-power in control

INSTALLATION INSTRUCTIONS AND REFERENCE HANDBOOK



MIC-2

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Please read this manual carefully before installation, operation and maintenance of the MIC-2 multi-instrument.
The following symbols are used in this user's manual and on the MIC-2 multi-instrument:

High voltage symbol. Electrical hazard voltage can cause shock, burns or person injury or death. Failure to observe the information may result in injury or death.

Danger symbol. Observe the information after the symbol to avoid possible injury or death.

Installation and maintenance of the MIC-2 multi-instrument should only be performed by qualified, competent personnel trained and experienced in working with high voltages and currents.

This document is not fit for any untrained people. DEIF is not responsible or liable for any damages cause by improper installation and/or operation.

Content

Congratulations!
You have purchased an advanced, versatile, multi-function power meter, the MIC-2. The MIC-2 can work as a remote terminal unit (RTU) that contributes to your system's stability and reliability by providing real-time power quality monitoring and analysis.

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

1. MIC-2 unit	1
2. Pluggable terminal	3
3. Installation clips	4
4. Rubber gasket	1
5. User's manual	1
6. Maintenance guarantee card	1

Please read this manual carefully before operating or installing the MIC-2 to avoid unnecessary trouble.

Powerful multifunction power meter
The MIC-2 multi-function digital power meter is designed using modern MCU and DSP technology. It integrates three-phase energy measuring and displaying, energy accumulating, power quality analysis, malfunction alarming, data logging and network communication. Large and vivid LCD meets your visual requirement, and the large character LCD display with backlight provides clear real-time monitoring data readout. The interface makes it easy to master. Multi-row displaying lets you observe various data without touching any keys.

Ideal choice for electric automation SCADA system
The MIC-2 is the ideal choice for replacing traditional, analogueue electric meters. Apart from providing clear real-time readings on the meter front, it can also be used as a remote terminal unit (RTU) for monitoring and controlling for a SCADA system. Users can access all measurement parameters via the standard RS485 communication port (or the optional Ethernet port) with the Modbus protocol.

Energy management
The MIC-2 is able to measure bidirectional, four quadrants kWh and kvarh. It provides maximum/minimum records for power usage and power demand parameters. All power and energy parameters, including measurement tables, can be viewed remotely so that users can monitor running load and energy usage status easily.

Remote power control
The MIC-2 is designed for measuring and monitoring of power quality parameters. Since different I/O modules can be added to the unit, this expands the capability and provides a very flexible platform for using the unit as a distributed RTU, for metering, monitoring and remote controlling, all in one unit.

Power quality analysis
Utilising digital signal processing (DSP) technology, the MIC-2 provides high accuracy power quality analysis and supports online parameter monitoring. The unit continuously updates metering results and allows users online access to monitor parameters such as voltage and current THD, harmonics up to the 31st order, voltage crest factor, current K factor, and voltage and current unbalance factor, etc.

1.2 Application area

Power distribution automation
Industry automation
Energy management system
Resident district power monitoring
Intelligent electric switch gear
Building automation
Substation automation

1.3 Function of the MIC-2

Multi-function, high accuracy
The MIC-2 offers powerful data collecting and processing functions. In addition to measuring various parameters, the meter is able to perform demand metering, harmonic analysis, max/min statistic recording, over/under limit alarming, energy accumulating, data logging, etc.

Accuracy of voltage and current is 0.2%, true RMS.
Accuracy of power and energy is 0.5%, four quadrants metering.

Small size and easy installation
The MIC-2 can be installed into a standard ANSI C39.1 (4" round) or an IEC 92mm DIN (Square) form. With the 51mm depth after mounting, the unit can be installed in a small cabin. Fixing clips are used for easy installation and removal.

Easy to use
The MIC-2 has a large, clear and easy to read LCD screen for displaying monitoring parameters. The unit screen with selectable backlight duration can be read easily under poor lighting conditions. All metering data and setting parameters can be accessed by using the front panel keys or via the communication port. Setting parameters are stored in the EEPROM so that content will be maintained even the meter is powered off.

Multiple wiring modes
The MIC-2 can be used in high voltage, low voltage, three-phase three wires, three-phase four wires and single-phase systems using different wiring mode settings.

High safety, high reliability
The MIC-2 was designed according to industrial standards. It can run reliably under high power disturbance condition as it has passed EMC and safety test according to IEC standards and UL certification.

Installation – before you begin!

- Installation of the unit must be performed by qualified personnel only, who follow standard safety precautions through the installation procedures. The personnel must have appropriate training and experience working with high voltage devices. Appropriate safety gloves, safety glasses and protective clothing are recommended.
- During normal operation, dangerous voltage may flow through many parts of the unit, including terminals, and any connected CTs (current transformers) and PTs (potential/voltage transformers), all I/Os (inputs and outputs) modules and their circuits. All primary and secondary circuits can, at times, produce lethal voltages and currents. AVOID contact with any current-carrying surfaces.
- The unit and its I/O output channels are NOT designed as primary protection devices and may NOT be used as primary circuit protection or in an energy-limiting capacity. The unit and its I/O output channels can only be used as secondary protection. AVOID using the unit under situations where failure of the unit may cause injury or death. AVOID using the unit for any application where risk of fire may occur.
- All unit terminals should be inaccessible after installation.
- Do NOT perform Dielectric (HIPOT) test to any inputs, outputs or communication terminals. High voltage testing may damage electronic components of the unit.
- Applying more than the maximum voltage the unit and/or its modules can withstand will permenately damage the unit and/or its modules. Please refer to the specifications for all devices before applying voltages.
- When removing unit for service, use shorting blocks and fuses for voltage leads and power supply to prevent harzardous voltage conditions or damage to CTs. CT grounding is optional.
- DEIF recommends using a dry cloth to wipe the unit.

NOTE: IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

NOTE: THERE IS NO REQUIRED PREVENTIVE MAINTENANCE OR INSPECTION NECESSARY FOR SAFETY. HOWEVER, ANY REPAIR OR MAINTENANCE SHOULD BE PERFORMED BY THE FACTORY.

DISCONNECT DEVICE: The following part is considered the equipment disconnect device.

A SWITCH OR CIRCUIT BREAKER MUST BE INCLUDED IN THE END-USE EQUIPMENT OR BUILDING INSTALLATION. THE SWITCH MUST BE IN CLOSE PROXIMITY TO THE EQUIPMENT AND WITHIN EASY REACH OF THE OPERATOR. THE SWITCH MUST BE MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT.

2.1 Appearance and dimensions

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

Appearance

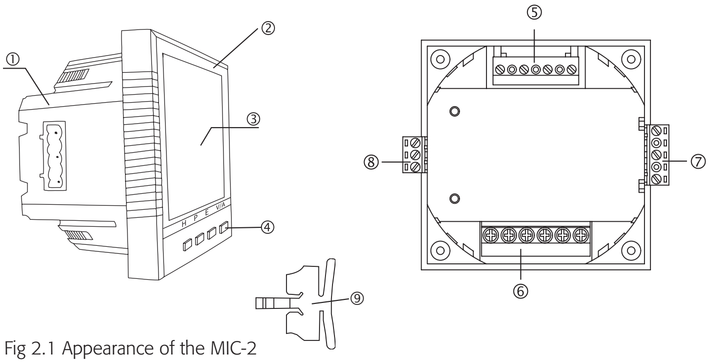


Fig 2.1 Appearance of the MIC-2

Part name	Description
1. Enclosure	The MIC-2 enclosure is made of high strength anti-combustible engineering plastic
2. Front Casing	Visible portion (for display and control) after mounting onto a panel
3. LCD Display	Large bright white backlight LCD display
4. Key	Four keys are used to select display and set
5. Voltage input terminals	Used for voltage input
6. Current input terminals	Used for current input
7. Power supply terminals	Used for aux. power supply input
8. Communication terminals	Communication output
9. Installation clip	Used for fixing the meter to the panel

Table 2.1 Part name of MIC-2

Dimensions – unit: mm(inches)

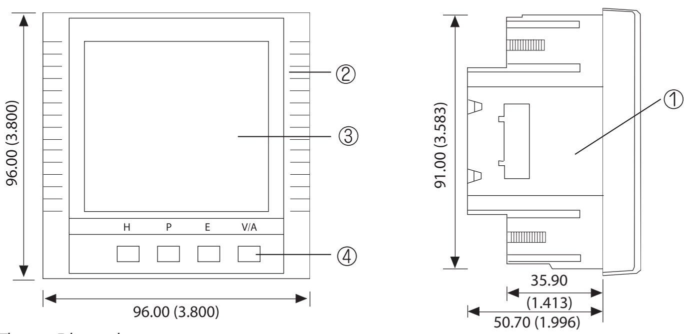


Fig 2.2 Dimensions

2.2 Installation method

Environmental
Before installation, please check the environment, temperature and humidity to ensure the MIC-2 is being placed where optimum performance will occur.

Temperature

Operation:	-25˚C to 70˚C
Storage:	-40˚C to 85˚C

Humidity
5% to 95% non-condensing.
The MIC-2 should be installed in a dry and dust free environment. Avoid exposing the unit to excessive heat, radiation and high electrical noise source.

Installation steps
The MIC-2 can be installed into a standard ANSI C39.1 (4" round) or an IEC 92mm DIN (square) form.

1. Cut a square hole or round hole on the panel of the switch gear.
   The cutting size is shown in fig 2.3. – unit: mm (inches)

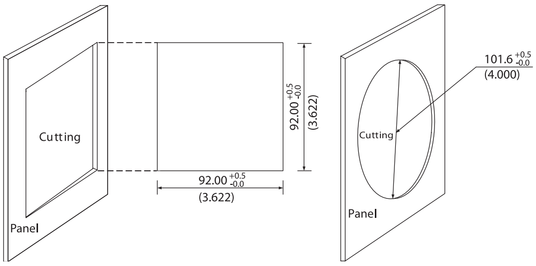


Fig 2.3 Panel cutting

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

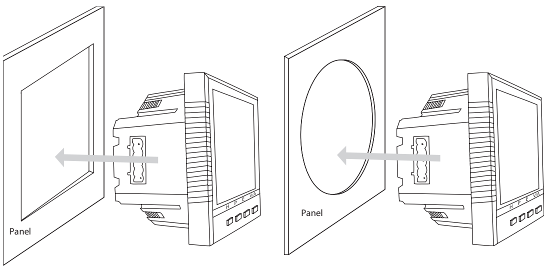


Fig 2.4 Put the meter into the square hole

3. Put clips back into the unit from the backside and push the clips tightly so that the unit is fixed on the panel.

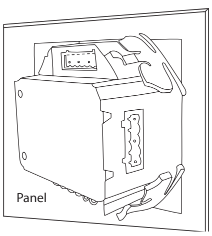
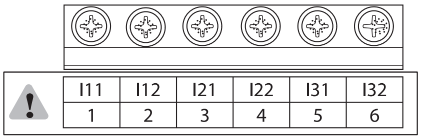


Fig 2.5 Use the clips to fix the unit on the panel

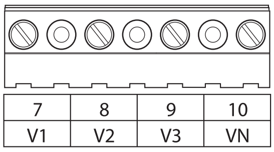
2.3.1 Terminal strips

There are four terminal strips at the back of the MIC-2 unit. The three phase voltage and current are represented by using 1, 2, and 3 respectively. These numbers have the same meaning as A, B, and C or R, S, and T used in other literature.

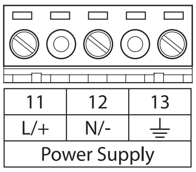
Current input terminal strip



Voltage input terminal strip



Power supply terminal strip



Communication terminal strip

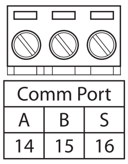


Fig 2-6. Terminal strips of the MIC-2

Safety earth connection

Before setting up the MIC-2 wiring, please make sure that the switch gear has an earth ground terminal. Connect both the MIC-2's and the switch gear's ground terminals together. The following ground terminal symbol is used in this user's manual.

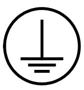


Fig 2-7 Safeth earth symbol

2.3.2 Power requirement

Auxiliary power

100~415V AC (50/60 Hz) or 100-300V DC.

DANGEROUS

Only qualified personnel to do the wire connection work. Make sure the power supply is cut off and all the wires are powerless. Failure to observe this may result in severe injury or death.

NOTE

Make sure the voltage of power supply equals the auxiliary power required by the MIC-2. Make sure the auxiliary power terminal of the MIC-2 ground is connected to the safety earth of the switchgear.

The unit'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. Terminals for the auxiliary power supply are 11, 12 and 13 (L, N, and Ground). A switch or circuit breaker is to be included in a building installation. It must be located in close proximity to the equipment, within easy reach of the operator, and clearly marked as the disconnecting device for the equipment.

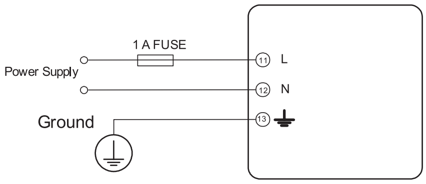


Fig 2-8 Power supply

A fuse (typical 1A/250V AC) should be used in auxiliary power supply loop. No. 13 terminal must be connected to the ground terminal of the switchgear. An isolated transformer or EMC filter should be used in the auxiliary power supply loop if there is a power quality problem in the power supply.

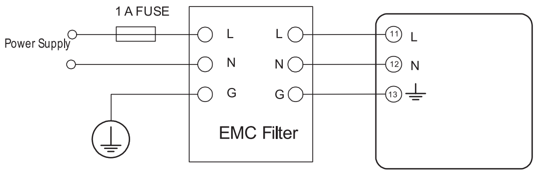


Fig 2-9 Power supply With EMC filter

Choice of wire of power supply could be AWG22-16 or 0.6-1.5 mm^2.

Voltage input

Maximum input voltage for the MIC-2 shall not exceed 400LN/690LL V AC rms for three phase or 400LN V AC rms for single phase.

Potential Transformer (PT) must be used for high voltage systems. Typical secondary output for PTs equals 100V or 120V. Please make sure to select an approprate PT to maintain the measurement accuracy of the unit. When connecting using the star configuration wiring method, the PT's primary side rated voltage should be equal to or close to the phase voltage of the system to utilise the full range of the PT. When connecting using the delta configuration wiring method, the PT's primary side rated voltage should be equal to or close to the line voltage of the system. A fuse (typical 1A/250V AC) should be used in voltage input loop. The wire of voltage input could be AWG16-12 or 1.3-2.0mm^2.

Note: Under no circumstance should the secondary of the PT be shorted. The secondary of PT should be grounded at one end. Please refer to the wiring diagram section for further details.

Current input

Current Transformers (CTs) are required in most engineering applications. The typical current rating for the secondary side of the CT equals 5A. CTs must be used if the system rated current is over 5A. The accuracy of the CT should be better than 0.5% with rating over 3VA is recommended in order to preserve the unit's accuracy. Keep the wire between CTs and the MIC-2 as short as possible. The length of the wire may increase the risk of measurement errors.

The wire size of current input could be AWG15-10 or 1.5-2.5mm^2.

Note: The secondary side of the CT should not be an open circuit in any circumstance when the power is turned on. There should not be any fuse or switch in the CT loop. One end of the CT loop should be connected to the ground.

Vn connection

Vn is the reference point of the MIC-2 voltage input. Low wire resistance helps improve the measurement accuracy. Different system wiring mode requires different Vn connection method. Please refer to the wiring diagram section for more details.

Three-phase wiring diagram

The MIC-2 can be used for almost all kinds of three-phase wiring diagrams. Please read this section carefully before choosing the suitable wiring method for your power system.

2.3.3 Voltage input wiring

3-phase 4-line wye mode (3LN)

The 3-phase 4-line wye mode is popularly used in low voltage electric distribution power systems. For voltages lower than 400LN/690LL V AC, the power line can be connected directly to the unit's voltage input port as shown in fig 2.10a. For high voltage systems (over 400LN/690LL Vac), PTs are required and the connection method is shown in fig 2.10b. The unit should be set to 3LN for both voltage levels.

