AcuRev 1312 DIN-Rail Power Meter

User's Manual

ACCUENERGY

Please read this manual carefully before installation, operation and maintenance of the AcuRev 1312 meter. 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 danger to personal health.

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

Prior to maintenance and repair, the equipment must be de-energized and grounded. All maintenance work must be performed by qualified, competent accredited professionals who have received formal training and have experience with high voltage and current devices. Accuenergy shall not be responsible or liable for any injuries caused by improper meter installation and/or operation.

Contents

Welcome to the AcuRev 1312!

You have purchased an advanced, versatile, multifunction power meter.

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

1. AcuRev 1312 power meter

2. Additional documentation (Quick Setup Guide & Calibration report)

Please note the following chapter descriptions in order to utilize the power meter properly.

Chapter 1 introduces the basic AcuRev 1312 features and application areas.

Chapter 2 provides an overview of installation and wiring methods for the AcuRev 1312.

Chapter 3 introduces the operation of the AcuRev 1312 via the display panel and how to use the meter to view measurement data and parameter settings.

Chapter 4 introduces the software associated with the meter and the main functions

Chapter 5 introduces communication related information, including communication protocol format and parameter address tables.

Appendix provides specifications and technical information about the AcuRev 1312.

AcuRev 1312 DIN-Rail Power Meter

Chapter 1: Introduction

1.1 Meter Overview

The AcuRev 1312 power meter is a Measurement Canada approved DIN rail-mounted single and three phase energy meter with high accuracy and small form factor that is ideal for use in tight and distributed spaces, in-suite metering and multi-customer metering system. The meter includes an easy to read Liquid Crystal Display(LCD) which displays the measurement data. It is ideal for building energy management systems, for energy monitoring and tenant billing systems.

Energy

Measurement Canada approved AcuRev 1312 supports unidirectional energy accumulation for the consumption of energy. The meter supports energy parameters such as the reactive and apparent energy with ANSI C 12.20 0.5 class and IEC 62053-22 0.5s class revenue grade accuracy.

Measurement Function

AcuRev 1312 provides real-time RMS measurement of the instantaneous Voltage, Current, Power, Frequency and Power Factor. All measurements can be viewed through the meter display or the AcuRev 1312 Utility Software.

Demand

The AcuRev 1312 provides demand measurement of the current being drawn as well as the demand for the Active, Reactive and Apparent Power. It provides demand forecasting as well as the peak demand.

Pulse Output

The AcuRev 1312 supports the energy Pulse Output function to output digital pulses. There is a dedicated channel that is KZ output type to transmit pulses proportional to the metered active energy.

Communication

Supports Modbus-RTU communication protocol over RS-485. The AcuRev 1312 can communicate with a computer over RS-485, Ethernet and USB.

For wireless communications, please refer to AcuMesh wireless RS485

1.2 Areas of Application

Multi-tenant Buildings:

- Condominium/Apartment
- Data Centers
- Malls
- Office Buildings
- Hotels

Schools

Public Facilities

Industrial Facilities

1.3 Product Features

Multifunction, high accuracy

The AcuRev 1312 meter has data collection and management function for energy and multi-parameters measurement. It also provides demand measurement and event logging.

The measurement accuracy of the energy, power, voltage and current is 0.5%.

Anti-Tampering for Billing

The AcuRev 1312 includes both physical and electronic sealing function. The meter is designed such that it cannot be opened without leaving obvious signs of tampering. Tenants cannot change parameter settings through the display when the electronic seal is closed preventing data being changed.

Small size, convenient installation

The appearance and dimension of the AcuRev 1312 meter is designed in accordance with IEC 35mm DIN standard.

Clear Display

The AcuRev 1312 includes a built-in display to provide clear visibility in all environments. The LCD display of the AcuRev 1312 includes a backlight to aid in visibility when the meter is installed in poor lighting. All the measurement parameters can be easily accessed through the display.

AcuRev 1312 DIN-Rail Power Meter

Chapter 2: Installation

2.1 Appearance and Dimensions

2.2 Installation Methods

2.3 Wiring

Before Installation

The installation must be performed by qualified accredited professionals who have received formal training and have experience with high voltage and current devices. The installer is required to wear the appropriate safety equipment to ensure safe installation.

During normal meter operation, caution should be used when handling the following as high voltage may be present:

- Terminal Blocks.
- Current/Potential Transformer leads and the related circuits.
- All primary and secondary may contain lethal current and voltage. Contact with current channels must be avoided.
- The AcuRev 1312 cannot be installed on the primary side of the transformer or where there is VA limitations. The AcuRev 1312 can only be installed on the secondary side. Avoid all contact with meter terminals after the completion of the installation.
- Do not input voltage above the rated specification of the AcuRev 1312 and the devices connected to it. Before energizing the meter, please refer to the meter's label and specifications.
- Do not perform high voltage test or insulation experiments to output, input or communication terminals.
- The use of shorting blocks and fuses are recommended. Current transformers need to be grounded.
- Use a dry cloth to wipe the meter.

This chapter mainly describes how to install the AcuRev 1312 power meter, which is an important step in using the meter correctly. This chapter provides wiring diagrams to reference when installing the meter. Before installing the meter, please read this section first.

2.1 Appearance and Dimensions

Figure 2.1.1

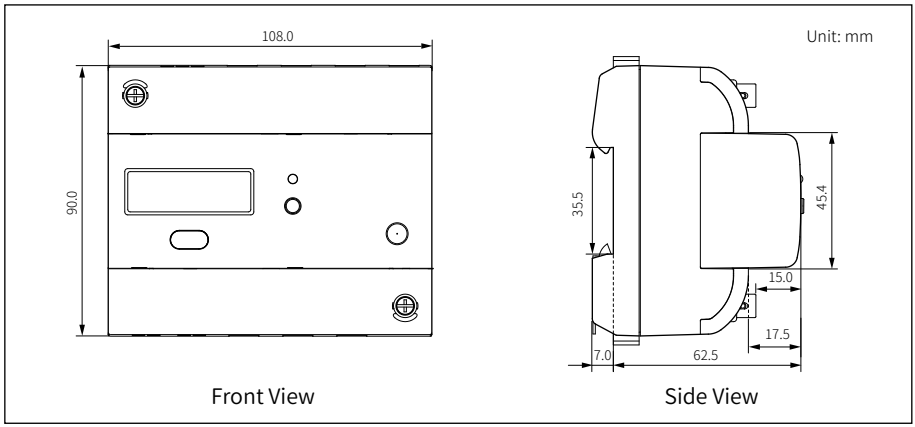


Figure 2.1.2 Front and side views of the AcuRev 1312

2.2 Installation Methods

> **Note**
> Temperature and humidity of the environment must accord with the requirement of AcuRev 1312, Otherwise it may cause the meter damaged.

Environmental

Before installation, please ensure that the AcuRev 1312 meter is installed in a place it will not be damaged and ensure the environment conditions such as temperature and humidity are within specifications.

Temperature

The AcuRev 1312 has an operating temperature of -25~53˚C. Exceeding this temperature range will cause damage to the meter. Please note that it can influence the meter's life negatively if the meter operates in extremely high or low temperatures.

Humidity

5% to 95% non-condensing.

Location

The AcuRev 1312 should be installed in a dry and dust free environment. Avoid exposing meter to excessive heat, radiation and high electrical noise sources.

Installation Steps:

This product is DIN railed mounted and fits on a standard 35 mm rail.

1. To install the meter on the rail insert the top of the rail into the groove on the back of the meter. Pull the metal clips back and slide the rail across the groove of the meter.

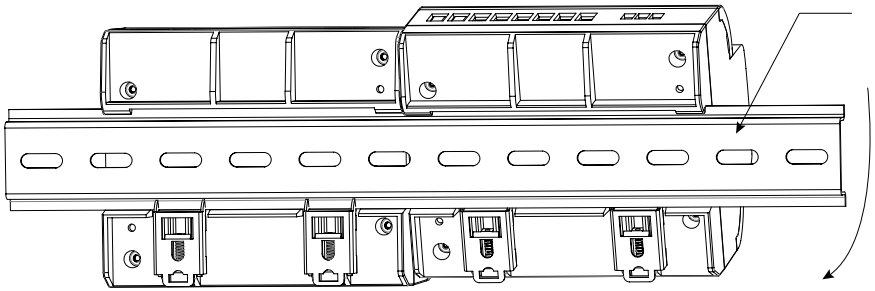


Figure 2.2.1

2. Use the metal clips to tighten onto the rail to complete installation.

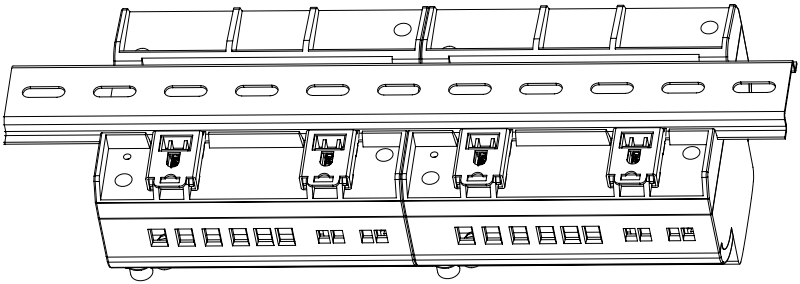


Figure 2.2.2

2.3 Wiring

The terminals of the AcuRev 1312 can be accessed by first removing the terminal covers on the meter.

