Acrel ACR320EL Rail-type Multifunction Electrical Instrument With External Split Core Current Transformer Instruction Manual

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Please read the manual carefully before using the product. The pictures, marks andsymbol in the manual belong to Acrel. The manual or part of it shall not be publiclyreprinted by people outside the company without written authorization.

The manual will be continuously updated and corrected but it is inevitable to see alittle discrepancy or error if compared with the real products. Please refer to the purchasedreal product. The latest version of the manual is available onwww.ACREL.cnor saleschannel upon request.

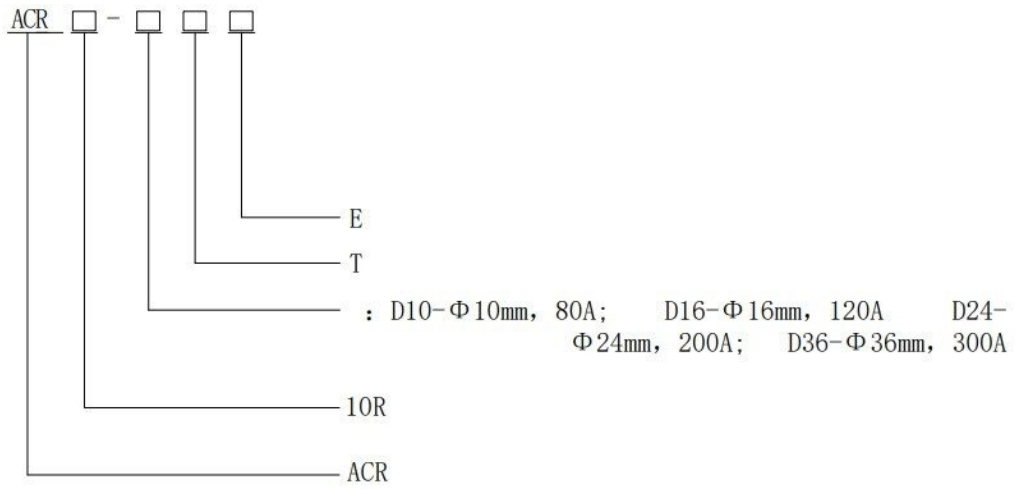
Note: The instrument must be installed on the spot together with a complementary split-core current transformer .

Contents

Overview

The rail-type multifunction electrical instrument with external Rogowski coil and split-corecurrent transformer is applicable for the energy-saving reconstruction project in high energyconsumption 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 fordistributed photovoltaic powercabinet 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-phasecurrent, voltage, active power, reactive power, apparent power, frequency and power factor andcomprehensive energy monitoring and examination management. Meanwhile, it also has various peripheralinterfaces for the user to choose: the RS485 communication interface with MODBUS-RTU protocol can meetthe need of online communication management; the interfaces with switch input and relay output canrealize the remote signalling and remote control of the circuit breaker switch. It is very suitablefor real-time power monitoring system with an LCD display and the panel buttons to realize the settingand control of parameters.

Product Specifications



E	E-Single-phase
T	T-External open current transformer
	Open current transformer model:
10R	IOR-Rail-type installation
ACR	ACR series grid electrical instruments

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 channelRS485 communication.

