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Low Voltage Reactive Power Automatic Compensation Controller

Installation instruction V1.0

ACREL Co. Ltd

Declaration

Our company Reserves the right to modify the product specifications described in this manual without prior notice. Before placing an order, please consult your local agent for new specifications of this product.

Contents

1 Product Overview

ARC28 (F)/Z - USB - L low voltage reactive power automatic compensation controller is on various aspects demand on electricity market, and combined with the smart grid construction requirements, with the mixed reactive compensation control strategy and the high accuracy measuring chip development, increased the front-end ports and USB interface, not only can be connected to the compensation capacitor, compensating reactive power losses in the grid, improve power factor, reduce line losses, so as to improve the load capacity of power grid and quality of power supply; but also real-time monitor the three-phase voltage, current, power factor, harmonics and other operation data of the power grid.

2. Execution Standards

JB/T 9663-2013 Low voltage reactive power compensation controller implementation standard

3. Model Specification

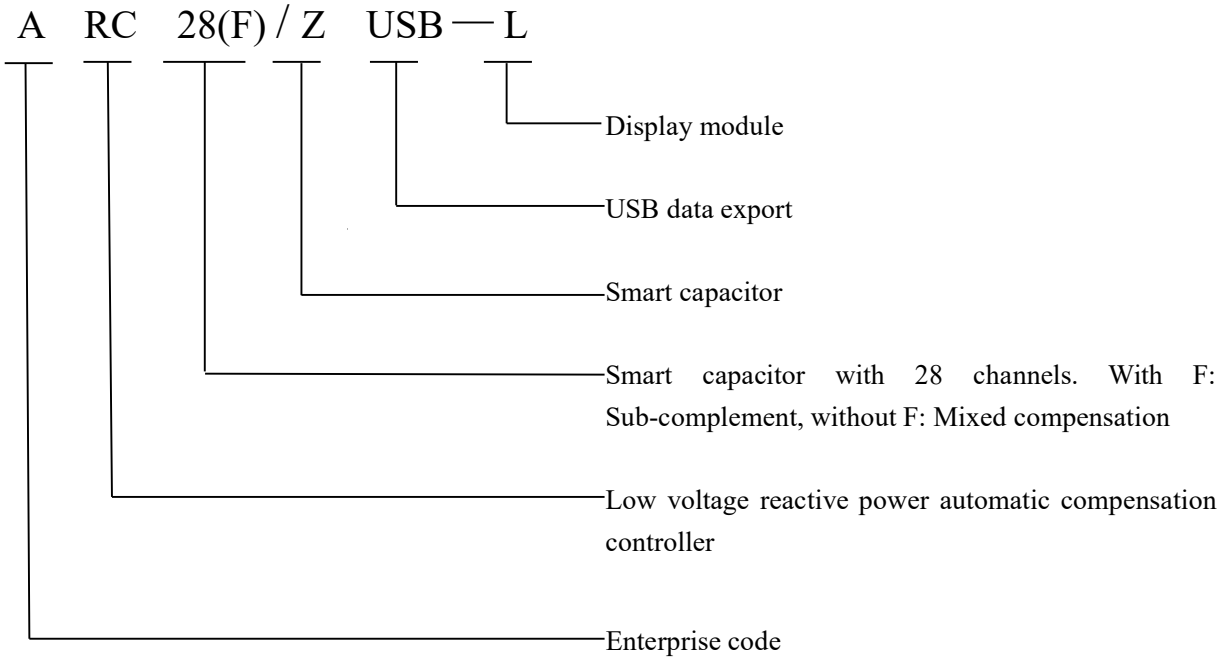


Fig. 1 Model description

Table 1 Model functions

model	The name of the function		Functional specifications
ARC-28 (F) /Z-USB-L	Collection and measurement function	Accuracy of measurement	Voltage: Level 1
			Current: Level 1
			Active power: 2.5 stage; Reactive power: 2.5 levels
			Power factor: 1.5 stage
			Clock error: <0.5 seconds/day
			Harmonic error: ≦±5%
	Real-time measurement function		①A, B, C phase current, A, B, C phase voltage; ②Phase A, B, C and total active power, reactive power and apparent power; ③A, B, C phases and total power factor;