1. To open the terminal cover, remove the seal if applicable, unscrew the sealing screws and lift the cover upwards to remove.

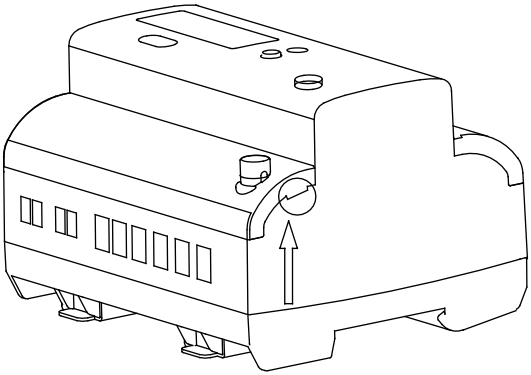


Figure 2.3.1

2. To attach the bottom terminal cover back onto the meter, place the left side of the cover down into the groove first and then press down onto the right side, see Figure 2.3.1. When installed correctly, you will hear a clicking sound. The steps to attach the top cover is to apply the right side of the cover down into the groove and press down onto the left side.

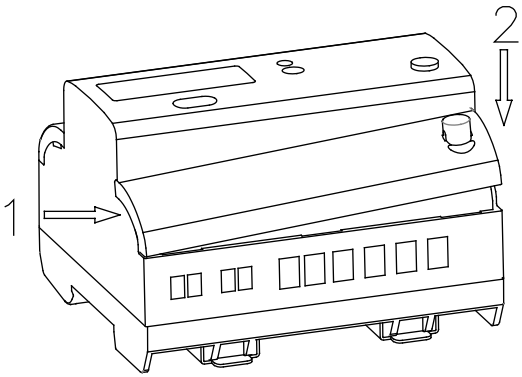


Figure 2.3.2

3. After inserting the cover, tighten the sealing screws and place the seal.

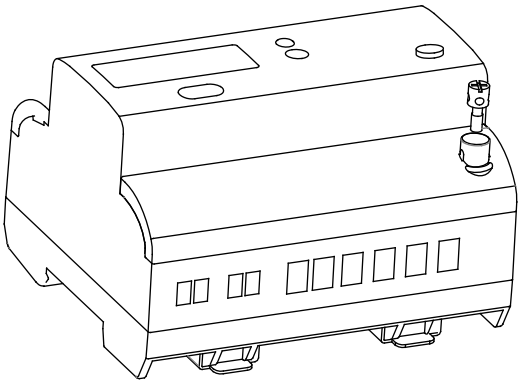


Figure 2.3.3

Terminals:

This manual will use V1, V2 and V3 to represent the three-phase conductors, which is the same as Va, Vb and Vc in other literature.

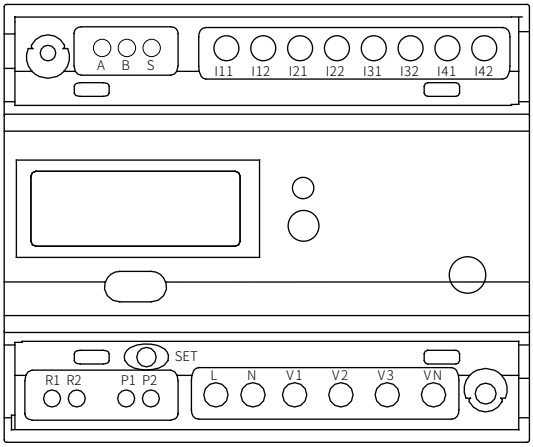


Figure 2.3.4

1	A, B, S	RS-485 Communication Terminals;
2	P1, P2	Pulse Output
3	L, N	Auxiliary Power
4	V1, V2, V3, Vn	Voltage Input Terminals
5	I11, I12, I21, I22, I31, I32, I41, I42	Current Input Terminals
6	R1, R2	Relay Output Terminals.

Auxiliary Power Supply:

The AcuRev 1312 power meter requires an AC supply of 100-415V at 60Hz for operation. In normal operation, the power consumption of the meter is less than 1 Watt so the meter can be powered by either an independent power supply or it can obtained from the circuit under test.

It is suggested that if the power is obtained from a source with large power fluctuation then a voltage stabilizer be used. A fuse (typically 1A/250Vac) is also suggested to be used when connecting the power supply to the meter.

The typical auxiliary power supply wiring is as follows:

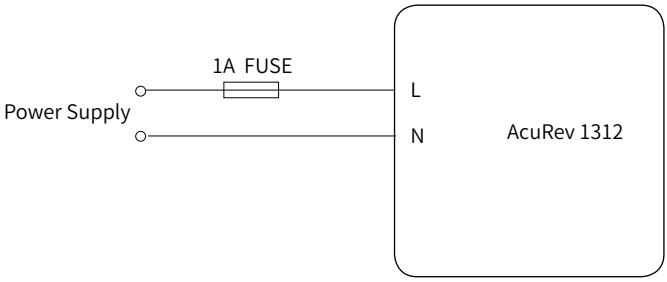


Figure 2.3.5

The meter requires AWG22-14 as the wires to connect the power supply.

Voltage Input:

The AcuRev 1312 can measure up to 240V LN/415V LL AC for a three phase system or 400VLN AC for a single phase system.

Potential Transformers (PT's) must be used when the system voltage is higher than the meter's rated voltage. The rated secondary output from the PT is typically 100V-120V. Please ensure to select an appropriate PT that will maintain the measurement accuracy of the AcuRev 1312. For measuring a system with a WYE wiring configuration, the PT's rated input or primary voltage rating should be equal to or close to the phase voltage of the system to utilize the full range of the PT that will be used. Similarly, when measuring a system with a Delta wiring configuration then the PT's rated input or primary voltage rating should be equal to or close to the line voltage of the system.

A fuse that is rated for 1A/600V should be used when connecting the voltage inputs to the meter.

The meter requires AWG22-14 as the wire size to the voltage input terminals.

Current Input:

Current Transformer's(CT's) are used in most practical applications. The AcuRev 1312 supports four CT input types, 5A, 1A, 80mA and 100mA. CT's must be used if the system's rated current is greater than 5A. The CT used should be Measurement Canada approved to maintain revenue grade accuracy of system. The distance between the CT and the meter should be as short as possible as the length of the of CT leads will affect the accuracy.

The meter requires AWG22-14 as the wire size to the current input terminals.

Note: The secondary side of the CT should not be open circuit in any circumstance when the system is energized. There should not be any fuse or switch in the CT loop. It is suggested to ground one end of the CT secondary.

The AcuRev 1312 meter supports different wiring configurations for both three phase and single phase systems. Please read this section carefully before choosing a suitable wiring method for your monitoring your system.

Here are some of the common installation methods, their respective diagrams and meter configurations for the AcuRev 1312 meter.

1. Three Phase: 4 wire-connection: (Three Phase with a neutral)

Wiring mode 3LN. Three CT's needed for this connection.

Common voltages for this connection: 120V LN/208V LL, 240V LN/415V LL

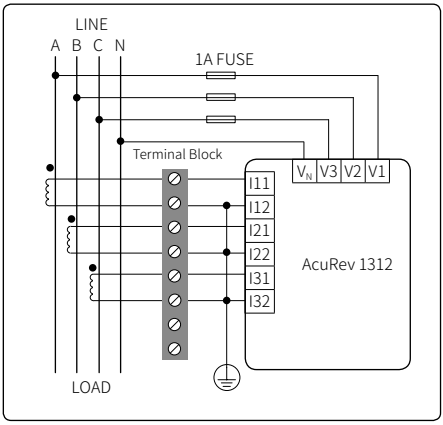


Figure 2.3.6a-3LN wiring diagram using three 5A CT's

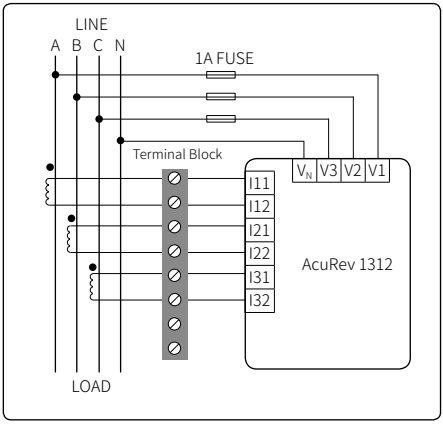


Figure 2.3.6b-3LN wiring diagram using three mA CT's

2. Three Phase: 3 wire-connection (Three phase without a neutral)

The wiring mode is set to 2LL. Two CT's needed for this connection.

