149

Rail-type Multifunction Electrical Instrument with External Split Core Current Transformer

Use and Installation Manual V1.3

Acrel Co., Ltd.

Announcement

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The manual will be continuously updated and corrected but it is inevitable to see a little discrepancy or error if compared with the real products. Please refer to the purchased real product. The latest version of the manual is available on www.ACREL.cn or sales channel upon request.

Content

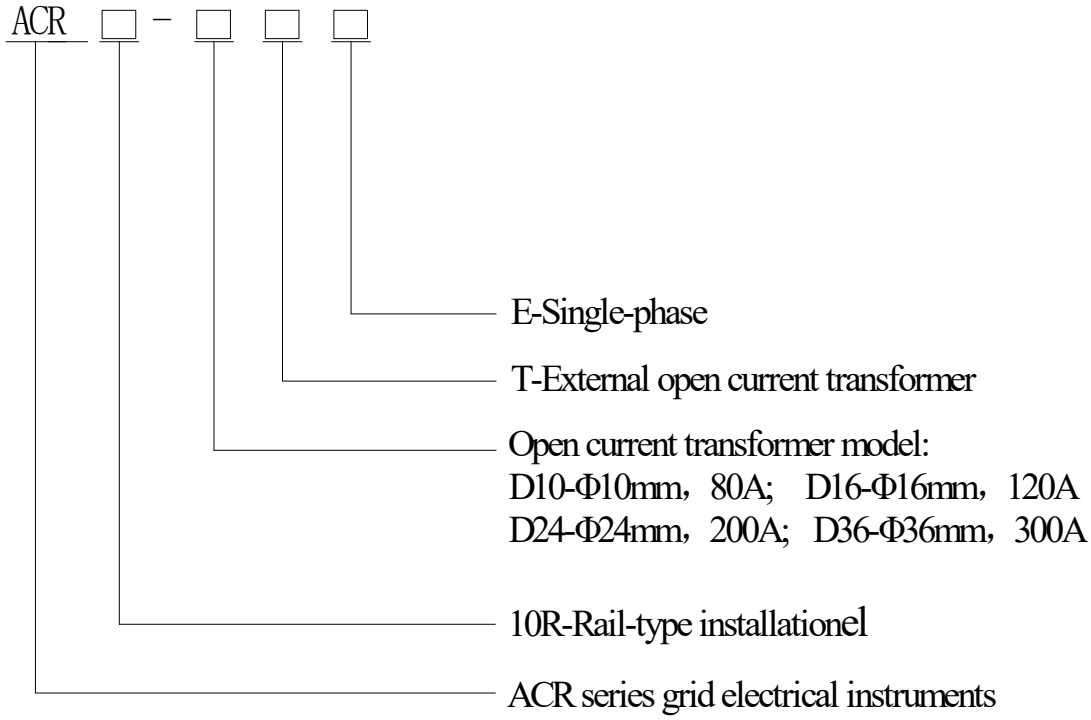
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Note: The instrument must be installed on the spot together with a complementary split-core current transformer .

1. Overview

The rail-type multifunction electrical instrument with external Rogowski coil and split-core current transformer is applicable for the energy-saving reconstruction project in high energy consumption industries including the smelting, iron and steel, welding and semi-conductor industry. It is also suitable for applications such as the power monitoring of grid-connected cabinet for distributed photovoltaic power cabinet and energy demand management. It boasts of no need of bus removal, easy connection and safe construction, saving reconstruction cost and raising efficiency for the user. It integrates the measurements of all electric parameters (including single-phase or three-phase current, voltage, active power, reactive power, apparent power, frequency and power factor ） and comprehensive energy monitoring and examination management. Meanwhile, it also has various peripheral interfaces for the user to choose: the RS485 communication interface with MODBUS-RTU protocol can meet the need of online communication management; the interfaces with switch input and relay output can realize the remote signalling and remote control of the circuit breaker switch. It is very suitable for real-time power monitoring system with an LCD display and the panel buttons to realize the setting and control of parameters.

