421

ARB5 Arc Flash Protection Relay

Operational Manual v1.1

Acrel CO.,LTD

DECLARATION

We reserve all the rights to revise product specification without notice. Please consult local agent to get the latest information of our products specification.

CONTENTS

1 Application

The device is applicable to arc protection of middle-lower voltage bus.

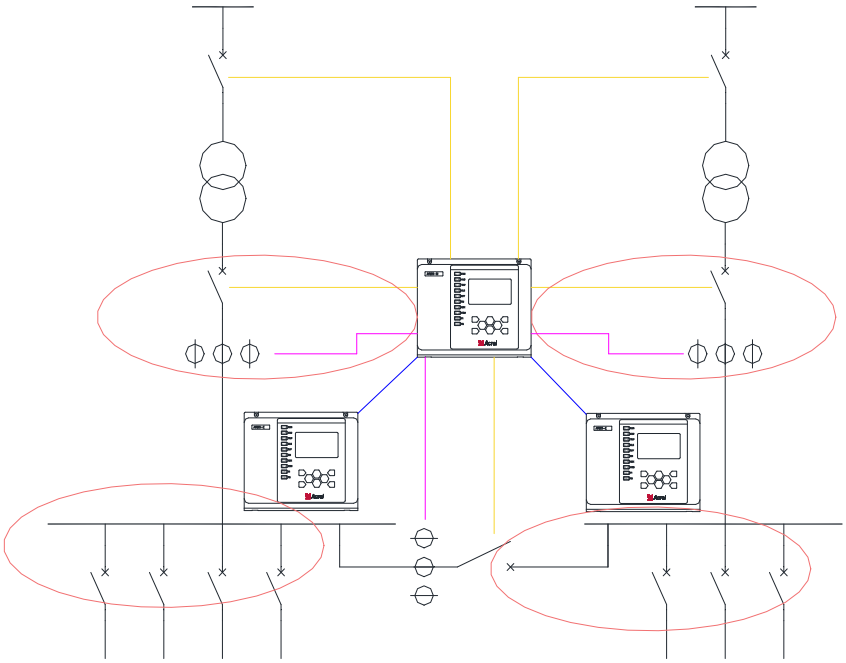
2 Major function

2.1 Function of device protection

1) Arc protection (8 groups)
2) Failure protection (4 groups)
3) TA disconnection monitoring (4 groups)
4) Non-electricity protection
5) Device fault alarm

2.2 Main Measurements and Controlling Control Function

1) 24-channel input Semaphore collection (adding input board can expand input quantity), except for some having special definition, other Semaphore can be defined by users. The input signals in this unit have two connection methods for option: one is active contact with external power supply; the other is electrical independent contact with the power supply provided by the device. Specific information shall see the schematic diagram behind. When ordering, usr shall provide description.
2) Measurement data
   - ✓ Basic data - current 1: IA1, IB1, IC1; current 2: IA2, IB2, IC2; current 3: IA3, IB3, IC3; current 4: IA4, IB4, IC4.
   - ✓ Harmonic data: current 1: IA1, IB1, IC1; current 2: IA2, IB2, IC2; current 3: IA3, IB3, IC3; current 4: 2-time harmonic wave, 3-time harmonic wave, 5-time harmonic wave respectively for IA4, IB4, IC4.
   - ✓ Symmetrical components - symmetrical component for current 1: I1_1, I2_1, 3I0_1; symmetrical component for current 2: I1_2, I2_2, 3I0_2; symmetrical component for current 3: I1_3, I2_3, 3I0_3; symmetrical component for current 4: I1_4, I2_4, 3I0_4.
3) Arc protection system is composed by main control unit ARB5-M and extension unit ARB5-E, and one main control unit can be configured with multiple extension units. Each extension unit can plug in multiple extensive plugins, each of which can collect 5-channel arc signal. One extension unit can plug in 6 extensive plugins. Those extension units mainly provide working power supply to the extensive plugins for arc signal analogue simulation etc.; four groups of three-phase current collection circuit on the main control unit can collect 12-channel simulation current signal; in addition, for arc collection plugins, each plugin can receive 30-channel arc signal. One main control unit can plug in 4-channel arc collection plugins, and 120-channel arc signals. An example of the scheme:



3 Technical parameters

3.1 Chassis structure size

Refer to Device Outline and Opening Size

3.2 Working environment

Index name	Unit	Index	Remark
Altitude	m	<2000	GB6162
Ambient temperature	℃	-10~55	GB6162
Relative humidity	%	5~95	GB6162
Atmospheric pressure	kPa	80~106	GB6162

3.3 Extreme ambient temperature for storage and transportation

Allowable ambient temperature for device storage, transportation and installation is within the range of -40～+70℃.

3.4 Mechanical properties

Vibration response, vibration durability, shock response, shock durability, collision; severity is grade 1.

