AcuDC 240 Series Power Meter
User's Manual

ACCUENERGY

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The information contained in this document is believed to be accurate at the time of publication, however, Accuenergy assumes no responsibility for any errors which may appear here and reserves the right to make changes without notice. Please ask the local representative for latest product specifcations before ordering.

Please read this manual carefully before installation, operation and maintenance. The following symbols in this manual are used to provide warning of danger or risk during the installation and operation of the meters.

Electric Shock Symbol: Carries information about procedures which must be followed to reduce the risk of electric shock and personal injury.

Alert Symbol: Carries information about circumstances which if not considered may result in injury or death.

Prior to maintanence and repair, the equipment must be de-energized and grounded. All maintainence work must be performed by qualified, competent accredited professionals. Accuenergy shall not be responsible or liable for any damages or injuries caused by improper meter installation and/or operation.

Contents

Welcome to AcuDC 240 !

You have purchased an advanced, versatile, multifunction power meter. This meter can work as a remote terminal unit (RTU) that contributes to your system's stability and reliability.

When you open the package, you will find the following items:

1. AcuDC 240 meter x1
2. Terminal Blocks x1-x5(depending on the model)
3. IO module x1(depending on the model)
4. Installation Clips x4 (already assembled on the meter, will be affixed to the meter.)
5. Product Disk (containing User's Manual and Warranty Card) x1

User's manual contents:

Chapter 1 Introduces the basic AcuDC 240 features and applications.

Chapter 2 Provides details on how to install AcuDC 240 and how to wire terminals and cables.

Chapter 3 Walks you through how to program AcuDC 240 via the front panel, display metering data and how to set parameters.

Chapter 4 Introduces AcuDC 240 features in detail.

Chapter 5 Detailed information related to communcation, including communcation protocol formats and parameter address mapping.

Appendix Provides all AcuDC 240 technical data and specifications, ordering information, etc.

Chapter 1 Introduction

1.1 Meter Overview

Powerful Yet Cost-Effective

AcuDC 240 series monitors DC voltage, current, power and energy. It supports bi-directional current measurement, and also displays meter running hour and load running hour. Analog Output applies to DCS systems, industrial monitoring and control. AcuDC 240 has a combination of accurate measurement, intelligent multifunction and simple human machine interface. The cost-effective meter fulfills the requirments of monitoring and controling the DC circuit.

Compact and Easy to Install

AcuDC 240 series dimensions meet DIN 72x72 requirements. With a mounting depth of only 65mm, the meter can even fit in small drawer type cabinets. It utilizes a self-lock installation mechanism, eliminating the necessity of fix bolts, which makes installation or removal quick and convenient.

User Friendly Interface

AcuDC 240 series utilizes a clear high-definition LCD screen with large characters. The LCD screen comes with a brightness adjustable backlight, which ensures easy observation of metering data in any enviornment. With a large LCD screen display, the four keys on the meter front allow users to observe multiple parameter data at the same time. The meter parameter settings can be set either via front panel keys or the communication port. The parameter settings are saved in non-volatile EEPROM, which remains when power is off.

High Safety and Reliability

AcuDC 240 series meter was designed according to industrial standards. It can run reliably under high power disturbance conditions. This meter has been fully tested for EMC and safety compliance in accordance with multiple international standards. The casing is highly fire resistant due to high quality, durable engineering plastics.

1.2 Area of Application

DC Energy Management Systems

Solar and Wind Energy Systems

Industrial DC Control Systems

DC Excitation Systems

Metallurgy,Galvanoplastics and Electroanalysis Industries

1.3 AcuDC 240 Series

AcuDC 240 series has three products: AcuDC 241, AcuDC 242, AcuDC 243. AcuDC 241 is a voltage meter, only monitors voltage; AcuDC 242 is a current meter, only monitors current; AcuDC 240 is a multifunction meter, monitors voltage, current, power and energy.

Category	Function		DC241	DC242	DC243
Measurement	Voltage	V	●		●
	Current	I		●	●
	Power	P			●
	Energy	E			●
	Ah	Ah			
I/O	2DI+2AO	Support DI counting	⊙	⊙	⊙
	2DI+2RO		⊙	⊙	⊙
	2DI+2DO		⊙	⊙	⊙
	2DI+±15Vdc		⊙	⊙	⊙
Communication	RS485 Port		⊙	⊙	⊙
Data Loging	Trend Records+Max/Min				⊙
Display	LCD		●	●	●
Dimensions	72×72×64.5mm(Opening size: 68×68mm)				

●: Standard ⊙: Optional Blank: Not Available

Table 1-1 AcuDC 240 Models

Chapter 2 Installation

The installation method is introduced in this chapter. Please read this chapter carefully before beginning installation.

2.1 Appearance and Dimensions

2.1.1 Appearance

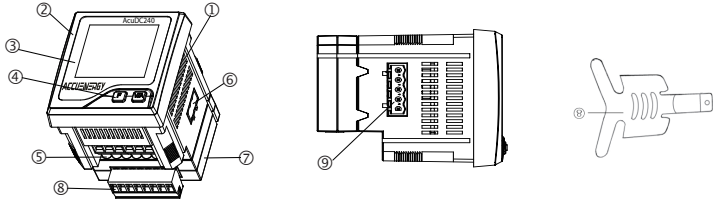


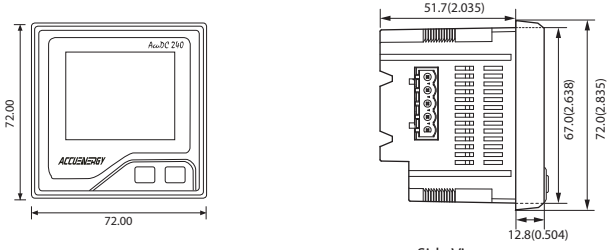
Figure 2-1 AcuDC 240 Appearance

Part	Description
①Casing	High intensity fire resistant engineering plastics
②Front Casing	Visible portion after mounting onto a panel.
③Display	Large LCD display
④Key	Two keys are used to select display and set
⑤Voltage Input Terminals	Used for voltage input
⑥Communication Terminals	Communication output
⑦IO Module	Optional IO module
⑧IO Terminal	Optional IO terminals, including 2DI,2AO/2RO
⑨Power Supply Terminals	Power Supply Terminal
⑩Installation Clips	Used for securing the meter to the panel

Table 2-1 Part name of AcuDC 240

2.1.2 Dimensions

Unit:mm(inch)



Front View

Side View

Figure 2-2 AcuDC 240 Dimensions

2.2 Installation Methods

Environmental

Alert

The installation enviorment must fulfill the designated termperature, humidity and location. Otherwise the meter will cause damage.

Before installation, please check the environment, temperature and humidity to ensure the AcuDC 240 series meter is being placed where it will not be damaged.

1. Termperature

AcuDC 240 operation temperture is -25°C~70°C, which will meet general user's requirements. If a larger temperature range is needed, please contact Accuenergy. Please note it can influence the meter life negatively if the meter operates in extremly high or extremly low temperature environments. AcuDC 240 storage temperature range is -40°C~85°C.

2. Humidity

5% to 95% non-condensing

3. Location

AcuDC 240 series meter should be installed in a dry and dust free environment. Avoid exposing meter to excessive heat, radiation and high electrical noise sources.

Installation Steps:

AcuDC 240 series power meter is generally installed into the switchboard panel.

1. Cut a square hole (standard DIN). See Figure 2-3 for dimensions. Unit: mm

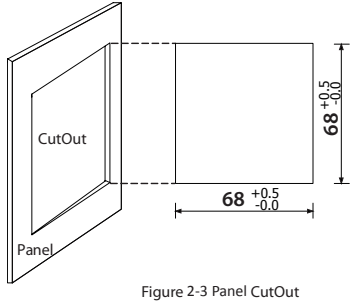


Figure 2-3 Panel CutOut

2. Remove the clips from the meter, and insert the meter into the square hole from the front side.

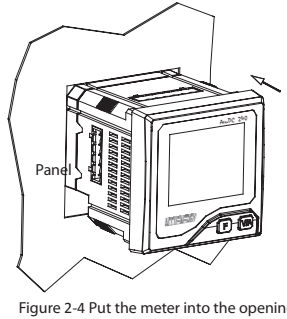


Figure 2-4 Put the meter into the opening

3. Install clips on the back side of the meter and secure tightly to ensure the meter is affixed to the panel. See Figure 2-5.

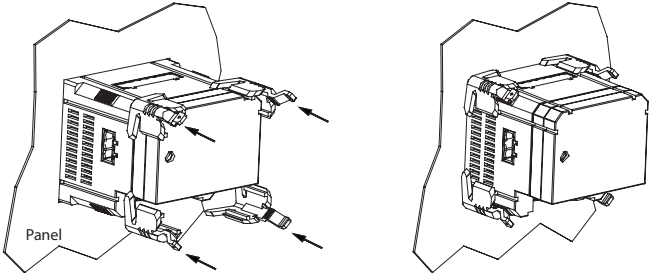


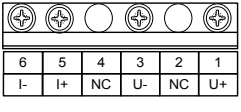
Figure 2-5 Install the clips

2.3 Wiring

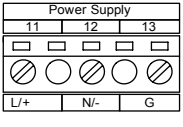
Terminal Strips

There are 3 groups of current terminal strips. There will be another terminal strip if the meter is connected with the I/O module.

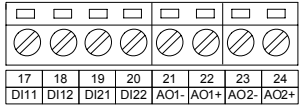
Voltage, Current terminal strip



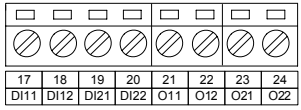
Power Supply terminal strip



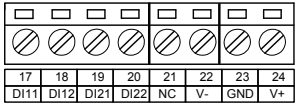
I/O terminal strip (2DI+2AO)



I/O terminal strip (2DI+2RO/2DO)



IO terminal strip(2DI+±15V)



Communicaton terminal strip

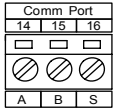


Figure 2-6 AcuDC 240 terminal strip

Safety Earth Connection

DANGER

Only qualified professionals should install, make sure the power supply is cut off and all wires are de-energized. Failure to do so may result in severe injury or death.