2. Product Specifications



3. Product Function

Function \ Model		ACR10R-DxxTE
Measurement Parameters	Single-phase current	■

	Single-phase voltage	■
	Single-phase (active power, reactive power, power factor）	■
	Three-phase (active energy, reactive energy)	■

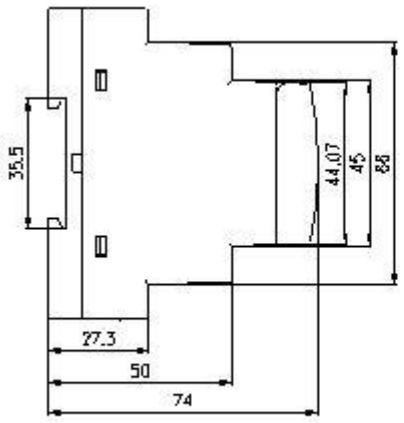
Note:1.“■”refers to standard function, the standard configuration for above instruments is 1 channel RS485 communication.

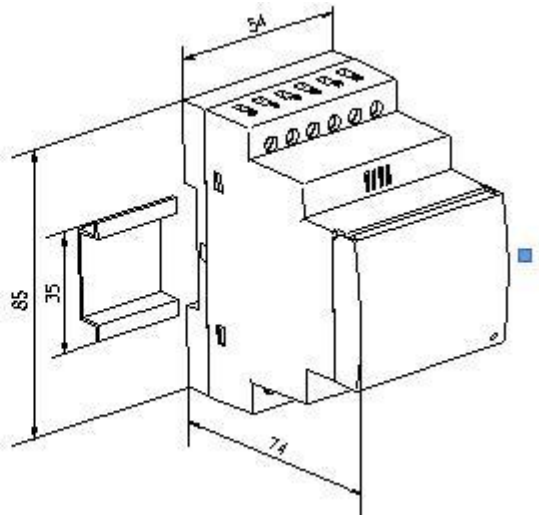
4．Technical Parameters

Technical parameters		Indicators
Input	Grid	Single-phase
	Frequency	45～65Hz
	Voltage	Rated voltage: AC 100V, 400V
		Overload: 1.2 times the rated voltage(continuous); 2 times the rated voltage lasting for 1 second
		Power consumption: less then 0.2VA
	Current	Rated current: 10A，20A，40A，80A，120A，200A etc. (for details see product specifications)
		Overload: 1.2 times the rated current(continuous);10 times the rated current lasting for 1 second
		Power consumption: less then 0.2VA
Output	Communication	RS485 interface, Modbus-RTU
	Display	LCD
Measurement precision		Voltage: 0.2 level, current, power Active energy: 0.5 level,0.01Hz frequency, Reactive energy: 1 level
Power supply		AC85～265V or DC100～350V; power consumption ≤10VA
Safety	Power frequency withstand voltage	AC2kV 1 min between power supply // current input//voltage input and communication AC2kV 1 min between each pair of combinations among power supply, urrent input and voltage input.
	Insulating resistor	Input,output terminal to housing >100MΩ
Environment		Working temperature: -10℃～+55℃;storage temperature: -20℃～+70℃ Relative humidity:5%～95%，non-condensing; altitude:≤2500m