3.5 Rated electrical data

Power (AC, DC)	AC voltage	DC voltage	Frequency
220V, 110V	220V (phase voltage), 380V (line voltage)	5A	50/60Hz

3.6 Rated power consumption

Circuit	AC Current Circuit	AC Voltage Circuit	Power Circuit
Power consumption	＜0.5VA/phase (rated 1A) ＜1VA/phase (rated 5A)	＜0.5VA/phase (rated 1A)	Normal < 15W Trip < 20W

3.7 Main property index

1) Realtime performance

Content	Switch Action Resolution	Serial Communication
Parameter	＜2ms	Band rate 2400-19200

2) Power supply

Type	Voltage	Waveform	Frequency Frequency	Power consumption	Ripple	Waveform distortion
DC (110V/220VDC)	80%~115%Un	DC		<20W	<5%	
AC (220VAC)	80%~115%Un	AC	50/60Hz	<20W		<5%

3) Accuracy of measurement

Content	Condition	Accuracy
Current	0.05A~20In	＜±5%

4) Error for set value

Content	Parameter
Error for current set value	<±2.5% setting value

Error for time set value	No-time-delay protection not larger than 40ms, time-delay protection not larger than 25ms or ±2.5%, arc protection act time <7ms

5) Insulation test

Insulation test meets the provisions of international GB/T 14598.3-2006.

Impulse voltage meets provisions of international GB/T 14598.3-2006.

6) Dielectric strength

Object	Frequency	Time	Effective value of test pressure
Signal circuit	50Hz	1min	2kV
AC circuit	50Hz	1min	2kV
Power circuit	50Hz	1min	2kV

7) Electromagnetic compatibility

Test item	**Severity**	**Standard**
Shockwave immunity test	Grade III	GB/T 14598.13
Electrostatic discharge immunity test	Grade IV	GB/T 14598.14
Radiated radio-frequency electromagnetic field immunity test	Grade III	GB/T 14598.9
Electrical fast transient burst immunity test	Grade A	GB/T 14598.10
Surge immunity test	Grade IV	GB/T 14598.18
Radio-frequency field induction immunity test	Grade III	GB/T 14598.17
Power frequency immunity test	Grade A	GB/T 14598.19
Conducted emission limit test	--	GB/T 14598.16

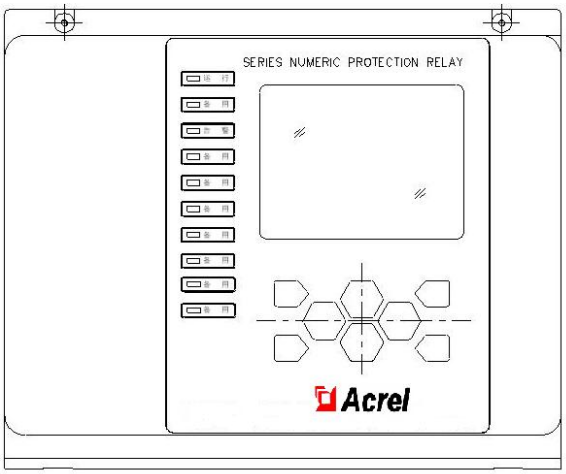
Radiated emission limit test	--	GB/T 14598.16

8) Exit relay parameter

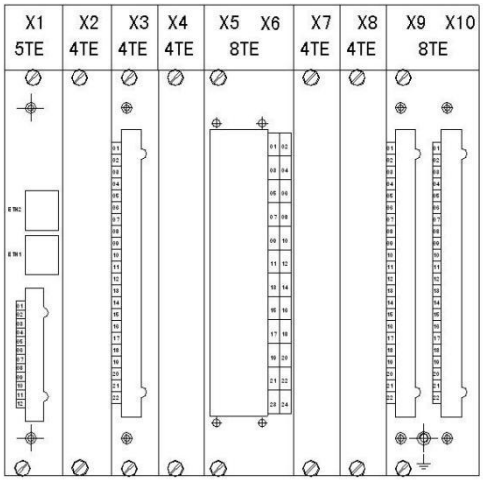
Content	Type	Contact capacity
Exit relay	ST2-DC24V	Allowable limiting continuous current 8A Breaking current: 0.3A DC220V
Signal relay, alarm relay	DSP2a-DC24V	Allowable limiting continuous current 5A Breaking current: 0.2A DC220V

4 Structure and installation

4.1 Panel layout



Front panel



Rear panel

4.2 Outline and opening size

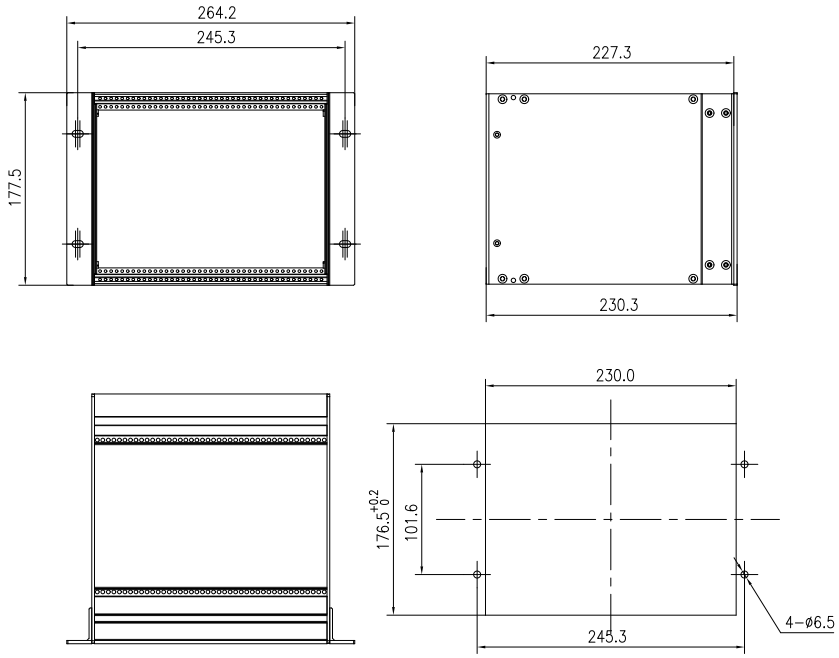
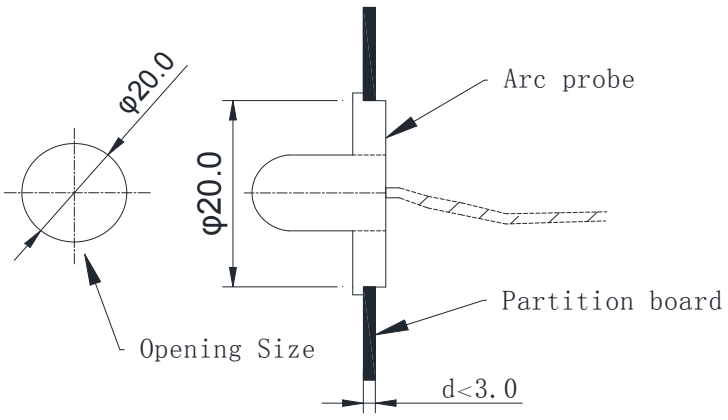