With Potential Transformers (PTs) - PTs are required if the system voltage is higher than 690V LL. Instead of connecting the voltage lines directly to the meter, the voltage lines are connected to the meter using PTs. The PTs should be connected as shown below.

Note: *Only two PTs are needed for this connection*

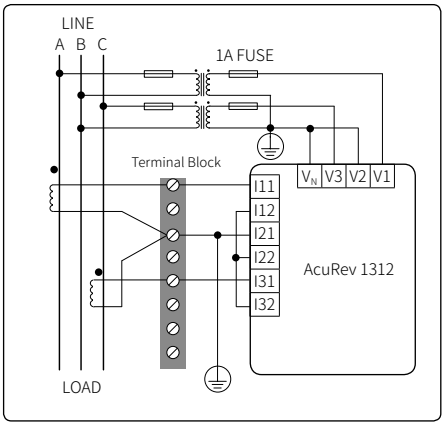


Figure 2.3.7a-2LL wiring diagram using two 5A CT's

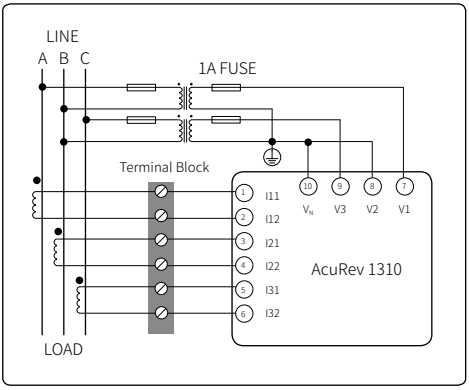


Figure 2.3.7b-2LL wiring diagram using three mA CT's

3. Single Phase: 2 Lines (Single phase with one line and a neutral)

The wiring mode is set to 1LN. One CT needed for this connection.

Common Voltage for this connection: 120V

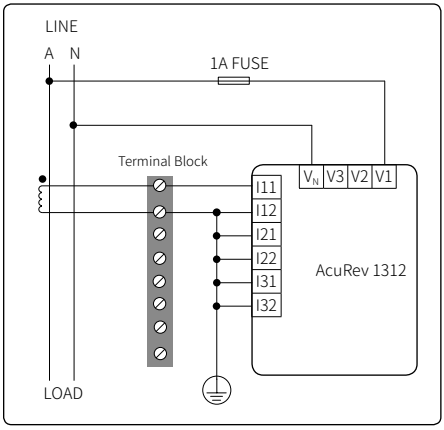


Figure 2.3.8a-1LN wiring diagram using one 5A CT

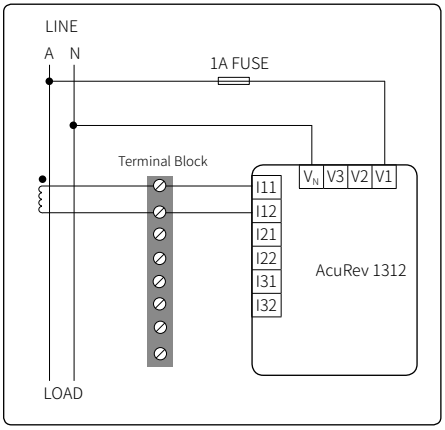


Figure 2.3.8b-1LN wiring diagram using one mA CT

4. Single Phase: 3 Lines (Single phase with 2 lines and a neutral)

   The wiring mode is set to 1LL. Two CT's needed for this connection

   Common Voltage: 120V LN/240V LL

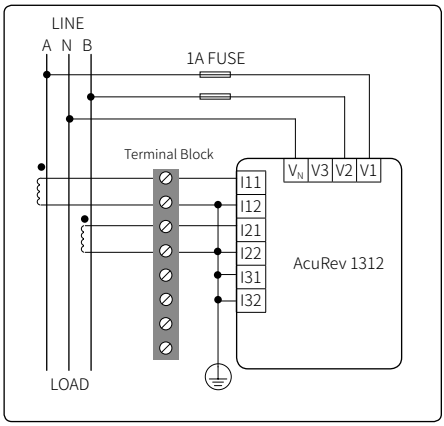


Figure 2.3.9a-1LL wiring diagram using two 5A CT's

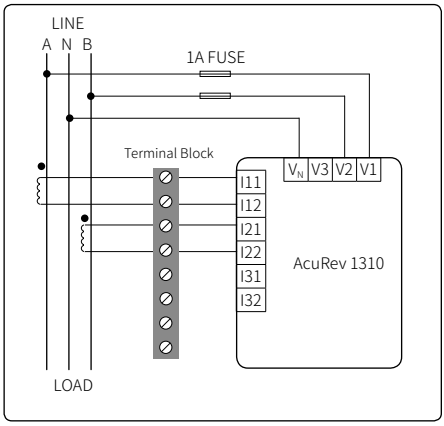


Figure 2.3.9b-1LL wiring diagram using two mA CT's

Communication

The AcuRev 1312 supports Modbus-RTU protocol through it's built-in RS485 port. The RS485 terminals are denoted as 'A', 'B' and 'S'. 'A' is the positive differential terminal, 'B' is the negative differential terminal and 'S' is for connecting the shield of the shielded twisted pair cable.

The maximum distance of the cable should not exceed 1200m. This distance should be shorter if more devices are connected to the same communication link or if using a higher baud rate.

If the master device does not have a RS485 port but a RS232 port then a RS232-RS485 converter should be utilized.

Please use the following to improve the communication quality:

- Use a high quality shielded twisted pair cable, AWG22 or lower is suggested.
- Pay attention to single point earthing. This means that there is only one side for the shield to be connected to the ground in a communication link.
- Every A(+) should be connected to A(+), and B(-) to B(-).
- 'T' type topologies should be avoided. This means no new branches can be formed except from the starting point.
- Keep the communication cables away as far as possible from sources of electrical noises. When several devices are connected in daisy chain to the same long communication line, a anti-signal reflecting resistor (typically 120-300Ohms, 0.25W) should be used at the end of the circuit (the last device of the chain).
- Use a RS232/RS485 or a USB/RS485 converter with optical isolated output and surge protection.

AcuRev 1312 DIN-Rail Power Meter

Chapter 3: Operation

3.1 Display Panel and Keys

3.2 Display Modand Key Operations

In this chapter, users will be introduced to the interface of the AcuRev 1312 meter as well as how to interact with the meter using the key on the display to read and configure parameters.

3.1 Display Panel and Keys

The AcuRev 1312 meter consists of a built-in LCD screen and a key (SCROLL key) for users to interact with the meter. Figure 3.1.1 shows the display of the AcuRev 1312 with all characters and number segments visible as a visual example only, they would not appear on one page. These symbols are explained in Table 3.1.

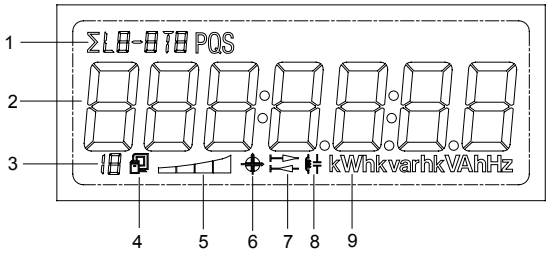


Figure 3.1.1

Table 1- Display icons

NO.	Content	Description
1	Description Area	Displays the type of parameter, distinguishes the type of power or energy, phase of parameter or page in settings.
2	Measurement parameter display area 7 segments can be displayed.	Displays measurement parameters
3		Indicates All parameter display mode.
4	Communication Icon	No icon: No communication; One icon: Query sent; Two icons: Query sent and response received
5	Load size icon	Displays the percentage of the load drawn based on the rated current.
6	Four- quadrant reactive power display	Indicates the quadrant of the reactive power.
7		Import icon(right arrow): Displays the energy consumed Export icon(left arrow) displays the energy generated
8	Load type	Inductance icon: Inductive load Capacitor icon: Capacitive load
9	unit	Unit of the parameter being displayed.

3.2 Display Mode and Key Operations

The LCD display of the AcuRev 1312 meter consists of three modes of display; Important parameter display, all parameters display and settings mode. By default, the important parameter display shows the Consumed Active Energy(kWh) parameter.