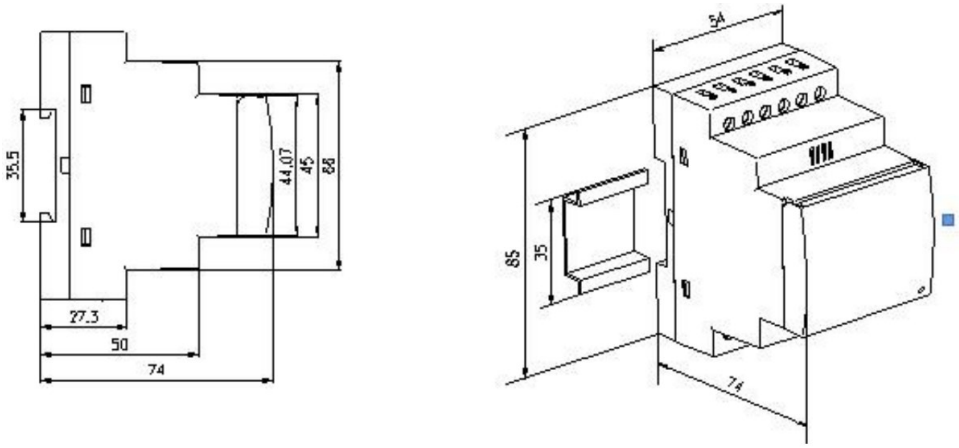
Technical Parameters

Technical parameters		Indicators	
Input	Grid	Single-phase,	
	Frequency	45 65Hz	
	Voltage	AC 100V 400V Rated voltage: AC 100V, 400V	
		Overload: 1.2 times the rated voltage(continuous); 2 times the rated voltage lasting for 1 second	
		0.2VA Power consumption: less then 0.2VA	

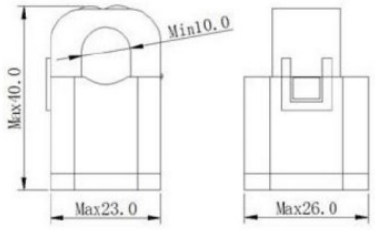
	Current	Rated current: 10A 20A 40A 80A 120A 200A etc. (for details see product specifications)	
		Overload: 1.2 times the rated current(continuous);10 times the rated current lasting for 1 second	
		Power consumption: less then 0.2VA	
Output	Communication	RS485 interface, Modbus- RTU	
	Display	LCD	
Measurement 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	

Installation

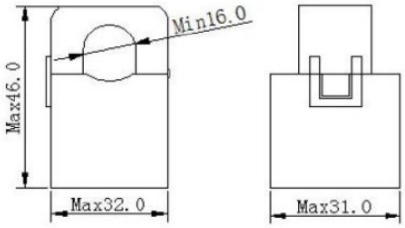
Overall and Installation Dimensions (Unit: mm)



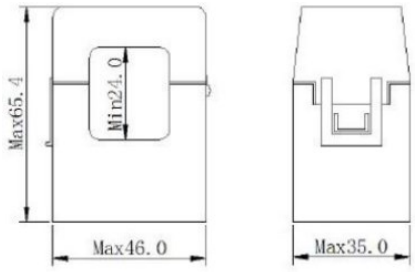
Open Current Transformer's Dimension (Unit: mm)