Diagram of outline size and opening size of the signal chassis

4.3 Opening and installation of arc sensor

The opening and installation of arc sensor (probe) should follow the following principles：

The recommended installation locations of arc probe include (but not limited to) circuit breaker room, cable room and bus room. It can be installed with panel opening or bracket. The detection range of arc probe is 180 degrees ° ， The radius of the semi-circular area is 0.5m, so this element should be fully considered when selecting the probe installation point to avoid the detection blind area。



Hole size and installation diagram of arc sensor

When there is a circuit breaker in the switch cabinet, it is recommended to install the arc sensor at the position where arc is likely to occur (for example, at the connection of bus contact, at the contact of upper or lower disconnector (2), at the contact of current transformer and at the cable joint). When there is no circuit breaker in the switch cabinet, it is recommended to install the arc sensor at the bus contact connection, the upper and lower disconnector contacts (1) and the cable joint。

Arc light sensors should be installed at both ends of enclosed bus bridge. If the overall protection of the switch cabinet is considered, an arc sensor can be installed in the circuit breaker room and the cable room of the switch cabinet。

5 Device settings

5.1 Setting values list

Setting is performed in the submenu of '05.setting value'.

1) Soft clamp of protection Input/exit（ON/OFF, Enable/Disable）

Clamp name	IEC symbol	IEEE symbol	Options
Arc protection 1	Arc1		Input/exit
Arc protection 2	Arc2		Input/exit
Arc protection 3	Arc3		Input/exit
Arc protection 4	Arc4		Input/exit
Arc protection 5	Arc5		Input/exit
Arc protection 6	Arc6		Input/exit
Arc protection 7	Arc7		Input/exit
Arc protection 8	Arc8		Input/exit
Failure protection 1	Failure Prot.	50BF	Input/exit
Failure protection 2	Failure Prot.	50BF	Input/exit
Failure protection 3	Failure Prot.	50BF	Input/exit
Failure protection 4	Failure Prot.	50BF	Input/exit
TA1 monitoring	TA Detection	CTS	Input/exit
TA2 monitoring	TA Detection	CTS	Input/exit
TA3 monitoring	TA Detection	CTS	Input/exit
TA4 monitoring	TA Detection	CTS	Input/exit
Non-electricity	Switch Trip	26/63	Input/exit

Setting instruction: Relevant protection can be inputted or exited by setting 'input' and 'exit'.

2) Numerical setting value

Name of setting value	Setting value	Setting ranges	Setting length of step	Remarks
Arc protection criterion1 ***Arc Criterion1***	ARCJuger	Light & Current/ Light		Arc&current/arc
Arc protection criterion2 ***Arc Criterion2***	ARCJuger	Light & Current/ Light		Arc&current/arc
Arc protection criterion3 ***Arc Criterion3***	ARCJuger	Light & Current/ Light		Arc&current/arc
Arc protection criterion4 ***Arc Criterion4***	ARCJuger	Light & Current/ Light		Arc&current/arc
Arc protection criterion5 ***Arc Criterion5***	ARCJuger	Light & Current/ Light		Arc&current/arc
Arc protection criterion6 ***Arc Criterion6***	ARCJuger	Light & Current/ Light		Arc&current/arc
Arc protection criterion7 ***Arc Criterion7***	ARCJuger	Light & Current/ Light		Arc&current/arc
Arc protection criterion8 ***Arc Criterion8***	ARCJuger	Light & Current/ Light		Arc&current/arc
Fault component startup coefficient	Ktb	0.05-10In	0.01	Startup threshold value for

Δ I start K				current break, suggesting (0.1-0.3) In
Constant startup coefficient Constant K	Kcl	0.05-10In	0.01	Slightly larger than overload set value, suggesting (0.8-1.2) In
Set value for failure 1 **Failure1 Set**	SLdz1	0.05-100A	0.01A	
Time for failure 1 Failure1 Time	SLT1	0.1-600s	0.01s	
Set value for failure 2 **Failure2 Set**	SLdz2	0.05-100A	0.01A	
Time for failure 2 Failure2 Time	SLT2	0.1-600s	0.01s	
Set value for failure 3 **Failure3 Set**	SLdz3	0.05-100A	0.01A	
Time for failure 3 Failure3 Time	SLT3	0.1-600s	0.01s	
Set value for failure 4 **Failure4 Set**	SLdz4	0.05-100A	0.01A	
Time for failure 4 Failure4 Time	SLT4	0.1-600s	0.01s	
TA monitoring time	TL	0-600s	0.01s	

Settings instruction：

a) All of the set values of the voltage and current depend on the values of the measurement transformers (TA, TV) secondary. In (current rating), default value is 5A.