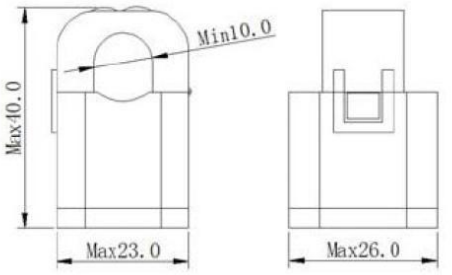
5. Installation

5.1 Overall and Installation Dimensions (Unit: mm)

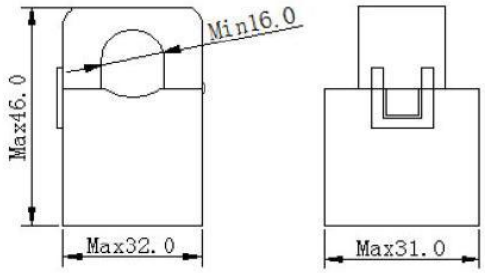




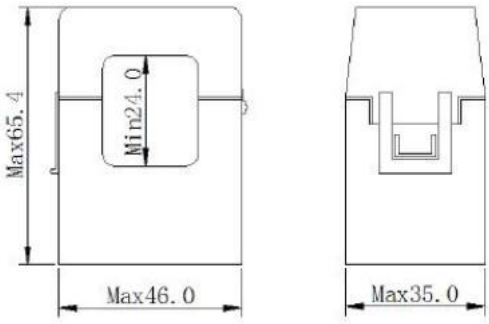
5.2 Open Current Transformer's Dimension (Unit: mm)



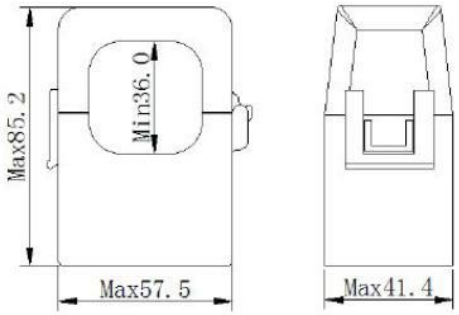
Φ10mm



Φ16mm

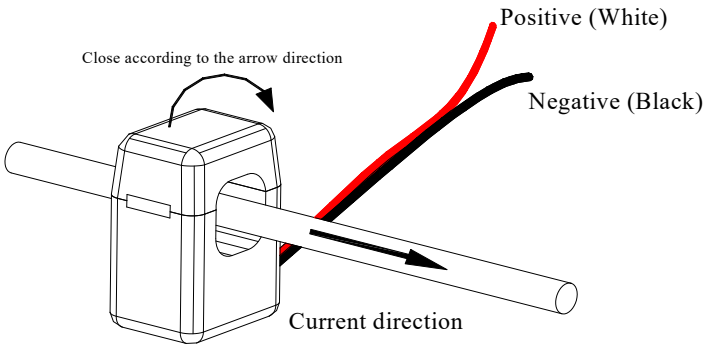


Φ24mm



Φ36mm

5.3Installation Method

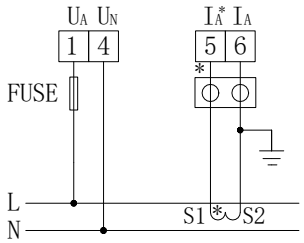


Installation Method of the Open Current Transformer Close

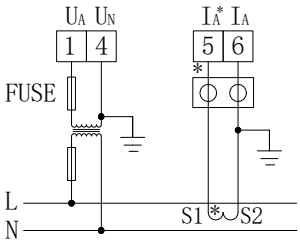
5.4 Connection Mode

(Note: The connection diagram on the instrument housing shall prevail in case of any discrepancies with it)

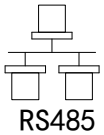
According to different design requirements ,it is recommended to add fuses at power supply and voltage input terminals to meet the safety requirements of relevant electrical specifications

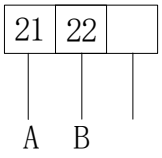


Single-phase 1CT



Single-phase 1PT, 1CT





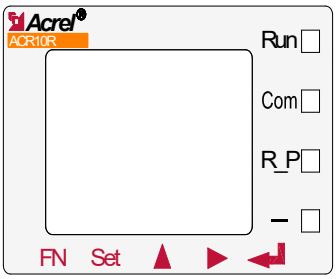
RS485 communication

NOTE：It is recommended to use 0.5A or 3A for the fuse in the connection diagram;

RS485 communication terminal connection can use either RJ45 female or normal connector.