Important parameter display:

The important parameter display is the default display mode of the meter, it will display the measurement parameters of the AcuRev 1312. Users will only see the Consumed Active Energy(kWh) parameter unless additional parameters are added through settings mode.

Users will be in this mode when they power on the meter or when they push the "SCROLL" key after a period of inactivity. Each measurement parameter in this mode will display on the screen for 6 seconds. When the "SCROLL" key is pressed in this display mode it will lock the current page for a minute and the backlight will remain on. Pressing the "SCROLL" key again will turn to the next page and lock the display for another minute. After, one minute of inactivity the display will continue operating normally by cycling through the enabled measurement parameters.

For adding additional parameters to the Important Parameter display, please refer to the AcuRev 1310 series user manual.

All parameter display:

The all parameter display will display all the parameters the meter supports as well as information about the AcuRev 1312 meter. Pressing and holding the "SCROLL" key from the important parameter display mode will direct the user to the all parameter display mode. In this mode there will be a 1 displayed in the bottom row of the display to indicate the AcuRev 1312 is in all parameter display mode.

Pressing the "SCROLL" key will turn to the next page in the display. Once the user has cycled through all the parameters pressing the "SCROLL" key again will take the user back to the first page.

Table 3.2-All parameter display

Page	Parameter
1	Voltage Wiring Check
2	Current Wiring Check
3	Device Address
4	Baud Rate
5	Parity
6	Hardware Version
7	Software Version

Page	Parameter
8	Release Date
9	Model
10	Consumed Active Energy(kWh)
11	Consumed Active Energy Phase A(kWh)
12	Consumed Active Energy Phase B(kWh)
13	Consumed Active Energy Phase C (kWh)
14	Phase A Voltage(V)
15	Phase B Voltage(V)
16	Phase C Voltage(V)
17	Phase A Current(A)
18	Phase B Current(A)
19	Phase C Current(A)
20	Total Current(A)
21	System Active Power(kW)
22	Active Power Phase A(kW)
23	Active Power Phase B(kW)
24	Active Power Phase C(kW)
25	Frequency(Hz)
26	Temperature
27	Meter run time
28	Load run time
---	End

Setting mode:

The settings mode is where the user can perform most configurations for the AcuRev 1312. Pressing the “SET” key that is located under the meter cover will prompt the user for the meter password.

For inputting the meter password, users will use the “SCROLL” key to change the value of the flashing digit. The “SET” key is used to move between digits and to confirm the entered password when on the last digit.

Upon entering the correct password, the AcuRev 1312 will direct users to the device address configuration of the meter or it will redirect the users back to the important parameter display if the electronic seal is enabled. In this mode there will be an “S” in the top row to indicate that the meter is in settings mode followed by the setting page number. After a minute of inactivity in this mode, the meter will be redirected back to the important parameter display. If the“SCROLL” key is press and held, the meter will also be redirected out of the settings mode.

Note: The default password of the meter is 0000.

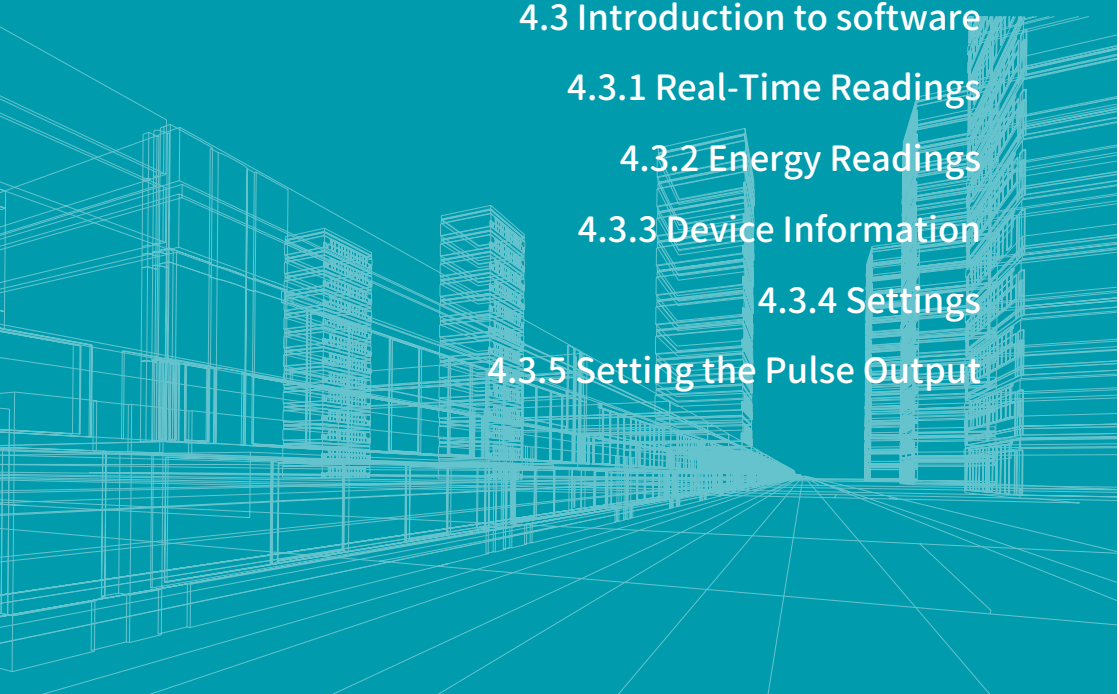
In the settings mode, the following operations apply for the keys:

- The “SET” key is used to enter edit mode of the setting and to confirm the setting change.
- The “SCROLL” key used to move to the next setting page and to change the value of the setting when in edit mode.

Table 3.3- Settings display

Page	Parameter	Range
1	Device Address	1-247
2	Baud Rate	1200;2400;4800;9600;19200;38400
3	Parity	Even, Odd, None2, None1
4	Energy Pulse Output	P: Real Energy; Q:Reactive Energy
5	Reactive Power Calculation	0:True; 1:Generalized
6	Password	0000-9999
7	Real-time reading mode	1: Primary; 2: Secondary
8	Wiring configuration	3LN; 1LN; 1LL;2LL
9	CT2	5A/1A(5A Current Input) 80mA/100mA (mA Current Input)
10	CT1	1~50,000
11	PT2	50~400
12	PT1	50~1000000
13	Pulse Constant	1~60000
14	Pulse Width	20~100ms
15	Energy Decimal places	0-3
16	Custom data display: Add	
17	Custom data display: Remove	
18	Wiring check enable	On; Off

Chapter 4: Functions and Software



This chapter will provide users with an overview on configuring the AcuRev 1312 to measure data correctly and introduces the energy pulse output function of the meter. Users will also be introduced to the AcuRev 1310 Utility software that can be used to read the meter's data as well as configure the meter.

4.1 Configuration

The AcuRev 1312 needs to be configured correctly in order for it to measure the data correctly.

For the initial meter setup, The wire mode, PT and CT ratios needs to be set configured. Here are the steps to setup the meter from the display. Users must ensure the lower terminal cover of the meter has been removed to gain access to the "SET" button.

- Press the "SET" key to enter the settings mode.
- The password screen will be displayed. Leave the password as default "0000" if no password was configured. Otherwise use the "SCROLL" and 'SET' keys to enter the configured password. "S-01 Addr" will appear.
- Press the "SCROLL" key until you get to "S-08 Lt" screen. Select the required voltage wiring mode. This will be based on your voltage connection. E.g. if it's a three phase 4 wire connection, select '3LN'.

Refer to Section 2.3 Wiring section for more details

  - ► Press "SET" to enter edit mode.
  - ► Press "SCROLL" to select the wiring mode.
  - ► Press "SET" to confirm the setting.

- Press the "SCROLL" key to move to the CT2 page. This setting should already be configured to the secondary value of the CT. After this is confirmed, press the "SCROLL" key to move to the next page.
- The ensuing page will be "S-10" for setting the primary value of the CT. If no CT is being used, leave this as the default value and press "SCROLL" to move to the next page. If CT's are being used, enter in the primary value of the CT here.
  - ► Press "SET" to enter edit mode and to change the flashing digit.
  - ► Press "SCROLL" to change the value of the digit.
  - ► Press "SET" to confirm the setting and move to the next page.
- The next page will correspond to the PT2 setting. If no PT's are being used, leave this set-

ting as the default and press the “SCROLL” key to go to the next page. If PT’s are being used, enter in the secondary value of the PT here.

- ► Press “SET” to enter edit mode and to change the flashing digit.
- ► Press “SCROLL” to change the value of the digit.
- ► Press “SET” to confirm the setting and move to the next page.