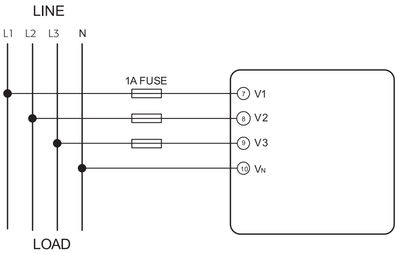


Fig 2.10a 3LN direct connection

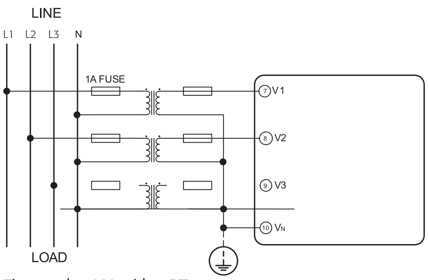


Fig 2.10b 3LN with 3PT

3-phase 4-line 2PT mode (2LN*)

In a 3-phase 4-line wye system, 2PT wye mode is used when the 3-phase power system is balanced. The connection method is shown in fig 2.11. The voltage of V2 is calculated according to the V1 and V3. The voltage input mode of the unit should be set to 2LN for the 2PT voltage input wiring mode.

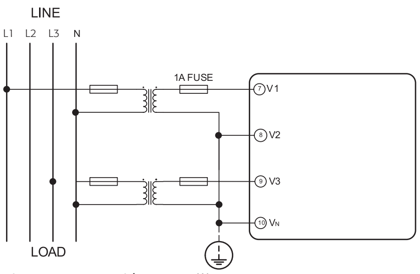


Fig 2.11 2LN with 2PTs (*)

3-phase 3-line direct connection mode (3LL)

In a 3-phase 3-line system, power line L1, L2 and L3 are connected to V1, V2 and V3 directly. Vn is floated. The voltage input mode of the unit should be set to 3LL.

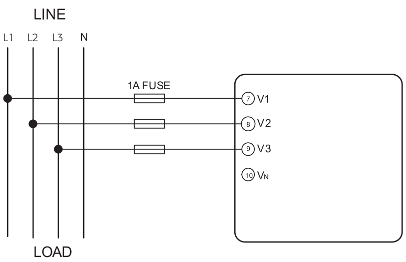


Fig 2.12 3LN 3-Phase 3-Line direct connection

3-phase 3-line open delta mode (2LL)

Open delta wiring mode is often used in high voltage system. V2 and Vn are connected together in this mode. The voltage input mode of the unit should be set to 2LL for this voltage input wiring mode.

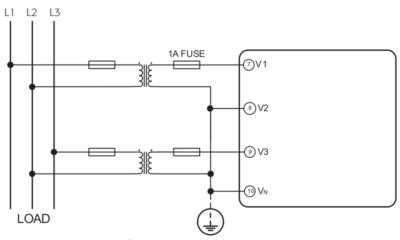


Fig 2.13 2LL with 2PTs

2.3.4 Current input wiring

3CT

The 3CT current wiring configuration can be used when either 3CTs are connected (as shown in Fig 2.14) or 2CTs are connected (as shown in Fig 2.15) to the system. In either case, there is current flowing through all three current terminals.

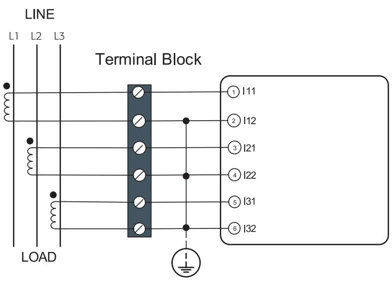


Fig 2.14 3CTs a

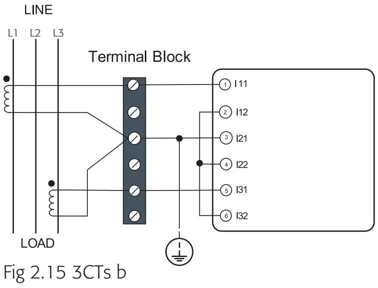


Fig 2.15 3CTs b

2CT

The difference between Fig 2.15 and Fig 2.16 is that no current flows through current input terminal I21 and I22. The unit should be set to the I2 value which is calculated from formula i1+i2+i3=0. The current input mode of the unit should be set to 2CT.

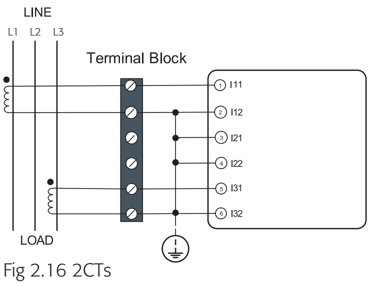


Fig 2.16 2CTs

1CT*

If it is a three-phase balance system, 1 CT connection method can be used. The other two channels are calculated accordingly.

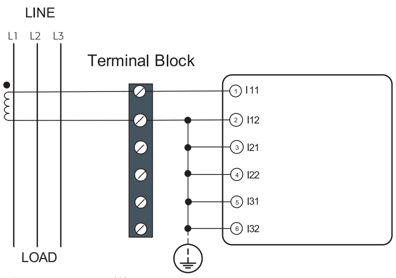


Fig 2.17 1CT (*)

2.3.5 Frequently used wiring method

In this section, most common voltage and current wiring connection combinations are put together into different diagrams. In order to display measurment readings correctly, please select the approprate wiring diagram according to your setup and application.

1. 3LN, 3CT with 3 CTs.

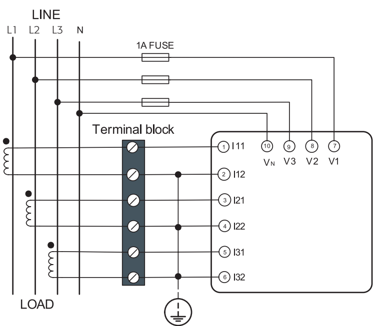


Fig 2.18 3LN, 3CT

2. 3LN, 3CT with 2 CTs

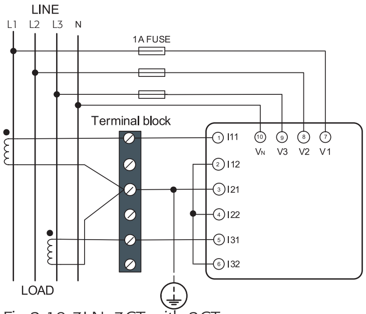


Fig 2.19 3LN, 3CT with 2CTs

3. 2LN, 2CT*

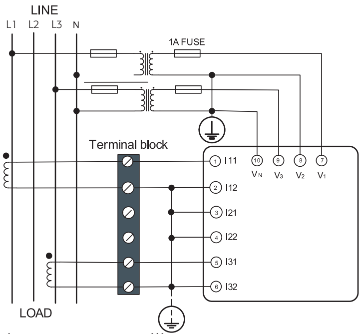


Fig 2.20 2LN, 2CT (*)

4. 2LN, 1CT*

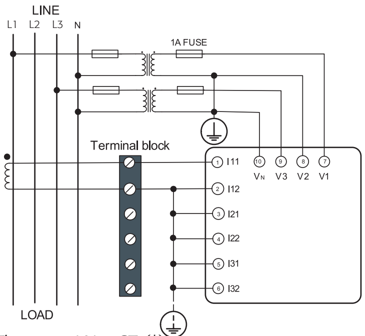


Fig 2.21 2LN, 1CT (*)

5. 2LL, 3CT

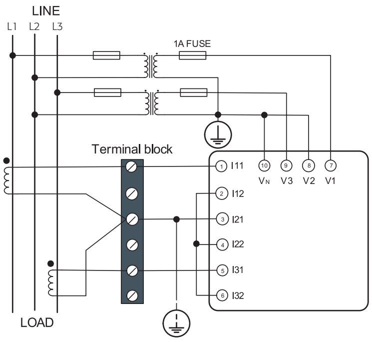


Fig 2.22 2LL, 3CT

8. Single-phase 2 line (wiring mode setting 3LN, 3CT)

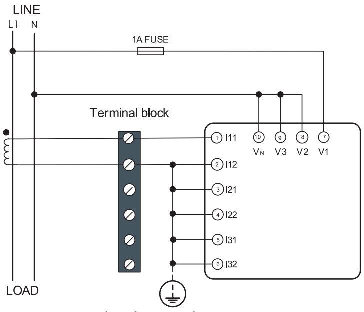


Fig 2.25 Single-phase 2 lines

9. Single-phase 3 line (wiring mode setting 3LN, 3CT)

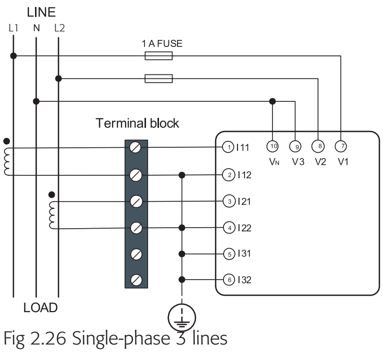


Fig 2.26 Single-phase 3 lines

2.3.6 Communication

The MIC-2 uses RS485 serial communication and the Modbus-RTU protocol. The terminals of communication are A, B, and S (14, 15, 16). A is differential signal +, B is differential signal – and S is connected to a shield of twisted pair cable. Up to 32 devices can be connnected on a RS485 bus. Use good quality shielded twisted pair cable, AWG22 (0.5 mm²) or higher. The overall length of the RS485 cable connecting all devices should not exceed 1200m (4000ft). The unit is used as a slave device of masters like PC, PLC, data collector or RTU.

If the master does not have RS485 communication port, a converter (such as a RS232/RS485 or a USB/RS485 converter) will be required. Typical RS485 network topologies include line, circle and star (wye).The shield of each segment of the RS485 cable must be connected to the ground at one end only.

Every A(+) should be connected to A(+), B(-) to B(-), or it will influence the network, or even damage the communication interface.

The connection topology should avoid "T" type which means there is a new branch and it does not begin from the beginning point.

Keep communication cables away from sources of electrical noise.
When several devices are connected to the same long communication an anti signal reflecting resistor (typical value 120Ω-300Ω/0.25W) must be added to the end of the circuit beside the last MIC-2 unit.

Use a RS232/RS485 or USB/RS485 converter with optically isolated output and surge protection.

The human-machine interface of the unit 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 MIC-2 consists of a LCD screen and four control keys. All display segments are illustrated in fig 3.1. Users should note that all the segments will not display in a single page under normal operating conditions.

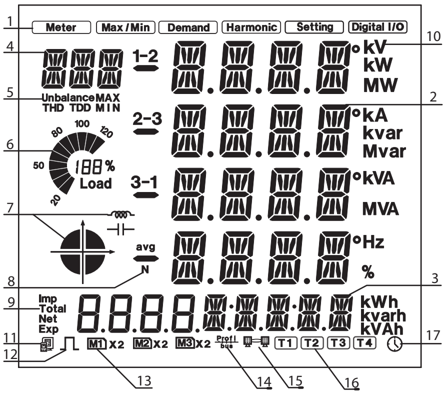


Fig3.1 All display segments

SN	Display	Description
1	Display mode indication	Show different modes on the display area, "Meter" for real-time measurement; "Max/Min" for statistic data; "Demand" for power demand data; "Harmonic" for harmonic data; "Setting" for parameters setting; "Digital I/O" for expended IO module data.
2	Four lines of " " digits in the metering area	Main display area: display metering data such as voltage, current, power, power factor, frequency, unbalance, phase angle, etc; display statistics such as maximum and minimum; display demand data; display settings and display expanded I/O data.
3	Four "8" and five " " digits	Display energy data and real-time clock. Also used for the setting mode and digital I/O mode display.
4	Three " " digits	Item icon: "U" for voltage; "I" for current; "P" for active power; "Q" for reactive power; "S" for apparent power; "PF" for power factor; "F" for frequency; "∠" for phase angles; "DMD" for demand; display setting page number; display expanded IO module type for "Mxx".
5	Unbalance, THD, TDD, MAX, MIN	Item icon: "Unbalance" for unbalance of the voltage and current; "THD" for total harmonics distortion; "TDD" for total demand distortion; "MAX" for maximum and "MIN" for minimum
6	Load rate	Display the percentage of the load current to the nominal current.
7	Four quadrant icon and load type icon	: the quadrant of the system power : inductive load : capacitive load
8	1-2, 2-3, 3-1, avg, N	1, 2, 3 for 3 phase L1, L2, L3; 1-2, 2-3, 3-1 for 3 phase line-to-line 12, 23, 31; avg for average and N for neutral.
9	Energy icon: Imp, Total, Net, Exp	Imp: import energy; Exp: export energy; Total: absolute sum of Imp and Exp energy Net: algebraic sum of Imp and Exp energy

10	Unit	voltage: V, kV; current: A, kA:active power: kW, MW; reactive power: kvar, Mvar; apparent power: kVA, MVA; frequency: Hz; active energy: kWh; reactive energy: kVarh; apparent energy: kVAh; percentage: %; phase angle: °
11	Communication icon	No icon: no communication One icon: inquiry Two icons: inquiry and answer
12	Energy pulse output indicator	No icon: no pulse output With icon: icon blinks when sending pulse output
13	Expanded I/O module indicator M1 x2 M2 x2 M3 x2	M1: one AXM-IO1 connected M1x2: two AXM-IO1 connected None: no AXM-IO1 connected M2: one AXM-IO2 connected M2x2: two AXM-IO2 connected None: no AXM-IO2 connected M3: one AXM-IO3 connected M3x2: two AXM-IO3 connected None: no AXM-IO3 connected
14	Profibus module indicator Profi bus	None: Profibus module not connected Illume: Profibus module connected
15	Ethernet module indicator	None: Ethernet module not connected Illume: Ethernet module connected
16	T1 T2 T3 T4	Reserved
17	Time icon	Time display in energy area

There are four keys on the front panel, label as H, P, E and V/A from left to right. Use these four keys to read real-time metering data, set parameters and unit navigation.

Note: If the LCD backlight is off, pressing any key once will bring the backlight on (no other function will be performed upon the backlight activation key press).

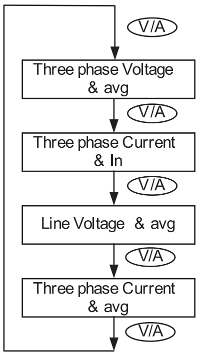
Pressing H and V/A simultaneously will activate the display mode selection and the cursor will flash. Press P or E to move the cursor right or left. To enter the metering mode, move the cursor to "Meter" then press V/A.

In the metering mode, the unit displays measurements such as voltage, current, power, power factor, phase angle, unbalance etc.

a) Voltage and current:

Press V/A to read voltage and current in the metering area. The screen will roll to the next page everytime when V/A is pressed. It will go back to the first screen if you press V/A at the last screen.

The following figure shows how it rolls:

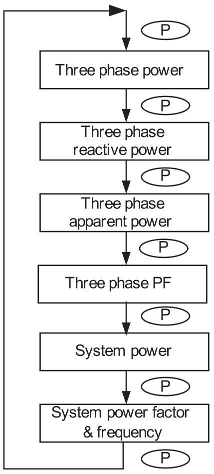


Note: When the unit is set to "2LL" or "3LL", there is no phase voltage and neutral current display. Therefore, only the third screen (line voltage & avg) and the the fourth screen (three phase current & avg) will be displayed.

b) Power, power factor and frequency:

Press P, display power related data.
The screen will roll to the next page everytime when P is pressed. It will go back to the first screen if you press P at the last screen.

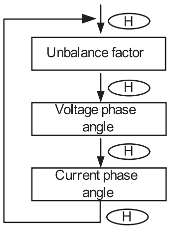
The following figure shows how it rolls:



Note: When the meter is set to "2LL" or "3LL", only the fifth screen (system power) and the sixth screen (system power factor & frequency) will be displayed.

c) Phase angles and unbalance:
Press H, display phase angles and unbalance data. The screen will roll to the next page everytime when H is pressed. It will go back to the first screen if you press H at the last screen.