Before setting up the meter's wiring, please make sure that the switchgear has an earth ground terminal. Connect both the meter's and the switchgear's ground terminal together. The following ground terminal symbol is used in this user's manual.

FIgure 2 -7 Grouding Sign

Power Supply

Alert

Make sure the power supply meets the standard of the power supply voltage on the meter's nameplate.

AcuDC 240 series meter power supply is 100-240Vac(50/60Hz) or 100-300Vdc,which is universally supported. Please contact us for other voltage options. The meter's typical power consumption is very low and can be supplied by an independent source or by the measured load line. A regulator or an uninterrupted power supply (UPS) should be used under high power fluctuation

conditions. The power supply terminals are 11, 12, 13(L, N, G).

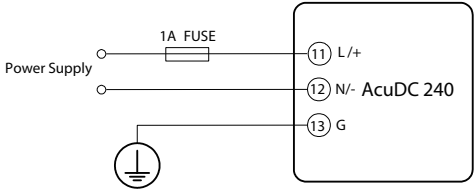


Figure 2-8 Power Supply Wiring

The independent power supply circuit loop must have a fuse or air circuit breaker. The fuse could be 1A/250Vac, time delay type. If circuit breaker is used, a CE certified product with compliance of IEC947 is recommended.

Terminal G (13) must be connected to the ground for safety purposes.

An isolated transformer or EMC flter should be used in the auxiliary power supply loop if there is a power quality problem in the power supply.

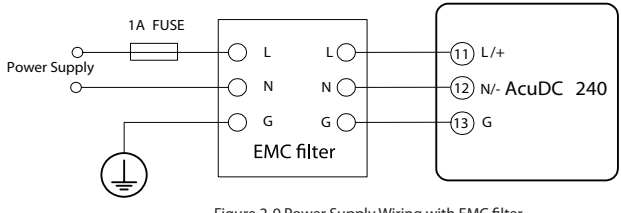


Figure 2-9 Power Supply Wiring with EMC filter

The wire size for the power supply is AWG16~22 or 0.6~1.5mm^2.

Voltage Input

AcuDC240 has two voltage input options: Direct Input and Via Hall Sensor. The wire size for the voltage input is AWG16-22 or 0.6-1.5mm^2. Please see the wiring diagrams for details.

Voltage Wiring

Two ways: Direct Input and Via Hall Sensor

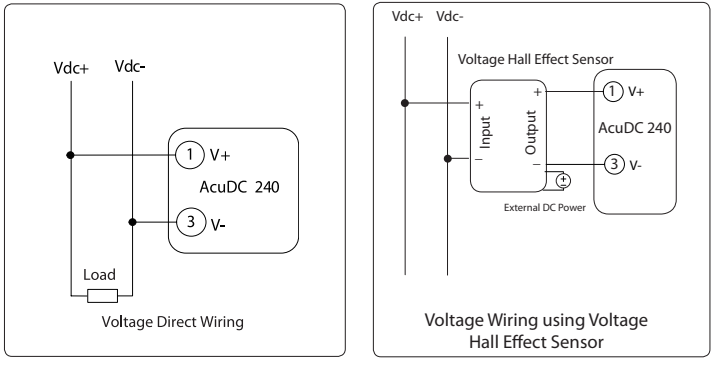
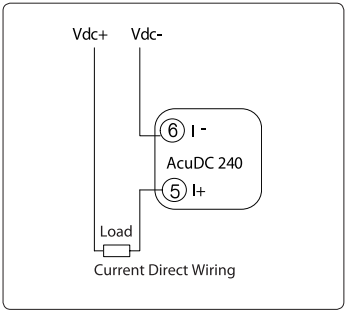


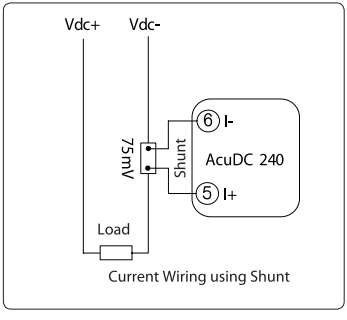
Figure 2-10 Voltage Input

Current Input

Current Wiring

Three ways: Direct Input, Via Shunt, Via Hall Effect Sensor





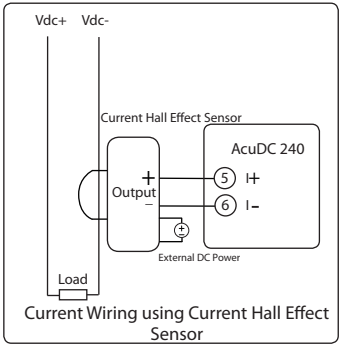
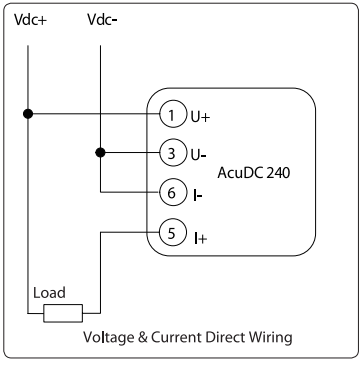
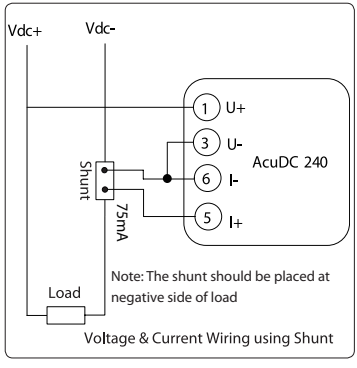


Figure 2-11 Current Input

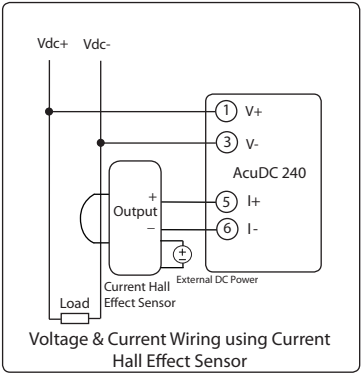
When voltage and current are wired at the same time:



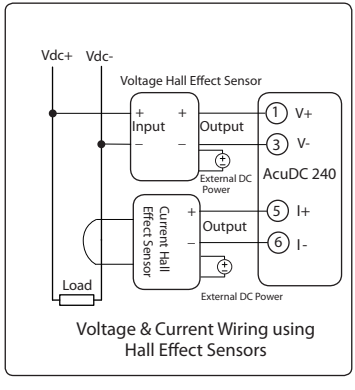
Voltage & Current Direct Wiring



Voltage & Current Wiring using Shunt



Voltage & Current Wiring using Current Hall Effect Sensor



Voltage & Current Wiring using Hall Effect Sensors

Note:The load's negative must be connected to meter's current input terminal.Current output terminal should be connected to the system's negative. The load is serially connected to the meter or the shunt.

The current input wire size is AWG15-16 or 1.5-2.5mm^2 or equivalent resistance wire.

Communication

AcuDC 240 series meter uses RS485 serial communication and the Modbus-RTU protocol. The terminals of communication are A, B, and S (14, 15 and 16). A is diferential signal +, B is diferential signal - and S is connected to the shield of twisted pair cable. The overall length of the RS485 cable connecting all devices can not exceed 1200m (4000ft). Utilizing a large number of RS485 devices and utilizing a high baud rate will make the communication range shorter. AcuDC 240 works as Slave device. Maser device can be PC, PLC, Data Acquisition Device, or RTU.

In order to improve communcation quality, please pay attention to the following:

☞ A high-quality Shielded Twisted Pair cable is very important, AWG22 (0.6mm^2) or lower is recommended. Two cables should be different colors.

☞ Pay attention to "single point earthing". It means there is only one point of the shielding connected to ground in a single communication link.

☞ Every A(+) should be connected to A(+), B(-) to B(-), or it will infuence the network and possibly damage the communication interface.

☞ “T” type connection topology should be avoided. This means no new branches except from the starting point.

☞ Keep communication cables away as much as possible from sources of electrical noise.

☞ When several devices are connected to the same long communication line, an anti signal reflecting resistor (typical value 120-300Ohm 0.25W) is often used at the end of the circuit (the last meter of the chain) if the communication quality is distorted.

☞ If a RS485 converter is used, it should support optical isolation and surge protection.

Digital Input

AcuDC 240 optional I/O module is equipped with two dry contact digital inputs. The terminals are DI11(17), DI12(18), DI21(19), DI22(20). The circuit is simplified as:

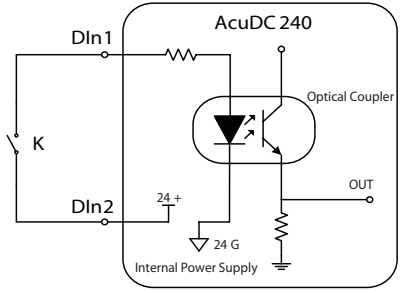


Figure 2-13 Digital Input

When the Switch is open, there is no current flow in the diode side of the optical coupler, the triode is off, OUT is in low state. When the Switch is closed, there is current flow in the diode side, the triode is on, OUT is in high state. In this way, the "high" and "low" state of OUT correspondes to "closed" and "open" state of the switch.

I/O module has built in power supply, digital input does not require external power supply. DI wire size is AWG22-16 or 0.5-1.5mm^2.

Analog Output

AcuDC 240 I/O module offers two Analog Outputs. The output type is 0-20mA/4-20mA(max 24mA), 0-5V/1-5V(max 6V)(as Figure 2.14 shows). Each module can only have one type of output, please specify when ordering.

