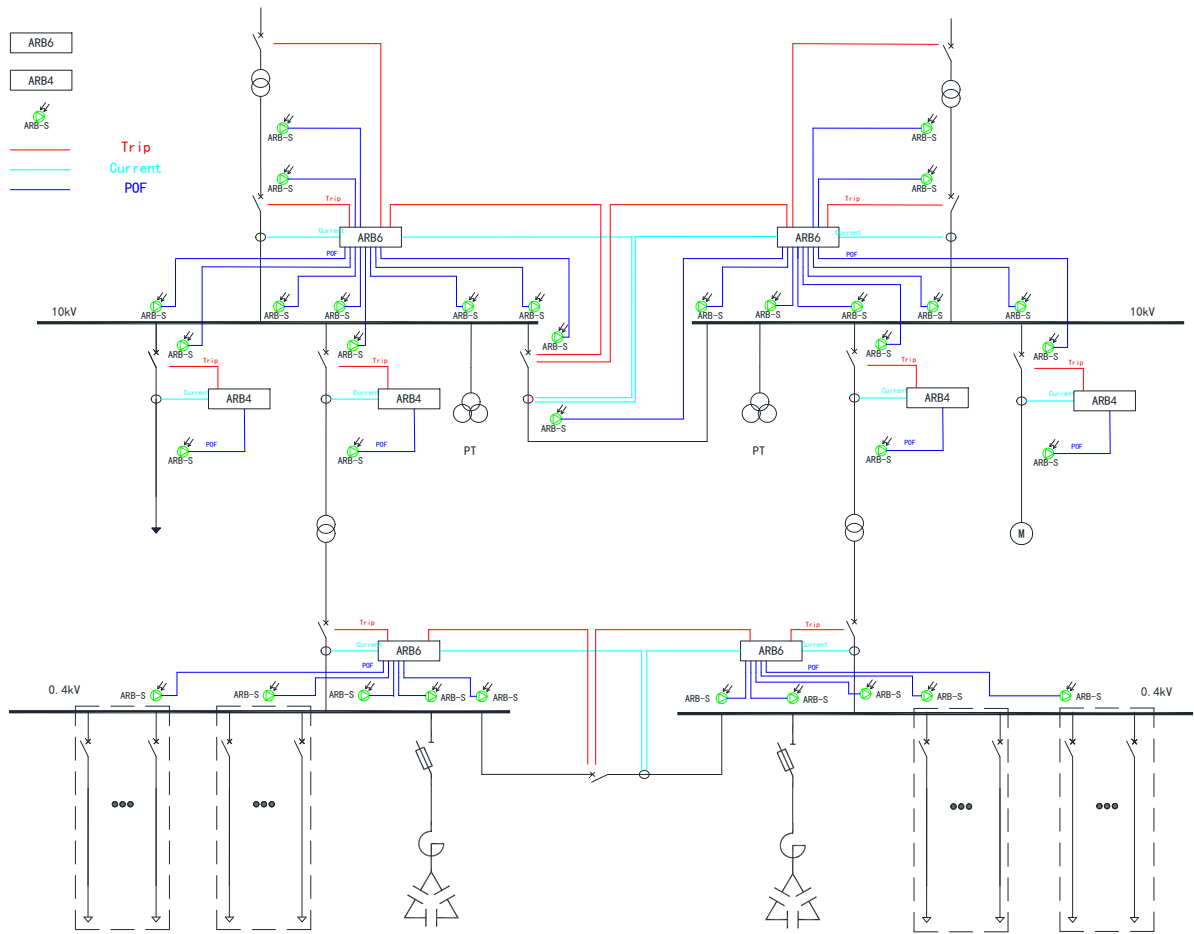


Figure 1.1 Typical Configuration of ARB Arc Protection

In the two incoming and one connecting system, each section of the busbar (or each row of switchgear) is equipped with one ARB6 series arc protection device (which can be installed in the incoming cabinet or PT cabinet), and one ARB-S arc sensor is installed in the busbar room of each high-voltage cabinet (or at the main busbar of the low-voltage cabinet). When it is necessary to monitor arc faults in areas such as handcart rooms and cable rooms, arc sensors can also be installed in the corresponding compartments.