The following figure shows how it rolls:

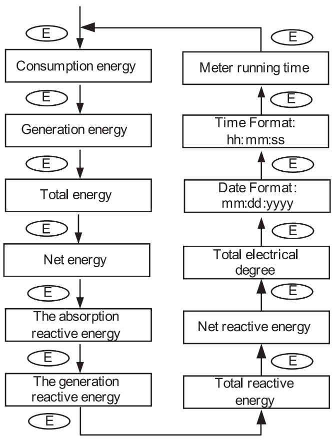


When using "2LL" or "3LL" wiring setting mode, voltage stands for line to line voltage. Otherwise, voltage stands for line-to-neutral voltage.

d) Energy:
Press E key, display energy and real time clock. The screen will roll to the next page everytime when E is pressed. It will go back to the first screen if you press E at the last screen.

The MIC-2 can be set to record primary power or secondary power. The unit of power is kWh for active power, kvarh for reactive power and kVAh for apparent power. The running time has a resolution of 0.01h. It starts accumulating time right from the beginning when the unit is first powered on. The accumulated time is stored in the non-volatile memory. It can be reset via communication or from the meter front.

The following figure shows how it rolls:



Pressing H and V/A simultaneously will activate the display mode selection and the cursor will flash. Press P or E to move the cursor right or left. To enter the statistics data mode, scroll the cursor to “Max/Min” then press V/A.

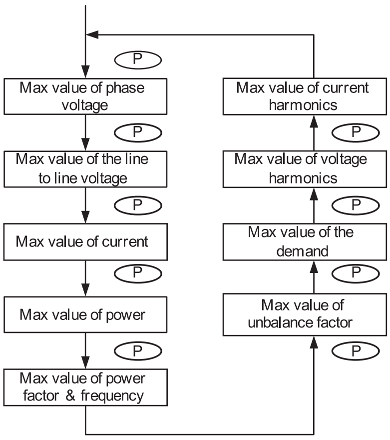
In the statistics data mode, the unit displays the maximum values and minimum values for voltage, current, power, power factor, unbalance, demand, THD etc. Users should note that the time stamp for the parameters can be only viewed from the software through communication. No commands are associated with the key H in “Max/Min” display mode.

Press H, no functions.

Press P, screen will roll to the next page, and will roll back to the first screen when pressed at the last page.

Press E, screen will roll back to the previous page, and will roll back to the last screen when pressed at the first page.
Press V/A to switch the view between maximum and minimum. For example, if the current display is the maximum phase voltage value, when V/A is pressed, the display will show the minimum phase voltage value. If V/A is pressed again, the display will switch back to show the maximum phase voltage value.

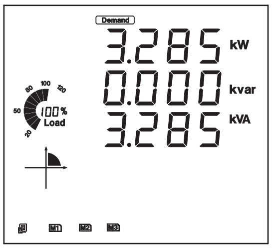
The following figure shows how it rolls:



Note:
i) The figure shows the rolling sequence when pressing P. The sequence will be reversed when pressing E.
ii) When the unit is set to “2LL” or “3LL”, the first screen(max value of phase voltage) will not be displayed.

Pressing H and V/A simultaneously will activate the display mode selection and the cursor will flash. Press P or E to move the cursor right or left. To enter demand mode, move the cursor to “Demand” then press V/A.

In the demand data mode, the first screen displays the demand of active power, reactive power and apparent power, and the second screen displays the current demand of phase L1, phase L2 and phase L3.



As shown in the figure, system active power demand is 3.285kW, system reactive power demand is 0 kvar, system apparent power demand is 3.285 kVA.

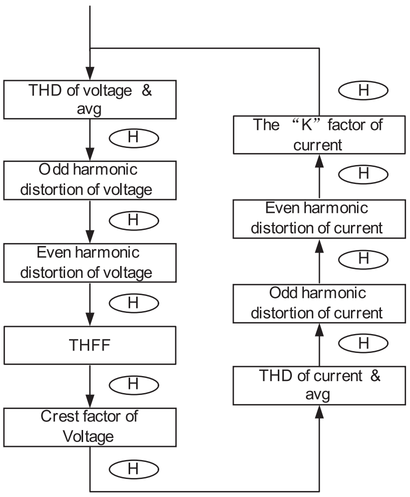
Pressing H and V/A simultaneously will activate the display mode selection and the cursor will flash. Press P or E to move the cursor right or left. To enter harmonic mode, move the cursor to "Harmonic" then press V/A.

In the harmonic data mode, the unit displays the harmonic ratio of voltage and current, THD, odd HD, even HD, THFF, CF and KF.

a) Power quality data:
Press H, display power quality data. It rolls to the next page when pressing H each time and rolls back to the first page when pressing H at the last page.

No commands are associated with the key P and E in "Hamonic" display mode.

Press V/A, switch to harmonic ratio data display.

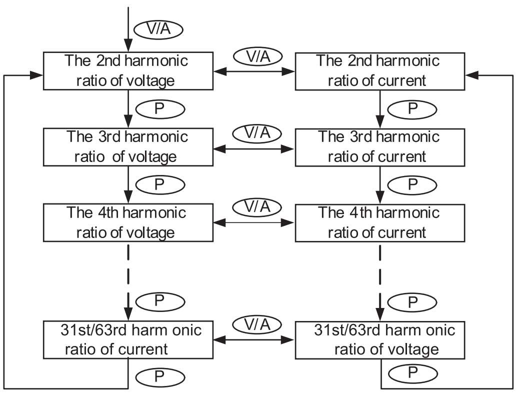


b) Harmonic ratio data
Press H, switch to power quality data display.

The harmonic order will increase by one when press P each time and will return to 2nd when press P at the 31st harmonic.

The harmonic order will decrease by one when pressing E each time and will return to the 31st when pressing E at the 2nd harmonic.

Press V/A, switch display between voltage harmonics and current harmonics.
The following figure shows how it rolls:



Note: The figure shows the rolling sequence when pressing key P. If press key E for rolling page, the sequence will reverse.

Pressing H and V/A simultaneously will activate the display mode selection and the cursor will flash. Press P or E to move the cursor right or left. To access data from the expanded I/O modules, move the cursor to “Digital I/O” then press V/A to enter the expanded I/O module data mode.

In the expanded I/O module data mode, the unit displays the data from expanded I/O modules, such as DI status, pulse counter number, relay status, analogue input, and analogue output etc.

In this mode, the first page is module selection. You can choose to view the available modules that are attached to the unit. If no expanded I/O modules are connected, the screen will display “NO IO”.

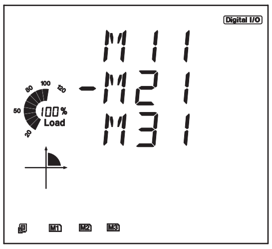
a) Module selection:
No commands are associated with the key H in the module selection screen.

Press P, move the cursor downwards, the cursor will move to the top when it reaches the bottom. If only one module is connected, pressing P will have no effect.

Press E, move the cursor upwards, the cursor will move to the bottom when it reaches the top. If only one module is connected, pressing E will have no effect.

Press V/A, select the module and enter the I/O module data selection mode.

As shown in the figure, three modules are connected, AXM-IO11, AXM-IO21, AXM-IO31, which are indicated by M11, M21, M31 respectively. The cursor points to M21, which indicates that AXM-IO21 is chosen now.



b) I/O Module data selection
Press H, return to module selection screen.

Press P, move the cursor downwards, the cursor will move to the top when it reaches the bottom. Please note that there are 3 parameters for AXM-IO1, 3 parameters for AXM-IO2 and 4 parameters for AXM-IO3.

Press E, move the cursor upwards, the cursor will move to the bottom when it reaches the top.

Press V/A, select the parameter and enter the display of the data.

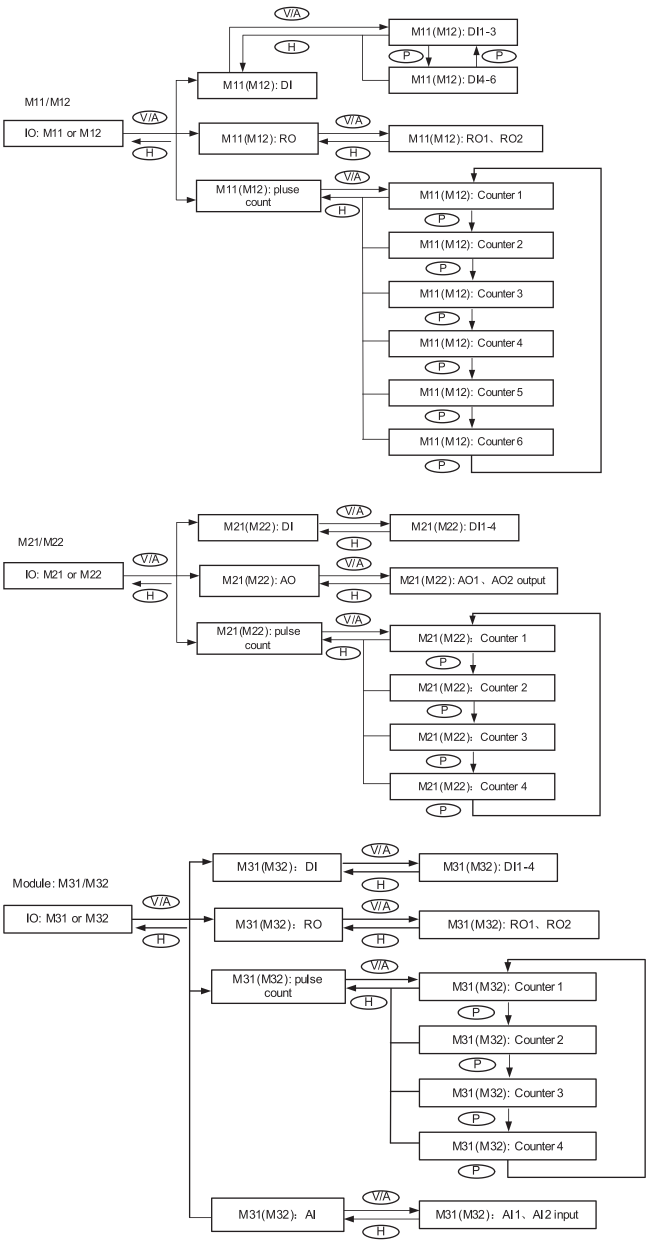
c) I/O module data display

Press H, return to I/O module data selection screen.

The screen will roll to the next page each time when pressing P and will return to the first page when pressing P at the last page. If only one page exist, pressing P will have no effect.

The screen will roll to the last page each time when pressing E and will return to the last page when pressing E at the first page. If only one page exist, press E will have no effect.
No commands are associated with the key V/A in this display.

The following figure shows how it rolls:



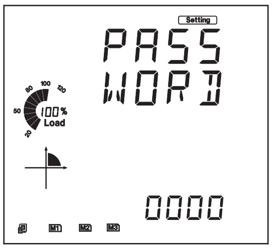
Note: The figure shows the rolling sequence for using key P. If using E key for rolling page, the sequence will reverse.

Pressing H and V/A simultaneously will activate the display mode selection and the cursor will flash. Press P or E to move the cursor right or left. To enter the parameter setting mode, move the cursor to "Setting" then press V/A.

In the parameter setting mode, parameters, such as system parameters, expanded I/O module parameters, alarm parameters and Ethernet module parameters, can be read and modified.

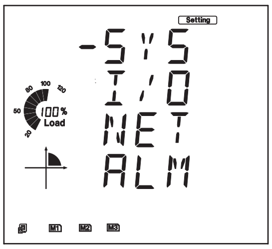
a) Password inquiry:
Parameter setting mode is password protected. Before entering the password and getting into the parameter setting mode, the unit's device communication address will display for 3 seconds. A four digit password (0000 to 9999) is required every time before accessing the parameter setting mode. The default password is 0000. After entering the password, press V/A to go to the parameter selection page. The unit will return to the metering mode if a wrong password is entered.

The following figure shows the password inquiry page.



To input password:
Press H, move the flashing cursor to the next position.
Press P, increase the number by 1 once a time.
Press E, decrease the number by 1 once a time.
Press V/A, confirm the password.

b) Parameter selection mode
There are four parameters to choose from in the parameter selection manual: system, expanded I/O module, Ethernet module and alarm.
No commands are associated with the key H in the parameter selection manual.
Press P, move the cursor downwards, the cursor will move to the top when it reaches the bottom.
Press E, move the cursor upwards, the cursor will move to the bottom when it reaches the top.
Press V/A, select and modify the parameter.



The figure shows the parameter selection page. "SYS" stands for system parameter, "I/O" stands for expanded I/O module parameter, "NET" stands for Ethernet module parameter and "ALM" stands for alarm parameter. As shown in the figure, the cursor points to the "SYS", which means system parameter is selected.

c) System parameter setting
Users can select and modify system parameters in the system parameter setting mode.

Key functions for modifying the parameter:

Press H, move the flashing cursor to the next position. Press P, increase the number by 1 once a time.
Press E, decrease the number by 1 once a time. Press V/A, confirm the modification and return to parameter selection mode.

The following figure shows how it rolls:

	SYS setting	
V/A	S01: Meter address	Any integer from 1~247
P	S02: Baud rate	Select form 600,1200, 2400,4800,9600,19200,38400 bps
P	S03: Voltage wiring	Voltage wiring mode can be one of "3LN", "2LN" "2LL", "3LL"
P	S04: Current wiring	Current wiring mode can be one of " 3CT", "1CT" "2CT"
P	S05: PT1	PT1: primary nominal value of PT, range from 50.0V~500,000.0V
P	S06: PT2	PT2: secondary nominal value of PT, range from 50.0V~400.0V If no PT used, set PT1 and PT2 as the nominal voltage of the meter.
P	S07: CT1	CT1: primary value of CT, range from 1A~50000A;
P	S08: CT2	CT2: secondary value of CT, choose from 1A or 5A;
P	S09 : pulse constant for active energy / active energy for pulse constant	MIC 2: IIIndicates the kWh for one pulse. Range from 1~6000 and the unit is 0.1kWh/pul;
P	S10 : pulse constant for reactive energy / reactive energy for pulse constant	MIC 2 should be indicates the kWh for one pulse. Range from 1~6000 and the unit is 0.1kvarh/pul;
P	S11: backlight time	The "ON" time can be set from 0 to 120 minutes. The backlight will automatically turn "OFF" after inactive for the preset period of time to conserve energy. The backlight will always be the "ON" if the setting value is 0.
P	S12: demand calculation method	1: sliding block, 2: thermal
P	S13: demand window	Range from 1~30 minutes
P	S14: demand clear	Yes: clear; No: not clear
P	S15: max/min clear	To clear the Max and Min value does not mean write 0 to all the registers, it will copy the metering value to the statistic registers and start a new statistic period.
P	S16: run hour clear	Yes: clear; No: not clear
P	S17: I1 direction	To adjust polarity of current, the three current's direction can be set as "Negative" which means reversing 180 degrees and "Positive" which means normal.
P	S18: I2 direction	
P	S19: I3 direction	
P	S20: VAR/PF Convention	0: IEC, 1: IEEE
P	S21: energy clear	Yes: clear; No: not clear
P	S22: energy mode	Fund: fundamental; Full: full wave (Acuvim IIR does not have this screen,only FULL mode is used in Acuvim IIR)
P	S23: calculation method of reactive power	0: true 1: generalized $= \sqrt{S^2 - P^2}$
P	S24: energy type	Pre: primary energy, Sec: secondary energy
P	S25: pulse counter clear	Range from 0-6. 0: not clear; 1: AXM-IO11 clear; 2: AXM-IO21 clear; 3: AXM-IO31 clear; 4: AXM-IO12 clear; 5: AXM-IO22 clear; 6: AXM-IO32 clear;
P	S26: SOE enable	Range from 0-6. 0: disable; 1: AXM-IO11 enable; 2: AXM-IO21 enable; 3: AXM-IO31 enable; 4: AXM-IO12 enable; 5: AXM-IO22 enable; 6: AXM-IO32 enable;
P	S27: Profibus address	Any integer from 0-126
P	S28: Basic Parameter mode	Per: primary basic parameters Per: primary basic parameters Refer to page 102 "Basic Analog Measurements" for more details.
P	S29: password	Last page of the system parameter setting. The password can be changed in this page. It is important to remember the new password.