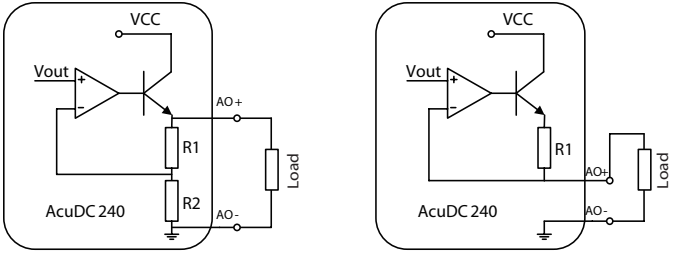


Figure 2-14 Analog Output

Analog Output can be used for scaling current, voltage, power. The output type is fixed (0-20mA/4-20mA or 0-5V/1-5V), the output range can be configured.

AcuDC 240 series can be configured via pressing the buttons on the meter. The meter with communication option can be configured via our software.

1. Select AO parameter.

2. Set AO upper and lower limits. For voltage, it can be set as 0% - +100%. For current and power, it can be set as 0% - +100%, 0% - -100%,-100% - +100% and 0 - ±100%. Selecting the proper upper and lower limits improves AO accuracy and efficiency.

3. The relationship between AO and its related parameter:

1:Voltage Type

$$0\sim5V:AO=\frac{\frac{\text{Measured Value}}{\text{Full Range Value}}\times 100\%-\text{Lower Limit}}{\text{Upper Limit}-\text{Lower Limit}}\times 5V$$

$$1\sim5V:AO=1+\frac{\frac{\text{Measured Value}}{\text{Full Range Value}}\times 100\%-\text{Lower Limit}}{\text{Upper Limit}-\text{Lower Limit}}\times 4V$$

2:Current Type

$$0\sim20mA:AO=\frac{\frac{\text{Measured Value}}{\text{Full Range Value}}\times 100\%-\text{Lower Limit}}{\text{Upper Limit}-\text{Lower Limit}}\times 20mA$$

$$4\sim20mA:AO=4+\frac{\frac{\text{Measured Value}}{\text{Full Range Value}}\times 100\%-\text{Lower Limit}}{\text{Upper Limit}-\text{Lower Limit}}\times 16mA$$

Note: for current and power 0 - ±100% limit setup, use absolute value for calculation:

$$\frac{\frac{|\text{Measured Value}|}{\text{Full Range Value}}\times 100\%-|\text{Lower Limit}|}{|\text{Upper Limit}|-|\text{Lower Limit}|}$$

$$\frac{\frac{-(\text{Measured Value})}{\text{Full Range Value}}\times 100\%-|\text{Lower Limit}|}{|\text{Upper Limit}|-|\text{Lower Limit}|}$$

for current and power 0 - 100% limit setup, use reversed polarity of Measured Value for calculation:

4. AO parameter code is listed in the following table.

Code	Parameter
0	Voltage
1	Current
2	Power

Table 2-3 AO parameter code

The following are a few examples:

(1)AO is voltage type:

Set AO parameter as Voltage, Upper Limit is 100%, Lower Limit is 0%, Full Range Value is 600V. When the Measured Value is 300V, AO is

$$AO = \frac{\frac{\text{Measured Value}}{\text{Full Range Value}} \times 100\% - \text{Lower Limit}}{\text{Upper Limit} - \text{Lower Limit}} \times 5 = \frac{\frac{300}{600} \times 100\% - 0\%}{100\% - 0\%} \times 5 = 2.5\ \text{V}$$

(2)AO is voltage type:

Set AO parameter as Current, Upper Limit is 100%, Lower Limit is -100%, Full Range Value is 20A. When the Measured Value is -10A, AO is:

$$AO = \frac{\frac{\text{Measured Value}}{\text{Full Range Value}} \times 100\% - \text{Lower Limit}}{\text{Upper Limit} - \text{Lower Limit}} \times 5 = \frac{\frac{-10}{20} \times 100\% - (-100\%)}{100\% - (-100\%)} \times 5 = 1.25\ \text{V}$$

(3)AO is current type:

Set AO parameter as Current, Upper Limit is -100%, Lower Limit is 0%, Full Range Value is 20A. When the Measured Value is -10A, AO is:

$$AO = 4 + \frac{\frac{-(\text{Measured Value})}{\text{Full Range Value}} \times 100\% - |\text{Lower Limit}|}{|\text{Upper Limit}| - |\text{Lower Limit}|} \times 5 = \frac{\frac{-(-10)}{20} \times 100\% - 0\%}{100\% - 0\%} \times 16 = 12\text{mA}$$

(4)AO is current type:

Set AO parameter as Power, Upper Limit is ±100%, Lower Limit is 0%, Full Range Value is 12kW. When the Measured Value is -6kW, AO is:

$$AO = 4 + \frac{\frac{-(\text{Measured Value})}{\text{Full Range Value}} \times 100\% - |\text{Lower Limit}|}{|\text{Upper Limit}| - |\text{Lower Limit}|} \times 5 = 4 + \frac{\frac{|-6|}{12} \times 100\% - 0\%}{100\% - 0\%} \times 16 = 8\text{mA}$$

Note:

1. For -100% - +100% setup, the Upper Limit value must be larger than the Lower Limit value. For all other setup, the absolute value of Upper Limit must be larger than the absolute value of Lower Limit. All Upper Limits cannot be set as 0%.

2. When the Measured Value is out of the Lower Limit, AO will be 0V/1V or 0mA/4mA. When the Measured Value is out of the Upper Limit, AO will be larger than 5V/20mA, but the maximum will be 6V/5.8V or 23.2mA/24mA.

Relay Output

AcuDC 240 series IO option has two relay outputs, which are terminal R11(21), R12(22) and R21 (23), R22 (24). They can be used to remotely control circuit breakers.

The relay outputs are Form A (normally open) electromagnetic relay. The nodal capacity is 3A/250Vac or 3A/30Vdc. If the coil current is high, a medium replay is recommended.

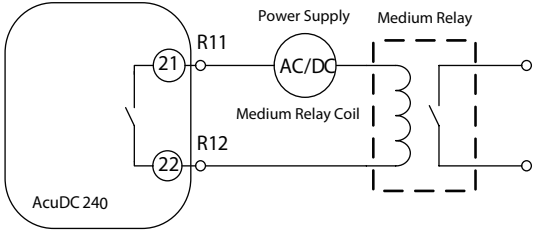


Figure 2-15 Relay Output

The wire size for the relay output circuit loop is AWG22~16or0.5~1.3mm^2.

The relay outputs have three options. One is Latch Mode: the output is "ON" and "OFF" state; the other is Momentary Mode, the output changes from "OFF" to "ON", holding it for a time period "Ton" and then go back to "OFF" state. Ton time can be set as 300-5000 ms.

The 3rd one is Alarm Mode,please refer to the next chapter for details.

Alarm Output

AcuDC 240 series offers over/under limit alarming function. When the monitored parameter goes beyond/below the preset limit and stays at the level over the preset amount of time delay, the over/under limit alarm will be triggered. RO1 and RO2 can be arbitrarily assigned to the alarm event. When an alarm happens, the corresponding relay will be closed.

Alarming setup steps:

Select the designated relay output(RO1/RO2)and set the relay type to alarm mode(set as 2).

1. Set the alarming parameter.
2. Set the alarming inequality. (0: smaller than; 1: larger than).
3. Set the threshold value.
4. Set the delay time(the minimum unit is second, the range is 0-255s)

Example:

Alarm condition is set for current larger than 10A. In a delay time of 15s, send alarm signal via RO1.

Steps:

1. Set RO1 as alarm mode (set RO1 mode as 2).
2. Select alarm parameter as current (set alarm parameter code as 2).
3. Set alarm inequality as larger than (set the inequality sign as 1).
4. Set the alarm threshold value as 10.

5. Set the delay time as 15 seconds.

Setting is completed. When the current is larger than 10A and lasts more than 15 seconds, RO1 will send out alarm signal.

Positive and negative output power

AcuDC 240 series meter can choose to contain positive and negative output power of IO module, standard ±15V power output, power 2W.Positive and negative power supply power supply is mainly used to give hall sensor, wiring method as shown in figure 2.16

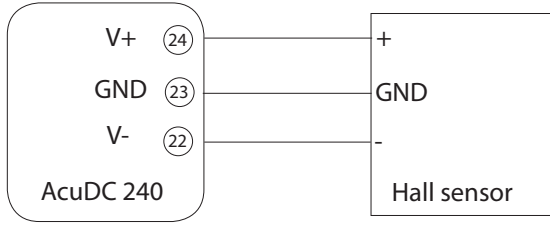


Figure 2-16

Chapter 3 Meter Display and Operation

Operational details of the meter will be described in this chapter. This includes viewing real-time metering data and setting parameters using different key combinations.

3.1 Display Panel and Keys

The front of the AcuDC 240 series meter consists of an LCD screen and two control keys. All display segments are shown in Fig. 3-1 below:

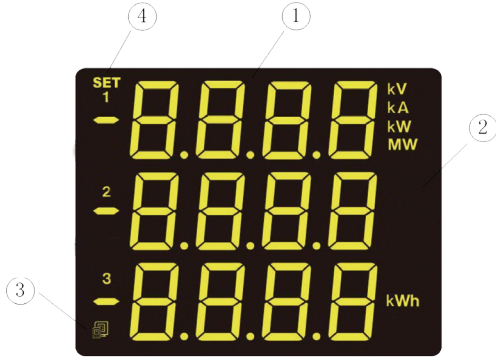


Figure 3-1 All display segments

Number	Display	Description
1		Displays data of voltage, current, power, energy.
2	kV,kA,kW,MW,Hz,kvar, Mvar,kVA,MVA,kWh ,kvarh,kVAh	Data unit.
3	 Communication	No icon: no communication; One icon: query sent Two icons: query sent and response received
4		Settings Mode Indicates the meter is in Settings Mode.

Table 3-1 LCD Display

There are two keys on the front panel, marked as "F" key and "V/A" key. Use these two keys to display different parameter data and parameter settings.

3.2 Metering Data

AcuDC 240 normally works in data display mode, which shows real-time measured data, such as voltage, current, power.