		④The current active and reactive power value; ⑤The current three-phase voltage and current of A, B and C 3-21 harmonic containing rate; ⑥Power grid frequency.
	Meter reading function	Store fault records through USB interface.
	Real-time monitoring function	Reactive power compensation device switching monitoring.
	Data statistics and analysis function	Data (viewed by upper computer software) ①A, B, C phase current, voltage; ②Phase A, B, C and total active and reactive power; ③A, B, C phases and total power factor;
	Time recording and alarm function	The controller can save the last 20 important event records.
	Self-diagnostic function	The controller automatically judges internal faults and abnormal conditions and displays symbols or graphic identifiers, including voltage disconnection and loss, internal program errors, hardware failures, communication failures, etc.
	Protection function	①Over-pressure protection: action back error (6-12) V, the total time limit of breaking should not be greater than 60s; ②Under voltage protection: the total time limit of breaking is not greater than 60S; ③loss of voltage protection: after power off, all switches should be automatically disconnected, to ensure that the capacitor bank is in the state of breaking; ④Harmonic protection: when the total voltage harmonic distortion rate exceeds the set value, automatic blocking capacitor input, concurrent instructions will be cut off the capacitor group by group. Voltage harmonic total distortion rate limit: 5%-20% adjustable, factory set 10%; ⑤phase loss protection: in the occurrence of phase loss or neutral line break, the protection loop can achieve fast cutting;
	Self-checking reset	After each power on, the terminal self - check and return to the output circuit to make it in the open state.

4 Technical parameters

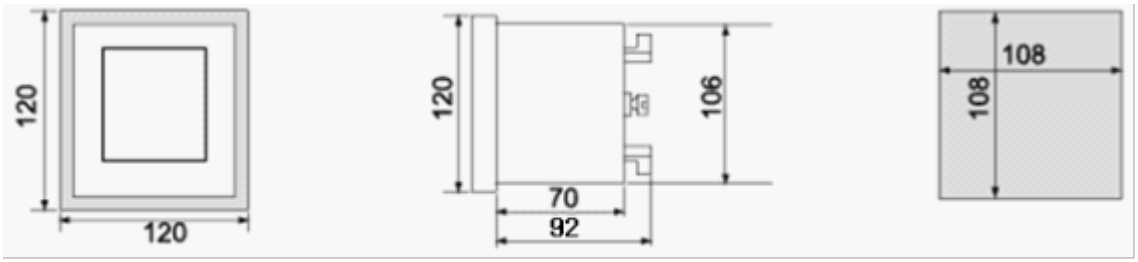
Table 2 Main technical parameters

The serial number	The parameter name		Technical indicators
1	The power supply parameters	Working power supply	Three-phase and four-wire power supply mode, under the condition of two-phase voltage off, AC power supply can maintain the normal operation of the controller. Rated voltage (AC):220V/380V, tolerance -20%~+20%
		Power consumption	≤5W
2	Safety performance	Electrical clearance and creepage	Under normal operating conditions, the minimum clearance between two live parts in the device shall be ≥4mm, the minimum electrical clearance between the power substitute

		distance	parts and the exposed conductor shall be ≥6mm, and the minimum creepage distance shall be ≥6mm.
		Dielectric strength	The tested parts between each phase circuit of the device, between each phase circuit and the auxiliary circuit to the shell (ground) can withstand the insulation strength test of 2500V 50HZ AC voltage for 1Min, and there is no breakdown, flashover and sudden voltage drop.
3	Analog access	voltage	Three-phase four-wire voltage direct access, rated voltage of 3×220V. AC voltage input range: permissible input range of voltage per phase is 0-264V (0-120%).
		current	Three-phase current is connected by current transformer, rated current is 5A. AC current input range: 0-5A.
4	The working conditions	The environment temperature	- 10 ℃ to + 50 ℃
		The altitude	2000m
		Relative humidity	≤95%
		The atmospheric pressure	79.5～106.0Kpa
		Environmental conditions	No conductive dust and corrosive gas, no flammable and explosive medium
5	Transportation and storage conditions	The environment temperature	-20~50℃
		Relative humidity	≤95%
6	The installation location		No violent vibration, installation inclination is not more than 5%
7	Appearance of the structure	display	128*64 dot matrix liquid crystal (black characters on white background)
		Device shell	Using liquid crystal display, plastic case encapsulation
		Enclosure protection class	The protection level meets the IP20 requirements
8	The system platform		Mainstream 32-bit microprocessor, system data storage capacity is 16Mbyte.
9	Scope of application		This product is suitable for 380V low voltage distribution network and can be installed indoors or outdoors.