- The next page will be “S-12” for setting the primary value of the PT if it is being used.
  - ► Press “SET” to enter edit mode and to change the flashing digit.
  - ► Press “SCROLL” to change the value of the digit.
  - ► Press “SET” to confirm the setting and move to the next page.

The Initial Setup is now complete. The meter will should now begin to read the data correctly.

4.2 Energy Pulse Output

The AcuRev 1312 supports the transmission of pulses through the P1 and P2 terminals of the meter. The AcuRev 1312 uses the KZ output to transmit test pulses that are proportional to the accumulated energy that the meter is measuring.

The maximum output voltage and current of the pulse output circuit in the AcuRev 1312 are 250V and 100mA respectively.

Configuration:

Ensure the following configurations in the meter are correct to ensure the accuracy of the meter:

- Wiring Mode
- CT2
- CT1
- PT2
- PT1

To check these settings, refer to section 4.1 to ensure the meter was configured.

With the above settings confirmed to ensure the meter will measure the voltage and current accurately, the next step is to configure the meter to output the desired number of pulses based on the required specification.

- Make sure you are in the settings mode. To get to this mode follow the procedure above for ensuring the meter has the correct settings to read accurately.

► Once in the "Setting" mode, press the "SET" to get to the "S-04 PULSE" page. This configuration is to enable the meter to output pulses based on the Active Energy(P) or the Reactive Energy(q).

- Press "SET" to modify the setting; the cursor should now flash.
- Press "SCROLL" to select the type of energy to output.
- Press "SET" to confirm the selection.

► Press "SCROLL" to get to the "S-13 Pn" page. This configuration will represent the number of pulses the meter will output per kWh/kVarh. This will be based on the required specification.

- Press "SET" to modify; the first digit will begin to flash
- Press "SET" to move to the next flashing digit.
- Press "SCROLL" to change the flashing digit's number.
- Press "SET" on the last digit to confirm all the changes after they have been made.

The procedure to calculate what value to enter in the meter for the DO Pulse constant is as followed:

First determine how many pulses are needed to represent 1 KWh or how many KWh will represent 1 pulse. The former is focused on smaller consumption.

In this procedure, we will assume 1 pulse = 10kWh is what is needed. Then follow these steps:

① Multiply the PT ratio and CT ratio i.e. PT1/PT2 * CT1/CT2

Example: PT ratio: 6600V/120V, CT ratio: 2000:5A => 6600/120 * 2000/5 = 22,000

NOTE: If no PTs were used, enter the PT ratio as the default on the meter, i.e. 400/400. If the CT2: 80/100/200mA, consider this as 1A for the calculation

② Divide 10KWh by 22,000 i.e. (10/22000) kWh = (1/2200) kWh

③ This means 1 pulse = (1/2200) kWh; therefore 2200 pulses = 1 kWh

④ Since we get 2200 pulse/kWh, enter 2200 as the pulse constant into the meter

► Press "SCROLL" to get to the "S-14 PH" page. This configuration will represent the pulse

width of the pulse that the meter will output. Put in the pulse width for the pulse output. The range is 20-100ms.

With the pulse output configured, the function can now be used to test the accuracy of the meter. Inject the meter with both voltage and current to ensure that the meter will accumulate energy and output the pulses based on the above settings.

4.3 Introduction to AcuRev 1310 Utility Software

The AcuRev 1312 meter can be accessed through the AcuRev 1310 Utility Software. This software can be used to read the meters' measurements or to configure the meters' configurations. To connect to the software, a USB-RS485 converter must be used.

Note: The AcuRev 1310 Utility Software is a Windows based software.

Once the software has been opened, users will be prompted to enter the baud rate, parity, device address of the AcuRev 1312 meter.

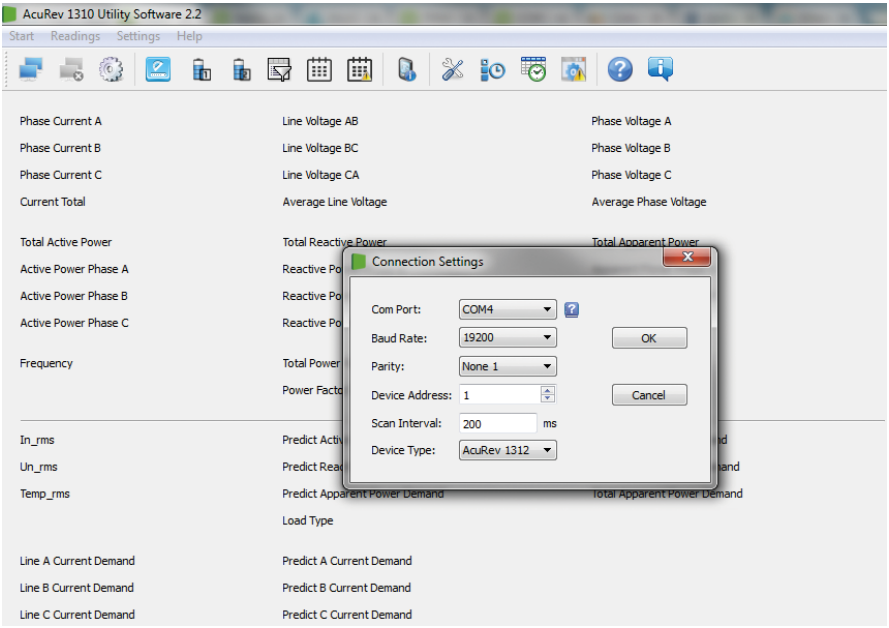


Figure 4.3.1

The Communication Port (Com Port) the meter is connected can be found from the Device Manager in Windows.

- Open the Windows Start menu.
- Right click on Computer and select Properties.
- In the window that appears, select Device Manager from the left navigation panel.
- In the Device Manager window, double click on Ports (COM & LPT) from the dropdown list.
- Locate the USB Serial Port(COMx) information where x is the port number to use.

Select the baud rate and parity of the meter and enter the device address. Click OK to connect the AcuRev 1312 to the software.

4.3.1 Real-time Readings

Upon successful connection, users will see readings appear in blue font beside each measurement parameter as shown in Figure 4.3.2

All meter measurements can be read from the Utility software under the “Readings” menu.

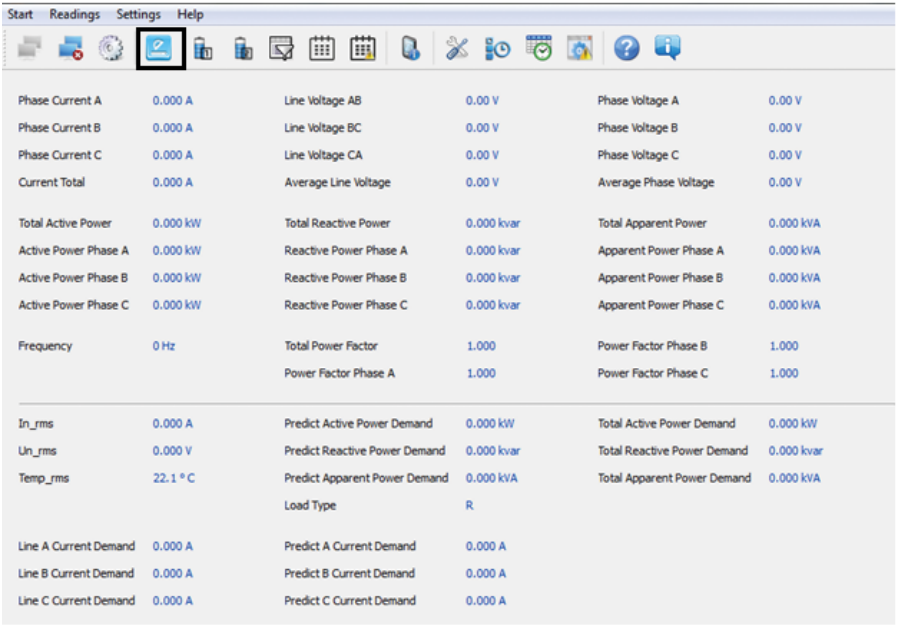


Figure 4.3.2

Measurement data such as the voltage, current, active power and etc. can be accessed by clicking on the “Readings” menu and selecting “Real-Time Metering”. Alternatively, users can click on the icon that is highlighted in the black box in Figure 4.3.2.

4.3.2 Energy Readings

Users can access the energy consumption by clicking on the “Readings” menu and selecting “Energy1”. Alternatively, users can click on the icon highlighted in the black box below.