Note: The figure shows the rolling sequence for using key P. If using E key for rolling page, the sequence will reverse.

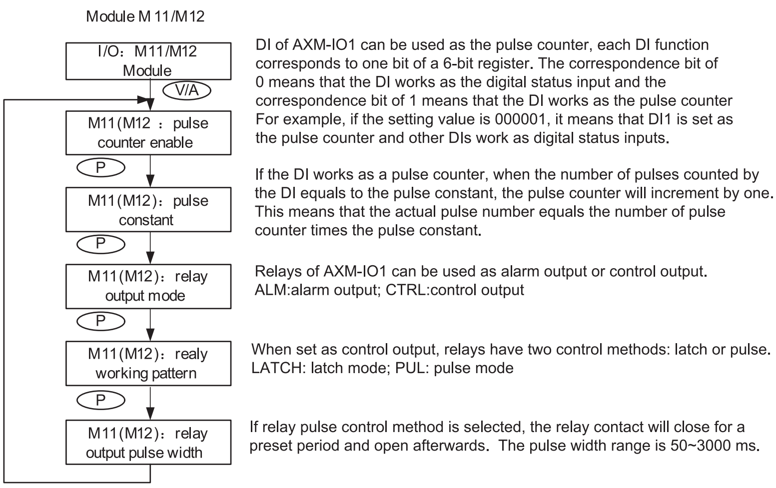
d) Expanded I/O module parameter
In the expanded I/O module parameter mode, users can choose to view and modify the available unit modules parameters. If no expanded I/O modules are connected, the screen will display "NO IO". To return to the system parameter setting mode main menu, press H (no commands are associated with other keys in this screen).

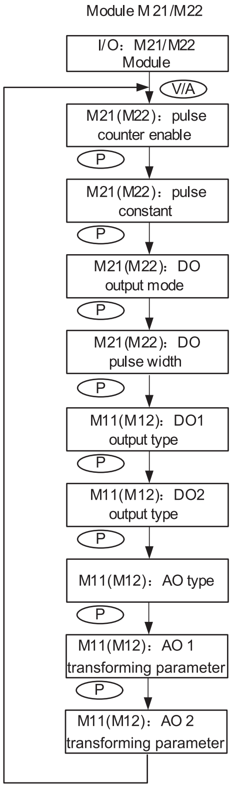
Key functions for I/O module selection:
Press H, return to parameter selection mode.
Press P, move the cursor downwards, the cursor will move to the top when it reaches the bottom. If there is only one module connected, pressing P will have no effect.
Press E, move the cursor upwards, the cursor will move to the bottom when it reaches the top.
If there is only one module connected, pressing E will have no effect.
Press V/A, select the module and enter the I/O module parameter setting mode.

Key functions for setting the I/O module parameter:
Press H, return to I/O module selection mode.
The screen will roll to the next page each time when pressing P and will return to the first page when pressing P at the last page.
The screen will roll to the last page each time when pressing E and will return to the last page when pressing E at the first page.
Press V/A, modify the selected parameter.

Key functions for modifying the parameter:
Press H, move the flashing cursor to the next position.
Press P, increase the number by 1 once a time.
Press E, decrease the number by 1 once a time.
Press V/A, confirm the modification and return to parameter selection mode.

The following table shows how it rolls:





DI of AXM-IO2 can be used as the pulse counter, each DI function corresponds to one bit of a 4-bit register. The correspondence bit of 0 means that the DI works as the digital status input and the correspondence bit of 1 means that the DI works as the pulse counter. For example, if the setting value is 0001, it means that DI1 is set as the pulse counter and other DIs work as digital status inputs.
If the DI works as a pulse counter, when the number of pulses counted by the DI equals to the pulse constant, the pulse counter will increment by one. This means that the actual pulse number equals the number of pulse counter times the pulse constant.
DO of AXM-IO1 can be used as either alarm output or energy pulse output. ALM: alarm output; PUL: energy pulse output.

Range from 20-1000 ms.

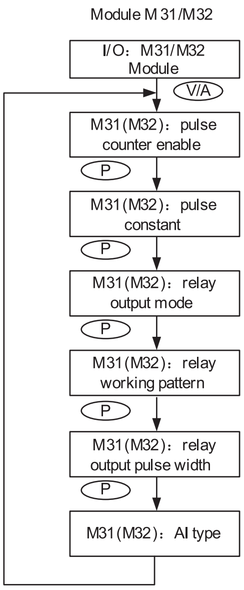
Choose output energy type for DO1. Range from 0-4. 0: no output; 1: import active energy; 2: export active power; 3: import reactive energy; 4: export reactive energy.

Follow the DO1 setup method to setup DO2.
If DO type is set as alarm output, DO1 and DO2 output type parameters will have no effect.

Range from 0 to 3, 0: 0-20 mA; 1: 4~20 mA; 2: 0-5V; 3: 1-5V.

Be aware that modules with current option cannot be set as voltage type (i.e. option 2 and 3 are unavailable); modules with voltage option cannot be set as current type (i.e. option 0 and 1 are unavailable).

For AO1 and AO2 transforming parameter:
Range: 0~29, see Chapter 5 “AO transforming parameter settings” in the I/O manual for more details.



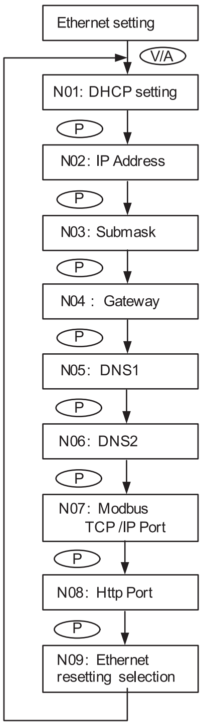
DI of AXM-IO3 can be used as the pulse counter, each DI function corresponds to one bit of a 4-bit register. The correspondence bit of 0 means that the DI works as the digital status input and the correspondence bit of 1 means that the DI works as the pulse counter. For example, if the setting value is 0001, it means that DI1 is set as the pulse counter and other DIs work as digital status inputs.
If the DI works as a pulse counter, when the number of pulses counted by the DI equals to the pulse constant, the pulse counter will increment by one. This means that the actual pulse number equals the number of pulse counter times the pulse constant.
When set as control output, relays have two control methods: latch or pulse
Relays of AXM-IO3 can be used as alarm output or control output. ALM:alarm output; CTRL:control output
If relay pulse control method is selected, the relay contact will close for a preset period and open afterwards. The pulse width range is 50~3000 ms.
Range from 0 to 3. 0: 0~20mA; 1: 4~20mA; 2: 0~5V; 3: 1~5V.
Be aware that modules with current option cannot be set as voltage type (i.e. option 2 and 3 are unavailable); modules with voltage option cannot be set as current type (i.e. option 0 and 1 are unavailable).

Note: The figure shows the rolling sequence for using key P. If using E key for rolling page, the sequence will reverse.

e) Ethernet module parameter
In the Ethernet module parameter mode, users can view and modify the parameters. If no Ethernet module is connected, settings will have no effect.

Key functions for finding the Ethernet module parameter:
Press H, return to parameter selection mode.
The screen will roll to the next page each time when press P and will return to the first page when press P at the last page.
The screen will roll to the last page each time when press E and will return to the last page when press E at the first page.
Press V/A, modify the selected parameter.

Key functions for modifying the parameter:
Press H, move the flashing cursor to the next position.
Press P, increase the number by 1 once a time.
Press E, decrease the number by 1 once a time.
Press V/A, confirm the modification and return to parameter selection mode.
The following figure shows how it rolls:



The selection of DHCP setting: MANU or AUTO
Default setting: MANU
IP address have four segments. Any segment can be set from 0~255.
Default setting: 192.168.1.254
Submask have four segments. Any segment can be set from 0~255.
Default setting: 255.255.255.0
Gateway have four segments. Any segment can be set from 0~255.
Default setting: 192.168.1.1
DNS1 have four segments. Any segment can be set from 0~255.
Default setting: 202.106.0.20

DNS2 have four segments. Any segment can be set from 0~255.
Default setting: 0.0.0.0

Range from 2000-5999, the default value is 502

Range from 6000-9999, the default value is 80

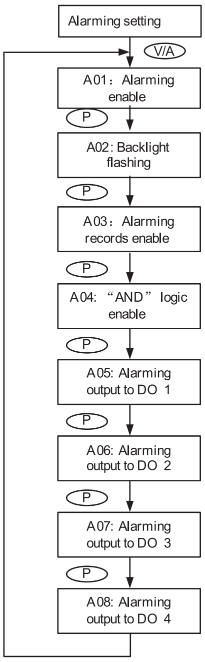
0: No resetting; 1: Reset module after modifying parameters; 2: Reset module to default values

Note: The figure shows the rolling sequence for using key P. If using E key for rolling page, the sequence will reverse.

f) Alarm parameter
In the alarm parameter mode, users can view and modify the parameters.

Key functions for finding the alarm parameter:
Press H, return to parameter selection mode.
The screen will roll to the next page each time when press P and will return to the first page when press P at the last page.
The screen will roll to the last page each time when press E and will return to the last page when press E at the first page.
Press V/A, modify the selected parameter.

Key functions for modifying the parameter:
Press H, move the flashing cursor to the next position.
Press P, increase the number by 1 once a time.
Press E, decrease the number by 1 once a time.
Press V/A, confirm the modification and return to parameter selection mode.
The following figure shows how it rolls:



Yes: Alarm enable; No: Alarm disable
It can be selected as cue signal for alarming.
Yes: backlight flashes upon alarm condition; No: No backlight flashing
There are 16 alarm channels available. Each channel is controlled and enabled 1 bit each from a 16-bit register. Bit value of 1 means that the corresponding alarm channel is enabled whereas 0 means that the channel is disabled. The meter will display the value of this 16-bit register in decimal numbers (for different channel combination). For example, 00000 means that all channels are disabled; 00001 means only the first channel is enabled; 65535 means that all channels are enabled. Refer to section 4.4 on page 65 for more details.
"AND" logic relationship can be set among channels. When an "AND" logic is in place, both channels have to be triggered before the meter sends out the alarm signal. The logic can be set according to the predefined rule (refer to section 4.4 for more details). Users can setup up to 8 logic relationships for alarming. Each logic relationship is controlled and enabled 1 bit each from a 16-bit register (only the lower 8 bits are used). Bit value of 1 means that the corresponding logic relationship is enabled whereas 0 means that the relationship is disabled. The meter will display this 8-bit value in decimal numbers (for different relationship combination). For example, 000 means that all relationships are disabled; 001 means only the first relationship is enabled; 255 means that all relationships are enabled.
When DO1 works in alarming mode, a 16-bit register is used to controlled which channels are associated with this output. Similar to alarm channels selection, this 16-bit value is expressed in decimal when reading on the meter front. For example, 00000 means that no alarm channels are associated to this output; 00001 means that alarm channel 1 is associated to DO1; 65535 means that all alarm channels are associated to DO1. Refer to section 4.4 for more details.
If 2 AXM-IO2 modules are attached to the meter, DO1 and DO2 denote to the first and the second DO channel of AXM-IO21; DO3 and DO4 denote to the first and the second DO channel of AXMIO22 respectively. DO2, DO3 and DO4 use the same setup method as DO1.

Note: The figure shows the rolling sequence for using key P. If using E for rolling page, the sequence will reverse.

3.8 Page recovery function

The MIC-2 has a page recovery function. This means that the unit stores current display page in the non-volatile memory upon power loss and reloads the page when power recovers. If power goes off when viewing under the parameter setting mode, the unit will show voltage display when power recovers. If power goes off when viewing under the expanded I/O module data mode, and if this expanded I/O module is not connected when power recovers, the unit will show the voltage display page instead.

The MIC-2 contains very advanced metering tools and is able to measure almost all power metering and quality parameters from a power system. Some advanced functions may not be accessible directly from the unit front; therefore, every unit comes with a powerful software that helps accessing those information. This chapter is dedicated to introduce these functions and the software.
4.1 Basic Analogue Measurements

The MIC-2 can measure voltage, current, power, frequency, power factor and demand etc. with high accuracy, shown as below:

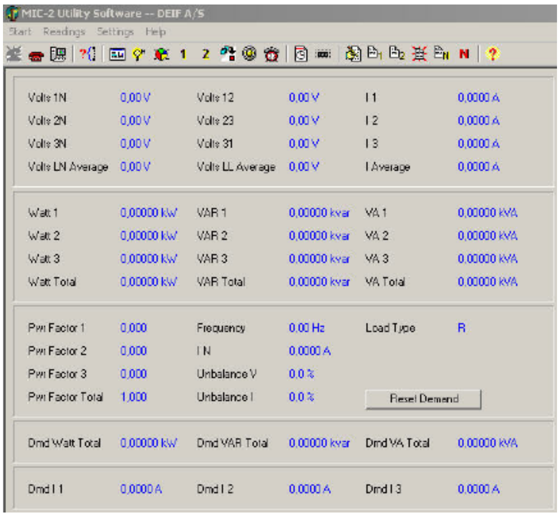


Fig 4.1 Real-time metering

Demand:
The MIC-2 consists of several types of demand calculation: total active power demand, total reactive power demand, total apparent power demand, phase L1 current demand, phase L2 current demand, and phase L3 current demand. When demand is reset, demand memory registers are set as 0.

Demand calculating mode can be set as sliding window and thermal by the user. The figure 4-7 shows how it works.

When using the sliding window interval method, the user selects an interval from 1 to 30 minutes, which is the period of the calculation. The demand updates every 1 minute.

Thermal demand method calculates the demand based on a thermal response which mimics the thermal demand meter. The user selects the period for the calculation and the demand updates at the end of each period.

Energy:
MIC-2 series meter measures and accumulates energy in different directions (import and export). For real-time energy monitoring, it accumulates energy for kWh, kvarh and kVAh continuous (since its last reset).

Calculating mode:

1. The user can select different energy calculating modes, fundamental based or full-wave based either from the unit front or via communication. Fundamental based calculating is to accumulate energy without taking harmonics into consideration while full-wave based calculating is to accumulate energy including fundamental and harmonics.
   Note: When fundamental based calculating mode is selected, PF calcuation will be based on the fundamental wave.

2. There are two ways to calculate reactive energy(power)
   Mode 0: real reactive energy $Q = \sqrt{S^2 - P^2 - D^2}$
   Mode 1: general reactive energy $Q = \sqrt{S^2 - P^2}$

3. User can choose primary energy or secondary energy either by pressing keys from the meter front or via communication as shown in figure 4-7.

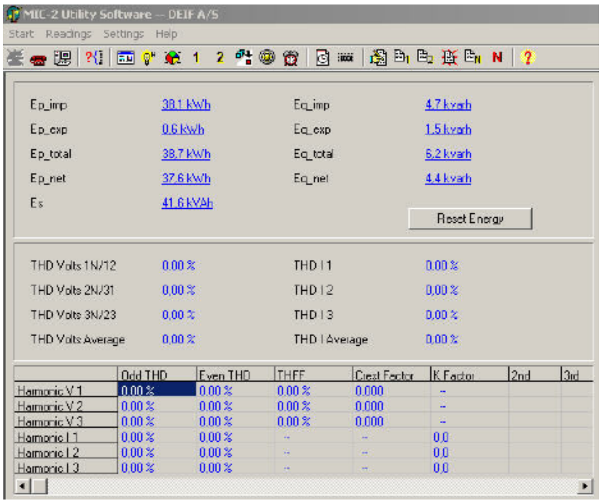
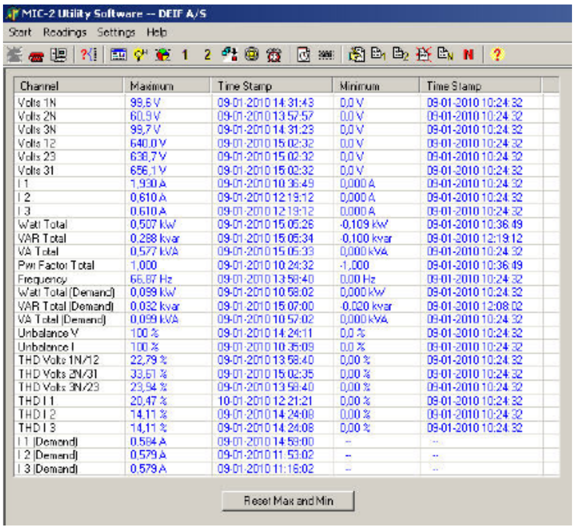


Figure 4-2 Energy and Power quality parameters

Current direction adjustment

Under normal circumstances, current flows from input terminal 1 to terminal 2 (i.e. from I11 to I12 for phase L1 current); however, current may flow in the opposite direction due to wrong wiring setup. Instead of rewiring the system, the MIC-2 provides the user with an option to reverse the polarity of the current. By default, the current direction is set as “positive”, to reverse the current polarity by 180 degrees, the user can set current direction as “negative”. Refer to Fig 4.7 for more details.