5. Installation and wiring

5.1 Mounting Dimension



Front view Side view Side openings

Fig. 2 Shape and opening size of installation (unit: mm)

5.2 Installation method

The installation mode of ARC meter is embedded, and the fixed mode is extruded. The specific operation is as follows:

1. On the distribution board, choose a suitable place to open an installation hole with the same size as the opening hole of the installed instrument;

2. Take out the meter, loosen the positioning screw (counterclockwise), and remove the mounting bracket;

3. Insert the instrument into the instrument hole of the distribution panel, and install the mounting bracket and positioning screw (clockwise) after inserting the instrument.

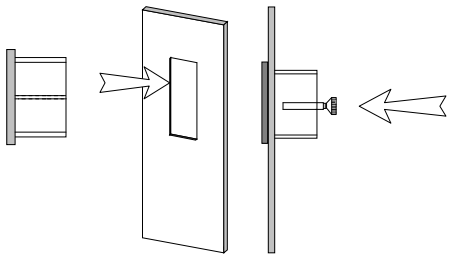


Fig. 3 Installation mode

5.3 Wiring diagram

5.3.1 Definition of output port

Definition of Separate compensation signal sampling port:

11	12	13	14	4	5	6	7	8	9
UA	UB	UC	UN	IA*	IA	IB*	IB	IC*	IC

Fig. 4 Definition of Separate compensation signal sampling port

Definition of common compensation signal sampling port:

11	12	13	14	6	7
UA	UB	UC	UN	IB*	IB

Fig. 5 Definition of common compensation signal sampling port

Control signal output RJ45 terminal definition:

<table>
<tr><td>21</td><td>22</td><td rowspan="2">RJ45A</td><td rowspan="2">RJ45B</td></tr>
<tr><td>A1</td><td>B1</td></tr>
<tr><td colspan="2">RS485</td><td colspan="2">CONNECT TO SMART CAPACITOR</td></tr>
</table>

Fig. 6 Control signal output RJ45 terminal definition

The output port is two RJ45 network cable interfaces, which takes over one interface to the RJ45 port of the intelligent capacitor; 485 port is connected to the computer.

5.3.2 Example diagram of reactive compensation output wiring

Separate compensation wiring diagram:

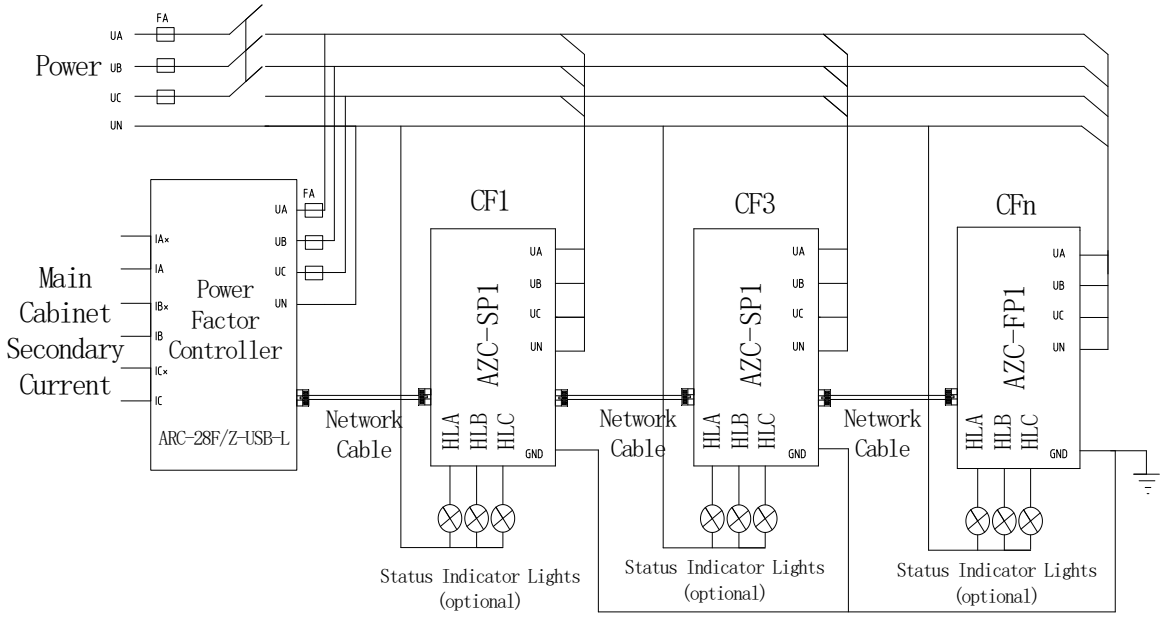


Fig. 7 Separate compensation Diagram

Common compensation wiring diagram:

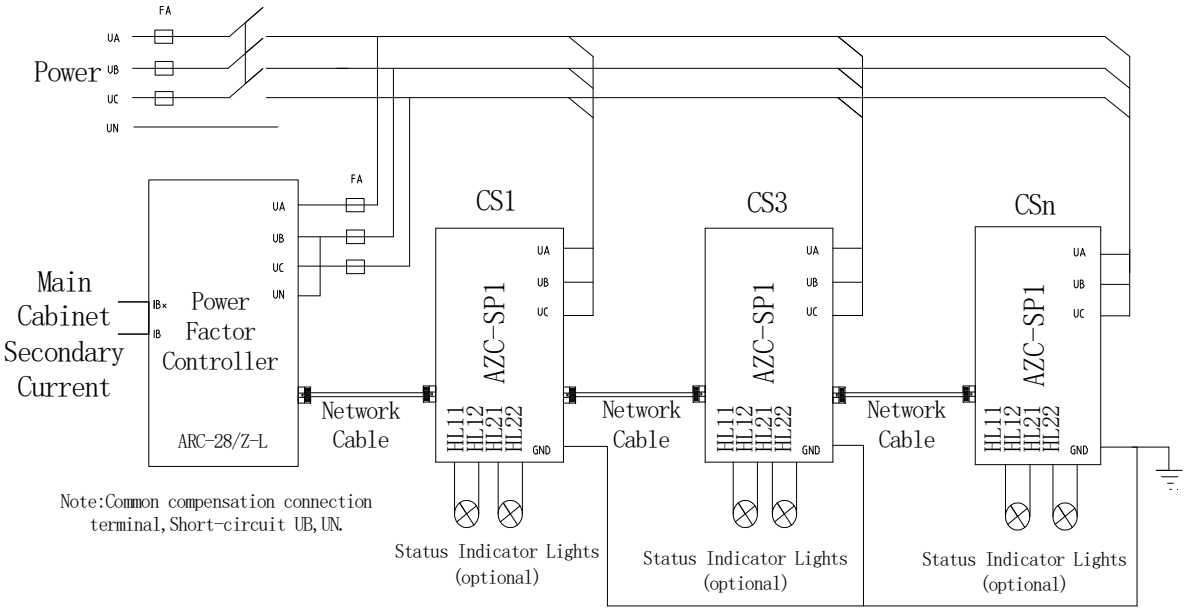


Fig. 8 Common compensation diagram

Note:

①The corresponding relationship between voltage and current when installation, phase sequence and the same end must be correct.

②Before the power must be checked in detail whether the wiring is correct, whether the wiring is wrong or short circuit phenomenon, whether the contact point is firm, and note down the installation of CT ratio;

③Check whether the CT ratio and configuration capacity are consistent with the display of the controller. If not, please modify the CT ratio and capacity Settings of the controller. (very important)

6. Operation guide

6.1 Panel and button description

6.1.1 LCD panel working state indicator diagram

Fig. 9 Schematic diagram of the panel

6.1.2 Button description

① "Esc" key: exit the current state and return to the previous menu.