6. Programming and Use

6.1Panel Description



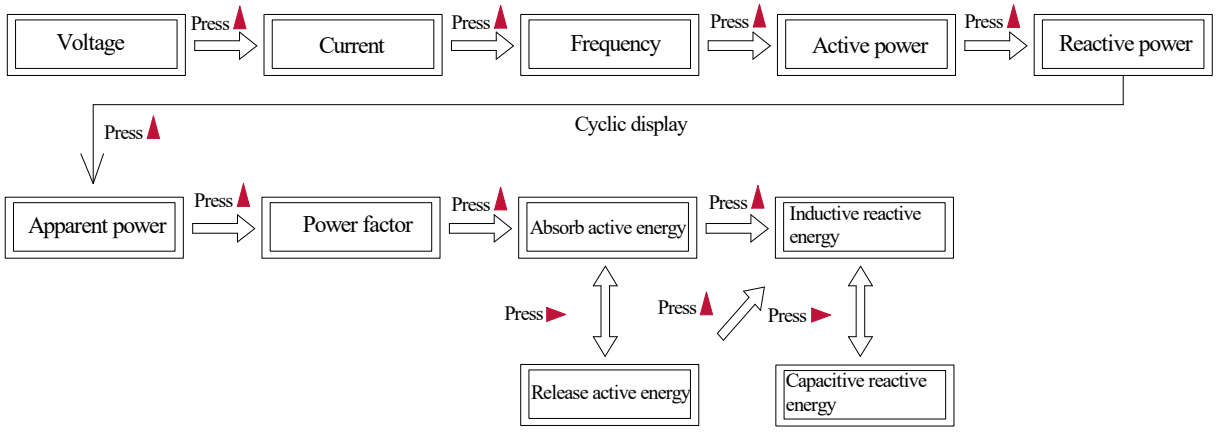
	Off	On	Flashing
Run (Green)	The instrument is not running	/	The instrument is running normally
Com (Red)	The instrument is not communicating	/	The instrument is in communication status.
R-P (Red)	Positive power	Negative power	/
— (Red)	/	Negative value indicator lamp	/

6.2 Button Function Description

The five buttons of the instrument are FN button, SET button,▲button,▸ button,Enter button from left to right.

FN button	The button function is not yet available.
SET button	In the measurement mode, press this button to enter the programming mode. The instrument will indicate entering password. When the correct password is entered, you can set the programming for the instrument; in the programming mode, use it to return to the previous menu
▲button	In the measurement mode, it is used to switch display items; In the programming mode, it is used to switch menus of the same level or reduce the units.
▸ button	In the measurement mode, it can be used to see relevant parameters. For details, see the display menu; In the programming mode, it is used to switch menus of the same level or increase the units.
Enter button	In the programming mode, it is used to confirm the items selected form the menu and the modification of parameters.
▲button+Enter button	In the programming mode, the combination is used to reduce hundreds
▸ button+Enter button	In the programming mode, the combination is used to increase hundreds