4.2 Max/Min



Channel	Maximum	Time Stamp	Minimum	Time Stamp
Volts 1N	99,6 V	09-01-2010 14:31:43	0,0 V	09-01-2010 10:24:32
Volts 2N	60,9 V	09-01-2010 13:57:57	0,0 V	09-01-2010 10:24:32
Volts 3N	99,7 V	09-01-2010 14:31:23	0,0 V	09-01-2010 10:24:32
Volts 12	640,0 V	09-01-2010 15:02:32	0,0 V	09-01-2010 10:24:32
Volts 23	638,7 V	09-01-2010 15:02:32	0,0 V	09-01-2010 10:24:32
Volts 31	656,1 V	09-01-2010 15:02:32	0,0 V	09-01-2010 10:24:32
I 1	1,930 A	09-01-2010 10:36:49	0,000 A	09-01-2010 10:24:32
I 2	0,610 A	09-01-2010 12:19:12	0,000 A	09-01-2010 10:24:32
I 3	0,610 A	09-01-2010 12:19:12	0,000 A	09-01-2010 10:24:32
Watt Total	0,507 kW	09-01-2010 15:05:26	-0,109 kW	09-01-2010 10:36:49
VAR Total	0,288 kvar	09-01-2010 15:05:34	-0,100 kvar	09-01-2010 12:19:12
VA Total	0,577 kVA	09-01-2010 15:05:33	0,000 kVA	09-01-2010 10:24:32
Pwr Factor Total	1,000	09-01-2010 10:24:32	-1,000	09-01-2010 10:36:49
Frequency	66,87 Hz	09-01-2010 13:58:40	0,00 Hz	09-01-2010 10:24:32
Watt Total (Demand)	0,099 kW	09-01-2010 10:58:02	0,000 kW	09-01-2010 10:24:32
VAR Total (Demand)	0,032 kvar	09-01-2010 15:07:00	-0,020 kvar	09-01-2010 12:08:02
VA Total (Demand)	0,099 kVA	09-01-2010 10:57:02	0,000 kVA	09-01-2010 10:24:32
Unbalance V	100 %	09-01-2010 14:24:11	0,0 %	09-01-2010 10:24:32
Unbalance I	100 %	09-01-2010 10:35:09	0,0 %	09-01-2010 10:24:32
THD Volts 1N/12	22,79 %	09-01-2010 13:58:40	0,00 %	09-01-2010 10:24:32
THD Volts 2N/31	33,61 %	09-01-2010 15:02:35	0,00 %	09-01-2010 10:24:32
THD Volts 3N/23	23,94 %	09-01-2010 13:58:40	0,00 %	09-01-2010 10:24:32
THD I 1	20,47 %	10-01-2010 12:21:21	0,00 %	09-01-2010 10:24:32
THD I 2	14,11 %	09-01-2010 14:24:08	0,00 %	09-01-2010 10:24:32
THD I 3	14,11 %	09-01-2010 14:24:08	0,00 %	09-01-2010 10:24:32
I 1 (Demand)	0,584 A	09-01-2010 14:59:00	--	--
I 2 (Demand)	0,579 A	09-01-2010 11:53:02	--	--
I 3 (Demand)	0,579 A	09-01-2010 11:16:02	--	--

Figure 4-3 Max/Min

The MIC-2 logs maximum and minimum value statistics for phase/line voltages, currents, power, reactive power, apparent power, power factor, frequency, demand, unbalance factor, THD as well as the time they occur. All data is stored in a non-volatile memory so that statistic information can be preserved even when the unit is shut off. All maximum and minimum data can be accessed via communication or from the unit front but time stamps can only be accessed via communication. Statistics can be cleared via communication or from the unit front.

1. Harmonics

The MIC-2 can measure and analyse THD, harmonics (2nd to 31st for MIC-2), even HD, odd HD, crest factor, THFF, K factor, etc. They are shown in figure 4-2.

2. Phase angle:

Phase angle indicates the angle between phase A voltage and other voltage/current parameters. Angle ranges from 0 to 360 degrees. This function is to help user to find out the relationship between all input signals avoiding wrong wiring. When it is set to "2LL" or "3LL", it gives out the phase angles of u23, i1, i2, i3 corresponding to u12. For other settings, it gives out the phase angles of u2, u3, i1, i2, i3 corresponding to u1. They are shown in figure 4-4.

3. Sequence component and unbalance analysis

The MIC-2 is able to perform sequential analysis for the input signal. It looks at the positive sequence, negative sequence and zero sequence of the fundamental frequency and performs unbalance analysis for voltage and current. Sequence components are shown in figure 4-4, unbalance of voltage and current are shown in figure 4-1.

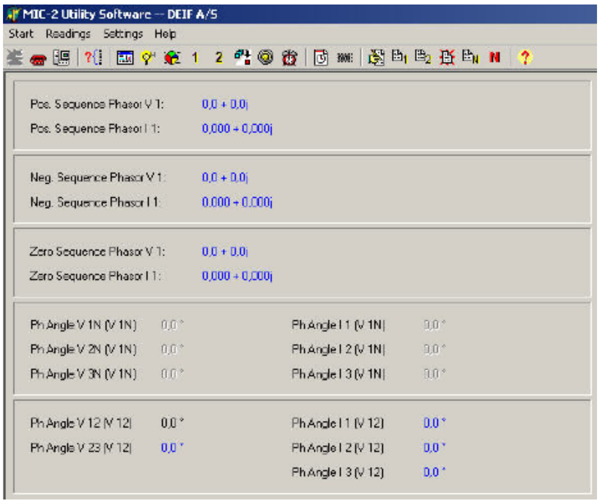


Figure 4-4 Sequence component and phase angle

The MIC-2 has over/under limit alarming capability. When the monitored parameter goes over/under the preset limit and stays at the level over the preset amount of time delay, the over/under limit alarm will be triggered. The over/under limit value and its time stamp will be recorded in the alarming log. The meter can record up to 16 alarming records. When extended I/O modules are attached, digital outputs (DO) and relay outputs (RO) can be triggered upon alarm conditions and used to activate downstream devices such as beacon light and buzzer.
Before using the alarming function, alarm conditions such as logic dependency, target setpoint, time delay, etc. must be set correctly. Settings can be accessed and modified from the software via communication connection as shown in Fig 4-5.

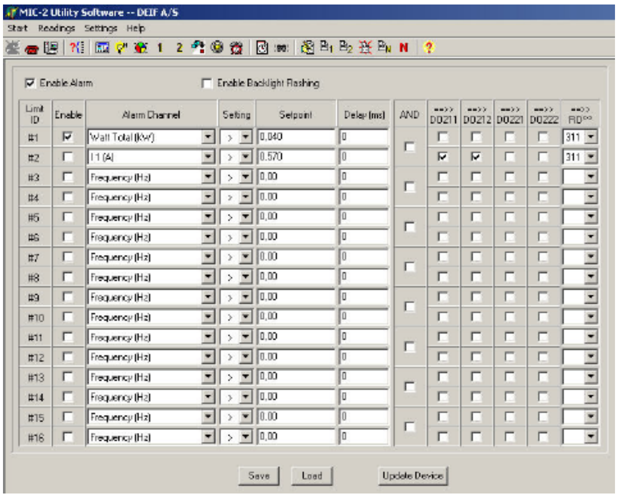


Figure 4-5 Alarm setting

1. Single alarming group setting

Table 4-1 indicates the first group of settings, there are 16 groups in total with the same format.

Address	Parameter	Range	Property
104eH	First group: parameter code	0~50	R/W
104fH	First group: comparison mode	1:larger,2:equal,3:smaller	R/W
1050H	First group: setpoint value	Related with parameters	R/W
1051H	First group: delay time	0~3000(*10ms)	R/W
1052H	First group: output to relay	0:none,1-8:related relay	R/W

Table 4-1 First group of alarming settings

Parameter code: select target parameter for alarm monitoring For example: 0-frequency, 44-AI4 sampling data.

Comparison mode: set alarming condition 1: greater than, 2: equal to, 3: smaller than. For example: if you choose target parameter to be “frequency”, condition to be “greater than” and setpoint to be “50”, alarm will be triggered when the frequency is greater than 50 Hz.
Note: setpoint value is the same as the actual value of the selected parameter.

Delay time: If the alarms condition lasts for the preset time period, the alarm signal will be triggered. The delay range is from 0 to 3000 (unit: 10 ms).

When it is set to 0, there is no delay, alarm will be triggered when the alarm condition is met. If it is set to 20, there will be a 200 ms (20 x 10 ms) delay.

Output to relay: 0-alarming signal will not be sent to RO; if it is set as 1 and AXM-IO11 is connected, it will output to RO1 when alarm triggers. RO1 will be turned off when all alarms output to RO1 are cleared. RO2~RO8 work in the same manner as RO1.

Note: If RO is under alarming mode, it can only work in “latch” mode.

After setting up the alarming parameters, the user must also setup the global settings in order for the alarm to work properly.

2. Global settings

Register addresses for global alarm settings are from 1046H~104dH.Please refer to section 5.3 “Global alarming settings” for more details.

“Global alarming enable” determines whether the alarming function of the meter is activated or not. The alarming function is enabled when it is set as “1”.

When “Alarming flash enable“ is set as “1”, backlight will flash when alarm is triggered.

“Alarming channel enable setting” determines whether the corresponding alarm group is enabled or not. There are 16 groups in all and each one is corresponding to one bit of a 16-bit register. The corresponding bit must be set to “1” in order to activate the alarm channel.

“Logical “AND” between alarming setting”: The 16 alarming records in MIC-2 are divided into 8 pairs. Each pair has two alarm groups. The two groups can be logically “AND” by controlling the logic check box. When two groups are “AND”, alarming triggers only if both AND conditions are met. If the “AND” logic box is unchecked, the two alarm channels will work independently.

The 8 “AND” logic pairs are arranged as follows: 1st,2nd channel form Pair 1; 3rd,4th channel form Pair 2; 5th,6th channel form Pair 3; 7th,8th channel form Pair 4; 9rd,10th channel form Pair 5; 11th,12th channel form Pair 6; 13th,14th channel form Pair 7; 15th,16th channel form Pair 8.

This function is controlled by the lower 8 bits of 16 bits register, each bit is corresponding to a pair. “1” means this function is enabled and “0” means disabled.

“Alarming output to DO1 setting”: When “Digital output mode” is set to “1”, DO1 can be used as alarming output. A 16-bit register is used to perform this function, its bit0~bit15 correspond to the 1st ~16th group respectively. When the related I/O module is connected and is under alarming mode, and if the corresponding bit is set to 1 and the alarming condition is met, alarm signal will be sent to DO1. DO1 will be turned off when all alarms correspond to DO1 are cleared. If related bit is set to 0, that alarm channel will not issue alarm signal to DO1. DO2~DO4 work in the same manner DO1.

After completing the setup steps correctly, the alarming function can be used.

3. Setting Eeample

Here is an example of showing how to apply the logical “AND” function for a pair of alarm channels.

The conditions are as follows: I1 greater than 180A, delay 5s for the 1st alarm channel; U1 less than 9980V, delay 10s for the 2nd alarm channel. No alarm signals will be sent to outputs. The CT primary value of I1 is 200A, and CT2 is 5A. The PT ratio for U1 is 10000:100. The following shows how all the related registers are to be set.

Settings of first group:

“Parameter code (104eH)” is set to 9, which stands for I1.
“Comparison mode (104fH)” is set to 1, which stands for “greater than”.
“Setpoint value (1050H)” is set to 4500, according to the relationship between actual value and communication value (I=Rx * (CT1/CT2) /1000).
“Delay time (1051H)” is set to 500, so the actual delay time is 500*10ms=5s.
“Output to relay (1052H)” is set to 0, because there is no output to RO.

Settings of second group:

“Parameter code (1053H)” is set to 1, which stands for U1.
“Comparison mode (1054H)” is set to 3, which stands for “smaller than”.
“Setpoint value (1055H)” is set to 998, according to the relationship between actual value and communication value (U=Rx X (PT1/PT2) /10).
“Delay time (1056H)” is set to 1000, so the actual delay time is 1000*10ms=10s.
“Output to relay (1057H)” is set to 0, because there is no output to RO.

Global settings:

“Alarming channel enable setting (1048H)” set to 0003H to enable the first and the second channel.
“Logical “AND” between alarming setting (1049H)” set to 0001H to enable logic “AND” in Pair 1.
“Alarming output to DO1 setting (104aH)” set to 0, since no output to DO1.
“Alarming output to DO2 setting (104bH)” set to 0.
“Alarming output to DO3 setting (104cH)” set to 0.
“Alarming output to DO4 setting (104dH)” set to 0.
“Alarming flash enable (1047H)” set to 0 to disable backlight flashing when alarming occurred.
“Global alarming enable (1046H)” set to 1 to enable over/under limit alarming.

4. Records of alarming event

The MIC-2 has built in alarm logging capability. There are 16 record entries in total. The record sequence of these entries do not depend on the sequence of the 16 alarm channels. The unit begins logging alarm status starting from the 1st record location to the last one. Alarm logs are being recorded in a "cycle" fashion which means the latest event will overwrite the oldest record. When over/under limit parameters return to normal, its value and time stamp will be recorded as well. Therefore, users can determine the over/under limit duration by checking the time difference. Here is the 1st group of record. Other groups of records have the same format.

Address	Parameter	Range
42a9H	First group: alarming status	0~65535
42aaH	First group: parameter code	0~50
42abH	First group: over/under limit or reset value	Related with parameters
42acH~42b2H	First group: occur time: yyyy:mm:dd:hh:mm:ss:ms	Time

Table 4-2 Alarming status of the 1st group of record

"Alarming status" indicates information of current alarm status. It is a 16-bit unsigned integer. Parameter code is stored in the higher 8 bits. Bit1 indicates whether logic "AND" is enabled or not, 1 means enabled and 0 means not. Bit0 indicates whether alarming is occurred or recovered, 1 means occurred and 0 means recovered. Undefined bits are 0.

"Parameter code" specifies the monitored parameter.

"Value" shows the recorded value of the selected parameter when alarm triggers and when it recovers.

"Time" indicates the time stamp with the accuracy of in milliseconds (ms).

Alarming event will set bit0 of "system status (102eH)" to be 1. At the same time, corresponding flags will be set to 1 to indicate new data. The flag will be cleared after the data is read. Bit0 of "system status (102eH)" will be set to 0.

Note: Although no alarming records will be lost during unit power off, alarm status will start recording from the 1st alarm log entry when the unit is powered on again.