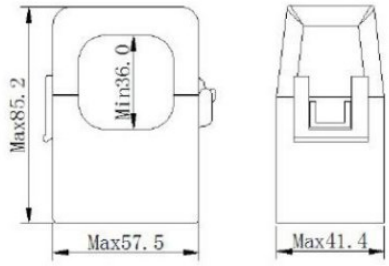
Φ10mm



Φ16mm

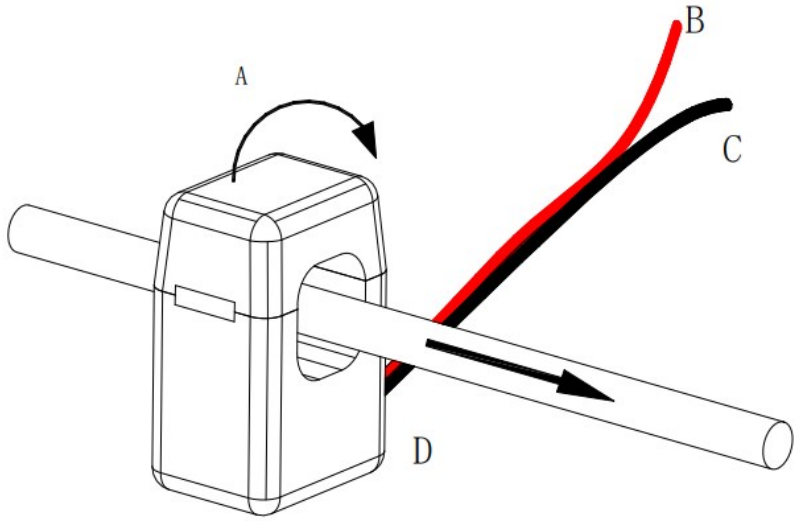


Φ24mm



Φ36mm

Installation Method



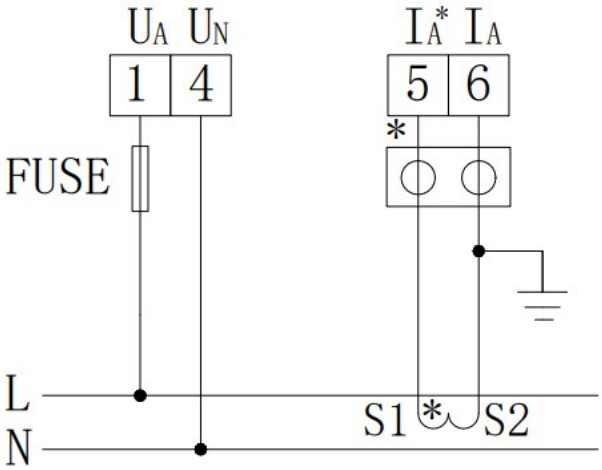
Installation Method of the Open Current Transformer Close

A	Close according to the arrow direction
B	Positive (White)
C	Negative (Black)
D	Current direction

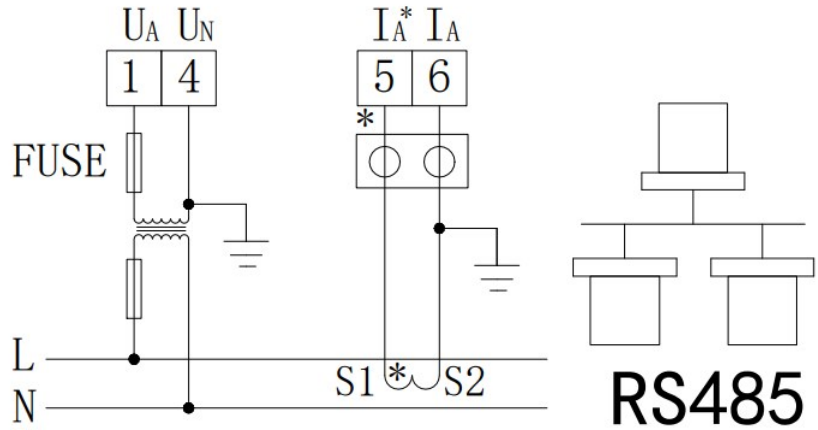
Connection Mode

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

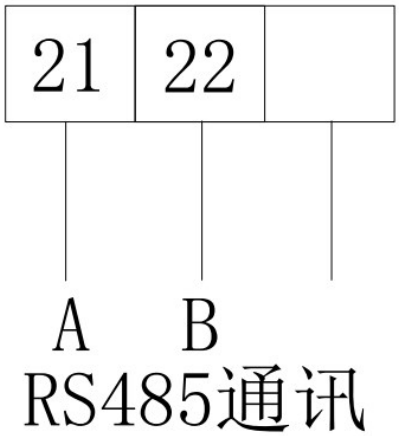
Single-phase 1CT



Single-phase 1PT, 1CT



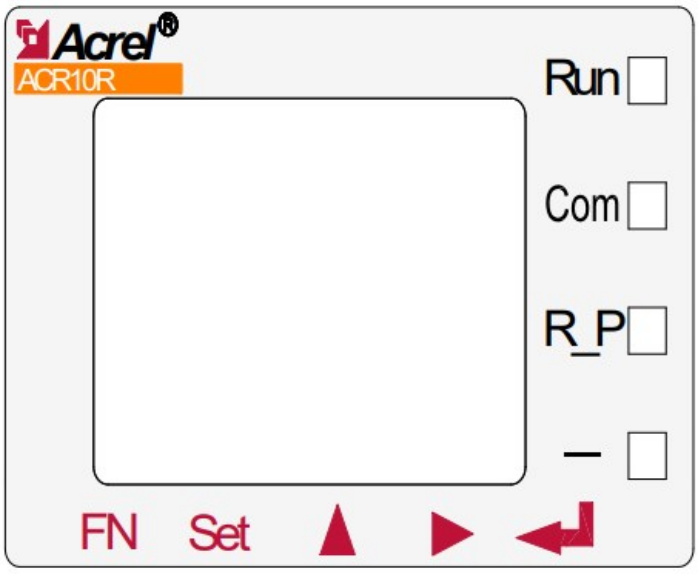
RS485 communication



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.

Programming and Use

Panel Description



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

Button Function Description

The five buttons of the instrument are FN button, SET 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
	
	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.
	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.
 +Enter button	In the programming mode, the combination is used to reduce hundreds
 Enter button	In the programming mode, the combination is used to increase hundreds

The switch output of the instrument adopts relay output with two control mode:

1. alarm mode(“SEL”is not zero);
2. bus control mode (“SEL”is selected as “0. do” and level output for zero “dLy”.When “dLy” is not zero, it is automatically cut off after do action in the set delay time.)