② "◀" key: press it once to move the cursor up or decrease the value by one.

③ "▶" key: the cursor can move down or add one value.

(4)"↵"Key: Confirm the Settings.

6.2 Operation method

Before starting operation, please successively check whether the wiring is correct, whether grounding, whether short circuit between terminals, whether the terminals, screws and so on are loose; Then power to the controller.

The main menu is as follows:

The run data
Parameter Settings
Cutting state

Fig. 10 main menu of instrument

Operation data: real-time display of various parameters of the power grid. Including: power parameters, harmonic data, alarm record, manual compensation, capacitance temperature, switching record and other submenus.

Parameter setting: Various terminal configuration parameters can be set. Including: system setting, compensation setting, protection setting, communication setting, collection, time and other sub-menus.

Cut status: Shows whether each route is cut or not.

6.2.1 The running data menu

Electric power parameters
Harmonic data
The alarm record
Manual compensation
Temperature of the capacitor
For record

Fig. 11 the running data menu

Press "Esc" key to return to the previous menu; Press "◀" and"▶"to select up and down the menu; Press the"↵"key is to confirm the selection.

6.2.2 Power parameters

6.2.2.1 Separate compensation panel

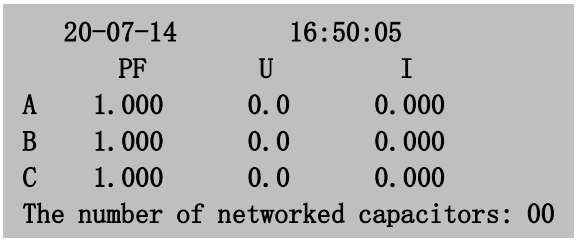


Fig. 12 Separate compensation panel

PF: A, B, C phase power factor; U: A, B, C phase voltage; I: A, B, C phase current; Number of networked capacitance; the number of networked capacitance of the current system; Press "Esc" key to return to the previous menu; Press "▶" key to select the next panel, press" Esc "key to return to the previous menu.

6.2.2.2 Common compensation panel

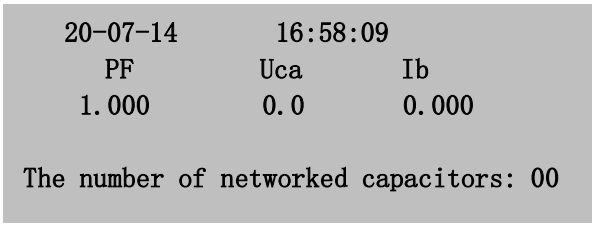


Fig. 13 Common compensation panel

PF: phase power factor; UCA: line voltage between AC; IB: Line B current; Number of networked capacitors; Press the "Esc" key to return to the previous menu.

6.2.3 Fundamental wave panel

6.2.3.1 Separate compensation fundamental wave panel

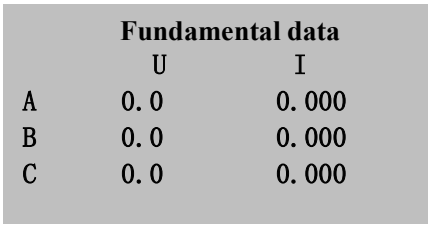


Fig. 14 Separate compensation fundamental wave panel

A、B、C phase voltage; A、B、C phase current. Press the "Esc" key to return to the previous menu.

6.2.3.1 Common compensation fundamental wave panel

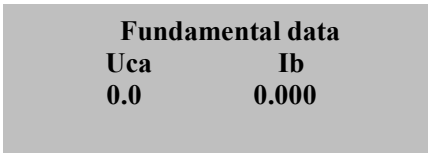


Fig. 15 Common compensation fundamental wave panel

6.2.4 Power

6.2.4.1 Separate compensation power panel

A	0.000kW	0.000kVA
B	0.000kW	0.000kVA
C	0.000kW	0.000kVA
T	0.000kW	0.000kVA
A	0.000kvar	
B	0.000kvar	
C	0.000kvar	
T	0.000kvar	F: 00.0Hz

Fig. 16 Separate compensation power panel

Three-phase active power, three-phase reactive power, three-phase apparent power, frequency; Press the "Esc" key to return to the previous menu.