3) Setting value of control word

Name	IEC symbol	Options
Arc protection 1	Arc1 Control	1/0
Arc protection 2	Arc2 Control	1/0
Arc protection 3	Arc3 Control	1/0
Arc protection 4	Arc4 Control	1/0
Arc protection 5	Arc5 Control	1/0
Arc protection 6	Arc6 Control	1/0
Arc protection 7	Arc7 Control	1/0
Arc protection 8	Arc8 Control	1/0
Failure protection 1	Failure1 Con	1/0
Failure protection 2	Failure2 Con	1/0
Failure protection 3	Failure3 Con	1/0
Failure protection 4	Failure4 Con	1/0

5.2 Input data Parameters

Details in “10. Factory Settings /A2. input data parameters” submenu.

The standard configuration of this device is 24 inputs, wherein parts of the inputs have been fixed, the others are for spare. Each input has its own control word which can be set separately. Each control word has 16 bits. The setting interface will prompt the setting on the screen. The way the control word can be set are shown in the following table. The symbol “√”signifies the bit is settable, otherwise it is not settable.

CONTROL WORD / INPUT QUANTITY	01 INPUT RESET	02 INPUT FAULT TRIPPING	03 INPUT ALARM	04 INPUT DISABLE PROTECTION	05 INPUT REVERSE	06 EVENT	07 EXIT RELAY 10	08 EXIT RELAY 9	09 EXIT RELAY 8	10 EXIT RELAY 7	11 EXIT RELAY 6	12 EXIT RELAY 5	13 EXIT RELAY 4	14 EXIT RELAY 3	15 EXIT RELAY 2	16 EXIT RELAY 1
IN01- DL1 normally open					√	√										
IN02- DL1 normally close					√	√										
IN03- DL2 normally open					√	√										
IN04- DL2 normally close					√	√										
IN05- DL3 normally open					√	√										
IN06- DL3 normally close					√	√										
IN07-Operation on-site					√	√										
IN08-Signal reset	√				√	√										
IN09-Device overhaul					√	√										
IN01- DL4 normally open					√	√										
IN02- DL4normally close					√	√										
IN12- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN13- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN14- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN15- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN16- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN17- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN18- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN19- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN20- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN21- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN22- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN23- input	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IN24-Input power source+					√	√										

Settings instruction:

Input quantity 03, 04 is different depending on the difference of switch cabinet type in “51 line parameters” under “05 protection parameters.” The type of switch cabinet is different, “01 primary system diagram” is also different.

Among control words of input quantity IN01～IN07、IN09~IN1 only the fifth, sixth bit (that is “input reverse” “event”) are settable, that is to say, for these inputs, only the operation set 1 to “input reverse”, “event” can be done, other bits are fixed of 0. When “input reverse” is set of 1, the device will reverse the input; due to the device needs external normally-open contacts by default, if there are only normally-closed contacts on site, it may also be contacted with, provided that set the bit “input reverse” of corresponding input control word as “1”. Whereas, “event” is set as 1, the process of input open-close will be recorded in “02 events recording”; no event recording for 0. By factory default, all the “event” bit of inputs are set “1”.

Not only are these input quantity used to realize “non-electric protection”, but also realize the blocking of protection in the device combined with corresponding setting. It will be exemplified after the introduction of control words in “input quantity parameter setting”.

"Input reset" function: that is the protection reset to the device may be realized remotely through input quantity. Specific settings: only need to set the corresponding bit "input reset" of the input quantity which is defined as protection reset by you as "1", after the protection action of the device, the reset function may be realized by close this contact point. It is not necessary to go to the site for resetting.

Example for realization of non-electric protection:

Requirement: when IN20 is closed, send alarm signal and the exit relay 6 exits at the same time; when IN21 is closed, sent fault signal and signal relay 7 exits at the same time.

Operation：First access to "51 protection press plate" put on "non-electric protection"; then access to "A2 input quantity parameters" choose input quantity IN20, set its bits "input alarm", "event" and "exit relay 6" as 1 (that is set control word as 0010 0100 0010 0000); choose input IN21, set its bits "input fault tripping", "event", "exit relay 7" and "protection tripping exit" as 1 (set control word as 0100 0100 0100 0100).

5.3 Input Parameters Adjusting

Setting introduction:

In "A3 input parameter" submenu of "10 factory settings", exit matrix can be set. For details see the input parameters setting table on next page.

Each control word signifies action symbol or exit relay, the bit of control word signifies protection function. For the definition of the bits see the following table (they are 1 to 30 bit from left to right):

For the protection requiring tripping, set the bit, which is corresponding to protection, in "protection acted symbol", "protection action symbol" and "protection start symbol" as 1. For the protection only need alarm, set the bit, which is corresponding to protection, in "protection alarm symbol" as 1.

Whether the control word of each protection exit is settable see the following table: the place where marked "√" indicts the bit is settable, otherwise it is not settable.

For DO01-DO11, exit can be set randomly.

Examples:

Requirement: DO01 relay has exit as instantaneous arc protection 1 protection acts.

Operation：set "protection action symbol", "protection action symbol", "protection start symbol" and "DO07 output" as "1000 0000 0000 0000 0000 0000 0000 00".