6.3 Operation Instructions



6.4Programming Menu

6.4.1General Programming Menu

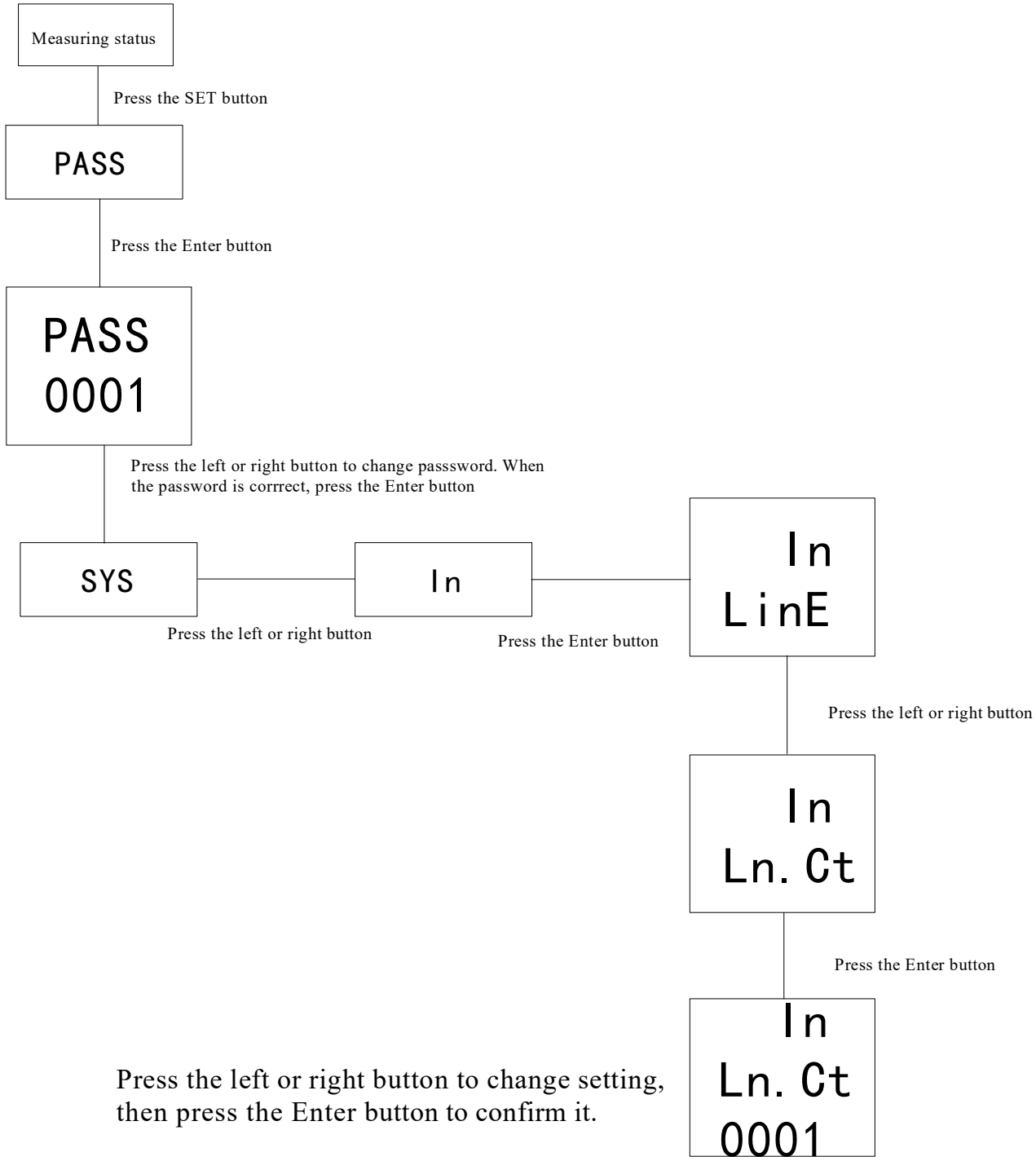
1st level menu	2nd level menu	3rd level menu	Description
SYS	d ISP		Selection for start-up picture without auto page turning
	CodE	0-9999	Password setting (initial password 0001)
	C lr.E		OK is displayed when energy cleared off
	Err		Abnormal data statistics
In	Ln E	1P2L,3P3L、3P4L	Connection mode(single-phase, three-phase three-wire, three-phase four-wire)
	In.U	100、400	Input voltage range
	In.I	10,20,40,80,120,200,300etc.(For details, please see product specifications)	Input current scope (not for user operation)
	InPt	0-9999	Voltage multiplier
	InCt	0-9999	Current multiplier
bUS	Addr	1-247	Communication address
	bAUd	4800、9600、19200、38400	Communication baul rate
	nodE	None/2bit/odd/even	Communication mode (no parity, 2 stop bit, odd parity, even parity)