Set Do output type in the “SEL”. “0. do” usually refers to communication control (if “dLy”is set to 0, the output is level or pulse. If dly is set to 2, the circuit will be off after closingfor two seconds) Others are alarm control (see list below).

“dLy”refers to alarm delay (which is not recommended to set as 0 to prevent disturbance or mistake.Pulse or level

output control for Do output type)

“bAnd” refers to setting of the non-action band

AL.Hi” refers to the setting of high alarm humber (no need to set the max. 9999)

“AL.Lo” refers to the setting of low alarm number (no need to set the min. -9999

(The above three settings correspond to the energy display which contains decimal point. Eg.input220V 100A/5A, three-phase four-wire, the calculation of 100% P total is 220*100*3=66kW. If high alarmfor 100% power, return for 90% power, the “AL.Hi” can be set to 66.00, the “bAnd” to 6.00. If highalarm for 100% voltage, return for 95% voltage, the “AL.Hi” can be set to 220.0, the “bAnd” to11.0. If high alarm for 100% current, return for 95% current, the “AL.Hi” can be set to 100.0, the“bAnd” to 5.0)

“In.=0”refers to whether low alarm is allowed if the signal is 0. Lo. on enable it and Lo.of disable it.

01	02	03	04	05	06	07	08
UA	UB	UC	Max/min value of three-phase phase voltage	UAB	UBC	UCA	Max/min value of three-phase linevoltage
09	10	11	12	13	14	15	16
IA	IB	IC	Max/min value of three-phase current	PA	PB	PC	P total
17	18	19	20	21	22	23	24
QA	QB	QC	Q total	SA	SB	SC	S total
25	26	27	28	29	30		31
PFA	PF B	PF C	PF	F	Unbalanced voltage		Unbalanced current

Three-phase

01	02	03	04	05	06	07
U	I	P	Q	S	PF	F

Single-phase

Note: 1. Max/min value of three-phase ….refers to:maximum value for three-phase high alarm,minimum value for three-phase low alarm.

The second channel DO can set a“32.FL” combined alarm function. After setting, the 2nd level menuwill become “SEL”(Function Selection), “dLy”(Delay), “H U”(Overvoltage), “L-U”(Undervoltage),“H-F”(Overfrequency), “L F”(Underfrequency), “H-P”(Overpower), “L-P”(Underpower), “H-I”(Overcurrent), “L-PF”(Underpower Factor), “H-b.U” Unbalanced Overvoltage. Missing phase for -1setting. The judgement conditions are at least one phase>0.2Ie, one phase<0.01Ie)

Unbalance calculation

(Difference between the max.mean deviation and the mean value)/mean value*100%. If the mean value

in the denomintor is less than the rated value, the denomintor will be the rated value.

Rated voltage value Ue: three-phase four-wire Ue is phase voltage. The 400Vinstrument set in themenu is 220V*PT, and 100V instrument is 57V*PT.

Rated current value Ie: 5A*CT for 5A instrument, 1A*CT for 1A instrument.

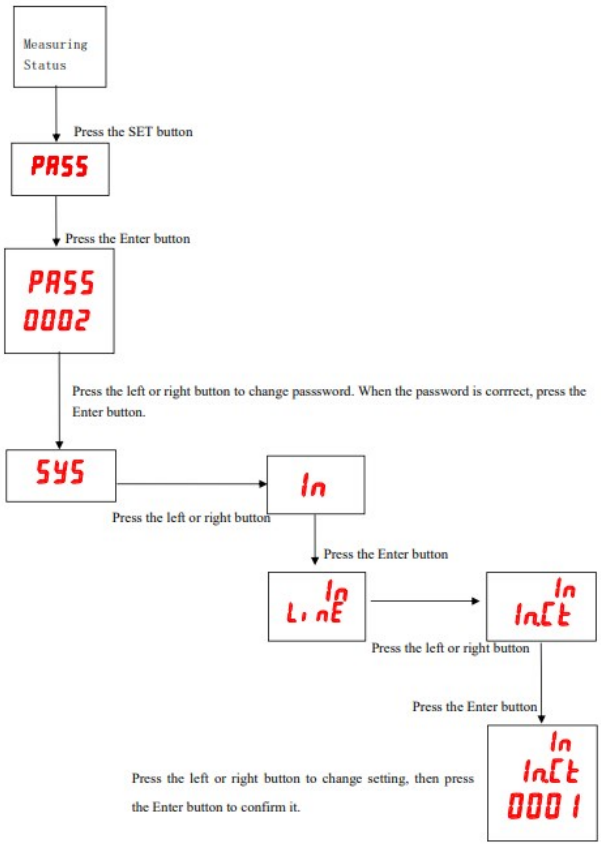
The parameter setting for the unblance is in the percentage form, such as 20 refers to 20%