Requirement: make arc protection 2 protection blocking by adding input quantity IN19.

Operation： Set the corresponding control word of IN19 as "0001 0100 0000 0000" in "A2. Input quantity parameters" the submenu of "10. Factory settings", "IN19 disable" control word (that is corresponding to the automatic configuration items of input parameters setting table) will appear in the last of submenu "A3. Input parameters". Set the control word as "0100 0000 0000 0000 0000 0000 0000 00", then as the input quantity IN19 closed, instantaneous over current protection will be blocked, not act.

Output Parameters Setting Table:

Name \ Bit	01 Arc protection 1	02 Arc protection 2	03 Arc protection 3	04 Arc protection 4	05 Arc protection 5	06 Arc protection6	07 Arc protection 7	08 Arc protection8	09 Failure protection 1	10 Failure protection2	11 Failure protection3	12 Failure protection4	13 TA1 monitoring	14 TA2 monitoring	15 TA3 monitoring	16 TA4 monitoring	17 Empty	18 Empty	19 Empty	20 Empty	21 Empty	22 Empty	23 Empty	24 Empty	25 Empty	26 Empty	27 Empty	28 Empty	29 Empty	30 Hold relay
Protection action symbol	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														
Protection action symbol	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														
Protection alarm symbol	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														
Protection start symbol	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														
XJ1output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
XJ2output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
Abnormal alarm signal	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
Signal of protecting operation	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO01 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO02output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO03 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO04 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO05 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO06 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO07 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO08 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO09 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO10 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
DO11 output	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√														√
Automatic configuration items 1																														
Automatic configuration items 2																														

5.4 Arc channel configuration

Main control unit can renumber the arc signals collected for corresponding to 1#~120# arc of the device.

Example: if the main control unit has two main control plugins G310, six ports set for the first plugin are ports 1#~6#, corresponding ports set for the second plugin are ports 7#~12#; if arcs for the first three ports on the first plugin are ARC1#~ARC15#, and arcs for the first three ports on the second plugin are ARC16#~ARC30#, then the settings as follows:

Table of arc channel adjustment:

Digit / Name	01#ARC	02#ARC	03#ARC	04#ARC	05#ARC	06#ARC	07#ARC	08#ARC	09#ARC	10#ARC	11#ARC	12#ARC	13#ARC	14#ARC	15#ARC	16#ARC	17#ARC	18#ARC	19#ARC	20#ARC	21#ARC	22#ARC	23#ARC	24#ARC	25#ARC	26#ARC	27#ARC	28#ARC	29#ARC	30#ARC
Channel 1	1					1					1					1					1					1				
Channel 2		1					1					1					1					1					1			
Channel 3			1					1					1					1					1					1		
Channel 4				1					1					1					1					1				1	
Channel 5					1					1					1					1					1				1
Port 1	1	1	1	1	1																									
Port 2						1	1	1	1	1																				
Port 3											1	1	1	1	1															
Port 4																														
Port 5																														
Port 6																														
Port 7																1	1	1	1	1										
Port 8																					1	1	1	1	1					
Port 9																										1	1	1	1	1
Port 10																														
Port 11																														
Port 12																														

....

5.5 Arc protection configuration

Main control unit can set arc serial number and current group number associated with acc protection randomly:

Example: for ARC 1# ~ ARC 8# associated with arc protection 1, group 1 and group 2 current; for ARC 9# ~ ARC 16# associated with arc protection 2, group 1 and group 3 current, settings as follows:

Table of adjustment of arc serial number associated with arc protection:

Digit / Name	01 #ARC	02 #ARC	03 #ARC	04 #ARC	05 #ARC	06 #ARC	07 #ARC	08 #ARC	09 #ARC	10 #ARC	11 #ARC	12 #ARC	13 #ARC	14 #ARC	15 #ARC	16 #ARC	17 #ARC	18 #ARC	19 #ARC	20 #ARC	21 #ARC	22 #ARC	23 #ARC	24 #ARC	25 #ARC	26 #ARC	27 #ARC	28 #ARC	29 #ARC	30 #ARC
Arc protection1	1	1	1	1	1	1	1	1																						
Arc protection2									1	1	1	1	1	1	1	1														
Arc protection3																														
Arc protection4																														
Arc protection5																														
Arc protection6																														
Arc protection7																														
Arc protection8																														

Table of adjustment of current associated with arc protection:

Digit / Name	01 IA1 IB1 IC1	02 IA2 IB2 IC2	03 IA3 IB3 IC3	04 IA4 IB4 IC4													
Arc protection 1	1	1															
Arc protection 2	1		1														
Arc protection 3																	
Arc protection 4																	
Arc protection 5																	
Arc protection 6																	
Arc protection7																	
Arc protection8																	

5.6 Fault protection configuration

Main control unit can set arc arc protection and current group number associated with fault protection randomly:

Example: actions for arc protection 1~4 can start fault protection 1, current for fault protection 1 is judged as group 1; actions for arc protection 5~6 can start fault protection 2, current for fault protection 2 is judged as group 2; the settings as follows:

Table of adjustment of arc protection associated with fault protection

Digit / Name	01 Arc 1	02 Arc 2	03 Arc 3	04 Arc 4	05 Arc 5	06 Arc 6	07 Arc 7	08 Arc 8								
Fault protection 1	1	1	1	1												
Fault protection 2					1	1	1	1								
Fault protection 3																
Fault protection 4																

Table of adjustment of current associated with fault protection:

Digit / Name	01 IA1 IB1 IC1	02 IA2 IB2 IC2	03 IA3 IB3 IC3	04 IA4 IB4 IC4												
Fault protection 1	1															
Fault protection 2		1														
Fault protection 3																
Fault protection 4																

6 Principe of main protection functions

6.1 Arc protection

1) Meaning of protection of set value

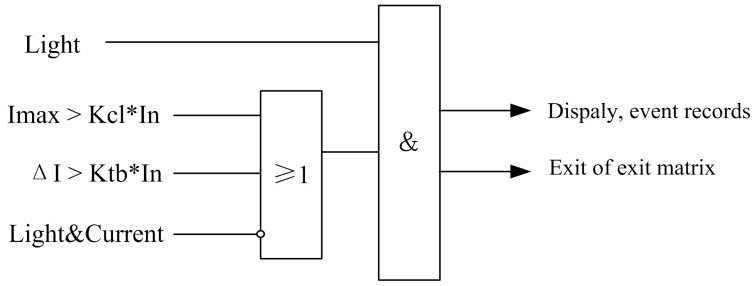
Arc Protection CriteriE: Light&Current (arc and current), Light (only arc);

Fault Component Startup Coefficient: it is only effective when the criteria is selected as Light&Current, the criteria: i_φ> Ktb*In+1.25ΔI_T, where: $\Delta I_T = mE(| I_\varphi(t-T)-2*I_\varphi(t-2T)+I_\varphi(t-3T)) |)$ is the mEimum value of current unbalance for phases current; Ktb is the fault component startup coefficient, In is rated current, $i_\varphi = | i_\varphi(t)-2* i_\varphi(t-T)+i_\varphi(t-2T) |$ is the fault component for phase current associated with the arc protection (where $i_\varphi(t)$, $i_\varphi(t-T)$, $i_\varphi(t-2T)$ are respectively current instantaneous values for t, t-T and t-2T, $I_\varphi(t-T)$, $I_\varphi(t-2T)$, $I_\varphi(t-3T)$ are respectively current effective values for t-T, t-2T and t-3T). When fault component for each phase is larger than startup threshold for consecutive three times, the startup will be protected.

Constant Startup Coefficient: when it is only effective when the criteria is selected as Light&Current, the criteria: ImE>Kcl*In,

Where: Kcl is constant startup coefficient, In is rated current, ImE is fundamental wave value of mEimum phase current associated with the arc protection. When the condition is met, protection starts up. Either of constant startup and fault component startup starts, which can be considered as startup conditions met, both are or relationship

2) Logic



The figure above:

Light is arc signal collected by arc channel sensor associated with the arc protection;

ImE is the fundamental wave of mEimum phase current associated with arc protection, ΔI is mEimum value of fault component for the group;

Ktb is fault component startup coefficient, Kcl is constant startup coefficient, In is rated current for associated current;

Light & Current is the basis for arc protection, it is 1 when selected as the criteria.

Logic of 8 groups of arc protection is consistent with the above.

6.2 Fault protection

1) Protection description

Fault protection can associate with numerous arc protection and current for a group, when associated arc protection starts and associated current is always larger than the fault set value (considering returned value) and fault action time reaches, fault protection action starts.

Logic of 4 groups of protection protection is consistent with the below.

2) Logic

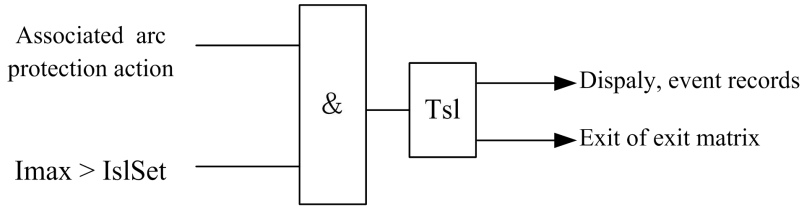


Figure above: ImE is the fundamental wave value of mEimum phase current associated with the arc protection;

Isl Set is fault protection action value, Tsl fault protection time.

6.3 TA monitoring

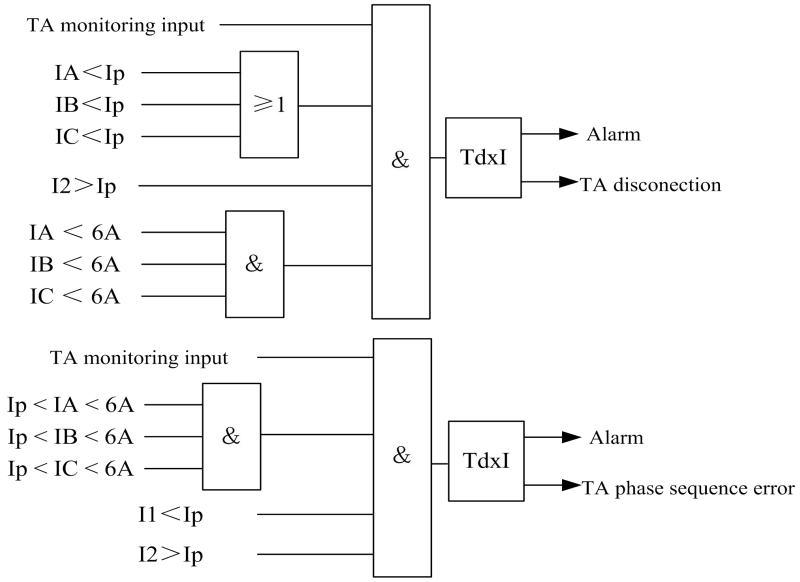
1) Used current criteria

Current Ip criteria: when current range is 100A, IP=0.2A; when current range is 24A, IP=0.1.