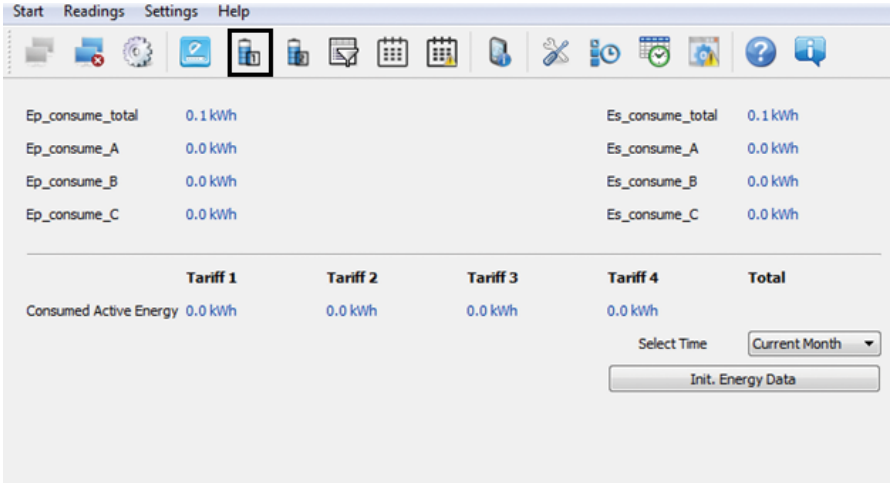


Figure 4.3.3

Users will see all the energy that the meter has accumulated since the life of the meter or since the last time that it was reset.

The lower half of the Energy1 page displays the consumed active energy readings that has been accumulated under the Time Of Use(TOU) function of the meter. Users can select the time period of the TOU energy as either the current month, previous month or the past two months.

Users can also provide initial values for the AcuRev 1312 to start to accumulate energy from. To do this users must have sufficient permission, which can be obtained from the General Settings page.

4.3.3 Device Information

Information regarding the meter can be found by clicking “Readings” and selecting “ Device Information. Alternatively, users can click on the icon that represents the Device Information page by clicking on the icon that is highlighted in the black box in Figure 4.3.4.

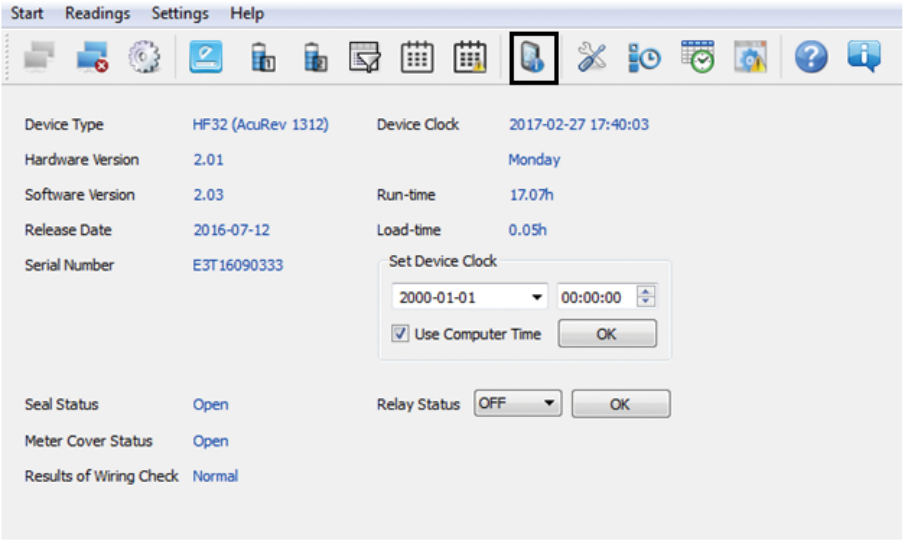


Figure 4.3.4

Device information such as the hardware and software version of the meter, serial number and seal status can be found in this page. It is important to note that when the Seal Status is set to “Closed”, the user will be unable to make any configuration changes to the meter.

Users can also configure the device clock of the meter from this page to the time of the computer the meter is connected to or give it another time.

4.3.4 Settings

The settings related to the AcuRev 1312 can be found by clicking on the “Settings” menu.

To set up the meter for initial use, the settings can be found from the “General Settings”. Alternatively, users can click on the icon highlighted below in the black box in Figure 4.3.5.

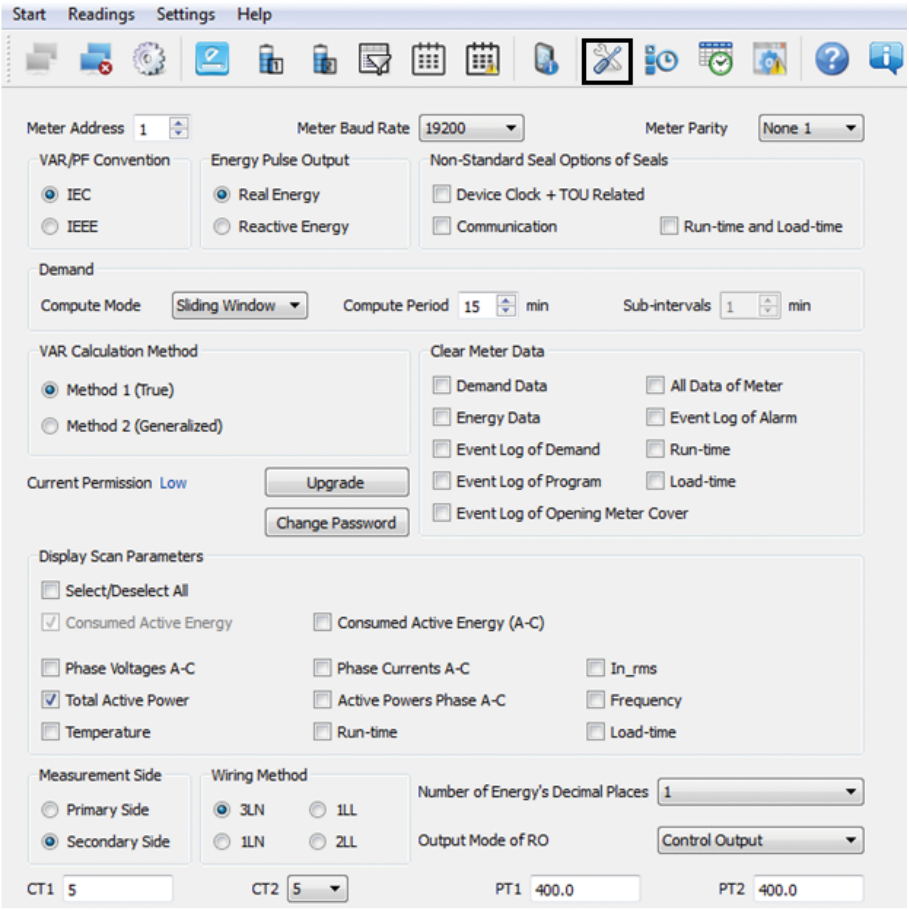


Figure 4.3.5

Users only need to select the “Wiring Method” and fill in the “CT1” field with the rated input of the CT they are using and the “PT1” and “PT2” fields with the PT ratio of the PT they are using.

Ensure to click on “Update Device” after making any changes so that the changes can be saved on the meter.

Other settings that the user can configure from this page are the meter address, baud rate and parity for communicating with the meter through Modbus, the demand mode and calculation time and the parameters that can be added to the meter’s Important parameter display.

Certain settings such as clearing meter data require the permission of the user to be configured to High.

Click on 'Upgrade' beside "Current Permission" and enter the password of the meter to elevate the Permission. The Permission will stay on High for 30 minutes before being demoted back the default Low permission status.

Note: The Permission will need to be on High so that the energy readings can be cleared and to initialize the energy value.

For more information regarding other configurations, please refer to the AcuRev 1310 series user manual.

4.3.5 Setting the Pulse Output:

From the "General Settings" page in the software, users can configure the meter to output pulses corresponding to the energy that the AcuRev 1312 is measuring.

Under "Energy Pulse Output", the type of energy that will be outputted needs to be selected as either "Real Energy" or "Reactive Energy" so that when either on the energy parameter is accumulating then there will be a pulse output associated for that energy parameter.

Users will need to enter the requirements for the pulse in the "Pulse Constant" and "Pulse Width" fields.

The "Pulse Constant" is the number of pulses the user needs one pulse to represent. Enter a value from 1-60000.

Note: Please see Section 4.2 Pulse Output on how to obtain the pulse constant.

The "Pulse Width" of the pulse is the duration it will last for. Enter a value from 20-100ms.

Click "Update Device" to save the settings to the meter.