2. Protection logic and parameter settings

The device can achieve no less than 16 sets of arc protection logic, and each set of arc protection logic can be associated with multiple sets of arc, current or voltage values, and action outlets.

If multiple arc sensors are associated with the current or voltage, and the logical quantities of the action outlet are consistent, these arc sensors can be

set as the same set of arc protection logic.

(1) Example 1

1) Two incoming lines and one busbar connection system, with 10 switchgear cabinets (high voltage or low voltage cabinets) for each section of the busbar, arranged in two rows.

2) Install one ARB-S arc sensor in each busbar compartment of each cabinet, and install one ARB6-A12 arc protection device in each of the two incoming cabinets (if space is not sufficient, it can be installed in other cabinets, such as PT cabinets).

3) Each ARB6-A12 arc protection device is connected to 10 arc sensors (No. 1-10 sensors), with dual criteria of arc and current (incoming line and busbar current in this section), which trip the incoming line and busbar switch in this section.

4) If the current channels 1-3 of each ARB6-A12 arc protection device are the three-phase current of the incoming line in this section, and the current channels 4-6 are the three-phase current of the busbar; The outlet relay DO1 trips the incoming switch of this section, and the outlet relay DO2 trips the busbar switch.

5) Each ARB6-A12 arc protection device consists of 10 arc sensors, forming a set of arc protection logic. Therefore, only the first set of arc protection needs to be activated. Combined with the fixed value table and the soft pressure plate table, the parameters of the two ARB6-A12 arc protection devices are set as follows.

ARB6 constant value setting				
No.	Protection Function	Value Name	Setting	Notice
7	Group 1 Arc protection	1K	ON	
8		1Crit	Arc & Current	
9		1Arc.T	0s	Issued by the power department, or default
10		1I	1.2Ie	Issued by the power department, or default
11		1IM	111 111 000 000	Associate the incoming current of this section of the busbar with the bus tie current
12		1U0	0.4Ue	No involvement, no modification required
13		1UM	000	No involvement, no modification required

14		1ARC	10klx	Issued by the power department, or default
15		1M1	11111 11111 00000	Associate sensors 1-10
16		1M2	00000 00000 00000	All are 0, no association required
17		1DO	11000 00000 00000 0	DO1 trips the incoming switch of this section, and DO2 trips the busbar switch

ARB6 soft pressing plate		
No.	Soft pressing plate name	Notice
1~10	Sensors 1-10 monitoring enable	ON
11~30	Sensors 11-30 monitoring enable	OFF

(2) Example 2

1) Two incoming lines and one busbar connection system, with 10 switchgear cabinets (high voltage or low voltage cabinets) arranged in a row for each section of the busbar.

2) Install one ARB-S arc sensor in each busbar compartment of the cabinet, and install one ARB6-A24 arc protection device in the busbar cabinet (if there is not enough space, it can be installed in other cabinets, such as busbar isolation cabinet).

3) The ARB6-A24 arc protection device is connected to 20 arc sensors, including 10 sensors (1st to 10th sensors) on the I-section busbar. The arc+current (I-section incoming line/busbar current) dual criterion trips the I-section incoming line and busbar switch; 10 sensors (11th to 20th sensors) on the II section busbar, with dual criteria of arc+current (II section incoming line/busbar current), trip the II section incoming line and busbar switch.

4) If the current channels 1-3 of the ARB6-A24 arc protection device are the three-phase current of the incoming line in section I, current channels 4-6 are the three-phase current of the incoming line in section II, and current channels 7-9 are the three-phase current of the busbar; The export relay DO1 is connected to the section I incoming switch, the export relay DO2 is connected to the section II incoming switch, and the export relay DO3 is connected to the busbar switch.

5) The 20 arc sensors of the ARB6-A24 arc protection device constitute two sets of arc protection logic, so it is necessary to input the first set of arc protection and the second set of arc protection. Combined with the setting table, the parameters of the ARB6-A24 arc protection device are set as follows.