Voltage Meter Display

Figure 3-2 Voltage Display

For AcuDC 241, it only displays voltage. U=220.2V.

Current Meter Display

Figure 3-3 Current Display

For AcuDC 242, it only displays current. I=49.99A.

Multifunction Meter Display

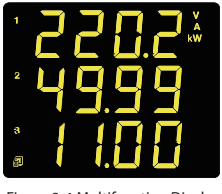


Figure 3-4 Multifunction Display

For AcuDC 243, the screen displays voltage, current and power. The first line displays voltage, the second line diplays current, the third line displays power.
U=220.2V, I=49.99A, P=11KW; Communication status is active.

Note:Communication status is displayed on every screen.

Figure 3-5 Positive Energy Display

1st screen: Positive Energy. E_pos=68.32kWh.
Press "V/A" to scroll to the 2nd screen.

Figure 3-6 Negative Energy Display

2nd screen: Negative Energy. E_neg=25.58kWh.
Press "V/A" to scroll to the 3rd screen.

Figure 3-7 Total Energy Display

3rd screen:Total Energy. E_total=93.90kWh.
Press "V/A" to scroll to the 4th screen.

Figure 3-8 Net Energy Display

4th screen: Net Energy. E_net=47.74kWh.
Press "V/A" to scroll to return to the 1st screen.

Press"F"scroll to Ah Display when on the Energy display

Figure3-9 Positive Ah Display

1st screen: Positive Ah. Ah_pos=75.23Ah.
Press"V/A"to scoll to the 2nd screen.

Figure3-10Negative Ah Display

2nd screen: Negative Ah. Ah_neg=18.01Ah.
Press"V/A"to scoll to the 3rd screen.

Figure 3-11 Total Ah Display

3rd screen: Total Ah.Ah_total = 92.24Ah
Press"V/A"to scoll to the 4th screen.

Figure 3-12 Net Ah Display

4th screen:Net Ah.Ah_net = 57.22Ah
Press"V/A"to scroll to return to the 1st screen

If the meter have storage capabilities, Press the "F" key can scroll to the date/time display screen.

Figure 3-13 Date display

1st screen: As shown in figure display: 2014-04-09.
Press"V/A"to scoll to the 2nd screen.

Figure 3-14 Time display

2nd screen Time Display screen. As shown in figure display: 14:19:52.
Press"V/A"to scroll to return to the 1st screen

If you choose to have DI counting function, press the "F" key can switch to the DI count display screen.

Figure 3-15 DI1 Count display

1st screen: DI1 Count display screen. As shown in figure shows that DI1 count: 716832.
Press"V/A"to scoll to the 2nd screen.

Figure 3-16 DI2 Count display

2nd screen: DI2 Count display screen. As shown in figure shows that DI1 count: 648362.
Press"V/A"to scoll to the 1st screen.

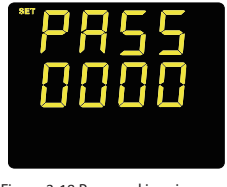
3.3 System Parameter Settings

Pressing "F" and "V/A" simultaneously will activate the parameter setting mode.

In parameter setting mode, "F" key is used to increase value by one for the flashing digit. "V/A" key is used to confirm the flashing digit and move the cursor. At the last digit of the parameter, pressing "V/A" key will confirm and go to the next screen. On any screen, pressing "F" and "V/A" simultaneously will exit system parameter settings mode and return to the metering data mode.

When entering the parameter settings mode via pressing "F" and "V/A", the first screen is device address screen. As the left figure shows, the current device address is 1. After 1 second, the screen will scroll to the password screen.

Figure 3-17 Device address screen display



Parameter settings mode is password protected. A four digit password (0000 to 9999) is required before accessing the parameter settings mode. The factory default password is 0000. After entering the password, press "V/A" to go to the parameter selection page. The meter will return to the metering mode if a wrong password is entered.

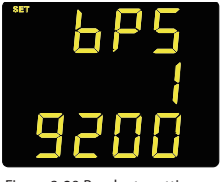
Figure 3-18 Password inquiry page

The following illustration is using AcuDC 243 as an example.

1st screen: Communication address setup. It is used to set communication address, which can be any integer 1-247. The left figure shows the address is 1. To change: press "F" to add one to the flashing digit. Press "V/A" to confirm and move the flashing digit. At the last digit, press "V/A" to save and go to the next screen.

Figure 3-19 Communication address setup

Note: Modbus-RTU communication protocol requires that all meters on the same bus should have different addresses.



2nd screen: Baud rate setting page. Baud rate can be set as 1200, 2400, 4800, 9600, 19200, 38400. The figure on the left indicates the baud rate is 19200 bps. Baud rate editing is not by digit, simply press "F" key to select the desired baud rate. Press "V/A" to go to the next screen.

Figure 3-20 Baud rate setting page

Note: Only meters with communication options have device address, baud rate and parity setting screens.

3rd screen: Parity setting page. It can be set as Even, Odd, None 1, None 2. Even: even parity, 1 stop bit; Odd: odd parity, 1 stop bit. None 1: no parity, 1 stop bit; None 2: no parity, 2 stop bits. Press ”F”to select. Press “V/A” to go to the next screen.

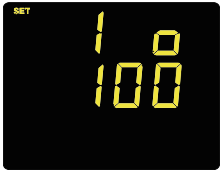
Figure 3-21 Parity setting page

Note: All devices on the same communication bus should use the same baud rate and parity settings.

4th screen: full range current setting. Range: 20-50000, unit is A. Press “F” and “V/A”to edit the vaule. Press “V/A”at the last digit to go to the next screen.

Note: only indirect current wiring has this screen.

Figure 3-22 full range current setting



5th screen: full range shunt setting. Range: 50-100, unit is mV. Press “F” and “V/A”to edit the vaule. Press “V/A”at the last digit to go to the next screen.

Note: only the current wiring via external shunt has this screen.

Figure 3-23 full range shunt setting

6th screen: current hall effect sensor setting. Two modes: 0: 0 - ±5V/4 - 20mA. 1: 0 - ±4V/4-12-20mA. Press "F" key to select. Press “V/A” to go to the next screen.

Note: only the current wiring via current hall effect sensor has this screen.

Figure 3-24 current hall effect sensor setting

7th screen: full range voltage setting. Range: 5-1200, unit is V. Press “F” and “V/A”to edit the vaule. Press “V/A”at the last digit to go to the next screen.

Figure 3-25 full range voltage setting

8th screen: voltage hall effect sensor setting. Two modes: 0: 0 - ±5V;1:0 - ±4V. Press "F" key to select. Press "V/A" to go to the next screen.

Note: only the voltage wiring via voltage hall effect sensor has the above two screens.

Figure 3-26 voltage hall effect sensor setting

9th screen: clear Energy. Display "YES"or "NO", "YES" means clear, "NO" means not clear, Press "F" key to select. If "YES" is selected, and then press "V/A", energy will be cleared to 0.

Figure 3-27 clear Energy

10th screen: clear Ah. Display "YES" or "NO", "YES" means clear, "NO" means not clear, Press "F" key to select. If "YES" is selected, and then press "V/A", Ah will be cleared to 0.

Figure 3-28 clear Ah

11th screen: DI counter reset. Display "YES" or "NO", "YES" means clear, "NO" means not clear, Press "F" key to select. If"YES"is selected, and then press"V/A", DI counter will be cleared to 0.

Figure 3-29 DI counter reset

Figure 3-30 backlight brightness setting

12th screen: backlight brightness setting. 5 levels of backlight brightness. 1 is minimum light level, 5 is maximum light level. Press "F" key to select. Press "V/A" to go to the next screen.

Figure 3-31 Date adjustment

13th screen: Date adjustment. This page is only in data storage function of meter. Press the "F" key to adjust the numerical, press "V/A" key switch digits and decide.

Figure 3-32 Time adjustment

14th screen: Time adjustment. This page is only in data storage function of meter. Press the "F" key to adjust the numerical, press "V/A" key switch digits and decide.

Figure 3-33 password settings

15th screen: password settings. This is the last screen in system parameter setting mode. The password can be changed in this page. Press "F" and "V/A" to edit the vaule. Press "V/A" at the last digit to return to the 1st screen.

By now the parameter settings are completed. Pressing “F” and “V/A” simultaneously will exit system parameter settings mode and return to the metering data mode.

3.4 I/O Parameter Settings

For meters with I/O module, under system parameter settings mode, hold “F” key for 3 seconds to enter I/O settings mode. In I/O settings mode, key functions are the same as the one in system parameter settings mode. “F” key is used to increase value by 1 for the flashing digit. “V/A” key is used to confirm the flashing digit and move the cursor. At the last digit of the parameter, pressing “V/A” key will confirm and go to the next screen. On any screen, pressing “F” and “V/A” simultaneously will exit I/O parameter settings mode and return to the system parameter settings mode.

I/O module has two types: AO type and RO type.

For AO type module, it offers two channel AO, which can be selected as voltage or current type. AO parameter can be voltage, current and power. AO upper and lower limits include "sign" and "percentage" digit. The sign digit has three options: **+** represents(+), **-** represents(-), **±** represents(±). The percentage digit's range is "0.00-1.00", representing "0%-100%".

When AO parameter is set as voltage, the upper and lower limit setting is "0%-100%". When AO parameter is set as current or power, there are four modes:“0% - +100%”;“0% - -100%”;“-100 - +100%”and“0% - ±100%.

Note:

1. there is no "sign" digit when AO is set as voltage. "sign" digit is invisible when percentage is 0.

2. For limit setting,1.00 is 100%,0.00 is 0%,0.25 is 25%.

Figure 3-34 AO1 parameter setting

1st screen: AO1 parameter setting. Three options: 0 , volage; 1, current ; 2 , power. Press "F" key to select. Press "V/A" to go to the next screen. The figure shows AO1 is set as current.

Note: 241 and 242 meter do not have this screen. AO1 is set as what is being measured.