Here is an example:

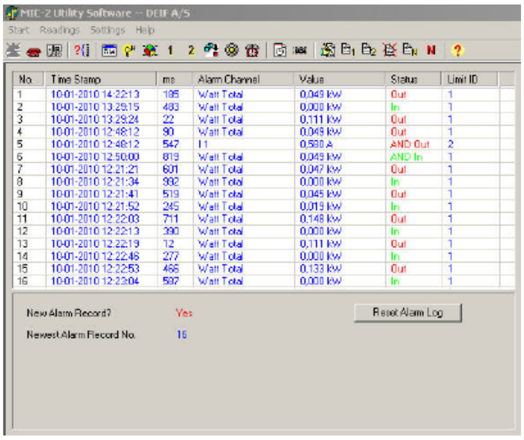


Fig 4-6 Alarming records

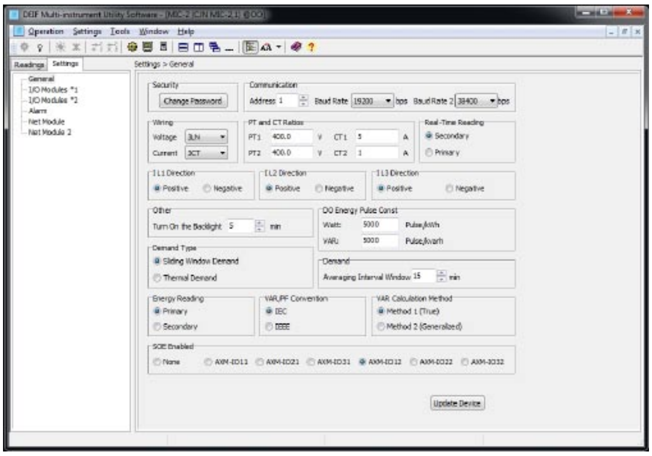
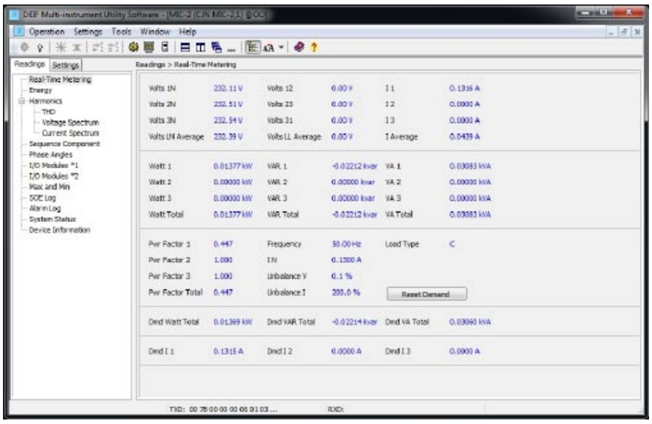


Figure 4-7 basic settings

4.4 Software

Software with data logging is available for software download on www.deif.com under “Download centre” > “Software download”.



This chapter will mainly discuss how to handle the unit via the communication port using software. To master this chapter, you should be familiar with Modbus and have read other chapters of this manual, and you a good understanding of the functions and applications of this product.
This chapter includes: Modbus protocol, format of communication and data address table and MIC-2 application details.

5.1 Modbus protocol introduction

ModbusTM RTU protocol is used for communication in MIC-2. Data format and error check methods are defined in Modbus protocol. The half duplex query and respond mode is adopted in Modbus protocol. There is only one master device in the communication net. The others are slave devices, waiting for the query of the master.

Transmission mode

The mode of transmission defines the data structure within a frame and the rules used to transmit data. The mode is defined in the following which is compatible with Modbus RTU Mode*.
Framing

Coding System	8-bit binary
Start bit	1
Data bits	8
Parity	no parity
Stop bit	1
Error checking	CRC check

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

Table 5.1 Data frame format

Address field

The address field of a message frame contains eight bits. Valid slave device addresses are in the range of 0~247 decimal. 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.

Function field

The function code field of a message frame contains eight bits. Valid codes are in the range of 1~255 decimal. 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 Relay Output Status	Obtain current status of Relay Output
02	Read Digital Input(DI) Status	Obtain current status of Digital Input
03	Read Data	Obtain current binary value from one or more registers
05	Control Relay Output	Force relay state to "ON" or "OFF"
16	Press Multiple-Register	Place specific binary values into a series of consecutive Multiple-Registers

Table 5.2 Function Code

Data Field
The data field is constructed using sets of two hexadecimal digits, in the range of 00 to FF hexadecimal. The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field. For example, if the master requests a slave to read a group of holding registers (function code 03), the data field specifies the starting register and how many registers are to be read. If the master writes to a group of registers in the slave (function code 10 hexadecimal), the data field specifies the starting register, how many registers to write, the count of data bytes to follow in the data field, and the data to be written into the registers.

If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken. The data field can be nonexistent (of zero length) in certain kinds of messages.

Error check field
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. If the two values are not equal, an error will be reported. 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 significant bit (LSB), with a zero filled into the most significant 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, 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.

Explanation of frame

Addr	Fun	Data start reg HI	Data start reg LO	Data #of regs HI	Data #of regs LO	CRC 16 HI	CRC 16 LO
06H	03H	00H	00H	00H	21H	84H	65H

Table 5.3 Explanation of frame

The meaning of each abbreviated word is,
Addr: Address of slave device
Fun: Function code
Data start reg HI: Start register address high byte
Data start reg LO: Start register address low byte
Data #of reg HI: Number of register high byte
Data #of reg LO: Number of register low byte
CRC16 HI: CRC high byte
CRC16 LO: CRC low byte

1. Read status of relay
Function Code 01
This function code is used to read status of relay in the MIC-2.
1=On 0=Off
Relay1's address is 0000H, Relay2's address is 0001H, and so on.

The following query is to read the relay status for the meter with communication address 17.

Query

Addr	Fun	Relay start reg HI	Relay start reg LO	Relay #of regs HI	Relay #of regs LO	CRC 16 HI	CRC 16 LO
11H	01H	00H	00H	00H	02H	BFH	5BH

Table 5.4 Read the status of Relay1 and Relay2 Query Message

Response
The MIC-2 response includes the MIC-2 address, function code, quantity of data byte, the data, and error checking. An example response to read the status of Relay1 and Relay2 is shown as Table 5.5. The status of Relay1 and Relay2 are responding to the last 2 bits of the data.
Relay1: bit0 Relay2: bit1

Address	Function code	Byte count	Data	CRC high	CRC low
11H	01H	01H	02H	D4H	89H

Table 5.5 Relay status responds

The content of the data is:

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

Relay1 = OFF (LSB), Relay2=ON (Left to LSB)

2. Read status of DI
Function Code 02
1=On 0=Off
DI1's address is 0000H, DI2's address is 0001H, and so on.
The following query is to read the status of 4 DIs of MIC-2 with communication address 17.

Query

Addr	Fun	DI start addr HI	DI start addr LO	DI num HI	DI num LO	CRC 16 HI	CRC 16 LO
11H	02H	00H	00H	00H	04H	7BH	59H

Table 5.6 Read 4 DIs Query Message

Response

The MIC-2 response includes the MIC-2 address, function code, quantity of data characters, the data characters, and error checking. An example response to read the status of 4 DIs is shown in Table in 5.7. The DI status corresponds to the last 4 bits of the data.
DI1: bit0; DI2: bit1; DI3: bit2; DI4: bit3.

Address	Function code	Byte count	Data	CRC high	CRC low
11H	02H	01H	03H	E5H	49H

Table 5.7 Read status of DI

The content of the data is:

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

DI1=On, DI2=On, DI3=Off, DI4=Off.

3. Read data (Function Code 03)

Query

This function allows the master to obtain the measurement results from the MIC-2. Table 5.8 is an example to read the 3 measured data (F, V1 and V2) from slave device number 17, the data address of F is 4000H, 4001H; V1's address is 4002H, 4003, and V2's address is 4004H, 4005H.

Addr	Fun	Data start addr HI	Data start addr LO	Data #of regs HI	Data #of regs LO	CRC 16 regs HI	CRC 16 regs LO
11H	03H	40H	00H	00H	06H	D2H	98H

Table 5.8 Read F, V1, V2 query message

Response

The MIC-2 response includes the MIC-2 address, function code, quantity of data byte, data, and error checking. An example response to read F, V1 and V2 (F=42480000H (50.00Hz), V1=42C7CCCDH (99.9V), V2=42C83333H (100.1V)) is shown:

Addr	Fun	Byte count	Data1 HI	Data1 LO	Data 2 HI	Data2 LO	Data3 HI	Data3 LO	Data4 HI	Data4 LO
11H	3H	0CH	42H	48H	00H	00H	42H	C7H	CCH	CDH

Data5 HI	Data5 LO	Data 6 HI	Data6 LO	CRC16 HI	CRC16 LO
42H	C8H	33H	33H	CAH	7FH

Table 5.9 Read F, V1 and V2 message

4. Control relay (Function Code 05)

Query

This message forces a relay to either turn "ON" or "OFF". Any relay that exists within the MIC-2 can be forced to either "ON" or "OFF" status. The data value FF00H will set the relay on and the value 0000H will turn it off; all other values are illegal and will not affect that relay.
The example below is a request to the MIC-2 with the address of 17 to turn on Relay1.

Addr	Fun	DO addr HI	DO addr LO	Value HI	Value LO	CRC 16 HI	CRC 16 LO
11H	05H	00H	00H	FFH	00H	8EH	AAH

Table5.10 Control relay query message

Response

The normal response to the command request is to retransmit the message as received after the relay status has been altered.

Addr	Fun	Relay addr HI	Relay addr LO	Value HI	Value LO	CRC HI	CRC LO
11H	05H	00H	00H	FFH	00H	8EH	AAH

Table5.11 Control relay response message

5. Preset/Reset multi-register (Function Code 16)

Query

Function 16 allows the user to modify the contents of a multi-register. Some registers of the MIC-2 can have their contents changed by this message. The example below is a request to an MIC-2 with the address of 17 to preset Ep_imp as "17807783.3KWh", while its HEX value is 0A9D4089H. Ep_imp data address is 4048H and 4049H.

Addr	Fun	Data start reg HI	Data start reg LO	Data #of reg HI	Data #of reg LO	Byte Count
11H	10H	40H	48H	00H	02H	04H

Value HI	Value LO	Value HI	Value LO	CRC HI	CRC LO
0AH	9DH	40H	89H	F1H	6AH

Table5.12 Preset multi-register query message

Response

The normal response to a preset multi-register request includes the MIC-2 address, function code, data start register, the number of registers, and error checking.

Addr	Fun	Data start reg hi	Data start reg lo	Data #of reg hi	Data #of Reg lo	CRC16 hi	CRC16 lo
11H	10H	40H	48H	00H	02H	D6H	8EH

Table5.13 Preset multi-register response message

There are several rules to follow in using the unit:

1. Data type:
"bit" refers to binary.
"word" refers to 16-bit unsigned integer using one data address and 2 bytes of memory, it varies from 0 to 65535.
"int" refers to 16-bit integer using one data address and 2 bytes of memory, it varies from -32768 to32767.
"dword" refers to 32-bit unsigned integer using two data addresses and 4 bytes of memory with high word at the front and low word at the end, it varies from 0 to 4294967295. Rx=high word *65536+low word.
"float" refers to 32-bit single value using two data addresses and 4 bytes of memory, it varies from -1.175494E-38 to 3.402823E+38.

2. Relationship between communication value and numerical value.
The numerical value may not be the same as the communication value, it is important to notice this. The following table shows how they respond to each other.

Parameters	Relationship	Unit	Format code
System parameters	Numerical value equals to communication value	No unit	F1
Run time	T=Rx/100	Hour	F2
Clock	Numerical value equals to communication value	Unit of time	F3
Energy(primary)	Ep=Rx/10	kWh	F4
Reactive energy(primary)	Eq=Rx/10	kvarh	F5
Apparent energy(primary)	Es=Rx/10	kVA	F6
Energy(secondary)	Ep=Rx/1000	kWh	F7
Reactive energy (secondary)	Eq=Rx/1000	kvarh	F8
Apparent energy (secondary)	Es=Rx/1000	kVA	F9
Frequency	F=Rx/100	Hz	F10
Voltage	U=Rx X(PT1/PT2)/10	V	F11
Current, current demand	I=Rx X(CT1/CT2)/1000	A	F12
Power, demand	P=Rx X(PT1/PT2)X(CT1/CT2)	W	F13
Reactive power, demand	Q=Rx X(PT1/PT2)X(CT1/CT2)	var	F14
Apparent power, demand	S=Rx X(PT1/PT2)X(CT1/CT2)	VA	F15
Power factor	PF=Rx/1000	No unit	F16
Unbalance factor	Unbl=(Rx/1000)X100%	No unit	F17
THD	THD=(Rx/10000) X 100%	No unit	F18
Harmonics	HDn=(Rx/10000) X 100%	No unit	F19
Total odd HD	HDo=(Rx/10000) X 100%	No unit	F20
Total even HD	HDe=(Rx/10000) X 100%	No unit	F21
Crest factor	CF=Rx/1000	No unit	F22
K factor	KF=Rx/10	No unit	F23
THFF	THFF=(Rx/10000) X 100%	No unit	F24
Phase angle	Phase angle=Rx/10	Degree	F25
Temperature	Temperature= Rx/10	°C	F26

Important Note: Regions from "System parameters settings" to "Data logging 3 settings" are the regions that can be set and modified. Please follow the rules when you communicate with the MIC-2.

1. When function code 10H is used, one communication command can only modify contents in one region, such as "System parameters settings", "System status parameter", "Date and Time table", "Over/under limit alarming-Global settings", "Over/under limit alarming-Single settings", "I/O Modules settings", Data logging 1 settings,Data logging 2 settings,Data logging 3 settings. It can not be accomplished in one communication order to modify contents in both of two or more regions above.

2. When function code 03H is used, the rules and limitations described above will not be applied.

5.3.1 System parameter setting

System parameters determine how the meter works. Please refer to Chapter 3 and Chapter 4 for more details.
Function code: 03H for reading, 10H for writing. Data type: word. Format code: F1.

Address	Parameter	Default	Range	Data type	Property
1000H	Password	0	0~9999	word	R/W
1001H	Communication address	1	1~247	word	R/W
1002H	Baud rate	19200	600~38400	word	R/W
1003H	Voltage input wiring type	0	0:3LN,1:2LN,2:2LL,3:3LL	word	R/W
1004H	Current input wiring type	0	0:3CT,1:1CT,2:2CT	word	R/W
1005H	PT1 (High 16 bit)	0	50.0~500000.0	word	R/W
1006H	PT1 (Low 16 bit)	220.0	50.0~500000.0	word	R/W
1007H	PT2	220.0	50.0~400.0	word	R/W
1008H	CT1	5	1~50000	word	R/W
1009H	CT2	5	1,5	word	R/W
100aH	kWh pulse constant	1	1~6000	word	R/W
100bH	kvarh pulse constant	1	1~6000	word	R/W
100cH	LCD backlight time	1	0~120	word	R/W
100dH	Demand slid window time	15	1~30	word	R/W
100eH	Demand calculating mode	1	1:sliding window 2:thermal	word	R/W
100fH	Clear demand memory	0	Only 1 works	word	R/W
1010H	Max/Min clear	55H	Only 0AH works	word	R/W
1011H	Run time clear	0	Only 1 works	word	R/W
1012H	Current I1 direction	0	0: Positive 1: Negative	word	R/W
1013H	Current I2 direction	0	0: Positive 1: Negative	word	R/W
1014H	Current I3 direction	0	0: Positive 1: Negative	word	R/W
1015H	VAR/PF convention	0	0: IEC, 1: IEEE	word	R/W
1016H	Energy clear	0	Only 1 works	word	R/W
1017H	Energy calculating mode	1	0: fundamental 1: full-wave	word	R/W
1018H	Reactive power measuring mode	0	0: real, 1: general	word	R/W
1019H	Energy display mode	0	0: primary, 1: secondary	word	R/W
101aH	Ethernet module reset	0	0: none, 1: reset, 2: load default and reset	word	R/W
101bH	SOE enable	0	0: none; 1: AXM-IO11; 2: AXM-IO21; 3: AXM-IO31; 4: AXM-IO12; 5: AXM-IO22; 6: AXM-IO32;	word	R/W
101cH	Pulse counter clear	0	0:none; 1:AXM-IO11; 2:AXM-IO21; 3:AXM-IO31; 4:AXM-IO12; 5:AXM-IO22; 6:AXM-IO32;	word	R/W
101dH	Basic parameter mode	0	0:secondary; 1:primary	word	R/W

5.3.2 System status parameter

"System status" indicates what events happened in the meter, what kinds of flags are read by user and to be the index of the storage of the events. Flags should be cleared after being read by the controller, otherwise new data will not be stored properly.
Function code: 03H for reading, 10H for writing. Data type: word.