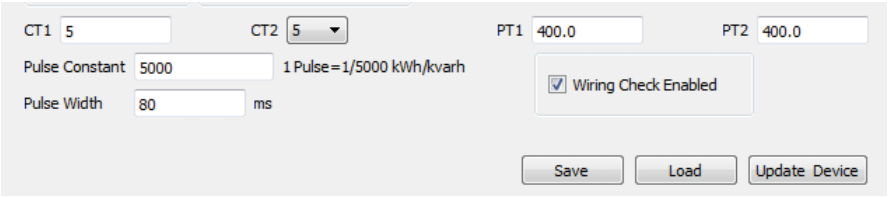


Figure 4.3.6

AcuRev 1312 DIN-Rail Power Meter

Chapter 5: Communication

5.1 Modbus Protocol Introduction

5.2 Communication Format

5.3 Application details

This chapter introduces users on how to communicate with the AcuRev 1312 through the Modbus communication protocol. A knowledge of the Modbus communication protocol would be beneficial for users who will read this chapter.

The chapter's contents include the Modbus protocol, communication format and application of the AcuRev 1312 meter.

5.1 Modbus Protocol Introduction

Transmission mode

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

- Coding System 8 bits
- Start bit 1 bit
- Data bits 8 bits
- Parity None/Odd/Even
- Stop bit 1 bit or 2 bits
- Error Checking CRC

Frame:

When the query to the AcuRev 1312 meter (slave device) is received, the meter removes the frame header and reads the data. If there are no errors, then the meter will implement the data's task. Once the task is completed, the meter will put its own data with the acquired header and send back the frame to the master device that queried the meter. The response data frame contains the address, function, data and CRC check. Any error will cause the response to fail.

Table 5.1 Data frame format

Address	Function	Data	Check
8 bits	8 bits	N x 8 bits	16 bits

Address Field: The address field is the data at the start of the frame, It is composed of a 8 bits(1 byte) and corresponds to the device address. It has a decimal value of 1-247.

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

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

Table 5.2 Function Code

Function Code	Meaning	Action
03	Read Holding Register	Obtain current value of 1 or more registers
16	Preset register	Set value of 1 or more register

Data Field: The data field contains the data that the slave device needs in order to complete the request. This data may be a numerical value, address or setting. For example, the function code tells the slave device to read one register however the data field specifies reading from which register and how many registers to read.

Error Check Field: This field allows for error checks to be performed by both master and slave devices. Sources of errors such as electrical noise and other interferences can cause the data to be changed while it is being transmitted from one device to other. The error check ensures that the master or slave devices do not respond to the distorted data during the transmission. The error check rule used is the 16 bit Cyclic Redundancy Check (CRC 16).

5.2 Communication Format

Addr	Fun	Data start register hi	Data start register low	#of registers hi	#of registers low	CRC16 hi	CRC16 low
06H	03H	00H	00H	00H	21H	84H	65H

Fun: Function code

Data start reg hi: High byte of starting register address

Data start reg lo: Low byte of starting register address

Data #of regs hi: High byte of number of registers

Data #of regs lo: Low byte of number of registers

1. Read Data (Function Code 03H)

This function code allows the user to obtain the measurement data from the AcuRev 1312.

Below is a example of an query for reading three of the AcuRev 1312's energy parameters. The query is requesting the total active energy, tariff 1 active energy and tariff 2 active energy from the meter with device address of 17. The data type of the energy parameters are double words. The data for each parameters will be in 2 registers where each register contains 2 bytes. The registers for the parameters to be polled in this example are 900H-901H, 902H-903H and 904H-905H

respectively.

Query:

Addr	Fun	Data start register hi	Data start register low	#of registers hi	#of registers low	CRC16 hi	CRC16 low
11H	03H	09H	00H	00H	06H	C4H	C4H

Response:

The AcuRev 1312 responds back to the master's query by responding with its slave device, function code, data and CRC check.

Below is the response from the AcuRev 1312 for returning the total active energy (1.27kWh), tariff 1 energy (1.00kWh) and tariff 2 energy(0.27kWh). When the values are returned in Modbus, they need to be scaled. The relationship for the energy data between the real value and the communication value is real value= communication value/100.

Addr	Fun	Byte count	Data 1hi	Data 1 low	Data 2 hi	Data 2 low	Data 3 hi	Data 3 low	Data 4 hi	Data 4 low
11H	03H	0CH	00H	00H	00H	7FH	00H	00H	00H	64H

Data 5 hi	Data 5 lo	Data 6 hi	Data 6 lo	CRC16 hi	CRC16 low
00H	00H	00H	1BH	96H	8DH

2. Preset/Reset Multi-Registers (Function Code 10H)

Function code 10H allows the user to write the contents of meters registers such as system parameters and energy initialization.

Below is an example on writing a value to the meters total active energy (0.2kWh)

Addr	Fun	Byte count	Data start register hi	Data start register low	#of registers hi	#of registers low	Byte Count
11H	10H	0CH	09H	00H	00H	00H	02H

Value hi	Value lo	Value hi	Value lo	CRC16 hi	CRC16 low
00H	00H	00H	14H	CDH	30H

5.3 Application Details

1. Data Types: The data types supported by the AcuRev 1312 have the following meanings.

Bit- binary value

Word- 16 bit unsigned integer using one register that contains 2 bytes. The data range is 0~65535.

Int16- 16 bit signed integer using one register that contains 2 bytes. The data range is -32768~32767.

Dword- 32 bit unsigned integer using two registers that contains 4 bytes in total. The high bytes follow the low bytes in this data type. The data range is 0-4294897295.

Int32- 32 bit signed integer using two registers that contains 4 bytes in total. The data range is from -32768~32767.

Float-Single precision floating point number using two registers. The data range is -2147483648~2147483647.

2.Relationship between communication value and real value.

The measurement values from the AcuRev 1312 meter obtained through Modbus may not always be equal to the real value. The values may be scaled or a relationship may need to be applied. It is very important that user is aware of these relationships when designing programs to poll the meter, otherwise the values may not be accurate.

Parameter	Relationship	Unit
System Parameter settings and Status	The communication value equals the real value	----
Real-time Clock, Timestamps	The communication value equals the real value	----
Electrical measurement parameters		Electrical measurement parameters unit
PT1 & PT2	Real = Communication/10	----
Meter run time & Load time	Real = Communication/10	Hours

3. Parameter Address Table

For the complete Modbus addresses that the AcuRev 1312 supports, please reference the AcuRev 1310 Series User Manual.

System Parameter Settings: Function Code: 03H to Read; 10H to Write

Modbus Address		Parameter	Data Type	Property	Range	Default	#of registers
Hex	Decimal						
200H	512	Meter Address	word	R/W	1-247	1	1
201H	513	Baud Rate	word	R/W	1200; 2400; 4800; 9600; 19200;38400	19200	1
202H	514	Parity	word	R/W	0: Even parity; 1: Odd parity 2: No parity, 2 Stop Bit 3: No parity, 1 Stop Bit	3	1
203H	515	Energy Pulse Output	word	R/W	0: Active Power 1: Reactive Power	0	1
204H	516	Demand Mode	word	R/W	0: Sliding Window; 1: Fixed Window; 2: Rolling Window 3: Thermal	0	1
205H	517	Demand Calculation Time	word	R/W	1-30 minutes	15	1
206H	518	Demand Calculation Slip Time	word	R/W	1-30 minutes	1	1
207H	519	Reactive Power Calculation Method	word	R/W	0: True (sinusoidal); 1: Generalized (harmonics present)	0	1
208H	520	VAR/PF Convention	word	R/W	0: IEC; 1: IEEE	0	1
210H	528	Parameter Measurement side	word	R/W	0: Primary side; 1:Secondary side	0	1
211H	529	Wiring Mode	word	R/W	0:3LN 1:2LL 2:1LL 3:1LN	0	1
212H	530	CT2	word	R/W	1:1A CT; 5:5A CT; 80:80mA CT; 100:100mA CT; 200:200mA CT;	According to order	1
213H	531	CT1	word	R/W	1~50000/5~50000	5	1
215H	533	PT2	word	R/W	50.0~400.0	220.0	1
216H-217H	534-535	PT1	word	R/W	50.0~999999.9	220.0	1
218H	536	Pulse Constant	word	R/W	1-60000	5000	1
219H	537	Pulse Width	word	R/W	20-100 ms	100	1

Modbus Address		Parameter	Data Type	Property	Range	Default	#of registers
Hex	Decimal						
21AH	538	Energy display Decimal	word	R/W	0,1, 2, 3	2	1