Programming Examples

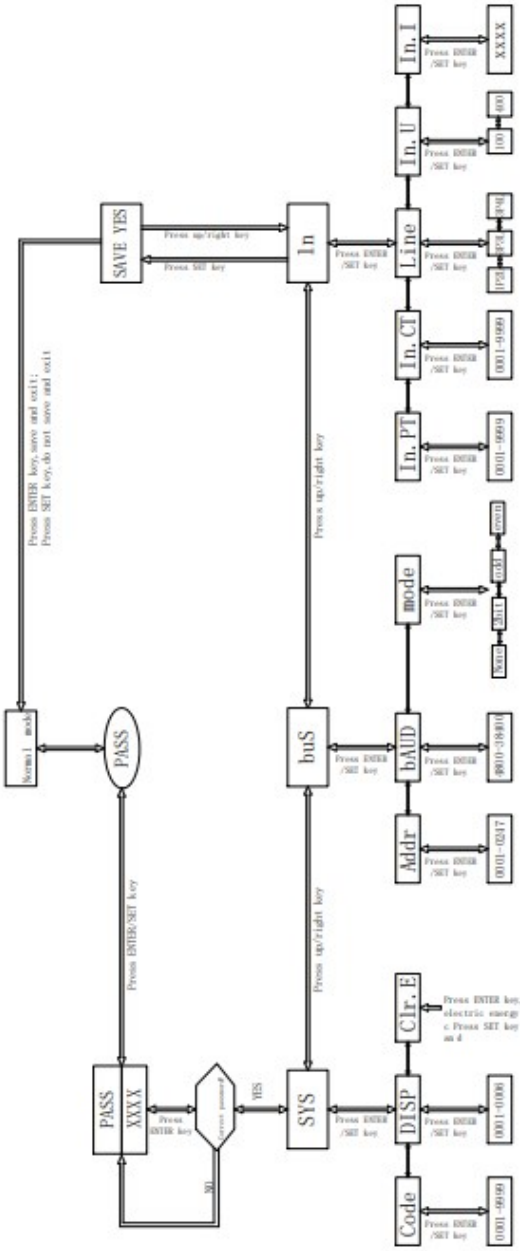
This section introduces some option change in the programming menu in the form of work flowchart, such as the current multiplier, transformer setting.

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

How to Change Current Multiplier (CT Transformation Ratio)



Programming Cases



Communication Connection

The instrument provides asynchronous half-duplex RS485 communication interface wich adoptsMODBUS-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 communicationaddress (Addr) and communication rate (baud) via setting.

For the communication connection, we recommend to use the three-core shielding wire .The core wiresare connected to A,B,COM2 respectively and the shielding layer is connected to the ground. COM2 isforbidden to have ground connection. When laying the wires, the communication line shall be kept awayfrom 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 resistancerange is 120Ω 10kΩ.

See 7.6 for specific connection case.

Transmitting Method

The information transmission is asynchronous and in bytes. The communication message tranmittedfrom the master to the slave is in 10-bit format including 1 start bit,8 data bit(LSB first delivered),noparity bit, one stop bit. If parity bit or 2 stop bit is et, the format is 11-bit.

Information Frame Format

Address code: the address code is in the beginning of the frame, which is composed of a byte (8bit binary code)representing 0~255 in decimal system. The PZ instrument only uses 1 247 and keepsother 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 sendsback a response, the responding slave address will tell the master which terminal is communicatingwith it.