Figure 3-35 AO1 lower limit setting

2nd screen: AO1 lower limit setting. Range: "0.00 - 1.00". There is no "sign" digit when the limit is 0. When the limit is not 0, "sign" digit will be visible, the sign can be adjusted by moving the cursor to the digit. Press "F" and "V/A"to edit the vaule. Press "V/A"at the last digit to confirm and go to the next screen.
The figure shows the lower limit is 0%.

Figure 3-36 AO1 upper limit setting

3rd screen: AO1 upper limit setting. Except"-100% - +100%", all the other upper limit's absolute value cannot be smaller or equal to the lower limit's. Under no circumstance can the upper limit be 0. Press "F" and "V/A"to edit the vaule. Press "V/A"at the last digit to go to the next screen.
The figure shows the upper limit is +100%.

4th screen: AO2 parameter setting. Three options: 0 , volage ; 1 , current ; 2 , power . Press "F" key to select. Press "V/A" to confirm and go to the next screen. The figure shows AO2 is set as voltage.

Note: 241 and 242 meter do not have this screen. AO2 is set as what is being measured.

Figure 3-37 AO2 parameter setting

5th screen: AO2 lower limit setting. Range:"0.00 - 1.00". There is no "sign" digit when AO2 is set as voltage. Press "F" and "V/A"to edit the vaule. Press "V/A" to confirm and go to the next screen. The figure shows the lower limit is 0%.

Figure 3-38 AO2 lower limit setting

6th screen: AO2 upper limit setting. Except"-100% - +100%", all the other upper limit cannot be smaller or equal to the lower limit. There is no "sign" digit when AO2 is set as voltage. Press "F" and "V/A"to edit the vaule. Press "V/A to confirm and go to the next screen. The figure shows the upper limit is 100%.

Figure 3-39 AO2 upper limit setting

RO type IO module offers two RO. There are three modes for RO: Latch, Momentary and Alarm. The mode setting depends on the object requirement. A circuit breaker uses Momentary. The momentary delay time is 300 -5000 ms. Due to the relay action time error, this delay time has up to 3 ms time error.

Figure 3-40 RO1 mode setting

1st screen: RO1 mode. Three modes : 0 , Latch ; 1 , Momentary ; 2 , Alarm . Press "F" key to select. Press "V/A" to confirm and go to the next screen.

Figure 3-41 RO1 momentary mode setting

2nd screen: when RO1 mode is set as Momentary mode, the 2nd screen is momentary delay time. The range is"300 - 5000 ms". Press "F" and "V/A"to edit the vaule. Press "V/A" to confirm and go to the next screen.

Figure 3-42 RO1 alarm parameter setting

3rd scrreen: RO1 alarm parameter when RO is set as Alarm mode. 0, no alarm; 1. voltage; 2. current; 3. power. Press "F" key to select. Press "V/A" to confirm and go to the next screen.

Figure 3-43 RO1 alarm inequality setting

4th screen: RO1 alarm inequality setting. 1, larger than; 0,smaller than. Press "F" key to select. Press "V/A" to confirm and go to the next screen.

5th screen: RO1 alarm threshold setting. The threshold setting range is the same as the measurement range. Voltage: 0-1200, Current: 0-50000,Power 0-60000. Press "F" and "V/A" to edit the vaule. Press "V/A" to confirm and go to the next screen.

Figure 3-44 RO1 alarm threshold setting

6th screen: RO1 alarm delay time 0-255,unit: second. The left figure shows the delay time is 15. When the alarm condition is met, after 15 seconds, alarm will be triggered. Or when the alarm condition is no longer met, after 15 seconds, the alarm will be restored. Press "F" and "V/A"to edit the vaule. Press "V/A" to confirm and go to the next screen.

Figure 3-45 RO1 alarm delay setting

7th screen: RO2 mode. Three modes: 0, Latch; 1, Momentary; 2, Alarm. Press "F" key to select. Press "V/A" to confirm and go to the next screen.

Figure 3-46 RO2 mode setting

8th screen: when RO2 mode is set as Momentary mode, the 2nd screen is momentary delay time. The range is"300 - 5000 ms". Press "F" and "V/A" to edit the vaule. Press "V/A" to confirm and go to the next screen.

Figure 3-47 RO2 momentary mode setting

9th screen: RO2 alarm parameter when RO is set as Alarm mode. 0, no alarm; 1, voltage; 2, current; 3, power. Press "F" key to select. Press "V/A" to confirm and go to the next screen.

Figure 3-48 RO2 alarm parameter setting

10th screen: RO2 alarm inequality setting. 1, larger than; 0, smaller than. Press "F" key to select. Press "V/A" to confirm and go to the next screen.

Figure 3-49 RO2 alarm inequality setting

11th screen: RO2 alarm threshold setting. The threshold setting range is the same as the measurement range. Voltage: 0-1200,Current: 0-50000,Power 0-60000. Press "F" and "V/A" to edit the vaule. Press "V/A" to confirm and go to the next screen.

Figure 3-50 RO2 alarm threshold setting

Figure 3-51 RO2 alarm delay setting

12th screen: RO2 alarm delay time 0-255,unit: second. The left figure shows the delay time is 15. When the alarm condition is met, after 15 seconds, alarm will be triggered. Or when the alarm condition is no longer met, after 15 seconds, the alarm will be restored. Press "F" and "V/A"to edit the vaule. Press "V/A" to confirm and go to the next screen.

In I/O parameter settings mode, pressing "F" and "V/A" simultaneously will exit and return to the system parameter settings mode.

3.5 Meter Information Display

In metering data mode, hold"F"key for 3 seconds to go to meter information display mode.

Figure 3-52 meter running hour display

1st screen: meter running hour display. It is the accumulated running hours of the meter since being powered up. The unit is hour. The left figure shows the meter running hour is 1471.32 hours.

Press "V/A" key to switch to load running hour display screen. Press "F" key to return to metering data mode.

Note: Current meter does not have this screen.

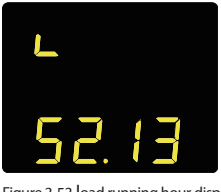


Figure 3-53 load running hour display

2nd screen: load running hour display. The running hour of the load connected with the meter. In other words, it is the accumulated hours where the current value has not been 0. Unit: hour. The left figure shows the load running hour is 52.13 hours.

Press "V/A" key to switch to meter running hour display screen. Press "F" key to return to metering data mode.

Note: Voltage meter does not have this screen.

Figure 3-54 meter serial number display

In the metering data mode, hold "V/A" key for 3 seconds to enter meter serial number display mode.

It displays the last 8 digits of the meter serial number. The left figure shows the meter serial number is DC12012501.
Press "V/A" key to return to the metering data mode.

Chapter 4 Function Introduction

This chapter will introduce you to the use of the important functions, many advanced features can't separate through the button control, need to interact through communication.

4.1 The basic function

AcuDC 240 series meter can measure dc voltage, current, power, Energy, Ah, etc..

1. Energy

AcuDC 243 type meter has the function of electric energy metering electricity measurement is divided into four parameters, positive energy, negative energy, total energy and net energy.

Positive energy is current through the meter is to measure the energy generated cumulative values;

Negative energy is current through the meter in reverse the energy generated cumulative values;

Total energy is Positive energy and the absolute value of negative energy and;

Net energy is Positive energy and the negative energy difference value;

2. Ah

AcuDC 243 type meter has the function of Ah measuring when the measurement is divided into four parameters, positive Ah, negative Ah, total Ah and net Ah.

Positive Ah is current through the meter is to measure the Ah generated cumulative values;

Negative Ah is current through the meter in reverse the Ah generated cumulative values;

Total Ah is Positive Ah and the absolute value of negative Ah and;

Net Ah is Positive Ah and the negative Ah difference value;

4.2 DI counting function

AcuDC 240 series meter can be set up the DI of the I/O module to counting mode, can be cumulative number of DI input pulse signal. Count value can see through communication, also through the meter button to view. Count value can be reset by communication or meter button operation.

4.3 Max/Min

With the function of data storage AcuDC 243 meter logs maximum and minimum value statistics for voltage, current and power as well as the time they occur. All data is stored in non-volatile memory so that statistic information can be preserved even when meter is shut off. All maximum and minimum data can be accessed via communication or from the meter front but time stamps can only be accessed via communication. Statistics can be cleared via communication or from the meter front.

4.4 Data Logging

The AcuDC 243 meter which has the data storage provides data logging that records the data at a set interval. This meter has 4 MegaBytes of memory which gives it extensive data-logging capabilities. It has a real-time clock that allows logs to be time-stamped when log events are created.

1. Data log settings

The AcuDC 243 meter can set up 13 parameters most. The parameters are voltage, current, power, positive energy, negative energy, total energy, net energy, positive Ah, negative Ah, total Ah net AH, DI1 count value and DI2 count value. The user can according to need to set the required parameters, usually set the data log need to set up the following contents:

1) Enable data logging

If enable the data logging, the meter can log the data according to the set,else the meter

can't log the data in any conditions

2) Three Modes of historical log:

A. Mode1: if correctly set historical log, can record without setting date and time, depending on firs-in firs-out recycling log.

B. Mode2: if correctly set historical log, as set date and time, can record within begin to end time. Record will stop after buffer is full.

C. Mode3: if correctly set historical log, as set hour and minute, only can record while the running time is equal to setting hour and minute, depending on firs-in firs-out recycling log.

3) Set the logging interval (in minutes).

Interval can be set from 0 - 1440 minutes according to different application.

4) Start time and enf time

Only used on mode 2. Set the start time and end time of data logging.

5) Start time

Only used on mode 3. Set the start time of data logging.

6) Select the parameters

Select the parameters which need to log from the 13 parameters.You can select one parameter, also can select all 13 parameters.

2. Read the data logging

There are two ways of retrieving the logs: "read one window" and "read all".

In the "read one window", you can according to need to set up the initial log number of read and each window contains the number of logs. You must set the Initial log number

berfor the oldest log number and the newest log number. The "window record num" is the maximum number of record entries the software can read at a time, it is calculated by 240 / Record Size. You can read less than or equal to the maximum number of logs. If you read the the number of logs equal to the number of the window, the initial log number will automatically increase the number of a window.