6.5Programming Examples

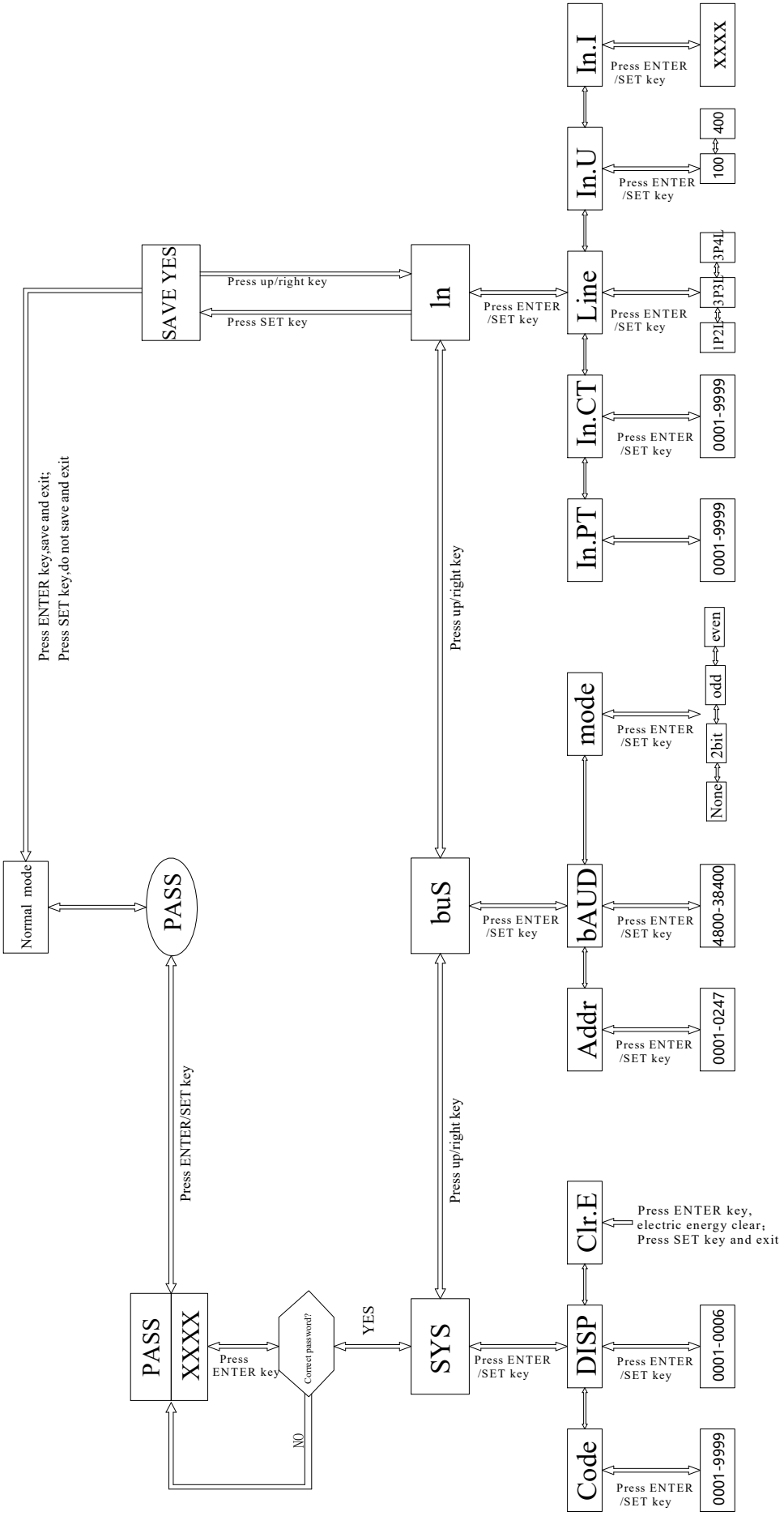
This section introduces some option change in the programming menu in the form of work flow chart, such as the current multiplier, transformer setting.