ARB6 constant value setting				
No.	Protection Function	Value Name	Setting	Notice
7	Group 1 Arc protection	1K	ON	
8		1Crit	(Arc & Current)	
9		1Arc.T	0s	Issued by the power department, or default
10		1I	1.2Ie	Issued by the power department, or default
11		1IM	111 000 111 000	Associate the incoming line of section I with the busbar current
12		1U0	0.4Ue	No involvement, no modification required
13		1UM	000	No involvement, no modification required
14		1ARC	10klx	Issued by the power department, or default
15		1M1	11111 11111 00000	Associate sensors 1-10
16		1M2	00000 00000 00000	All are 0, no association required
17		1DO	10100 00000 00000 0	DO1 trip section I incoming switch, DO3 trip busbar switch
18	Group 2 Arc protection	2K	ON	
19		2Crit	Arc & Current	
20		2Arc.T	0s	Issued by the power department, or default
21		2I	1.2Ie	Issued by the power department, or default
22		2IM	000 111 111 000	Associate the incoming line of section II with the busbar current
23		2U0	0.4Ue	No involvement, no modification required

24		2UM	000	No involvement, no modification required
25		2ARC	10klx	Issued by the power department, or default
26		2M1	00000 00000 11111	Associate sensors 11-15
27		2M2	11111 00000 00000	Associate sensors 16-20
28		2DO	01100 00000 00000 0	DO2 trip section II incoming switch, DO3 trip busbar switch

ARB6 soft pressing plate		
No.	Soft pressing plate name	Notice
1~20	Sensors 1-20 monitoring enable	ON
21~30	Sensors 21-30 monitoring enable	OFF

3 Arc protection function debugging

During the debugging process, when the protection trips, the "trip" indicator light on the device panel lights up, corresponding to the relay action outlet, and the corresponding event record information is displayed on the LCD; When a protection alarm occurs, the "alarm" indicator light on the device panel lights up, corresponding to the relay action outlet, and the corresponding event record information is displayed on the LCD.

Based on the actual project diagram and switchgear layout, configure the arc protection device and arc sensor reasonably, and refer to the parameter setting method provided in the previous section "Protection Logic and Parameter Setting". After setting the parameters correctly for the device, debugging can be carried out.

(1) Arc single criterion

1) Simulate the occurrence of arc using a handheld cursor or other high intensity light source to illuminate the arc sensor.

2) When the fiber optic cable is not connected, the arc acquisition board terminals on the device backplane can be illuminated.

2) Arc and current dual criteria

1) Apply current to the device according to the quadratic diagram.

2) Simulate the occurrence of arc using a handheld cursor or other high intensity light source to illuminate the arc sensor.

3) When the fiber optic cable is not connected, the arc acquisition board terminals on the

device backplane can be illuminated.

(3) arc and voltage dual criteria

1) Apply voltage to the device according to the quadratic diagram.

2) Simulate the occurrence of arc using a handheld cursor or other high intensity light source to illuminate the arc sensor.

3) When the fiber optic cable is not connected, the arc acquisition board terminals on the device backplane can be illuminated.

4 Maintenance and common problems

The device is a maintenance free product, and as long as the installation and operation environment meets the requirements, there is no need for daily or regular maintenance during normal operation. But pay attention to the loosening of screws caused by long-term slight vibration.

The following table shows the problems that may be encountered during the use of the device and corresponding handling suggestions.

Table 5.1 Problems and corresponding handling suggestions

Problems	Possible causes	Processing suggestions
Arc sensor link abnormality	1. Fiber optic not in good contact with device or sensor 2. Fiber optic not ground smooth 3. The sensor acquisition port on the device backplane is not connected to a sensor (fiber optic), but the sensor is used to monitor and enable the soft pressing plate	1. Correctly plugging in optical fibers 2. Remake the connector and grind the fiber optic cable 3. Exit the sensor monitoring enable soft pressing plate without connecting the fiber optic cable
The DO without trip	1. The Enale is exit 2. Protection activation conditions not met 3. Export mapping configuration error	1. Input corresponding protection in the fixed value 2. Check and debug methods 3. Configure the corresponding exit in the debugging menu
No communication	1. Reverse polarity of wiring 2. Inconsistent communication parameters or protocols 3. Communication cable disconnection 4. Device address setting error	1. Swapping polarity wiring 2. Reset communication parameters or protocols 3. Repair or replace communication cables 4. Set device address in the communication menu
Abnormal indicator light display	1. Device in initialization state 2. Indicator light color configuration error	1. Please press the reset button once 2. Configure indicator light colors in the debugging menu

Remote communication without display	Corresponding remote signaling did not receive input signal	Check the voltage between the device terminals and the common terminal
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