2) Logic diagram of TA disconnection

When TA disconnection form is 2CT, TA monitoring doesn't include phase criteria.

The figure below is logic diagram of protective current, in the figure: Ip is current criteria, 11 is positive sequence current, I2 is negative sequence current, TdxI is adjusted time for TA monitoring.



Logic of four groups of TA disconnection monitoring is independent, as shown in figure above, positive sequence current and negative sequence current for each group are only required to be replaced

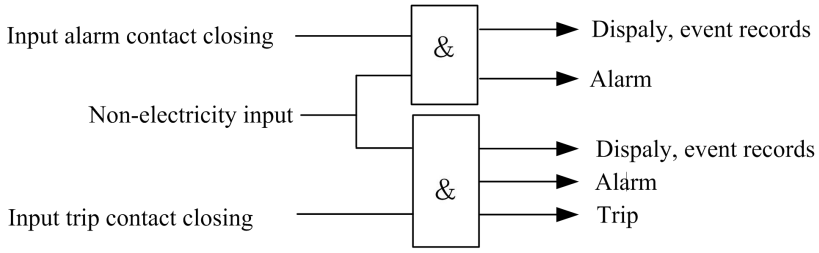
6.4 Non-electricity protection

Settings for non-electricity protection see adjustment of input parameters.

1) Action conditions

When non-electricity protection is used, input alarm contact closes at alarm; input failure trip contact closes at instantaneous trip.

2) Protection logic diagram



6.5 Device fault alarm

When the device is loss of power or internal fault occurs in the device, the unit passes X9-15, 16 exits. When the device is loss of power, X9-15, 16 always have exits; when self-test in the device fails, units X9-15, 16 send intermittent alarm signal, and meanwhile the device alarm lamp is on.

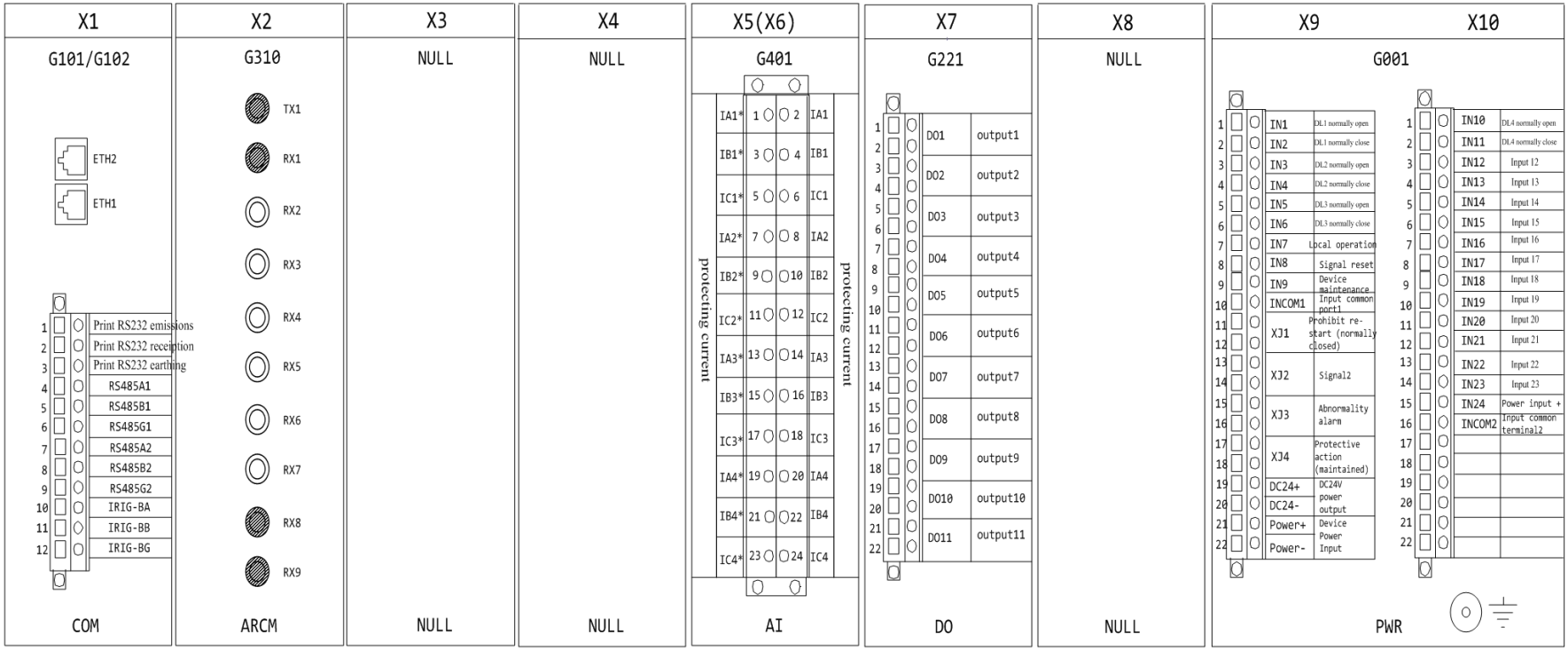
6.6 Device failure alarm

XJ3 (X9-15, 16) outlet when the device loses power or internal failure occurs. XJ3 always has an outlet when the device loses power; When the internal self-check of the device is wrong, XJ3 sends an intermittent alarm signal, and the alarm light of the device is on