The "read all" method accesses and reads the historical data log automatically, the initial log number will automatically increaseuntil all the logs are retrievcd.

Chapter 5 Communication

This chapter will mainly discuss how to operate the meter via communication port using software. To master this chapter, you should be familiar with Modbus and read other chapters of this manual to make sure that you have a good understanding of the functions and applications of this product.

This chapter includes: Modbus protocol, communication format and communication address table.

5.1 MODBUS-RTU Protocol

Modbus RTU protocol is used for AcuDC 240's communication. Data format and error check methods are defined in Modbus protocol. The half duplex query and respond mode is adopted in Modbus protocol.

Modbus allows master device (PC, PLC etc.) to communicate with slave devices, it will not allow data exchange between slave devices. Therefore, terminal devices will not engage the communcation link at initialization, only responsed to the master's request.

1. Transmission mode

The mode of transmission defines the data structure within a frame and the rules used to transmit data.

▲ Coding System 8 bit

▲ Start Bit 1 bit

▲ Data Bits 8 bit

▲ Parity Even/Odd/None 2/None 1

▲ Stop Bit 1/2 bit

▲ Error Checking CRC

2. Modbus Protocol

2.1 Frame

When data frame reaches the terminal unit,the unit removes the data frame's header, reads the data, if there is no error, then it implements the data's task. Afterwards, the unit puts its own data with the acquired header, and sends back the frame to the sender. The response data frame contains: Address, Function, Data and CRC Check. Any error will cause a failure to respond.

Address	Function	Data	Check
8-Bits	8-Bits	N x 8-Bits	16-Bits

Table 5-1 Data Frame Format

2.2 Address Field

The address field is at the start of the frame. It is composed of 1 byte (8 bits), its decimal value range is 0-255.

A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

2.3 Function Field

When a message is sent from a master to a slave device the function code field tells the slave what kind of action to perform.

Code	Meaning	Action
01	Read RO status	Obtain Relay Output current status (ON/OFF)
02	Read DI status	Obtain Digital Input current status (ON/OFF)
03	Read holding register	Obtain current binary value of one or multiple registers
05	Control RO	Control Relay Output(ON/OFF)
16	Preset multiple registers	Place specifc binary value into multiple registers

Table 5-2 Function Code

2.4 Data Field

Data field contains the data that terminals need to complete the request and the data that terminals respond to the request. This data may be a numerical value, address or setting. For example, Function Code tells the terminal to read one register, Data Field needs to specify reading from which register and how many registers to read.

2.5 Error Check Field

The field allows the error check by master and slave devices. Due to electrical noise and other interferences, a group of data may be changed while transmitting from one location to the other. Error Check ensures master or slave devices do not respond to the distorted data during the transmission, which enhances the system security and efficiency. Error Check uses 16-bit Cyclic Redundancy Check (CRC 16).

2.6 CRC Check

Every message includes an error checking field which is based on the Cyclical Redundancy Check (CRC) method. The CRC field checks the contents of the entire message. It is applied regardless of any parity check method used for the individual characters of the message. The CRC field is two bytes long, containing a 16-bit binary value. The CRC value is calculated by the transmitting device, and is appended to the message.

The receiving device recalculates the CRC value during reception of the message, and compares the calculated value to the actual value it received in the CRC field.

An error will be reported if the two values are not equal. CRC calculation is first started by preloading the whole 16-bit register to 1's. The process begins by applying successive 8-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC.

When generating the CRC, each 8-bit character is exclusive ORed with the register contents. The result is shifted towards the least signifcant bit (LSB), with a zero filled into the most signifcant bit (MSB) position. The LSB is extracted and examined, if the LSB equals to 1, the register is exclusive ORed with a preset, fixed value; if the LSB equals to 0, no action will be taken. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8-bit byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied,the final contents of the register, which should exchange the high-byte and the low-byte, is the CRC value. When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

5.2 Communication Format

This chapter will illustrate the format indicated in Table 5-3 (Hex value).

Addr	Fun	Data start reg hi	Data start reg lo	Data #of regs hi	Data #of regs lo	CRC16 hi	CRC16 lo
06H	03H	00H	00H	00H	21H	84H	65H

Table 5-3 Protocol Illustration

Addr: Slave device address

Data start reg hi: Start register address, high byte

Data start reg lo: Start register address, low byte

Data #of reg hi: Number of registers, high byte

Data #of reg lo: Number of registers, low byte

CRC16 hi: CRC high byte

CRC16 lo: CRC low byte

1. Read Relay Output Status(Function Code 01)

Query

The master device sends query frame to the salve deivce. Function Code 01 allows users to acquire the relay output status (1=ON, 0=OFF) of the slave device with the specified address. Along with slave device address and function code, query frame must contain the relay register starting address and the number of registers to be read.

AcuDC 240 relay output address starts from 0000H(Relay1=0000H,Relay2=0001H)

Table 5.4 depicts reading Relay 1 and Relay 2 status from slave address 17.

Addr	Fun	DO start reg hi	DO start reg lo	DO #of regs hi	DO #of regs lo	CRC16 Hi	CRC16 Lo
11H	01H	00H	00H	00H	02H	BFH	5BH

Table 5-4 Query frame of reading Relay Output status

Response

The slave device anwsers the master device's query. The response frame contains slave device address, function code, data quantity and CRC check. Each relay utilizes one bit(1 = ON , 0 = OFF). Table 4-5 depicts the response frame.

Addr	Fun	Byte count	Data	CRC16 hi	CRC16 lo
11H	01H	01H	02H	D4H	89H

Data Bytes

7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	0

(Relay 1=OFF,Relay 2=ON)

Table 5-5 Response frame of reading Relay Output status

2. Read DI status (Function Code 02)

This function allows the user to obtain DI status ON/OFF(1 = ON , 0 = OFF). On top of slave device address and function code, query frame must contain the digital input register, starting address and the number of registers to be read. AcuDC 240 DI address starts from 0000H(DI1=0000H,DI2=0001H)

Table 5.6 depicts of reading DI1 to DI2 status of the slave device with the address of 17.

Addr	Fun	DI start addr hi	DI start addr lo	DI num hi	DI num lo	CRC16 hi	CRC16 lo
11H	02H	00H	00H	00H	02H	FBH	5BH

Table 5-6 Query frame of reading DI status

Response

The slave device anwsers the master device's query. The response frame contains slave device address, function code, data quantity and CRC check. Each DI utilizes one bit(1 = ON , 0 = OFF). Table 5.7 depicts the response frame.

Addr	Fun	Byte count	Data0	CRC16 hi	CRC16 lo
11H	02H	01H	01H	64H	88H

Data

7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1

MSB LSB

Table 5-7 Response frame of reading DI status

3. Read Data(Function Code 03)

Query

This function allows the master to obtain the measurement results from the meter.

Table 5-8 depicts reading slave device (address 1) voltage. AcuDC 240 voltage address is 0200H-0201H.

Addr	Fun	Data start reg hi	Data start reg lo	Data #of regs hi	Data #of regs lo	CRC16 hi	CRC16 lo
01H	03H	02H	00H	00H	02H	C5H	B3H

Table 5-8 Query frame of reading voltage

Response

Response frame contains slave device address, function code, data quantity and CRC check.

Table 5.9 depicts the response of V=402851D8H(2.6299953V).

Addr	Fun	Byte count	Data1 hi	Data1 lo	Data2 hi	Data2 lo	CRC16 hi	CRC16 lo
01H	03H	04H	40H	28	51	D8	52	31H

Table 5-9 Response frame of reading voltage

4. Control Relay Output (Function Code 05)

Query

This query frame forces the relay status to ON or OFF. AcuDC 240 relay output address starts from 0000H(Relay1=0000H,Relay2=0001H).

Data FF00H changes the relay status to ON, data 0000H changes the relay status to OFF. The relay will not be influenced by any other data input

The following is to query slave device 1 to set relay status as ON.

Addr	Fun	Do addr hi	Do addr lo	Value hi	Value lo	CRC16 hi	CRC16 lo
01H	05H	00H	00H	FFH	00H	8CH	3AH

Table 5-10 Control relay status query frame

Response

The correct response to this request is to send back the received data after the relay status is changed.

Addr	Fun	Do addr hi	Do addr lo	Value hi	Value lo	CRC16 hi	CRC16 lo
01H	05H	00H	00H	FFH	00H	8CH	3AH

Table 5-11 Control relay status response frame

5. Preset Multiple Registers (Function Code 16)

Query

Function Code 16(10H Hex) allows the user to modify the contents of multiple registers. AcuDC 240 system parameters can be written by this function code.

The following example depicts how to preset slave device 1's AO1 parameter (current), lower limit sign (+), lower limit value (0%), upper limit sign (+), upper limit value (100%).

Addr	Fun	Data start reg hi	Data start reg lo	Data #of reg hi	Data #of reg lo	Byte count	Value1 hi	Value1 lo
01H	10H	01H	09H	00H	05H	0AH	00H	01H

Value2 hi	Value2 lo	Value3 hi	Value3 lo	Value4 hi	Value4 lo	Value5 hi	Value5 lo	CRC16 hi	CRC16 lo
00H	00H	00H	00H	00H	00H	00H	64H	C5H	8AH

Table 5-12 Preset multiple registers query frame

Response

The correct response is to send back address, function code, data starting address, data number, CRC check after the value is changed .

Addr	Fun	Data start reg hi	Data start reg lo	Data #of reg hi	Data#of reg lo	CRC16 hi	CRC16 lo
01H	10H	01H	09H	00H	05H	D1H	F4H

Table 5-13 Preset multiple registers response

5.3 AcuDC 240 Communication Address Table

Basic Measurement Parameter Address

Use Function Code 03 to read.