Note: When the setting or selection is done, the Enter button must be pressed to confirm it. After the confirmation is complete, continuously press the SET button until the SAVE/YES page appears. At this time, the Enter button must be pressed at this time or the setting will not be valid.

6.5.1 How to Change Current Multiplier (CT Transformation Ratio)



6.5.2Programming Cases



7. Communication Connection

The instrument provides asynchronous half-duplex RS485 communication interface wich adopts MODBUS-RTU protocol so all kinds of data can be transmitted on the communication line. Theoretically, one communication line can be connected with up to 128 instruments, each of which can set a communication address (Addr) and communication rate (baud) via setting.

For the communication connection, we recommend to use the three-core shielding wire .The core wires are connected to A,B,COM2 respectively and the shielding layer is connected to the ground. COM2 is forbidden to have ground connection. When laying the wires, the communication line shall be kept away from the strong current cable or other strong electric field.

It is recommended to add a matching resistor between A and B of the end instruments. The resistance range is 120Ω～10kΩ.

See 7.6 for specific connection case.

7.1Transmitting Method

The information transmission is asynchronous and in bytes. The communication message tranmitted from the master to the slave is in 10-bit format including 1 start bit,8 data bit(LSB first delivered),no parity bit, one stop bit. If parity bit or 2 stop bit is et, the format is 11-bit.

7.2Information Frame Format

Address code	Function code	Data zone	CRC check code
1 byte	1 byte	n byte(s)	2 bytes

Address code: the address code is in the beginning of the frame, which is composed of a byte (8 bit binary code)representing 0~255 in decimal system. The PZ instrument only uses 1～247 and keeps other addresses. The bits indicate the address of the terminal device designated by the user. The device will receive the data from the linked master. The address of every terminal device must be unique. Only the end addressed will correspond to the query containing its address. When the terminal sends back a response, the responding slave address will tell the master which terminal is communicating with it.

Function code: the function code tells the addressed termnial to carry out which functions. The table below lists up the function codes used by this instrument as well as their meanings and funcitons.

Function	Definition	Operation
03H/04H	Data reading register	Obtaining the current binary value of one or more registers.
10H	Preset multi-register	Set the binary value into a series of multi-register

Data zone: the data zone contains the data needed for carrying out certain functions or collected when the terminal responds to the query. The content of the data may be number, reference address or set value. For example: if the function code tells the terminal to read a register,the data zone needs to specifiy which register to start with and how much data to be read. The embedded address and data will vary with types and different content of the slaves.

CRC check code:CRC field occupies two bytes including one 16-bit binary value. The CRC value is calculated by the transmitting devicie then added to the data frame. The receiving device will recalculate the CRC value upon receiving the data then compare it with the received value in the CRC field. If the two values are not identical, there is an

error.

The procedure to generate a CRC"

A.Preset a 16-bit register as 0FFFFH (full 1), which is called CRC register.

B.Make XOR calculation with 8 bit of the first byte in the data frame and the lower byte in the CRC register and store the result into the CRC register.

C.Shift the CRC register right a bit and fill the MSB with 0 and take out the LSB for checking.

D.If the LSB is 0, repeat step 3 (one more shift); if the LSB is 1, m,ake XOR calculation with CRC register and preset fixed value (0A001H).

E.Repeat step three and step four until the 8th shift. The entire 8 bit processing is complete in this way.

F.Repeat step two to five to process the next 8 bits until all bytes are processed.

G.Finally, the CRC register value becomes the CRC value.

Besides, there is also a wayt to calculate CRC using the preset table. It is characterized by rapid calculation speed. However, the table needs relatively large storage room. We will not introduce it here, please refer to relevant materials.