Address	Parameter	Format code	Range	Data type	Property
101eH~102dH	Recording pointer bj_st0-15		1: new data	word	R/W
102eH	System status		Bit0:new alarming or not Bit1: new SOE or not	word	R
102fH~1031H	Reserved			word	
1032H	Alarming group number	F1	0~15	word	R
1033H	SOE group number	F1	0~19	word	R
1034H	Run time (high)	F2	0~999999999	word	R
1035H	Run time (low)	F2	0~999999999	word	R
1036H	Expanded IO Modules connecting status		Bit0: AXM-IO11; Bit1:AXM-IO12; Bit2:AXM-IO21; Bit3:AXM-IO22; Bit4:AXM-IO31; Bit5:AXM-IO32; 0:disconnected 1:connected	word	R
1037H	Temperature	F26		word	R
1038H~103fH	Reserved			word	

Please refer to Chapter 3 and Chapter 4 for more details about parameter settings.

5.3.3 Date and time table

Function code: 03H for reading, 10H for presetting.

Address	Parameter	Format code	Range	Data type	Property
1040H	Year	F3	2000~2099	word	R/W
1041H	Month	F3	1~12	word	R/W
1042H	Day	F3	1~31	word	R/W
1043H	Hour	F3	0~23	word	R/W
1044H	minute	F3	0~59	word	R/W
1045H	second	F3	0~59	word	R/W

This setting consists of global alarming settings and single channel alarming settings. Global alarming settings contain settings of all global variables. There are 16 groups of records with the same format. Function code: 03H for reading, 10H for writing. Please refer to Chapter 4 for more details.

Global alarming settings

Address	Parameter	Range	Data type	Property
1046H	Global alarming enable	0:disable;1:enable	word	R/W
1047H	Alarming flash enable	0:disable;1:enable	word	R/W
1048H	Alarming channel enable setting	0~65535 Bit0:channel 1 1:enable; 0:disable Bit1: channel 2 … Bit15: channel 16	word	R/W
1049H	Logical "And " between alarming setting	0~255 Bit0: first logic switch 1:enable;0:disable Bit1: second logic switch … Bit7: eighth logic switch	word	R/W
104aH	Alarming output to DO1 setting	0~65535 Bit0: channel 1 output 1:enable;0:disable Bit1: channel 2 output … Bit15: channel 16 output	word	R/W
104bH	Alarming output to DO2 setting	0~65535 The same as previous	word	R/W
104cH	Alarming output to DO3 setting	0~65535 The same as previous	word	R/W
104dH	Alarming output to DO4 setting	0~65535 The same as previous	word	R/W

Single channel alarming settings

Address	Parameter	Format code	Range	Data type	Property
104eH	First group: parameter code	F1	0~50	word	R/W
104fH	First group: comparison mode	F1	1: greater than; 2: equal to; 3: less than	word	R/W
1050H	First group: setpoint value	F10~F18	Related with parameters	word	R/W
1051H	First group: delay	F1	0~3000(*10ms)	word	R/W
1052H	First group: output to relay	F1	0:none, 1~8: related relay	word	R/W
1053H~109dH	2nd to 16th group		Same as the first group	word	R/W

5.3.4 Over/Under limit alarming setting

Alarming parameter code table

Setting value	Alarming object	Setting value	Alarming object	Setting value	Alarming object
0	Frequency	1	V1	2	V2
3	V3	4	Average phase voltage	5	V12
6	V23	7	V31	8	Average line voltage
9	Line current of phase L1	10	Line current of phase L1	11	Line current of phase L3
12	Average line current	13	Neutral current	14	Power of phase L1
15	Power of phase L2	16	Power of phase L3	17	Power of all
18	Reactive power of phase L1	19	Reactive power of phase L2	20	Reactive power of phase L3
21	Reactive power of all	22	Apparent power of phase L3	23	Apparent power of phase L2
24	Apparent power of phase L3	25	Apparent power of all	26	PF of L1
27	PF of L2	28	PF of L3	29	PF
30	Voltage unbalance factor U_unbl	31	Current unbalance factor I_unbl	32	Load characteristic(R/L/C)
33	THD_V1(V1 or V12)	34	THD_V2(V2 or V31)	35	THD_V3(V3 or V23)
36	Average THD_V	37	THD_I1	38	THD_ I2
39	THD_ I3	40	Average THD_I	41	AI1 sampling value
42	AI2 sampling value	43	AI3 sampling value	44	AI4 sampling value
45	Active power demand of all	46	Reactive power demand of all	47	Apparent power demand of all
48	Current demand of phase L1	49	Current demand of phase L2	50	Current demand of phase L3

I/O module setting changes will be made only if the corresponding I/O modules are installed, no changes will be made otherwise. Please check the I/O module connection status before doing any settings. Function code: 03H for reading, 10H for writing. Please refer to <<User's manual of extended I/O Modules>>for more details.

AXM-IO11

Address	Parameter	Default	Range	Data type	Property
109eH	DI1~6 type	0	Bit0: DI1, Bit1: DI2 Bit2: DI3, Bit3: DI4 Bit4: DI5, Bit5: DI6 0: DI,1: pulse counter	word	R/W
109fH	DI pulse constant	0	1~65535	word	R/W
10a0H	Working mode of relay 1 and 2	0	0: control output, 1: alarming output	word	R/W
10a1H	Output mode of relay 1 and 2	0	0: latch, 1: pulse	word	R/W
10a2H	Pulse width	50	50~3000ms	word	R/W

AXM-IO21

Address	Parameter	Default	Range	Data type	Property
10a3H	DI7~10 type	0	Bit0: DI7, Bit1: DI8 Bit2: DI9, Bit3: DI10 0: DI,1: pulse counter	word	R/W
10a4H	DI pulse constant	0	1~65535	word	R/W
10a5H	Working mode of DO	0	0: pulse output 1: alarming output	word	R/W
10a6H	DO pulse width	20	20~1000ms	word	R/W
10a7H	DO1 output	0	0: none 1: consumption power 2: gererating power 3: absorption reactive power 4: generating reactive power	word	R/W
10a8H	DO2 output	0	Same as above	word	R/W
10a9H	AO 1,2	1	0: 0~20mA, 1: 4~20mA	word	R/W

5.3.5 I/O modules settings

AXM-IO11

Address	Parameter	Default	Range	Data type	Property
109eH	DI1~6 type	0	Bit0: DI1, Bit1: DI2 Bit2: DI3, Bit3: DI4 Bit4: DI5, Bit5: DI6 0: DI,1: pulse counter	word	R/W
109fH	DI pulse constant	0	1~65535	word	R/W
10a0H	Working mode of relay 1 and 2	0	0: control output, 1: alarming output	word	R/W
10a1H	Output mode of relay 1 and 2	0	0: latch, 1: pulse	word	R/W
10a2H	Pulse width	50	50~3000ms	word	R/W

AXM-IO21

Address	Parameter	Default	Range	Data type	Property
10a3H	DI7~10 type	0	Bit0: DI7, Bit1: DI8 Bit2: DI9, Bit3: DI10: 0: DI,1: pulse counter	word	R/W
10a4H	DI pulse constant	0	1~65535	word	R/W
10a5H	Working mode of DO	0	0: pulse output 1: alarming output	word	R/W
10a6H	DO pulse width	20	20~1000ms	word	R/W
10a7H	DO1 output	0	0: none 1: consumption power 2: gererating power 3: absorption reactive power 4: generating reactive power	word	R/W
10a8H	DO2 output	0	Same as above	word	R/W
10a9H	AO 1,2	1 or 2	0: 0~20mA, 1: 4~20mA,	word	R/W

AXM-IO31

Address	Parameter	Default	Range	Data type	Property
10aaH	DI11~14 type	0	Bit0: DI11,Bit1: DI12, Bit2: DI13, Bit3: DI14 0: DI, 1: pulse counter	word	R/W
10abH	DI pulse constant	0	1~65535	word	R/W
10acH	Working mode of relay 3 and 4	0	0: control output, 1: alarming output	word	R/W
10adH	Output mode of relay 3 and 4	0	0: latch, 1: pulse	word	R/W
10aeH	Pulse width	50	50~3000ms	word	R/W
10afH	AI 1,2	1 or 2	0: 0~20mA, 1: 4~20mA,	word	R/W

AXM-IO12

Address	Parameter	Default	Range	Data type	Property
10b0H	DI15~20 type	0	Bit0: DI15, Bit1: DI16, Bit2: DI17, Bit3: DI18, Bit4: DI19, Bit5: DI20 0-DI,1-pulse counter	word	R/W
10b1H	DI pulse constant (high)	0	1~65535	word	R/W
10b2H	Working mode of relay 5 and 6	0	0: control output, 1: alarming output	word	R/W
10b3H	Output mode of relay 5 and 6	0	0: latch, 1: pulse	word	R/W
10b4H	Pulse width	50	50-3000ms	word	R/W

AXM-IO22

Address	Parameter	Default	Range	Data type	Property
10b5H	DI21~24 type	0	Bit0: DI21, Bit1: DI22, Bit2: DI23, Bit3: DI24 0: DI, 1: pulse counter	word	R/W
10b6H	DI pulse constant	0	1~65535	word	R/W
10b7H	Working mode of DO3,4	0	0: pulse output, 1: alarming output	word	R/W
10b8H	DO Pulse width	20	20~1000ms	word	R/W
10b9H	DO3 output	0	0: none 1: consumption power 2: gererating power 3: absorption reactive power 4: generating reactive power	word	R/W
10baH	DO4 output	0	Same as above	word	R/W
10bbH	AO 3,4	1	0: 0~20mA, 1: 4~20mA	word	R/W

AXM-IO32

Address	Parameter	Default	Range	Data type	Property
10bcH	DI25~28 type	0	Bit0: DI25, Bit1: DI26, Bit2: DI27, Bit3: DI28 0: DI, 1: pulse counter	word	R/W
10bdH	DI pulse constant	0	1~65535	word	R/W
10beH	Working mode of relay 7 and 8	0	0: control output, 1: alarming output	word	R/W
10bfH	Output mode of relay 7 and 8	0	0: latch, 1: pulse	word	R/W
10c0H	Pulse width	50	50~3000	word	R/W
10c1H	AI 3,4	1 or 2	0: 0~20mA, 1: 4~20mA,	word	R/W

AO transforming select

Address	Parameter	Default	Range	Data type	Property
10c2H	AO1 transforming parameter	0	Refer to following table	word	R/W
10c3H	AO2 transforming parameter	0	Refer to following table	word	R/W
10c4H	AO3 transforming parameter	0	Refer to following table	word	R/W
10c5H	AO4 transforming parameter	0	Refer to following table	word	R/W

AO transforming parameter settings

Setting value	Ttransforming object	Setting value	Transforming object	Setting value	Transforming object
0	Frequency	1	V1	2	V2
3	V3	4	Average phase voltage	5	V12
6	V23	7	V31	8	Average line voltage
9	Line current of phase L1	10	Line current of phase L2	11	Line current of phase L3
12	Average line current	13	Neutral current	14	Power of phase L1
15	Power of phase L2	16	Power of phase L3	17	Power of all
18	Reactive power of phase L1	19	Reactive power of phase L2	20	Reactive power of phase L3
21	Reactive power of all	22	Apparent power of phase L1	23	Apparent power of phase L2
24	Apparent power of phase L3	25	Apparent power of all	26	PF of L1
27	PF of L2	28	PF of L3	29	PF

5.3.6 Metering parameter addresses

Basic analogue measurements

There are two different modes to read basic analogue measurements, one is secondary mode, and another is primary mode. In primary mode, the numerical value in register of the MIC-2 equals to the real physical value. In secondary mode, the relationship between numerical value in register and the real physical value is shown in the following table. (Rx is the numerical value in register of the MIC-2)

Function code: 03H for reading.

Address	Parameter	Code	Relationship	Data type	Property
4000H~4001H	Frequency	F1	F = Rx	float	R
4002H~4003H	Phase voltage V1	F1	U=Rx×(PT1/PT2)	float	R
4004H~4005H	Phase voltage V2	F1	U=Rx×(PT1/PT2)	float	R
4006H~4007H	Phase voltage V3	F1	U=Rx×(PT1/PT2)	float	R
4008H~4009H	Average voltage Vavg	F1	U=Rx×(PT1/PT2)	float	R
400aH~400bH	Line voltage V12	F1	U=Rx×(PT1/PT2)	float	R
400cH~400dH	Line voltage V23	F1	U=Rx×(PT1/PT2)	float	R
400eH~400fH	Line voltage V31	F1	U=Rx×(PT1/PT2)	float	R
4010H~4011H	Average line voltage Vlavg	F1	U=Rx×(PT1/PT2)	float	R
4012H~4013H	Phase(line)current I1	F1	I=Rx×(CT1/CT2)	float	R
4014H~4015H	Phase(line)current I2	F1	I=Rx×(CT1/CT2)	float	R
4016H~4017H	Phase(line)current I3	F1	I=Rx×(CT1/CT2)	float	R
4018H~4019H	Average current Iavg	F1	I=Rx×(CT1/CT2)	float	R
401aH~401bH	Neutral current In	F1	I=Rx×(CT1/CT2)	float	R
401cH~401dH	Phase L1 power P	F1	P=Rx×(PT1/PT2)×(CT1/CT2)	float	R
401eH~401fH	Phase L2 power P	F1	P=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4020H~4021H	Phase L3 power P	F1	P=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4022H~4023H	System power Psum	F1	P=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4024H~4025H	Phase L1 reactive power Q	F1	Q=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4025H~4027H	Phase L2 reactive power Q	F1	Q=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4028H~4029H	Phase L3 reactive power Q	F1	Q=Rx×(PT1/PT2)×(CT1/CT2)	float	R
402aH~402bH	System reactive power Qsum	F1	Q=Rx×(PT1/PT2)×(CT1/CT2)	float	R
402cH~402dH	Phase L1 apparent power S	F1	S=Rx×(PT1/PT2)×(CT1/CT2)	float	R
402eH~402fH	Phase L2 apparent power S	F1	S=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4030H~4031H	Phase L3 apparent power S	F1	S=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4032H~4033H	System apparent power Ssum	F1	S=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4034H~4035H	Phase L1 power factor PF	F1	PF = Rx	float	R
4036H~4037H	Phase L2 power factor PF	F1	PF = Rx	float	R
4038H~4039H	Phase L3 power factor PF	F1	PF = Rx	float	R
403aH~403bH	System power factor PFsum	F1	PF = Rx	float	R
403cH~403dH	Voltage unbalance factor U_unbl	F1	Unbalance = Rx × 100%	float	R
403eH~403fH	Current unbalance factor I_unbl	F1	Unbalance = Rx × 100%	float	R
4040H~4041H	Load characteristic(L/C/R)	F1	76.0/67.0/82.0(ASCII)	float	R
4042H~4043H	Power demand	F1	P=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4044H~4045H	Reactive power demand	F1	P=Rx×(PT1/PT2)×(CT1/CT2)	float	R
4046H~4047H	Apparent power demand	F1	P=Rx×(PT1/PT2)×(CT1/CT2)	float	R

Real time energy measurement
Data stored in this block can be preset or cleared.

Function code: 03H for reading, 10H for writing. Data type: dword.

It can be set as primary energy or secondary energy according to user. Please refer to F7, F8, and F9 for more details about the relationship between numerical value in register and the real physical value.