Address	Parameter	Data Type	Property
0200H, 0201H	Voltage	Float	R
0202H, 0203H	Current	Float	R
0204H, 0205H	Power	Float	R
0206H, 0207H	AO1	Float	R
0208H, 0209H	AO2	Float	R
020AH, 020BH	DI1 count velue	UINT32	R
020CH, 020DH	DI2 count velue	UINT32	R

Table 5-14 Real-time measurement address table

Note:The high byte is followed by the low byte.

Running time

The data space below is for running time;
Function code: 03 Read.

Address	Parameter	Range	Data Type	Property
0280H 0281H	Meter running time	0~999999999	long	R
0282H 0283H	Load running time	0~999999999	long	R

Energy

The data space below is for energy;
Function code: 03 Read; 16: Write;

Address	Parameter	Range	Data Type	Property
0300H 0301H	Positive energy	0~999999999	long	R/W
0302H 0303H	Negative energy	0~999999999	long	R/W
0304H 0305H	Total energy	0~999999999	long	R/W
0306H 0307H	Net energy	0~±999999999	long	R/W

0308H 0309H	Import Ah	0~99999999	long	R/W
030AH 030BH	Export Ah	0~99999999	long	R/W
030CH 030DH	Total Ah	0~99999999	long	R/W
030EH 030FH	Net Ah	0~±99999999	long	R/W

Table 5-15 Energy and Ah address table

The relationship between the register value and the real value. (Rx is the register value)

Parameter	Relationship	Unit
Voltage	Real =Rx	V
Current	Real =Rx	A
Power	Real =Rx	KW
Energy	Real =Rx/100	KWh
Ah	Real = Rx/100	Ah
AO	Real =Rx	V or mA (depends on the AO Type)
Running time	Real =Rx/100	Hour

Table 5-16 The relationship between register value and real value

Real time clock area (Only the AcuDC 243 meter which has the storage functionhas this functionha)

Use Function code 03 to read,Function code 16 to preset.

Address	Parameter	Range	Data Type	Property
0284H	Year	2000~2099	Word	R/W
0285H	Month	1~12	Word	R/W
0286H	Day	1~31	Word	R/W
0287H	Hour	0~23	Word	R/W
0288H	Minute	0~59	Word	R/W
0289H	Second	0~59	Word	R/W

Table 5-17 Real time clock address table

MAX records

(Only the AcuDC 243 meter which has the storage functionhas this function)
Function code: 03H for reading.

Address	Parameter	Range	Data Type	Property
0400H 0401H	Voltage MAX		Float	R
0402H	Time of occurrence,Year,	High byte: years; Low byte:month	Word	R
0403H	Month, Day, Hour, Minute,	High byte: day; Low byte:hour		
0404H	Second	High byte: Minute; Low byte: Second		
0405H 0406H	Current MAX		Float	R
0407H	Time of occurrence, Year,	High byte: years; Low byte:month	Word	R
0408H	Month, Day, Hour, Minute,	High byte: day; Low byte:hour		
0409H	Second	High byte: Minute; Low byte: Second		
040AH 040BH	Power MAX		Float	R
040CH	Time of occurrence, Year,	High byte: years; Low byte:month	Word	R
040DH	Month, Day, Hour, Minute,	High byte: day; Low byte:hour		
040EH	Second	High byte: Minute; Low byte: Second		

Table 5-18 MAX records address table

MIN records

(Only the AcuDC 243 meter which has the storage function has this function)
Function code: 03H for reading.

Address	Parameter	Range	Data Type	Property
0460H 0461H	Voltage MIN		Float	R
0462H	Time of occurrence, Year,	High byte: years; Low byte:month	Word	R
0463H	Month, Day, Hour, Minute,	High byte: day; Low byte:hour		
0464H	Second	High byte: Minute; Low byte: Second		

0465H 0466H	Current MIN		Float	R
0467H	Time of occurrence, Year,	High byte: years; Low byte:month	Word	R
0468H	Month, Day, Hour, Minute,	High byte: day; Low byte:hour		
0469H	Second	High byte: Minute; Low byte: Second		
046AH 046BH	Power MIN		Float	R
046CH	Time of occurrence, Year,	High byte: years; Low byte:month	Word	R
046DH	Month, Day, Hour, Minute,	High byte: day; Low byte:hour		
046EH	Second	High byte: Minute; Low byte: Second		

Table 5-19 MIN records address table

Data Logging Setting

(Only the AcuDC 243 meter which has the storage functionhas this function)
Use Function code 03 to read,Function code 16 to preset.

Address	Parameter	Range	Initial value	Data Type	Property	Register number
0500H	Enable data logging	0: Disable 1: Enable	0	Word	R/W	1
0501H	Mode of data logging	0: mode 1 continuous mode(start after set parameters) 1: mode 2 Timing start and stop 2: mode 3 Specifies the start time(hour Minute)	0	Word	R/W	1
0502H	interval time	1~1440(Minute)	5	Word	R/W	1

0503H	Start time (year,month)	High Byte: Year(00-99) Low Byte: Month(1-12)	(Only used in mode 2)	Word	R/W	1
0504H	Start time(day,hour)	High Byte: day(1-31) Low Byte: hour(0-23)		Word	R/W	1
0505H	Start time(Minute,)	High Byte: Minute(0-59) Low Byte: reserve		Word	R/W	1
0506H	End time(year,month)	High Byte: Year(00-99) Low Byte: Month(1-12)		Word	R/W	1
0507H	End time(day,hour)	High Byte: day(1-31) Low Byte: hour(0-23)		Word	R/W	1
0508H	End time(Minute,)	High Byte: Minute(0-59) Low Byte: reserve		Word	R/W	1
0509H	The specified start recording time: hour and minute	High Byte: hour(0~23) Low Byte: Minute(0~59)	(Only used in mode 3)	Word	R/W	1
050AH	number of registers in a log	Register number: 1~26	0	Word	R/W	1
050BH ~ 0524H	The contents of a log (ModBus Register)		0	Word	R/W	26
0525H ~ 057FH	reserve					91

Table 5-20 Data Logging Setting address table

The contents of one log

Users can select any parameters they want to log from the 13 parameters. In order to generate historical logs for the selected parameters, users should program the meter so that selected parameters from the cooresponding Modbus registers can be copied to the historical log record, that is to say, if you want to log a certain parameters, only need to set the cor-

responding Modbus address in the register of data logging. One parameter in the meter is taking up two Modbus registers. The 13 parameters are voltage, current, power, positive energy, negative energy, total energy,net energy, positive Ah, negative Ah, total Ah, net Ah, DI1 count value and DI2 count value.

For example: Log the current data, registers 0200h and 0201h programmed to be recorded.

The number of registers in a log

In a log, a parameter using two registers, if you select all of 13 parameters, the are 26 registers to be used.

Log Status Block

(Only the AcuDC 243 meter which has the storage functionhas this functionha)

Function code: 03H for reading.

Address	Parameter	Range	Data Type	Property	Register number
0700H 0701H	MAX Records	0~350890	Uint32	R	2
0702H 0703H	Used Records	0~350890	Uint32	R	2
0704H	MAX records in the Retrieval window		Word	R	1
0705H 0706h	Newest NO. of Records		Uint32	R	2
0707H 0708H	Oldest NO. of Records		Uint32		2

0709H 070AH 070BH	Newest Record Time stamp	High Byte: Year Low Byte: Month High Byte: day Low Byte: hour High Byte: Minute Low Byte: reserve	Word	R	3
070CH 070DH 070EH	Oldest Record Time stamp	High Byte: Year Low Byte: Month High Byte: day Low Byte: hour High Byte: Minute Low Byte: reserve	Word	R	3
070FH	memory status	High Byte: reserve Low Byte: FEH: memory is erasing; Other: Erased	Word	R	1

Table 5-21 Log Status address table

1) MAX Records

The MAX number of Records of memory can be stored in, according to the maximum capacity and a log amount of space is calculated.

2) Used Records

The number of Records has been recorded at present, this article Numbers less than or equal to the maximum number of records

3) Max records in the Retrieval window

In the Retrieval window, can read the maximum number of Records

4) Newest NO. of Records

A record number for each record, which means serial number, show the sequence of records. The first record starting from 1, increase a record, the relative record number plus 1, so has

been accumulating. Memory will delete the old record after record full, but the new record number not reset, continue to accumulate.

5) Oldest NO. of Records

After memory record full, It will delete the old data to record the new data. The oldest NO. of Records is the oldest record number under the current state

6) Newest Record Time stamp

The latest record of recording time

7) Oldest Record Time stamp

The oldest one record record time

8) memory status

Check the state of the memory, whether in erasing.

Log Retrieval Block

(Only the AcuDC 243 meter which has the storage functionhas this function)

Use Function code 03 to read,Function code 16 to preset.

Address	Parameter	Range	Data Type	Property
0600H	Reserve			R/W
0601H 0602H	Start record NO. to read	Oldest NO. of Records ~(Newest NO. of Records +1)	UINT32	R/W

0603H	Records number (High byte)	High byte:1 ~ the MAX record number in the window	Word	R/W
	Record status(low byte)read only, Write Invalidate	low byte : 0 ~ the MAX record number in a Block: Effective number of records in the window FDH: Noneffective "Start record NO."or"record number in a window" FEH: memory is erasing FFH: Noneffective data		
0604H~067BH	window	Window data: time mark(6 byte)+[data1~dataN](4N byte) Invalid data set to 0	Word	R

Table 5-22 Log Retrieval address table

1) Start record NO. to read

The start record number to reading record, decided to record from what position began to read. this value is to be set between the oldest record number and the newest record number. When readed a window data, start record number will automatically increase the number of a window. If the increase of initial record number is greater than the newestest record number, the starting record number = the newest record number + 1.

For example, began to set up start record number is 34, after read eight logs of a window, start record number automatically into 42.

2)Records number

The number of records that fit within a window. The value is not greater than the maximum number of records in a window.

The MAX number of records = 240 / the number of bytes in a single record

3) Record status

The status of the current window. Since the time to prepare a window may exceed an ac-

ceptable Modbus delay (1 second), the byte is characterized by read data validity, if display is invalid, window data should be ignored. If set up correctly and read correctly, return a valid data article number, otherwise the return error markers, this value is read-only, write any data is invalid.