7.3Function Code Introduction

7.3.1Function Code 03H or 04H: Reading Register

The function allows the user to obtain the data collected and recorded by the device and system parameters. The data number requested by the master computer for one time has no limitation but cannot exceed the defined address range.

The following examples are 3 basic data read from 01 slave computer (every address in the data frame takes up 2 bytes):UAB, UBC, UCA. Among them, UAB's address is 0028H, UBC's address is 0029H and UCA's address is 002AH.

Sent by master		Sent message
Address code		01H
Function code		03H
Start address	UB	00H
	LB	28H
Number of registers	UB	00H
	LB	03H
CRC check code	LB	85H
	UB	C3H

Feedback by slave		Feedback message
Address code		01H
Function code		03H
Bytes		06H
Register data	UB	Undefined
	LB	Undefined
Register data	UB	Undefined
	LB	Undefined
Register data	UB	Undefined
	LB	Undefined
Register data	LB	Undefined
	UB	Undefined

7.3.2Function Code 10H: Writing Register

The function code 10H allows the user to change the contents of multiple registers. The function code can be used to write the system parameters and switch output status. The master computer can write a maximum of 16 pieces of data (32 bytes) at once.

The following example shows than when the preset address is 01, the switch output is Do1. The switch input/output status indication register's address is 0022H. The 9-12 bit corresponds to DI1-DI4, the 13-14 bit corresponds to D01-D02 respectively.

Sent by master		Sent message
Address code		01H
Function code		10H
Start address	UB	00H
	LB	22H
Register number	UB	00H
	LB	01H
Byte number		02H
0022H data to be written	UB	10H
	LB	00H
CRC check code	LB	ADH
	UB	12H

Feedback by slave		Feedback message
Address code		01H
Function code		10H
Start address	UB	00H
	LB	22H
Register number	UB	00H
	LB	01H
CRC check code	LB	A1H
	UB	C3H

7.4Communication Application Details

The instrument design has a uniform planning for the communication address list. The user can easily realize the functions of remote measurement, remote signalling and remote control according to the following introduction.

7.5 Communication Address List (MODBUS-RTU Protocol)

(1Float=2Word，1Word=8Byte)

Address	Parameters	attribute	Number range	Data type	Remarks
0000H	Protective password	R/W	0001-9999	word	
0001H UB	Communication address	R/W	0001-0247	word	
0001H LB	Baud rate	R/W	0-3：38400、19200、 9600、4800bps		
0002H	Reserved	R	Factory parameters. Users are not allowed to write an order.	word	
0003H	PT transformation ratio	R/W	1-9999	word	
0004H	CT transformation ratio	R/W	1-9999	word	
0005H～0021H	Reserved	R	Factory parameters. Users are not allowed to write an order.	word	
0061H	U	R	0-65535	word	1 bit decimal is reserved
0062H～0063H	Reserved	R		word	
0064H	I	R	0-65535	word	2 bit decimal is reserved
0065H～0066H	Reserved	R		word	
0067H	P	R	-32760—+32760	word	3 bit decimal is reserved, KW
0068H～006AH	Reserved	R		word	

006BH	Q	R	-32760—+32760	word	3 bit decimal is reserved, KVar
006CH～006EH	Reserved	R		word	
006FH	S	R	0—65535	word	3 bit decimal is reserved, KVA
0070H～0072H	Reserved	R		word	
0073H	PF	R	0-100	word	2 bit decimal is reserved
0074H～0076H	Reserved	R		word	
0077H	F	R	4500-6500		2 bit decimal is reserved
0078H～007AH	Reserved				
Energy adress list below					
0047H～0048H	Absorbing active energy	R	0-99999999999	Float	Primary energy
0049H～004AH	Releasing active energy	R	0-99999999999	Float	Primary energy
004BH～004CH	Reactive energy	R	0-99999999999	Float	Primary energy
004DH～004EH	Capacitive reactive energy	R	0-99999999999	Float	Primary energy