6.2.4.2 Common compensation power panel

Three-phase power	
P	0.000kW
Q	0.000kvar
S	0.000kVA
F	00.0Hz

Fig. 17 Common compensation power panel

P: active power; Q: Reactive power; S: Apparent power; F: Frequency. Press the "Esc" key to return to the previous menu.

6.2.5 Harmonic data

Separate compensation:

	THDu	THDi
A	0.0%	0.0%
B	0.0%	0.0%
C	0.0%	0.0%

Fig. 18 Separate compensation Harmonic Panel

Three-phase voltage harmonic content; Harmonic content of three-phase current, press "SET" key to return to the previous menu.

	THDu (%)		
	A	B	C
03	0.0	0.0	0.0
05	0.0	0.0	0.0
07	0.0	0.0	0.0
09	0.0	0.0	0.0
11	0.0	0.0	0.0

Fig. 19 Voltage Harmonics

	THDi (%)		
	A	B	C
03	0.0	0.0	0.0
05	0.0	0.0	0.0
07	0.0	0.0	0.0
09	0.0	0.0	0.0
11	0.0	0.0	0.0

Fig. 20 Current Harmonics

Fig. 19 Show the harmonic content of phase A, B and C voltages. Fig. 20 shows each harmonic possession ratio of phase A, B and C currents.

Press "SET" key to return to the menu of the next layer, and press "▶" and"◀"buttons to turn the page for

harmonic frequency (voltage/current harmonic).

Common compensation：

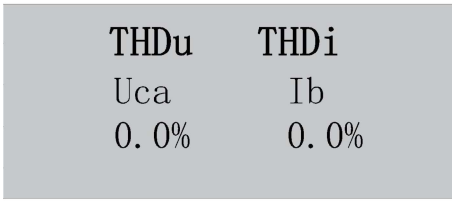
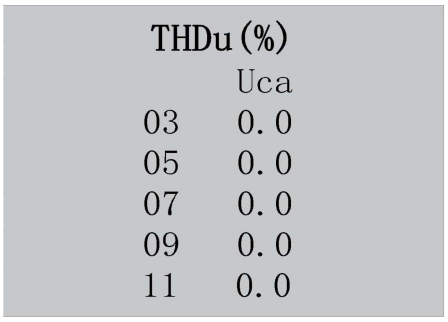


Fig. 21 Common compensation harmonic panel

C、A line voltage harmonic content; B line current harmonic holdup rate.



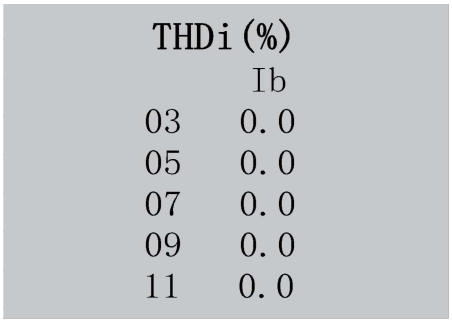
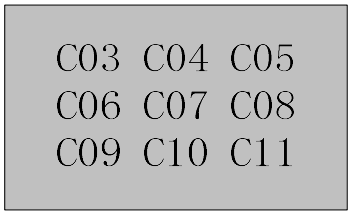
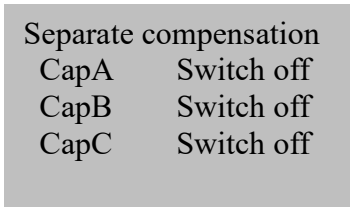


Fig. 22 Voltage Harmonics Fig. 23 Current Harmonics

Fig. 22 shows the harmonic content of the voltage. Fig. 23 shows the harmonic content of the current.