0 ~ The biggest store trend in a single window number: window data effective number of records

FDH: invalid " Start record NO " or invalid " number of records in the window"

FEH: memory is erasing

FFH: The window is invalid data

4) window

Returns the record data effectively, as a read-only area.

The contents of each record is: time mark (6 bytes) + [data 1 ~ data N] (4N bytes)

note that the number of records in the window as an integer

System Parameter Setting Address

The system parameter settings, including communication settings, I/O settings, use Function Code 03 to read, Function Code 16 to preset.

Address	Parameter	Range	Default	Data Type	Property
0100H	Password	0-9999	0000	Word	R/W
0101H	Device Address	1-247	1	Word	R/W
0102H	Baud Rate	1200-38400	19200	Word	R/W
0103H	Parity Setting	0: Even 1: Odd 2: None 2 3: None 1	3	Word	R/W
0104H	Full Range Current Value	20-50000(A)	20	Word	R/W
0105H	Full Range Shunt Value	50- 100(mV)	100	Word	R/W

0106H	Current Hall Effect Sensor (V)	0: 0-5V 1:0-4V	1		
	Current Hall Effect Sensor (mA)	0:4-20mA 1:4-12-20mA			
0107H	Full Range Voltage Value	5-1200	1000	Word	R/W
0108H	Voltage Hall Effect Sensor	0: 0-5V 1:0-0V	1	Word	R/W
0109H	AO1 Parameter	0:voltage;1:current; 2: power	0	Word	R/W
010AH	AO1 Lower Limit Sign	0: +; 1: -; 2: ±	0	Word	R/W
010BH	AO1 Lower Limit	0-100(percentage)	0	Word	R/W
010CH	AO1 Upper Limit Sign	0: +; 1: -; 2: ±	0	Word	R/W
010DH	AO1 Upper Limit	0~100(percentage)	100	Word	R/W
010EH	AO2 Parameter	0: voltage; 1: current; 2: power	0	Word	R/W
010FH	AO2 Lower Limit Sign	0: +; 1: -; 2: ±	0	Word	R/W
0110H	AO2 Lower Limit	0-100(percentage)	0	Word	R/W
0111H	AO2 Upper Limit Sign	0: +; 1: -; 2: ±	0	Word	R/W
0112H	AO2 Upper Limit	0-100(percentage)	100	Word	R/W
0113H	RO1 Mode	0:latch; 1: momentary; 2: alarm	2	Word	R/W
0114H	RO1 Momentary Time Delay	300-5000ms	1000	Word	R/W
0115H	RO1 Alarm Parameter	0: no Alarm; 1: voltage; 2: current; 3: power	0	Word	R/W
0116H	RO1 Alarm Inequality	0: smaller than; 1:larger than	0	Word	R/W
0117H	RO1 Alarm Time Delay	0-255 s	5	Word	R/W
0118H 0119H	RO1 Alarm Threshold	The same as full range value's		Float	R/W
011AH	RO2 Mode	0:latch; 1: momentary; 2:alarm	2	Word	R/W
011BH	RO2 Momentary Time Delay	300-5000ms	1000	Word	R/W

011CH	RO2 Alarm Parameter	0: no Alarm; 1: voltage; 2: current; 3: power	0	Word	R/W
011DH	RO2 Alarm Inequality	0: smaller than; 1:larger than	0	Word	R/W
011EH	RO2 Alarm Time Delay	0-255 s	5	Word	R/W
011FH 0120H	RO2 Alarm Threshold	The same as full range value's		Float	R/W
0121H	Backlight Brightness Level	1-5	5	Word	R/W
0122H	Clear Energy	0x0A: enable		Word	W
0123H	Clear Meter Running Hour	0x0A: enable		Word	W
0124H	Clear Load Running Hour	0x0A: enable		Word	W
0125H	DI Working mode	Enable as bit, 0: Level mode; 1: Count mode Bit0: DI1 Working mode Bit1: DI2 Working mode	3	Word	R/W
0126H	Clear DI count value	Enable as bit, 0: not clear; 1: clear Bit0: clear DI1; Bit1: clear DI2;		Word	W
0127H	Clear Ah	0x0A Effective		Word	W
0128H	Clear MAX/MIN value	0x0A Effective		Word	W
0129H	Clear data logging	0xAA Effective		Word	W

Table 5-23 System Parameter Settings

DI Status

Use Function Code 02 to read DI status.

Address	Parameter	Range	Data Type	Property
0000H	DI1	1=ON, 0=OFF	Bit	R
0001H	D12	1=ON, 0=OFF	Bit	R

Table 5-24 DI Address

Relay Status

Use Function Code 01 to read Relay Status, Function Code 05 to control.

Address	Parameter	Range	Data Type	Property
0000H	DO1	1=ON, 0=OFF	Bit	R/W
0001H	DO2	1=ON, 0=OFF	Bit	R/W

Table 5-25 Relay Status

Note:

1. Data Type: "Bit" is 1-bit binary; "Word" is 16-bit unsigned integer; "Integer" is 16-bit signed interger; "Float" is 32-bit floating point.

2.Read/Write: " R "is read only, reading DI is Function Code 02H; reading DO is Function Code 01H; reading the other parameters is 03H; " R/W "is read/write, write (control) relay by Function Code 05H; Use Function Code 10H to write system parameters.Writing into non-writable addresses is forbidden.

Appendix

Appendix A Technical Data and Specification

1. Measurement

Parameter	Accuracy	Resolution	Range
Voltage	0.2%	0.001V	0-1200V
Current	0.2%	0.005A	0 - ±50000A
Power	0.5%	0.001kW	0 - ±60000kW
Energy	0.5%	0.01kWh	0 - 9999999.99kWh
Drift with Temperature	<100ppm/°C		
Stability	0.5‰/year		

2. Input

DC Voltage	
Input Range	Direct Input 0-1000V; Via Hall Effect Sensor 0-1200V
Impedance	2MΩ
Load	<0.6W
Accuracy	0.2%

DC Current	
Input Range	0 - ±20A(direct input, start up current 0.02A) 0 - ±50000A(via Shunt or Hall Effect Sensor, range is programmable)
Shunt	50 - 100mV(programmable)
Hall Effect Sensor	0 - ±5V/ 0 - ±4V or 4 - 20mA/12mA±8mA
Consumption	2W(Max)
Accuracy	0.2%

Digital Input	
Input Type	Dry Contact
Isolation Voltage	2500 Vac

3.Output

Relay Output(RO)	
Type	Mechanical, Form A
Max Load Volage	250Vac/30Vdc
Max Load Current	3A
ON resistance	100mΩ(Max)
Isolation Voltage	4000Vac
Mechanical Life	5×10^6

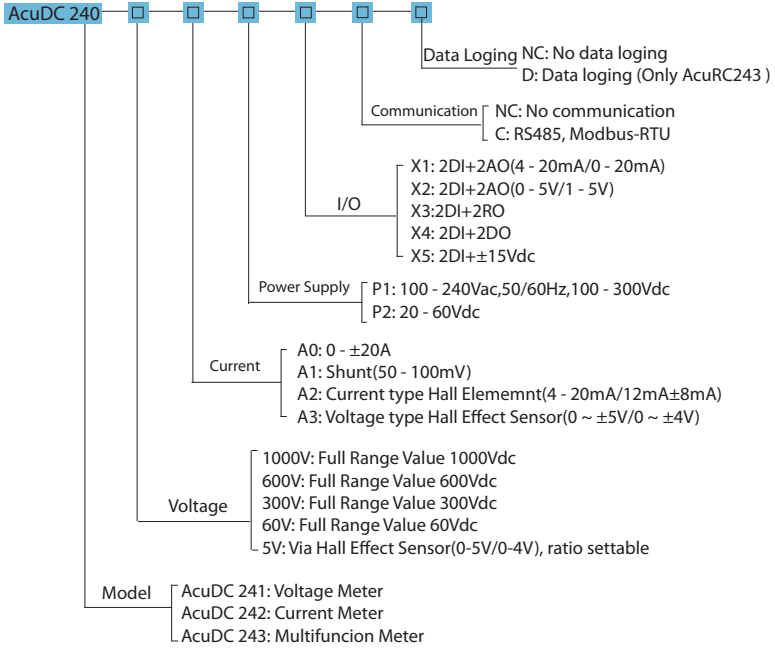
Analog Output	
Range	4 - 20mA/0 - 20mA; 0 - 5V/1- 5V
Accuracy	0.5%
Load Capacity	mA type: max load resistance 750Ω V type: max load current 20mA

Communication	
Type	RS485, Half Duplex, Optical Isolated
Protocol	Modbus-RTU
Baud Rate	1200-38400 bps
Isolation Voltage	2500Vac

Power Supply	
Input	(P1)100-240Vac, 50/60Hz, 100-300Vdc (P2) 20-60Vdc
Consumption	3W(typical)

Operating Environment	
Operating Temperature	-25℃ ~ +70℃
Storage Temperature	-40℃ ~ +85℃
Humidity	5%~95% non-condensing

Appendix B Ordering Information



Example: AcuDC 243 - 300 - A2 - P1 - X1 - C - D

Voltage Hall Effect Sensor Ordering Information

Special order

Please contact your local Accuenergy Representative for further details

Current Hall Effect Sensor Ordering Information

Special order

Please contact your local Accuenergy Representative for further details

Note:

1. When the input voltage is above 1000V, or the system design requires an isolation, the voltage input can be selected as Via Hall Effect Sensor. The Voltage Hall Effect Sensor requires 0-5 V.

2. I/O X1 type is configured as 4 - 20mA by factory default,X2 type as 0 - 5V by factory default. If any other type is required, please contact us in advance.

Appendix C Version Information

Version	Data	Description
V1.01	20120723	1st version
V1.02	20140424	Add Ah, DI counting, Max/Min and Data loging
V1.03	20140911	Modify "Current wiring using shunt" and "Voltage&Current wiring using shunt"

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