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

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

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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 collectedwhen the terminal responds to the query. The content of the data may be number, reference address orset value. For example: if the function code tells the terminal to read a register,the data zone needsto specifiy which register to start with and how much data to be read. The embedded address and datawill 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 iscalculated by the transmitting devicie then added to the data frame. The receiving device willrecalculate the CRC value upon receiving the data then compare it with the received value in the CRCfield. If the two values are not identical, there is an error.

The procedure to generate a CRC

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

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

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

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

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

Repeat step two to five to process the next 8 bits until all bytes are processed. 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 willnot introduce it here, please refer to relevant materials

Function Code Introduction

Function 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 addressin the dataframe takes up 2 bytes):UAB, UBC, UCA. Among them, UAB’s address is 0028H, UBC’s address is 0029Hand 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
	LB	85H
CRC check code		
	UB	C3H

Feedback by slave		Feedback message
ddress 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
CRC Register data	LB	Undefined
	UB	Undefined

Function Code 10H: Writing Register

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

The following example shows than when the preset address is 01, the switch outputis Do1. The switchinput/output status indication register's address is 0022H. The 9 12 bit corresponds to DI1-DI4, the13-14 bit corresponds to D01-D02 respectively.

Sent by master			Sent message		Feedback by slave		Feedback message
Address code			01H		Address code		01H
Function code			10H		Function code		10H
Start address	UB		00H		Start address	UB	00H
	LB		22H			LB	22H
Register number	UB		00H		Register number	UB	00H
	LB		01H			LB	01H
Byte number			02H		CRC check code	LB	A1H
0022H data to be written		UB	10H			UB	C3H
		LB	00H				
CRC check code		LB	ADH				
		UB	12H				

Communication Application Details

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

Switch Input and Output

The switch input of the instrument adopts dry contact switch signal input method. The instrumentis equipped with +5V operating power inside so it does not needexternal power supply. When the externalcontact is close or open, the instrument will show the switch status locally. At the same time, thecommunication port of the instrument can realize the long distance transmission function, i.e., the“remote signalling” function.

When the switch output is the relay output, the instrument can not only be remotely controlledby the upper computer(two ways of remote control:1.level triggering 2. Pulse triggering) to realize“remote control” function but also realize corresponding alarm function upon customer’s request(such as overcurrent, undervoltage).

The communication address related to the switch input/output is 0022H with relations to the switchI/O as below:

0022H	16	15	14	13	12	11	10	9	8 1
			DO2	DO1	DI4	DI3	DI2	DI1	Reserved

Communication Address List (MODBUS-RTU Protocol)(1Float=2Word 1Word=8Byte)

	Address	Parameters	R/W 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	1-9	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	
	0022H	Switch I/O status	R/W	7.3.2	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 r eserved	
	0078H 007AH	Reserved					
Energy adress list below							
0047H 0048 H	Absorbing active ener gy	R	0-99999999999	Float	Primary energy		
0049H 004A H	Releasing active ener gy	R	0-99999999999	Float	Primary energy		
004BH 004 CH	Reactive energy	R	0-99999999999	Float	Primary energy		
004DH 004 EH	Capacitive reactive energy	R	0-99999999999	Float	Primary energy		

Communication Connection Cases

The communication connection cases are shown as below:

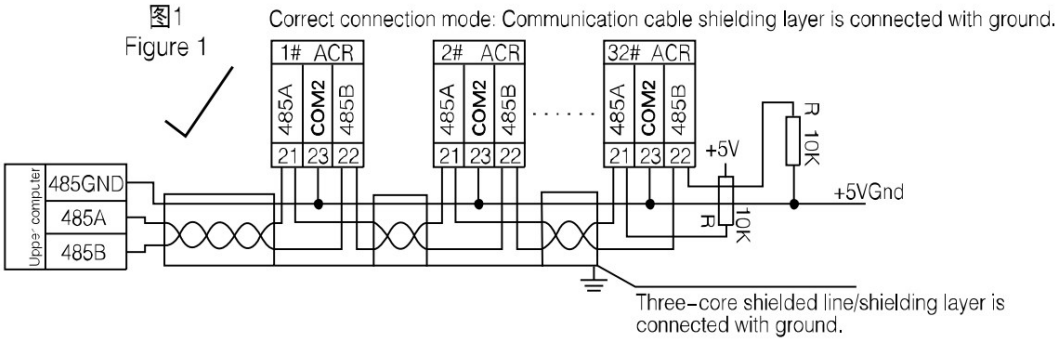


图2
Figure 2

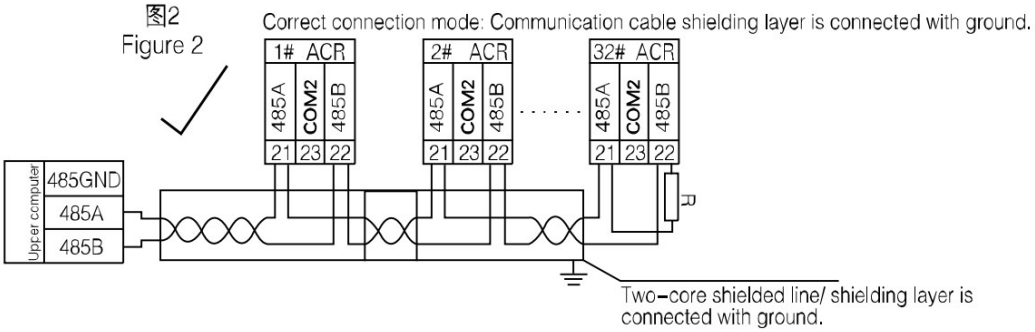


图3
Figure 3

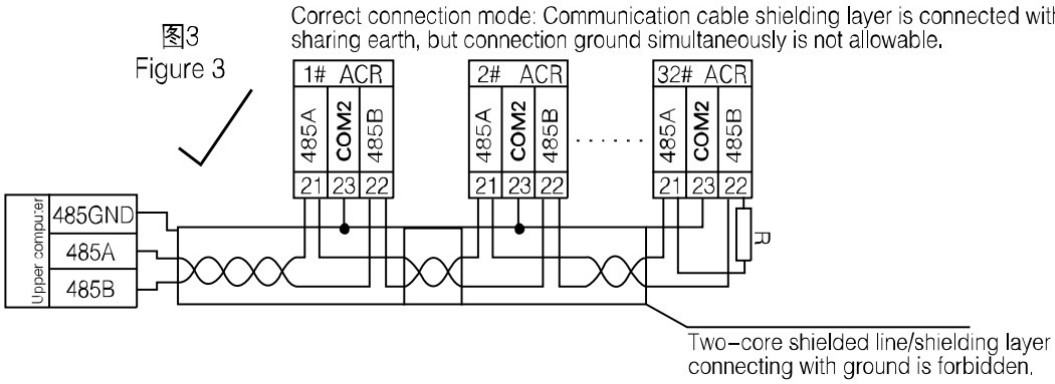
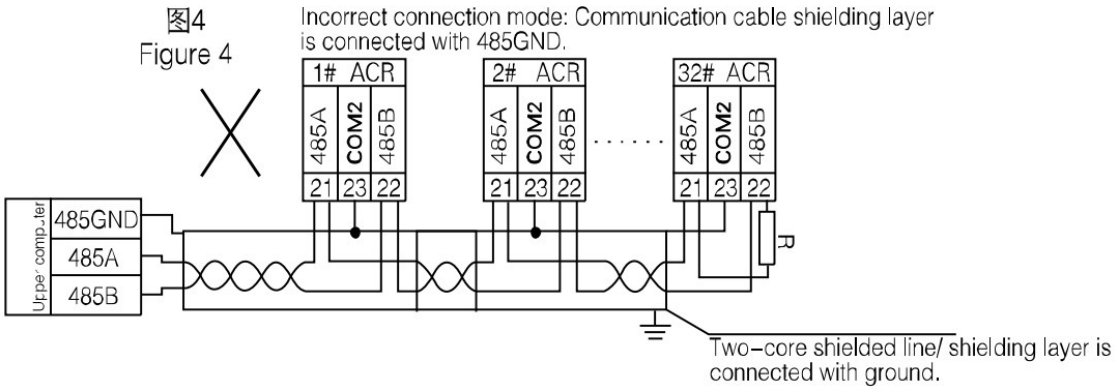


图4
Figure 4



Suppport

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Documents / Resources

	**Acrel ACR320EL Rail-type Multifunction Electrical Instrument With External Split Core Current Transformer** [pdf] Instruction Manual ACR320EL Rail-type Multifunction Electrical Instrument, ACR320EL, Rail-type Multifunction Electrical Instrument, Electrical Instrument

References

- VIP163 - - -