6.2.6 Manual compensation





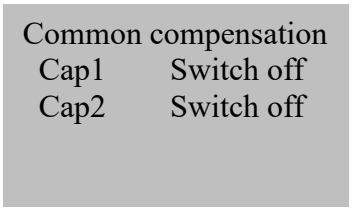


Figure 24 Manual compensation panel

C03... C28: denotes the address number of the capacitor in the network. After selecting a certain address, press"↵"Key, the capacitor can be switched operation.

Press "◀" first to select the capacitor circuit to be switched, and then press"▶"to select input or cut; finally press the"↵", choose to put in or cut out; Press the "Esc" key to return to the previous menu.

6.2.7 Capacitance temperature

Display the capacitance address number and temperature in the network. Press the "Esc" key to return to the previous menu.

Num	C3	C4	C5
T(C)			
Num	C6	C7	C8
T(C)			
Num	C9	C10	C11
T(C)			

Fig. 25 Capacitance Temperature Display Panel

6.2.8 Throwing record

Display the parameters of the switch.

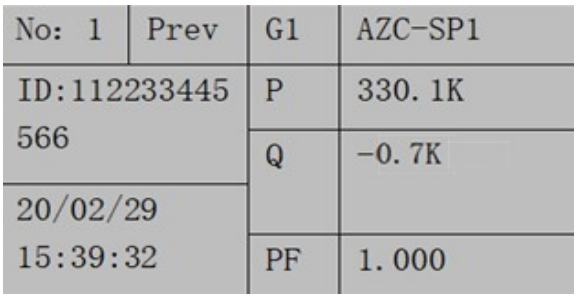


Fig. 26 Casting Record Panel

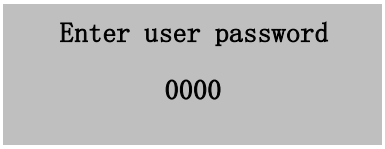


Fig. 27 Password entry

6.3 Setting parameters

Select "Control Parameters" from the main menu, and press"↵ After the key, "Please enter user password" is displayed. After entering the correct 4-digit password, the parameter setting can be entered (factory default value is: 0008).

Press "▶" and"◀"to increase or decrease the number; Press the"↵ "Key to confirm numeric input.

After the password is entered correctly, enter the parameter setting menu:

Fig. 28 Parameter setting

The parameter setting menu is as follows:

Table 3 Parameter setting menu

Parameter properties	The name of the menu	Value range	Parameter function	note
system	Current ratio	1-1260	For example, the setting of 500/5 is 100, and the factory setting is 1	
	Number of capacitance	1 ~ 28	Network number setting, factory setting: 20	

	The user password	0001 ~ 9999	As a means of protecting the control parameters, when the user needs to modify the parameter setting, it must input 4 digits consistent with the system to enter the parameter modification menu. Factory setting: 0001	
	Backlight delay	Light/Auto	Set backlight turn-off time: Light: Always backlight. Auto: Auto mode.	
	Connection mode	3P4L and 3P3L	Different working mode, different wiring. Factory set to 3P4L	
	The operation mode	Auto/Hand	Operation mode of reactive power compensation: Auto: Automatic operation mode. Reactive power compensation is automatically executed Hand: Manual cutting mode. When the output loop needs to be tested in the plant, you can set this mode for manual switching capacitance test. Factory setting: AUTO	
	contrast	1% ~ 100%	Set contrast, user can set, factory set to 20%	
	Software version		Displays the current program version number	
Compensation	Input power factor	0.85 ~ 1.00	When the power factor of the grid is below this value, the terminal will be put into the capacitor bank. Factory set to 0.90	
	Excision power factor	1.00 ~ 1.00	When the grid power factor is higher than this value, the terminal will cut off the capacitor bank. Factory set to L0.98	
	For the delay	000s~999s	Refers to the time between the same set of capacitors being removed and being put in again. Factory setting: 5S	This time should not be too short
	The output delay	000s~999s	Refers to the delay between the time when the terminal detects that the power capacitor needs to be put in and the actual power capacitor switching instruction is issued. Factory setting: 5S	