Clock Parameters: Function Code: 03H to Read; 10H to Write

Modbus Address		Parameter	Data Type	Property	Range	Default	#of registers
Hex	Decimal						
300H	768	Clock: year	word	R/W	2000-2099	2000	1
301H	769	Clock: month	word	R/W	1-12	1	1
302H	770	Clock: date	word	R/W	1-31	1	1
303H	771	Clock: hour	word	R/W	0-23	0	1
304H	772	Clock: minute	word	R/W	0-59	0	1
305H	773	Clock: second	word	R/W	0-59	0	1
306H	774	Week	word	R/W	0-6 0: Sunday; 1-6: Monday - Saturday	6	1
310H-311H	784-785	Run Time	Dword	R	0-999999999		2
312H-313H	786-787	Load Time	Dword	R	0-999999999		2

Real-Time Parameters: Function Code: 03H to Read

Modbus Address		Parameter	Data Type	Property	Range	Default	#of registers
Hex	Decimal						
2000H-2001H	8192-8193	Total Current	float	R			2
2002H-2003H	8194-8195	Phase A Current	float	R			2
2004H-2005H	8196-8197	Phase B Current	float	R			2
2006H-2007H	8198-8199	Phase C Current	float	R			2
2008H-2009H	8200-8201	Phase Average Voltage	float	R			2
200AH-200BH	8202-8203	Phase A Voltage	float	R			2
200CH-200DH	8204-8205	Phase B Voltage	float	R			2
200EH-200FH	8206-8207	Phase C Voltage	float	R			2
2001H-2011H	8208-8209	Line Average Voltage	float	R			2
2012H-2013H	8210-8211	Line AB Voltage	float	R			2
2014H-2015H	8212-8213	Line BC Voltage	float	R			2
2016H-2017H	8214-8215	Line CA Voltage	float	R			2
2018H-2019H	8216-8217	Frequency	float	R			2
201AH-201BH	8218-8219	Total Active Power	float	R			2
201CH-201DH	8220-8221	Phase A Active Power	float	R			2
201EH-201FH	8222-8223	Phase B Active Power	float	R			2
2020H-2021H	8224-8225	Phase C Active Power	float	R			2
2022H-2023H	8226-8227	Total Apparent Power	float	R			2
2024H-2025H	8228-8229	Phase A Apparent Power	float	R			2
2026H-2027H	8230-8231	Phase B Apparent Power	float	R			2

Modbus Address		Parameter	Data Type	Property	Range	Default	#of registers
Hex	Decimal						
2028H-2029H	8232-8233	Phase C Apparent Power	float	R			2
202AH-202BH	8234-8235	Total Reactive Power	float	R			2
202CH-202DH	8236-8237	Phase A Reactive Power	float	R			2
202EH-202FH	8238-8239	Phase B Reactive Power	float	R			2
2030H-2031H	8240-8241	Phase C Reactive Power	float	R			2
2032H-2033H	8242-8243	Power Factor	float	R			2
2034H-2035H	8244-8245	Phase A PF	float	R			2
2036H-2037H	8246-8247	Phase B PF	float	R			2
2038H-2039H	8248-8249	Phase C PF	float	R			2
1208H-1209H	4616-4617	System Active Power Demand	Float	R			2
120AH-120BH	4618-4619	System Reactive Power Demand	Float	R			2
120CH-120DH	4620-4621	System Apparent Power Demand	Float	R			2
120EH-120FH	4622-4623	Phase A Current Demand	Float	R			2
1210H-1211H	4624-4625	Phase B Current Demand	Float	R			2
1212H-1213H	4626-4627	Phase C Current Demand	Float	R			2

Energy: Function Code: 03H to Read; 10H to Write

Modbus Address		Parameter	Data Type	Property	Range	Default	#of registers
Hex	Decimal						
204EH-204FH	8270-8271	Total Active Energy Consumed	Dword	R/W	0-999999999 Wh		2
2050H-2051H	8272-8273	Total Active Energy Consumed: Phase A	Dword	R/W	0-999999999 Wh		2
2052H-2053H	8274-8275	Total Active Energy Consumed: Phase B	Dword	R/W	0-999999999 Wh		2
2054H-2055H	8276-8277	Total Active Energy Consumed: Phase C	Dword	R/W	0-999999999 Wh		2
205EH-205FH	8286-8287	Total Apparent Energy	Dword	R/W	0-999999999 VAh		2
2060H-2061H	8288-8289	Total Apparent Energy: Phase A	Dword	R/W	0-999999999 VAh		2
2062H-2063H	8290-8291	Total Apparent Energy: Phase B	Dword	R/W	0-999999999 VAh		2
2064H-2065H	8292-8293	Total Apparent Energy: Phase C	Dword	R/W	0-999999999 VAh		2
2066H-2067H	8294-8295	Total Reactive Energy Consumed: Q1	Dword	R/W	0-999999999 varh		2
2068H-2069H	8296-8297	Total Reactive Energy Consumed: Q1 Phase A	Dword	R/W	0-999999999 varh		2

Modbus Address		Parameter	Data Type	Property	Range	Default	#of registers
Hex	Decimal						
206AH-206BH	8298-8299	Total Reactive Energy Consumed: Q1 Phase B	Dword	R/W	0-999999999 varh		2
206CH-206DH	8300-8301	Total Reactive Energy Consumed: Q1 Phase C	Dword	R/W	0-999999999 varh		2
206EH-206FH	8302-8303	Total Reactive Energy Consumed: Q2	Dword	R/W	0-999999999 varh		2
2070H-2071H	8204-8205	Total Reactive Energy Consumed: Q2 Phase A	Dword	R/W	0-999999999 varh		2
2072H-2073H	8206-8207	Total Reactive Energy Consumed: Q2 Phase B	Dword	R/W	0-999999999 varh		2
2074H-2075H	8208-8209	Total Reactive Energy Consumed: Q2 Phase C	Dword	R/W	0-999999999 varh		2
2076H-2077H	8210-8211	Total Reactive Energy Generated: Q3	Dword	R/W	0-999999999 varh		2
2078H-2079H	8212-8213	Total Reactive Energy Generated: Q3 Phase A	Dword	R/W	0-999999999 varh		2
207AH-207BH	8214-8215	Total Reactive Energy Generated: Q3 Phase B	Dword	R/W	0-999999999 varh		2
207CH-207DH	8216-8217	Total Reactive Energy Generated: Q3 Phase C	Dword	R/W	0-999999999 varh		2
207EH-207FH	8218-8219	Total Reactive Energy Generated: Q4	Dword	R/W	0-999999999 varh		2
2080H-2081H	8220-8221	Total Reactive Energy Generated: Q4 Phase A	Dword	R/W	0-999999999 varh		2
2082H-2083H	8222-8223	Total Reactive Energy Generated: Q4 Phase B	Dword	R/W	0-999999999 varh		2
2084H-2085H	8224-8225	Total Reactive Energy Generated: Q4 Phase C	Dword	R/W	0-999999999 varh		2

AcuRev 1312 DIN-Rail Power Meter

Appendix

METERING

Parameter	Accuracy	Resolution	Range
Active energy	0.5%	1Wh	0-999999999
Reactive energy	0.5%	1varh	0-999999999
Apparent energy	0.5%	1VAh	0-999999999
Voltage	0.5%	0.1V	10V-1000KV
Current	0.5%	0.001A	10mA-500000A
Active power	0.5%	1W	-99-99MW
Reactive power	0.5%	1var	-99-99Mvar
Apparent power	0.5%	1VA	-99-99MVA
Power factor	0.5%	0.001	-1.000-1.000
Frequency	0.2%	0.01Hz	50/60
Power demand	0.5%	1W/var/VA	99MW/Mvar/MVA
Current demand	0.5%	0.001A	10mA-5000A

SPECIFICATIONS

Voltage	
Rated Voltage	240Vac L-N/415Vac L-L
Input Impedance	2M /Phase
Measurement Frequency	50/60Hz
Accuracy	0.5%

Current Input	
Stated Current (IN)	5A/1A/100mA/80mA
Start Current	10mA/2mA/0.2mA/ 0.16mA
Accuracy	0.5%

Pulse Output	
Isolation voltage	2500Vac
Load Voltage	0-250Vac
Load Current	100mA(max)

Power Supply	
Working Power Supply	100-415Vac,50/60Hz; 100-300Vdc
Power Consumption	<2W or <10VA

Relay Output	
Load Voltage	250Vac30Vdc
Max Load current	5A(Resistant Load)
Isolation voltage	2000Vac(1min)
Action Time	10ms
Mechanical Life	20million times
Electrical Life	Above 50,000Times (5A,250Vac,Resistant Load)

Communication	
RS485Baud Rate	1200-38400
Communication protocol	Modbus-RTU
Infrared Communication	2000Vac(1min)
Infrared Baud Rate	10ms

Environment	
Working temperature	-25 to 53° C
Storage temperature	-40 to 85° C

ACCUENERGY

MAKE ENERGY USAGE SMARTER

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