Address	Parameter	Code	Range	Data type	Property
4048H~4049H	Energy IMP	F4/F7	0~999999999	dword	R/W
404aH~404bH	Energy EXP	F4/F7	0~999999999	dword	R/W
404cH~404dH	Reactive energy IMP	F5/F8	0~999999999	dword	R/W
404eH~404fH	Reactive energy EXP	F5/F8	0~999999999	dword	R/W
4050H~4051H	Energy TOTAL	F4/F7	0~999999999	dword	R/W
4052H~4053H	Energy NET	F4/F7	0~999999999	dword	R/W
4054H~4055H	Reactive energy TOTAL	F5/F8	0~999999999	dword	R/W
4056H~4057H	Reactive energy NET	F5/F8	0~999999999	dword	R/W
4058H~4059H	Apparent energy	F6/F9	0~999999999	dword	R/W

Harmonics

THD, Harmonics, odd HD, even HD, Crest Factor, THFF, K factor etc are all stored here. The data type is "word". Voltage parameters refer to line voltage when it is set to "2LL/3LL" and phase voltage for others. Function code: 03H for reading.

The following are the THD of voltage and current

Address	Parameter	Code	Range	Data type	Property
405aH	THD_V1 of V1(V12)	F18	0~10000	word	R
405bH	THD_V1 of V2(V31)	F18	0~10000	word	R
405cH	THD_V1 of V3(V23)	F18	0~10000	word	R
405dH	Average THD_V	F18	0~10000	word	R
405eH	THD_I1	F18	0~10000	word	R
405fH	THD_I2	F18	0~10000	word	R
4060H	THD_I3	F18	0~10000	word	R
4061H	Average THD_I	F18	0~10000	word	R

Voltage Harmonics, even HD, odd HD, Crest Factor are shown as below

Address	Parameter	Code	Range	Data type	Property
4062H~407fH	Harmonics of V1(V12) (the 2nd to 31st)	F19	0~10000	word	R
4080H	Odd HD of V1(V12)	F20	0~10000	word	R
4081H	Even HD of V1(V12)	F21	0~10000	word	R
4082H	Crest Factor of V1(V12)	F22	0~65535	word	R
4083H	THFF of V1(V12)	F24	0~10000	word	R
4084H~40a5H	Parameters of V2(V31)	Same as V1		word	R
40a6H~40c7H	Parameters of V3(V23)	Same as V1		word	R

Current Harmonics, even HD, odd HD, Crest Factor are shown as below

Address	Parameter	Code	Range	Data type	Property
40c8H~40e5H	Harmonics of I1 (the 2nd to 31st)	F19	0~10000	word	R
40e6H	Odd HD of I1	F20	0~10000	word	R
40e7H	Even HD of I1	F21	0~10000	word	R
40e8H	K Factor of I1	F23	0~65535	word	R
40e9H~4109H	Parameters of I2	Same as I1		word	R
410aH~412aH	Parameters of I3	Same as I1		word	R

MAX/MIN records

MAX/MIN value and time stamp. Function code: 03H for reading.

Address	Parameter	Code	Range	Data type	Property
4136H	MAX of V1	F11	-32768~32767	int	R
4137H~413cH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
413dH	MAX of V2	F11	-32768~32767	int	R
413eH~4143H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4144H	MAX of V3	F11	-32768~32767	int	R
4145H~414aH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
414bH	MAX of V12	F11	-32768~32767	int	R
414cH~4151H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4152H	MAX of V23	F11	-32768~32767	int	R
4153H~4158H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4159H	MAX of V31	F11	-32768~32767	int	R
415aH~415fH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4160H	MAX of I1	F12	-32768~32767	int	R
4161H~4166H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4167H	MAX of I2	F12	-32768~32767	int	R
4168H~416dH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
416eH	MAX of I3	F12	-32768~32767	int	R
416fH~4174H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4175H	MAX of system power	F13	-32768~32767	int	R
4176H~417bH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
417cH	MAX of system reactive power	F14	-32768~32767	int	R
417dH~4182H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4183H	MAX of system apparent power	F15	-32768~32767	int	R
4184H~4189H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
418aH	MAX of power factor	F16	-32768~32767	int	R
418bH~4190H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4191H	MAX of frequency	F10	-32768~32767	int	R

MAX/MIN records

MAX/MIN value and time stamp. Function code: 03H for reading.

Address	Parameter	Code	Range	Data type	Property
4136H	MAX of V1	F11	-32768~32767	int	R
4137H~413cH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
413dH	MAX of V2	F11	-32768~32767	int	R
413eH~4143H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4144H	MAX of V3	F11	-32768~32767	int	R
4192H~4197H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
4198H	MAX of power demand	F13	-32768~32767	int	R
4199H~419eH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
419fH	MAX of reactive power demand	F14	-32768~32767	int	R
41a0H~41a5H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41a6H	MAX of apparent power demand	F15	-32768~32767	int	R
41a7H~41acH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41adH	MAX of voltage unbalance factor	F17	-32768~32767	int	R
41aeH~41b3H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41b4H	MAX of current unbalance factor	F17	-32768~32767	int	R
41b5H~41baH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41bbH	MAX of V1(V12) THD	F18	-32768~32767	int	R
41bcH~41c1H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41c2H	MAX of V2(V31) THD	F18	-32768~32767	int	R
41c3H~41c8H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41c9H	MAX of V3(V23) THD	F18	-32768~32767	int	R
41caH~41cfH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41d0H	MAX of I1 THD	F18	-32768~32767	int	R
41d1H~41d6H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41d7H	MAX of I2 THD	F18	-32768~32767	int	R
41d8H~41ddH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R
41deH	MAX of I3 THD	F18	-32768~32767	int	R
41dfH~41e4H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	time	int	R

The addresses for the MIN value of the above parameters are located in 41e5H to 4293H. They have the same format as the MAX value.

Sequence component

U1 (U12), I1 consist of a real part and complex part. They have positive sequence, negative sequence and zero sequence. Data type is "int". Function code: 03H for reading.

Address	Parameter	Code	Range	Data type	Property
4294H	positive sequence real part of V1	F11	-32768~32767	int	R
4295H	positive sequence complex part of V1	F11	-32768~32767	int	R
4296H	negative sequence real part of V1	F11	-32768~32767	int	R
4297H	negative sequence complex part of V1	F11	-32768~32767	int	R
4298H	zero sequence real part of V1	F11	-32768~32767	int	R
4299H	zero sequence complex part of V1	F11	-32768~32767	int	R
429aH	positive sequence real part of I1	F12	-32768~32767	int	R
429bH	positive sequence complex part of I1	F12	-32768~32767	int	R
429cH	negative sequence real part of I1	F12	-32768~32767	int	R
429dH	negative sequence complex part of I1	F12	-32768~32767	int	R
429eH	zero sequence real part of I1	F12	-32768~32767	int	R
429fH	zero sequence complex part of I1	F12	-32768~32767	int	R

Phase angle

All voltage and current's phase angles corresponding to V1 (V12) are stored here. You can find out the phase sequence according to them. Data type is "word". Function code: 03H for reading.

Address	Parameter	Code	Range	Data type	Property
42a0H	phase angle of V2 to V1	F25	0~3600	word	R
42a1H	phase angle of V3 to V1	F25	0~3600	word	R
42a2H	phase angle of I1 to V1	F25	0~3600	word	R
42a3H	phase angle of I2 to V1	F25	0~3600	word	R
42a4H	phase angle of I3 to V1	F25	0~3600	word	R
42a5H	phase angle of V23 to V12	F25	0~3600	word	R
42a6H	phase angle of I1 to V12	F25	0~3600	word	R
42a7H	phase angle of I2 to V12	F25	0~3600	word	R
42a8H	phase angle of I3 to V12	F25	0~3600	word	R

Alarming records

There are 16 groups of records with the same format. Function code: 03H for reading, 10H for writing. Please refer to Chapter 4 for more details.

Address	Parameter	Code	Range	Data type	Property
42a9H	First group: alarming status	F1	0~65535	word	R
42aaH	First group: alarming parameter code	F1	0~50	word	R
42abH	First group: over/under limit or reset value	F10~F18	Related with parameters	word	R
42acH~42b2H	First group: Time stamp: yyyy:mm:dd:hh:mm:ss:ms	F3		word	R
42b3H~42bcH	Second group	Same as the first group			
42bdH~42c6H	Third group	Same as the first group			
42c7H~42d0H	Fourth group	Same as the first group			
42d1H~42daH	Fifth group	Same as the first group			
42dbH~42e4H	Sixth group	Same as the first group			
42e5H~42eeH	Seventh group	Same as the first group			
42efH~42f8H	Eighth group	Same as the first group			
42f9H~4302H	Ninth group	Same as the first group			
4303H~430cH	Tenth group	Same as the first group			
430dH~4316H	Eleventh group	Same as the first group			
4317H~4320H	Twelfth group	Same as the first group			
4321H~432aH	Thirteenth group	Same as the first group			
432bH~4334H	Fourteenth group	Same as the first group			
4335H~433eH	Fifteenth group	Same as the first group			
433fH~4348H	Sixteenth group	Same as the first group			

Counting number of I/O modules

DI are arranged according to expanded I/O module addresses, user can check out the counting number of DI along with those modules. The DI counting records are stored in a non-volatile memory and will not be erased during power off. They can be reset via communication and panel. Data type is "dword". Function code: 03H for reading.

AXM-IO11

Address	Parameter	Code	Range	Data type	Property
4349H~434aH	DI1 pulse counter number	F1	0~4294967295	dword	R
434bH~434cH	DI2 pulse counter number	F1	0~4294967295	dword	R
434dH~434eH	DI3 pulse counter number	F1	0~4294967295	dword	R
434fH~4350H	DI4 pulse counter number	F1	0~4294967295	dword	R
4351H~4352H	DI5 pulse counter number	F1	0~4294967295	dword	R
4353H~4354H	DI6 pulse counter number	F1	0~4294967295	dword	R

AXM-IO21

Address	Parameter	Code	Range	Data type	Property
4355H~4356H	DI7 pulse counter number	F1	0~4294967295	dword	R
4357H~4358H	DI8 pulse counter number	F1	0~4294967295	dword	R
4359H~435aH	DI9 pulse counter number	F1	0~4294967295	dword	R
435bH~435cH	DI10 pulse counter number	F1	0~4294967295	dword	R

AXM-IO31

Address	Parameter	Code	Range	Data type	Property
435dH~435eH	DI11 pulse counter number	F1	0~4294967295	dword	R
435fH~4360H	DI12 pulse counter number	F1	0~4294967295	dword	R
4361H~4362H	DI13 pulse counter number	F1	0~4294967295	dword	R
4363H~4364H	DI14 pulse counter number	F1	0~4294967295	dword	R

AXM-IO12

Address	Parameter	Code	Range	Data type	Property
4365H~4366H	DI15 pulse counter number	F1	0~4294967295	dword	R
4367H~4368H	DI16 pulse counter number	F1	0~4294967295	dword	R
4369H~436aH	DI17 pulse counter number	F1	0~4294967295	dword	R
436bH~436cH	DI18 pulse counter number	F1	0~4294967295	dword	R
436dH~436eH	DI19 pulse counter number	F1	0~4294967295	dword	R
436fH~4370H	DI20 pulse counter number	F1	0~4294967295	dword	R

AXM-IO22

Address	Parameter	Code	Range	Data type	Property
4371H~4372H	DI21 pulse counter number	F1	0~4294967295	dword	R
4373H~4374H	DI22 pulse counter number	F1	0~4294967295	dword	R
4375H~4376H	DI23 pulse counter number	F1	0~4294967295	dword	R
4377H~4378H	DI24 pulse counter number	F1	0~4294967295	dword	R

AXM-IO32

Address	Parameter	Code	Range	Data type	Property
4379H~437aH	DI25 pulse counter number	F1	0~4294967295	dword	R
437bH~437cH	DI26 pulse counter number	F1	0~4294967295	dword	R
437dH~437eH	DI27 pulse counter number	F1	0~4294967295	dword	R
437fH~4380H	DI28 pulse counter number	F1	0~4294967295	dword	R

AI input value

The output of AI is mapped to the range of 0~4095 according to its sampling value using some algorithm. Data type is "word". Function code: 03H for reading. Please refer to <<User's manual of expanded I/O modules>> for more details.

Address	Parameter	Code	Range	Data type	Property
4385H	AI1 sampling value	F1	0~4095	word	R
4386H	AI2 sampling value	F1	0~4095	word	R
4387H	AI3 sampling value	F1	0~4095	word	R
4388H	AI4 sampling value	F1	0~4095	word	R

AO output

The output of AO is the actual value of output. Over/under limit or Data type is "float". Function code: 03H for reading. Please refer to <<User's manual of expanded I/O modules>> for more details.

Address	Parameter	Code	Range	Data type	Property
438aH~438bH	Value of A01	F1		float	R
438cH~438dH	Value of A02	F1		float	R

SOE Records

There are 20 groups of records with the same format. Function code: 03H for reading. Before gathering SOE records, the selected I/O module must be SOE enabled. If the SOE enabled I/O module is not connected, SOE record logs will not be collected. Please refer to <<User's manual of expanded I/O modules>> for more details.

Address	Parameter	Code	Range	Data type	Property
4399H~439fH	First group: time stamp: yyyy:mm:dd:hh:mm:ss:ms	F3		word	R
43a0H	First group: DI status	F1		word	R
43a1H~4438H	2nd to 20th group			word	R
4439H	I/O module of SOE	F1	0:none; 1:AXM-IO11; 2:AXM-IO21; 3:AXM-IO31; 4:AXM-IO12; 5:AXM-IO22; 6:AXM-IO32	word	R

Current demand

Include real-time current demand, the maximum current demand and time of occurance. Function code: 03H for reading.

Address	Parameter	Code	Range	Data type	Property
4600H-4601H	Phase I1 current demand	F1	I=Rx×(CT1/CT2)	float	R
4602H-4603H	Phase I2 current demand	F1	I=Rx×(CT1/CT2)	float	R
4604H-4605H	Phase I3 current demand	F1	I=Rx×(CT1/CT2)	float	R
4606H	Max of Phase I1 current demand	F12	-32768~32767	int	R
4607-460cH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	Time	int	R
460dH	Max of Phase I2 current demand	F12	-32768~32767	int	R
460e-4613H	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	Time	int	R
4614H	Max of Phase I3 current demand	F12	-32768~32767	int	R
4615-461AH	Time stamp: yyyy:mm:dd:hh:mm:ss	F3	Time	int	R

DI Status

Current DI status, if related I/O module isn't connected, the DI status will be set to 0. Function code: 02H for reading.

AXM-IO11

Address	Parameter	Range	Data type
0000H	DI1	1=ON,0=OFF	bit
0001H	DI2	1=ON,0=OFF	bit
0002H	DI3	1=ON,0=OFF	bit
0003H	DI4	1=ON,0=OFF	bit
0004H	DI5	1=ON,0=OFF	bit
0005H	DI6	1=ON,0=OFF	bit

AXM-IO21

Address	Parameter	Range	Data type
0006H	DI7	1=ON,0=OFF	bit
0007H	DI8	1=ON,0=OFF	bit
0008H	DI9	1=ON,0=OFF	bit
0009H	DI10	1=ON,0=OFF	bit

AXM-IO31

Address	Parameter	Range	Data type
000aH	DI11	1=ON,0=OFF	bit
000bH	DI12	1=ON,0=OFF	bit
000cH	DI13	1=ON,0=OFF	bit
000dH	DI14	1=ON,0=OFF	bit

AXM-IO12

Address	Parameter	Range	Data type
000eH	DI15	1=ON,0=OFF	bit
000fH	DI16	1=ON,0=OFF	bit
0010H	DI17	1=ON,0=OFF	bit
0011H	DI18	1=ON,0=OFF	bit
0012H	DI19	1=ON,0=OFF	bit
0013H	DI20	1=ON,0=OFF	bit

AXM-IO22

Address	Parameter	Range	Data type
0014H	DI21	1=ON,0=OFF	bit
0015H	DI22	1=ON,0=OFF	bit
0016H	DI23	1=ON,0=OFF	bit
0017H	DI24	1=ON,0=OFF	bit

AXM-IO32

Address	Parameter	Range	Data type
0018H	DI25	1=ON,0=OFF	bit
0019H	DI26	1=ON,0=OFF	bit
001aH	DI27	1=ON,0=OFF	bit
001bH	DI28	1=ON,0=OFF	bit