7 Definition and wiring schematic diagram of terminals for device backplane

7.1. Definition schematic diagram of terminals for device backplane

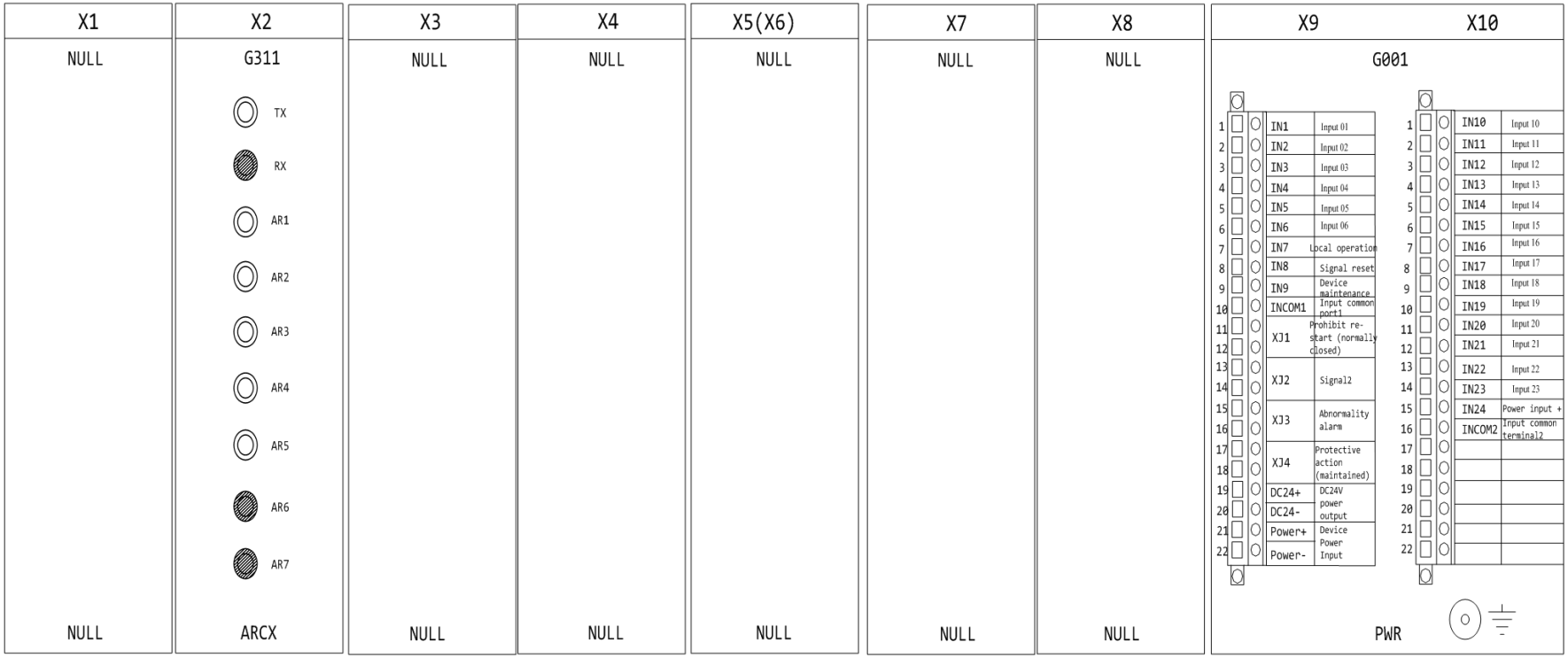
ARB5-M main control unit



Note 1: when required arc channel (input/output) increases, corresponding plugins (X3/X4/X8) can be added.

Note 2: when shaded area in terminal for G310 plate is void, reception ports of arc collection signal corresponding to RX2-RX7 are Port1-Port6, respectively connecting to signal transmission ports for 6 arc collection board using multimode fibre.

ARB5-E extension unit



Note 1: when required arc channel (input/output) increases, corresponding plugins (X3/X4/X5/X7/X8) can be added.

Note 2: when shaded area in terminal for G313 plate is void, TX is transmission port for collection signal requiring to connect to G310 plate for main control unit using multimode fibre, AR1-AR5 are collection signal interfaces, collecting to arc collection probe using special plastic optical fiber, with connection distance less than 20m.

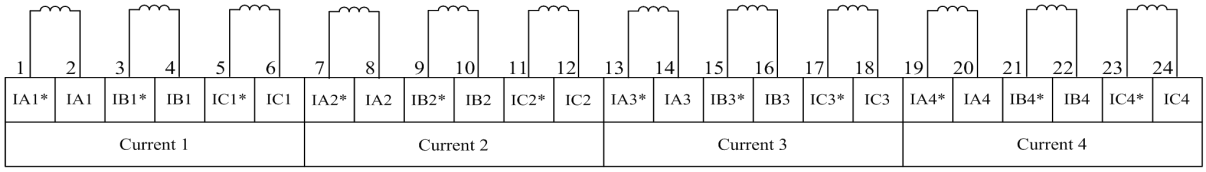
7.2 Terminal definition description

For all undefined terminals (Void terminals), do not wire in the site, letting it hang in the air.

For input circuit for analogue current, if there is no corresponding current transformer in the site, the corresponding terminal can be hung in the air without short circuit.

7.3 AC wiring schematic diagram

Schematic diagram of AC input circuit wiring for X5 plugin



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