	To networking	Y/N	Used for intelligent capacitor rennet working	
Protection	Over voltage setting	110% ~ 150%	In case of over voltage, the capacitor is cut off at a rate of 0.5 seconds. After over voltage, the voltage will not be restarted until it reaches 5V below the over voltage value (5V is the reverse voltage). Factory setting: 265V	
	Under voltage setting	50% ~ 90%	Under voltage, the controller is cut off at a rate of 0.5 seconds. After under voltage, there is no back-off voltage. As long as the voltage is higher than the under voltage value, it will be restarted immediately. Factory setting: 180V	
	Over current Settings	110% ~ 800%	When the current is over, cut off the capacitor at a rate of 0.5 seconds. Factory set to 120%	
	Owe flow set	1% ~ 60%	In case of undercurrent, the controller is cut off at a rate of 0.5 seconds and restarted immediately as soon as the current is higher than the undercurrent value. Factory setting: 50%	
	Voltage distortion	1.0% ~ 99.9%	When the total voltage distortion rate is greater than the set value, the capacitor is cut off at a rate of 0.5 seconds, and the capacitor will be reinvested only when the distortion rate is within the set value. Factory setting: 5.0%	
	Current distortion	1.0% ~ 99.9%	When the total current distortion rate is greater than the set value, the capacitor is cut off at a rate of 0.5 seconds, and the capacitor will be reinvested only when the distortion rate is within the set value. Factory setting: 5.0%	
Communication	Baud rate	1200, 4800, 9600, 19200, 38400	Communication baud rate setting, factory setting: 9600	
	Check digit	None Odd Even	Check bit setting: None: There is no check bit; Odd: parity bit	

			-Sheldon: Even. Factory setting: None	
	Stop bit	1bit 2bit	Stop bit setting, factory setting: 1bit	
	Correspondence address	1-247		
Collection	Storage U disk	Y/N	Select whether to use USB flash disk to collect data. Factory setting: N	
	Store the reset	Y/N	Select whether to clear the storage to zero. Factory setting: N	
The clock			You can modify the current year, month, day, in time, minutes, seconds by pressing the ENT key after modification, the clock will be automatically saved.	

6.4 Switching state

Displays the switching status, capacitance type, capacitance capacity, total input time and total input times of each route. Press the "Esc" key to return to the previous menu.

3		10		17		24	
4		11		18		25	
5		12		19		26	
6		13		20		27	
7		14		21		28	
8		15		22		29	
9		16		23		30	

Fig. 29

NO	Type /Cap				
3		Tim (h)			
		Num			

Fig. 30

7 Random accessories, maintenance and matters needing attention

7.1 Random attachments

The device is attached to the manual. please check after opening the box, if there is any discrepancy can contact the manufacturer.

7.2 Transportation and storage

① Transport and loading and unloading should not be subjected to severe impact.

② The ambient temperature of storage is -25-70℃, the relative humidity is not more than 85%, and there is no corrosive gas in the air.

7.3 Maintenance

During the operation of the device, the working state should be observed regularly. In case of any abnormal situation, please stop the machine immediately for inspection or contact the manufacturer.

7.4 Precautions

①The device is strictly prohibited to be operated by non-electricians.

② Before installation and use, the voltage of the pre-connected power network should be measured, strictly

according to the requirements of the power management regulations.

③Maintenance, must first power off, such as the connection of the capacitor discharge, can be carried out.

8 Ordering Instructions

1. Please specify the model name and quantity of the product.
2. Supply address and time.
3, special requirements, please state in advance.

Headquarters: Acrel Co., LTD.

Address: No.253 Yulv Road Jiading District, Shanghai , China

TEL.: 0086-21-69158338 0086-21-69156052 0086-21-59156392 0086-21-69156971
Fax: 0086-21-69158303
Web-site: www.acrel-electric.com
E-mail: ACREL008@vip.163.com
Postcode: 201801

Manufacturer: Jiangsu Acrel Electrical Manufacturing Co., LTD.
Address: No.5 Dongmeng Road,Dongmeng industrial Park, Nanzha Street,Jiangyin City,Jiangsu Province,China
TEL./Fax: 0086-510-86179970
Web-site: www.jsacrel.com
Postcode: 214405
E-mail: JY-ACREL001@vip.163.com